DEFENSE ACQUISITION GUIDEBOOK
Chapter 9 - Test and Evaluation (T&E)

9.0. Overview

9.0.1. Purpose

This chapter supplements direction and instruction in DoDD 5000.01 and DoDI 5000.02 with processes and procedures for planning and executing an effective and affordable T&E program in the DoD acquisition model. A rigorous and efficient T&E program provides early knowledge of developmental and operational issues. Correcting these issues early enough can mitigate risks of cost overruns and schedule slippages, and can ultimately contribute to delivery of effective and suitable weapons, information technology (IT) and National Security Systems (NSS) to the Warfighters in a timely manner. The principles and practices in this chapter apply to all acquisition programs regardless of size or cost; however, some aspects focus on acquisition programs of sufficient interest, cost, size, complexity, or need for interoperability, requiring oversight by the Office of the Secretary of Defense (OSD): the OSD T&E Oversight List.

9.0.2. Contents

Section 9.1 OSD T&E Organization provides a guide to OSD organizations having roles

in the accomplishment or overseeing the DoD T&E mission.

Section 9.2 Service-level T&E Management identifies the top level management structure for the Services and the Major Range and Test Facilities Base (MRTFB).

Section 9.3 Test and Evaluation describes the different types of T&E and test events.

Section 9.4 Integrated Test and Evaluation defines integrated testing and describes how all areas within T&E utilize Integrated Testing.

Section 9.5 T&E Planning describes actions needed to develop an Evaluation Plan, Test and Evaluation Strategy (TES), Test and Evaluation Master Plan (TEMP), and test plan.

Section 9.6 T&E Reporting describes actions and documentation needed to report T&E results and evaluations.

Section 9.7 Special Topics addresses T&E programs deviating from the DoDI 5000.02 Defense Acquisition System model (e.g., associated with urgent needs programs, defense business systems, National Security Systems (NSS), etc.).

Section 9.8 Best Practices presents examples of best practices to improve planning, execution, and reporting of T&E.

Section 9.9 Prioritizing Use of Government Test Facilities for T&E provides information on the mandate to use Government test facilities for T&E.

Throughout this chapter, interpret the terms developmental and operational as broad statements of the types of testing or evaluation, and not as the testing controlled by a particular organization.

9.1. OSD T&E Organization

The Director of Operational Test and Evaluation (DOT&E) for operational test and evaluation (OT&E) and live fire test and evaluation (LFT&E), and the Deputy Assistant Secretary of Defense for Developmental Test and Evaluation (DASD(DT&E)) within the office of the Assistant Secretary of Defense for Research and Engineering (ASD(R&E))

in the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) provide oversight and policy for T&E of certain acquisition programs within OSD. The DASD(DT&E) also serves as the Director, Test Resource Management Center (TRMC) and has responsibility for oversight of DoD T&E resources and infrastructure. By law, DASD(DT&E) closely coordinates with Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE)), and routinely coordinates with other OSD organizations, such as Cost Assessment and Program Evaluation (CAPE).

DOT&E and DASD(DT&E) share or coordinate on the following responsibilities:

- Prescribe policies and procedures for the T&E within the DoD
- Provide advice and make recommendations to the Secretary of Defense (SecDef),Deputy SecDef (DepSecDef), and USD(AT&L); as well as support Overarching Integrated Product Teams (OIPTs) and Defense Acquisition Boards/Information Technology Acquisition Boards for programs on the OSD T&E Oversight List
- Develop, in consultation with the DoD Components, the OSD T&E Oversight List
- Ensure the adequacy of T&E strategies and plans for programs on the OSD T&E Oversight List
- Ensure DoD Components do not terminate or substantially reduce participation in joint Acquisition Category (ACAT) ID or ACAT IAM programs without Requirements Authority review and USD(AT&L) approval
- Attend systems engineering technical reviews
- Monitor and review DT&E, OT&E, and LFT&E events of oversight programs
- Participate in the operational test readiness review (OTRR) process by providing recommendations concerning a systems readiness for operational testing
- Provide independent performance, schedule, and T&E assessments to the Defense Acquisition Executive Summary (DAES) process
- Provide representatives to the T&E working-level integrated product team (T&E WIPT) for oversight programs to assist program managers (PMs) in developing their strategy as well as preparing a TES / TEMP

9.1.1. OSD T&E Oversight List

The DOT&E and the DASD(DT&E), jointly, and in consultation with the DoD Component T&E executives and other offices as appropriate, publish an annual OSD T&E Oversight List . DOT&E and the DASD(DT&E) designate programs for DT&E, OT&E, and/or LFT&E oversight. They consider all programs for inclusion, regardless of ACAT level, and can add to or delete from the list at any time during the year. OSD considerations for inclusion on formal T&E oversight include:

- ACAT level
- Potential for Joint designation
- Potential for establishment as an acquisition program (such as Technology Projects identified in Enclosure 3 of DoDI 5000.02 or a pre-Major Defense

Acquisition Program (MDAP))
- Stage of development or production
- Potential for DAES reporting
- Congressional and/or DoD interest
- Programmatic risk (cost, schedule, or performance)
- Past programmatic history of the developmental command
- Relationship with other systems as part of a system-of-systems (SoS)
- Technical complexity of system

9.1.2. Director of Operational Test and Evaluation

The DOT&E, a Principal Staff Assistant and advisor to the Secretary of Defense, has specific responsibilities as identified in DoDD 5141.02 , "Director of Operational Test and Evaluation", dated February 2, 2009. Sections 139 and 2399 of title 10 USC prescribe the duties for OT&E and section 2366 of title 10 USC for LFT&E . For additional information on the DOT&E office, visit the DOT&E website . For purposes here, DOT&E:

- Prescribes policies and procedures for the conduct of OT&E and LFT&E for DoD.
- Assesses the adequacy of OT&E and LFT&E performed by the Services and operational test agencies (OTAs) for programs on the OSD T&E Oversight List, for their effectiveness and suitability for advising the USD(AT&L) as well as for reporting to the SecDef and Congress.
- Advises the DoD Executive Agent for Space and the acquiring Military Department on T&E of DoD Space MDAPs and other space programs designated for T&E oversight, in support of DoDD 3100.10 Space Policy, dated July 9, 1999.
- Manages:
    - The efforts to improve interoperability and information assurance (IA) through the operational evaluation of the systems under oversight and major exercises conducted by the Combatant Commands and the Military Departments.
    - The Joint Test and Evaluation (JT&E) Program .
    - The Joint Live Fire Program.
    - The Center for Countermeasures .
    - The activities of the Joint Aircraft Survivability Program .
    - The activities of the Joint Technical Coordinating Group for Munitions Effectiveness and producing the Joint Munitions Effectiveness Manual.
    - The activities of the T&E Threat Resource Activity .
- Provides support to the Director, Joint Improvised Explosive Device Defeat Organization (JIEDDO), consistent with DoDD 2000.19E Joint Improvised Explosive Device Defeat Organization (JIEDDO), dated February 14, 2006.
- Assists the Chairman of the Joint Chiefs of Staff (CJCS) in efforts to ensure the Joint Capabilities Integration and Development System (JCIDS) documents, in terms verifiable through testing or analysis in support of CJCS Instruction 3170.01 Joint Capabilities Integration and Development System, dated March 1,

2009, provides the expected joint operational mission environment, mission level measures of effectiveness (MOEs), and key performance parameters (KPPs).
- Oversees and assesses operational capability demonstrations conducted by the Missile Defense Agency, consistent with DoDD 5134.09 Missile Defense Agency (MDA), dated September 17, 2009.
- Establishes policy on the verification, validation, and accreditation (VV&A) of models and simulations used in support of OT&E and LFT&E.
- Oversees the International T&E (IT&E) program for the SecDef.
- Oversees and prescribes policy, as appropriate, to ensure adequate usage and verification of protection of human subjects and adherence to ethical standards in OT&E and LFT&E; in support of DoDD 3216.02 Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research, dated November 8, 2011.

9.1.3. Deputy Assistant Secretary of Defense for Developmental Test and Evaluation

As an advisor to the USD(AT&L) for DT&E through ASD(R&E), the DASD(DT&E) has responsibilities and duties as prescribed in section 139b of title 10 USC . For additional information on DASD(DT&E), visit the ODASD(DT&E) website. For purposes here, the DASD(DT&E):

- Develops policies and guidance:
    - For the conduct of DT&E in the DoD (including integration and developmental testing of software).
    - In coordination with the DOT&E, for the integration of DT with OT.
    - For the conduct of DT&E conducted jointly by more than one Component or Defense Agency.
    - In coordination with DASD(SE), ensure the full integration of DT&E activities of the DoD into and consistent with the SE and developmental planning processes of the Department.
- Monitors and reviews the DT&E activities of the MDAPs, including approval of the TEMP and TES.
- Reviews and approves the DT&E plan within the TEMP for each DoD MDAP.
- Develops DT&E technical workforce, by providing advocacy, oversight, and guidance to elements of the acquisition workforce responsible for DT&E.
- Periodically reviews the organizations and capabilities of the Components and Defense Agencies with respect to DT&E; identifies needed changes or improvements to such organizations and capabilities; and provides input regarding needed changes or improvements to the strategic plan for DoD T&E resources.

Additionally, the DASD(DT&E) functions as Director, TRMC ; a field activity reporting directly to the USD(AT&L). DoDD 5105.71 , Department of Defense Test Resource Management Center (TRMC), dated March 8, 2004, states TRMC shall plan for and assess the adequacy of the Major Range Test Facility Base (MRTFB) . . . to provide

adequate testing in support of development, acquisition, fielding, and sustainment of defense systems; and, maintain awareness of other T&E facilities and resources, within and outside the Department, and their impacts on DoD requirements. The above directive also provides the specific responsibilities of the TRMC.

TRMC provides reports and recommendations on current and projected MRTFB infrastructure issues to ensure adequate capabilities and resources exist to support testing of DoD acquisition programs in accordance with responsibilities found in DoDD 3200.11 Major Range and Test Facility Base (MRTFB), December 27, 2007.

9.2. Service-Level T&E Management

9.2.1. Program Managers

9.2.2. T&E Board of Directors (BoD(ES))

9.2.3. Component and Joint T&E Organizations

9.2.3.1. Defense Information Systems Agency (DISA) T&E Executive (TEO)

9.2.3.2. Assistant Deputy Under Secretary of the Army for Test & Evaluation (ADUSA(T&E))

9.2.3.3. Director, Air Force Test & Evaluation (AF/TE)

9.2.3.4. Department of the Navy Test & Evaluation Executive (OPNAV N091)

9.2.4. Office of the Secretary of Defense T&E Management

9.2.4.1. Developmental Test & Evaluation

9.2.4.2. Operational Test & Evaluation

9.2.5. Major Range and Test Facility Base

9.2. Service-Level T&E Management

9.2.1. Program Managers

Ultimately, management responsibility for an acquisition programs T&E resides with the PM. However, the planning, executing, and reporting of T&E involves interactions, support, and oversight from other organizations within OSD, the Services, Defense Agencies, and in some cases, other government agencies; as well as the system contractor(s). The PM charters a T&E WIPT early in the acquisition model to support development of test strategies and estimates of resource requirements, strengthening the overall input to the programs integrated product team (IPT). For additional

information, consult Rules of the Road A Guide for Leading a Successful Integrated Product Team , October 1999.

The PM, in concert with the user and the T&E community, coordinates DT&E,

OT&E, LFT&E, family-of-systems (FoS) interoperability testing, IA testing, reliability and maintainability (RAM) growth testing (DTM 11003 , Reliability Analysis, Planning, Tracking, and Reporting, dated December 2, 2011), and modeling and simulation (M&S) activities, into an efficient continuum, closely integrated with requirements definition and systems design and development. The PM has responsibility for the development and final approval of the TEMP that effectively describes the overall strategy for T&E supporting the programs acquisition strategy and Systems Engineering Plan (SEP) , and the resources necessary to execute the test program. MDAP/MAIS programs and programs identified as being on OSD T&E Oversight List require Component level approval and OSD approval by DASD DT&E for programs on DT&E oversight and DOT&E for programs on OT&E and/or LFT&E oversight. For a program requiring LFT&E in accordance with section 2366 of title 10 USC , the PM must ensure timely submission of waivers and alternative plans to meet SecDef obligations to advise Congress of any deviations from full up, system level (FUSL) LFT&E requirements. All MDAP/MAIS programs should identify key leadership positions (KLPs) early in the acquisition process. An early charter for a T&E WIPT proves essential to the success of a test and evaluation program.

9.2.2. T&E Board of Directors (BoD(ES))

Acting as the agent for the Service Vice Chiefs and equivalent OUSD and Defense Agency representatives with T&E management responsibilities is the BOD Executive Secretariat (BOD(ES)), consisting of the Service T&E principals and equivalent OUSD and Defense Agency representatives with T&E infrastructure management responsibilities. The BOD(ES):

- Endorses guidance and policy for T&E infrastructure and investment management to ensure a disciplined test process that supports weapon, IT & NSS system acquisition and operational, safety, suitability, and effectiveness assessments with a cost-effective infrastructure.
- Supports program review and advocacy for T&E capabilities and requisite infrastructure to OSD and Congress.
- Endorses the T&E Executive Agent Test Resources Master Plan.
- Approves and directs studies in support of T&E infrastructure management, standards, policy, configuration and investments.
- Endorses T&E infrastructure standards that promote interoperability and commonality among test centers and ranges.
- Endorses processes for workload measurement, forecasting, utilization, and full cost visibility application to T&E infrastructure investments and other related decisions.
- Endorses principles of T&E Reliance (joint OSD and individual Services efforts to

maximize commonality, interoperability, and effective utilization of products and services in support of the T&E infrastructure).
- Approves joint T&E requirements and recommends solutions from the needs and solutions process for the Central T&E Investment Program (CTEIP) consideration.
- Serves as the T&E representatives on the OSD chartered Defense Test and Training Steering Group (DTTSG).

9.2.3. Component and Joint T&E Organizations

9.2.3.1. Defense Information Systems Agency (DISA) T&E Executive (TEO)

The DISA T&E Executive serves as the Test, Evaluation, and Certification (TE&C) subject matter expert and Special Advisor to the DISA Director, DISA, and Senior Executive Leadership. The DISA T&E Executive duties and responsibilities include:

- Establishing and providing oversight of DISAs overarching TE&C strategies, policies, and procedures as well as missions and functions.
- Coordinating accomplishment of TE&C goals and investment strategies with DISAs Joint Interoperability Test Command (JITC) , program executive officer (PEOs), and PMOs for the development and management of the DISA T&E Resource Management Plan.
- Providing oversight of DISA TE&C missions and functions, to include formulation of overarching T&E strategies, policies, and program direction.
- Providing policy oversight and resource management.
- Publishing and enforcing TE&C policies and guidance related to agency acquisition programs and projects, examines TE&C strategies to ensure consistent application of sound agile TE&C strategies, methodologies, and processes.
- Providing TE&C oversight and support for the agency in the development of program documentation (e.g., TES and TEMP) to ensure governance, construct, infrastructure, and operations satisfy legal and regulatory requirements for adequate TE&C. Functions as the final TE&C review authority and signatory for TEMPs prior to Component Acquisition Executive (CAE) and OSD approval and signature.
- Leading internal and external transitional TE&C concepts and methodologies to ensure agile, mission capabilities-based, and Warfighter-relevant processes for IT Systems and Services for the agency and DoD.
- Representing the agency to the DoD T&E community, ensuring alignment with the OSD and Joint Staff as a member of the T&E BoD(ES) and as a voting member of the Military Communications-Electronics Board (MCEB) Interoperability Policy & Certification Panels (IP/ICP) as well as other OSD TE&C advisory working groups.
- Providing oversight and development of Agency's TE&C career management plan for recruiting, training, and retaining a professional TE&C workforce. Serves

as the track manager for the DAWIA T&E component.

9.2.3.2. Assistant Deputy Under Secretary of the Army for Test & Evaluation (ADUSA(T&E))

Within the Army, the T&E Executive is the Director, T&E Office under the authority, direction, and control of the Deputy Under Secretary of the Army. Key Army T&E Executive duties and responsibilities include:

- Serving as the senior advisor to the Secretary of the Army and the Chief of Staff, Army, on all Army T&E matters.
- Advising the Army Systems Acquisition Review Council (ASARC), the Army Requirements Oversight Council (AROC), and OIPTs on T&E matters.
- Approving test-related documentation for the Secretary of the Army and forwards, as appropriate, to OSD.
- Coordinating T&E matters with the Joint Staff and OSD, to include serving as principal Army interface on matters of T&E with the USD(AT&L) and DOT&E.
- Overseeing all Army T&E missions and functions, to include formulating overarching Army T&E strategy, policy, and program direction, providing policy oversight, and managing resources.
- Providing HQDA oversight on the funding of the Army Threat Simulator Program , Army Targets Program , and Army Instrumentation Program ; and coordinate with the Project Manager for Instrumentation, Targets, and Threat Simulators (PM ITTS).
- Overseeing Army responsibilities in Joint T&E, Foreign Comparative Testing (FCT), and multi-Service and multinational T&E acquisition programs.
- Serving as the Acquisition Workforce Functional Chief for the T&E acquisition workforce Career Field.

9.2.3.3. Director, Air Force Test & Evaluation (AF/TE)

The Air Force T&E Executive serves as the Director, Air Force Test and Evaluation (AF/TE), who serves under the authority and direction of the Secretary of the Air Force (SECAF) and the Chief of Staff of the Air Force (CSAF). In this capacity, the AF/TE:

- Functions as the sole focal point for Air Force T&E policy, guidance, direction, and oversight for the formulation, review, and execution of T&E plans, programs, and budgets.
- Functions as the chief T&E advisor to senior Air Force leadership on T&E processes; DT&E, including contractor testing and LFT&E; OT&E; and the use of M&S in T&E.
- Functions as the final T&E review authority and signatory for TEMPs prior to CAE and OSD approval and signature.
- Collaborates with requirements sponsors and system developers to improve operational requirements, system development, and the fielding of operationally effective, suitable, safe, and survivable systems.

- Reviews and/or prepares T&E information for timely release to OSD, Congress, and decision makers.
- Oversees the Air Force T&E infrastructure by determining the adequacy of T&E resources required to support system acquisition activities. Administers various T&E resource processes and chairs or serves on various committees, boards, and groups supporting T&E activities.
- Acts as the single point of entry for the Air Force Foreign Materiel Program.
- Manages the Air Force Joint Test & Evaluation Program according to DoDI 5010.41 Joint Test and Evaluation (JT&E) Program, dated September 12, 2005.
- Functions as the certifying authority for T&E personnel for T&E Level 3 in the Acquisition Professional Development Program (APDP) when not delegated to the Major Commands (MAJCOMs).

9.2.3.4. Department of the Navy Test & Evaluation Executive (OPNAV N091)

The Director, Test and Evaluation and Technology Requirements (OPNAV N091) serves as the Department of Navy (DON) T&E Executive. The DON T&E Executive reports to the Chief of Naval Operations (CNO), the Commandant of the Marine Corps (CMC), and the Principle Military Deputy to the Assistant Secretary of the Navy for Research, Development, and Acquisition (PMD ASN (RDA)) on all matters pertaining to test and evaluation.

The DON T&E Executive supports and advises the Vice Chief of Naval Operations (VCNO) regarding the VCNOs role on the T&E BOD and serves as the Navy representative on the T&E BOD Executive Secretariat.

The Director, Test and Evaluation and Technology Requirements (N091):

- Approves all Navy Test and Evaluation Master Plans for CNO.
- Establishes Navy T&E requirements and promulgates policy, regulation, and procedures governing Navy T&E.
- Acts for CNO in resolving T&E requirements.

9.2.4. Office of the Secretary of Defense T&E Management

9.2.4.1. Developmental Test & Evaluation

Statute and policy prescribes the management of DT by the DASD(DT&E), who, for all programs on DT oversight, acts as the final approval authority for DT planning in the TEMP. ODASD(DT&E) staff representatives actively participate in acquisition program T&E WIPTs and provide advice to the T&E WIPT and PM; as well as providing independent assessments to DASD(DT&E) on progress of performance of the test program and overall performance of the system. By statute, the DASD(DT&E) has access to all test data and program information relevant to the execution of testing and fulfillment of the ODASD(DT&E) responsibilities. As a member of the OIPT, the DASD(DT&E) provides advice and recommendations at Defense Acquisition Board

(DAB), reviews and submits an independent Assessment for Operational Test Readiness (AOTR) to the Component Acquisition Executive (CAE) and USD(AT&L) for all programs on DT oversight prior to the CAE decision on material readiness for initial operational test and evaluation (IOT&E).

The PM should initiate early engagement with the ODASD(DT&E) and charter a T&E WIPT to aid in development of test strategies and building a TEMP. Given that DT spans the entire lifecycle of an acquisition program and remains a vital part of all levels in the work structure of the systems engineering process, DASD(DT&E) expects due diligence from the PMs to ensure they base program and design decisions on test results conducted and reported as independent verification steps in the process, and not simply pulled from design and test learning processes. This effort requires close and continuous coordination with the SEP, Information Support Plan (ISP), and developing activity engineering and test activities to ensure test plans and reports reflect independent evaluation of the test data from the engineering staff vested in the development activities.

Ideally, the PM bases all development decisions on test events and not schedules or costs; but in the pragmatic environment of developing systems for the Warfighter, time and cost prove significant drivers in pressuring test activities. Therefore, DT activities must provide realistic T&E schedules to PMs during the establishment of the programs integrated management schedule. This effort ensures the effective management of the overall progress and cost of the program; particularly with complex systems that have a number of dependent sub systems and technologies requiring efficient integration as an end product.

As such, the DASD(DT&E):

- Develops policies and guidance for the planning, execution, and reporting of DT&E in the DoD, according to section 139b of title 10 USC .
- Develops policies and guidance for the integration of DT and OT, in coordination with DOT&E.
- Publishes, in conjunction with DOT&E, a combined list of OSD T&E Oversight programs for DT&E, OT&E, and LFT&E.
- Monitors and reviews the DT&E activities of MDAPs and other programs.
- Periodically conducts AOTRs.
- Provides advocacy, oversight, and guidance to the acquisition workforce responsible for test and evaluation.
- Reviews and approves TES/TEMPs and selected DT&E plans.
- Periodically reviews the Services organizational DT&E capabilities to identify needed changes or improvements.

9.2.4.2. Operational Test & Evaluation

By law, DOT&E prescribes policies and procedures for the conduct of OT&E in the Department of Defense. For programs on DOT&E OT oversight, DOT&E serves as the

final approval authority for OT&E planning to include approval of the TEMP. DOT&E staff representatives actively participates in acquisition program T&E WIPTs and provide advice to the T&E WIPT and PM; as well as providing independent assessments to the DOT&E on progress of performance of the test program and overall performance of the system. By law, DOT&E has access to all data and records DOT&E considers necessary to review in fulfillment of DOT&E OT&E responsibilities. DOT&E serves as a member of both the Joint Requirements Oversight Council and the OIPT, providing advice and recommendations at DAB reviews; and has direct access to both USD(AT&L) and the SecDef, on all matters relating to operational test and evaluation.

The PM should initiate early engagement with DOT&E through the Service and Defense Agency T&E Executive and independent OTA and charter a T&E WIPT to aid in development of T&E strategies and the TEMP. Since OT&E generally acts as the validation process in SE, early engagement of the OTA and DOT&E, as early as the Analysis of Alternatives and requirements development, ensures a comprehensive assessment of measurability and testability of requirements; and the associated implications to cost and schedule to effectively evaluate the system capabilities and limitations. This requires close and continuous coordination with users, sponsors, developers, and all test activities to ensure understanding and articulation of end-game expectations during program planning and documentation.

Per section 2399 of title 10 USC , an MDAP must complete IOT&E before proceeding beyond full-rate production (FRP). Law also requires DOT&E to provide a Beyond Low-Rate Initial Production (BLRIP) report to the SecDef, USD(AT&L), and congressional defense committees on the adequacy of OT&E conducted; as well as the results of T&E to confirm effectiveness and suitability for combat. Additionally, DoDI 5000.02 charges DOT&E with completing the section 2366 of title 10 USC LFT&E report requirement for submission to the congressional defense committees, SecDef, and USD(AT&L) before the system may proceed to FRP. For purposes of compliance with completion of IOT&E, the PM must ensure the system under test reflect production configured or representative systems, preferably Low Rate Initial Production (LRIP) systems. Title 10 requires DOT&E to determine the number of LRIP systems for all operational testing of programs on DOT&Es OT&E oversight and the Service OTA to determine LRIP requirements for non-OSD T&E oversight programs. DOT&E and the OTAs routinely engage the PM in those decisions. For programs not on the OSD T&E Oversight List, the Service or Defense Agency OTA will work with the PMs for OT&E, including planning, applicable oversight, execution and reporting. Service or Defense Agency OTAs may delegate the responsibilities to other responsible DoD test agencies.

DOT&E approves all OT&E plans, to include early operational assessments (EOAs), OAs, Limited User Tests (LUTs), IOT&E, and Follow-on Operational Test & Evaluation (FOT&E). DOT&E requires the OTAs to provide plans to assess adequacy of data collection and analysis planning to support the operational evaluation of a systems operational effectiveness and operational suitability, since integrated test concepts aid in generating test efficiencies and reduced development time. OTAs must schedule test concept briefings 180 days prior to an operational test. PMs must provide OT&E plans

for DOT&E approval 60 days prior to test events.

In addition to OT&E oversight, the SecDef charges DOT&E with approving waivers to full up system level (FUSL) LFT&E and approval of required alternative LFT&E plans prior to Milestone B.

For programs to effectively track through the complex acquisition process and meet their cost, schedule, and performance goals, it remains essential to engage OSD early, continuously, and to quickly resolve working issues presenting obstacles to any of the T&E stakeholders duties. Service T&E Executives must establish clear issue resolution processes to resolve issues in a timely fashion.

As such, the DOT&E:

- Prescribes OT&E and LFT&E policies for the DoD according to sections 139 , 2366 , 2399 , and 2400 of title 10; and DoDD 5141.2 , Director of Operational Test and Evaluation (DOT&E), dated February 2, 2009.
- Exercises oversight responsibility for ACAT I or other programs in which the SecDef has special interest. Monitors and reviews OT and LF activities in the DoD.
- Participates in integrated test teams and test integrated product teams to foster program success.
- Publishes, in conjunction with the DASD(DT&E), a combined list of OSD T&E Oversight programs for DT, OT, and LF.
- Approves, in writing, the adequacy of operational test plans for those programs on OSD OT&E Oversight prior to the commencement of operational testing. Approves the operational test portions of integrated test plans. Approves the quantity of test articles required for operational testing of major defense acquisition programs (MDAP).
- Approves TEMP and T&E strategies for OSD T&E Oversight programs in conjunction with the DASD(DT&E) and DoD Chief Information Officer (CIO).
- Approves LFT&E strategies and waivers prior to commencement of LFT&E activities.
- Submits a report to SecDef and Congress before systems on OSD OT&E Oversight may proceed BLRIP.

9.2.5. Major Range and Test Facility Base

The DoD, through the TRMC, oversees sustainment of twenty-four T&E organizations or activities with a skilled workforce and T&E technical capabilities and processes, and available to all components under a common charge policy. In accordance with DoDD 3200.11 Major Range and Test Facility Base MRTFB, dated December 27, 2007 and DoDI 3200.18 Management and Operation of the Major Range Test Facility Base (MRTFB), dated February 1, 2010, TRMC manages the following activities:

ARMY ACTIVITIES

White Sands Test Center

High Energy Laser Systems Test Facility

U.S. Army Kwajalein Atoll (Ronald Reagan Ballistic Missile Defense Test Site)

Yuma Test Center

Cold Regions Test Center

Tropic Regions Test Center

West Desert Test Center

Aberdeen Test Center

Electronic Proving Ground

NAVY ACTIVITIES

Naval Air Warfare Center-Weapons Division, Point Mugu

Naval Air Warfare Center-Weapons Division, China Lake

Naval Air Warfare Center-Aircraft Division, Patuxent River

Atlantic Undersea Test and Evaluation Center

Pacific Missile Range Facility

Keyport Pacific Northwest Range Complex (Nanoose and Dabob Ranges)

AIR FORCE ACTIVITIES

45th Space Wing

30th Space Wing

Arnold Engineering Development Center

Nevada Test and Training Range

Air Force Flight Test Center

Utah Test and Training Range

46 th Test Wing, to include 46 th Test Group

DEFENSE-WIDE ACTIVITIES

Defense Information Systems Agency, Information Technology Test bed, to include capabilities in the National Capitol Region

Joint Interoperability Test Command, to include capabilities at Indian Head, MD, and Fort Huachuca, AZ

9.3. Test and Evaluation

DoD employs three formal types of T&E (directed by statute) in the acquisition of weapon systems, business systems, NSS, and joint systems administered by OSD: DT&E, OT&E, and LFT&E. The TRMC, also directed by statute, oversees the MRTFB to ensure availability of capabilities to support the three T&E types. Within these broad categories, the military departments and Defense Agencies have their own directives, guidance, organizations, T&E resources, ranges, and facilities specific to their needs. This section provides distinguishing features of each type.

9.3.1. Developmental Test and Evaluation

Programs conduct DT&E throughout the systems life cycle, from program initiation through system sustainment, to reduce design and programmatic risks and provide assessments. DT&E can occur as either contractor testing or government testing or a mix of both. As such, DT&E:

- Assesses achievement of Critical Technical Parameter(s) (CTPs) and Key System Attribute(s) (KSAs) along with assessment of progress toward achievement of KPPs and Critical Operational Issue(s) (COIs).
- Assesses system satisfaction of the thresholds as described in the capabilities requirements documentation.

- Supports progress toward and final characterization of the system readiness for dedicated IOT&E via the AOTR process and document.
- Characterizes system functionality and provides information for cost, performance, and schedule tradeoffs.
- Assesses system specification compliance.
- Reports progress to plan for Reliability Growth and characterizes reliability and maintainability.
- Identifies system capabilities, limitations, and deficiencies.
- Assesses system safety.
- Assesses compatibility with legacy systems.
- Stresses the system within an intended mission environment.
- Supports the joint interoperability certification process and achieves information assurance certification and accreditation.
- Documents achievement of contractual technical performance and verifies incremental improvements and system corrective actions.

In general, DT&E is the disciplined process of generating experimental performance data from systems, subsystems, components and materiel for the purpose of informing optimum solutions and the state of performance progress toward design performance goals.

Evaluation in the context of DT&E refers to evaluating the generated performance data to ensure it appropriately depicts the performance of the item as tested in the conditions of the test.

Testing in the context of DT&E refers to the process of establishing appropriate conditions and generating performance data from systems, subsystems, components and materiel.

9.3.2. Operational Test and Evaluation

Service and Defense Agency OTAs have a responsibility for OT&E. OT&E determines the operational effectiveness and operational suitability of a system under realistic operational conditions, including joint combat operations; determines the satisfaction of thresholds in the approved JCIDS documents and critical operational issues; assesses impacts to combat operations; and provides additional information on the systems operational capabilities.

OTAs have a responsibility for early involvement in a systems acquisition; for example, EOAs during the Technology Development (TD) phase, OAs during engineering and manufacturing development (EMD) phase, and review of Capabilities Documents to assess measurability, testability, and operational relevancy of requirements in the JCIDS documents (that is, Capability Development Document (CDD) and Capability Production Document (CPD)). OTAs also have responsibility for the assessment and evaluation of systems operational effectiveness, operational suitability, and survivability or operational security completed in IOT&E, and when necessary, Follow-on

Operational Test and Evaluation (FOT&E).

General guidelines for the conduct of OT&E include:

- For dedicated OT&E, typical users operate and maintain the system under test conditions simulating combat and peacetime operations.
- OT&E uses threat or threat representative forces, targets, and threat countermeasures, validated by the Defense Intelligence Agency (DIA) or the DoD Component intelligence agency, as appropriate, and approved by DOT&E during the test plan approval process.
- Conducting IA Testing and evaluation for all weapon, information, and C4ISR programs depending on external information sources, or providing information to other DoD systems.
- Persons employed by the contractor for the system under development may only participate in the OT&E of MDAPs to the extent the PM planned for their involvement in the operation, maintenance, and other support of the system when deployed in combat.
- Testing production representative systems, which include any system accurately representing it's final configuration using mature and stable hardware and software; that accurately mirrors the production configuration, but not produced on a final production line (although production tooling may account for some components).

9.3.2.1. Evaluation of Operational Effectiveness

DoD defines operational effectiveness as the overall degree of mission accomplishment of a system when used by representative personnel in the environment planned or expected for operational employment of the system considering organization, training, doctrine, tactics, survivability or operational security, vulnerability, and threat.

The evaluation of operational effectiveness links to mission accomplishment. The early planning for the evaluation should consider any special test requirements, such as the need for large test areas or ranges or supporting forces, requirements for threat systems or simulators, new instrumentation, or other unique support requirements.

For weapon systems, integrate LFT&E of system lethality into the evaluation of weapon system effectiveness. For example, operational testing could identify likely shot lines, hit points, burst points, or miss distances providing a context for LFT&E lethality assessments. Fuse performance, as determined under DT&E, can provide information for both OT&E and LFT&E assessments.

9.3.2.2. Evaluation of Operational Suitability

Operational suitability defines the degree in which a system satisfactorily places in field use, with consideration given to reliability, availability, compatibility, transportability, interoperability, wartime usage rates, maintainability, safety, human factors, manpower

supportability, logistics supportability, documentation, environmental effects, and training requirements.

Early planning for the operational suitability evaluation should include any special needs for the number of operating hours, environmental testing, maintenance demonstrations, testing profiles, usability of DT&E data, or other unique test requirements.

Operational suitability evaluates a mission context to provide meaningful results. For example, maintaining a required operations tempo over an extended period while conducting realistic missions gives insight into the interactions of various suitability factors.

9.3.2.3. Evaluation of Survivability or Operational Security

Survivability or operational security includes the elements of susceptibility, vulnerability, and recoverability. As such, survivability or operational security acts as an important contributor to operational effectiveness and suitability. All systems under OT&E oversight should receive survivability or operational security assessment if exposed to threat weapons in a combat environment or to combat-induced conditions that may degrade capabilities, regardless of designation for LFT&E oversight. For example, unmanned vehicles may not have a requirement to undergo survivability LFT&E under section 2366 of title 10 USC , but should receive an assessment for survivability or operational security. The assessment may identify issues needing addressed through testing.

Integrate DT&E, OT&E, and LFT&E strategies to ensure the consistent assessment of the full spectrum of system survivability or operational security. The COIs should include any issues needing addressed in the OT&E evaluation of survivability or operational security. Systems under LFT&E oversight must address personnel survivability (reference section 2366 of title 10 USC) and integrate it into the overall system evaluation of survivability or operational security conducted under OT&E.

Generally, LFT&E address vulnerability while OT&E addresses susceptibility, but areas of overlap exist. The evaluation of LFT&E results requires realistic hit distributions. The OT&E evaluation of susceptibility might identify realistic hit distributions of likely threats, hit/burst points, and representative shot lines providing a context for LFT&E vulnerability assessments. DT&E and OT&E testing of susceptibility may provide other LFT&E insights, such as information on signatures, employment of countermeasures, and tactics used for evasion of threat weapons. Similarly, LFT&E tests, such as Total Ship Survivability trials, may provide OT&E evaluators with demonstrations of operability and suitability in a combat environment.

Recoverability addresses the consequences of system damage. Typically, LFT&E addresses recoverability; however, both OT&E and LFT&E have an interest in tests relating to recoverability from combat damage or from peacetime accidents, battle

damage assessment and repair, crashworthiness, crew escape, and rescue capabilities.

LFT&E conducts real time casualty assessment (RTCA) during IOT&E to ensure assumptions supporting the RTCA remain consistent with LFT&E results.

Networked and C3I systems evaluation should include effectiveness of IA and Computer Network Defense (CND) measures against cyber threats in accordance with the DOT&E memo Clarification of Procedures for Operational Test and Evaluation of Information Assurance in Acquisition Programs , dated November 4, 2010, and Procedures for Operational Test and Evaluation of Information Assurance in Acquisition programs , dated January 21, 2009.

9.3.3. Live Fire Test and Evaluation

9.3.3.1. Life Fire Test & Evaluation Objectives

9.3.3.2. Covered Systems

9.3.3.3. Early Live Fire Test and Evaluation

9.3.3.4. Full-Up, System-Level Testing and Waiver Process

9.3.3.5. Personnel Survivability

9.3.3. Live Fire Test and Evaluation

9.3.3.1. Life Fire Test & Evaluation Objectives

LFT&E objectives provide a timely assessment of the vulnerability/lethality of a system as it progresses through its design and development, prior to full-rate production. In particular, LFT&E should:

- Provide information to decision-makers on potential user casualties, vulnerabilities, and lethality; taking into equal consideration susceptibility to attack and combat performance of the system.
- Ensure testing of the system under realistic combat conditions includes knowledge of user casualties and system vulnerabilities or lethality.
- Allow correction in design or employment of any design deficiency identified by T&E before proceeding BLRIP.
- Assess recoverability from battle damage and battle damage repair capabilities and issues.

Structure and schedule the LFT&E Strategy to incorporate any design changes resulting from testing and analysis before proceeding beyond LRIP.

9.3.3.2. Covered Systems

The DoD term for a covered system includes all categories of systems or programs requiring LFT&E. A "covered system" defines a system that DOT&E, acting for the SecDef, designates for LFT&E oversight. These systems include, but are not limited to, the following categories:

- Any major system within the meaning of that term in section 2302(5) of title 10 USC , including user-occupied systems and designed to provide some degree of protection to its occupants in combat; or
- A conventional munitions program or missile program; or a conventional munitions program planning to acquire more than 1,000,000 rounds (regardless of major system status); or
- A modification to a covered system likely to significantly affect the survivability or lethality of such a system.

9.3.3.3. Early Live Fire Test and Evaluation

DOT&E approves the adequacy of the LFT&E Strategy before the program begins LFT&E. LFT&E issues identified in the strategy should drive the program, and fully integrate it with planned DT&E and OT&E. LFT&E typically includes testing at the component, subassembly, and subsystem level; and may also draw upon design analyses, modeling and simulation, combat data, and related sources such as analyses of safety and mishap data. As a standard practice, this occurs regardless of whether the LFT&E program culminates with FUSL testing, or obtaining a waiver from FUSL testing. Conducting LFT&E early in the program life cycle allows time to correct any design deficiency demonstrated by the T&E. Where appropriate, the program manager may correct the design or recommend adjusting the employment of the covered system before proceeding beyond LRIP.

9.3.3.4. Full-Up, System-Level Testing and Waiver Process

DoD defines "full-up, system-level testing" as testing that fully satisfies the statutory requirement for "realistic survivability" or "realistic lethality testing," as defined in section 2366 of title 10 USC . The criteria for FUSL testing differs somewhat based on the type of testing: survivability or operational security or lethality. The following describes FUSL testing:

Vulnerability testing conducted using munitions likely to be encountered in combat on a complete system loaded or equipped with all the dangerous materials that normally would be on board in combat (including flammables and explosives), and with all critical subsystems operating that could make a difference in determining the test outcome; or

Lethality testing of production-representative munitions or missiles, for which the target is representative of the class of systems that includes the threat; and the target and test conditions are sufficiently realistic to demonstrate the lethality effects the weapon is

designed to produce.

The statute requires a LFT&E program to include FUSL testing unless granted a waiver in accordance with procedures defined by the statute. To request a waiver, submit a waiver package to the appropriate Congressional defense committees prior to Milestone B; or, in the case of a system or program initiated at Milestone B, as soon as practicable after Milestone B; or if initiated at Milestone C, as soon as practicable after Milestone C. Typically, this should occur at the time of TEMP approval.

The waiver package includes certification by the USD(AT&L) or the DoD CAE that FUSL testing would prove unreasonably expensive and impractical. It also includes a DOT&E-approved alternative plan for conducting LFT&E in the absence of FUSL testing. Typically, the alternative plan appears similar or identical to the LFT&E Strategy contained in the TEMP. This alternative plan should include LFT&E of components, subassemblies, or subsystems; and, as appropriate, additional design analyses, M&S, and combat data analyses.

Programs receiving a waiver from FUSL testing conduct their plans as LFT&E programs (with exception of the statutory requirement for FUSL testing). In particular, the TEMP contains an LFT&E Strategy approved by DOT&E; and DOT&E, as delegated by the SecDef, submits an independent assessment report on the completed LFT&E to the Congressional committees as required by statute.

9.3.3.5. Personnel Survivability

LFT&E has a statutory requirement to emphasize personnel survivability for covered systems occupied by U.S. personnel (section 2366 of title 10 USC). In general, LFT&E addresses personnel survivability through dedicated MOEs, such as "expected casualties." Address the ability of personnel to survive even in cases where the platform cannot survive. If designated by DOT&E for survivability LFT&E oversight, the system or program should integrate the T&E to address crew survivability issues into the LFT&E program supporting the DOT&E LFT&E Report to Congress.

9.4. Integrated Test and Evaluation

9.4. Integrated Test and Evaluation

According to OSD Memorandum Definition of Integrated Testing , dated April 25, 2008, OSD defines integrated testing as the collaborative planning and collaborative execution of test phases and events to provide shared data in support of independent analysis, evaluation, and reporting by all stakeholders, particularly the development (both contractor and government) and operational test and evaluation communities.

Integrated testing’s goal: conduct a seamless test program producing credible qualitative and quantitative data useful to all evaluators, and addressing developmental, sustainment, and operational issues. Integrated testing allows for the collaborative

planning of test events; where a single test point or mission can provide data to satisfy multiple objectives, without compromising the test objectives of participating test organizations. Test points in this context, mean a test condition denoted by time, three-dimensional location and energy state, and system operating configuration; where applying a pre-planned test technique to the system under test and observing and recording the response(s).

Integrated testing includes more than just concurrent or combined DT and OT, where both DT and OT test points remain interleaved on the same mission or schedule. Integrated testing focuses the entire test program (contractor test, Government DT, OT, and LFT) on designing, developing, and producing a comprehensive plan that coordinates all test activities to support evaluation results for decision makers at required decision reviews.

Integrated testing may include all types of test activities such as contractor testing, developmental and operational testing, interoperability and IA testing, and certification testing. All testing types, regardless of the source, should receive consideration; including tests from other Services for multi-Service programs. Software intensive and IT systems should use the reciprocity principle as much as possible, i.e., "Test by one, use by all." Specifically name any required integrated test combinations.

For successful integrated testing, understanding and maintaining the pedigree of the data proves vital. The pedigree of the data refers to accurately documenting the configuration of the test asset and the actual test conditions under which each element of test data was obtained. The pedigree of the data should indicate whether the test configuration represented operationally realistic or representative conditions. The T&E WIPT plays an important role in maintaining the data pedigree within the integrated test process for a program. The T&E WIPT establishes agreements between the test program stakeholders; regarding roles and responsibilities in not only implementing the integrated test process, but also in developing and maintaining data release procedures, and data access procedures or a data repository, where all stakeholders will have access to test data for separate evaluations.

Integrated testing must provide shared data in support of independent analyses for all T&E stakeholders. A requirement exists for a common T&E database, including descriptions of the test environments to ensure commonality and usability by other testers. Integrated testing must allow for and support separate, independent OT&E according to section 2399 of title 10 USC and DoDI 5000.02 , Operation of the Defense Acquisition System, dated December 8, 2008. It does not include the earliest engineering design or testing of early prototype components.

Integrated testing serves as a concept for test design, not a new type of T&E. Programs must intentionally design it into the earliest program strategies, plans, documentation, and test plans, preferably starting before Milestone A. Developing and adopting integrated testing strategies early in the process increases the opportunities and benefit’s. If done correctly, the enhanced operational realism in DT&E provides greater

opportunity for early identification of system design improvements, and may even change the course of system development during EMD. Integrated testing can increase the statistical confidence and power of all T&E activities. Most obviously, integrated testing can also reduce the number of T&E resources needed in OT&E. However, integrated testing does not replace or eliminate the need for dedicated IOT&E, as required by section 2399 of title 10 USC , "Operational Test and Evaluation of Defense Acquisition Programs" and DoDI 5000.02 .

The T&E strategy should embed integrated testing, although most of the effort takes place during the detailed planning and execution phases of a test program. It is critical that all stakeholders understand the required evaluations to assess risks, assess maturity of the system and assess the operational effectiveness, operational suitability and survivability or operational security /lethality. Up front, define the end state for evaluation, ensuring all stakeholders work toward the same goal. Once accomplished, develop an integrated test program that generates the data required to conduct the evaluations.

Early identification of system and mission elements enable the development and execution of an efficient and effective T&E strategy and an integrated DT/OT program. The use of scientific and statistical principles for test and evaluation; for example, design of experiments (DOE), will help develop an integrated DT/OT program by providing confidence about the performance of a system in a mission context.

Although DT and OT require different fidelity to meet their individual objectives (e.g., data parameters, mission control, onboard and test range instrumentation, data collection and analysis), some of areas of commonality include:

- Evaluation in complex joint mission operating environments with systems of different levels of maturity (integrating upgraded systems with legacy systems)
- Replication of the real world environment as closely as practical in a safe and affordable manner
- Need for a distributive live/virtual/constructive (LVC) representation of the joint operational environments (the only affordable way to test and train in a complex system-of-systems environment)
- Use of validated tactics, techniques, and procedures (TTPs)
- Representation of Blue and Red Forces
- Validated scenarios
- Threat and threat countermeasures
- Dedicated instrumented ranges. (differences exist in the instrumentation fidelity required to control participants, collect data, and support real-time and post-event analyses)
- Data collection, management, archiving, and retrieval processes
- Embedded sensors and instrumentation

Integrated DT/OT initiatives encourage all testers contractor, developmental, operational, and live fire to plan an integrated test program, seeking an efficient

continuum. They focus on the early discovery of problems in a mission context and in realistic operational environments even for component testing. The appropriate T&E environment includes the system under test (SUT) and any interrelated systems (that is, it's planned or expected environment in terms of weapons, sensors, command and control, and platforms, as appropriate) needed to accomplish an end-to-end mission in combat. The following includes a few integrated test concerns:

1. Balancing the test event to effectively capture different DT and OT data collection objectives
2. Requiring early investment in detailed planning that many programs lack in early stages
3. Requiring constant planning and updates to effectively maximize test results
4. Much of the early information for a program is preliminary, requiring rework and updates
5. Analyzing proves difficult when unanticipated anomalies appear in test results

9.5. Test and Evaluation Planning

T&E planning should include statistically defensible test results to effectively support decision makers. A common approach, DOE serves as a structured process to assist in developing T&E strategies utilizing statistical analyses. Many constraints exist in testing limited test resources, limited test time, and limited test articles. DOE aids in the understanding of the tradeoffs among these constraints and their implications. Additionally, DOE can provide a statistically optimum allocation of assets under given constraints. It can also provide optimal allocation test points between multiple phases of testing. DOE ensures the synergistic results in the data collected in multiple phases in sequential learning about the system.

A program applying DOE should start early in the acquisition process and assemble a team of subject matter experts who can identify operational and environmental conditions (the driving factors in the successful performance of the system and the consideration of levels of each factor). The team should include representation for all testing (contractor testing, Government DT and OT). The developed TEMP should include the resources needed, the plan for early tests (including component tests), and use of the results of early tests to plan further testing.

9.5.1. DT&E Planning

A well planned and executed DT&E program supports the technology development and acquisition strategies as well as the systems engineering process; providing the information necessary for informed decision-making throughout the development process and at each acquisition milestone. DT&E provides the verification and validation (V&V) of the systems engineering process as well as confidence that the system design solution satisfies the desired capabilities. The strategy for T&E should remain consistent with and complementary to the SEP and acquisition strategy. The T&E WIPT, working closely with the PM and the system design team, facilitates this process. Rigorous component and sub-system DT&E enables early performance and reliability assessments for utilization in system design. DT&E and integrated testing events should advance to rigorous, system-level and system-of-systems (SoS) level T&E; ensuring the system maturity to a point where it can enter production, and ultimately meet operational employment requirements.

DT&E reduces technical risk and increases the probability of a successful program. During early DT&E, the prime contractor focuses contractor testing on technical contract specifications. Government testers observe the critical contractor testing, conduct additional T&E, and, when practical, facilitate early user involvement. The PMs contract with industry must support open communication between government and contractor testers. The OSD document, "Incorporating Test and Evaluation into Department of Defense Acquisition Contracts," dated October 2011, provides additional guidance on contract-related issues for the successful solicitation, award, and execution of T&E related aspects of acquisition contracts. Items such as commercial-off-the-shelf, non-developmental items, and Government-off-the-shelf products, regardless of the manner of procurement, must undergo DT&E to verify readiness to enter IOT&E, for proper evaluation of operational effectiveness, operational suitability, and survivability or operational security for the intended military application. Programs should not enter IOT&E until the DoD Components indicate confidence that the production representative system will successfully demonstrate effective, suitable, and survivable criteria established in the capability production document (CPD). In addition, the government will report DT&E results at each program milestone, providing knowledge to reduce the risk in those acquisition decisions.

9.5.2. OT&E Planning

DoDI 5000.02 Enclosure 6 lists mandatory elements of OT&E planning and execution.

Other considerations include:

- Planning should consider an integrated testing approach. The integrated approach should not compromise either DT&E or OT&E objectives. Planning should provide for an adequate OT period and report generation, including the DOT&E BLRIP report to the SecDef and Congress prior to the FRP decision.
- OT&E should take maximum advantage of training and exercise activities to increase the realism and scope of both the OT&E and training, and to reduce testing costs.
- OTAs should participate in early DT&E and M&S to provide operational insights to the PM, the JCIDS process participants, and acquisition decision-makers. OT&E responsibility resides with the DoD Component OTA; including planning, gaining DOT&E plan approval, execution, and reporting.
- Prototype testing should be emphasized early in the acquisition process and during EOAs to identify technology risks and provide operational user impacts. OTAs should maximize their involvement in early, pre-acquisition activities. T&E provides early operational insights during the developmental process. This early operational insight should reduce the scope of the integrated and dedicated OT&E, thereby contributing to reduced acquisition cycle times and improved performance.
- OT&E planning should consider appropriate use of accredited M&S to support DT&E, OT&E, and LFT&E and be coordinated through the T&E WIPT. Test planners should collaborate early with the PMs M&S proponent on the planned use of M&S to support or supplement their test planning or analyze test results. Where feasible, consider the use or development of M&S that encompasses the needs of each phase of T&E. Test planners must coordinate with the M&S proponent/developer/operator to establish acceptability criteria required to allow VV&A of proposed M&S. It is the responsibility of the PMs M&S proponent to ensure the conduct of V&V in a manner supporting accreditation of M&S for each intended use. Whenever possible, an OA should draw upon test results with the actual system, or subsystem, or key components thereof, or with operationally meaningful surrogates. When a PM cannot conduct actual system testing to support an OA, such assessments may utilize computer modeling and/or hardware in the loop, simulations (preferably with real operators in the loop), or an analysis of information contained in key program documents. However, the PM must ensure they receive a risk assessment when system testing cannot support an OA. The TEMP explains the extent of M&S supporting OT&E, whether to develop M&S, the identification of resources, and a cost/benefit analysis. Naval vessels, the major systems integral to ship construction, and military satellite programs typically have development and construction phases extending over long periods of time and involve small procurement quantities. To facilitate evaluations and assessments of system performance (operational effectiveness, operational suitability and mission capability) the PM should ensure the involvement of the independent OTA in the monitoring of or participating in all relevant activity to make use of any/all relevant results to complete operational assessments (OAs). The OTA should determine the

inclusion/exclusion of test data for use during OAs and determine the requirement for any additional operational testing needed for evaluation of operational effectiveness, operational suitability and mission capability.
- OT&E uses threat or threat representative forces, targets, and threat countermeasures, validated by the DIA or the DoD Component intelligence agency, as appropriate, and approved by DOT&E during the operational test plan approval process. DOT&E oversees threat target, threat simulator, and threat simulation acquisitions and validation to meet OT&E and LFT&E needs.
- PMs and OTAs assess the reliability growth required for the system to achieve its reliability threshold during IOT&E and report the results of that assessment to the MDA at Milestone C.

- OT&E will evaluate Information Assurance on any system collecting, storing, transmitting, or processing unclassified or classified information. This evaluation will include IA vulnerability and penetration testing. Additionally, all networked and command, control, communications & intelligence (C3I) systems on the OSD T&E Oversight List shall receive IA effectiveness evaluations and Computer Network Defense (CND) measures against cyber threats in accordance with the DOT&E memo " Clarification of Procedures for Operational Test and Evaluation of Information Assurance in Acquisition Programs ," dated 4 November, 2010, and " Procedures for Operational Test and Evaluation of Information Assurance in Acquisition programs " dated 21 January 2009.
- OT&E will evaluate potentially adverse Electromagnetic Environmental Effects (E3) and spectrum supportability situations. Operational testers should use all available data and review DD Form 1494 , "Application for Equipment Frequency Allocation," dated August 1996, to identify which systems need field assessments.

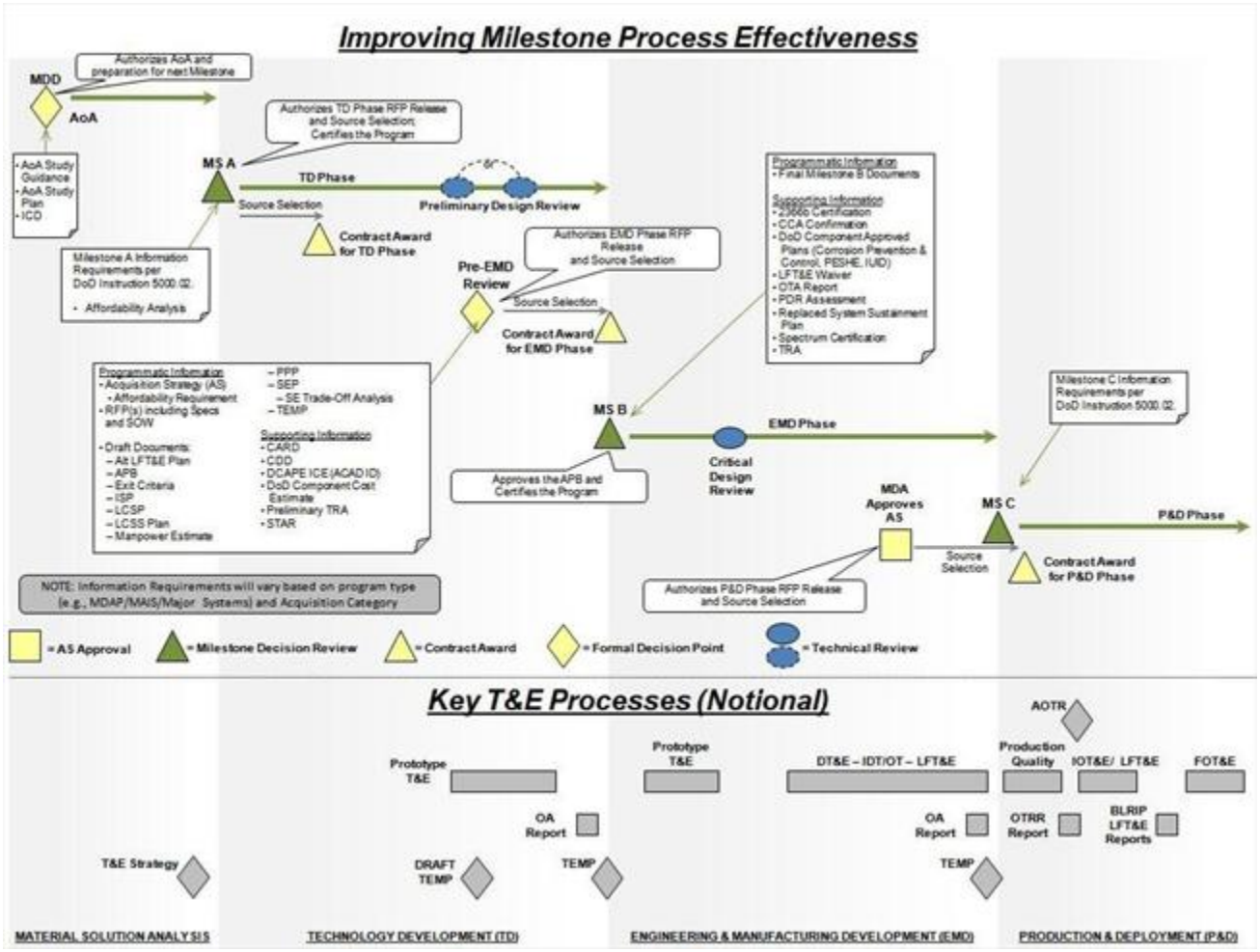
9.5.3. Early Involvement

T&E early involvement advises program offices on the testability of requirements, scoping the T&E program and resources for inclusion in the technology and acquisition strategies, contractual requirements, and other upfront actions helping the acquisition program succeed. This requires the active engagement of skilled T&E personnel in the requirements and acquisition processes to get the up-front right, particularly in terms of definitional precision in describing the operational context, mission and system measures, integration of DT and OT, and the construct for translating performance results into mission effectiveness terms. Developing a framework to accomplish those objectives enhances the efficiencies and effectiveness of T&E programs, and results in less conflict during T&E planning and execution.

An integral element of the Defense Acquisition System (DoDI 5000.02), T&E has a role across the entire lifecycle as depicted in the following Figure 9.5.3.F1. The Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System Chart (v5.3.4, 15 Jun 2009) outlines the key activities in the systems acquisition processes that must work in concert to deliver the capabilities required by the warfighters: the

requirements process (JCIDS; the acquisition process (Defense Acquisition System); and program and budget development (Planning, Programming, Budgeting, and Execution (PPBE) process).

Figure 9.5.3.F1: Key T&E Processes across the Lifecycle T&E Perspective



NOTE: A larger version of the process is available by clicking on the image above.

Key sources of T&E information, used during the formulation of a Materiel Solution, include the capabilities-based assessment (CBA), Analysis of Alternatives (AOA), JCIDS documents, etc. Items of particular interest to the T&E community include:

- Mission description, scenarios, Concept of Operations (CONOPS), performance attributes and effectiveness metrics, targets and threats, operational environments, etc.
- Mission to task decomposition and scenario-based task performance standards.
- Task to system/sub-system associations and functionality.
- Alignment of mission Measures of Effectiveness (MOEs) with system

performance attributes and measures.

The requirements process defines and subsequently refines a programs operational capability requirements (system attributes) and operational environments (mission attributes) throughout the development process in the CBA, Initial Capabilities Document (ICD), CDD, and CPD.

Critical to the developers, testers, and representative of the COCOM Area of Responsibility (AOR) for operational employment ,the pedigree of operational context across the lifecycle and the design of the operational context of the system should remain the same as the evaluated operational context,. If the operational context changes over the course of development, those changes should be documented in both the AOA and JCIDS updates.

9.5.3.1. Defining Mission Measures: Early Involvement JCIDS (Measures of Effectiveness (MOE) and Measures of Performance (MOP))

JCIDS processes are currently undergoing a significant revision, with the expectation of releasing the new policy in late FY 2011. The current JCIDS process has evolved from a joint mission-based process, focused on evaluating MOE and MOP in a mission context to deliver a capability to an operational environments-based process focused on evaluating system performance attributes to deliver a required capability, as seen in excerpt from the current JCIDS policy below:

- The JCIDS primary objective ensures the identification of the capabilities required by the joint Warfighter with their associated operational performance criteria in order to successfully execute the missions assigned.
- The JCIDS process supports the acquisition process by identifying and assessing capability needs and associated performance criteria used as a basis for acquiring the right capabilities, including the right systems.
- The CDD primary objective specifies the operational technical performance attributes of the system delivering the capability to fill the gaps identified in the ICD.
- The CPD primary objective describes the actual performance of the system delivering the required capability.

- If the system does not meet all of the threshold levels for the KPPs, the Joint Requirements Oversight Council (JROC) will assess whether or not the system remains operationally acceptable.
- The CDD and CPD identify the attributes contributing most significantly to the desired operational capability in threshold-objective format. Whenever possible, state attributes in terms reflecting the range of military operations the capabilities must support and the joint operational environment intended for the system (family of systems (FoS) or SoS).
- Other compatibility and interoperability attributes (e.g., databases, fuel, transportability, and ammunition) might need identification to ensure a

capability's effectiveness.

The CJCSI 3170.01H Joint Capabilities Integration and Development System, dated January 10, 2012 complements the JCIDS instruction. Additionally:

- DOT&Es role with respect to the ICD is included in the JCIDS Manual: DOT&E will advise on the testability of chosen capability attributes and metrics so that the systems performance measured in operational testing can be linked to the CBA.
- The JCIDS manual further states The ICD will include a description of the capability, capability gap, threat, expected joint operational environments, shortcomings of existing systems, the capability attributes and metrics, joint Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities (DOTMLPF), and policy impact and constraints for the capabilities.

Director of Operational Test and Evaluation (DOT&E) (DoDD 5141.02).

- Assist the CJCS in efforts to ensure the specification of expected joint operational mission environment, mission-level MOE, and KPPs in JCIDS documents in terms verifiable through testing or analysis.

Note: the JCIDS policy no longer requires or discusses MOPs and MOEs; however, the JCIDS derives and documents performance attributes from analysis that supported the CBA and the AOA. Additionally, the CBA, AOA, and MOPs and MOEs remain essential metrics needed for evaluation of those performance attributes.

- Measure of Effectiveness (MOE) The data used to measure the military effect (mission accomplishment) that comes from the use of the system in its expected environment. That environment includes the system under test and all interrelated systems, that is, the planned or expected environment in terms of weapons, sensors, command and control, and platforms, as appropriate, needed to accomplish an end-to-end mission in combat.
- Measures of Performance (MOPs) System-particular performance parameters such as speed, payload, range, time-on-station, frequency, or other distinctly quantifiable performance features. Several MOPs may be related to the achievement of a particular MOE.

Further, the OTAs and DOT&E have a requirement to address effectiveness in their evaluations. In the memorandum Reporting of Operational Test and Evaluation (OT&E) Results , dated January 6, 2010, DOT&E states:

- The data used for evaluation are appropriately called measures of effectiveness, because they measure the military effect (mission accomplishment) that comes from the use of the system in its expected environment. This statement of policy precludes measuring operational effectiveness and suitability solely on the basis of system-particular performance parameters.
- . . . "performance attributes (*sic*) are often what the program manager is

required to deliver they are not the military effect or measure of operational effectiveness required for achieving the primary purpose of a mission capability".

- It is therefore unacceptable in evaluating and reporting operational effectiveness and suitability to parse requirements and narrow the definition of mission accomplishment so that MOP are confused with MOE.

9.5.3.2. Defining the Operational Context: Early Involvement - CBA: Operational Context (Scenarios, Missions and Objectives, Environments, etc.)

The JCIDS process begins with the CBA, which provides the bases for JCIDS to articulate the systems performance attributes required by the warfighters. Any DoD organization may initiate a CBA. See the Manual for the Operation of the Joint Capabilities Integration and Development System , dated July 31, 2009 for CBA information.

9.5.3.3. Analysis of Alternatives

For potential and designated ACAT I and IA programs, the Director, Cost Assessment and Program Evaluation (CAPE) should draft, for MDA approval, AoA study guidance for review at the Materiel Development Decision. Following approval, the guidance should be issued to the DoD Component designated by the MDA, or for ACAT IA programs, to the office of the Principal Staff Assistant responsible for the mission area. According to DoDI 5000.02, Enclosure 7 , dated December 8, 2008, the DoD Component or the Principal Staff Assistant shall designate responsibility for completion of the study plan and the AoA; neither of which may be assigned to the PM. The study plan shall be coordinated with the MDA and approved by the CAPE prior to the start of the AoA. The final AoA shall be provided to the CAPE not later than 60 days prior to the DAB or Information Technology Acquisition Board milestone reviews. The CAPE shall evaluate the AoA and provide an assessment to the Head of the DoD Component or Principal Staff Assistant and to the MDA. In this evaluation, the CAPE, in collaboration with the OSD and Joint Staff, shall assess the extent to which the AoA:

a) Illuminated capability advantages and disadvantages.

b) Considered joint operational plans.

c) Examined sufficient feasible alternatives.

d) Discussed key assumptions and variables and sensitivity to changes in these.

e) Calculated costs.

f) Assessed the following:

1. Technology risk and maturity.
2. Alternative ways to improve the energy efficiency of DoD tactical systems with

end items that create a demand for energy, consistent with mission requirements and cost effectiveness.
3. Appropriate system training to ensure that effective and efficient training is provided with the system.

9.5.3.4. Defining Critical Technical Parameters (CTPs)

T&E programs will have hundreds or thousands of technical parameters needing capture to support data analysis and evaluations; however, every technical parameter is not a CTP. CTPs measure critical system characteristics that, when achieved, enable the attainment of desired operational performance capabilities in the mission context. CTP do not simply restate the KPPs and/or KSAs. Each CTP must have a direct or significant indirect correlation to a KPP and or KSA that measures a physical characteristic essential to evaluation of the KPP or KSA. The 2011 JCIDS Manual, The Director, Operational Test & Evaluation (DOT&E) will advise on the testability of chosen capability attributes and metrics so that the systems performance measured in operational testing can be linked to the CBA. The ICD will include a description of the capability, capability gap, threat, expected joint operational environments, shortcomings of existing systems, the capability attributes and metrics, joint DOTMLPF, and policy impact and constraints for the capabilities.

CTPs should focus on critical design features or risk areas (e.g., technical maturity, reliability, availability, and maintainability (RAM) issues, physical characteristics or measures) that if not achieved or resolved during development will preclude delivery of required operational capabilities. CTPs will likely evolve/change as the system matures during EMD. Resolve existing CTPs and identify new CTPs as the system progresses during development. Identify any CTPs not resolved prior to entering LRIP and establish an action plan to resolve them prior to the FRP Decision Review.

The Program T&E Lead has responsibility for coordinating the CTP process with the Programs Chief or Lead Systems Engineer, with assistance from the appropriate test organization subject matter experts and lead OTA. The evaluation of CTPs proves important in projecting maturity of the system and to inform the PM as to whether the system is on (or behind) the planned development schedule or will likely (or not likely) achieve an operational capability, but are not sufficient in projecting mission capability. The projection of mission capability requires an evaluation of the interoperability of systems and sub-systems in the mission context, when used by a typical operator, CTPs associated with the systems/sub-systems provide a basis for selecting entry or exit criteria demonstrated for the major developmental test phases.

9.5.4. Test and Evaluation Strategy (Milestone A)

9.5.4.1. Description

The TES describes the concept for tests and evaluations throughout the program life cycle, starting with Technology Development and continuing through EMD into Production and Deployment. The TES evolves into the TEMP at Milestone B. Development of a TES requires early involvement of testers, evaluators, and others as a program conducts pre-system acquisition activities. These personnel provide the necessary technical, operational, and programmatic expertise to ensure nothing is overlooked in laying out a complete strategy. The TES approval process is explained in 9.5.4.3.

The TES must remain consistent with the Technology Development Strategy (TDS) and Initial Capabilities Document (ICD) . The TES should address the identification and management of technology risk, the evaluation of system design concepts against the preliminary mission and sustainment requirements resulting from the analysis of alternatives, competitive prototyping, early demonstration of technologies in operationally relevant environments, and the development of an integrated test approach. The TES also satisfies the TDS test plan to ensure the completion of goals and exit criteria for the technology demonstrations in a relevant environment in accordance with section 2359a of title 10 USC . It also provides a road map for evaluations, integrated test plans, and resource requirements necessary to accomplish the TD phase objectives.

The TES begins by focusing on TD phase activities, and describes the demonstration of component technologies under development in an operationally relevant environment to support the program's transition into the EMD Phase. It contains hardware and software maturity success criteria used to assess key technology maturity for entry into EMD. For programs following an evolutionary acquisition strategy with more than one developmental increment, the TES describes the application of T&E and M&S to each planned increment to provide the required operational effectiveness, suitability, and survivability or operational security, as would be required of a program containing only one increment. TES development supports the initial Milestone A decision. The TEMP subsumes the TES for all increments thereafter, unless a follow-on increment requires a new Milestone A decision. TES development establishes an early consensus among T&E WIPT member organizations on the programs scope for testing and evaluation, with particular consideration given to needed resources to support PPB&E process

activities. The TES requires the inclusion of cost estimates beginning with program initiation and continuing through development and production, including nonrecurring and recurring research and development (R&D) costs for prototypes, engineering development equipment and/or test hardware (and major components thereof). Additionally, the TES fully identifies and estimates contractor T&E and Government support to the test program. Estimate any support, such as support equipment, training, data, and military construction. Include the cost of all related R&D (such as redesign and test efforts necessary to install equipment or software into existing platforms). See DoD 5000.4-M , "Cost Analysis Guidance Procedures," Table C2.T2, "Defense Acquisition Program Life-Cycle Cost Categories Research and Development," for a more specific list of R&D costs. The basis for the T&E resources required in the Cost Analysis Requirements Description comes from the TES cost information.

9.5.4.2. TES Content and Format

The following content and format provides all necessary information for a TES, and assists in the transition to a TEMP at Milestone B.

PART I INTRODUCTION

1.1. Purpose. State the purpose of the TES. Reference the documentation initiating the TES (i.e., ICD, AoA, CONOPS).

1.2. Mission Description. Briefly summarize the mission need described in the capability requirements documents in terms of the capability it will provide to the Joint Forces Commander. Briefly summarize the CONOPS, and include a high level operational concept graphic **(** OV-1) or similar diagram.

1.3. System Description. Describe the system or prototype configurations. Identify key features, technologies, and components, both hardware and software for the planned Technology Development phase.

1.3.1. System Threat Assessment. Succinctly summarize the threat environment in which the system or components will operate. Reference the appropriate DIA- or DoD Component-validated threat documents.

1.3.2. Program Background. Briefly discuss any background information. Reference the AoA, the materiel development decision, and any previous tests or evaluations that have an effect on the T&E strategy.

1.3.3. Key Capabilities. Identify the system attributes that support key capabilities from the ICD. Identify the T&E-related TD Phase exit criteria.

1.3.3.1. Key Interfaces. Identify interfaces with existing or planned systems architectures (to the extent known at Milestone A) that are required for mission

accomplishment.

1.3.3.2. Special Test Requirements. Identify unique system characteristics or support concepts that will necessitate development of special test and evaluation assets or techniques.

1.3.3.3. SE Requirements. Summarize SE-based information driving the Technology Development phase and prototype development. Reference the SEP and other applicable source documents.

PART II TEST and EVALUATION PROGRAM MANAGEMENT AND SCHEDULE

2.1. T&E Management. Discuss the test and evaluation role of participating organizations. Describe the role of contractor and governmental personnel. Provide organizational construct that includes organizations such as the T&E WIPT or Service equivalent.

2.2. T&E Data Strategy. Describe the strategy and methods for collecting, validating, and sharing data as it becomes available from the contractors, DT&E, and oversight organizations.

2.3. Integrated Test Program Schedule. Provide the overall time sequencing of the major events with an emphasis on the TD phase. Include event dates such as major decision points, preliminary design reviews, prototypes and test article availability, and phases of DT&E.

PART III TEST AND EVALUATION STRATEGY

3.1. T&E Strategy Introduction. This section should summarize an effective and efficient approach to the T&E program.

3.2. Evaluation Framework. Describe the overall concept of the T&E program with an emphasis on decisions in the Technology Development phase and information required to draft the CDD. Specific areas of evaluation should include Technology Readiness Level (TRL) and prototype testing. Include a Top-Level Evaluation Framework matrix that shows the correlation between decisions, the primary capabilities, critical technologies, critical technical parameters, and other key test measures.

3.3. Developmental Evaluation Approach. The discussion should be related to the TD phase, including a focus on ICD issues. If applicable, discuss the T&E supporting the reliability growth approach.

3.3.1. Developmental Test Objectives. Summarize the planned objectives and state the methodology to test the technology attributes defined by the TDS.

3.3.2. Modeling & Simulation. Describe the key models and simulations and their

intended use. Identify who will perform M&S verification, validation, and accreditation.

3.3.3. Test Limitations. Discuss any test limitations that may significantly affect the evaluator's ability to draw conclusions about the TRL and capabilities.

3.4. Operational Evaluation Approach. Discuss the approach during the TD phase to providing operational insights from the user perspective, including resolution of the ICD issues. Include reliability growth testing, if appropriate.

3.4.1. Mission-Oriented Approach. Describe the approach to evaluate the system performance at the appropriate TRLs.

3.4.2. Operational Test Objectives. Summarize the planned objectives and state the methodology to test the technology attributes defined by the TDS.

3.4.3. M&S. Describe the key models and simulations and their intended use. Identify who will perform M&S verification, validation, and accreditation.

3.4.4. Test Limitations. Discuss any test limitations that may significantly affect the evaluator's ability to draw conclusions about the TRL and capabilities.

3.5. Future Test and Evaluation. Summarize all remaining significant T&E that has not been discussed yet, extending through the acquisition life cycle. Test events after Milestone B will be described in detail in the Milestone B TEMP update.

PART IV RESOURCE SUMMARY

4.1. Introduction. Testing will be planned and conducted to take full advantage of existing DoD investment in ranges, facilities, and other resources wherever practical. Describe all key test and evaluation resources, both government and contractor, that will be used during the course of the TD phase. Include long-lead items for the next phase, if known.

4.1.1. Test Articles. Identify the prototypes and test articles.

4.1.2. Test Sites and Instrumentation. Identify the test ranges and facilities to be used for testing.

4.1.3. Test Support Equipment. Identify test support, analysis equipment, and personnel required to conduct testing.

4.1.4. Threat Representation. Identify the type, number, availability, fidelity requirements, and schedule for representations of the threat (to include threat targets) to be used in testing.

4.1.5. Test Targets and Expendables. Specify the type, number, availability, and

schedule for test targets and expendables, (e.g. targets, weapons, flares, chaff, sonobuoys, countermeasures).

4.1.6. Operational Force Test Support. Specify the type and timing of aircraft flying hours, ship steaming days, and on-orbit satellite contacts/coverage, and other operational force support.

4.1.7. Simulations, Models and Testbeds. Specify the models and simulations to be used. Identify opportunities to simulate any of the required support. Identify the resources required to validate and accredit their usage, responsible agency, and timeframe.

4.1.8. Joint Mission Environment. Describe the live, virtual, or constructive components or assets necessary to create an acceptable environment to evaluate TRLs and mission capabilities.

4.1.9. Special Requirements. Identify requirements for non-instrumentation capabilities or instrumentation and analysis tools that require development or upgrades.

4.2. Test and Evaluation Funding Summary. Provide initial estimates of DT&E, OT&E, and LFT&E costs.

9.5.4.3. TES Approval Process

For programs under OSD T&E oversight, the PM or leader of the concept development team, with the T&E WIPT providing support, submits the DoD Component/Defense Agency-approved TES to OSD for staffing and approval before Milestone A. The PM should submit the TES at least 45 days prior to Milestone A to support the decision. The DOT&E and the DASD(DT&E) approve the TES for all programs on the OSD T&E Oversight List. For programs not on the OSD T&E Oversight List, the CAE, or designated representative, approves the TES.

9.5.5. Test and Evaluation Master Plan

9.5.5.1. Strategy for Test and Evaluation

9.5.5.2. Evaluation Framework

9.5.5.3. TEMP Format

9.5.5.4. Other Milestone TEMPs and Updates

9.5.5. Test and Evaluation Master Plan

The TEMP serves as the overarching document for managing a T&E program. PMs should develop a draft TEMP for the pre-EMD review and a formal TEMP for Milestone

B, based on the AT&L memo Improving Milestone Process Effectiveness, dated June 23, 2011. Prior to each subsequent Defense Acquisition System Milestone, the PMs must submit an updated TEMP. The TEMP should include sufficient detail to support development of other test related documents.

PMs develop a TEMP and subsequent updates meeting the following objectives:

- Accomplish all certification requirements necessary for the conduct of T&E.
- Provide an event-driven T&E schedule.
- Ensure the T&E strategy aligns with and supports the approved acquisition strategy to provide adequate, risk-reducing T&E information to support decisions.
- Integrate DT&E and OT&E objectives into an efficient test continuum for use in the TEMP to maximize efficiencies during test execution, and increase the test sample size while minimizing test resource requirements.
- Identify and describe design, technical, integration, operational, safety, and security risks . The T&E strategy should naturally flow from the user mission requirements and concept of operations (CONOPS), systems engineering processes of requirements analysis, functional allocation, and design synthesis.
- Serve as the basis for T&E budgetary estimates identified in the Cost Analysis Requirements Description (required by DoD 5000.4-M Cost Analysis Guidance and Procedures, dated December 11, 1992).
- Identify test strategies to efficiently identify technology limitations and capabilities of alternative concepts to support early cost performance tradeoff decisions.
- Provide data and analytic support to certify the system ready for IOT&E . The DT&E report discussed below provides this data.
- Assess technical progress and maturity against critical technical parameters (CTPs), key system attributes (KSAs), KPPs, and critical operational issues (COIs) as documented in the TEMP and test plans. CTPs can be used to assess completion of a major phase of developmental testing such as ground or flight testing; and determine readiness to enter the next phase of testing, whether developmental or operational.
- To mitigate technical risk, the required assessment of technical progress should also include reliability, maintainability and supportability desired capabilities, software functionality, and technical and manufacturing risks.
- Include reliability growth curves at Pre-EMD and report progress to plan at future updates.
- Include adequate measures to support the programs reliability growth plan and requirements for a RAM Cost Rationale Report defined in DOD RAM Cost Rationale Manual, for MS B and C. For more information, read DTM 11003 , Reliability Analysis, Planning, Tracking, and Reporting, dated December 2, 2011.
- Some technical parameters can be expressed as either a rate of change or a simple specific value in assessing level of success. For example, the rate at which a system accuracy or reliability is increasing, or simply the success rate of a system meeting a certain accuracy or reliability threshold. The PM may use a combination of both to tailor the test strategy to support decision requirements.
- Utilize M&S and ground test activities, to include integration laboratories,

hardware-in-the-loop simulation, and installed-system test facilities prior to conducting full-up, system-level and end-to-end testing in open-air realistic environments. Programs normally limit DT&E of military medical devices to airworthiness certification and environmental testing to ensure the device does not fail due to the austere or harsh environments imposed by the operational environment or interfere with the aircrafts operational environment. This can often be integrated into, or performed alongside, the requisite OT.

- Perform V&V in the use of M&S and the systems engineering process.
- Stress the system under test to at least the limits of the Operational Mode Summary/Mission Profile, and for some systems, beyond the normal operating limit's to ensure the robustness of the design. This testing will reduce risk for performance in the expected operational environments.
- Provide safety releases (to include formal Environment, Safety, and Occupational Health (ESOH) risk acceptance), in concert with the user and the T&E community, to the developmental and operational testers prior to any test using personnel.
- Demonstrate the maturity of the production process through Production Qualification Testing (PQT) of low-rate initial production (LRIP) assets prior to full-rate production (FRP). The focus of this testing is on the contractor's ability to produce a quality product, since the design testing should have been completed.
- Provide data and analytic support to the Milestone C decision to enter LRIP.
- For weapons systems, use the System Threat Assessment (STA) or System Threat Assessment Report (STAR) as a basis for scoping a realistic test environment.
- For IT & NSS, use DIA, North American Industry Class System (NAICS), or other applicable standard as a basis for scoping a realistic test environment.
- Conduct Information Assurance (IA) testing on any system that collects, stores, transmits, and processes unclassified or classified information; The extent of IA testing depends upon the assigned Mission Assurance Category and Confidentiality Level. DoDI 8500.2 , "Information Assurance (IA) Implementation," dated February 6, 2003, mandates specific IA Control Measures a system should implement as part of the development process.
- In the case of IT systems, including NSS , support the DoD Information Assurance Certification and Accreditation Process and Joint Interoperability Certification process.
- Discover, evaluate, and mitigate potentially adverse electromagnetic environmental effects (E3) .
- Support joint interoperability assessments required to certify system-of-systems interoperability.
- For business systems, the TEMP identifies certification requirements needed to support the compliance factors established by the Office of the Under Secretary of Defense (Comptroller) (USD(C)) for financial management, enterprise resource planning, and mixed financial management systems.
- Demonstrate performance against threats and their countermeasures as identified in the Defense Intelligence Agency (DIA) or component-validated threat document. Any impact on technical performance by these threats should be

identified early in technical testing, rather than in operational testing where their presence might have serious repercussions.
- Assess SoS Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) prior to OT&E to ensure interoperability under loaded conditions will represent stressed OT&E scenarios.

9.5.5.1. Strategy for Test and Evaluation

PMs should structure a T&E program strategy to provide knowledge to reduce risk in acquisition and operational decisions. The evaluations of all available and relevant data and information from contractor and government sources develop that knowledge. The evaluation should focus on providing essential information to decision makers, specifically with regard to attainment of technical performance attributes and an assessment of the systems missions operational effectiveness, operational suitability, and survivability or operational security. The evaluation framework supports estimates for test resource requirements and provides a basis for determining test program adequacy and assessing risk margins within the T&E plans and events.

The PM should structure the strategy to provide essential information to decision-makers, assess attainment of technical performance parameters, and determine whether systems are operationally effective, suitable, survivable, and safe for intended use. The conduct of T&E, integrated with M&S, should facilitate learning, assess technology maturity and interoperability, facilitate integration into fielded forces, and confirm performance against documented capability needs and adversary capabilities as described in the system threat assessment.

In other words, the evaluation should describe the links between key program and user decisions, as well as the developmental and operational tests that requiring evaluation for those decisions. It correlates the knowledge required concerning KPPs/ KSAs, CTPs, key test measures (i.e., MOEs and Measure of Suitability (MOSs)), and the planned test methods, key test resources, facility, or infrastructure needs. The framework discussion should also identify major risks or limitations to completing the evaluations. The TEMP should clearly reflect what key questions the evaluations will answer for the program and user, and at what key decision points. This layout and discussion provides a rationale for the major test objectives and the resulting major resource requirements shown in the Resources portion of the TEMP.

The evaluation should also discuss the intended maturation of key technologies within the overall system, the evaluation of capabilities in a mission context, and evaluations needed to support required certifications or to comply with statute(s). Separate evaluation plans should provide details for the PMs overall evaluation strategy (e.g., System Evaluation Plan (Army), Operational Test and Evaluation plan, LFT&E plan).

The DT&E section describes the evaluation of the maturation of a system or capability, and should address the overall approach to evaluate the development of system capabilities, in operationally relevant environments. The approach should cover CTPs,

key system risks, and any certifications required (weapon safety, interoperability, etc.). The evaluation of technology maturity should support the TDS.

The evaluation of system maturity should support the acquisition strategy. The amount of development in the acquisition strategy will drive the extent of the discussion. For example, if a non-developmental item (i.e., Commercial-Off-The-Shelf (COTS) or Government-off-the-shelf (GOTS)) then there may not be much, if any, maturation of the system required. If a new technology effort, pushing the state-of-the-art or capabilities significantly improved over what is currently being achieved in the operational environment, then it may require a significant amount of effort in maturing or developing the system or it's support system, and therefore more decisions requiring knowledge from evaluations. In assessing the level of evaluations necessary, give equal consideration to the maturity of the technologies used, the degree to which system design (hardware and software) has stabilized, as well as the operational environment for the employment of the system. Using COTS items in a new environment can result in significant capability changes, potentially eliminating a true COTS item from a system maturity perspective.

The system maturation discussions should also cover evaluations for production qualification, production acceptance, and sustainment of the system. The Defense Contract Management Agency (DCMA) representatives and procedures may cover the production evaluations at the contractors manufacturing plant, or may require the T&E effort to establish and mature the processes. Therefore, the appropriate level of evaluation could range from none, for normal DCMA practices, to minimal for first article qualification checks, to more extensive evaluations based upon PQT results for new or unique manufacturing techniques, especially with new technologies. The sustainment evaluation discussions should address key risks or issues in sustaining or assessing the system capability in operational use. The sustainment evaluation discussion should address the overall T&E logistics effort, maintenance (both corrective and preventative), servicing, calibration, and support aspects.

The discussion of mission context evaluations addresses the approach to evaluate operational effectiveness and operational suitability of the system for use by typical users in the intended mission environments. This should also include joint operations issues. These evaluations provide a prediction of how well the system will perform in field use as well as in IOT&E, and may reduce the scope of the IOT&E, but will not replace or eliminate the need for IOT&E.

COIs also prove relevant to this discussion. COIs act as key operational effectiveness or operational suitability issues requiring examination in OT&E to determine the systems capability to perform its mission. COIs must be relevant to the required capabilities and of key importance to the systems operationally effectiveness, operationally suitability and survivability, and represent a significant risk if not satisfactorily resolved.

The strategy for T&E must include those evaluations required by statute, specifically IOT&E, survivability or operational security, and lethality. The IOT&E discussion should

describe the approach to conduct the independent evaluation of the system, including official resolution of COIs. The discussion of the approach to evaluate the survivability or operational security /lethality of the system should show how it will influence the development and maturation of the system design. The discussion should include a description of the overall live fire evaluation strategy for the system (as defined in section 2366 of title 10 USC); critical live fire evaluation issues; and any major evaluation limitations.

9.5.5.2. Evaluation Framework

The Evaluation Framework Matrix describes in table format the most important links and relationships between the types of testing conducted to support the entire acquisition program. It also shows the linkages between the KPPs/KSAs, CTPs, key test measures (i.e., MOEs, MOSs), planned test methods, key test resources (i.e., facility and infrastructure), and the decisions supported. Table 9.5.5.2.T1. depicts Top-Level Evaluation Framework Matrix from the TEMP format annex (and shown below) shows a notional Evaluation Framework Matrix. Programs may also use equivalent Service-specific formats identifying the same relationships and information. **Note:** the Evaluation Framework Matrix provides a tabular summary of the evaluation strategy.

Table 9.5.5.2.T1. Top-Level Evaluation Framework Matrix

Key Requirements and T&E Measures				**Test Methodologies/Key Resources (M&S, SIL, MF, ISTF, HITL, OAR)**	**Decision Supported**
Key Reqs	**COIs**	**Key MOEs/ MOSs**	**CTPs & Threshold**		
KPP#1:	**COI #1.** Is the XXX effective for	**MOE 1.1.**	Engine thrust	Chamber measurement Observation of performance profiles OAR	PDR CDR
	COI #2. Is the XXX suitable for		Data upload time	Component level replication Stress and Spike testing in SIL	PDR CDR
	COI #3. Can the XXX be	**MOS 2.1.**			MS-C FRP
		MOE 1.3.			Post-CDR FRP

		MOE 1.4.	Reliability based on growth curve	Component level stress testing Sample performance on growth curve Sample performance with M&S augmentation	PDR CDR MS-C
KPP #2		**MOS 2.4.**	Data link		MS-C SRR
KPP #3	**COI #4.** Is training.	**MOE 1.2.**		Observation and Survey	MS-C FRP
KSA #3.a	**COI #5.** Documentation	**MOS 2.5.**			MS-C FRP

The Evaluation Framework Matrix acts as a key tool used to capture all major parts of a complete T&E program, identify gaps in coverage, and ensure more efficient integrated testing. Programs must include it in Part III of the TEMP and base it on the strategy for T&E (aka evaluation strategy) developed at Milestone A. The Evaluation Framework Matrix should succinctly enumerate the top-level, key values and information for all types of T&E. Updates should occur as the system matures and the updating of source documents (e.g., CDD/CPD, AS, STAR, SEP, ISP). Include demonstrated values for measures and parameters as the acquisition program advances from milestone to milestone and as the updating of the TEMP.

Three major sections comprise the Evaluation Framework Matrix: Key Requirements and T&E Measures; Test Methodologies/Key Resources; and Decisions Supported. When filled in, readers can scan the matrix horizontally and see all linkages from the beginning of a program (i.e., from the requirement document) to the decision supported. Each requirement should associate with at least one or more T&E issues and measures. However, T&E measures can exist without an associated key requirement or COI/ COI Criteria (COIC). Hence, some cells in Table 9.5.5.2.T1. may be void.

Key Requirements and T&E Measures These include KPPs and KSAs and the top-level T&E issues and measures for evaluation. The top-level T&E issues would typically include COIs and COIC, CTPs, and key MOEs/MOSs. This should also include SoS issues. Each measure should be associated with one or more key requirements. However, there could be T&E measures without an associated key requirement or COI/COIC. Hence, some cells in Table 9.5.5.2.T1. of the TEMP may be void. A simple test to determine if this section of the matrix is minimally adequate is to confirm that each decision supported has at least one T&E measure associated with it, and each key requirement also has at least one T&E measure associated with it. Outside of that, only

include the T&E issues and measures that drive size or scope of the T&E program.

Test Methodologies/Key Resources These identify test methodologies or key resources necessary to generate data for evaluations to support decisions. The content of this column should indicate the key methodologies or significant resources required. Test methodology refers to high-level descriptions of methods used to obtain the data. For example, modeling and simulation, system integration lab, or open-air range, each represents a different methodology for obtaining test data. Where multiple methodologies are acceptable, it is necessary to show the preferred methodology utilized. Short notes or acronyms should be used to identify the methodology. Models or simulations should be identified with the specific name or acronym.

Decisions Supported these are the major design, developmental, manufacturing, programmatic, acquisition, or employment decisions driving the need for knowledge to be obtained through T&E. These decisions include acquisition milestones, design reviews, certifications, safety releases, production acceptance, and operational employment/deployment. The operational employment/deployment decisions include those made by operators and maintainers that drive the need for validated operating and maintenance manuals. The decisions supported column would not contain each decision an operator or maintainer would make, but just the overall level of knowledge needed for operating or maintenance data or instructions, or those that steer significant or top-level decisions. The key determinant for what to include in this section is whether the decision supported (or knowledge requirement) drives trade space for performance, cost or schedule, or the size or scope of the T&E program. Only those decisions that facilitate program decisions or the size or scope of the T&E program should be included.

If portions of any T&E activity are missing, those become immediately evident. For example, if a KPP for reliability, availability, and maintainability (RAM) is listed, then there must be a supporting COI (or criterion in the set of COIC), along with CTPs and MOSs, to show that RAM will be fully evaluated in DT&E and OT&E. Specifically in the case of RAM measures, many acquisition programs included little to no RAM testing in DT&E and subsequently failed Suitability in OT&E (i.e., were rated "Not Suitable" by DOT&E). Had the TEMPs for those programs contained a full Evaluation Framework Matrix, the weak or missing RAM areas may have been identified early and properly tested before systems reached OT&E. Increasing the visibility of all key measures will help ensure these areas are developed and properly tested in DT&E and are ready for OT&E.

The Evaluation Framework Matrix also aids integrated testing and systems engineering by providing a broad outline of the linkages and corresponding areas for each kind of T&E activity. Mutual support between tests can be planned based on these linkages. For example, DT&E can augment the high visibility areas in OT&E, and OT&E can "right-size" their T&E concept based on what they can use in DT&E. More synergy is possible where DT and OT measures are the same or similar, or where the same T&E resources (test articles and/or facilities) are used. Data sharing protocols can be

developed early to aid test planning. DOD Information Assurance Certification and Accreditation Process(s) (DIACAP's) Certification & Accreditation (C&A) requirements can be folded in early. Redundancy and gaps can be spotted and eliminated. Greater visibility and transparency between T&E activities will generate countless ways to enhance integration. The discussion of the evaluation strategy can fill in all the details.

Table 9.5.5.2.T2. provides key inputs within the TEMP.

Table 9.5.5.2.T2 Key Inputs within the TEMP

TEMP	**Milestone**	
	B **(Updated from MS A when developed)**	**C** **(Updated from MS B)**
Part I, Introduction		
	Include Purpose	
	Include Mission Description	
	Include System Description	
	Include System Threat Assessment	
	Include Program Background	
	Include Key Capabilities / SE Requirements	
Part II, Management & Schedule		
	Include T&E Management / Organizational Construct	
	Include Common T&E Database Requirements (for integrated testing)	
	Include Deficiency Reporting	
	Include TEMP Update	
	Include Integrated Test Program Schedule within the TEMP, updated prior to each MS.	
Part III, T&E Strategy		
	Evaluation Framework Matrix (cross referenced with; COIs (or COIC), KPPs, CTPs, KSAs, MOPs, MOEs, & MOSs)	
	Should describe planned DT&E, OT&E and LFT&E in detail. Include overview and use of integrated test (CT, DT&E, & OT&E) and list out those events requiring stand-alone (or dedicated) Government DT&E and OT&E. Delineate test limitations (Annotate by DT&E, LFT&E, or OT&E).	
	A list of supporting interfaces, consistent with the ISP/TISP. SV-5b should be included with each interface cross-referenced to any planned EMD phase T&E or C&A activities utilizing each interface.	Provide for operational evaluation of mission-level interoperability across key interfaces.

	Plan for the conduct of dedicated Government DT&E or integrated test (lead by Government personnel) to provide confidence that the system design solution is on track to satisfy the desired capabilities.	A listing of all test events within the dedicated IOT&E
	Identify Lead Government DT&E organization.	
	Plan for one full-up system level government DT&E event and at least one OA with intended operational users.	
	Reliability Growth Curve(s) (RGCs) reflecting the reliability growth plans at the appropriate level of analysis for the program	Updated RGC
	Listing of all commercial and NDIs	
	Provide a tabulation of factors	
	Determination of critical interfaces and information security	
	The TEMP should describe the T&E program in sufficient detail for decision makers to determine whether the planned activities are adequate to achieve the T&E objectives for the program.	
	Identify each test event as Contractor or Government DT&E	
	Identify M&S to be used and VV&A process. Annotate supporting usage (i.e., DT&E or OT&E)	
	T&E Support of Reliability Growth Plan	
	Plan for data collection	
	The TEMP should identify entrance and exit criteria and their associated test events or test periods.	
	The TEMP should consider the potential impacts on the environment and on personnel.	
Part IV, Resource Summary		
	The TEMP should describe the resources required in sufficient detail and aligned with Part III of the TEMP.	
	Programs should maximize the use DoD Government T&E capabilities and invest in Government T&E infrastructure unless an exception can be justified as cost-effective to the Government.	

9.5.5.3. TEMP Format

TEST AND EVALUATION MASTER PLAN

FOR

PROGRAM TITLE/SYSTEM NAME

ACRONYM

ACAT Level

Program Elements

Xxxxx

****

SUBMITTED BY

_____ _____

Program Manager DATE

CONCURRENCE

_____ _____

Program Executive Officer or Developing Agency DATE

(If not under the Program Executive Officer structure)

_____ _____

Operational Test Agency DATE

_____ _____

Users Representative DATE

DoD COMPONENT APPROVAL

_____ _____

DoD Component Test and Evaluation Director DATE

_____ _____

DoD Component Acquisition Executive (Acquisition Category I) DATE

Milestone Decision Authority (for less-than-Acquisition Category I)

Note: For Joint/Multi Service or Agency Programs, each Service or Defense Agency should provide a signature page for parallel staffing through its CAE or Director, and a separate page should be provided for OSD Approval

****

OSD APPROVAL

_____ _____

DASD(DT&E) DATE

_____ _____

D,OT&E DATE

TABLE OF CONTENTS

APPENDIX B ACRONYMS

APPENDIX C POINTS OF CONTACT

ADDITIONAL APPENDICES AS NEEDED

1. PART I - INTRODUCTION

1.1. **Purpose**.

- State the purpose of the Test and Evaluation Master Plan (TEMP).
- Identify if this is an initial or updated TEMP.
- State the Milestone (or other) decision the TEMP supports.
- Reference and provide hyperlinks to the documentation initiating the TEMP (i.e., Initial Capability Document (ICD), Capability Development Document (CDD), Capability Production Document (CPD), Acquisition Program Baseline (APB), Acquisition Strategy Report (ASR), Concept of Operations (CONOPS)).
- State the Acquisition Category (ACAT) level, operating command(s), and if listed on the OSD T&E Oversight List (actual or projected)

1.2. **Mission Description**.

- Briefly summarize the mission need described in the program capability requirements documents in terms of the capability it will provide to the Joint Forces Commander.
- Describe the mission to be accomplished by a unit equipped with the system using all applicable CONOPS and Concepts of Employment.
- Incorporate an OV-1 of the system showing the intended operational environment.
- Also include the organization in which the system will be integrated as well as
- [Include] significant points from the Life Cycle Sustainment Plan, the Information Support Plan, and Program Protection Plan.
    - Provide links to each document referenced in the introduction.
- For business systems, include a summary of the business case analysis for the program.

1.3 **. System Description**.

- Describe the system configuration.
- Identify key features and subsystems, both hardware and software (such as architecture, system and user interfaces, security levels, and reserves) for the planned increments within the Future Years Defense Program (FYDP).

1.3.1. System Threat Assessment.

- Succinctly summarize the threat environment (to include cyber-threats) in which

the system will operate.
- Reference the appropriate DIA or component-validated threat documents for the system.

1.3.2. Program Background.

- Reference the Analysis of Alternatives (AoA), the APB and the materiel development decision to provide background information on the proposed system.
- Briefly describe the overarching Acquisition Strategy (for space systems, the Integrated Program Summary (IPS)), and the Technology Development Strategy (TDS).
- Address whether the system will be procured using an incremental development strategy or a single step to full capability.
- If it is an evolutionary acquisition strategy, briefly discuss planned upgrades, additional features and expanded capabilities of follow-on increments.
    - The main focus must be on the current increment with brief descriptions of the previous and follow-on increments to establish continuity between known increments.

1.3.2.1. Previous Testing.

- Discuss the results of any previous tests that apply to, or have an effect on, the test strategy.

1.3.3. Key Capabilities.

- Identify the Key Performance Parameters (KPPs) and Key System Attributes (KSAs) for the system.
    - For each listed parameter, provide the threshold and objective values from the CDD/CPD and reference the paragraph.

1.3.3.1. Key Interfaces.

- Identify interfaces with existing or planned systems architectures that are required for mission accomplishment.
- Address integration and modifications needed for commercial items.
- Include interoperability with existing and/or planned systems of other Department of Defense (DoD) Components, other Government agencies, or Allies.
- Provide a diagram of the appropriate DoD Architectural Framework (DoDAF) system operational view from the CDD or CPD.

1.3.3.2. Special test or certification requirements.

- Identify unique system characteristics or support concepts that will generate special test, analysis, and evaluation requirements

    - (e.g., security test and evaluation and Information Assurance (IA) Certification and Accreditation (C&A),
    - post deployment software support,
    - resistance to chemical, biological, nuclear, and radiological effects;
    - resistance to countermeasures;
    - resistance to reverse engineering/exploitation efforts (Anti-Tamper);
    - development of new threat simulation, simulators, or targets.

1.3.3.3. Systems Engineering (SE) Requirements.

- Reference all SE-based information that will be used to provide additional system evaluation targets driving system development.
    - Examples could include hardware reliability growth and software maturity growth strategies.
    - The SEP should be referenced in this section and aligned to the TEMP with respect to SE Processes, methods, and tools identified for use during T&E.

2. PART II TEST PROGRAM MANAGEMENT AND SCHEDULE

2.1 **T&E Management**.

- Discuss the test and evaluation responsibilities of all participating organizations (such as developers, testers, evaluators, and users).
- Describe the role of contractor testing in early system development.
- Describe the role of government developmental testers to assess and evaluate system performance.
- Describe the role of the Operational Test Agency (OTA) /operational testers to confirm operational effectiveness, operational suitability and survivability.

2.1.1. T&E Organizational Construct.

- Identify the organizations or activities (such as the T&E Working-level Integrated Product Team (WIPT) or Service equivalent, LFT&E IPT, etc.) in the T&E management structure, to include the sub-work groups, such as a modeling & simulation, or reliability.
- Provide sufficient information to adequately understand the functional relationships. Reference the T&E WIPT charter that includes specific responsibilities and deliverable items for detailed explanation of T&E management.
    - These items include TEMPs and Test Resource Plans (TRPs) that are produced collaboratively by member organizations.

2.2. **Common T&E Database Requirements**.

- Describe the requirements for and methods of collecting, validating, and sharing

data as it becomes available from the contractor, Developmental Test (DT), Operational Test (OT), and oversight organizations, as well as supporting related activities that contribute or use test data (e.g., information assurance C&A, interoperability certification, etc.).
- Describe how the pedigree of the data will be established and maintained. The pedigree of the data refers to understanding the configuration of the test asset, and the actual test conditions under which the data were obtained for each piece of data.
- State who will be responsible for maintaining this data.

2.3. **Deficiency Reporting**.

- Briefly describe the processes for documenting and tracking deficiencies identified during system development and testing.
- Describe how the information is accessed and shared across the program.
- The processes should address problems or deficiencies identified during both contractor and government test activities.
- The processes should also include issues that have not been formally documented as a deficiency (e.g., watch items).

2.4. **TEMP Updates**.

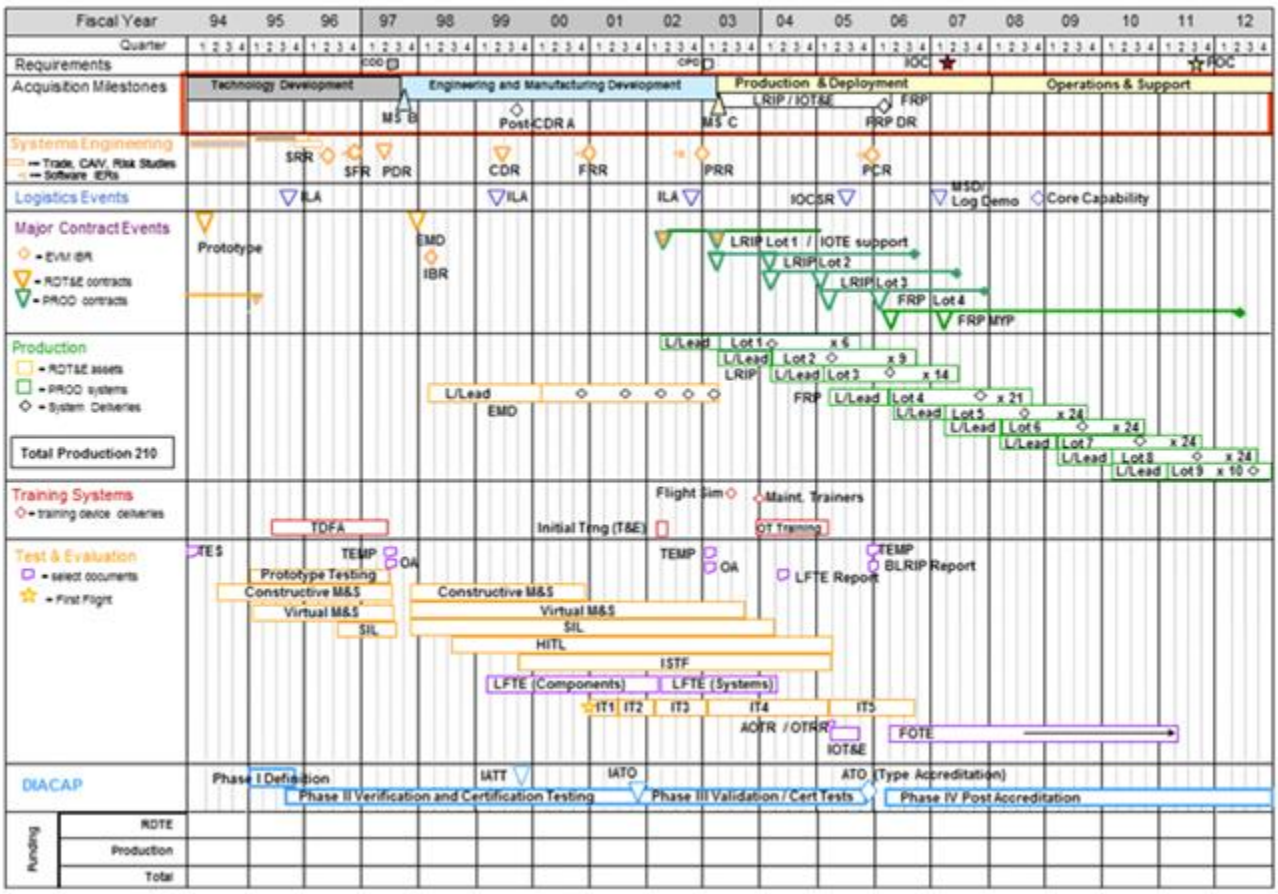
- Reference instructions for complying with DoDI 5000.02 required updates or identify exceptions to those procedures if determined necessary for more efficient administration of document.
- Provide guidelines for keeping TEMP information current between updates.
- For a Joint or Multi-Service TEMP, identify references that will be followed or exceptions as necessary.

2.5. **Integrated Test Program Schedule**.

- Display (see Figure 2.1) the overall time sequencing of the major acquisition phases and milestones (as necessary, use the NSS-03-01 time sequencing).
    - Include the test and evaluation major decision points, related activities, and planned cumulative funding expenditures by appropriation by year.
    - Include event dates such as
        - Major decision points as defined in DoD Instruction 5000.02, e.g., operational assessments,
        - Preliminary and critical design reviews,
        - Test article availability; software version releases;
        - Appropriate phases of DT&E; LFT&E; Joint Interoperability Test Command (JITC) interoperability testing and certification date to support the MS-C and Full-Rate Production (FRP) Decision Review (DR).
        - Include significant Information Assurance certification and accreditation event sequencing, such as Interim Authorization to

Test (IATT), Interim Authorization to Operate (IATO) and Authorization to Operate (ATO).
    - Also include operational test and evaluation;
    - Low-Rate Initial Production (LRIP) deliveries;
    - Initial Operational Capability (IOC); Full Operational Capability (FOC);
    - Statutorily required reports such as the Live-Fire T&E Report and Beyond Low-Rate Initial Production (B-LRIP) Report.
- Provide a single schedule for multi-DoD Component or Joint and Capstone TEMPs showing all related DoD Component system event dates.

Figure 2.1 SAMPLE Integrated Program Test Schedule



3. PART III TEST AND EVALUATION STRATEGY

3.1 T&E Strategy .

- Introduce the program T&E strategy by briefly describing how it supports the acquisition strategy as described in Section 1.3.2. This section should summarize an effective and efficient approach to the test program.
- The developmental and operational test objectives are discussed separately

below; however this section must also address how the test objectives will be integrated to support the acquisition strategy by evaluating the capabilities to be delivered to the user without compromising the goals of each major kind of test type.
- Where possible, the discussions should focus on the testing for capabilities, and address testing of subsystems or components where they represent a significant risk to achieving a necessary capability.
- As the system matures and production representative test articles are available, the strategy should address the conditions for integrating DT and OT tests.
- Evaluations shall include a comparison with current mission capabilities using existing data, so that measurable improvements can be determined.
    - If such evaluation is considered costly relative to the benefit's gained, the PM shall propose an alternative evaluation strategy.
    - Describe the strategy for achieving this comparison and for ensuring data are retained and managed for future comparison results of evolutionary increments or future replacement capabilities.
- To present the programs T&E strategy, briefly describe the relative emphasis on methodologies (e.g., Modeling and Simulation (M&S), Measurement Facility (MF), Systems Integration Laboratory (SIL), Hardware-In-the-Loop Test (HILT), Installed System Test Facility (ISTF), Open Air Range (OAR)).

3.2. Evaluation Framework .

- Describe the overall evaluation approach focusing on key decisions in the system lifecycle and addressing key system risks, program unique Critical Operational Issues (COIs) or Critical Operational Issue Criteria (COIC), and Critical Technical Parameters (CTPs).
- Specific areas of evaluation to address are related to the:

(1) Development of the system and processes (include maturation of system design)

(2) System performance in the mission context

(3) OTA independent assessments and evaluations

(4) Survivability and/or lethality

(5) Comparison with existing capabilities, and

(6) Maturation of highest risk technologies

- Describe any related systems that will be included as part of the evaluation approach for the system under test (e.g., data transfer, information exchange requirements, interoperability requirements, and documentation systems).

- Also identify any configuration differences between the current system and the

system to be fielded.
    - Include mission impacts of the differences and the extent of integration with other systems with which it must be interoperable or compatible.
- Describe how the system will be evaluated and the sources of the data for that evaluation.
    - The discussion should address the key elements for the evaluations, including major risks or limitations for a complete evaluation of the increment undergoing testing.
    - The reader should be left with an understanding of the value-added of these evaluations in addressing both programmatic and warfighter decisions or concerns.
    - This discussion provides rationale for the major test objectives and the resulting major resource requirements shown in Part IV - Resources.
- Include a Top-Level Evaluation Framework matrix that shows the correlation between the KPPs/KSAs, CTPs, key test measures (i.e., Measures of Effectiveness (MOEs) and Measures of Suitability (MOSs)), planned test methods, and key test resources, facility or infrastructure needs.
    - When structured this way, the matrix should describe the most important relationships between the types of testing that will be conducted to evaluate the Joint Capabilities Integration and Development System (JCIDS)-identified KPPs/KSAs, and the programs CTPs.
    - Figure 3.1 shows how the Evaluation Framework could be organized. Equivalent Service-specific formats that identify the same relationships and information may also be used.
    - The matrix may be inserted in Part III if short (less than one page), or as an annex.
    - The evaluation framework matrix should mature as the system matures. Demonstrated values for measures should be included as the acquisition program advances from milestone to milestone and as the TEMP is updated.

The suggested content of the evaluation matrix includes the following:

- Key requirements & T&E measures These are the KPPs and KSAs and the top-level T&E issues and measures for evaluation. The top-level T&E issues would typically include COIs/Critical Operational Issues and Criteria (COICs), CTPs, and key MOEs/MOSs. System-of-Systems and technical review issues should also be included, either in the COI column or inserted as a new column. Each T&E issue and measure should be associated with one or more key requirements. However, there could be T&E measures without an associated key requirement or COI/COIC. Hence, some cells in figure 3.1 may be empty.
- Overview of test methodologies and key resources These identify test methodologies or key resources necessary to generate data for evaluating the COIs/COICs, key requirements, and T&E measures. The content of this column should indicate the methodologies/resources that will be required and short notes or pointers to indicate major T&E phases or resource names. M&S should be

identified with the specific name or acronym.

- Decisions Supported These are the major design, developmental, manufacturing, programmatic, acquisition, or employment decisions most affected by the knowledge obtained through T&E.

Figure 3.1, Top-Level Evaluation Framework Matrix

Key Requirements and T&E Measures				**Test Methodologies/Key Resources (M&S, SIL, MF, ISTF, HITL, OAR)**	**Decision Supported**
Key Reqs	**COIs**	**Key MOEs/ MOSs**	**CTPs & Threshold**		
KPP#1:	**COI #1.** Is the XXX effective for	**MOE 1.1.**	Engine thrust	Chamber measurement Observation of performance profiles OAR	PDR CDR
	COI #2. Is the XXX suitable for		Data upload time	Component level replication Stress and Spike testing in SIL	PDR CDR
	COI #3. Can the XXX be	**MOS 2.1.**			MS-C FRP
		MOE 1.3.			Post-CDR FRP
		MOE 1.4.	Reliability based on growth curve	Component level stress testing Sample performance on growth curve Sample performance with M&S augmentation	PDR CDR MS-C
KPP #2		**MOS 2.4.**	Data link		MS-C SRR
KPP #3	**COI #4.** Is training.	**MOE 1.2.**		Observation and Survey	MS-C FRP
KSA #3.a	**COI #5.** Documentation	**MOS 2.5.**			MS-C FRP

3.3. Developmental Evaluation Approach.

- Describe the top-level approach to evaluate system and process maturity, as well as, system capabilities and limitations expected at acquisition milestones and decision review points.

- The discussion should include logistics, reliability growth, and system performance aspects.
- Within this section, also discuss:

1) rationale for CTPs (see below for a description of how to derive CTPs),

2) key system or process risks,

3) any certifications required (e.g. weapon safety, interoperability, spectrum approval, information assurance),

4) any technology or subsystem that has not demonstrated the expected level of technology maturity at level 6 (or higher), system performance, or has not achieved the desired mission capabilities for this phase of development,

5) degree to which system hardware and software design has stabilized so as to determine manufacturing and production decision uncertainties,

6) key issues and the scope for logistics and sustainment evaluations, and

7) reliability thresholds when the testing is supporting the systems reliability growth curve.

- **CTPs are measurable critical system characteristics that, if not achieved, preclude the fulfillment of desired operational performance capabilities.** While not user requirements, CTPs are technical measures derived from desired user capabilities. Testers use CTPs as reliable indicators that the system is on (or behind) the planned development schedule or will likely (or not likely) achieve an operational capability.

- Limit the list of CTPs to those that support the COIs. Using the system specification as a reference, the chief engineer on the program should derive the CTPs to be assessed during development.

3.3.1. Mission-Oriented Approach.

- Describe the approach to evaluate the system performance in a mission context during development in order to influence the design, manage risk, and predict operational effectiveness and operational suitability.

- A mission context focuses on how the system will be employed. Describe the

rationale for the COIs or COICs.

3.3.2. Developmental Test Objectives.

- Summarize the planned objectives and state the methodology to test the system attributes defined by the applicable capability requirement document (CDD, CPD, CONOPs) and the CTPs that will be addressed during each phase of DT as shown in Figure 3.1, Top-Level Evaluation Framework matrix and the Systems Engineering Plan.

- Subparagraphs can be used to separate the discussion of each phase.
- For each DT phase, discuss the key test objectives to address both the contractor and government developmental test concerns and their importance to achieving the exit criteria for the next major program decision point.
- If a contractor is not yet selected, include the developmental test issues addressed in the Request For Proposals (RFPs) or Statement of Work (SOW).
- Discuss how developmental testing will reflect the expected operational environment to help ensure developmental testing is planned to integrate with operational testing.
- Also include key test objectives related to logistics testing.
- All objectives and CTPs should be traceable in the Top-Level Evaluation Framework matrix to ensure all KPPs/KSAs are addressed, and that the COIs/COICs can be fully answered in operational testing.
- Summarize the developmental test events, test scenarios, and the test design concept.
- Quantify the testing sufficiently (e.g., number of test hours, test articles, test events, test firings) to allow a valid cost estimate to be created.
- Identify and explain how models and simulations, specific threat systems, surrogates, countermeasures, component, or subsystem testing, Testbeds, and prototypes will be used to determine whether or not developmental test objectives are achieved.
- Identify the DT&E reports required to support decision points/reviews and OT readiness.
- Address the systems reliability growth strategy, goals, and targets and how they support the Evaluation Framework.
- Detailed developmental test objectives should be addressed in the System Test Plans and detailed test plans.

3.3.3. Modeling & Simulation (M&S).

- Describe the key models and simulations and their intended use.
- Include the developmental test objectives to be addressed using M&S to include any approved operational test objectives.
- Identify data needed and the planned accreditation effort.
- Identify how the developmental test scenarios will be supplemented with M&S, including how M&S will be used to predict the Sustainment KPP and other

sustainment considerations.
- Identify who will perform M&S verification, validation, and accreditation. Identify developmental M&S resource requirements in Part IV.

3.3.4. Test Limitations.

- Discuss any developmental test limitations that may significantly affect the evaluator's ability to draw conclusions about the maturity, capabilities, limitations, or readiness for dedicated operational testing.
    - Also address the impact of these limitations, and resolution approaches.

3.4. Live Fire Test and Evaluation Approach.

- If live fire testing is required, describe the approach to evaluate the survivability/lethality of the system, and (for survivability LFT&E) personnel survivability of the systems occupants.
- Include a description of the overall live fire evaluation strategy to influence the system design (as defined in Title 10 U.S.C. 2366), critical live fire evaluation issues, and major evaluation limitations.
- Discuss the management of the LFT&E program, to include the shot selection process, target resource availability, and schedule.
- Discuss a waiver, if appropriate, from full-up, system-level survivability testing, and the alternative strategy.

3.4.1. Live Fire Test Objectives.

- State the key live fire test objectives for realistic survivability or lethality testing of the system.
- Include a matrix that identifies all tests within the LFT&E strategy, their schedules, the issues they will address, and which planning documents will be submitted for DOT&E approval and which will be submitted for information and review only.
- Quantify the testing sufficiently (e.g., number of test hours, test articles, test events, test firings) to allow a valid cost estimate to be created.

3.4.2. Modeling & Simulation (M&S).

- Describe the key models and simulations and their intended use.
- Include the LFT&E test objectives to be addressed using M&S to include operational test objectives. Identify data needed and the planned accreditation effort.
- Identify how the test scenarios will be supplemented with M&S.
- Identify who will perform M&S verification, validation, and accreditation. Identify M&S resource requirements in Part IV

3.4.3. Test Limitations.

- Discuss any test limitations that may significantly affect the ability to assess the systems vulnerability and survivability.
    - Also address the impact of these limitations, and resolution approaches.

3.5. Certification for Initial Operational Test and Evaluation (IOT&E).

- Explain how and when the system will be certified safe and ready for IOT&E.
- Explain who is responsible for certification and which decision reviews will be supported using the lead Services certification of safety and system materiel readiness process.
- List the DT&E information (i.e., reports, briefings, or summaries) that provides predictive analyses of expected system performance against specific COIs and the key system attributes - MOEs/MOSs.
- Discuss the entry criteria for IOT&E and how the DT&E program will address those criteria.

3.6. Operational Evaluation Approach.

- Describe the approach to conduct the independent evaluation of the system.
- Identify the periods during integrated testing that may be useful for operational assessments and evaluations.
- Outline the approach to conduct the dedicated IOT&E and resolution of the COIs.
    - COIs must be relevant to the required capabilities and of key importance to the system being operationally effective, operationally suitable and survivable, and represent a significant risk if not satisfactorily resolved. A COI/COIC is typically phrased as a question that must be answered in the affirmative to properly evaluate operational effectiveness (e.g., "Will the system detect the threat in a combat environment at adequate range to allow successful engagement?") and operational suitability (e.g., "Will the system be safe to operate in a combat environment?"). COIs/COICs are critical elements or operational mission objectives that must be examined.
    - COIs/COICs should be few in number and reflect total operational mission concerns. Use existing documents such as capability requirements documents, Business Case Analysis, AoA, APB, war fighting doctrine, validated threat assessments and CONOPS to develop the COIs/COICs.
    - COIs/COICs must be formulated as early as possible to ensure developmental testers can incorporate mission context into DT&E.
    - If every COI is resolved favorably, the system should be operationally effective and operationally suitable when employed in its intended environment by typical users.

3.6.1. Operational Test Objectives.

- State the key MOEs/MOSs that support the COIs/COICs.

- Ensure the operational tests can be identified in a way that allows efficient DOT&E approval of the overall OT&E effort in accordance with Title 10 U.S.C. 139(d).
- Describe the scope of the operational test by identifying the test mission scenarios and the resources that will be used to conduct the test.
- Summarize the operational test events, key threat simulators and/or simulation(s) and targets to be employed, and the type of representative personnel who will operate and maintain the system.
- Identify planned sources of information (e.g., developmental testing, testing of related systems, modeling, simulation) that may be used to supplement operational test and evaluation.
- Quantify the testing sufficiently (e.g., number of test hours, test articles, test events, test firings) to allow a valid cost estimate to be created.

3.6.2. Modeling & Simulation (M&S).

- Describe the key models and simulations and their intended use.
- Include the operational test objectives to be addressed using M&S. Identify data needed and the planned accreditation effort.
- Identify how the operational test scenarios will be supplemented with M&S.
- Identify who will perform the M&S verification, validation, and accreditation.
- Identify operational M&S resource requirements in Part IV.

3.6.3. Test Limitations.

- Discuss test limitations including threat realism, resource availability, limited operational (military; climatic; Chemical, Biological, Nuclear, and Radiological (CBNR), etc.) environments, limited support environment, maturity of tested systems or subsystems, safety, that may impact the resolution of affected COIs.
- Describe measures taken to mitigate limitations.
- Indicate if any system contractor involvement or support is required, the nature of that support, and steps taken to ensure the impartiality of the contractor providing the support according to Title 10 U.S.C. 2399.
- Indicate the impact of test limitations on the ability to resolve COIs and the ability to formulate conclusions regarding operational effectiveness and operational suitability. Indicate the COIs affected in parenthesis after each limitation.

3.7. Other Certifications.

- Identify key testing prerequisites and entrance criteria, such as required certifications (e.g. DoD Information Assurance Certification and Accreditation Process (DIACAP) Authorization to Operate, Weapon Systems Explosive Safety Review Board (WSERB), flight certification, etc.)

3.8. Reliability Growth.

- Since reliability is a driver during system development, identify, in tabular form, the amount of operating time being accrued during the each of the tests listed in the Figure 2.1.
    - Table should contain the system configuration, operational concept, etc. Reference and provide hyperlinks to the reliability growth planning document.

3.9. Future Test and Evaluation.

- Summarize all remaining significant T&E that has not been discussed yet, extending through the system life cycle.
    - Significant T&E is that T&E requiring procurement of test assets or other unique test resources that need to be captured in the Resource section.
    - Significant T&E can also be any additional questions or issues that need to be resolved for future decisions.
    - Do not include any T&E in this section that has been previously discussed in this part of the TEMP.

4. PART IV-RESOURCE SUMMARY

4.1. Introduction.

- In this section, specify the resources necessary to accomplish the T&E program.
- Testing will be planned and conducted to take full advantage of existing DoD investment in ranges, facilities, and other resources wherever practical.
- Provide a list in a table format (see Table 4.1) including schedule (**Note:** ensure list is consistent with figure 2.1 schedule) of all key test and evaluation resources, both government and contractor, that will be used during the course of the current increment. Include long-lead items for the next increment if known.
- Specifically, identify the following test resources and identify any shortfalls, impact on planned testing, and plan to resolve shortfalls.

4.1.1. Test Articles.

- Identify the actual number of and timing requirements for all test articles, including key support equipment and technical information required for testing in each phase of DT&E, LFT&E, and OT&E.
    - If key subsystems (components, assemblies, subassemblies or software modules) are to be tested individually, before being tested in the final system configuration, identify each subsystem in the TEMP and the quantity required.
- Specifically identify when prototype, engineering development, or production models will be used.

4.1.2. Test Sites and Instrumentation.

- Identify the specific test ranges/facilities and schedule to be used for each type of testing.
- Compare the requirements for test ranges/facilities dictated by the scope and content of planned testing with existing and programmed test range/facility capability.
- Identify instrumentation that must be acquired specifically to conduct the planned test program.

4.1.3. Test Support Equipment.

- Identify test support equipment and schedule specifically required to conduct the test program.
- Anticipate all test locations that will require some form of test support equipment. This may include test measurement and diagnostic equipment, calibration equipment, frequency monitoring devices, software test drivers, emulators, or other test support devices that are not included under the instrumentation requirements.

4.1.4. Threat Representation.

- Identify the type, number, availability, fidelity requirements, and schedule for all representations of the threat (to include threat targets) to be used in testing.
- Include the quantities and types of unit's and systems required for each of the test phases. Appropriate threat command and control elements may be required and utilized in both live and virtual environments.
- The scope of the T&E event will determine final threat inventory.

4.1.5. Test Targets and Expendables.

- Specify the type, number, availability, and schedule for all test targets and expendables, (e.g. targets, weapons, flares, chaff, sonobuoys, smoke generators, countermeasures) required for each phase of testing.
- Identify known shortfalls and associated evaluation risks.
- Include threat targets for LFT&E lethality testing and threat munitions for vulnerability testing.

4.1.6. Operational Force Test Support.

- For each test and evaluation phase, specify the type and timing of aircraft flying hours, ship steaming days, and on-orbit satellite contacts/coverage, and other operational force support required.
- Include supported/supporting systems that the system under test must interoperate with if testing a system-of-systems or family-of-systems.

- Include size, location, and type unit required.

4.1.7. Models, Simulations, and Testbeds.

- For each test and evaluation phase, specify the models and simulations to be used, including computer-driven simulation models and hardware/software-in-the-loop Testbeds.
- Identify opportunities to simulate any of the required support.
- Identify the resources required to validate and accredit their usage, responsible agency and timeframe.

4.1.8. Joint Mission Environment.

- Describe the live, virtual, or constructive components or assets necessary to create an acceptable environment to evaluate system performance against stated joint requirements.
- Describe how both DT and OT testing will utilize these assets and components.

4.1.9. Special Requirements.

- Identify requirements and schedule for any necessary non-instrumentation capabilities and resources such as: special data processing/data bases, unique mapping/charting/geodesy products, extreme physical environmental conditions or restricted/special use air/sea/landscapes.
- Briefly list any items impacting the T&E strategy or government test plans that must be put on contract or which are required by statute or regulation. These are typically derived from the JCIDS requirement (i.e., Programmatic Environment, Safety and Occupational Health Evaluation (PESHE) or Environment, Safety and Occupational Health (ESOH)).
- Include key statements describing the top-level T&E activities the contractor is responsible for and the kinds of support that must be provided to government testers.

4.2. Federal, State, and Local Requirements.

- All T&E efforts must comply with federal, state, and local environmental regulations.
- Current permit’s and appropriate agency notifications will be maintained regarding all test efforts.
- Specify any National Environmental Policy Act documentation needed to address specific test activities that must be completed prior to testing and include any known issues that require mitigations to address significant environmental impacts.
- Describe how environmental compliance requirements will be met.

4.3. Manpower/Personnel and Training.

- Specify manpower/personnel and training requirements and limitations that affect test and evaluation execution. Identify how much training will be conducted with M&S.

4.4. Test Funding Summary.

- Summarize cost of testing by FY separated by major events or phases and within each Fiscal Year (FY) DT and OT dollars.
    - When costs cannot be estimated, identify the date when the estimates will be derived.

Table 4.1 Test Sites and Instrumentation Example

Fiscal Year		06	07	08	09	10	11	12	TBD
TEST EVENT TEST RESOURCE		IT-B1	IT-B2	IT-B2 / IT-C1	IT-C1	IT-C1	IT-C2	OT-C1	OT-D1
Integration Lab		X	X	X	X	X	X		
Radar Integration Lab		X	X	X	X	X	X		
Loads (flights)									
Operating Area #1 (flights)			X (1)	X (1)				X (1)	X (2)
Operating Area #2 (flights)			50 (1)	132 (1)	60	100	140	X (1)	X (2)
Northeast CONUS Overland (flights)			10					X (1)	X (2)
SOCAL Operating Areas (flights)					X		X		
Shielded Hangar (hours)				160			160		
Electromagnetic Radiation Facility (hours)				40			40		
Arresting Gear (Mk 7 Mod 3)(events)					10		10		
NAS Fallon					5	5	A/R	X (1)	X (2)
Link-16 Lab, Eglin AFB								X	
NAWCAD WD, China Lake Range								X	
Eglin AFB ESM Range								X	

1. Explanations as required.

2. Enter the date the funding will be available.

9.5.5.4. Other Milestone TEMPs and Updates

An updated TEMP is required as part of entry criteria for entering each acquisition phase, and at any time a major programmatic change occurs. For example, an updated TEMP may be required due to a change resulting in a CDR or configuration change, change to the acquisition strategy, or changes to capability requirements.

9.5.6. Contractual

9.5.7. Government T&E Program Support

9.5.6. Contractual

All contract preparation documents (RFP, statement of work) and contract documents (contract, Contract Data Requirements List (CDRL)) are to identify contractor requirements for conducting DT&E, and supporting government DT&E, OT&E, and LFT&E events. At a minimum, contract documents should provide for data rights to contractor performed DT&E, identification of M&S to be used, and the V&V methodology to be used. For more information, read the OSD "Incorporating Test and Evaluation into Department of Defense Acquisition Contracts" , dated October 2011.

9.5.7. Government T&E Program Support

The Department's program support implementation strategy includes establishment of key leadership positions (KLPs) that have a significant level of responsibility and authority and have proven key to the success of programs or efforts. The Services and Defense Agencies may designate any position which meets the criteria. However, the following have been identified as mandatory KLPs in Section 805, P.L. 111-84, National Defense Authorization Act for FY 2010 ; or have significant levels of responsibility and authority, proving essential for the success of a program:

- PEO/Deputy PEO
- PM (ACAT I, IA and II)
- DPM (DPM) (ACAT I)
- Senior Contracting Official
- MDAP/MAIS positions (ACAT I and IA) when the function is required based on the phase or type of acquisition program:
    - Program Lead SE
    - Program Lead Cost Estimator
    - Program Lead Contracting Officer
    - Program Lead Logistician (Product Support Manager)
    - Program Lead Business Financial Manager
    - Program Lead T&E
    - Program Lead Production, Quality, and Manufacturing
    - Program Lead IT

In general, the Service/Defense Agency should fill the "program lead" positions with military members at the lieutenant colonel/colonel or commander/Navy captain levels or by the civilian equivalent. Program leads advise the PM/DPM and may be matrixed to the program office. Although program leads may report to a higher-level functional (i.e., command/center functional lead or his or her direct report), these positions must be designated as KLPs. Program lead KLPs must be designated in the position category associated with the lead function. For example, "lead logistician" positions must be designated as positions in the "Life Cycle Logistics" position category.

Services/Defense Agencies will submit KLP metrics at Senior Steering Boards, in accordance with DoDI 5000.55 "Reporting Management Information on DoD Military and Civilian Acquisition Personnel and Positions," dated September 11, 1991. Mandatory metrics include KLP fill rates and qualification rates of workforce members assigned to KLPs.

9.5.8. System Readiness for Operational Test and Evaluation (OT&E)

9.5.8.1. Operational Test Readiness Process

9.5.8.2. System Readiness for IOT&E

9.5.8. System Readiness for Operational Test and Evaluation (OT&E)

9.5.8.1. Operational Test Readiness Process

DoD Components should develop and institutionalize processes to determine a systems performance and readiness for operational assessments and tests. These processes should focus on ensuring systems are in a realistic configuration and have demonstrated technical and production maturity under the expected operating conditions. Successful execution of these processes should enable the gathering of relevant and appropriate data, during integrated testing, to satisfy early operational test objectives prior to dedicated, operational testing.

9.5.8.2. System Readiness for IOT&E

For programs on the OSD T&E Oversight List for OT&E, the DoD CAE is required to evaluate and determine materiel system readiness for IOT&E. The intent of this requirement is to ensure systems do not enter IOT&E before they are sufficiently mature. Scarce resources are wasted when an IOT&E is halted or terminated early because of technical problems with the System Under Test (SUT); problems that should have been resolved prior to the start of IOT&E.

Prior to CAE determination of readiness for IOT&E, programs must have an independent AOTR for all ACAT I and IA programs, as well as any special interest programs designated by the DASD(DT&E). The AOTR will focus on the technical and materiel readiness of the program to proceed into IOT&E. Assessment results are

based on capabilities demonstrated in DT&E and earlier OAs. As outlined in DoDI 5000.02, Enclosure 6, paragraphs 4.b and 4.c, a DT&E report of results and the progress assessment shall be provided to the DASD(DT&E) and the DOT&E prior to the AOTR. That report can be a written document or a briefing to the DASD(DT&E) and DOT&E representatives, and should include the following: an analysis of the systems progress in achieving CTPs, satisfaction of approved IOT&E entrance criteria, a technical risk assessment, level of software maturity and status of software trouble reports, and predicted IOT&E results, including the impacts of any shortcomings on the systems expected performance during IOT&E. Provide the report at least 20 days prior to the CAE's determination of system readiness. This will allow OSD time to formulate and provide its recommendation to the CAE. All appropriate developmental and operational T&E organizations should be invited to the IOT&E readiness review.

The goal of the AOTR is to assess the risk associated with the system's ability to meet operational suitability and effectiveness goals, identify system and subsystem maturity levels, assess programmatic and technical risk, and provide risk mitigation recommendations. The results of the AOTR will be provided to the USD(AT&L), DOT&E, and CAE. As outlined in DoD Instruction 5000.02, Enclosure 6, paragraphs 4.b and 4.c, the CAE shall consider the results of the AOTR prior to making a determination of materiel readiness for IOT&E.

9.6. T&E Reporting

9.6.1. Milestone B Reporting

9.6.2. Milestone C Reporting

9.6. T&E Reporting

Programs on the OSD T&E Oversight List report to the appropriate OSD oversight organization(s) on a periodic or event-driven basis. Reports are required from the program office, the proposed lead DT&E Organization, and the lead OTA to assist OSD in preparation for the Milestone Decision Authority (MDA) review of system development and operational progress and risk, and for congressionally mandated annual reports.

9.6.1. Milestone B Reporting

The risk associated with a Milestone B decision, should be based on reports to the DASD(DT&E) and the DOT&E to permit assessments from the TD Phase for: (1) technology maturity, (2) performance of Critical Technology Element (CTEs) to meet CTPs or other performance parameter thresholds, and (3) adequacy of executing the test plan submitted for the TD Phase. The assessment (for TRLs for all CTEs) will be based on objective evidence gathered during events such as tests, demonstrations, pilots, or physics-based simulations. Based on the requirements, identified capabilities, system architecture, software architecture, CONOPS, and/or the concept of

employment, the IRT (Integrated Requirements Team) will define operationally relevant environments and determine which TRL is supported by the objective evidence. This metric would evaluate the adequacy of the test/demonstration approach used for determining the CTPs for each CTE; i.e., the confidence the DASD(DT&E) has that the CTE was appropriately stressed and the TRL was accurately assessed. This confidence will be based on a number of factors assessed by comparing test and/or evaluation reports with the approved TEMPs. Some of those factors may include adequacy of:

- Operationally relevant environment and/or end-to-end mission simulation
- Instrumentation/facility/range/threat representation
- Skills of test personnel
- Number of test articles
- Interfaces and integration
- Human Systems Integration considerations
- Government participation
- Use of design of experiments; e.g., sample size determination
- M&S VV&A
- Support vehicles/systems/services
- Highest fidelity test resource used in the DoD test process

9.6.2. Milestone C Reporting

Development of an OSD position on the risk of a Milestone C approval for initiating the Production and Deployment (P&D) Phase should be based on: (1) the DT&E results from the preceding EMD phase, including consideration of how thoroughly the system was stressed during EMD (mission-oriented context and operationally realistic environments); and (2) adequacy of the DT&E planning for the remaining P&D phase. EMD phase DT results and evaluations extracted from DT&E reports, OA results if the OTA conducted one, and action officer observations from monitoring EMD phase DT&E and participating in Program Support Review(s) (PSRs), WIPT meetings, test readiness reviews, and data analysis working group meetings to provide the basis for assessing whether Milestone C entrance criteria were met. Reporting should permit OSD to determine the adequacy of the TEMP the PM submits for Milestone C, knowledge of the mission and operating environment requirements, and knowledge of both T&E infrastructure capabilities (including threat surrogates) and the projected threat at the time of program IOC, and provide the basis for assessing the adequacy of P&D phase DT&E planning. The assessment based on DT&E results should speak directly to the maturity of the system being developed and its readiness to advance to the P&D phase; the assessment based on P&D Phase DT&E planning speaks directly to the adequacy of the planned DT&E to deliver a system that will succeed in IOT&E, and for assessing and articulating the risk associated with an acquisition program proceeding into LRIP and the P&D phase.

Reporting should demonstrate, based on the DT&E and OA results of EMD, the degree of compliance for:

- Acceptable performance in DT&E and OA
- Mature software capability
- Acceptable interoperability
- Acceptable operational supportability
- IA certification and acceptance

9.7. Special Topics

9.7.1. Network Centric Operations

9.7.2. Modeling and Simulation in T&E

9.7.3. Validation of Threat Representations (targets, threat simulators, or M&S)

9.7.4. Mission-oriented Context

9.7. Special Topics

9.7.1. Network Centric Operations

Implementation of the Department's transformation strategy, calling for shifting to an information-age military, will result in fewer platform-centric and more net-centric military forces. This requires increased information sharing across networks. The net-centric concept applies to a DoD enterprise-wide information management strategy that includes not only military force operations but also all defense business processes, such as personnel actions, fuel purchases and delivery, commodity buying, deployment and sustainment activities, acquisition and development. Key tenets of the strategy include: handle information only once, post data before processing it, users access data when it is needed, collaborate to make sense of data, and diversify network paths to provide reliable and secure network capabilities.

The shift away from point-to-point system interfaces to net-centric interfaces brings implications for the T&E community. The challenge to the test community will be to represent the integrated architecture in the intended operational environment for test. Furthermore, the shift to net-centric capabilities will evolve gradually, no doubt with legacy point-to-point interfaces included in the architectures. PMs, with PEO support, are strongly encouraged to work with the operating forces to integrate operational testing with training exercises, thereby bringing more resources to bear for the mutual benefit of both communities. It is imperative the T&E community engages the user community to assure that test strategies reflect the intended operational and sustainment/support architectures and interfaces within which the intended capabilities are to be tested and evaluated.

9.7.2. Modeling and Simulation in T&E

For T&E, the appropriate application of M&S is an essential tool in achieving both an

effective and efficient T&E program. T&E is conducted in a continuum of Live, Virtual, Constructive (LVC) environments. DoD Components have guidelines for use of M&S in acquisition, especially T&E. These guidelines are intended to supplement other resources. The PM should have an M&S subgroup to the T&E WIPT that develops the program's M&S strategy that should be documented in the programs SEP and the TES / TEMP . Some DoD components require planning for M&S to be documented in a separate M&S Support Plan. This M&S strategy will be the basis for program investments in M&S. M&S should be planned for utility across the programs life cycle, modified and updated as required to ensure utility as well as applicability to all increments of an evolutionary acquisition strategy. A program's T&E strategy should leverage the advantages of M&S. M&S planning should address which of many possible uses of M&S the program plans to execute in support of T&E. M&S can be used in planning to identify high-payoff areas in which to apply scarce test resources. Rehearsals using M&S can help identify cost effective test scenarios and reduce risk of failure. During conduct of tests, M&S might provide adequate surrogates to provide stimulation when it is too impractical or too costly to use real world assets. This impracticality is particularly likely for capability testing or testing a system that is part of a system-of-systems, or for hazardous/dangerous tests or in extreme environments, or for testing the systems supportability. M&S can be used in post-test analysis to help provide insight and for interpolation or extrapolation of results to untested conditions.

To address the adequacy and use of M&S in support of the testing process the program should involve the relevant OTA in planning M&S to ensure support for both DT and OT objectives. This involvement should begin early in the programs planning stages.

An initial goal for the T&E WIPT is to assist in developing the programs M&S strategy by helping integrate a programs M&S with the overall T&E strategy; plan to employ M&S tools in early designs; use M&S to demonstrate system integration risks; supplement live testing with M&S stressing the system; and use M&S to assist in planning the scope of live tests and in data analysis.

Another goal for the T&E WIPT is to develop a T&E strategy identifying ways to leverage program M&S which could include how M&S will predict system performance, identify technology and performance risk areas, and support in determining system effectiveness and suitability. For example, M&S should be used to predict sustainability or KSA drivers. The T&E WIPT should encourage collaboration and integration of various stakeholders to enhance suitability (see section 5.2.3).

A philosophy for interaction of T&E and M&S is to use the model-test-fix-model. Use M&S to provide predictions of system performance, operational effectiveness, operational suitability, and survivability or operational security and, based on those predictions, use tests to provide empirical data to confirm system performance and to refine and further validate the M&S. This iterative process can be a cost-effective method for overcoming limitations and constraints upon T&E. M&S may enable a comprehensive evaluation, support adequate test realism, and enable economical,

timely, and focused tests.

Computer-generated test scenarios and forces, as well as synthetic stimulation of the system, can support T&E by creating and enhancing realistic live test environments. Hardware-in-the-loop simulators enable users to interact with early system M&S. M&S can be used to identify and resolve issues of technical risk, which require more focused testing. M&S tools provide mechanisms for planning, rehearsing, optimizing, and executing complex tests. Integrated simulation and testing also provides a means for examining why results of a physical test might deviate from pre-test predictions. Evaluators use M&S to predict performance in areas impractical or impossible to test.

All M&S used in T&E must be accredited by the intended user (PM or OTA). Accreditation can only be achieved through a rigorous VV&A process as well as an acknowledged willingness by the user to accept the subject M&S for their application requirements. Therefore, the intended use of M&S should be identified early so resources can be made available to support development and VV&A of these tools. The OTA should be involved early in this process to gain confidence in the use of M&S and possibly use them in support of OT. DoDI 5000.61 , "DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)," dated December 9, 2009, provides further guidance on VV&A.

The following is provided to help the M&S subgroup to the T&E WIPT think through the planning process to best incorporate M&S into the testing process. Additional guidance for M&S is available in section 4.5.8 .

- Document the intended use of models and simulations:
  - Decisions that will rely on the results of the M&S.
  - The test objectives/critical operational and sustainment issues the models and simulations will address.
  - The requirements for the use of the M&S.
  - Risk of use of M&S.
- Identify all M&S intended to support T&E including (but not limited to):
  - Type: LVC simulations, distributed simulations and associated architecture, federates and federations, emulators, prototypes, simulators, and stimulators;
  - Suitability of model use: Legacy systems, new developments, and modified or enhanced legacy M&S;
  - Management of M&S: Developed in-house, Federally Funded Research and Development Centers (FFRDC), industry, academia, and other Federal or non-Federal government organizations;
  - Source: COTS and GOTS M&S;
  - Facilities: hardware-in-the loop, human-in-the-loop, and software-in-the-loop simulators; land-based, sea-based, air-and space-based test facilities;
  - Threat models, simulations, simulators, stimulators, targets, threat systems, and surrogates;

    - Synthetic countermeasures, Testbeds, environments, and battlespaces;
    - M&S whether embedded in weapon systems, implemented as stand-alone systems, or integrated with other distributed simulations; and
    - Test assets, test planning aids, and post-test analysis tools that address other than real time characteristics.
- Infrastructure needed to conduct the test(s), to include networks, integration software, and data collection tools:
    - Provide descriptive information for each M&S resource:
        - Title, acronym, version, date;
        - Proponent (the organization with primary responsibility for the model or simulation);
        - Assumptions, capabilities, limitations, risks, and impacts of the model or simulation;
        - Availability for use to support T&E; and
        - Schedule for obtaining.
- Identify the M&S data needed to support T&E:
    - Describe the input data the M&S needs to accept;
    - Describe the output data the M&S should generate;
    - Describe the data needed to verify and validate the M&S; and
    - Provide descriptive information for each data resource:
        - Data title, acronym, version, date;
        - Data producer (organization responsible for establishing the authority of the data);
        - Identify when, where, and how data was or will be collected;
        - Known assumptions, capabilities, limitations, risks, and impacts;
        - Availability for use to support T&E; and
        - Schedule for obtaining.
- For each M&S and its data, describe the planned accreditation effort based on the assessment of the risk of using the model and simulation results for decisions being made:
    - Explain the methodology for establishing confidence in the results of M&S;
    - Document historical source(s) of VV&A in accordance with DoDI 5000.61 ; and
    - Provide the schedule for accreditation prior to their use in support T&E.
- Describe the standards (both government and commercial) with which the M&S and associated data must comply; for example:
    - IT standards identified in the DoD IT Standards Registry (DISR);
    - Standards identified in the DoD Architecture Framework Technical Standards Profile (TV-1) and Technical Standards Forecast (TV-2);
    - M&S Standards and Methodologies (requires registration/login);
    - Data standards; and
    - VV&A standards:
        - IEEE Std 1516.4TM -2007, IEEE Recommended Practice for VV&A of a Federation-An Overlay to the High Level Architecture Federation Development and Execution Process;
        - IEEE Std 1278. 4TM -1997(R2002), IEEE Recommended Practice

for Distributed Interactive Simulation - VV&A;
- MIL-STD-3022 , DoD Standard Practice for Model & Simulation VV&A Documentation Templates, dated January 28, 2008.

M&S is an essential tool for achieving both an effective and efficient T&E program. T&E should be conducted in a continuum of LVC environments throughout a systems acquisition process. DoD Components have guidelines for the use of M&S in acquisition, especially T&E. The PM should have an M&S subgroup to the T&E WIPT that develops the program's M&S strategy which should be documented in the programs SEP and the TES / TEMP or in a separate M&S Support Plan.

M&S can be used in test planning to identify high-payoff areas in which to apply scarce test resources, and in dry-running a test to assess the sensitivity of test variables to the response variable being used, and to evaluate system operational effectiveness, operational suitability or survivability or operational security. During the conduct of tests, M&S can provide surrogates to provide stimulation when it is too impractical or too costly to use real world assets. This impracticality is particularly likely for capability testing or testing a system that is part of a system-of-systems, or for hazardous/dangerous tests or in extreme environments, or for testing the systems supportability. M&S can be used in post-test analysis to help provide insight, and for interpolation or extrapolation of results to untested conditions.

9.7.3. Validation of Threat Representations (targets, threat simulators, or M&S)

To ensure test adequacy, OT should only incorporate validated and accredited threat representations unless coordinated with DOT&E.

The following are the recommended validation guidelines:

- Threat representation validation supports the objective of ensuring that threat representations meet DT&E and OT&E credibility requirements. Validation of threat representations is defined as "the baseline comparison of the threat to the threat representation, annotation of technical differences, and impact of those differences on testing."
- Validation of threat representations is typically conducted by the DoD Component responsible for the threat representation and culminates in a validation report which documents the results. DOT&E approves the DoD Component-validated reports.
- Only current, DIA- or DoD Component-approved threat data should be used in the validation report. Specifications pertaining to the threat representation should accurately portray it’s characteristics and may be obtained from a variety of sources including the developer and/or government-sponsored testing. For new developments, validation data requirements should be integrated into the acquisition process to reduce the need for redundant testing.
- Incorporation of an Integrated Product and Process Development (IPPD) process for new threat representation developments is recommended. The objective of

the IPT is to involve DOT&E and its Threat Systems Office (TSO) early and continuously throughout the validation process. DoD Component organizations responsible for conducting threat representation validation should notify DOT&E of their intent to use an IPPD process and request DOT&E/TSO representation at meetings and reviews, as appropriate. The DOT&E representative will be empowered to provide formal concurrence or non-concurrence with these validation efforts as they are accomplished. After the IPPD process, DOT&E will issue an approval memorandum, concurring with the threat representation assessment.

- When a WIPT is not used, draft threat representation validation reports should be forwarded to the TSO for review. The TSO will provide recommendations for corrections, when necessary. Final reports are then submitted by the TSO for DOT&E approval.
- DOT&E approval confirms that an adequate comparison to the threat has been completed. It does not imply acceptance of the threat test asset for use in any specific test. It is the responsibility of the OTA to accredit the test resource for a specific test and for DOT&E to determine if the threat test resource proves adequate.

These guidelines do not address the threat representation verification or accreditation processes. Verification determines compliance with design criteria and requires different methods and objectives. Accreditation, an OTA responsibility, determines the suitability of the threat representation in meeting the stated test objectives. The data accumulated during validation should be the primary source of information to support the accreditation process.

9.7.4. Mission-oriented Context

A mission-oriented context to T&E means being able to relate evaluation results to an impact on the warfighters' ability to execute their mission-essential tasks. Including mission context during test planning and execution provides for a more rigorous test environment, and allows for the identification of design issues that may not be discovered in a pure developmental test environment. The results of testing in a mission-oriented context will allow these issues to be addressed earlier in the development phase of a component or system. Additionally, testing in a mission-oriented context will allow the developmental evaluators to predict system performance against the COIs evaluated in OT&E.

Testing in a mission-oriented context will also allow the OTA to participate earlier in the development cycle and use the results of integrated tests to make operational assessments. Integrated planning of tests is a key element in this process. This allows the data to be used by the developmental community to better predict system performance and allows the OTA to potentially reduce the scope of IOT&E while still providing an adequate evaluation of the COIs .

9.7.5. Testing in a Joint Operational Environment

The phrase testing in a joint environment originated in the U.S. Department of Defense 2006-2011 Strategic Planning Guidance for Joint Testing in Force Transformation. It refers to testing military systems as participating elements in overarching joint SoS. This testing in a joint operational environment initiative supports the departments long-term strategy to test as it fights. Joint operations have become the mainstay of Warfighting. Force transformation will require the T&E community to place a greater emphasis on testing joint war fighting capabilities developed in response to the JCIDS process. Future T&E must ensure combatant commanders can rely on equipment to operate together effectively without introducing problems to warfighters. For a detailed discussion of changes needed to bring about this vision of T&E, see the DepSecDefs Testing in a Joint Environment Roadmap , dated November 12, 2004. The proposals in this roadmap provide important enablers for acquiring new systems created with joint and testing legacy equipment and systems that are made joint.

The Joint Mission Environment (JME) is defined as, "a subset of the joint operational environment composed of force and non-force entities; conditions, circumstances and influences within which forces employ capabilities to execute joint tasks to meet a specific mission objective". It describes the expected operating environment of the system (or system of systems) under test, and includes all of the elements that influence the required performance the new capability must demonstrate. These include the particular mission requirements in which the system is being employed; physical factors such as the blue and opposing force structures; geographic and demographic aspects of the joint operating area, etc., as well as the interactions between these elements.

To be successful, testing in the JME cannot be a new step added at the end of operational T&E, nor can it replace current DT or OT. It does however represent a departure from the way DoD acquisition professionals plan and execute systems engineering, DT&E, and OT&E indeed the entire acquisition process. Testing in a JME involves the appropriate combination of representative systems, forces, threats and environmental conditions to support evaluations. These representations can be LVC, or distributed combinations thereof.

Testing in a JME applies throughout the life cycle of the system. Identification of a joint issue/problem early in a systems life (including as early as the conceptual phase) will reduce costs and issues. This applies to evaluating system performance, or how well

the system does what it is designed to do, as well as the systems contribution to the joint mission, or how DoD employs the system to achieve the mission. A systems interaction with the JME is evaluated along an evaluation continuum using constructive and virtual representations and live systems in various combinations.

The JME and associated joint capability requirements will be defined in the ICD, CDD, and the CPD. The evaluation plans for assessing these requirements will be articulated in the SEP and the TES at Milestone A. At the pre-EMD Review, evaluation plans for assessing these requirements will be articulated in the Pre-EMD draft documents (SEP, TEMP, and ISP). At Milestones B and C, they will be articulated in the SEP, TEMP, and ISP.. For each case, the selection of LVC systems that will be used to recreate the JME to support testing will depend on the purpose of the assessment and on the interactions the SUT will have with other elements in the JME.

This section also briefly addresses some additional areas as outlined in the Testing in a Joint Environment Methods and Processes (M&P) Implementation Plan originally produced by the M&P Working Group that was formed during the summer of 2004 to address testing in a joint environment. The areas of concern outlined below are: (1) Description of Joint Mission Environments, (2) How to use the Joint Mission Environment, (3) Testing in a Joint Mission Environment Program Management Office Support, and (4) Important Acquisition Program Responsibilities.

9.7.5.1. Description of Joint Mission Environments

The JCIDS will create requirements for effects and capabilities at the joint mission level. This means JCIDS will identify desired mission level effects that are shortfalls. Shortfalls are addressed by materiel and non-materiel solutions. Materiel or possible system (for a new/modified system or SoS) KPPs are then proposed to provide the desired mission level effect(s). Because of this, systems development should not begin and testing cannot occur without definition(s) of the JME and a defined joint mission associated with a shortfall to be addressed by a system or systems.

With respect to obtaining information for selected joint missions, users of the joint environment can start with the universal joint planning process to break down missions, but it is a process that starts at the Universal Joint Task List (UJTL) level and extends down to the COCOM level to plan joint task force operations and/or training events. However, this level of "fidelity" may not be available at the JCIDS ICD/CDD/CPD level because it is mission specific at the COCOM or Joint Task Force level.

The joint mission descriptions should set the stage for evaluation of a system(s) within a joint mission area and provide the tester what they need to plan the test. There are essential elements of the joint mission description necessary to plan, execute, and analyze assessments and T&E throughout a systems acquisition process.

Additionally, users of the joint environment determine and obtain representations for the threat, threat composition and disposition, and threat scheme of maneuver appropriate

for the selected joint mission/task. The currently approved Guidance for the Development of the Force (GDF) scenarios and/or the maturing Defense Planning Scenarios will provide the source of this information. There is also a Threat Scenarios Group from the U.S. Army Test & Evaluation Office working threat scenarios. In addition, coordination with the Service intelligence agencies and the DIA is critical. The threat must be system specific (specific to the platform under examination) and also mission specific (specific to the joint mission examined). The next step (after identification of the threat scenarios) is to determine what should be used to represent the threat; which can be a LVC representation.

Different Services should be referred to depending on the type of model needed for test. As the Services have generally focused their modeling efforts based on their usual area of operations. The Army and/or the National Geospatial-Intelligence Agency are the best sources for all terrain models. The Navy is the best source for all oceanographic (surface and subsurface) models, and the Air Force is the best source for air and space models. DoD M&S responsibilities are delineated in DoDD 5000.59 , DoD Modeling and Simulation (M&S) Management, dated August 8, 2007, and there are M&S Executive Agents with responsibilities defined by the DMSO. There should also be a standard set of environment/background models established for the JME.

9.7.5.2. How to use the Joint Mission Environment

Systems engineering and testing will require insertion of concepts and systems into the JME as a standard part of the acquisition process. Since this is a change of scope for previous assessments and tests, a process for how to use the joint mission environment needs established.

The ultimate goal for systems engineering and testing in a joint environment is the ability to insert any system into the applicable JME at any time during the life of a system. Two basic items will be examined through insertion into the JME. The first item is to ensure the systems to be acquired are interoperable with other systems. This includes not only how they interact and communicate as expected and required, but also understanding SoS dependencies. The second item goes beyond the system interaction and communications to examine what value the systems add to joint military capabilities. In other words, the second item is to assess the contribution of the system to the mission success.

Interoperability and contribution should be examined each time a system is inserted into the JME, including times when substantive changes or upgrades are made to an individual system. Users can determine which joint mission/task(s) to test for a system with a role in multiple missions.

Selection of the most stressing mission(s) and/or the mission(s) with the most interactions appears to be the most defensible approach. Test authorities must ensure that if another required mission involves a system interaction not included in the "most stressing" mission, the interaction is tested separately. Examining different joint

missions as the system progresses through the acquisition process is also a good approach especially if there appear to be multiple stressing missions. Another option is to consult with the intended joint users (COCOM & Service Combatant) and have them define representative mission tasks.

With respect to the criteria/process to determine the appropriate representation (live, virtual, or constructive) of players in each engineering (DT or OT) event, the supporting players that constitute the family-of-systems for the joint mission will have to be determined on a case-by-case basis. The goal is for the system being inserted into the JME to be the most mature representation available. However, it will always be a live system for IOT&E.

9.7.5.3. Joint Mission Environment (JME) Program Management Office

Scheduling all of the assets in the JME, especially live assets participating in exercises, will prove a complex undertaking. A management and scheduling capability must exist, and it is assumed the PM will establish a JME PMO (or equivalent) for this purpose. The JME PMO will coordinate all LVC assets, and the script of events, which is the plan for the specific JME missions incorporating acquisition systems under test in accordance with their schedules. Note that acquisition systems tend to have fixed decision points where unplanned delays could severely impact production. Finally, with a complex facsimile of a mission environment in place and acquisition systems scheduled to perform missions within it, additional programs may ask to "join in" the scheduled events, for testing, training exercises, or other special events. This is encouraged, but the testing needs of the sponsoring program must of course take precedence over the needs of other participants, and their participation should not interference with the core purpose of the JME events.

9.7.6. Information Assurance Testing

9.7.7. Interoperability Testing

9.7.8. Software Test and Evaluation (T&E)

9.7.9. Post Implementation Review (PIR)

9.7.10. System-of-Systems (SoS) Test and Evaluation (T&E)

9.7.11. Reliability Growth Testing

9.7.12. Evaluation of Test Adequacy

9.7.13. Medical Materiel T&E

9.7.14. FY 2012 National Defense Authorization Act (NDAA) Section 835

9.8. Best Practices

9.9. Prioritizing Use of Government Test Facilities for T&E

9.7.6. Information Assurance Testing

An integral part of the overall T&E process includes the T&E of IA requirements. DoDI 5000.02 , Operation of the Defense Acquisition System, dated December 8, 2008, directs the conducting of IA T&E during both DT&E and OT&E. To ensure IA testing adequately addresses system IA requirements, the PM must consider IA requirements that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation. This includes providing for restoration of information systems by incorporating protection, detection, and reaction capabilities. DoDI 8500.02 , Information Assurance (IA) Implementation, dated February 6, 2003, specifies baseline IA controls for DoD systems. PMs should ensure adequate testing of all applicable IA controls prior to testing in an operational environment or with live data, except for those programs requiring testing in an operational environment. In consultation with the PM or Systems Manager, the Designated Approving Authority (DAA) determines which programs require testing of IA controls in an operational environment. In addition to baseline IA controls, some capabilities documents (e.g., ICD, CDD, and CPD) may also specify unique IA requirements, such as a specific level of system availability. PMs may also identify additional IA requirements as a result of the risk management process, or as directed by the DoD Components. They should also consider the impact of the DoD Information Assurance Certification and Accreditation Process (DIACAP) on the systems overall T&E cost and schedule.

Prior to conducting operational tests programs must receive an Interim Authorization to Operate or Authorization to Operate from the cognizant DAA, followed by a corresponding authorization to connect (ATC) from the system or network manager providing the system connection (e.g. DISA).

Significant C&A activities and events should be visible on the integrated test schedule to ensure appropriate coordination of events. The DoD Component IA program regularly and systematically assess the IA posture of DoD Component-level information systems, and DoD Component-wide IA services and supporting infrastructures through combinations of self-assessments, independent assessments and audit's, formal testing and certification activities, host and network vulnerability or penetration testing, and IA program reviews. The planning, scheduling, conducting, and independent validation of conformance testing should include periodic, unannounced in-depth monitoring and provide for specific penetration testing to ensure compliance with all vulnerability mitigation procedures; such as the DoD information assurance and vulnerability assessment or other DoD IA practices. Testing ensures the systems IA capabilities provide adequate assurance against constantly evolving threats and vulnerabilities.

PMs should consider the re-use and sharing of information to reduce rework and cycle

time. DoD memorandum for establishing DoD Information System Certification and Accreditation Reciprocity , dated June 11, 2009, mandated a mutual agreement among participating enterprises to accept each other's security assessments in an effort to reuse IS resources and/or accept each other's assessed security posture for the timely deployment of IS critical to attaining the Departments strategic vision of Net-Centricity. Additionally, DOT&E memorandum, Procedures for Operational Test and Evaluation (OT&E) of Information Assurance in Acquisition Programs , dated January 21, 2009 contains the OT&E strategy for IA assessment; addressing the test process, identification of required IA test resources and funding, and a reference to the appropriate threat documentation. For more information, see DAG Section 7.5 .

9.7.7. Interoperability Testing

All IT & NSS must undergo joint interoperability testing and evaluation for certification prior to fielding, in accordance with section 2223 of Title 10 USC , DoDI 5000.02 , DoDD 4630.05 , Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS), dated April 23, 2007, DoDI 4630.8 , Procedures for Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS), dated June 30, 2004, CJCSI 3170.01H , and CJCSI 6212.01F , Interoperability and Supportability of Information Technology and National Security Systems, dated March 21, 2012. This includes IT & NSS compliance with technical standards, Net-Ready Key Performance Parameters (NR-KPP), solution architectures, and spectrum supportability requirements. Interoperability compliance with joint interoperability test certification requirements remains a continuous process throughout a systems life cycle. JITC bases a Joint interoperability test certification on test and evaluation results from operationally realistic test configurations as well as joint and coalition environments. It then provides input to the MDA and PM for a fielding decision. The PM must plan, program, budget, execute and provide resources according to agreed-to costs, schedules, and test plans. Interoperability requirements impact a programs schedule and costs, so PMs must provide adequate time and funding for Interoperability and Supportability (I&S), NR-KPP, test certification, and Spectrum Supportability Risk Assessments (SSRA). Additional information can be found in Chapter 7.6.4.

Joint interoperability certification testing involves system-of-systems and family-of-systems simulated/live events, and verifies the actual net-centric interoperability characteristics. Additionally, certification testing validates the capability's interoperability, ensuring it proves sufficient in support of a fielding decision. As with most other aspects of a system, PMs should consider net-readiness during early consideration for design and test. The PM should include the strategy for evaluating net-readiness in the TEMP. One important aspect includes developing a strategy for testing each system in the context of the system-of-systems or family-of-systems architecture in which the system operates.

Early assessments and testing opportunities reduce interoperability risk as well as minimize the impact of interoperability requirements on schedule and program costs.

Early identification and resolution of interoperability issues minimizes negative impact to the joint, multi-national, interagency, and Warfighter community. Interoperability testing of all IT & NSS follows the NR-KPP development process. Net-ready attributes determine specific measurable and testable criteria for interoperability, and operationally effective end-to-end information exchanges. The NR-KPP identifies operational, net-centric requirements with threshold and objective values that determine its measure of effectiveness (MOE) and measure of performance (MOP). Architectures provide a foundation to effectively evaluate the probability of interoperability and net-centricity. The NR-KPP covers all communication, computing, and electromagnetic spectrum requirements involving information elements among producer, sender, receiver, and consumer. Information elements include the information, product, and service exchanges. These exchanges enable successful completion of the Warfighter mission or joint business processes. Mandatory KPPs for all program increments include the NR-KPP.

JITC acts as the DoD organization responsible for joint interoperability testing and net-readiness certifications. Statute requires JITC to provide a system Net-Ready certification evaluation memorandum to the Director, Joint Staff J-8, throughout the system life cycle and regardless of acquisition category. Based on net-readiness evaluations and other pertinent factors, the Joint Staff J-8 issues a Net-Ready System Certification memorandum to the respective DoD Components as well as developmental and operational test organizations in support of the FRP Decision Review. JITC collaborates with the PM and lead DT&E organization during development of the TEMP, recommending interoperability T&E measures to ensure I&S testing satisfies all requirements during DT&E, OT&E, or IA T&E events. PMs should include JITC as a member of the T&E WIPT and ensure they participate in TEMP development. JITCs philosophy leverages test results from planned test events or exercises to generate the necessary data for joint test and net-ready certifications; combining valuable resources, eliminating redundancy, and ultimately ensuring one test. JITC evaluates the operational effectiveness of information exchanges using joint mission threads in an operational environment. JITC establishes processes to ensure operational tests include operationally mission-oriented interoperability assessments and evaluations using common outcome-based assessment methodologies to test, assess, and report on the impact interoperability and information exchanges have on a systems effectiveness and mission accomplishment for all acquisitions, regardless of ACAT level.

9.7.8. Software Test and Evaluation (T&E)

Software is a rapidly evolving technology that has emerged as a major component in most DoD systems. Within the DoD acquisition domain, the following are essential considerations for success in testing software; to include a security focused code audit/analysis as part of the Software Development Life Cycle (SDLC), IAW the Application Security and Development Security Technical Implementation Guide (STIG) , dated June 3, 2012:

- The T&E strategy should address evaluation of highest risk technologies in system design and areas of complexity in the system software architecture. The strategy should identify and describe:
    - Required schedule, materiel and expertise,
    - Software evaluation metrics for Resource Management, Technical Requirements and Product Quality, including Reliability,
    - Types and methods of software testing to support evaluation in unit, integration and system test phases across the life cycle,
    - Data and configuration management methods and tools,
    - Models and simulations supporting software T&E including accreditation status.
- A defined T&E process consistent with and complementing the software and system development, maintenance and system engineering processes, committed to continuous process improvement and aligned to support project phases and reviews, including an organizational and information flow hierarchy.
- Software test planning and test design initiated in the early stages of functional baseline definition and iteratively refined with T&E execution throughout allocated baseline development, product baseline component construction and integration, system qualification and in-service maintenance.
- Software T&E embedded with and complementary to software code production as essential activities in actual software component construction, not planned and executed as follow-on actions after software unit completion.
- Formal planning when considering reuse of COTS or GOTS, databases, test procedures and associated test data that includes a defined process for component assessment and selection, and T&E of component integration and functionality with newly constructed system elements.
- The following link provides additional information:
    - The Handbook of Software Reliability Engineering , published by IEEE Computer Society Press and McGraw-Hill Book Company (specifically, Chapter 13).

Medical devices and systems must comply with the SEP, in terms of Health Insurance Portability and Accountability Act (HIPAA) and DIACAP information protection procedures and measures. These procedures and measures ensure the software complies with the security standards specified in the Health Insurance Portability and Accountability Act of 1996 (Public Law 104.191) as well as Subtitle D of the Health Information Technology for Economic and Clinical Health (HITECH) Act, Title VIII of Division A and Title IV of Division B of the American Recovery and Reinvestment Act of 2009 (Public Law 111.5). Most medical devices will require IM/IT testing and validation of information security protocols. Given that requirement, programs should start test planning as early as possible. Programs must also validate FDA clearance prior to any medical software implementation.

9.7.9. Post Implementation Review (PIR)

Subtitle III of Title 40 of the United States Code (formerly known as Division E of the Clinger-Cohen Act) requires that Federal Agencies ensure that outcome-based performance measurements are prescribed, measured, and reported for IT (including NSS) programs. DoDI 5000.02 requires that PIRs be conducted for MAIS and MDAP programs in order to collect and report outcome-based performance information. The T&E community will participate in the planning, execution, analysis, and reporting of PIRs, whose results will be used to confirm the performance of the deployed systems and possibly to improve the test planning and execution for follow-on increments or similar systems. For further information, refer to the Acquisition Community Connection or Chapter 7 .

9.7.10. System-of-Systems (SoS) Test and Evaluation (T&E)

SoS testing can result in unexpected interactions and unintended consequences. T&E of SoS must not only assess performance to desired capability objectives, but must also characterize the additional capabilities or limitations due to unexpected interactions. The SoS concept should include the system in the broadest sense, from mission planning to sustainment. SoS is a new and evolving area for development, acquisition, and T&E. For further information refer to the Systems Engineering Guide for Systems of Systems , dated August 2008.

9.7.11. Reliability Growth Testing

Reliability growth testing supports improvements in system and component reliability over time through a systematic process of stressing the system to identify failure modes and design weaknesses. The emphasis in reliability growth testing is in finding failure modes. The reliability of the system is improved, or experiences growth, as the design is modified to eliminate failure modes. The reliability growth testing approach is sometimes referred to as Test-Analyze-Fix-Test (TAFT). A successful reliability growth program depends on a clear understanding of the intended mission(s) for the system, including the stresses associated with each mission and mission durations, and configuration control. Reliability growth testing should be a part of every development program and used to provide input to predicted sustainment needs and the reliability KSA. In addition, the results should be used in developing a realistic product support package. For further information, see the DoD Guide for Achieving Reliability, Availability, and Maintainability , dated August 3, 2005 and associated template . For more information, read DTM 11003, Reliability Analysis, Planning, Tracking, and Reporting , dated December2, 2011.

9.7.12. Evaluation of Test Adequacy

Operational Test and Evaluation adequacy encompasses both test planning and test execution. Considerations include the following:

- Realistic combat-like conditions
- Equipment and personnel under realistic stress and operations tempo
- Threat representative forces
- End-to-end mission testing
- Realistic combat tactics for friendly and enemy
- Operationally realistic environment, targets, countermeasures
- Interfacing systems
- Articles off production line preferred
- Production representative materials and process
- Representative hardware and software
- Representative logistics, maintenance manuals
- Sample size
- Size of test unit
- Threat portrayal
- Properly trained personnel, crews, unit
- Supported by typical support personnel and support package
- Missions given to unit's (friendly and hostile)
- Production representative system for IOT&E
- Adequate resources
- Representative typical users

9.7.13. Medical Materiel T&E

The acquisition and management of medical materiel must ensure quality, availability, and economy in meeting the clinical requirements of the Military Health Systems (MHS). Medical programs, by nature, consist almost exclusively of GOTS, COTS and NDI (non-developmental item) items; and with the inclusion of other government agencies participation (i.e., FDA) follow a similar acquisition strategy to other T&E programs. PMs must not disregard T&E of COTS, NDI, and GFE. The operational effectiveness, operational suitability, and operational capabilities of these items and any military-unique applications must be tested and evaluated before a FRP or fielding decision. The ITT will plan to take maximum advantage of pre-existing T&E data to reduce the scope and cost of government testing.

The PM governs medical materiel procurement as a program with significant oversight, consisting of performance-based requirements composed by an IPT or a high performance team (HPT). Whether Joint or Service-specific, the FDA must clear medical materiel for use, if applicable, and comply with the FDAs rules governing manufacturing. Medical devices must also comply with the SEP in terms of the HIPAA and DIACAP information protection procedures and measures.

PMs, Joint and Service procurement agencies, Service/Defense Agency T&E activities, and other governmental organizations assist with development of operational testing and performance evaluation criteria for medical materiel evaluation; for both developmental and non-developmental programs, as stipulated in DoDI 6430.02 , Defense Medical Materiel Program, dated August 17, 2011. Testing of medical devices,

due to the reliance on COTS items, may not involve the rigorous DT&E imposed on other systems. Unless developed for military use, PMs normally limit DT&E to airworthiness and environmental testing to ensure the device does not fail due to austere or harsh conditions imposed by the operational environments or interfere with the aircrafts operating environment. Programs can integrate this testing, or perform it alongside, operational testing events to determine the operational effectiveness and operational suitability of the device. Often, this usability question can identify the difference between various devices of like construction or capability.

Lead DT&E test organizations can perform medical item testing, as delineated by the individual Service/Defense Agency, and may not require the approval or input of the Service/Defense Agency OTA. Defer to Service/Defense Agency guidelines for these processes.

9.7.14. FY 2012 National Defense Authorization Act (NDAA) Section 835

Based on the FY 2012 NDAA , Section 835, a Chief Developmental Tester will be designated for MDAP and MAIS programs. PMs for MDAP programs shall designate a government test agency as the Lead DT&E organization. All of these designations shall be made as soon as practical after the Materiel Development Decision (MDD). They shall be maintained until the program is removed from OSD T&E oversight or as agreed.

The Chief Developmental Tester position shall be performed by a properly qualified member of the Armed Forces or full-time employee of the DoD. The Chief Developmental Tester shall be in a T&E acquisition-coded position, designated as a Key Leadership Position, assigned or matrixed to the MDAP or MAIS program office, unless otherwise specified within the TEMP. The Chief Developmental Tester for a program shall be responsible for coordinating the planning, management, and oversight of all DT&E activities; maintaining insight into contractor activities; overseeing the T&E activities of other participating Government activities; and helping the PM make technically informed, objective judgments about contractor and Government T&E planning and results.

The Lead DT&E organization shall be separate from the program office. The Lead DT&E organization shall be responsible for providing technical expertise on T&E issues to the Chief Developmental Tester; conducting DT&E activities as directed by the Chief Developmental Tester; assist the Chief Developmental Tester in providing oversight of contractors; and assist the PM and Chief Developmental Tester in reaching technically informed, objective judgments about contractor and Government T&E planning and results.

9.8. Best Practices

Best practices as derived from lessons learned are available and continuously updated

at the DAU Best Practices Clearinghouse .

9.9. Prioritizing Use of Government Test Facilities for T&E

Programs shall use DoD Government T&E capabilities and invest in Government T&E infrastructure unless an exception can be justified as cost-effective to the Government. PMs shall conduct a cost-benefit analysis for exceptions to this policy and document the assumptions and results of the CBA in an approved TEMP before proceeding.