Department of the Army
United States Army Test and Evaluation Command
Alexandria, VA 23302-1458

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

Department of the Air Force
Headquarters Air Force Operational Test and Evaluation Center
Kirtland Air Force Base, NM 87117-5558

MEMORANDUM OF AGREEMENT

ON

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

AND

OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

October 2007

THIS PAGE INTENTIONALLY LEFT BLANK

1. INTRODUCTION

a. Purpose. This Memorandum of Agreement (MOA) provides a basic framework for Multi-Service Operational Test and Evaluation (MOT&E) conducted by two or more Service Operational Test Agencies (OTA) in a representative joint operational environment and in accordance with Department of Defense (DoD) Directive 5000.1, 14 May 03, *The Defense Acquisition System*; DoD Instruction 5000.2, 14 May 03, *Operation of the Defense Acquisition System*; National Security Space (NSS) 03-01 NSS Acquisition Policy, 28 Jul 2003; and DUSA (TE) memorandum, Subject, *Test and Evaluation (T&E) Policy for Chemical and Biological Defense Program (CBDP) Systems*, 23 Jul 07.

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

2. COMMON ELEMENTS OF MULTI-SERVICE OPERATIONAL TEST (OT).

a. Relationship between lead OTA and supporting OTAs.

(1) A lead OTA is designated by the Milestone Decision Authority (MDA), or as a result of Service initiatives, to be responsible for management of a MOT&E. 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 OTA 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 be chosen by OTA 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 (TE) memorandum, Subject, *Test and Evaluation (T&E) Policy for Chemical and Biological Defense Program (CBDP) Systems*, 23 Jul 07.

(2) The designated lead OTA will have the overall responsibility for management of the MOT&E program and will ensure that supporting OTA critical operational issues (COI) and requirements are included in formulation of basic resource and planning documents. The supporting OTAs will ensure their COIs and Service-unique requirements are made known, and will assist the lead OTA in execution of the MOT&E. Annex A contains guidelines with regard to duties and responsibilities of participants to consider in establishing and conducting all MOT&Es.

b. Test Management Council.

(1) Provisions will be made on every MOT&E program for a Test Management Council (TMC) to arbitrate all disagreements that cannot be resolved at the team level. The TMC will be composed of one senior representative from each supporting Service 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 supporting 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 Operational Test (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 lead OTA directives. The lead OTA invites supporting 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), test and evaluation Working-level IPT (T&E WIPT), integrated product teams (IPT), and program test integration working groups which produce a test and evaluation strategy (TES) per DoDI 5000.2. Supporting OTAs will participate early in MOT&E test planning and remain proactive throughout the test planning process. Safety will be addressed throughout all phases MOT&E test planning. The lead OTA will produce the OTA test plan.

e. Responsibilities.

(1) The lead OTA for a multi-Service program (Annex G, Glossary) is responsible for initiating the test and evaluation strategy (TES) and test and evaluation master plan (TEMP) OT&E inputs, forming the appropriate multi-Service integrated test team 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, briefings and working groups as required, participating in data generating events, and providing mutually agreed upon support.

(3) Each Service is responsible for funding and supervision of its own personnel and any Service-unique requirements supporting OT activity.

(4) The lead OTA will begin the planning process by forming a core team comprised of the participating OTAs The OTAs will communicate Service user requirements, critical operational issues (COI), test objectives, and key resource requirements.

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

(6) The lead OTA will consolidate and provide MOT&E TEMP inputs. The lead OTA will accommodate supporting 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, 24 Jul 06.

(7) Participating OTA project officers 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.

(8) The lead OTA, with assistance from supporting OTAs, will develop a matrix to provide a comparison of the user's requirements, and Service operational criteria. It is not a source document, but it increases visibility of program requirements, increases communications, and identifies areas for resolution. The lead OTA's format will be used when developing the matrix.

(9) Each OTA will prepare the portion of the overall OTA test plan(s) for its assigned objectives in the lead OTA's test plan(s) format and will identify its Service-specific data needs.

(10) The lead OTA will prepare the OTA test plan(s), consolidating the inputs from all supporting activities. After consolidation, the OTA test plan(s) will be approved by the supporting OTAs. See Annex E for the recommended format for the signature page.

(11) The lead OTA is responsible for scheduling OTA test plan briefings for programs requiring OSD oversight. The briefing may be presented jointly by all OTAs involved.

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

(13) The lead OTA will provide inputs to the T&E WIPT Charter with inputs from the supporting OTAs. The charter should contain an event-driven deliverables table identifying deliverables needed by the T&E WIPT to plan and execute integrated test activities and the offices responsible for those deliverables. (see Table 2)

3. MULTI-SERVICE OT&E.

a. MOT&E Participation. All affected DoD components will participate and support MOT&E planning, conduct, reporting, and evaluation:

(1) Lead and supporting OTAs will participate in the designated MOT&E.

(2) An OTA not originally designated as "lead" or "supporting" may participate in MOT&E as a supporting OTA 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 supporting 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 supporting 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 supporting OTA DTD will be determined on a program-by-program basis by individual Services.

c. Resources.

(1) The lead OTA, in coordination with the supporting 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 supporting OTAs will prepare their portions of the CRE in their formats and staff through Service channels. After staffing and approval, supporting 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.

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

ATEC	DCSOPS	(703) 681-2936/6518	DSN: 761-2936/6518
AFOTEC	XPP- Programming	(505) 846-1785	DSN: 246-1785
OPTEVFOR	Test Fleet Resource Scheduling	(757) 282-5546 Ext. 3284	DSN: 564-5546 Ext. 3284
MCOTEA	Deputy Director	(703) 784-3143	DSN: 278-3143

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.

(1) The individual Services will budget for funds required to support their individual participation in MOT&E, except for items funded by OSD.

(2) Each participating OTA will ensure sufficient funding for the testing necessary to accomplish their assigned test objectives and for participation of their personnel and equipment Each OTA's funding profile and resource requirements for testing will be included in the TEMP.

e. Deficiency Reporting.

(1) The deficiency reporting system of the lead service will normally be used. All members of the multi-Service integrated test team will report deficiencies in that system and adhere to the reporting timelines called out in the lead services 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. The deficiency report will then be submitted to the appropriate developing agency with that explanation attached. The underlying philosophy is that each participating OTA be allowed to report all deficiencies that it identifies; the lead OTA will not suppress those deficiency submitted by supporting OTAs into Service-specific deficiency reporting systems.

(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) Items undergoing test will not necessarily be used by each of the Services for identical purposes. 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 one 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 OTA with the circumstances concerning the deficiency, the positions put forth by DTDs, with a final decision and rationale.

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

(1) For those programs that require joint interoperability certification, the lead OTA will work with the Joint Interoperability Test Command (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 the detailed test procedures being developed and how interoperability is being addressed. The lead OTA will ensure JITC is invited to participate in test planning activities, reviews, as well as to observe operational testing as required.

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

g. Modeling and Simulation.

(1) The lead OTA will conduct modeling and simulation (M&S), including threat models, in accordance with their Service guidelines and policies. M&S development, use, and accreditation plans will be briefed to supporting OTAs and DOT&E, as appropriate, at milestone decisions or as requested. Supporting OTA accreditation requirements will be incorporated to the extent feasible, after which the supporting OTAs may elect to augment with their own efforts.

(2) Supporting OTAs will review lead OTA proposed M&S development, use, and accreditation plans. If acceptable levels of model management, version control, validation, and levels of model performance are projected, the supporting OTA may plan for their use in supplementing operational testing. The supporting OTA may then accredit the model or simulation for its specific purpose. At any point the supporting OTA may reject in whole or part any aspects of the model deemed not to meet their Service specific requirements.

h. 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 different operational requirements and joint operational environment; state findings and put those findings into perspective; and present rational why there is or is not consensus on the operational effectiveness, operational suitability, and mission accomplishment of the system.

(2) All participating OTAs will sign the report. Use Annex E as a recommended format for the signature page.

(3) There are four types of OTA reports, Table 1:

Table 1. 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**	
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

Notes:

*Assessment is defined slightly differently 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 and suitability.

** Evaluation is the determination of the system's effectiveness, suitability, and survivability (ATEC).

(4) Each participating OTA 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 all separate participating Service independent assessment or evaluation reports are appended to the overall final report prepared by the lead OTA for submission to the decision authority.

(6) Reports, as required, will be submitted to OSD's DOT&E and Deputy Director, Strategic and Tactical Systems, DT&E, (DD, S&TS/DT&E, OUSD (AT&L)) 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. All participating OTAs shall agree on the definition of the official end of test.

(7) Interim test reports will normally not be prepared. For test phases that extend for lengthy periods, interim test reports should be submitted when required to support Service or 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 OTAs prior to release. The separate 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 those reports not requiring submission to DOT&E and DD, S&TS/DT&E, OUSD (AT&L), or CBDP reports, an OTA Assessment or Evaluation Report 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.

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

i. Release of Data. Release of data will be accomplished in the manner prescribed by lead OTA directives, with each participating OTA having equal access to data as the lead OTA. Data will be shared among the test team regardless of OTA affiliation. Exceptions will be handled by lead OTA directives.

j. MOT&E Products, Coordination Process, and Timeline.

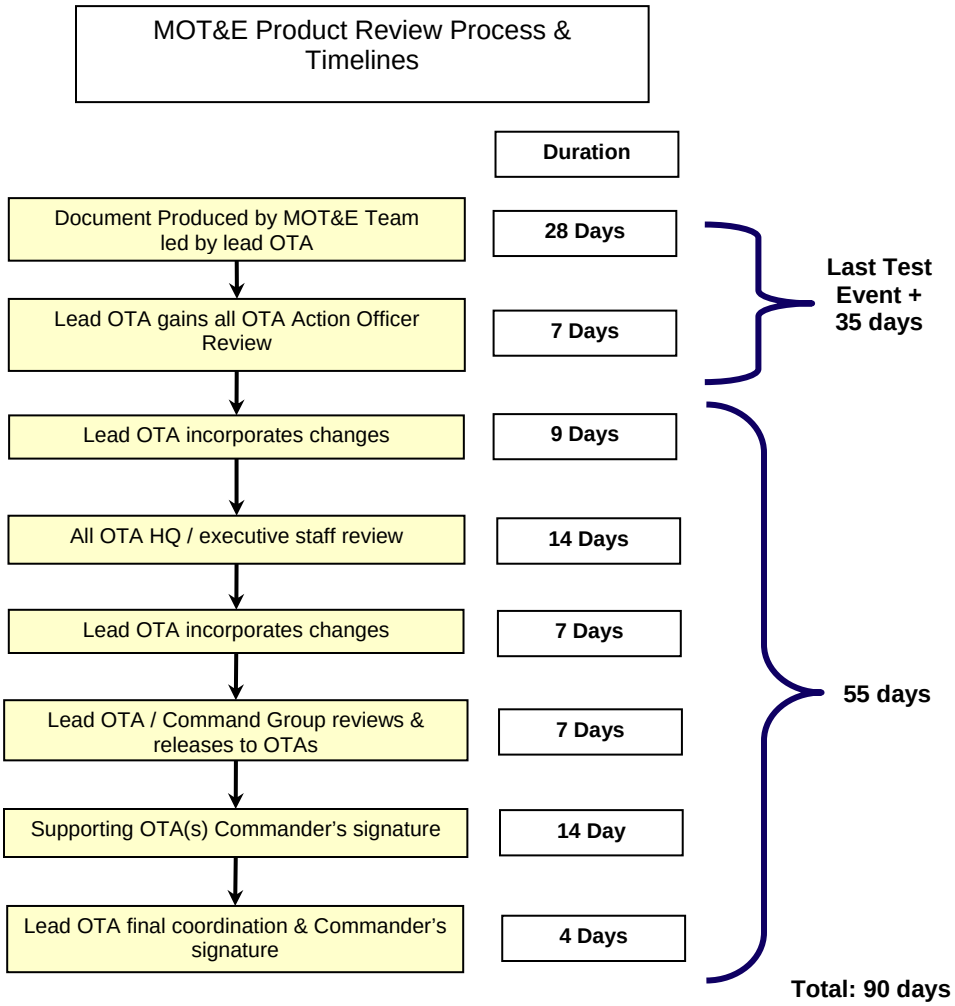
(1) The OTA test plan and report products in the event-driven deliverables table, Table 2 are based on DoD 5000 terminology for products used to inform specific milestone decision-makers or unique requests. The lead OTA will be responsible for producing the OTA test plan and report to inform the decision authority; documentation will be prepared in accordance with lead OTA directives. All Service-specific reports should be included as annexes to the formal OTA report.

Table 2. Event-Driven Deliverables

Milestone A	Milestone B	Milestone C/LRIP	Full Rate Production/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 Management Plan (LCMP) (*PMO*)	LCMP **Update** (*PMO*)	
Program Direction *(PEO, Program Executive Officer)*	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/RTO, Responsible Test Organization/ *lead* OTA)	
Test and Evaluation Strategy (TES) *(PMO/DA/RTO/lead OTA)*	Test and Evaluation Master Plan (TEMP) *(PMO/RTO/lead OTA)*	TEMP **Update** *(PMO/RTO/ lead OTA)*	
		Integrated Test Concept/Plan *(RTO/OTA)*	
	OTA Test Plan *(lead OTA)*	OTA Test Plan *(lead OTA)*	OTA Test Plan *(lead OTA)*
			Operational Test Readiness Review (OTRR) *(PMO/lead OTA)*
	OTA Milestone Assessment Report *(lead OTA)*	OTA Milestone Assessment Report (l*ead OTA)*	OTA Evaluation Report *(lead OTA)*
	Deficiency Reporting *(PMO/User)*	Deficiency Reporting *(PMO/User)*	Deficiency Reporting *(PMO/User)*

The coordination process and timeline for MOT&E products, OTA test plans, and OTA assessment and evaluation reports is described in Figure 1.

Figure 1



Note: Days are calendar days

4. QUADRI-SERVICE REVIEW

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

b. The OTA responsible for coordinating MOA changes/additions for the fall conference 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. 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.

15 Oct 07
STEPHEN T. SARGEANT, Major General, USAF
Commander, AFOTEC

ROGER W. NADEAU, Major General, USA 10 Oct 07
Commander, ATEC

M. S. Bohn Col USMC
M. S. BOHN, Colonel, USMC
Director, MCOTEA

S. S. VOETSCH, Rear Admiral, USN
Commander, OPTEVFOR

THIS PAGE INTENTIONALLY LEFT BLANK

Annex A
DUTIES AND RESPONSIBILITIES OF PARTICIPANTS IN MOT&E

Functional Service	Lead OTA	Supporting OTA(s)
1. Personnel	- Assign the lead OTA Test Director. - In conjunction with the supporting Service(s), establish joint manning requirements. - Staff the test team as indicated in the Consolidated Resource Estimate (CRE).	- Assign supporting 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 supporting 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.	- Fund own-Service unique requirements and TDY costs.
4. Threat Assessment	- Ensure that a coordinated system specific threat assessment has been developed IAW lead Service or Defense Undersecretary for Acquisition DUSA (TE) (for CBDP) directive(s) coordinated with the Defense Intelligence Agency (DIA) and is provided to all participants. - Provide an updated system-specific threat assessment to each participant sufficiently prior to each major program review in order for them to prepare briefings and reports which support those reviews.	- Support lead OTA efforts in the development and periodic update of the system specific threat assessment. - 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 for the lead OTA all resources required to conduct the test. - Extract Service resources requirements from the basic documentation. - Coordinate to provide Service unique required resources.

Functional Service	Lead OTA	Supporting OTA(s)
6. Environmental Compliance Requirements	- Ensure Program Manager (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 supporting 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 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 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.
8. Data Management – (see note)	- 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 in accordance with lead Service directives. - Make provisions for the attachment of Service-unique documentation requirements as annexes to the basic documents.	- Provide inputs to the basic documents. - Provide Service documentation requirements to lead OTA as an annex to the basic documentation. Prepare an independent operational evaluation report in accordance with

Functional Service	Lead OTA	Supporting OTA(s)
	- Prepare a single joint independent operational evaluation report in accordance with Service directives and coordinate with supporting Services operational test agencies prior to the release. - Obtain supporting OTA signature(s) on all Multi-Service TEMPs, test plans, reports, and coordinate on all other MOT&E program documents.	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 supporting 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. Briefings	- Provide briefings to appropriate OTAs and OSD.	- Provide Service-unique inputs to lead OTA.

NOTE: To ensure a progressive evaluation of the system, there will be an unrestricted exchange of validated data only among the OTA, DOT&E, and/or test teams. Said data shall be distributed with agencies that are not signatories to this document only after coordination with the other involved OTAs and in accordance with DOT&E Policy, dated 1 Oct 01, Subject: DoD Policy on OT&E Information Promulgation.

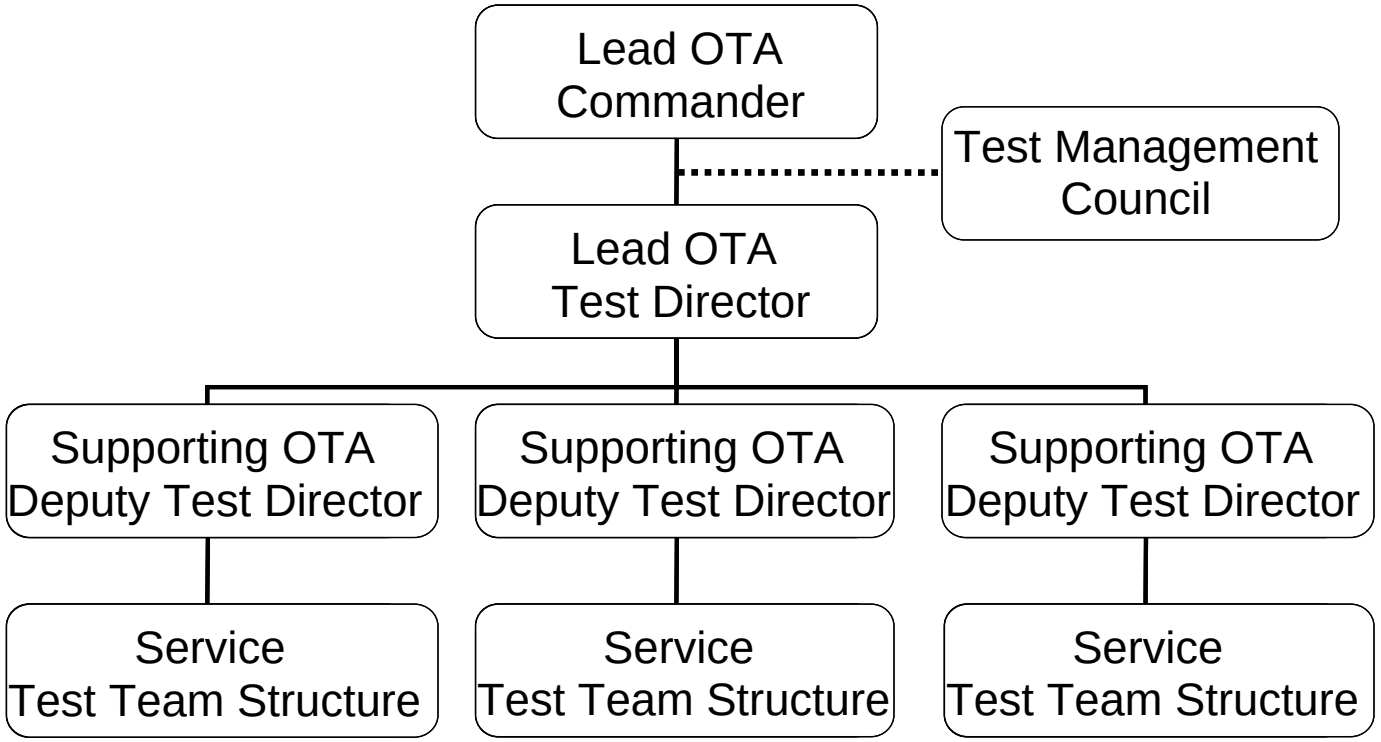
Annex B
CONSOLIDATED RESOURCE ESTIMATE CHECKLIST

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) Human Factors
        (9) Weather
        (10) 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. 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)

Annex C

Multi-Service OT&E (MOT&E) Team Composition



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

Annex E
SIGNATURE PAGES

OTA TEST PLAN– Use the below format when more than one signature is required on the plan. Ensure the lead OTA's signature block appears in the first position. Additionally, ensure you are using the correct/latest OTA Commander's signature block.

OTA Organization Title TP 0X-XXX

Program Long Title
OTA Test Plan

Day Month Year

Prepared by:

GEORGE A. JONES
Major, USAF
Test Director

Reviewed by:

SAMUEL T. CASSIDY
Colonel, USAF
Detachment Commander

Approved By:

STEPHEN T. SARGEANT Major General, USAF Commander, AFOTEC	S. S. VOETSCH Rear Admiral, USN Commander, OPTEVFOR
ROGER A. NADEAU Major General, USA Commander, ATEC	M. S. BOHN Colonel, USMC Director, MCOTEA

Annex E

<u>OTA Assessment; Milestone X Assessment; Evaluation; or Follow-on Evaluation REPORT</u>– Ensure the lead OTA's signature block appears in the first position. Additionally, ensure you are using the correct/latest OTA's signature block.

FROM THE COMMANDERS

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxx

STEPHEN T. SARGEANT
Major General, USAF
Commander, AFOTEC

S. S. VOETSCH
Rear Admiral, USN
Commander, OPTEVFOR

ROGER A. NADEAU
Major General, USA
Commander, ATEC

M. S. BOHN
Colonel, USMC
Director, MCOTEA

<u>OTA REPORT SAMPLE #2</u> – Use the below format when OTAs have participated in the MOT&E, and there are others who are interested parties, but who are not approval authorities.

FROM THE COMMANDERS

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxx

Approved By

STEPHEN T. SARGEANT
Major General, USAF
Commander, AFOTEC

S. S. VOETSCH
Rear Admiral, USN
Commander, OPTEVFOR

Coordinating Agencies

ROGER A. NADEAU
Major General, USA
Commander, ATEC

M. S. BOHN
Colonel, USMC
Director, MCOTEA

Annex F
SERVICE OTA COMMANDERS' CONFERENCE PROCEDURES

1. PURPOSE. This Annex establishes the schedule for the conference and outlines the basic policy and procedures for its conduct.

2. GOALS. To structure and use the conference as a forum for exchanging information, resolving issues of mutual concern, and promoting consistency and commonality among the OTAs in the conduct of OT&E.

3. SCHEDULE. The conference will be held on a bi-annual basis. Host's duties for the OTA CC conference will rotate in the following order: MCOTEA, AFOTEC, ATEC, and COMOPTEVFOR.

4. RESPONSIBILITIES:

a. Host OTA responsibilities are:

(1) Determine a suitable location and coordinate overall use of required facilities (i.e., conference rooms, dining, billeting, etc.). Attendees from each OTA will be responsible for making their own specific travel reservations.

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

(3) Establish the conference agenda. An initial message will announce the next conference and solicit agenda inputs. A planning meeting is recommended to consolidate these inputs into a draft agenda, which will then be distributed for coordination and approval. A final agenda will be distributed no later than (NLT) 7 calendar days prior to the conference and will include talking papers covering the agenda items. (See Participating OTA responsibilities.)

(4) Provide conference folders containing the agenda and talking papers on agenda items to the Commanders, Vice/Deputy Commanders, and Technical Directors/ Chief Scientists.

(5) Provide administrative support to conference attendees.

(6) Coordinate any social activities held in conjunction with the conference. Attendees on an individual basis will normally cover expenses for such events.

(7) Publish conference minutes. These will be distributed NLT 30 calendar days after the conference.

b. Participating OTA responsibilities are:

(1) Establish a point of contact (POC) to assist the host OTA POC in conference planning and agenda development.

(2) Accomplish any required coordination prior to the conference 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 the conference.

5. CONFERENCE STRUCTURE. In addition to the OTA Commanders, attendees may include the OTA Vice/Deputy Commanders and/or Technical Directors/Chief Scientists. At their discretion, the Commanders may invite additional participants who can add to or benefit from the conference agenda. However, the number of additional participants should be kept to a minimum. The host OTA Commander will chair each conference.

a. All agenda items will have an assigned POC. Topics will usually be introduced through a briefing 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 briefing slides for attendees will not normally be required. Agenda items will generally fall into two basic categories:

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

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

b. An executive session among the commanders and the Director, Operational Test and Evaluation (DOT&E), if needed, should be coordinated in advance.

6. POLICY. The following provides guidance for the implementation of decisions or agreements reached by the Commanders during conference proceedings:

a. Tasking resulting from a conference will have an assigned POC, suspense dates, and representatives identified from each OTA as required for coordination. This information will be documented in the conference minutes to provide a means of tracking the item's status.

b. Agreements or decisions reached 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.

Annex G

MOT&E GLOSSARY
(Excluding Operational Suitability Terminology and Definitions - see Annex H)

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 ways and means to perform a set of tasks. [DAU Glossary]

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. [Defense Acquisition University Glossary] Compatibility may apply to a specific investigation of a system's electrical, electromagnetic, physical, and man-machine interface characteristics.

Concept of Operations (CONOPS): Verbal or graphic statement, in broad outline, of a commander's assumptions or intent in regard to an operation or series of operations. 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. [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 Operational Test and Evaluation (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 decomposed into a set of Measures of Effectiveness and/or Measures of Performance, and Measures of Suitability. See Measure of Effectiveness, Measure of Performance, and Measure of Suitability. [DAU Glossary]

Early Operational Assessment (EOA): An OA conducted prior to, or in support of, MS B. An EOA assesses the most promising design approach sufficiently early in the acquisition process to ensure it has the potential to fulfill user requirements.

Executive Agent/Service: See Lead Service

Full-Rate Production: Contracting for economic production quantities following stabilization f the system design and validation of the production process. [DAU Glossary]

Human Factors: 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]

Initial Capabilities Document (ICD): Documents the need for a materiel approach, or an approach that is a combination of materiel and non-materiel, to satisfy specific capability gap(s). The ICD defines the gap in terms of the functional area; the relevant range of military operations; desired effects; time and Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF); and policy implications and constraints. [DAU 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 so exchanged to enable them to operate effectively together. [DAU Glossary]

Key Decision Point (KDP): Major decision points that separate the phases of a Department of Defense space program. [DAU Glossary]

Lead OTA: The OTA designated by the Milestone Decision Authority (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 can not 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]

Measure of Effectiveness (MOE): A measure of operational success that must be closely related to the objective of the mission or operation being evaluated. For example, the number of enemy submarines sunk or enemy tanks destroyed may be satisfactory MOEs if the objective is to destroy such weapon systems. However, if the real objective is to protect shipping or an infantry battalion, then the best course of action might be one that results in fewer friendly submarines or tanks actually killed. A meaningful MOE must be quantifiable and measure to what degree the real objective is achieved.

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 Measures of Suitability may be related to the achievement of a particular Measure of Effectiveness (MOE).

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. [DAU Glossary]

Milestone (MS): Major management decision points in the system acquisition decision process requiring OSD and (or) DoD component program review. Milestones include both Defense Acquisition Board (DAB) and DoD component equivalent program reviews.

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

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 assessment of risk and progress towards operational effectiveness, operational suitability, and survivability and progress towards IOT&E made by an independent operational test activity, with user support as required, on other than production systems. The focus of an OA is on significant trends noted in development efforts, programmatic voids, areas of risk, adequacy of requirements, and the ability of the program to support adequate operational testing. OAs may be made at any time using technology demonstrators, prototypes, mockups, engineering development models, or simulations but will not substitute for the initial operational test and evaluation (IOT&E) necessary to support full production decisions.

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 Test Agency (OTA):
1. The Agency established by a Service to conduct OT&E for that Service. Those agencies are signatories of this MOA;
2. 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: The Test Plan produced by the Service OTA.

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

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

OTA Milestone "X" Assessment Report: (OMAR) for assessments supporting a milestone 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)

Outline test plan (OTP): A formal resource document prepared for Test Schedule and Review Committee (TSARC) review. It contains resource and administrative information necessary to support an OT or Force Development Test and Evaluation FDT/E. OTPs are also prepared for Developmental Testing (DT) when Soldier participants or other operational resources are required. The OTP contains the critical test issues, test conditions, scope, tactical context (OT or FDT/E only), resource requirement suspense dates, test milestone dates, and cost estimates (for user T&E only).

Supporting OTA: The OTA of a supporting Service.

Supporting 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. Used interchangeably with Participating Service. Participating Services may include lead Service, depending on its use.

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.

Test and Evaluation Master Plan (TEMP): Documents the overall structure and objectives of the Test and Evaluation (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), Operational Test and Evaluation (OT&E), and Live Fire Test and Evaluation (LFT&E) activities. It relates program schedule, test management strategy and structure, and required resources to: Critical Operational Issues (COIs), Critical Technical Parameters (CTPs), objectives and thresholds documented in the Capability Development Document (CDD), evaluation criteria, and milestone decision points. For multiservice 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.

Annex H
OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

1. PURPOSE. This annex provides the policy and suitability terminology and definitions to be used by the Service Operational Test Agencies (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.

4. INTRODUCTION.

a. The terms described in this annex will be used as appropriate in all OT&E. If additional terms are necessary, they must be clearly defined in OT&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, space, ships, vehicles, etc.). This is due to differences among a system's 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 3170.01F and CJCSM 3170.01C .

Annex H
OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

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

a. Availability. A measure of the degree to which an item is operable and can be committed at the start of a mission when the mission is called for at an unknown (random) point in time. [Defense Acquisition University 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. [Defense Acquisition University 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. 1. The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together. 2. The conditions achieved among communications-electronics systems, or items of communications-electronics equipment, when information or services can be exchanged directly and satisfactorily between them or their users. The degree of interoperability should be defined when referring to specific cases. [Defense Acquisition University 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 ability of a system and its parts to perform its mission without failure, degradation, or demand on the support system (Defense Acquisition University Glossary).

f. 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.

g. 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. [Defense Acquisition University Glossary.]

Annex H
OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

h. Safety. Freedom from conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. [Defense Acquisition University Glossary]

i. Human Factors. 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. [Defense Acquisition University 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.

j. 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.

k. Logistics 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. [Defense Acquisition University Glossary].

l. Natural Environmental Effects and Impacts

(1) Environment. Includes the air, water, land, plants, animals, and other living organisms, man-made structures, historical and cultural resources, and the interrelationships that exist among them and with people. [The Defense Acquisition University 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.

m. 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. (Defense Acquisition University Glossary).

n. 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 Logistics Support (LS) planning for

Annex H
OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

training equipment and training device acquisitions and installations. A traditional element of LS. (Defense Acquisition University 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 warfight. Based on adequate and trained personnel, material condition, supplies/reserves of support system and ammunition, numbers of units available, etc. [Defense Acquisition University 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. (Defense Acquisition University 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. Reliability consists of two major areas: mission reliability and logistics related reliability.

(1) Mission 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. [Defense Acquisition University 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.)

(2) Logistics Reliability. The measure of the ability of an item to operate without placing a demand on the LS structure for repair or adjustment. Logistics reliability recognizes the effects of occurrences that place a demand on the LS structure without regard to the effect on mission or function. (Defense Acquisition University Glossary.) Measures of logistics reliability include the probability that no corrective (or unscheduled) maintenance, unscheduled removals, or unscheduled demands for spare parts will occur following the completion of a specific mission profile. Logistics reliability may be expressed as a function of Mean Time Between

Annex H
OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

Unscheduled Maintenance (MTBUM) (see paragraph 8 for definition) and/or Mean Time Between Demand for Spares.

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 (Ao) 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 given that a fault has occurred (Pcd), (3) the percent of correct fault isolation (and/or fault location) given a correct detection (Pcfi and/or Pcfl), 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): The total operating time (e.g., driving time, flying time, or system-on time) divided by the total number of OMFs.

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 operational mission failure (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.

Annex H
OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

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 Operational Mission Failure.

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 Maintenance Ratio (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 users maintenance requirements, are included without regard to their effect on mission or availability of the system.

h. Operational Availability (Ao): The degree (expressed as a decimal between 0 and 1, or the percentage equivalent) to which one can expect a piece of equipment or weapon system to work properly when it is required. Operational Availability is calculated by dividing uptime by the sum of uptime and downtime. It is the quantitative link between readiness objectives and supportability. [Defense Acquisition University Glossary.] It can also be calculated by the number of systems that are ready, divided by the number possessed (e.g., the number of times the system was available, divided by the number of times the system was required) for on-demand systems.

i. Measures of False Alarms (FA): False alarms 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.

Annex H
OPERATIONAL SUITABILITY TERMINOLOGY AND DEFINITIONS

9. QUADRI-SERVICE REVIEW

a. Responsibility for issuing a call for a review of this MOA will be rotated among the Services. This call will be initiated at least 30 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.

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

APPENDICIES:
1 – Army Terms and Definitions
2 – Navy Terms and Definitions
3 – Marine Corps Terms and Definitions
4 – Air Force Terms and Definitions

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX 1

ARMY TERMS AND DEFINITIONS

1. PURPOSE. This Appendix provides the RAM terms and definitions used most often within the Army in accordance with HQ TRADOC Guidelines for Developing Failure Definition & Scoring Criteria, and TRADOC/AMC PAMPHLET 70-11. It also includes some terms that have recently been used in new requirements documents but have not been documented in Army Regulations or Pamphlets. This information is included in this Annex to assist other services in understanding RAM terms that may be used by the Army in addition to the common terms provided in Paragraph 8 of this Annex.

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. 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.)

c. 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 EF 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).

d. 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 EUMDs that require parts or line-replaceable units (LRU) and all scheduled maintenance demands that require parts or LRUs. ELDs also include crew correctable maintenance demands (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), it may include items/parts consumed during the conduct of PMCS.

e. Essential Unscheduled Maintenance Demand (EUMD). An unscheduled maintenance event resulting from an essential function failure or system abort. Fully redundant component failures, albeit do not cause 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 TM or other applicable document), generates both an EUMD and a CCMD.

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

g. 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.

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

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

j. 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 line-replaceable units (LRU) and all scheduled maintenance demands which require parts or LRUs. ELDs also include crew correctable maintenance demands (CCMD) that use parts from the BII. It does not include preventive maintenance checks and services (PMCS) or maintenance that does not require parts.

k. 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.

l. 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., Organizational Level of Maintenance (OLM), Intermediate Level of Maintenance (ILM), and combined levels. Additionally, it may be also be stratified by scheduled and unscheduled. All maintenance actions are considered (that is, scheduled as well as corrective, and without regard to their 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.

m. Maximum Time To Repair (MaxTTR). That 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 organizational and intermediate levels of maintenance. MaxTRR is used as an "on-system" maintainability parameter; it is not used for the off-system repair of replaced components.

n. 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.

o. 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.)

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

q. 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.

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

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

s. 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.

t. 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.

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

v. 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.

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

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

y. 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:

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

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

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.)

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.

z. 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.

aa. 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.

ab. Reliability. The probability that an item can perform its intended functions for a specified time interval under stated conditions.

ac. 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.

ad. 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.

ae. 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 Essential Function Failures (EFF). A SA renders the system not mission capable (NMC) under wartime definitions.

APPENDIX 2

NAVY TERMS AND DEFINITIONS

1. PURPOSE. This Appendix provides the RAM terms and used within the Navy in conducting and reporting OT&E activity in accordance with Agreement so as 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). For aircraft, system operating time may be expressed in flight hours, resulting in the parameter mean flight hours between operational mission failures (MFHBOMF) rather than 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 multimission 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 nonavailability, do not impede the successful completion of the mission.

MCR may be used in addition to other reliability measures. MCR may be used alone if necessary but should not be used to replace other reliability measures.

(e) 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 ($MCMTOMF_{SW}$), mean reboot time (MRT), built-in test (BIT), and maintenance ratio (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.

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

On-board logistic delay is the logistic delay associated with obtaining the spare part at the unit or organizational level. For aircraft systems, the unit level will be considered to be the squadron. 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 operational mission failure (OMF); e.g., 90% 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.

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

(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 $MCMTOMF_{SW}$.

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

(5) BIT is addressed using these parameters: probability of correct detection (Pcd); probability of correct fault isolation (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:

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

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

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

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

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

For aircraft, you may also calculate the number of false BIT indications per system operating hour (FAh).

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

(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 multimission 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:

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

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:

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

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:

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

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.

No Mission Capability (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 'not mission capable 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.

APPENDIX 3

MARINE CORPS TERMS AND DEFINITIONS

1. Purpose. This Appendix provides RAM definitions and quantitative MOEs for USMC OT plans and reports.

2. Background. Effective testing and evaluation of a system can only be accomplished if all system peculiar terms and MOEs are defined and understood during the test design. Definitions and the selection of MOEs 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 IER should interpret the MOEs to present a meaningful picture of the impact of the evaluation to the decision makers.

It is MCOTEA policy to test against RAM requirements contained in the approved, validated Capabilities Document. (Initial Capabilities Document [ICD], Capability Development Document [CDD], Capability Production Document [CPD]). When these Capabilities-based requirements differ from those defined and contained in this Appendix, those Capabilities-based requirements will be tested against, and the adequacy of demonstrated performance will be resolved against the Capabilities-based thresholds. However, to support comparability and the intent of this Appendix, in MOT&E MCOTEA may also measure and report the related RAM terms contained in this Appendix, although the reported values will not be used for resolution of RAM criteria.

3. Definitions. Definitions are organized into five sections: time, status, reliability, availability, and maintainability. Within each category, terms and MOEs are listed and defined. Note that while the acronyms and equations used are not consistent with notations in the 1982 DoD RAM Primer, they are computationally consistent. For example, mission time as defined here is computationally equivalent to the operating time defined in the RAM Primer. 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. Note that some time classifications may not apply to a specific system. Boxes within the figure are mutually exclusive. Figure 3-1 shown on page H 3-2.

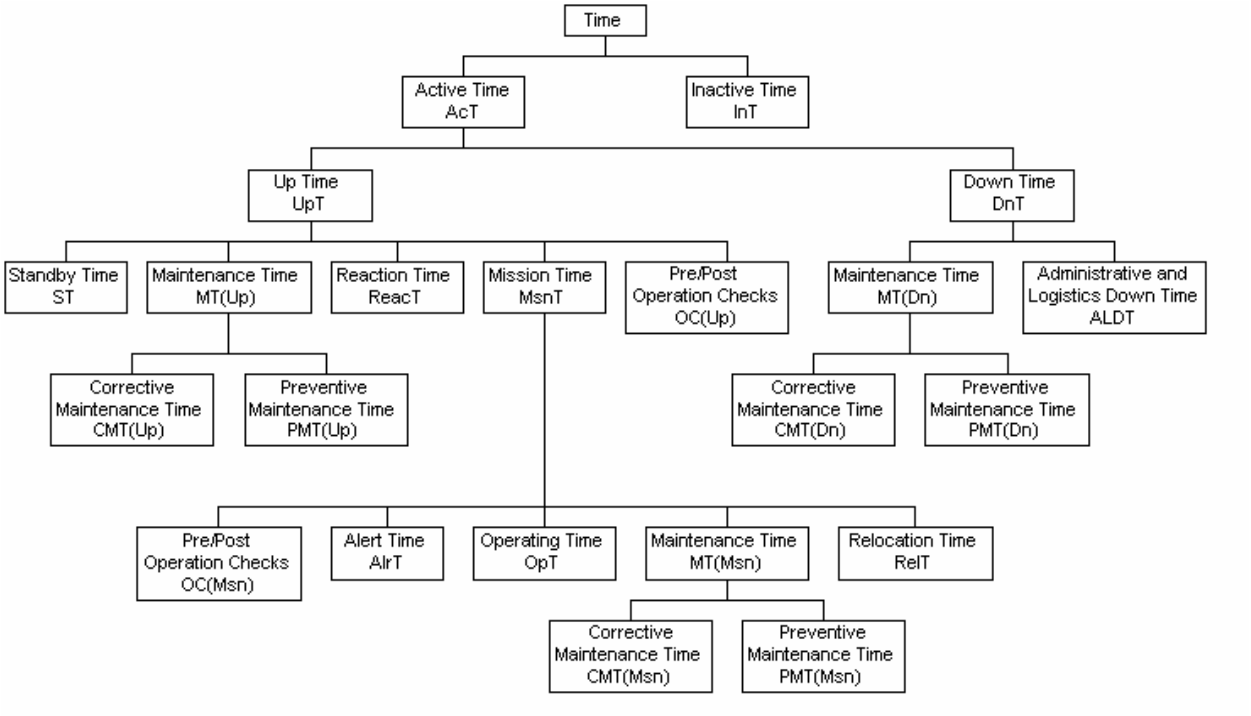


Figure 3-1. Test Time Classifications

Table 3-1. Test Time Classifications

• Active Time (AcT). Consists of all time when the system under test is assigned to an operational unit, and is being used consistent with its Concept of Employment. During AcT, the system under test is being used to accomplish its intended missions and Operational Test data should be collected. The most important aspect of AcT is that it only occurs when the system under test is being used, as it is expected to be used, when fielded in the realistic operational environment. Thus, time accruing due to test artificiality's, not representative of realistic use, must be excluded from AcT.
• Administrative and Logistics Down Time (ALDT). The portion of downtime when active corrective maintenance is not being performed that includes (but is not limited to) time waiting for parts, processing records, and transporting equipment and/or maintenance personnel between the using unit and repair facility.
• Alert Time (AlrT). Mission time (up time) when an item is required to be in a specified operating condition and is awaiting a command to perform its intended mission. Alert time occurs when a system is employed on a specific mission profile but is not actually operating. The system is awaiting the command to continue its specific mission. This may apply to systems with a "Standby" mode.

Table 3-1. Test Time Classifications (cont.)

- Corrective Maintenance Time (CMT). Time when maintenance is performed on a scheduled or nonscheduled basis to restore system functions by actively troubleshooting, performing system diagnostics, or correcting a malfunction. Corrective Maintenance can occur during up time, down time, and mission time.
- Down Time (DnT). Active time when the system cannot perform one or more Mission Essential Functions (mefs).
- Inactive Time (InT). Consists of time when the system under test is either not assigned to an operational test unit, or, while assigned, is not being used consistent with its Concept of Employment. During InT, the system under test is not being used to accomplish its intended missions, and reportable OT data will not be collected. Typically, InT is time when the system under test is not being used as it would be, when fielded, in a realistic operational environment. Once OT begins, InT should largely consist of unrealistic lulls in activity due to planned schedule breaks, such as weekends, etc. Note that, during InT, no actions can be taken that alters the system under test in any way. For example, no maintenance, preventive or corrective, related to any previous AcT time segments can be conducted.
- Maintenance Time (MT). Time when preventative or corrective maintenance is being performed on the system. Maintenance time can occur during up time, down time or mission time.
- Mission Time (MsnT). Up time when the system is required to perform its mission profile as stated in the COE or the Operational Mode Summary/Mission Profile (OMS/MP).
- Operating Time (OpT). The period of time that the system is powered, capable of performing all mefs, and required to perform within its stated mission profile.
- Pre/Post Operation Checks (OC). Time when checks are routinely accomplished prior to and just after operating a system. These checks can occur outside or during mission time.
- Preventative Maintenance Time (PMT). Time when preventative maintenance actions are performed to retain an item in a specified condition by systematic inspection, detection, and prevention of incipient failures. These actions can occur during up time, down time, or mission time, on a scheduled or unscheduled basis.
- Reaction Time (ReacT). Portion of up time that starts with receipt of the mission and ends with initiation of the mission.
- Relocation Time (RelT). Mission time when the item is moved from one location to another where it is employed on a specific mission profile.
- Standby Time (ST). The period of up time that the system is presumed operationally ready for use, but it does not have power applied if applicable, is not being operationally employed, and maintenance is not being performed.
- Up Time (UpT). Active time when an item is able to perform all mefs.

b. Status. Three general questions must be answered to determine the general status of an item (active/inactive, up/down, mission/other). Specific determinations of status within general categories are system dependent and must be defined in the DTP. The questions follow.

(1) Is the system assigned to an operational unit which is using the system consistent with its COE, to accomplish the missions for which it was designed, in the realistic operational environment? (Note: Items evacuated for maintenance remain assigned to the operational unit.)

Yes - active
No - Inactive

(2) Can the item perform all of its mefs?

Yes - up
No - down

(3) Is the item being required to perform its intended function in accordance with its mission profile?

Yes - mission
No - other

c. 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 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 Operational Mission Failure (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 mission 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. A subscript of "c" indicates that only OMFs charged to CFE are used in the calculation.

$$MTBOMF = \frac{MsnT}{Total\ Number\ of\ OMFs}$$

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:

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

(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 (MTBUM). Average mission time between unscheduled maintenance actions:

$$MTBUM = \frac{MsnT}{Number\ of\ Incidents\ Requiring\ Unscheduled\ Maintenance}$$

d. 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 PMT. Defining 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.

$$A_o = \frac{UpT}{UpT + DnT}$$

Where UpT and DnT are determined by totaling their subcomponent times (Refer to Figure 3-1).

(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.

$$A_i = \frac{OpT}{OpT + CMT(Dn)}$$

(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.

$$A_a = \frac{OpT}{OpT + MT(Dn)}$$

e. 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 MOEs. Table 3-2 includes the three levels of maintenance that may be used. Table 3-2 shown on page H 3-7.

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, and 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 Corrective Maintenance Time (MCMT). MCMT is the average of active corrective maintenance times. This replaces the obsolete term Mean Time to Repair (MTTR). 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.

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

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

Table 3-3. Three Qualifiers to MaxCMT

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

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

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

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 replaces the obsolete 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. The selected measure must be clearly stated in the appropriate Capabilities Document and DTP.

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 DTP.

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

APPENDIX 4

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 AFI 10-602, Determining Mission Capability and Supportability Requirements, 18 Mar 05.

2. Definitions.

a. Break Rate: The percentage of sorties flown during a specified period of time that return with one or more previously working mission-critical systems or subsystems inoperable, thus rendering the aircraft not mission capable or partially mission capable relative to the previous type mission.

b. Measures of False Alarm (FA). A system-indicated malfunction that can not be validated because no request for corrective maintenance follows. A CND differs from a false alarm in that it signifies a malfunction that can not be confirmed. (AFI 10-602, Determining Mission Capability and Supportability Requirements, 18 Mar 05.)

c. 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 hour and 8 hour points; for all others, measurements are taken at the 12 hour point. 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).

d. 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, schedules 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

e. 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.

f. 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:

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

g. 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:

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

h. 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.

i. 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).

j. 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:

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

k. 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:

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

l. Mission Reliability (MR): The probability that the system is operable and capable of performing its required function for a stated mission duration or at a specified time into the mission. MR is based on the effects of system reliability during mission time only. MR does not take into account system maintainability. For systems with exponential failures, MR is defined as follows:

$$\text{MR} = e^{(-t / \text{MTBCF})}$$

where t is the average mission time. If the system is used under significantly different mission lengths, the specific mission time should be used to determine the MR for each mission. Note: Exponential systems are systems whose times to failure exhibit an exponential probability density function (i.e., systems that exhibit a constant hazard rate).

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): Weapon System Reliability (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.