SUPPLEMENT TO
MEMORANDUM OF AGREEMENT ON MULTI-SERVICE OPERATIONAL TEST AND EVALUATION (MOT&E)
AND OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

11 August 2017

Department of the Army

United States Army Test and Evaluation Command

Aberdeen Proving Ground MD 21005-3103

United States Marine Corps

Marine Corps Operational Test and Evaluation Activity

Quantico VA 22134-5014

Department of the Navy

Commander Operational Test and Evaluation Force

Norfolk VA 23505-1498

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Fort Huachuca AZ 85613-7098

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Supplement 1
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SUPPLEMENT TO THE

MEMORANDUM OF AGREEMENT

ON

MULTI-SERVICE OPERATIONAL TEST AND EVALUATION (MOT&E)

AND

OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

August 2017

This supplement implements the MOT&E Commanders' decision during the April 2017 MOT&E Commanders' Roundtable to include the Joint Interoperability Test Command (JITC) as an inclusive, equal partner to the MOT&E Memorandum of Agreement (MOA), dated February 2017. This supplement includes the JITC's basic roles, responsibilities, deliverables, terms, and definitions. Points of contact are included in a supplemental annex. The February 2017 OTA Commanders' MOT&E MOA remains the capstone document and is supplemented by the information in this document. Future reviews will fully incorporate all Service OTAs and JITC within the document.

Bolded text references page, paragraph, and tables from the February 2017 MOA. The modified text or table follows, replaces, or adds to the original.

The Memorandum of Agreement on Multi-Service Operational Test and Evaluation (MOT&E) and Operational Suitability Terminology and Definitions February, 2017, is supplemented as follows:

Global. For the purpose of this supplement Multi-Service OT&E includes JITC and any references to "Service" in the parent document should be viewed as encompassing JITC.

Replaced:

Pg 1 (Opening paragraph). This is a Memorandum of Agreement (MOA) among the Army Test and Evaluation Command (ATEC), the Marine Corps Operational Test and Evaluation Activity (MCOTEA), Operational Test and Evaluation Force (OPTEVFOR), the Air Force Operational Test and Evaluation Center (AFOTEC), and the Defense Information Systems Agency (DISA) Joint Interoperability Test Command (JITC). These five entities, when referred to collectively, are the "Parties".

Pg 3. paragraph 2.d.(13) The lead OTA will invite the Joint Interoperability Test Command (JITC) to participate in test planning to address interoperability evaluation requirements (i.e., joint interoperability certification or interoperability assessment). This role is separate from JITC's possible role as a lead or participating party.

Pg 5. **Table 1. Resource POCs**

ATEC	G-9 Test Management Division	(443) 861-9402	DSN: 848-9402
AFOTEC	A-8P- Programming	(505) 846-1859	DSN: 246-1859
OPTEVFOR	Test Fleet Resource Scheduling	(757) 282-5546 Ext. 3041	DSN: 564-5546 Ext. 3041
MCOTEA	S-3	(703) 784-6694	DSN: 278-6694
JITC	OT&E Division Chief	(520) 538-4230	DSN: 879-4230

Pg 6. paragraph 3.f. Joint Interoperability Test, Evaluation, and Certification in MOT&E. JITC may be involved in MOT&E programs as a participating OTA, as the Joint Interoperability Certifier, or both. Serving in its capacity as Joint Interoperability Certifier, the following provisions apply:

Pg 6 – 7. paragraph 3.f.(1) JITC is the lead OTA's source for identifying data needed from a specific test event. Programs will coordinate with JITC to develop an interoperability evaluation plan based on the interoperability T&E goals. JITC derives data needs for a specific event from the interoperability evaluation plan and documents them in a test support package. The lead OTA will establish points of contact and coordinate with JITC during the development of the T&E strategy and plans, to include development of a test support package with detailed test procedures addressing interoperability. The lead OTA will invite JITC to participate in test planning activities, reviews and to observe operational testing, as required.

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Pg 7 paragraph 3.f.(2) Each Service OTA has an MOA with JITC to facilitate coordination of Service OTA and JITC common tasks, responsibilities, and requirements during MOT&E and Joint Interoperability Certification. The lead OTA has responsibility for OT&E reporting. JITC issues a Joint Interoperability Certification or an interoperability assessment, as appropriate, in accordance with DoDI 8330.01.

Pg 7 paragraph 3.f.(3) The Lead OTA will ensure that interoperability data is collected as coordinated with JITC.

Pg 12 paragraph 4. Review of Agreement.

Pg 12 paragraph 4.a. The Commanders will meet on an as-needed basis to exchange views on OT&E matters of mutual interest as described in Annex E.

Pg 12 paragraph 4.b. The OTA responsible for coordinating MOA changes/additions for the working group will rotate between AFOTEC, COMOPTEVFOR, MCOTEA, ATEC, and JITC. The call for MOA changes/additions will be sent out no later than 60 calendar days prior to the anniversary date of the MOA. That OTA also has the responsibility for calling such meetings as are required to reach agreement on proposed changes/additions to this MOA and will take the lead in publishing change pages or republishing the entire document.

Pg 12 paragraph 4.d. Entire Agreement. It is expressly understood and agreed that this supplement modifies the February 2017 MOA to include JITC as an operational test partner. The supplement, in conjunction with the February 2017 MOA embodies the entire agreement among the parties regarding MOT&E.

APPROVED. See DOT&E/OTA Commanders' Roundtable Minutes, 23 May 2017

//approved//
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Pg F-2 Annex F MOT&E Glossary: 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. Information Technology (IT), including National Security Systems (NSS) 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 (formerly IA). (DoDI 8330)

Annex G Operational Suitability Terminology and Definitions

Pg G-1 paragraph 3.c. Chairman of the Joint Chiefs of Staff Instruction 3170.01J, Joint Capabilities Integration and Development System, 23 January 2015.

Pg G-1 paragraph 3.d. (added). Department of Defense Instruction 8330.01, Interoperability of Information Technology (IT), Including National Security Systems (NSS), 21 May 2014.

Pg G-2 paragraph 5.d. 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 so exchanged to enable them to operate effectively together. Information Technology (IT), including National Security Systems (NSS), interoperability includes both the technical exchange of information and the end-to-end operational effectiveness of that exchanged 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 (formerly IA). (DoDI 8330.01). Note that interoperability is often addressed as part of the operational effectiveness evaluation in OTA test plans and reports.

(Added) Appendix 5 to Annex G

Joint Interoperability Test Command Terms and Definitions

1. Purpose. This Appendix provides the Suitability terms and definitions used by JITC in planning, executing, and reporting the OT&E of Information Technology (IT) based systems.

2. Background. Operational suitability is defined as:

> *Degree to which a system can be placed and sustained satisfactorily in field use with consideration given to availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, environmental, safety, human factors, habitability, manpower, logistics supportability, natural environmental effects, and impacts, documentation, and training requirements. (DAU Glossary)*

Traditionally, the approach to address suitability has been to develop Measures of Suitability (MOSs) and Measures of Performance (MOPs) in the following areas:

- Reliability
- Availability
- Maintainability
- Training
- Service Desk

This approach is still viable and in many cases applies to the systems the Joint Interoperability Test Command will test and evaluate. However, in recent years, the Department of Defense (DoD) adopted the Department of Defense Enterprise Service Management Framework (DESMF). The purpose of the DESMF is to provide guidance on the application of best practices to plan, implement, monitor, and improve service management initiatives and improve the holistic management of all Information Technology (IT) services across the DoD.

With this new approach, JITC has shifted the evaluation of operational suitability to these areas:

- Availability Management
- Capacity Management
- Service Transition
- Service Operations (Service Desk)
- User Experience

3. Terms.

a. Availability Management. Addresses the system's ability to meet its availability requirements including the processes to track availability. This includes establishing and validating operational reliability, availability, and maintainability metrics. Availability

Management evaluates the level of availability delivered against agreed needs in a cost-effective and timely manner, availability monitoring, reporting, and forecasting. The Availability area addresses:

- System monitoring and alerts – Are availability monitoring processes documented, implemented, and exercised?
- System meets documented thresholds and/or Service Level Agreements – operational availability, reliability, and maintainability metrics are verified.

The process provides an understanding of the agreed current and future system availability demands. Specifically, the program should:

- Produce and maintain an appropriate and up-to-date availability plan that reflects the current and future needs of the system
- Describe how the system will meet the agreed levels of availability in a cost-effective and timely manner
- Reflect the reliability growth strategy and employ reliability growth curves to plan, illustrate, and report reliability growth
- Identify the proactive measures the program will implement to improve system availability when cost-justifiable

b. Availability, Reliability, and Maintainability Relationship.

(1) Operational Availability (A_o). The availability of a system or configuration item (CI) to perform its agreed function when required is usually calculated as a percentage based on agreed service time and downtime.

Ao = Uptime ÷ (Uptime plus Downtime)

Uptime is the period of time during which a system or CI is able to perform its required functions. Downtime is the period of time during which a system of CI is not available to users in support of their mission tasks including downtime for or caused by:

- Administrative and logistics reasons
- Corrective or Preventive Maintenance
- Relocation of the CI

(2) Reliability. The reliability is the ability of a system or CI to perform its agreed function without interruption and is typically measured as Mean Time Between System Incidents (MTBSI).

MTBSI = (Uptime plus Downtime) ÷ Number of service interruptions during a single summarization period (i.e. Quarterly, Monthly, Weekly, Daily)

(3) Maintainability. Maintainability is the ability of a system or CI to be restored

to normal working status after a failure and is typically measured as Mean Time to Restore System (MTRS).

MTRS = Average elapsed time from the detection of an interruption until service restoration

c. Capability Management. Addresses:

This area of evaluation addresses:

- Characterization of Load (Users, Transactions, etc.) – Capacity requirements documented in terms of characterized load. Architecture products describe increments of capacity in terms of load.
- System Resources (Computer Processing Unit, Memory, Storage, etc.) – Capacity estimates verified through testing and/or modeling.
- Demand Forecasting and Scaling Processes – Demand forecasting and scaling processes documented and exercised.

During the Evaluation Phase, evaluators determine the extent the quantifiable levels of performance the system must provide are satisfied. For example:

- Can the system satisfy the projected production and peak levels of demand?
- Are the system resources provided adequate to sustain system operations?
- Can future capacity demand be adequately forecasted?
- Can the scaling process meet the system's future capacity demands?

Examples of Capability Management MOSs and MOPs are found in the following table.

Table G.5-1. Example Capacity Management Measures of Suitability and Topics for Measure of Performance Development

Measures of Suitability	Measures of Performance Topics
Characterization of Load. Ability of the system to support the projected production and peak load and usage	Peak Users
	Concurrent Users
	Peak Transactions
	Concurrent Transactions
	Peak Performance Degradation
System Resources. Ability of system resources to support the projected production load with appropriate excess capacity	Central Processing Unit
	Memory
	Storage
	Throughput
Demand Forecasting. Ability to monitor load and forecast future capacity demand	System Resource Monitoring
	User Monitoring
	Transaction Monitoring

d. Service Transition. Focuses on the following management topics:

- Change Management – Change Management process is to allow all changes to be assessed, approved, implemented, and reviewed in a controlled manner. The process should provide standardized methods and procedures for efficient and prompt handling of technical changes of any asset of a CI that supports the system.
- Configuration Management – Configuration Management process controls, identifies, records, and reports IT components, with accurate, reliable, and available information on how they have been configured and the relationships between them.
- Records Management (DoD Instruction 5015.02) Compliance – Not all programs require Records Management. If records are not kept by the program, this section is not applicable. Otherwise, the Program Manager must implement a Records Management Program that identifies, safeguards, and properly manages all information and records created or received by the program in accordance with established priorities and operational guidance.

Table G.5-2 lists example MOSs and topics for MOP development for Change Management, Configuration Management, and Records Management Compliance.

Table G.5-2. Suggested Service Transition Management Measures of Suitability and Topics for Measure of Performance Development

Measures of Suitability	Measures of Performance Topics
Change Management. Ability to assess, approve, implement, and review all system changes in a controlled manner	Create Change Requests
	Record Change Requests
	Categorize Change
	Evaluate Change
	Coordinate Change Implementation
	Continuous Monitoring
Configuration Management. Ability to identify, record, and report system configuration items	Perform Configuration Identification
	Conduct Configuration Control
	Conduct Configuration Verification and Audit
Records Management Compliance. Ability to identify, capture, and protect system records	Identify Records
	Capture Records
	Protect Records
	Configure the Records Schedule
	Monitor the Records Schedule
	Support Finding Records

e. Service Operations. Focuses on the subjects below. For each management process, the system should describe:

- Incident Management – The process for using standardized methods and procedures, communicating incidents, aligning incident management activities and priorities, and maintaining user satisfaction.
- Event Management – The process that monitors all event that occur during system operations. It allows for normal operation and also detects, escalates, and determines the appropriate control actions for exceptional conditions.
- Access Management – The process for managing access to systems, granting access to systems, changing and restricting access rights, and the proper granting and changing of rights.
- Request Fulfillment – The process for defining what systems are provided, defining who is qualified, and providing information to users and customers about the availability and procedures.
- Problem Management – The process for diagnosing the root cause and determining resolution; implementing incident resolutions; maintaining information about problems, workarounds, and resolutions; and proactively preventing problems.

Table G.5-3 lists example Service Operations MOSs and topics for MOP development.

Table G.5-3. Suggested Service Operations Measures of Suitability and Topics for Measure of Performance Development

Measures of Suitability	Measures of Performance Topics
Incident Management Process. Ability to define the Incident Management Process	Policies and Procedures
	Roles and Responsibilities
	Training
Service Desk (SD) Function Ability of the SD to handle incidents according to the defined process	Register Incidents
	Monitor Incidents
	Communicate Incidents
	Escalate Incidents
	Provide Information
Event Management Process. Ability to define the Event Management Process	Policies and Procedures
	Roles and Responsibilities
	Training
Service Desk Function Ability of the SD to handle events according to the defined process	Register Events
Access Management Process. Ability to define the Access Management Process	Policies and Procedures
	Roles and Responsibilities
	Training
Service Desk Function Ability of the SD to handle system access according to the defined process	Identity Verification
	Rights and Permissions
	Password Resets
	Provide Information
Request Fulfillment Process. Ability to define the Request Fulfillment Process	Process and Procedures
	Roles and Responsibilities
	Training
	Identification of Requests
Service Desk Function Ability of the SD to handle request fulfillment according to the defined process	Non-supported Requests
	Catalog of Services
	Request Data
Problem Management Process. Ability to define the Problem Management Process	Maintain Known Error Database
	Update Workarounds
	Provide Criteria for Incident Referrals
	Review Referred Incidents
	Communicate Problem Records
	Inform SD on Change Record Status
Service Desk Function Ability of the SD to handle problems according to the defined process	Identify Workarounds
	Register Problem
	Communicate with Mission Partners
	Monitor Open Problems

f. User Experience. Focuses on user involvement in testing and users' ability to compete mission tasks using the system. The User Experience addresses:

- Usability/User Perception of Value – Determining the extent users can use a product to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context.

- Documentation and Training – Providing user access to training and user guides.
- Transition and Onboarding – Providing new and unanticipated users the knowledge, skills and behaviors to effectively complete mission tasks, and determining the users' ability to complete those tasks.
- Section 508 Compliance – Meeting the needs of people with disabilities by achieving Section 508 Compliance or obtaining a waiver.

Table G.5-4 lists example User Experience MOSs and topics for MOP development.

Table G.5-4. Suggested User Experience Measures of Suitability and Topics for Measure of Performance Development

Measures of Suitability	Measures of Performance Topics
Characterization of Value. Ability of users to complete mission tasks using the service. Do users perceive the service as valuable in completing mission tasks? Are user representatives included in testing?	Task Completion Rate
	Net Promoter Score
	Service Usability Scale Score
	After-Scenario Questionnaire
	Standardized User Experience Percentile Rank Questionnaire
	User Involvement
Documentation and Training. Are user documents and training guides complete and available?	User Guides
	Training Materials
	Transition and Onboarding
Section 508 Compliance. Is the system Section 508 compliant?	Section 508 compliance

(Added)

Annex H

Service Operational Test Agency Contact Information

AFOTEC
1251 Wyoming Blvd SE, Kirtland AFB, NM 87117-5535
Director of Staff, Comm: (505) 846-1026 DSN: 246-1026, cc.afotec@us.af.mil
Operations: (505) 846-4151 DSN: 246-4151, afotec.a3-02@us.af.mil

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Command Group Admin, Comm: (520) 538-5000 DSN: 879-5000
Chief, Operational Test and Evaluation and Enterprise Services Division,
Comm: (520) 538-4230 DSN: 879-4230, Michael.r.koester.civ@mail.mil
Operations: JITC Operations, Comm: (520) 538-0355 DSN: 879-0355, disa.huachuca.jt.cal.jt2e-operations-management-branch@mail.mil

MCOTEA
2032 Barnett Avenue, Quantico, VA 22134
Deputy Director, Comm: (703) 784-3143 DSN: 278-3143, Thomas.mcgowan@usmc.mil
Executive Assistant: Rachel McGrath, 703-4-784-6657, Rachel.mcgrath@usmc.mil
Chief of Staff: Michael Moore, 703-432-0954, Michael.s.moore1@usmc.mil
Operations: Contact Deputy Director (above)

OPTEVFOR
7970 Diven Street, Norfolk, VA 23505-1498
Technical Director, Comm: 757-282-5546 ext 3185 DSN: 564-5546, mark.lucas@cotf.navy.mil
Policy & Operations: Comm: 757-282-5546 ext 3150 DSN: 564-5546,
mark.rupprecht@cotf.navy.mil or cotf.policy@cotf.navy.mil

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Commander, Operational Test and Evaluation Force

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MEMORANDUM OF AGREEMENT

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This is a Memorandum of Agreement (MOA) between the Army Test and Evaluation Command (ATEC), the Marine Corps Operational Test and Evaluation Activity (MCOTEA), Operational Test and Evaluation Force (OPTEVFOR) and the Air Force Operational Test and Evaluation Center (AFOTEC). These four entities are also referred to as Operational Test Agencies (OTAs). When referred to collectively, the OTA are referred to as the "Parties."

1. Introduction.

a. Purpose. This MOA provides a basic framework for Multi-Service Operational Test and Evaluation (MOT&E) conducted by two or more Service OTAs in a representative, joint, operational environment and per Department of Defense (DoD) Directive 5000.01, *The Defense Acquisition System*; DoD Instruction 5000.02, *Operation of the Defense Acquisition System*; and Deputy Under Secretary of the Army (Test and Evaluation) (DUSA(T&E)) memorandum, Subject, *Test and Evaluation (T&E) Policy for Chemical and Biological Defense Program (CBDP) Systems*, 23 July 2007.

b. Policy. This memorandum provides guidelines for planning, conducting, evaluating, and reporting MOT&E. The agreements contained herein apply to MOT&E (as defined in Annex F). This MOA may be supplemented for program-unique considerations with a supplemental letter of agreement. Annex G defines basic operational suitability terminology and definitions.

2. Common Elements of Multi-Service Operational Test (MOT).

a. Relationship between lead OTA and participating OTAs.

(1) For MOT&E, the lead developing/acquisition Service's OTA will be the lead OTA. If the Service's OTA declines, the lead OTA will be chosen by mutual agreement between participating Services. For Office of the Secretary of Defense (OSD)-directed programs where there is no designated lead Service, the lead OTA will again be chosen by mutual agreement or by Director, Operational Test and Evaluation (DOT&E) in the case where OTAs do not agree. For CBDP Systems, the lead OTA is determined as outlined in DUSA(T&E) memorandum, Subject, *Test and Evaluation (T&E) Policy for Chemical and Biological Defense Program (CBDP) Systems*, 23 July 2007.

(2) T&E of multi-Service acquisition programs are conducted on systems being acquired by more than one DoD component. The designated lead OTA will prepare and coordinate Test and Evaluation Master Plan (TEMP) input, a single test plan, and a single T&E report reflecting system technical performance and operational effectiveness, suitability, and survivability for each service component. The lead OTA will have the overall responsibility for management of the MOT&E program and will ensure that participating OTA critical operational issues (COI) and requirements are included in formulation of basic resource and planning documents. The lead OTA will notify all participating OTAs of all upcoming meetings and test events, to include planning, execution, evaluation, and reporting events. The participating OTAs will ensure that their COI and Service-unique requirements are made known and will assist the lead OTA in the planning and execution of the MOT&E. Annex A contains guidelines regarding duties and responsibilities of participants to consider in establishing and conducting all MOT&Es.

b. Test Management Council (TMC).

(1) Provisions will be made on every MOT&E program for a TMC to arbitrate all disagreements that cannot be resolved at the team level. The TMC will be composed of one O-6/GS-15 level representative from each participating OTA and chaired by the lead OTA representative.

(2) Issues between participants will be resolved at the lowest level possible. It is anticipated that most will be resolved either internally or by the TMC. In the rare event that agreement cannot be reached at or below the TMC level, participating OTA commanders will confer to resolve the disagreement.

c. Early MOT&E Considerations. When supporting early MOT&E activities led by another Service OTA, some or all of the participating OTA processes may not be required. The level of support depends on unique Service capability requirements. Each Service shall determine the appropriate level of support required to meet OT requirements for their Service with consideration given to the overall objectives of the MOT&E effort.

d. Test Planning. Test planning will be accomplished in the manner prescribed by the lead OTA's directives. The lead OTA invites participating OTAs to participate in early activities (between acquisition entities, developmental testers, and operational testers) which focus on developing strategies to leverage and integrate test efforts and use of data between developmental and operational testing (DT and OT). Examples would include the activities of integrated test teams (ITT), T&E Working-level Integrated Product Team (T&E WIPT), Integrated Product Team (IPT), and program test integration working groups, which produce a Milestone A TEMP per DoDI 5000. (Series). Participating OTAs will participate early in MOT&E planning and remain proactive throughout the test planning process. Safety will be addressed throughout all phases of MOT&E test planning. The lead OTA will produce the OTA test plan with concurrence from the participating OTAs.

(1) The lead OTA for a MOT&E is responsible for initiating the operational test and evaluation (OT&E) inputs to the TEMP. The participating OTA will provide Service-unique test requirements for the TEMP. The lead OTA will ensure participating OTA participation in the appropriate multi-Service ITT or T&E WIPT, providing lead OTA document guidance, and preparing all OT documents.

(2) The lead OTA is responsible for providing input to the documents, participating in meetings, briefs, and working groups, as required, participating in data generating events and providing mutually agreed upon support.

(3) The lead OTA will integrate DT and OT whenever cost and feasibility allow.

(4) Each Service OTA plans resource requirements in accordance with their Service procedures and directives. Some Services rely on Program Objective Memorandums (POMs) for test funding and some rely on the Program Manager (PM)/Joint Program Office (JPO) to fund testing resources. Consequently, the lead OTA will ensure that the TEMP clearly identifies each Service's specific test resources (assets and funding) and the source of funding (specific PM/JPO, POM, etc.).

(5) The lead OTA will begin the planning process by forming a core team comprised of the participating OTAs. The OTAs will communicate Service-unique test requirements, COI, test objectives, concerns, and key resource requirements.

(6) The lead OTA will consolidate test requirements, test objectives, key resource requirements, and test scenarios and gain agreement by all involved Service OTAs. Service-unique issues will be included as COI or additional issues when deemed appropriate by that Service.

(7) The lead OTA will consolidate and provide MOT&E TEMP input. The lead OTA will accommodate participating Service peculiar OT&E requirements and inputs in the formal coordination action of the TEMP. Coordination actions will accommodate Service-unique staffing approval requirements. The TEMP is prepared in accordance with the Defense Acquisition Guidebook and the DOT&E TEMP Guidebook.

(8) Participating OTA representatives will meet with the lead OTA for the purpose of assigning OTA specific responsibilities for accomplishment of test objectives. These assignments will be made in a mutually agreeable manner. Each OTA will be responsible for resource identification and accomplishment of its assigned test objectives under the direction of the lead OTA.

(9) Each OTA will prepare and identify Service specific data requirements and provide the requirements to the lead OTA in the lead OTA format.

(10) The lead OTA will prepare the test plan(s), consolidating the inputs from all participating activities. After consolidation, the test plan(s) will be approved by the participating OTAs. OTAs will integrate their cybersecurity test requirements into the test plan.

(11) The lead OTA will ensure that all planning and execution documents not captured in an evaluation plan or operational test plan are reviewed and approved by the participating OTAs. This includes the detailed schedule, data collection plans to include forms (quantitative, qualitative, and verification), instrumentation plans, and Safety Plan.

(12) Based upon the program's inclusion in one or more of the categories of OSD T&E oversight, the lead OTA is responsible for scheduling test plan briefs to the cognizant OSD authority. The brief may be presented jointly by all OTAs involved.

(13) The lead OTA will invite Joint Interoperability Test Command (JITC) to participate in test planning to address interoperability certification and operational interoperability reporting.

(14) The lead OTA, in coordination with participating OTAs, should ensure the T&E WIPT Charter contains an event-driven deliverables table identifying deliverables needed by the T&E WIPT to plan and execute integrated test activities. The table will also identify the offices responsible for those deliverables (see Table 3).

(15) The lead OTA, in coordination with participating OTAs, will ensure that Cybersecurity testing is in compliance with DOT&E *Procedures for Operational Test and Evaluation of Cybersecurity in Acquisition Programs*, 1 August 2014. The lead OTA will also

lead coordination efforts for Cybersecurity testing with participating OTAs. This responsibility is applicable to all acquisition systems under test and not specifically oversight programs. The described guidance from DOT&E should be used across all acquisition systems when testing Cybersecurity.

(16) The lead OTA for the program will provide the DOT&E with a memorandum that assesses the T&E implications of the initial concept of operations provided by the user as soon as practical after the Materiel Development Decision.

(17) For software acquisitions, the lead OTA will conduct an analysis of operational risk to mission accomplishment covering all planned capabilities or features in the system. The analysis will include commercial and non-developmental items. The initial analysis will be documented in the Milestone A TEMP and updated thereafter.

e. This MOA will be referenced when developing MOT&E team charters.

f. Special Access Programs (SAP).

(1) The lead OTA will identify all SAP requirements associated with the conduct of a MOT&E program. The identified SAP access requirements will be provided to all participating OTAs through coordination with each OTA Security Assistance Policy Coordinating Office. If an OTA desires to use a Service SAP capability or resource in the conduct of a MOT&E program, it is the responsibility of the sponsoring Service to verify test team members can have access to the capability.

(2) Every effort will be made to implement reciprocity of adjudications, at the same sensitivity level, to include supporting SAPs. Reciprocity of access between OTA personnel will be requested when the Program Access Request (PAR) includes a statement certifying access was satisfactorily completed by a Security Officer or Government SAP Security Officer (GSSO) and that the clearance and investigation are current within 5 years.

(3) Specific relationships and procedures for test team members accessing Service specific SAPs will be formalized in a written Memorandum of Agreement /Understanding as outlined in the DoDM 5205.07 Volumes 1-4.

3. MOT&E.

a. MOT&E Participation. All affected DoD components will participate and support OT&E planning, conducting, evaluating and reporting. An OTA not originally designated as "lead" or "participating" may request to participate in MOT&E in a limited capacity by mutual agreement with the participating OTAs. Any OTA may originate the request for participation. Inclusion of the new OTA in MOT&E will be documented in the TEMP at the next regularly scheduled update.

b. Test Team Structure. MOT&E may be conducted by a multi-Service test team, or concurrently with separate test teams, as the participating Services deem necessary for a given program. The basic MOT&E test team composition is shown in Annex C. The lead OTA Test Director (TD) will exercise test management authority over the test teams. The lead OTA TD's responsibilities include integration of test requirements and scheduling test events, but not

operational control of test teams. Service test teams work through a participating OTA Deputy Test Director (DTD) or a senior Service representative. The supporting OTA DTD exercises operational control or test management authority over their Service test teams. Additionally, they will help correlate and present test results as directed by the lead OTA TD. In addition, the participating OTA DTD will represent their Service's interests and be responsible, at least in an administrative sense, for resources and personnel provided by their Services. MOT&E team composition below the level of the participating OTA DTD will be determined on a program-by-program basis by individual Services. Cybersecurity operational testing integration will be coordinated among the OTAs.

c. Resources.

(1) The lead OTA, in coordination with the participating OTAs, will include all resource requirements in a consolidated resource estimate (CRE). The MOT&E program CRE will contain applicable information from the checklist contained in Annex B. The lead OTA resource requirements document can serve this purpose. The participating OTAs will prepare their portions of the CRE in their formats and staff through Service channels. After staffing and approval, participating OTAs will submit their requirements and changes to the CRE in lead OTA format. The CRE should contain Service-specific detail on anticipated resources to support each test event. The Lead OTA may incorporate the CRE within the TEMP or test plan as appropriate.

(2) Each Service OTA has established an internal point of contact (POC) for requests and coordination when a single Service requires resources from other Services. The single Service OTA conducting a test will initiate the request, coordinate the use of required joint assets, and also be responsible for the scheduling and managing of those assets. The OTA POCs for test resources are listed in Table 1.

Table 1. OTA Resource POCs

ATEC	G-9 Test Management Division	(443) 861-9402	DSN: 848-9402
AFOTEC	A-8P- Programming	(505) 846-1859	DSN: 246-1859
OPTEVFOR	Test Fleet Resource Scheduling	(757) 282-5546 Ext. 3409	DSN: 564-5546 Ext. 3409
MCOTEA	S-3	(703) 784-6694	DSN: 278-6694

d. Funding. Funding for MOT&E will be in accordance with public law, DoD 7000.14-R, Volume 02B, chapter 5, of the Department of Defense Financial Management Regulation, or Service directives, depending on program peculiarities. As presented in paragraph 2, each Service has its own standard resource procedures for the execution of OT. Consequently, the lead OTA will ensure that the TEMP clearly identifies Service specific test resources. Clear identification allows each Service to facilitate their funding requirement via the appropriate Program Office/Joint Program Office. This MOA does not document or provide for the exchange of funds or manpower between the Parties nor does it make any commitment of funds or resources. Each Party to this MOA is responsible for all costs of its personnel, including pay, benefits, support, and travel. Each Party is responsible for supervision and management of its personnel. To the extent that funding or resources need to be committed to implement this MOA, separate Support Agreements will be

executed using a DD1144 or similar instrument in accordance with the procedures set forth in DoDI 4000.19.

e. System Deficiency Reporting.

(1) The deficiency reporting system of the lead Service will normally be used. All members of the multi-Service ITT will report deficiencies and adhere to the reporting timelines called out in the lead Service's deficiency reporting system. Each deficiency report will be coordinated with all DTDs prior to release. If the TD and/or any DTD non-concurs with the report, they may attach the non-concurrence rationale to the deficiency report. Using the appropriate Service reporting schedule, the deficiency report will then be submitted to the appropriate developing agency with that explanation attached. The underlying philosophy is that each participating OTA can report all deficiencies that it identifies; the lead OTA will not suppress the reporting of deficiencies submitted by participating OTAs.

(2) The lead OTA will ensure a system is set up by the Program Office to track reported deficiencies and provide periodic (monthly is preferred) status reports of deficiencies to participating OTAs. Annex D identifies the minimum information that must be maintained in the tracking system.

(3) Test articles may not serve similar purposes for each Service. As a result, a deficiency considered disqualifying by one Service is not necessarily disqualifying for all Services. Deficiency reports of a disqualifying nature must include rationale by the concerned Service explaining classification. It should include other OTA positions on Service-specific impacts.

(4) If any of the participating OTAs identifies a deficiency that warrants a stop test, all testing will be suspended to afford participating OTAs an opportunity to discuss the deficiency. If all participants agree, the test will be halted until the deficiency is corrected. If appropriate, participants may determine that tests can continue safely on a limited basis pending subsequent correction of the deficiency. If agreement cannot be reached concerning the nature and magnitude of the deficiency, it will be necessary for the TD to consider what portions of the test, if any, are unaffected by the deficiency and can be continued safely while the deficiency is being corrected. Immediately upon making such a determination, the TD shall provide the OTAs with the circumstances concerning the deficiency, the positions put forth by DTDs, with a final decision and rationale.

(5) Additional data collection, beyond system deficiency reporting, may be needed to fulfill Service-unique requirements (e.g., Reliability and Maintainability). The lead OTA will query the participating OTAs early in the test planning process to identify the potential for additional data requirements above and beyond standard deficiency reporting. The interested OTAs will provide sufficient detail about their requirements that impacts to cost and test scope can be evaluated. The lead OTA will develop courses of actions to satisfy the data requirements and will capture the data requirements in all applicable test planning documents.

f. Joint Interoperability Test and Certification in MOT&E.

(1) For those programs requiring joint interoperability certification, the lead OTA will work with JITC to establish points of contact to facilitate coordination. JITC is the lead

OTA's source for Interoperability Test Plans/Interoperability Certification Evaluation Plans (ITP/ICEP) for the applicable programs. The lead OTA will coordinate with JITC during the development of the T&E strategy and plans, to include development of detailed test procedures addressing interoperability. The lead OTA will invite JITC to participate in test planning activities, reviews, as well as, to observe operational testing, as required.

(2) Each Service OTA has an MOA with JITC to facilitate coordination of Service OTA and JITC common tasks, responsibilities, and requirements during MOT&E and Joint Interoperability Certification. The lead OTA has responsibility for OT&E reporting. JITC issues a Joint Interoperability Test Certification or assessment report, in accordance with CJCSI 6212.01F.

(3) The Lead OTA will ensure that Service critical interoperability testing is conducted.

g. Modeling and Simulation (M&S). M&S, including threat models, will be conducted per the Lead OTA's guidelines and policies. M&S will be a collaborative effort of all OTAs involved if they have the same specific intended use. If not, it will be necessary to develop separate and distinct accreditation plans and reports. If the OTAs have determined that the specific intended use is the same, M&S development and decisions to use M&S for evaluation will be made with the concurrence of all OTAs. M&S documentation, including accreditation plans and accreditation reports, when the specific intended uses are the same for all OTAs, will be approved and signed by all participating OTAs. DOT&E will be briefed, as appropriate, at milestone decisions or as requested.

h. Threat Representations. All threat representations used in MOT&Es will be validated per OSD guidelines and will be accredited per the Lead OTA's policies/guidelines. Validation and accreditation of threat representations used in MOT&Es will be a collaborative effort of all involved OTAs. All threat representation accreditation reports will be signed by all involved OTAs.

i. Test Reporting. The following test reporting policy will apply for all OTA report products:

(1) The lead OTA will prepare and coordinate the report; synthesize the operational requirements and joint operational environment; state findings and put those findings into perspective; and present rational why there is or is not consensus.

(2) All participating OTAs will sign the report.

(3) There are five types of OTA reports shown in Table 2.

Table 2. OTA Reports

Reports	Purpose of Report
Assessments*	
OTA Assessment Report (OAR)	For assessments not supporting a milestone decision
OTA Milestone "x" Assessment Report (OMAR)	For assessments supporting a milestone decision (i.e., A/B/C)
Evaluations	
Emerging Results, Quick Look, Initial Impressions Message, or Interim Report	An interim report based on preliminary results of authenticated data, prior to the completion of an OER or OFER.
OTA Evaluation Report (OER)	For Initial Operational Test and Evaluation (IOT&E) evaluations in support of a full rate production (FRP) decision
OTA Follow-on Evaluation Report (OFER)	For post FRP decision OT evaluations

Note: *Assessment is defined slightly different by each Service; however, the basis is the same - assessing risk/progress towards meeting system requirements and assessing risk/progress towards a determination of effectiveness, suitability, and survivability.

(4) Participating OTAs may prepare an independent assessment or evaluation report as required, in its own format, and process that report through its normal Service channels.

(5) The lead OTA will ensure that participating Service independent assessment or evaluation reports are appended to the final report prepared by the lead OTA for submission to the decision authority.

(6) Reports, as required, will be submitted to the DOT&E and Deputy Assistant Secretary of Defense for Developmental Test and Evaluation (DASD(DT&E)) at least 45 calendar days prior to a milestone decision or the date announced for the final decision to proceed beyond Low Rate Initial Production (LRIP). An interim summary OTA report shall be submitted if the final report is not available 45 days prior to the milestone decision review. A single integrated multi-Service report will be submitted no later than 90 calendar days after the official end of test is declared by the Lead OTA. All participating OTAs shall agree on the definition of the official end of test.

(7) Interim test reports will normally not be prepared. For lengthy or extended test phases, interim test reports should be submitted (when required) to support Service/OSD decisions or program events. Test reporting requirements will be defined in the TEMP or the test plan. When required, interim reports will be prepared in accordance with the lead OTA's directives and coordinated with all participating OTAs prior to release. To support Warfighter needs, coordination can be on an expedited timeline based upon Service-unique requirements. OTAs may submit interim reports through Service channels based on Service-unique requirements, coordinating with other participating OTAs to ensure there are no conflicting results.

(8) For reports that do not require submission to DOT&E and DASD(DT&E), or CBDP reports, an OAR or OER is still required for the Milestone Decision Authority (MDA). Reports

will be forwarded to appropriate Services and the other OT&E participants within 90 calendar days after official end of test is declared by the lead OTA. As stated above in paragraph 3.i. (6), all participating OTAs shall agree on the definition of the official end of test.

(9) The lead OTA will be responsible for preparing the MDA and other appropriate agency/committee briefs. The briefs will be coordinated with all participating OTAs.

j. Release of Data. Release of data among the Parties will be accomplished in the manner prescribed by lead OTA directives, with equal access given to participating OTAs. Data will be shared among the test team regardless of OTA affiliation. Exceptions will be handled by lead OTA directives. Release of data to the public will be governed by the procedures of the Freedom of Information Act (FOIA) and no release shall be made without prior coordination among the Parties.

k. MOT&E Products, Coordination Process, and Timeline. The OTA test plan and report products in the event-driven deliverables table (Table 3) are based on DoD 5000 terminology. The deliverables may be used to inform specific milestone decisions or unique requests. Documentation will be prepared in accordance with DoDI 5000(.series).

Table 3. Event-Driven Deliverables

Milestone A	Milestone B	Milestone C/LRIP	FRP/Fielding
Initial Capabilities Document (ICD) *(User)*	Capability Development Document (CDD) (*User)*	Capability Production Document (CPD) *(User)*	
Concept of Operations (CONOPS) *(User)*	(CONOPS) **Update** *(User)*	(CONOPS) **Update** *(User)*	
Analysis of Alternatives (AoA) *(User)*	AoA **Update** *(User)*	AoA **Update** *(User)*	
Acquisition Strategy *(Program Management Office (PMO)/Developing Agency (DA) / User)*	Life Cycle Sustainment Plan (LCSP) (*PMO*)	LCSP **Update** (*PMO*)	
Program Direction *(Program Executive Officer (PEO))*	Program Direction **Update** *(PEO)*	Program Direction **Update** *(PEO)*	
T&E WIPT (ITT) Charter *(PMO)*	T&E WIPT (ITT) Charter **Update**	T&E WIPT (ITT) Charter **Update**	
	Information Support Plan (ISP) *(PMO)*	ISP **Update** (DA/LDTO, Lead Development Test Organization/ *lead* OTA)	
	Interim Authority to Test (IATT), Approval to Operate (ATO) or ATO with conditions	ATO (PMO)	
TEMP *(PMO DA LDTO lead OTA)*	TEMP *(PMO LDTO lead OTA)*	**TEMP Update** *(PMO LDTO lead OTA)*	
TEMP *(PMO DA LDTO lead OTA)*	TEMP *(PMO LDTO lead OTA)*	Integrated Test Concept/Plan *(LDTO OTA)*	
	OTA Test Plan *(lead OTA)*	OTA Test Plan *(lead OTA)*	OTA Test Plan *(lead OTA)*
			Operational Test Readiness Review (OTRR) *(PMO lead OTA)*
	OMAR*(lead OTA)*	OMAR (*lead OTA)*	OER *(lead OTA)*
	Deficiency Reporting *(PMO/User)*	Deficiency Reporting *(PMO User)*	Deficiency Reporting *(PMO User)*

The coordination process and timeline for MOT&E products and OTA assessment and evaluation reports is depicted in Figure 1. The timeline and 90-day cycle is a suggestion for standard programs; however, timely delivery of a quality product is the goal for any MOT&E effort. Accelerated priorities may require a shorter timeline and every effort should be made to accommodate such requests. All timelines and priorities will be agreed upon early, at the lowest levels, and by all participating OTAs.

l. Signature pages of plans and reports. For all documents requiring all OTA signatures, to include plans, and reports, ensure the Lead OTA's signature block appears in the first position. Additionally, ensure the document uses the correct OTA Commander's signature block.

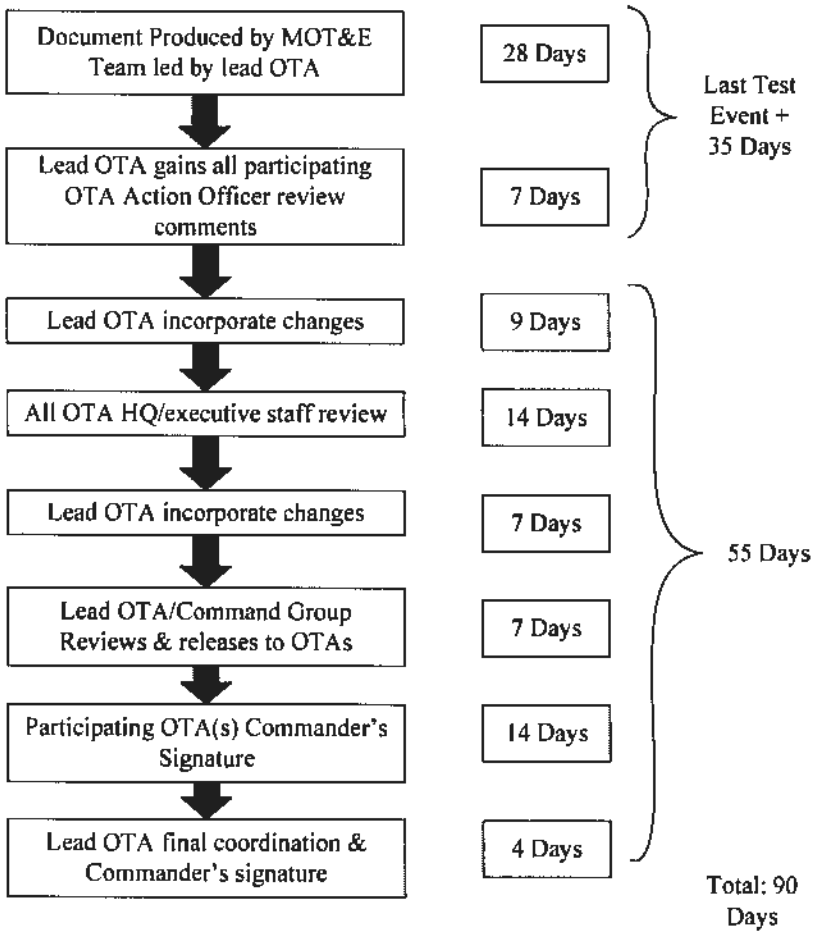

Figure 1. MOT&E Product Review Process and Timeline in Calendar Days

4. Quadri-Service Review of Agreement.

a. The Service OTA Commanders will meet on an as-needed basis to exchange views on OT&E matters of mutual interest as described in Annex E.

b. The OTA responsible for coordinating MOA changes/additions for working group will rotate between AFOTEC, COMOPTEVFOR, MCOTEA, and ATEC. The call for MOA changes/additions will be sent out no later than 60 calendar days prior to the anniversary date of the MOA. That Service also has the responsibility for calling such meetings as are required to reach agreement on proposed changes/additions to this MOA and will take the lead in publishing change pages or republishing the entire document.

c. Transferability. This MOA is not transferable except with the written consent of the OTA Commanders.

d. Entire Agreement. It is expressly understood and agreed that this MOA embodies the entire agreement between the OTAs regarding MOT&E.

e. Cancellation of Previous Agreement. This MOA cancels and supersedes the previously signed agreement between the OTAs with the subject; Multi-Service Operational Test and Evaluation (MOT&E) and Operational Suitability Terminology and Definitions effective date of April 2015.

f. Terms of this understanding become effective upon signature by all parties and may be revised by mutual consent provided such changes are accomplished by written agreement.

g. This MOA will be terminated on the second anniversary of its effective date. The MOA may also be terminated prior to that date with the agreement of all signing OTA commanders.

Agreed:

MOLLOY.MATTHEW.H.1154666385

Digitally signed by MOLLOY.MATTHEW.H.1154666385
DN: c=US, o=U.S. GOVERNMENT, ou=DOD, ou=PKI, ou=USAF, cn=MOLLOY.MATTHEW.H.1154666385
Date: 2017.05.05 17:09:49 -07'00'

MATTHEW H. MOLLOY
Major General, USAF
Commander, AFOTEC

MIELE.ROBERT.M.1229226416

Digitally signed by MIELE.ROBERT.M.1229226416
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=MIELE.ROBERT.M.1229226416
Date: 2017.05.09 10:06:38 -04'00'

For JOHN W. CHARLTON
Major General, USA
Commander, ATEC

BRINKMAN.MARK.THOMAS.1143497972

Digitally signed by BRINKMAN.MARK.THOMAS.1143497972
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USMC, cn=BRINKMAN.MARK.THOMAS.1143497972
Date: 2017.03.10 11:21:41 -05'00'

MARK T. BRINKMAN
Colonel, USMC
Director, MCOTEA

SOHL.PAUL.ALAN.1091451030

Digitally signed by SOHL.PAUL.ALAN.1091451030
Date: 2017.02.23 07:52:09 -05'00'

PAUL A. SOHL
Rear Admiral, USN
Commander, OPTEVFOR

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Annex A

Duties and Responsibilities of Participants in MOT&E

Functional Service	Lead OTA	Participating OTA(s)
1. Personnel	- Assign the lead OTA Test Director. - In conjunction with the participating Service(s), establish joint manning requirements. - Staff the test team as indicated in the Consolidated Resource Estimate (CRE).	- Assign participating OTA Deputy Test Directors to the test team. - Establish Service manning requirements to support the joint manning requirements. - Staff the test team as indicated in the CRE.
2. Administration	- Provide initial administrative support services until the formulation and staffing of the test team. - Consolidate participating OTA inputs and distribute functional tasks to the appropriate level of the test team.	- Provide administrative support for Service-unique requirements. - All participating Services provide functional tasks requirements to the lead OTA.
3. Funding	- Fund initial organizational, planning, and administrative costs except TDY and other Service-unique requirements. - Fund own-Service TDY and unique requirements. - Will ensure that the TEMP clearly identifies those Service specific test resources so that funding can be facilitated by the specified Service via the appropriate Program Office/Joint Program Office.	- Fund own-Service unique requirements and TDY costs. For Navy and Marine corps unique requirements, ensure funding is facilitated per the TEMP by the appropriate program office/joint program office.
4. Threat Assessment (see note 1)	- The System Threat Assessment Report (STAR)/Validated Online Lifecycle Threat (VOLT) VOLT is developed, coordinated, and updated by the Lead Service. When Threat Support Packages are required the lead OTA will use it to develop OT scenarios based on appropriately selected Vignettes	- Ensure the coordinated system specific threat assessment recognizes any unique Service operational environment.
5. Resources	- Consolidate total resource requirements and include same in basic program documents. - Indicate Service responsible for providing each resource. - Prepare Service documents to support basic resource requirements document.	- Identify resources required to conduct the test. - Extract Service resource requirements from the basic documentation. - Coordinate Service unique required resources.

Functional Service	Lead OTA	Participating OTA(s)
6. Environmental Compliance Requirements	- Ensure PM includes OT requirements in programmatic environmental analyses and other National Environmental Policy Act (NEPA) documentation, including T&E-related documents. - Ensure plans address any NEPA certification contingencies added to the documentation. - Obtain NEPA certifications from common-use test sites and assist participating OTAs with unique test sites where necessary. (NEPA planning for MOT&E phases imbedded in an exercise are the responsibility of the exercise managing authority—participant compliance will be built into exercise plans.) - Obtain OT-required local, state, or federal environmental regulatory permits—PM will assist.	- Request NEPA analysis from each OT-specific test site's environmental planning function using the appropriate Service/agency process. Assist environmental planners with the NEPA analysis as requested.
7. Safety	- Ensure Environment, Safety and Occupational Health (ESOH) hazards have been identified and mitigated, and accepted to a low risk level. In some cases, when it is not possible to mitigate all risks to low, a risk assessment for hazards not adequately controlled (e.g., residual hazards) will have to be performed. - Ensure PM provides safety releases to the operational testers prior to any test using personnel.	- Ensure that all Service-specific ESOH hazards have been identified and provided to the lead OTA to ensure that they have been mitigated to a low level or have had a risk assessment performed and the appropriate risk acceptance authority must formally accept the risk.
8. Data Management – (see note 2)	- Ensure that a comprehensive data collection/management plan is formulated and coordinated with OTA test teams. - Designate a central repository for data collected. - Provide ready access to the collected data to all participating agencies. - Strive for commonality of data, terms, and reduction methods.	- Support Lead OTA in preparing the data collection/management plan. - Ensure that all data collected are made available to the Lead OTA for storage in the central data repository.
9. Documentation	- Prepare overall program documentation per lead Service directives.	- Provide input to the basic documents.

Functional Service	Lead OTA	Participating OTA(s)
	- Make provisions for the attachment of Service-unique documentation requirements as annexes to the basic documents. - Prepare a single joint independent operational evaluation report in accordance with Service directives and coordinate with participating Services operational test agencies prior to the release. - Obtain participating OTA signature(s) on all Multi-Service TEMPs, test plans, reports, and coordinate on all other MOT&E program documents.	- Provide Service documentation requirements to Lead OTA as an annex to the basic documentation. - Prepare an independent operational evaluation report in accordance with Service Directives. Independent evaluations appended to a Lead OTA report will be released by the Service OTA concurrent with or later than the release of the lead OTA. - Coordinate with lead OTA on all MOT&E program documents.
10. Deficiency Reporting	- Provide deficiency reporting procedures, formats, and direction. Accept deficiency reports (DR) from DTDs. Submit DRs to appropriate program managers. Ensure participating Services receive deficiency status reports periodically.	- Submit DRs concerning Service-unique or general deficiencies with the test item in the format prescribed by the lead OTA prescribed definitions, DR system, and forms.
11. Briefs	- Provide briefs to appropriate OTAs, the MDA, and OSD.	- Provide Service-unique inputs to lead OTA.

NOTE 1: The STAR/VOLT is the baseline document used to determine the appropriate threats that must be replicated in the MOT&E. It is used to answer the COI/Critical Operational Issue and Criteria (COIC), per the lead OTA's documentation. Threat assessment should include natural and man-made threats impacting the capability of the system to perform across its operational envelope. The STAR format is in transition to the more dynamic Validated Online Lifecycle Threat (VOLT) format throughout 2017. STARs will remain validated for two years after their completion.

NOTE 2: To ensure a progressive evaluation of the system, there will be an unrestricted exchange of validated data among the OTAs, DOT&E, and/or test teams. Data can be distributed to non-signatory agencies after coordination with the participating OTAs and per DOT&E Policy, DoD Policy on OT&E Information Promulgation, dated 1 October 2001.

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Annex B

Consolidated Resource Estimate Checklist

1. Test Title
2. References
3. Purpose of Test
4. Scope and Tactical Content
5. Test Objective
6. Lead/Participant Services
7. Services POC Lists
8. Test Installation Locations
9. Test Dates
10. Test Directorate Personnel/Equipment

a. Test Staff

(1) Data Management

(2) Logistical

(3) Administrative

(4) Test Operation

(5) Controllers

(6) Data Collectors

(7) Software Evaluators

(8) Cyber Security

(9) Human Factors

(10) Weather

(11) Intelligence

b. Aviation Support

c. Signal/Communications

d. Miscellaneous Equipment

e. Training Requirements

11. Player Participants Personnel/Equipment

a. Blue Force

(1) Ground Players/Units

(2) Aviation Players/Units

(3) Fleet Players/Units

(4) Ground Players Equipment

(5) Aircraft Hours/Types

(6) Fleet Days/Units

(7) Training Requirements

b. Red Force

(1) Ground Players/Units

(2) Aviation Players/Units

(3) Fleet Players/Units

(4) Ground Players Equipment

(5) Aircraft Hours/Types

(6) Fleet Days/Units

(7) Training Requirements

12. Installation Support

13. Test Targets

14. Instrumentation

15. Automated Data Processing (ADP)

16. Ammunition/Missiles

17. Petroleum, Oil, Lubricant (POL)

18. Contractor Support

19. Funding Estimates

20. Milestones

21. Test Range Support

22. Computer Simulators/Models/Test Beds

23. Threat Systems/Surrogates/Simulators

24. Foreign Material to Replicate the Threat

25. Accreditation Support

26. Environmental Compliance

27. Lab Equipment (CBDP)

28. Transportation of Simulants (CBDP)

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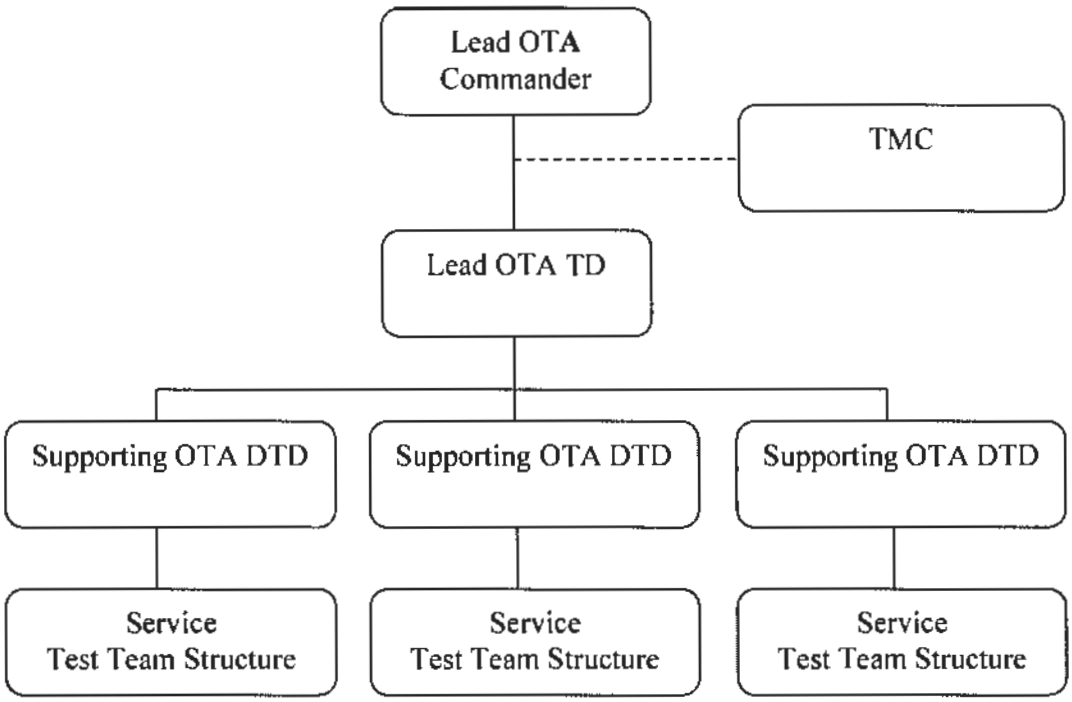
Annex C

MOT&E Team Composition



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Annex D

Sample Deficiency Report Summary

Current Date

Equip Nomen	Report I.D.	Report Date	Type of Deficiency	Deficiency Description	Cog. Agency	Closure Code	Action Ref	Remarks	Status	Date Information		
										Action AC CLO Date	Test for CLO Date	Last Update
	A		B		C	D						
AN/TCY-38 CNCE, ETC.	EPR 101-41.11-23001-YC-20-JFT, ETC.		INFO. MINOR, OPERATIONAL, ETC.	SHORT TITLE, PART NO, SUBASSEMBLY, ETC. PLUS PROGRAM EXAMPLES 1. OX-34 INVERTERS FAILED 2. SOFTWARE FLT-8 (E7R31) (DIAG) TRAINING PROBLEM WHEN TTY ON LINE. 3. YDU 8 CARD FAILURE	GTE, ESO, RCA, ETC.	NEEDHAM, FORT HUACHUCA, ETC.	FM-MS-404, ESD LTR 18 MAR 79	DEPOT REPAIR/REPLACE. TAPE PATCH DUE BY 24 AUG 79. SEE ECP AK-000, ETC.				

A. SERVICE UNIQUE REPORT NUMBER, i.e., EPR KH-41

B. TERMS LIKE "MAJOR," "MINOR," ETC.

C. WHERE THE CORRECTIVE ACTIONS WILL TAKE PLACE

D. PROBLEM REPORT #, DATE OF LETTER SENT TO AGENCY, ETC.

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Annex E

Service OTA Commanders' Working Group Procedures

1. Purpose. This Annex establishes the schedule for the working group and outlines the basic policy and procedures for its conduct.

2. Goals. To structure and use the working group as a forum for exchanging information concerning Service T&E best practices, resolving T&E issues of mutual concern, and promoting consistency and commonality among the OTAs in the conduct of OT&E.

3. Schedule. The working group will be held when requested by the OTA commanders (CDR). Host's duties for the OTA CDR working group will rotate in the following order: AFOTEC, COMOPTEVFOR, MCOTEA, and ATEC.

4. Responsibilities

a. Host OTA responsibilities are as follows:

(1) Determine the least cost venue for accomplishing the goals of the working group. First consideration should be given to the use of existing video teleconference (VTC) facilities or a teleconference. Both VTC and teleconferences will usually be scheduled and executed with reduced planning time compared to a face-to-face working group. Improvisation on the procedures outlined in paragraphs 4.a. (3)-(6) and (8) will be likely be needed. The hosting OTA will adhere to the spirit of those procedures to the maximum feasible extent.

(2) If the working group host determines a face-to-face meeting is required, they will provide a suitable location and coordinate use of required facilities (i.e., group working rooms, dining, billeting, etc.). Use of government facilities will be the first consideration for working group locations and lodging. Attendees from each OTA will be responsible for making their own travel reservations.

(3) Establish working group dates in coordination with the other OTAs and DOT&E. Normally, the working group will not exceed 2 days. Once the dates are established, every effort should be made to adhere to them.

(4) Establish the working group agenda. An initial message will announce the next working group and solicit agenda inputs. A planning meeting is recommended to consolidate input into a draft agenda. The agenda will be distributed for coordination and approval. A final agenda will be distributed NLT 7 calendar days prior to the working groups. It will include talking papers covering the agenda items (see participating OTA responsibilities).

(5) Provide working group folders, containing the agenda and talking papers, to the Commanders, Vice/Deputy Commanders, and TDs/Chief Scientists.

(6) Provide administrative support to working group attendees.

(7) Coordinate any social activities for the working group. Attendees will cover expenses for social events with personal funds.

(8) Publish working group minutes. Minutes will be distributed NLT 30 calendar days after the working group.

b. Participating OTA responsibilities are as follows:

(1) Establish a POC to assist the host OTA POC in working group planning and agenda development.

(2) Accomplish required coordination, prior to the working group, on agenda items for which it is the POC. Additionally, 1-to-2 page summaries (talking paper format with short, bullet statements) of the agenda items will be provided to the host OTA POC NLT 14 calendar days prior to face-to-face working groups. For VTC and telecoms, the host OTA POC will provide a due date to the participating OTA for any required documentation.

5. Working Group Structure. In addition to the OTA Commanders, attendees may include the OTA Vice/Deputy Commanders and/or TDs/Chief Scientists. At their discretion, the Commanders may invite additional participants that can add to, or benefit from, the working group agenda. However, additional participants should be kept to a minimum. The host OTA Commander will chair the working group.

a. All agenda items will have an assigned POC. Topics will usually be introduced through a brief and followed by discussion as required. POCs are responsible for coordinating any particular audio/visual requirements in advance with the host OTA POC. Paper copies of briefs for attendees will not normally be required. Agenda items will generally fall into two basic categories:

(1) Informational. Briefs given to provide a status update or promote discussion on a particular topic. Such briefs are not designed to result in a decision, but they may generate action items for future consideration.

(2) Decision items. Presentations regarding a plan of action, or decision, will be provided to the Commanders for approval. Whether the result of a previous tasking or new initiative, these items will be fully staffed and coordinated among the OTAs to arrive at a joint recommendation for the Commanders.

b. If required, executive sessions between Commanders and the DOT&E will be coordinated in advance.

6. Policy. The following provides guidance for the implementation of decisions or agreements reached by the Commanders during working group proceedings:

a. Tasks will have an assigned POC, suspense dates, and representatives identified from each OTA as required for coordination. The POC and task information will be documented in the working group minutes.

b. Agreements or decisions may be implemented through any means deemed appropriate by the Commanders. Written documents, such as MOAs, may be developed, but these documents will not supersede any DoD or Service regulations and may require OSD coordination. Implementation of any written agreement requires approval and signature of all four OTA Commanders.

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Annex F

MOT&E Glossary

(For Operational Suitability Terminology and Definitions - see Annex G)

This glossary lists in alphabetical order terminology used by the OTAs. Individual terms may have multiple definitions drawn from various sources. Test teams should choose the definition most appropriate for the system under test and the concepts of operations and maintenance.

Capability. The ability to achieve a desired effect under specified standards and conditions through combinations of means and ways across the doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) to perform a set of tasks to execute a specified course of action. (CJCSI 3170.01H)

Compatibility. The capability of two or more items or components of equipment or material to exist or function in the same system or environment without mutual interference. Compatibility may apply to a specific investigation of a system's electrical, electromagnetic, physical, and man-machine interface characteristics. (Defense Acquisition University (DAU) Glossary)

Concept of Operations (CONOPS). A verbal or graphic statement, in broad outline, of a commander s assumptions or intent in regard to an operation or series of operations. It is designed to give an overall picture of the operation. It is also called the Commander's Concept. (DAU Glossary)

Critical Operational Issue (COI). A key Operational Effectiveness (OE) and/or Operational Suitability (OS) issue (not a parameter, objective, or threshold) that must be examined in OT&E to determine the system's capability to perform its mission. A COI is normally phrased as a question that must be answered in order to properly evaluate OE (e.g., "Will the system detect the threat in a combat environment at adequate range to allow successful engagement?") or OS (e.g., "Will the system be safe to operate in a combat environment?"). A COI may be broken down into a set of Measures of Effectiveness (MOE) and/or Measures of Performance (MOP), and Measures of Suitability (MOS). (DAU Glossary)

Cyber Security. Prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communications services, wire communication, and electronic communication, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and nonrepudiation. (National Security Presidential Directive-54/Homeland Security Presidential Directive-23, "Cybersecurity Policy," January 8, 2008)

Early Operational Assessment (EOA). An Operational Assessment (OA) conducted early in an acquisition program, often on subsystems and early prototype equipment, to forecast and evaluate the potential operational effectiveness and suitability of the system during development. EOAs also assist in determining any system-unique test assets for future developmental and operational tests. (DAU Glossary)

Executive Agent/Service. See Lead Service

Full-Rate Production. Contracting for economic production quantities following stabilization of the system design and validation of the production process. (DAU Glossary)

Human Factors Engineering. The systematic application of relevant information about human abilities, characteristics, behavior, motivation, and performance to provide for effective human-machine interfaces and to meet Human System Integration (HSI) requirements. Where practicable and cost effective, system designs should minimize or eliminate system characteristics that requires excessive cognitive, physical, or sensory skills; entail extensive training or workload-intensive tasks; result in mission-critical errors; or produce safety or health hazards.

Human Systems Integration. Human Systems Integration (HSI) is simply put the relationship between humans and their environment and how systems are design and used relative to that relationship. Human Systems Integration includes humans, in their different roles in the system (as operator, maintainer, trainer, designer, etc.), Systems including hardware, software and processes (including the acquisition process and the design process), and the integration of all of these elements to optimize the performance and safety of the whole. The principle goal is to ensure a safe and effective relationship between the human and the system that meets the mission. This systems integration includes; the integrated and comprehensive analysis, design and assessment of requirements, concepts and resources for system manpower, personnel, training, safety and occupational health, habitability, personnel survivability, and human factors engineering. (DAU Glossary)

Initial Capabilities Document (ICD). Summarizes a Capabilities Based Assessment (CBA) and justifies the requirement for a materiel or non-materiel approach, or an approach that is a combination of materiel and non-materiel, to satisfy specific capability gap(s). It identifies required capabilities and defines the capability gap(s) in terms of the functional area, the relevant range of military operations, desired effects, time and DOTMLPF and policy implications and constraints. The ICD summarizes the results of the DOTMLPF and policy analysis and the DOTMLPF approaches (materiel and non-materiel) that may deliver the required capability. The outcome of an ICD could be one or more joint DCRs or recommendations to pursue materiel solutions. (CJCSI 3170.01H)

Interoperability. 1. The ability to operate in synergy in the execution of assigned tasks. 2. The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases. (JP 1-02)

Issues. Any aspect of the system's capability (operational, technical, or other) that must be questioned before the system's overall military utility can be known. (DAU Test and Evaluation Management Guide)

Lead OTA. The OTA designated by the MDA, or as a result of Service initiatives, to be responsible for management of an MOT&E. For MOT&E, the lead developing/acquisition Service's OTA will be the lead OTA, unless that Service's OTA declines, in which case the lead OTA will be chosen by mutual agreement of the OTAs of the participating Services. For OSD

directed programs where there is no designated lead Service, the lead OTA will be chosen by mutual agreement of the OTAs or by DOT&E in the case where OTAs cannot agree. For CBDP Systems, the lead OTA is determined as outlined in CBDP Memo.

Lead Service. The DoD Component responsible for management of a system acquisition involving two or more DoD Components in a joint program. (DAU Glossary)

Memorandum of Agreement (MOA). A type of intra-agency, interagency, or National Guard agreement between two or more parties, which includes specific terms that are agreed to, and a commitment by at least one party to engage in action. It includes either a commitment of resources or binds a party to a specific action. (DoDI 4000.19)

Measure of Effectiveness (MOE). Measure designed to correspond to accomplishment of mission objectives and achievement of desired results. (CJCSI 3170.01H) MOEs may be further decomposed into Measures of Performance and Measures of Suitability. See OE, MOP, OS, and MOS. (DAU Glossary)

Measure of Performance (MOP). Measure of a system's performance expressed as speed, payload, range, time on station, frequency, or other distinctly quantifiable performance features. Several MOPs and/or MOSs may be related to the achievement of a particular MOE. (DAU Glossary)

Measure of Suitability (MOS). Measure of an item's ability to be supported in its intended operational environment. MOSs typically relate to readiness or operational availability, and hence reliability, maintainability, and the item's support structure. Several MOSs and/or MOPs may be related to the achievement of a particular MOE. See MOE and OS. (DAU Glossary)

Milestone (MS). The point at which a recommendation is made and approval sought regarding starting or continuing an acquisition program, i.e., proceeding to the next phase. MSs established by DoDI 5000.02 are: MS A that approves entry into the Technology Development phase; MS B that approves entry into the Engineering and Manufacturing Development (EMD) phase; and MS C that approves entry into the Production and Deployment (P&D) phase. See Decision Points. 2. In the context of scheduling, a specific definable accomplishment in the contract network that is recognizable at a particular point in time. MSs have zero duration, do not consume resources, and have defined entry and exit criteria. A MS may mark the start and/or finish of an interim step, event, or program phase. (Government-Industry Earned Value Management Working Group). (DAU Glossary)

Mission. The objective or task, together with the purpose, which clearly indicates the action to be taken. (DAU Glossary)

Modeling and Simulation. The development and use of live, virtual, and constructive models including simulators, stimulators, emulators, and prototypes to investigate, understand, or provide experiential stimulus to either (1) conceptual systems that do not exist or (2) real life systems which cannot accept experimentation or observation because of resource, range, security, or safety limitations.

This investigation and understanding in a synthetic environment will support decisions in the domains of research, development, and acquisition and advanced concepts and requirements, or transfer necessary experiential effects in the training, exercises, and military operations domain.

Multi-Service Operational Test and Evaluation (MOT&E). OT&E conducted by two or more Service OTAs in a representative joint operational environment for systems. MOT&E is conducted according to the T&E directives of the lead OTA, or as agreed in a memorandum of agreement between the participants.

Operational Assessment (OA). An OA is a test event that is conducted before initial production units are available and which incorporates substantial operational realism. An OA is conducted by the lead OTA in accordance with a test plan approved by DOT&E for programs that are on OSD OT&E oversight. As a general criterion for proceeding through Milestone C, the lead OTA will conduct and report results of at least one OA. An OA is usually required in support of the first limited fielding for acquisition models employing limited fielding's. An operational test, usually an OA, is required prior to deployment of Accelerated Acquisition programs that are on OSD OT&E or LFT&E oversight.

Operational Capability (OC). The measure of the results of the mission, given the condition of the systems during the mission (dependability). (DAU Glossary)

Operational Effectiveness. Measure of overall ability to accomplish a mission, when used by representative personnel in the environment planned or expected for operational employment of the system considering organization, doctrine, tactics, supportability, survivability, vulnerability, and threat. (DAU Glossary)

Operational Suitability. Degree to which a system can be placed and sustained satisfactorily in field use with consideration given to availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, environmental, safety, human factors, habitability, manpower, logistics supportability, natural environmental effects, and impacts, documentation, and training requirements. (DAU Glossary)

Operational Survivability. The capability of a system and crew to avoid or withstand a man-made hostile environment without suffering an abortive impairment of its capability to accomplish its designated mission. Survivability includes ballistic effects, cyber security, electromagnetic effects, nuclear weapons effects, vulnerability/lethality (determined during LFT&E), electronic warfare, etc.

Operational Test Agency (OTA).

a. The Agency established by a Service to conduct OT&E for that Service. Those agencies are signatories of this MOA.

b. Each Service has one designated operational test agency: the Air Force has the Air Force Operational Test and Evaluation Center (AFOTEC); the Navy has the Operational Test and Evaluation Force (OPTEVFOR); the Army has the Army Test and Evaluation Command (ATEC); and the Marine Corps has the Marine Corps Operational Test and Evaluation Activity (MCOTEA).

OTA Test Plan. Documents specific operational test scenarios, objectives, MOEs, threat simulation, detailed resources, known test limitations and the methods for gathering, reducing, and analyzing data. Operational Transition Period begins with delivery of first production article and extends to program management responsibility transition. (DAU Glossary)

OTA Assessment Report (OAR). Report for assessments not supporting a milestone decision.

OTA Evaluation Report (OER). Report for IOT&E evaluations in support of a FRP decision.

OTA Follow-on Evaluation Report (OFER). Report for post-FRP decision OT evaluations.

OTA Milestone "X" Assessment Report (OMAR). Report for assessments supporting a MS decision.

Operational Test and Evaluation (OT&E). The field test, under realistic combat conditions, of any item of (or key component of) weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment or munitions for use in combat by typical military users, and the evaluation of the results of such test. (10 USC Section 139)

Participating Service. A Service designated by the Secretary of Defense, or as the result of Service initiatives, to assist the designated lead OTA in the management of a MOT&E program. Participating Services may include the lead Service, depending on the use of the term.

Supporting OTA. The OTA of a supporting Service.

Test. Any program or procedure that is designed to obtain, verify, or provide data for the evaluation of any of the following: 1) progress in accomplishing developmental objectives; 2) the performance, operational capability, and suitability of systems, subsystems, components, and equipment items; and 3) the vulnerability and lethality of systems, subsystems, components, and equipment items. (DAU Glossary)

Test and Evaluation Master Plan (TEMP). Documents the overall structure and objectives of the T&E program. It provides a framework within which to generate detailed T&E plans and it documents schedule and resource implications associated with the T&E program. The TEMP identifies the necessary Developmental Test and Evaluation (DT&E), OT&E, and Live-Fire Test and Evaluation (LFT&E) activities. It relates program schedule, test management strategy and structure, and required resources to: COIs, Critical Technical Parameters (CTP), objectives and thresholds documented in the CDD, evaluation criteria, and milestone decision points. For multi-Service or joint programs, a single integrated TEMP is required. Component-unique content requirements, particularly evaluation criteria associated with COIs, can be addressed in a component-prepared annex to the basic TEMP. (DAU Glossary)

Test Management Authority. The authority granted a multi-Service test director that provides control over all aspects of a MOT&E. This includes planning, coordination of resource requirements, resource scheduling, conduct of OT&E, and reporting. This authority generally does not include administration and discipline of subordinate organizations or operational control during contingencies or combat.

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Annex G

Operational Suitability Terminology and Definitions

1. Purpose. This annex provides the policy and suitability terminology and definitions to be used by the Service OTAs for the quantitative portion of suitability evaluations.

2. Background. The terms and definitions in this annex are intended to convey the same meaning to all Services. Therefore, they attempt to avoid terms used elsewhere with different meanings. Existing terms used by one or more Services were selected when possible.

3. References.

a. Joint Publication 1-02, 12 April, 2001, The DoD Dictionary of Military and Associated Terms, as amended through 13 June 2007.

b. Defense Acquisition University Glossary of Defense Acquisition, Acronyms and Terms, 12th Edition, July 2005.

c. Chairman of the Joint Chiefs of Staff Instruction 3170.01H, Joint Capabilities Integration and Development System, 10 January 2012.

4. Introduction.

a. The terms described in this annex will be used as appropriate in all MOT&E. If additional terms are necessary, they must be clearly defined in MOT&E Plans.

b. Applicable terms selected from this annex will be included in the system Test and Evaluation Master Plan. As this requirement involves agreement by the program office and system user, an implementation period of two years is anticipated.

c. Measurement of the terms described in this memorandum may vary between types of system (aircraft, spacecraft, ships, ground vehicles, projectiles, weapon systems, etc.). This is due to variations between different systems' operating characteristics (continuous operation, intermittent operation, non-operating, etc.), part of the system under test (end item, segment, subsystem, etc.), design requirements (redundancy, non-redundancy), system maintenance policies, mission requirements, and reliability incident classifications (mission failures, system failures, unscheduled maintenance, etc.). As such, specific measures associated with each term will be clearly defined in the test plan and other appropriate test documentation.

5. Basic Operational Suitability Terminology. Operational suitability - The degree to which a system can be placed and sustained satisfactorily in field use with consideration given to availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, environment, safety, and occupational health risks, human factors, habitability, manpower, logistics, supportability, logistics supportability, natural environmental effects and impacts, documentation, and training requirements. (CJCSI 3170.01 and CJCSM 3170.01)

The following defines those basic suitability terms and definitions to be used by the OTAs:

a. Availability. The probability that an item is mission capable at an arbitrary point in time. (DAU Glossary)

b. Compatibility. The capability of two or more items or components of equipment or material to exist or function in the same system or environment without mutual interference. [DAU Glossary]. Compatibility may apply to a specific investigation of a system's electrical, electromagnetic, physical, and man-machine interface characteristics. Because of such applications, compatibility may also be addressed as part of the operational effectiveness evaluation in OTA test plans and reports.

c. Transportability. The capability of materiel/personnel to be moved by towing, self-propulsion or carrier via any means, such as railways, highways, waterways, pipelines, oceans, and airways. Full consideration of available and projected transportation assets, mobility plans and schedules and the impact of system equipment and support items on the strategic mobility of operating military forces are required to achieve this capability.

d. 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 so exchanged to enable them to operate effectively together. National Security System (NSS) and Information Technology System (ITS) interoperability includes both the technical exchange of information and the operational effectiveness of that exchanged information as required for mission accomplishment (DAU Glossary and Joint Pub 1-02). Interoperability is often addressed as part of the operational effectiveness evaluation in OTA test plans and reports.

e. Reliability. The probability that an item will perform a required function without failure under stated conditions for a stated period of time. (Practical Reliability Engineering, 5th edition, by Patrick D.T. O'Connor and Andre Kleyner)

f. Human System Integration (HSI). A comprehensive management and technical strategy, initiated early in the acquisition process, to ensure that human performance, the burden the design imposes on manpower, personnel, training, safety, and health aspects are considered throughout the system design and development processes. Human Factors Engineering (HFE) requirements are also established to develop effective human-machine interfaces, and minimize or eliminate system characteristics that require extensive cognitive, physical, or sensory skills; to require excessive training or workload for intensive tasks; or to result in frequent or critical errors or safety and/or health hazards. The capabilities and limitations of the operator, maintainer, repairer, trainer, and other support personnel will be identified prior to program initiation (usually MS A), and refined during the development process (DoDI 5000.02, Enclosure 7). MANPRINT is the Army's process for HSI and includes Soldier survivability considerations.

g. Usage Rates.

(1) Wartime Usage Rates. The quantitative statement of the projected manner in which the system is to be used in its intended wartime environment.

(2) Peacetime Usage Rates. The quantitative statement of the projected manner in which the system is to be used in its intended peacetime environment.

h. Maintainability. The ability of an item to be retained in, or restored to, specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair. (DAU Glossary)

i. Safety. Freedom from conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. (DAU Glossary)

j. Human Factors Engineering (HFE). The systematic application of relevant information about human abilities, characteristics, behavior, motivation, and performance. It includes principles and applications in the areas of human engineering, anthropometrics, personnel selection, training, life support, job performance aids, and human performance evaluation. (DAU Glossary) Within the context of this definition, human factors also may be addressed as part of the operational effectiveness evaluation in OTA test plans and reports.

k. Manpower Supportability. The identification and acquisition of military and civilian personnel with the skills and grades required to operate and support a material system over its lifetime at peacetime and wartime rates.

l. Logistic Supportability. The degree of ease to which system design characteristics and planned logistics resources (including the logistics support (LS) elements) allow for the meeting of system availability and wartime usage requirements. (DAU Glossary)

m. Natural Environmental Effects and Impacts.

(1) Environment. Includes the air, water, land, living things, built infrastructure cultural resources, and the interrelationships that exist among them. (JCIDS Manual) 2. The aggregate of all external and internal conditions (such as temperature, humidity, radiation, magnetic and electric fields, shock vibration, etc.) either natural or man-made, or self-induced, that influences the form, performance, reliability, or survival of an item. (DAU Glossary)

(2) Environmental Effects. The effects of the natural environment on the system. For example, corrosion is a natural environmental effect caused by weather, ocean conditions, etc.

(3) Environmental Impacts. The system's impact on the natural environment as a result of its operational use, maintenance, transportation, and storage. For example, impacts include pollution (noise, air, and water), threat to endangered species, threat to public health, etc.

n. Documentation. Documents used to determine suitability e.g., operator and maintenance instructions, repair parts lists, support manuals, and manuals related to computer programs and system software. (DAU Glossary)

o. Training and Training Support. The processes, procedures, techniques, training devices, and equipment used to train civilian and active duty and reserve military personnel to operate and support a materiel system. This includes individual and crew training; new equipment training; initial, formal, and On-the-Job (OJT) training; and LS planning for training equipment and training device acquisitions and installations. A traditional element of LS. (DAU Glossary)

6. Other Suitability Terminology. Suitability considerations defined above may be aggregated to give a higher level determination of the system's capability to be placed in field use. When doing so, other terminology related to suitability is used. These other terms are:

a. Readiness. State of preparedness of forces or weapon system or systems to meet a mission or to engage in military operations. Based on adequate and trained personnel, material condition, supplies/reserves of support system and ammunition, numbers of units available, etc. (DAU Glossary)

b. Sustainability. The ability to maintain the necessary level and duration of operational activity to achieve military objectives. Sustainability is a function of providing for and maintaining those levels of ready forces, materiel and consumables necessary to support military effort. (DAU Glossary)

c. Diagnostics. The ability of integrated diagnostics (automated, semi-automated, and manual techniques taken as a whole) to fault-detect and fault-isolate in a timely manner.

7. Common Reliability, Availability, and Maintainability (RAM) Definitions.

a. Reliability. The probability that a system will perform its required mission critical functions for the duration of a specified mission under conditions stated in the mission profile. (DAU Glossary) Mission reliability can also be stated as the probability a system can complete its required operational mission without an operational mission failure (OMF). An OMF is a failure that prevents the system from performing one or more mission essential functions. For some systems, mission reliability may be better expressed as a function of Mean Time (miles, rounds, etc.) Between Operational Mission Failure (MTBOMF). (See paragraph 8 for definition.)

b. Maintainability. Maintainability consists of three major areas: time to repair OMFs, total corrective maintenance time, and maintenance burden or maintenance ratio. Maintainability may be expressed as (1) Mean Corrective Maintenance Time for Operational Mission Failure Repairs (MCMTOMF), (2) Mean Corrective Maintenance Time for all incidents (MCMT), (3) Maximum (e.g., 90 Percentile Time) Corrective Maintenance Time for Operational Mission Failures (MaxCMTOMF), (4) Maximum (e.g., 90 Percentile) Corrective Maintenance Time for all incidents (MaxCMT), and (5) various maintenance ratios (MR), e.g., Maintenance Man-Hours Per Operating Hour, Mile, Round, etc. (See paragraph 8 for definitions.)

c. Availability. When conducting OT&E, Availability is normally expressed as Operational Availability (A_o) which is a measure of the probability that a system will be operating or capable of operation when required. (See paragraph 8 for definition.)

d. Diagnostics. Diagnostics may be expressed as:

(1) A measure of false alarms (number, percent, probability, rate, etc.)

(2) The percent of correct detection (Pcd) given that a fault has occurred

(3) The percent of correct fault isolation (Pcfi and/or Pcfl) (and/or fault location) given a correct detection , and

(4) Mean Time to Fault Locate (MTTFL). (See paragraph 8 for definitions.)

8. Common RAM Measures. The purpose of this list of measures is to standardize terminology, not tests. It is not mandatory to design tests, collect data, or calculate a measure, just because it is listed below. However, if the measure is calculated, use the common term in test planning and documentation. Relevant, Service-unique RAM measures are provided in appendices to this MOA.

a. Mean Time Between Operational Mission Failures (MTBOMF). In the event that the rate of occurrence of system-level failures is constant, MTBOMF may be estimated as the total operating time (e.g., driving time, flying time, or system-on time) divided by the total number of OMFs. When the rate of occurrence of failures is non-constant, other estimators should be used for MTBOMF.

b. Mean Time Between Unscheduled Maintenance (MTBUM). The total operating time divided by the total number of incidents requiring unscheduled maintenance.

c. Mean Corrective Maintenance Time for Operational Mission Failures (MCMTOMF). The total number of clock-hours of corrective, on-system, active repair time, which was used to restore failed systems to mission-capability status after an OMF occurs, divided by the total number of OMFs.

d. Mean Corrective Maintenance Time (MCMT). The total number of clock-hours of corrective, on-system, active repair time due to all corrective maintenance divided by the total number of incidents requiring corrective maintenance.

e. Maximum Corrective Maintenance Time for Operational Mission Failures (MaxCMTOMF). That time below which a specified percentage of corrective maintenance tasks must be completed to restore the system to operation after an OMF.

f. Maximum Corrective Maintenance Time (MaxCMT). That time below which a specified percentage of all corrective maintenance tasks must be completed.

g. Maintenance Ratio (MR). The most common expression for MR, is Maintenance Man-hours per Operating Hour, which is an indication of the maintenance burden associated with the system. The cumulative number of maintenance man-hours during a given period divided by the cumulative number of operating hours. If appropriate, other terms such as miles or rounds may be substituted for hours. Scheduled as well as corrective maintenance, in keeping with the user's maintenance requirements, are included without regard to their effect on mission or availability of the system.

h. Operational Availability (A_o). The probability that an item will be mission capable when it is required. A_o is defined mathematically as the ratio between uptime and total time. It is the quantitative link between readiness objectives and supportability. (DAU Glossary) For on-

demand systems, it can also be defined as the ratio of ready systems to the number of available systems. See the various Service appendices to this annex for Service-specific A_o formulas.

i. Measures of False Alarms (FA). FAs are faults, where upon investigation, it is found the fault cannot be confirmed. Measures of FA may be expressed as a total number, a percentage, a rate of occurrence, a probability of occurrence, etc. The selected measure must be clearly stated.

j. Percent of Correct Detection (given that a fault has occurred) (Pcd). The number of correct detections divided by the total number of confirmed faults times 100 (to express the quotient as a percent.)

k. Percent of Correct Fault Isolation (and Correct Fault Location) given correct detection (Pcfi). The number of correct fault isolations (and/or correct fault locations) divided by the number of correct detections times 100 (to express the quotient as a percent). "Fault isolation" and/or "fault location" must be clearly defined.

l. Mean Time To Fault Locate (MTTFL). The total amount of time required to locate faults divided by the total number of faults.

9. Integrated Product Support (IPS). A key life cycle management enabler, IPS is the package of support functions required to deploy and maintain the readiness and operational capability of major weapon systems, subsystems, and components, including all functions related to weapon systems readiness. The package of product support functions related to weapon system readiness, which can be performed by both public and private entities, includes the tasks that are associated with the IPS Elements that scope product support. The 12 IPS Elements include the following: Computer Resources, Design Interface. Facilities & Infrastructure, Maintenance Planning & Management, Manpower & Personnel, Product Support Management, Supply Support, Support Equipment, Sustaining Engineering, Technical Data Management, and Training & Training Support.

APPENDICES:

1 – Army Terms and Definitions

2 – Navy Terms and Definitions

3 – Marine Corps Terms and Definitions

4 – Air Force Terms and Definitions

Appendix 1 to Annex G

Army Terms and Definitions

1. Purpose. This Appendix provides the RAM, ILS and MANPRINT (HSI) terms and definitions used most often within the Army in accordance with AR 73-1 (Test and Evaluation Policy), AR 700-127 (Integrated Logistics Support), AR 602-2 (Manpower and Personnel Integration in the System Acquisition Process), HQ TRADOC Guidelines for Developing Failure Definition & Scoring Criteria, and TRADOC/AMC PAMPHLET 70-11.

2. Definitions.

a. Crew Correctable Maintenance Demand (CCMD). CCMDs result from failures corrected by the systems crew within guidelines determined by the combat developer, taking into account the impact on system performance and mission accomplishment.

b. Customer Wait Time (CWT). The supply chain performance metric which measures total customer response time (the time required to satisfy a supply request from the end user level). CWT measures pipeline performance from the unit's perspective. CWT commences when a requirement is created by an entry in the Unit Level Logistics System (ULLS) / Standard Army Maintenance System (SAMS)/ Standard Property Book System-Redesign (SPBS-R) and stops when these unit-level systems acknowledge receipt to Standard Army Retail Supply System (SARSS). It includes all requisitions filled by Supply Support Activity (SSA) which includes those items stocked at the SSA as well as those acquired through the wholesale system.

c. Detailed Test Plan (DTP). A plan used to supplement the Test Design Plan (TDP) with information required for day-to-day conduct of the test. It provides requirements for activities to be conducted to ensure proper execution of the test. The DTP is a document compiled by the activity responsible for test execution.

d. Durability. A special case of reliability; the probability that an item will successfully survive to its projected life, overhaul point, or rebuild point (whichever is the more appropriate durability measure for the item) without a durability failure. (See Durability Failure.)

e. Early Operational Assessment Report (EOA Report). An EOA Report documents the analyses, conducted in accordance with an approved TDP, of a system's progress in identifying operational design constraints, developing system capabilities, and mitigating program risks. For systems that enter the defense acquisition system at Milestone B, the lead OTA will, as appropriate, present the EOA results. The EOA Report will be completed after program initiation and prior to the Critical Design Review. The EOA Report is equivalent to the OTA Assessment Report (OAR) or if provided in support of a Milestone B, the EOA Report is equivalent to an OTA Milestone B Assessment Report (OMAR).

f. Essential Function Failure (EFF). Any incident or malfunction of the system that causes (or could have caused) the loss of one or more essential functions or degradations of an EFF below specified levels. An EFF prevents the system from being fully mission capable (FMC) under wartime definitions. EFFs of such degree that cause the system to be not mission capable (NMC) are also defined as System Aborts (SA).

g. Essential Logistics Demand (ELD). A measure of the impact on supply channels which meets the DoD guidance for a logistics reliability parameter. ELDs include all Essential Unscheduled Maintenance Demands (EUMD) that require parts or line-replaceable units (LRU) and all scheduled maintenance demands that require parts or LRUs. ELDs also include CCMD that use parts from the Basic Issue Item (BII). This category does not include operator or crew level preventive maintenance checks and services (PMCS), although it may include items/parts consumed during the conduct of PMCS.

h. Essential Unscheduled Maintenance Demand (EUMD). An unscheduled maintenance event resulting from an essential function failure or system abort. Fully redundant component failures, while not causing the loss of a mission essential function due to redundancy, should be classified in this category since they are necessary for the system to be fully capable. An EFF that is corrected by the crew/operator (and authorized in the technical manual or other applicable document), generates both an EUMD and a CCMD.

i. Failure. The event, or inoperable state, in which an item or part of an item does not, or would not, perform as specified. (See MIL-STD-721)

j. Failure, Durability. A malfunction that precludes further operation of the item, and is great enough in cost, safety, or time to restore, that the item must be replaced or rebuilt.

k. Failure Factor (FF). The average number of critical item demands or removals per 100 end items per year.

l. Failure Mechanism. The mechanism through which failure occurs in a specified component (for example, fatigue, fracture, or excessive wear). (See MIL-STD-721.)

m. Fill Rate. The percentage of time that demands are satisfied from items in stock. The metric can be calculated by dividing the number of incidents when parts sought from the stock point were on hand by the number of total incidents when parts were requested from the stock point.

n. Inherent RAM Value. Any measure of RAM that includes only the effects of an item design and its application and assumes an ideal operating and support environment.

o. Logistics Demand (LD). A measure of the total impact on supply channels which meet the DoD guidance for a logistics reliability parameter. LDs are more encompassing than ELDs, since they include all UMDs which require parts or LRU and all scheduled maintenance demands which require parts or LRUs. ELDs also include CCMDs that use parts from the BII. It does not include PMCS or maintenance that does not require parts.

p. Logistics Footprint. The government/contractor size of logistics support required to deploy, sustain, and move a weapon system for a given mission profile. Measurable elements should include, but not be limited to: inventory/equipment, personnel, facilities, transportation assets, supply, and real estate. Measures should quantify the footprint, i.e., weight, area, volume, and personnel etc., as appropriate.

q. Logistics Response Time (LRT). The period of calendar time from when a failure/malfunction is detected and validated by the maintainer to the time that the failure/malfunction has been resolved. This includes: the time from when a need is identified until the provider satisfies that need, all associated supply chain and maintenance time, and delivery times of parts.

LRT = Date (or time) of satisfaction of the logistics demand - Date (or time) of issue of logistics demand

r. Maintainability. A measure of the ability of an item to be retained in, or restored to, a specified condition when maintenance is performed by personnel having specified skill levels using prescribed procedures.

s. Maintenance Ratio (MR). A measure of the maintenance manpower required to maintain a system in an operational environment. It is expressed as the cumulative number of direct maintenance man-hours (see AR 570-2) during a given period, divided by the cumulative number of system life units (such as hours, rounds, or miles) during the same period. The MR is frequently expressed by individual maintenance level; e.g., Crew, Maintainer, Field Level, Below Depot, Depot, and Sustainment levels of maintenance (See DA PAM 750-1). Additionally, it may be stratified by scheduled and unscheduled. All maintenance actions are considered (that is, scheduled, as well as corrective, and without regard to the effect on mission or availability of system). Man-hours for off-system repair of replaced components are included in the MR for the respective level.

t. Maintenance Task Distribution (MTD). This reflects the percent of time that an item is repaired at each maintenance support level and the percent of time the item is replenished.

u. MANPRINT. The comprehensive technical effort to identify and integrate all relevant information and considerations regarding the full range of manpower, personnel capabilities, training, HFE, system safety, health hazards, and Soldier survivability into the system development and acquisition process to improve Soldier performance, total system performance, and reduce the cost of ownership to an affordable level throughout the system's entire lifecycle (AR 606-2). MANPRINT is the Army's process for HSI.

(1) Manpower. The personnel strength (military and civilian) that is available to the Army. Manpower refers to the consideration of the net effect of Army systems on overall human resource requirements and authorizations (spaces) to ensure that each system is affordable from the standpoint of manpower. It includes analysis of the number of people (including contractors) needed to operate, maintain, repair, and support each new system being acquired, including maintenance and supply personnel, and personnel to support and conduct training. It requires a determination of the Army manpower changes generated by the system, comparing the new manpower needs with those of the old systems being replaced, and an assessment of the impact of the changes on the total manpower limits of the Army.

(2) Personnel. Military and civilian persons (including contractors) of the aptitudes and grades required to operate, maintain, and support a system in peacetime and war. Personnel refers to the consideration of the ability of the Army to provide qualified people in terms of

specific aptitudes, experiences, and other human characteristics needed to operate, maintain, and support Army systems. It requires detailed assessment of the aptitudes that Soldiers must possess in order to complete training successfully and operate, maintain, and support the system to the required standard. Iterative analyses must be accomplished for the system being acquired, comparing projected quantities of qualified personnel with the requirements of the new system, any systems being replaced, and overall Army needs for similarly qualified people. Personnel analyses and projections are needed in time to allow orderly recruitment, training, and assignment of personnel in conjunction with system fielding.

(3) Training. Consideration of the necessary time and resources required to impart the requisite knowledge, skills, and abilities to qualify Army personnel for operation, maintenance, and support of Army systems.

(4) Human Factors Engineering (HFE). The technical effort to integrate design criteria, psychological principles, human behavior, capabilities, and limitations as they relate to the design, development, test, and evaluation of systems. The HFE goals are to maximize the ability of Soldiers to perform at required levels by eliminating design-induced errors, and to ensure that system operation, maintenance, and support are compatible with the capabilities and limitations of the range of fully-equipped Soldiers who would be using such systems. HFE provides an interface between the other MANPRINT domains and system engineers. HFE supports the MANPRINT goal of developing equipment that will permit effective Soldier-machine interaction within the allowable established limits of training time, Soldier aptitudes and skill, physical endurance, physiological tolerance limits, and Soldier physical standards. HFE provides this support by determining the Soldier's role in the system, and by defining and developing Soldier-machine interface characteristics, workplace layout, and work environment.

(5) System Safety. The application of engineering and management principles, criteria, and techniques to optimize safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system lifecycle.

(6) Health Hazards. The inherent conditions in the use, operation, maintenance, repair, support, storage, disposal of a system, or the test environment (e.g., acoustical energy, biological substances, chemical substances, oxygen deficiency, radiation energy, shock, temperature extremes, trauma, or vibration) that can cause death, injury, illness, disability, or reduce job performance of personnel.

(7) Soldier Survivability. Addresses the characteristics of a system that can reduce fratricide, as well as reduce detectability of the Soldier, prevent attack if detected, prevent damage if attacked, minimize medical injury if wounded or otherwise injured, and reduce physical and mental fatigue. It also includes those factors (combat ensemble, training, or combat equipment) that enable Soldiers to withstand or avoid adverse military action or the effects of natural phenomena that would result in the loss of capability to continue effective performance of the prescribed mission.

v. Materiel Availability (A_m). A measure of the percentage of the total inventory of a system that is operationally capable (ready for tasking) of performing an assigned mission at a given time, based on materiel condition. A_m addresses the total population of end items planned

for operational use, including those temporarily in a non-operational status once placed into service (such as for depot-level maintenance). The total life-cycle timeframe, from placement into operational service through the planned end of service life, must be included. An instantaneous point estimate for A_m can be expressed as:

$$A_m = \frac{\text{Number of Operational End Items (Ready for Tasking)}}{\text{Total population of End Items.}}$$

Equations expressing an average A_m over a period of time are only valid if the assumptions listed for the A_o closed form equations hold. The Army OTA recommends modeling and simulation as a means to address the complexities that arise from various life-cycle events such as training cycles, deployments, resets, etc., that can affect availability. It is ATEC policy that modeling and simulation be used to evaluate A_m as part of the sustainment KPP.

w. Maximum Time To Repair (MaxTTR). The time below which a specified percentage of all corrective maintenance tasks must be completed. When stated as a requirement, the MaxTRR should be stated for Field Level and Sustainment or Crew, Maintainer, Below Depot, and Depot levels of maintenance. MaxTRR is used as an "on-system" maintainability parameter; it is not used for the off-system repair of replaced components.

x. Mean Time Between Essential Function Failure (MTBEFF). A measure of operational effectiveness that represents the frequency a system would be unable to fully perform any essential functions at or above specified levels.

y. Mean Time Between Essential Maintenance Actions (MTBEMA). For a particular measurement interval, the total number of system life units (hour, mile, round, etc.) divided by the total number of non-deferrable maintenance actions. This parameter indicates the frequency of demand for essential maintenance support and includes incidents caused by accidents, maintenance errors, and item abuse. (Not included are crew maintenance completed within a specified number of minutes, maintenance deferrable to the next scheduled maintenance, system modification, and test-peculiar maintenance.)

z. Mean Time Between Operational Mission Failure (MTBOMF)/Mean Time Between Mission Affecting Failure (MTBMAF). A measure of operational suitability that considers the inability to perform one or more mission-essential functions.

aa. Mean Time Between System Abort (MTBSA). A measure of operational effectiveness that reflects the frequency a commander would remove a system from the ongoing mission and/or not begin another mission.

bb. Mean Time Between Unscheduled Maintenance Actions (MTBUMA). Computed by the following formula:

$$\text{MTBUMA} = \frac{\text{Operating Time}}{\text{Total Number of Unscheduled Maintenance Actions}}$$

cc. Mean Time To Repair (MTTR). The sum of corrective maintenance times divided by the total number of corrective maintenance actions during a given period of time under stated

conditions. MTTR may be used to quantify the system's maintainability characteristic. MTTR applies to the system-level configuration; it will be used as an "on-system" maintainability index and not for the repair of components. MTTRs will be stated for the unit and the intermediate direct support levels of maintenance along with the percentage of all actions performed at each level.

dd. Mission Reliability (Rm). A measure of operational effectiveness. It is stated in terms of a probability of completing a specified mission profile or as a function of the mean time (or distance or rounds) between critical failures.

ee. Mission-Essential Functions. The minimum operational tasks that the system must be capable of performing to accomplish its mission profiles.

ff. No Evidence of Failure Rate (NEOF). A measure of false pull removals causing item demands when a failure did not occur to the item. This is a function of fault diagnosis and maintenance impacted by Built-In Test (BIT)/BITE, TMDE, and TM repair procedures.

gg. Non-Essential Unscheduled Maintenance Demand (NUMD). A NUMD results from an incident requiring unscheduled maintenance that can be deferred until the next scheduled maintenance service at the prescribed level of maintenance. NUMDs can be deferred indefinitely or until the next scheduled service without impacting the system's essential functions, causing danger to the crew, or causing potential damage to the system.

hh. Not Mission Capable Maintenance (NMCM). The time (days or hours) the system is inoperable due to delays in maintenance that are attributable to delays in obtaining maintenance resources (personnel, equipment, or facilities).

ii. Not Mission Capable Supply (NMCS). The percentage of time (days or hours) the system is not capable of performing any of their assigned mission(s) because of maintenance work stoppage due to a supply shortage. NMCS exists when the parts are needed for immediate installation on or repair of primary weapons and equipment under the following conditions: (1) Equipment is deadlined for parts (2) Aircraft is out of commission for parts (3) Engine is out of commission for parts, etc.

jj. Off-System Maintenance. Maintenance associated with the diagnosis and repair of components for return to stock.

kk. On-System Maintenance. Maintenance necessary to keep a system in, or return a system to, an operating status.

ll. Operational Assessment Report (OA Report). An OA Report addresses the progress toward achieving system requirements and resolution of issues. The scope of issues to be addressed by the OA Report is flexible in that it may or may not cover all aspects of operational effectiveness, operational suitability, and survivability. An OA Report may address technical aspects of a system. For example, it may provide a program manager with an assessment of a system's exit criteria (some level of demonstrated performance) or an indication that a system is progressing satisfactorily. An OA Report is not required for programs that enter the defense acquisition system at Milestone C (e.g., commercial-off-the-shelf and non-developmental items).

For an acquisition program employing the incrementally deployed software intensive program model, a risk-appropriate OA Report is usually required in support of every limited deployment. The OA Report is typically produced as input to non-milestone decisions or inquiries and to support system evaluation. The OA Report is equivalent to the OTA Assessment Report (OAR) unless provided in support of a Milestone C, in which case it is equivalent to the OTA Milestone C Assessment Report (OMAR).

mm. Operational Availability. The proportion of time a system is either operating, or is capable of operating, when used in a specific manner in a typical maintenance and supply environment. All calendar time when operating in accordance with wartime operational mode summary/mission profile (OMS/MP) is considered. The formula is as follows:

$$A_o = \frac{OT + ST}{OT + ST + TCM + TPM + TALDT}$$

$$= \frac{\text{Total Calendar Time minus Total Downtime}}{\text{Total Calendar Time}}$$

Where:

OT = The operating time during OMS/MP
ST = Standby time (not operating, but assumed operable) during OMS/MP
TCM = The total corrective maintenance downtime in clock hours during OMS/MP
TPM = The total preventive maintenance downtime in clock hours during OMS/MP
TALDT = Total administrative and logistics downtime (caused by OMFs) spent waiting for parts, maintenance personnel, or transportation during OMS/MP. (Note that events attributed to downtime may consist of System Aborts, Mission Affecting Failures, Essential Function Failures, and Essential Maintenance Actions and are system specific dependent on that system's formally defined Failure Definition/Scoring Criteria.)

These closed-form equations are valid when a number of specific assumptions hold and when the system matures to the point that a steady-state behavior develops. The assumptions that must be valid include: 1) the time between failures, times to repair, and ALDT are each exponentially distributed and 2) there is no competition for parts and maintenance resources between individual items. The Army OTA recommends modeling and simulation as a means to address the complexities that arise when the assumptions are not applicable. It is ATEC policy that modeling and simulation be used to evaluate A_o as part of the sustainment KPP. Other forms of this equation are substituted depending on the system type (See AMC/TRADOC PAM 70-11) such as the inclusion of relocation time.

nn. Operational Mission Failure (OMF)/Mission Affecting Failure (MAF). Any incident or malfunction of the system that causes (or could cause) the inability to perform one or more designated mission-essential functions.

oo. Operational RAM Value. Any measure of RAM that includes the combined effects of item design, quality, installation, environment, operation, maintenance, and repair. This measure

encompasses hardware, software, crew, maintenance personnel, equipment publications, tools, TMDE, and the natural, operating, and support environments.

pp. Order and Ship Time (OST) to a designated level of supply. Average time from order placement to receiving the shipment at designated supply level.

qq. Ownership Cost Key System Attribute (KSA). Ownership Cost provides balance to the sustainment solution by ensuring that the operations and support (O&S) costs associated with Availability are considered in making decisions. For consistency, and to capitalize on existing efforts in this area, the Cost Analysis Improvement Group O&S Cost Estimating Structure will be used in support of this KSA. As a minimum, the following cost elements are required: 2.0 Unit Operations (2.1.1 (only) Energy (fuel, petroleum, oil, lubricants, electricity)); 3.0 Maintenance (All); 4.0 Sustaining Support (All except 4.1, System Specific Training); 5.0 Continuing System Improvements (All). Fuel costs will be based on the fully burdened cost of fuel. Costs are to be included regardless of funding source. The O&S value should cover the planned lifecycle timeframe, consistent with the timeframe used in the Materiel Availability metric. Sources of reference data, cost models, parametric cost estimating relationships, and other estimating techniques or tools must be identified in supporting analysis. Programs must plan for maintaining the traceability of costs incurred to estimates and must plan for testing and evaluation. The planned approach to monitoring, collecting, and validating operating and support cost data to supporting the O&S must be provided. Development of the Ownership Cost metric is a program manager responsibility.

rr. Reliability KSA. Reliability is a measure of the probability that the system will perform without failure over a specific interval. Reliability must be sufficient to support the warfighting capability needed. Considerations of reliability must support both Availability metrics. Reliability may initially be expressed as a desired failure-free interval that can be converted to a failure frequency for use as a requirement (e.g., 95 percent probability of completing a 12-hour mission free from mission-degrading failure; 90 percent probability of completing five sorties without failure). Specific criteria for defining operating hours and failure criteria must be provided together with the Reliability. Single-shot systems and systems for which other units of measure are appropriate must provide supporting analysis and rationale. Development of the Reliability metric is a requirements manager responsibility.

ss. Reliability after Storage. This may be a stated requirement. If appropriate, it specifies the amount of deterioration acceptable during storage. Length of storage, storage environment, and surveillance constraints are identified. This requirement may not be testable; it may rely on an engineering analysis for its assessment before deployment.

tt. Repair Cycle Time (RCT). The elapsed time (days or hours) from the induction of the unserviceable item located at the repair facility/maintenance unit until the item is repaired and placed in stock or reissued. Retrograde time for a given item may need to be added to establish a complete RCT.

uu. Requisition Wait Time (RWT). An Army supply chain metric which measures the elapsed time required to satisfy an SSA requisition that must be sourced from either wholesale or

referral process. RWT measures source of fill performance from the SSA perspective. The RWT is composed of the several pipeline segments as shown in supporting metrics.

vv. Retrograde Ship Time (RST). The average elapsed time from an item failure to the receipt of the item by the maintenance echelon specified to repair the item.

ww. Scheduled Maintenance Demand (SMD). SMDs result from regularly scheduled service, as well as "on-condition" maintenance (usage, wear, etc.), such as tire or track replacement based on documented replacement criteria. Crew preventive maintenance, checks, and services (PMCS) are also considered scheduled maintenance. (PMCS is normally not considered when calculating maintenance ratios.) To qualify as an SMD, the incident must meet the necessary intervals/conditions/durability requirements as defined in the technical documentation for the system.

xx. Stock Availability (SA) at designated level of supply. Percentage of time an order is filled immediately at designated level of supply support.

yy. Sustainment Key Performance Parameter (KPP). The Sustainment KPP is intended to ensure an adequate quantity of the capability solution will be ready for tasking to support operational missions. It is comprised of two KPP-level parameters: Materiel Availability (AM) and Operational Availability (AO). The KPP also contains two mandatory KSAs: Reliability and Operations and Support Costs.

zz. System Abort (SA). Any incident or malfunction of the system that causes (or could have caused) the system to be removed from the ongoing mission and/or not begin another mission. All SAs are also EFF. A SA renders the system NMC under wartime definitions.

aaa. System Evaluation Plan (SEP). The SEP documents the evaluation strategy and overall test/simulation execution strategy effort of a system for the entire acquisition cycle through fielding. Integrated T&E planning is documented in a SEP. The detailed information contained in the SEP supports parallel development of the TEMP and is focused on evaluation of operational effectiveness, operational suitability, and survivability. While the documents are similar, the TEMP establishes "what" T&E will be accomplished and the SEP explains "how" the T&E will be performed.

bbb. System Evaluation Report (SER). The SER documents the independent evaluation and formal position of a system's operational effectiveness, operational suitability, and survivability to decision makers at the Full Rate Production (FRP)/Full Deployment (FD) decision reviews. It addresses and answers the COIC and additional evaluation focus areas in the SEP based on all available credible data and the system evaluator's analytic treatment of the data. The SER is equivalent to the OTA Evaluation Report (OER) and OTA Follow-on Evaluation Report (OFER) if post FRP/FD.

ccc. Test Design Plan (TDP). A TDP contains information on test design, factors and conditions, methodology, scenarios, instrumentation, simulation and stimulation, data management, and all other requirements necessary to support the evaluation requirements stated in the SEP. The TDP is the primary T&E planning document used by ATEC.

ddd. Turnaround Time (TAT). The average time required to complete a logistics task or service. In the case of maintenance, TAT is the average time required to receive an item from a unit, perform repairs on the item and make the item available to the unit or place the serviceable item back into the inventory.

Appendix 2 to Annex G

Navy Terms and Definitions

1. Purpose. This Appendix provides the RAM terms used within the Navy when conducting and reporting OT&E activities in accordance with this MOA to assist other Services in understanding RAM terms as used by the Navy.

2. Suitability Calculations.

a. Reliability. The parameters for addressing reliability are mission reliability (R) and mean time between operational mission failures (MTBOMF).

(1) R is the probability that the system will complete a mission without an operational mission hardware failure or operational mission software fault. R is recommended for systems that are operated only during a relatively short duration mission (as opposed to operating more or less continuously).

$$R = \frac{\text{Number of Missions Without an Operational Mission Hardware Failure or Software Fault}}{\text{Total Number of Missions}}$$

(2) MTBOMF is used for more or less continuously operating systems and is addressed using the following parameters:

(a) MTBOMF-Hardware (MTBOMF $_{HW}$). MTBOMF $_{HW}$ is the mean time between operational mission hardware failures occurring during system operation and is calculated as:

$$MTBOMF_{HW} = \frac{\text{Total System Operating Time}}{\text{Number of Operational Mission Hardware Failures}}$$

Where an operational mission hardware failure is one which prevents the system from performing one or more mission essential functions. System operating time includes only the time the system is operating and being stressed under operational loads. It does not include standby time. For aircraft, system operating time is from the attempt to start the aircraft with the intent to perform a mission until engine shutdown.

(b) MTBOMF-Software (MTBOMF $_{SW}$). MTBOMF $_{SW}$ is the mean time between operational mission software faults. A software fault is any interruption of system operation not directly attributable to hardware, and is calculated as:

$$MTBOMF_{SW} = \frac{\text{Total System Operating Time}}{\text{Number of Operational Mission Software Faults}}$$

(c) MTBOMF-System ($MTBOMF_{SYS}$). $MTBOMF_{SYS}$ is the mean time between operational mission hardware failures and operational mission software faults which occur during system operation and is calculated as:

$$MTBOMF_{SYS} = \frac{\text{Total System Operating Time}}{\text{Total Number of Operational Mission Hardware Failures + Software Faults}}$$

As a general rule, $MTBOMF_{SYS}$ should not be used as a test measure when $MTBOMF_{HW}$ and/or $MTBOMF_{SW}$ can be used instead.

(d) Mission Completion Rate (MCR). MCR is for multi-mission systems with short mission duration (whole aircraft), and is calculated as:

$$MCR = \frac{\text{Number of Missions Successfully Completed}}{\text{Number of Missions Attempted}}$$

A mission is not successfully completed when it is aborted due to the occurrence of a system failure that precludes the system from performing the assigned mission. The number of missions attempted includes only those missions in which factors beyond the design control of the system, such as range delays or asset non-availability, do not impede the successful completion of the mission. MCR is rare, and, when used, should be in conjunction with one of the other reliability measures.

(e) Mean Time Between Unscheduled Maintenance/Mean Flight Hours Between Unscheduled Maintenance (MTBUM/MFHBUM). These are measures of the time (flight hours) between unscheduled maintenance actions (may or may not be hardware failure related) compared to total operating time.

$$MTBUM / MFHBUM = \frac{\text{Total System Operating Hours (Flight Hours)}}{\text{Number of Unscheduled Maintenance Actions}}$$

MTBUM/MFHBUM will be thresholded and reported on a case-by-case basis.

b. Maintainability. The parameters for addressing maintainability are mean corrective maintenance time for operational mission failures (MCMTOMF), maximum corrective maintenance time for operational mission failures (MaxCMTOMF), mean corrective maintenance time for operational mission faults-software ($MCMTOMF_{SW}$), MRT, BIT, and MR.

(1) MCMTOMF is the average elapsed corrective maintenance time needed to repair all operational mission hardware failures. It includes time for maintenance preparation, fault location and isolation, on-board parts procurement, fault correction, adjustment and calibration, as well as follow-up checkout time. It does not include off-board logistic delay time.

$$MCMTOMF = \frac{\text{Total Elapsed Time to Correct Operational Mission Failures}}{\text{Total Number of Operational Mission Failures}}$$

Onboard logistic delay is the logistic delay associated with obtaining the spare part at the unit or organizational level. For aircraft systems, the squadron will be considered the unit level. Therefore; MCMTOMF will be calculated as the mean of the elapsed maintenance time (block A45 of the maintenance action form).

(2) MaxCMTOMF is that time below which a specified percentage of corrective maintenance tasks must be completed to restore the system to operation after an OMF; e.g., 90 percent of all corrective maintenance times for operational mission hardware repairs will be less than MaxCMTOMF. This parameter is recommended when the time required to repair and restore the system due to operational urgency is considered an important aspect of the system under test.

(3) $MCMTOMF_{SW}$ is the average elapsed time needed to restore a software-intensive system following an operational mission software fault. The system is considered to be restored when a tactical picture that is useful to the tactical action officer/operator is first established. This may include the time to restore all processes, functions, files, and databases to a tactically useful state as well as the time required to physically reboot the system following an operational mission software fault.

It does not include the time to obtain spare parts or utilize the expertise of personnel outside the unit or organizational level. For aircraft systems, the unit level will be the squadron.

$$MCMTOMFsw = \frac{\text{Total Elapsed Time to Restore Software - Intensive Systems After an Operational Mission Software Fault}}{\text{Total Number of Operational Mission Software Faults}}$$

(4) MRT is the average elapsed time required to reboot a software-intensive system. MRT is addressed as cold start MRT (MRT_C) and warm start MRT (MRT_W). Both MRT_C and MRT_W include only the time necessary to physically reboot the system, not the time required for restoration of the tactical picture as in $MCMTOMF_{SW}$.

$$MRT = \frac{\text{Total Elapsed Time to Reboot a Software - Intensive System}}{\text{Total Number of Software Reboots}}$$

(5) BIT is addressed using these parameters: Pcd; Pcfi; and probability of a False Alarm (FA). It is recommended that all three equations be used together to ensure a complete picture of BIT performance.

(a) Pcd is a measure of BIT's capability to detect failures/faults and is calculated as:

$$Pcd = \frac{\text{Number of Failures/ Faults Correctly Detected by BIT}}{\text{Number of Actual System Failures/ Faults}}$$

(b) Pcfi is a measure of BIT's capability to isolate the failure/fault to a specified replaceable assembly and is calculated as:

$$Pcfi = \frac{\text{Number of Failures/Faults Correctly Isolated}}{\text{Total Number of Failures/Faults Correctly Detected by BIT}}$$

(c) FA is the measure of BIT indicating a failure/fault when none has occurred and is calculated as:

$$FA = \frac{\text{Number of Incorrect BIT Failure/Fault Indications}}{\text{Total Number of BIT Failure/Fault Indications}}$$

For system tests with few BIT failure indications, the FA rate may not provide an accurate measure of false alarms. The Operational Test Director may also calculate the number of False Alarms per System Operating Hour (FAh).

$$FAh = \frac{\text{Number of Incorrect BIT Failure/Fault Indications}}{\text{Total Number of Operating Hours}}$$

(d) MR is a measure of the ratio of total maintenance man-hours required to perform required preventive maintenance and repair all hardware failures to operating/flight hours and is calculated as:

$$MR = \frac{\text{Total Maintenance Man - Hours to Accomplish Required Preventive Maintenance and Repair all Failures}}{\text{Total System Operating / Flight Hours}}$$

c. Availability. The parameter for addressing operational availability is A_o.

(1) For continuously operating systems, A_o is calculated as:

$$A_O = \frac{\text{Uptime}}{\text{Uptime} + \text{Downtime}}$$

Where uptime is that time when the system is considered to be ready for use and is either operating, in standby, or off. Downtime is the time the system is down for repair of operational mission hardware failures and/or for restoration from operational mission software faults, including off-board logistic delays. It also includes planned maintenance time with a periodicity less than or equal to the test duration time that prevents the system from performing its assigned mission. Planned maintenance time that is of periodicity greater than the test duration time is considered neutral time and is not included in the availability calculation.

(2) For on-demand systems, A_o is calculated as:

$$A_O = \frac{\text{Number of Times System was Available}}{\text{Number of Times System was Required}}$$

Where the number of times the system was required shall include the number of times it was operationally required but not used because the system was known to be inoperable.

(3) For multi-mission systems (i.e., whole aircraft, ships, or submarines) the measures of availability are full mission capable (FMC), partial mission capable (PMC), and mission capability by mission area (MC_{MA}).

(a) FMC is defined as the material condition of a system in which it can perform all of its missions. FMC is calculated as:

$$FMC = \frac{Uptime}{Uptime + Downtime}$$

Where uptime is the time the test system is capable of performing all its missions as defined by the MC_{MA} mission areas.

(b) PMC is defined as the material condition of a system in which it can perform at least one of its missions. PMC is calculated as:

$$PMC = \frac{Uptime}{Uptime + Downtime}$$

Where uptime is the time the system is capable of performing at least one of its missions as defined by the MC_{MA} mission areas.

(c) MC_{MA} is a measure of the system's capability to perform a specified mission and is calculated as:

$$MC_{MA} = \frac{Uptime}{Uptime + Downtime}$$

Where uptime is the time the test system is capable of performing a specified mission. For aircraft, mission areas will be determined from the aircraft type Mission Essential Subsystem Matrices (MESM) in accordance with OPNAVINST 5442.4 series, as supplemented by operational experience.

NMC would be a measure of the proportion of time during which a system can perform none of its missions. Since NMC is the complement of PMC (i.e., NMC = 1 - PMC), there is no need to use NMC. When calculating FMC and PMC, it may be useful to refer to "NMC time," which would be equivalent to PMC downtime. But, take care not to confuse terms for the measures with terms for system states or time accounting.

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Appendix 3 to Annex G

Marine Corps Terms and Definitions

1. Purpose. This Appendix provides RAM definitions and quantitative MOSs for USMC test plans and reports.

2. Background. Effective testing and evaluation of a system can only be accomplished if all system peculiar terms and MOSs are defined and understood during the test design. Definitions and the selection of MOSs cannot be changed subsequent to the start of a test without running the risk of either invalidating the data already collected or biasing the subsequent data collection effort and analysis. Every OER should interpret the MOSs to present a meaningful picture of the impact of the evaluation to the decision makers.

3. Definitions. Definitions are organized into four sections: time, reliability, availability, and maintainability. Within each category, terms and MOSs are listed and defined. Note that the acronyms and equations used are consistent with notations in the 1982 DoD RAM Primer and TRADOC/AMC PAMPHLET 70-11. The terms "item" and "system" are used interchangeably throughout.

a. Time. Time that elapses during a test can be measured and classified in many ways. Figure 3-1 illustrates the time relationships within a test. Table 3-1 is a legend for Figure 3-1 (next page). Note that some time classifications may not apply to a specific system. Boxes within the figure are mutually exclusive.

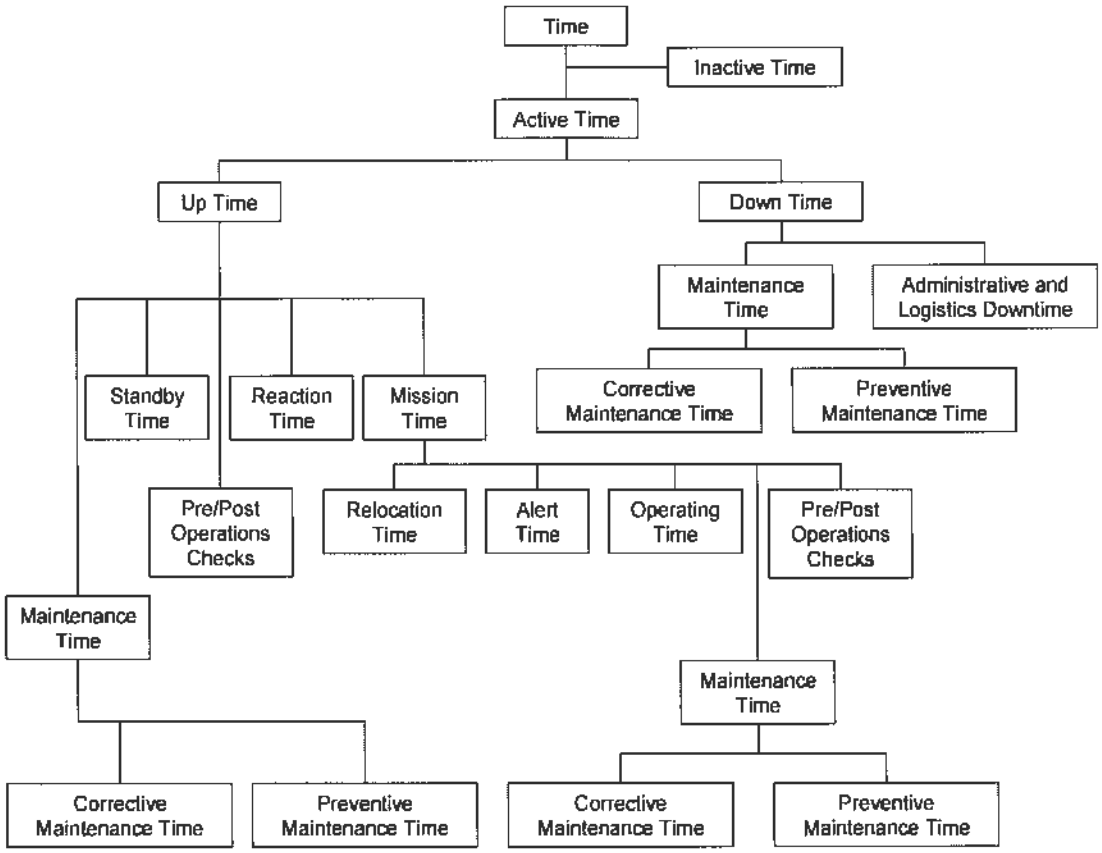

Figure 3-1. Test Time Classifications

Table 3-1. Test Time Classifications

• Active Time: That time during which an item is in an operational inventory. The item is assigned to an operational unit that uses the item to accomplish the mission for which it was designed.
• Administrative and Logistic Downtime (ALDT): That portion of downtime caused by the administrative and logistics reasons. Active maintenance is not being performed on the downed piece of equipment. ALDT delays can occur while waiting for parts, maintenance personnel, or transportation.
• Alert Time: That element of uptime during which an item is required to be in a specified operating condition and is awaiting a command to actively support users in the performance of the intended mission. Alert Time occurs when a system is operational and in support of a specific mission profile but is not actually being employed. The system is awaiting the command to continue functioning in support of the specific mission intended.
• Corrective Maintenance Time: That time spent on actions to restore an item to an operational condition such as a result of failure. This can occur during downtime, uptime, or mission time. Corrective maintenance that occurs during uptime or mission time is normally minor in nature and short duration.
• Down Time: That element of active time during which the system under test is not in condition to perform a mission essential function.
• Inactive Time: That time during which an item is in the inactive inventory. An example would be a maintenance float that is not assigned to an operational unit for employment on the missions for which it was designated.
• Mission Time: That element of uptime when the users are executing the intended mission.
• Operating Time: This is the time during a mission profile when the system is turned on and actively performing at least one, if not all, of its functions.
• Pre/Post Operation Checks: These are checks that are routinely accomplished prior to and just after operating a system on a mission. They can be accomplished either before or during mission time.
• Preventive Maintenance Time: That time used to perform actions in an attempt to retain an item in a specified condition by providing systematic inspection, detection, and prevention of imminent failures. These actions can occur during downtime, uptime, or mission time.
• Reaction Time: That element of uptime needed to initiate a mission, measured from the time the command is received.
• Relocation Time: That portion of mission time when a system is being moved from one location to another location where it is employed on a specific mission profile.
• Standby Time: The amount of time during a given period when a system is not operating, but assumed to be operable. Standby time does not occur when a system is committed to accomplishing a specific mission profile. Standby time is uptime when the system is not committed to a specific mission profile.
• Uptime: That element of active time during which an item is in condition to perform its required functions.

b. Reliability. Reliability consists of two major areas: mission reliability and logistics-related reliability.

(1) Mission Reliability. Mission reliability is the probability the system will perform Mission Essential Functions (MEFs) for a period of time under the conditions stated in the mission profile. Mission reliability can also be stated as the probability a system can complete its required operational mission without an OMF. An OMF is a failure that prevents the system from performing one or more MEFs. Two measures of mission reliability are mean time between operational mission failure and item reliability.

Mean Time Between Operational Mission Failure (MTBOMF). MTBOMF is the average amount of operating time between OMFs. Alternatively, time can be replaced with cycles, rounds, miles, etc. (i.e., MCBOMF, MRBOMF, MMBOMF, etc.), as appropriate for the system under test.

$$MTBOMF = \frac{OT}{\#OMFs}$$

Where:

OT is Operating Time; the time during a mission profile when the system is turned on and actively performing at least one, if not all, of its functions.

OMFs is the number of Operational Mission Failures.

Item Reliability (R). Item reliability is the probability that an item will perform its intended function for a specified interval under stated conditions. Generally this is the probability that an item will perform its MEFs for its specified Mission Duration (MD) under conditions corresponding to its mission profile as stated in the COE or OMS/MP. MD is the length of a mission as defined in the mission profile. All OMFs, regardless of chargeability, are used in the calculations. Depending upon the nature of the item, either a discrete or continuous reliability model will be used. Generally, the distribution of failure can be assumed to be binomial for discrete items, and exponential for continuous items. Other failure distributions may be used when appropriate.

Discrete Model.

$$R = \frac{Number\ of\ Successful\ Missions}{Total\ Number\ of\ Missions\ Attempted}$$

Continuous Model. In cases where the analyst can demonstrate that the distribution of times between failures is independent and exponentially distributed, the following equation may be used to express reliability:

$$R = 1 - F(MD) = e^{\left(\frac{-MD}{MTBOMF}\right)}$$

Where:

MD is mission duration.

MTBOMF is the Mean Time Between Operational Mission Failure

(2) Logistics Related Reliability. The probability that no corrective (or unscheduled) maintenance, unscheduled removals, and/or unscheduled demands for spare parts will occur following the completion of a specific mission profile.

Mean Time Between Unscheduled Maintenance Actions (MTBUMA). Average operating time between unscheduled maintenance actions:

$$MTBUM = \frac{OT}{\#UMA}$$

Where:

OT = Operating Time; the time during a mission profile when the system is turned on and actively performing at least one, if not all, of its functions.

UMAs = the number of unscheduled maintenance actions.

c. Availability. Availability is the probability that a system is operable and committable at the start of a mission when the mission is called for at a random point in time. There are three measures of availability: operational availability, inherent availability, and achieved availability.

(1) Operational Availability (A_o). A_o is availability during all segments of time when the equipment is intended to be operational. A_o provides the most realistic measure of availability of equipment deployed and functioning in a combat environment. However, one significant problem associated with determining A_o is the calculation of ALDT and Preventative Maintenance Time (PMT). Determining ALDT and PMT under combat conditions is not feasible in most instances and data collected during a test may not provide a good estimate. Either the discrete model (for on-demand equipment) or the continuous model of operational availability may be used, as appropriate.

Discrete Model.

$$A_o = \frac{Number\ of\ Times\ the\ System\ is\ Available}{Number\ of\ Times\ the\ System\ is\ Required}$$

Continuous Model.

$$A_o = \frac{UpT}{UpT + DnT} = \frac{OT + ST}{OT + ST + TCM + TPM + TALDT}$$

Where:

OT = The operating time during OMS/MP
ST = Standby time (not operating, but assumed operable) during OMS/MP
TCM = The total corrective maintenance downtime in clock hours during OMS/MP
TPM = The total preventive maintenance downtime in clock hours during OMS/MP
TALDT = Total administrative and logistics downtime (caused by OMFs) spent waiting for parts, maintenance personnel, or transportation during OMS/MP. (Note that events attributed to downtime may consist of Operational Mission Failures and Essential Maintenance Actions; and, are system specific dependent on that system's formally defined Failure Definition/Scoring Criteria.)

(2) Inherent Availability (A_i). A_i is availability, only with respect to operating time and corrective maintenance. A_i is useful in determining basic operational characteristics under conditions that might include testing in a contractor's facility or other controlled facility. A_i provides a very poor estimate of true combat potential for most systems, because it provides no indication of the time required to obtain necessary field support. This measure should normally not be used to support an operational test.

$$A_i = \frac{OT}{OT + TCM}$$

(3) Achieved Availability (A_a). A_a is a hardware-oriented measure primarily used during developmental testing and initial production testing when the system is not operating in its intended support environment. Excluded are operator maintenance checks, standby, and ALDT.

$$A_a = \frac{OT}{OT + TCM + TPM}$$

4.

d. Maintainability. The ability of an item to be retained in or restored to specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair. Maintainability consists of two major categories: maintenance and diagnostics.

(1) Maintenance

Levels of Maintenance. Marine Corps doctrinal maintenance levels may be used to categorize thresholds for maintainability MOS's. Table 3-2 includes the four levels of maintenance that are used. Table 3-2 is shown below.

Table 3-2. Doctrinal Levels of Maintenance

• Preventative Maintenance (PM): Specified maintenance actions to retain an item in a specified condition by systematic inspection, detection, and prevention of incipient failures (i.e., before, during, after and at halt checks and other similar actions requiring only first echelon maintenance)"
• Organizational Level Maintenance (OLM): OLM is authorized maintenance performed by the responsible using organization, on its own equipment. OLM consists of 1st and 2nd echelon maintenance.
• Intermediate Level Maintenance (ILM): Maintenance that is authorized by designated maintenance activities in support of using organizations. The principal function of ILM is to repair subassemblies, assemblies, and major items of equipment for return to a lower echelon or to supply channels. ILM consists of 3rd and 4th echelon maintenance.
• Depot Level Maintenance (DLM): Maintenance that is performed by designated industrial-type activities using production-line techniques programs and schedules. The principal function is to overhaul or completely rebuild parts. DLM is equivalent to 5th echelon maintenance.

Mean Time to Repair (MTTR). MTTR is the average of active corrective maintenance times. The time is clock time vice man-hours. Notations following the MTTR indicate maintenance levels: (O) for organizational, (I) for intermediate, or (D) for depot level.

$$MTTR = \frac{CMT}{Total\ Number\ of\ CM\ Actions}$$

Maximum Time to Repair (MaxTTR). MaxTTR is time below a specified percentage of all corrective maintenance tasks are completed. The time is clock time vice man-hours. Three types of qualifiers to MaxTTR are identified in Table 3-3.

Table 3-3. Three Qualifiers to MaxTTR

• Percentile: As a subscript between the "Max" and "CMT," a percentile may be specified. Example, $Max_{90}TTR$ indicates the 90th percentile CM period.
• Type of CM: Without a subscript, "MaxTTR" refers to all CM intervals. Example, "MaxTTR (Dn)" refers to TTR (Dn) intervals.
• Level of Maintenance: Indicated by letters in parentheses after TTR. MaxTTR (O) refers only to organizational level maintenance, while MaxTTR (I) refers to intermediate and MaxTTR (D) refers to depot level maintenance.

Maintenance Ratio (MR). Total man-hours of maintenance, per operating hour, including times for both preventive and corrective maintenance regardless of whether the systems is up or down.

$$MR = \frac{Total\ Man\text{–}hours\ of\ Maintenance}{OT}$$

Mean Restore Function Time (MRFT). The average of all restore function intervals. That is, the average interval between when a system or component computer begins to reboot (re-initialize) and when all its MEFS are restored. This is synonymous with the metric Mean Time to Restore Function (MTTRF). All intervals are elapsed clock times. Without a subscript, MRFT refers to the average of all restore function intervals. MRFT(Up) is the average of all restore function-equipment up intervals, while MRFT(Dn) is the average of all restore function-equipment down intervals.

(2) Diagnostics.

False Alarms (FA). False alarms are faults where, upon investigation, the fault cannot be confirmed. Measures of FA may be expressed as a total number, a percentage, a rate of occurrence, a probability of occurrence, etc.

Mean Time to Fault Locate (MTTFL). Average time to fault locate:

$$MTTFL = \frac{Total\ Time\ to\ Fault\ Locate}{Total\ Number\ of\ Faults}$$

Percent of Correct Detection (Pcd). Given that a fault has occurred, the proportion of faults correctly detected:

$$Pcd = \frac{Number\ of\ Correct\ Detections}{Total\ Number\ of\ Confirmed\ Faults} \times 100\%$$

Percent of Correct Fault Isolation (Pcfi). Given a correct detection, the proportion of correct fault isolations (and/or fault locations). "Fault isolation" and/or "fault location" must be clearly defined in the appropriate Capabilities Document and OTA test plan.

$$Pcfi = \frac{Number\ of\ Correct\ Fault\ Isolations\ and/or\ Locations}{Number\ of\ Correct\ Detections} \times 100\%$$

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Appendix 4 to Annex G

Air Force Terms and Definitions

1. Purpose. This Appendix provides the RAM terms and definitions that are most relevant to this MOA and used within the Air Force in conducting and reporting OT&E activity. They have been adapted from AF Pamphlet 63-128, Guide to Acquisition and Sustainment Life Cycle Management, 5 October 2009.

2. Definitions.

a. Break Rate. The percentage of sorties from which an aircraft returns with an inoperable, mission-essential system that was previously operable. Break rate includes "Code 3" conditions, such as ground and air aborts. Number of A/C breaks during a measurement period x 100 divided by number of sorties.

b. Fix Rate. The percentage of broken aircraft returned to flyable status in a certain amount of clock hours. For fighter aircraft, measurements are made at the 4- and 8-hour points. A broke aircraft is an aircraft that lands with an overall status of Code 3 (a grounding condition in which the aircraft is unable to meet at least one of its wartime missions). Number of aircraft fixed within "x" hours divided by total number of Broken A/C).

c. Logistics Reliability. Logistics reliability is the ability of a system to perform failure free, under specified operating conditions and time without demand on the support system. Typical measures include mean time between maintenance (MTBM), demand (MTBD), or removals (MTBR). They are defined as follows:

MTBM = Number of life units (flight hours, operating hours, possessed hours, etc.)/ Number of maintenance events, scheduled and/or unscheduled

MTBD = Number of life units (flight hours, operating hours, possessed hours, etc.)/ Number of spares consumed

MTBR = Number of life units (flight hours, operating hours, possessed hours, etc.)/ Number of item removals

d. Maintainability. The ability of an item to be retained in or restored to a specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

e. Mean Downtime (MDT). The average elapsed clock-time between loss of mission-capable status and restoration of the system to mission-capable status. This downtime includes maintenance and supply response, administrative delays, and actual on-equipment repair. In addition to the inherent repair and maintainability characteristics, mean downtime is affected by technical order availability, and adequacy, support equipment capability, and availability supply levels, and manning. Thus, MDT is not the same as the contractual term mean time to repair (MTTR).

f. Mean Repair Time (MRT). The average on-equipment, off-equipment, or both corrective maintenance times. It includes all maintenance actions needed to correct a malfunction, including preparing for test, troubleshooting, removing and replacing components, repairing, adjusting, re-assembly, alignment, adjustment, and checkout. MRT does not include maintenance, supply or administrative delays. MRT is defined as:

$$\text{MRT} = \frac{\text{Number of corrective repair hours}}{\text{Number of corrective maintenance events}}$$

NOTE: MRT differs from the contractual term Mean Time To Repair (MTTR) in that it measures maintenance activities that occur in the operational environment.

g. Mean Time Between Critical Failures (MTBCF). The average time between failure of mission-essential system functions. Critical failures do not have to occur during a mission, they merely must or could cause mission impact. MTBCF is defined as:

$$\text{MTBCF} = \frac{\text{Number of operating hours}}{\text{Number of critical failures}}$$

h. Mean Time Between Downing Event (MTBDE). The average time between events that bring a system down. Downtime can include critical or non-critical failures, preventative maintenance, training, maintenance and supply response, administrative delays, and actual equipment repair. Besides the inherent repair and maintainability characteristics, field conditions such as tech-order availability and adequacy, support equipment capability and availability, supply levels, manning, experience level, and shift structure also affect down times. MTBDE is defined as:

$$\text{MTBDE} = \frac{\text{Number of operating hours}}{\text{Number of downing events}}$$

i. Mean Time Between Failure (MTBF). MTBF is a measure of the average operating time between any failure of the system, excluding scheduled maintenance. It can be expressed as follows:

$$\text{MTBF} = \frac{\text{Operating Hours}}{\text{Number of PMCMU + NMCMU events}} \quad \text{or} \quad \frac{\text{Active hours} - (\text{NMC Hours / Number of Failures})}{\text{Number of PMCMU + NMCMU events}}$$

j. Mean Time to Restore Function (MTTRF). The average time required, as the result of a critical failure, to restore a system to full operating status. It includes administrative and logistics delay times associated with restoring function following a critical failure. MTTRF is defined as:

$$\text{MTTRF} = \frac{\text{Total critical restore time}}{\text{Number of critical failures}}$$

k. Measures of False Alarm (FA). A system-indicated malfunction that cannot be validated because no request for corrective maintenance follows. A 'Can Not Duplicate' differs from a false alarm in that it signifies a malfunction that cannot be confirmed. (AF Pamphlet 63-128, Integrated Life Cycle Management, 10 July 2014.)

l. Mission Reliability (MR). The probability that a system will perform satisfactorily for a given mission time when used under specified operational conditions. MR is expressed as Weapon System Reliability (WSR), Break Rate, Combat Rate, and MTBCF in accordance with AFPAM 63-128, Attachment 6 for various types of systems.

m. Operational Availability. The probability that a system can be used for any specified purpose when desired. It includes both the inherent reliability and maintainability parameters and logistics support effectiveness of the system that relates to the total time the system might be desired for use. A_o is defined as follows:

$$A_o = \frac{\text{Uptime}}{\text{Total Time}}$$

Which is equivalent to:

$$A_o = \frac{\text{MTBDE}}{\text{MTBDE} + \text{MDT}}$$

n. Uptime Ratio (UTR). The percentage of time that operational equipment is able to satisfy mission demands. UTR is similar to MC, except that system status depends on current use of the system, as well as the designated operational capability (DOC). For example, a system with several DOC missions can be MC if at least one of those missions can be accomplished. However, if an immediate need exists for a mission capability that is "down", the overall system is considered to be "down."

o. Weapon System Reliability (WSR). WSR is the probability that a system will perform satisfactorily for a given mission time when used under specified operational conditions. For aircraft and munitions, compute WSR by dividing the number of missions completed successfully by the number of missions attempted. Base WSR on a design reference mission profile to allow for translation of WSR into contractual requirements. Determine functional profiles for storage, build-up, preflight, takeoff, ingress, over-target, weapons delivery, egress, landing, and shutdown.

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