



MARINE CORPS OPERATIONAL TEST AND EVALUATION ACTIVITY

Operational Test & Evaluation Manual

6th Edition, Rev 0

INSIDE FRONT COVER



UNITED STATES MARINE CORPS
MARINE CORPS OPERATIONAL TEST AND EVALUATION ACTIVITY
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From: Director, Marine Corps Operational Test and Evaluation Activity (MCOTEA)
To: MCOTEA All Hands
Subj: MCOTEA OPERATIONAL TEST AND EVALUATION MANUAL 6TH EDITION

1. The MCOTEA Operational Test and Evaluation Manual 6th Edition provides clear direction and amplification on why we exist, how we accomplish our mission, and what we produce as an organization.
2. To set the stage, the Marine Corps is in a new era focusing on the specific tasks set forth in the Commandants Planning Guidance and Force Design 30. Specifically, there is deliberate pressure on the acquisition community to increase the speed at which systems are developed, tested, and fielded to maintain a technological advantage over our adversaries. Additionally, there is a heavy emphasis being placed on experimentation and prototyping as a means to place capabilities into Marines' hands sooner with the intent of gaining valuable and candid feedback on a system's military utility. As such, decision makers are in need of rapid information from experimentation and test events to make investment decisions that will have significant impacts on our Corps' ability to fight and win.
3. As always, MCOTEA has a critical role to play and our mission is essential to the Marine Corps. Our professionals stand ready to fulfill MCOTEA responsibilities by executing diligent planning, testing, and reporting with the sole purpose of providing independent and credible information to those who need it, when they need it. The Six-step process defined within this manual blends the Marine Corps Planning Process with the Scientific Method to establish our rigorous and repeatable means to perform all phases of testing. It enables early involvement, adaptability, and a methodology to provide a fair and transparent way to determine a system's effectiveness, suitability, and survivability. The Six-step process serves as the foundation for all of our work.
4. As you read this manual, please do so while embracing the tasks set forth by the Commandant's Planning Guidance and Force Design 30. Our individual skill sets and collective roles have never been more important. This manual is our framework for the deliberate planning and preparation that enables our mission success and ability to inform decision makers. Together, let's press forward!

D. B. MCDANIEL

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Record of Revisions

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Why MCOTEA Exists

Marine Corps decision makers need information that is *independent, objective, operational*, and, most importantly, *defensible* for critical resource and acquisition decisions. MCOTEA exists to fulfill those information needs.

MCOTEA's Mission

MCOTEA independently plans, executes, and evaluates materiel solutions against approved warfighter capabilities/requirements under prescribed realistic conditions and doctrine, to determine operational effectiveness, suitability, and survivability.

MCOTEA's Stakeholders

To accomplish its mission, MCOTEA maintains working relationships with Marine Corps stakeholders and external stakeholders at the Department of the Navy (DON) and Department of Defense (DoD). MCOTEA's relationship with these stakeholders depends on the type of program being supported. Cost, multi-service, and special interest all play a role in determining who and how MCOTEA will interact for a given program.

Key stakeholders are described in the following sections and illustrated below. In the figure, solid lines represent chain of command relationships between organizations, while dashed lines represent reporting, policy, and working relationships. Figure 1 outlines key communities that MCOTEA is involved with broken down by Test & Evaluation, Material Development, Capabilities Development, and Operational Users.

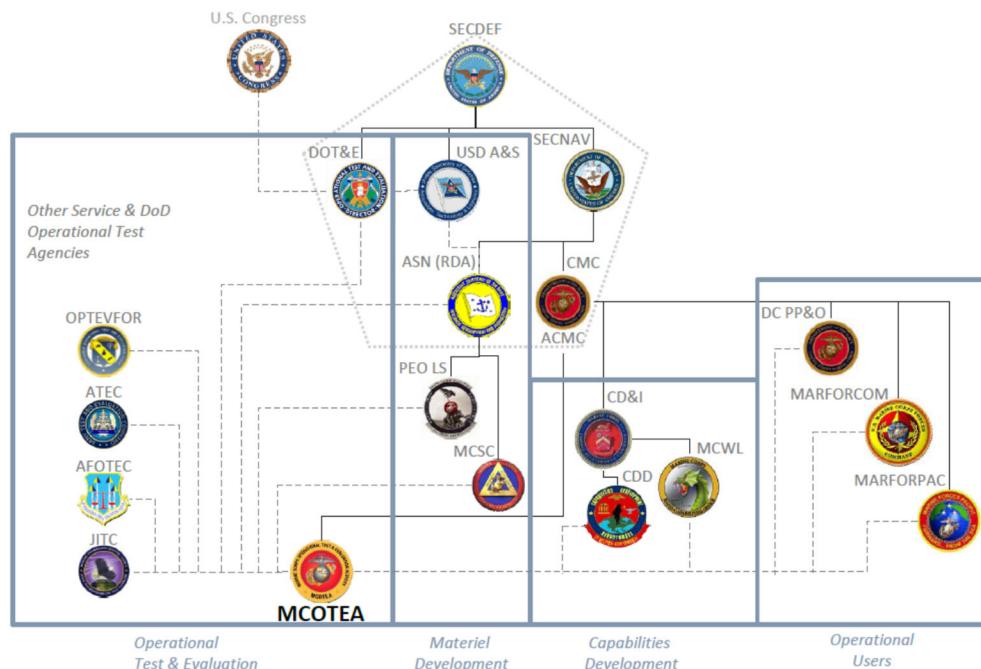


Figure 1. MCOTEA Links to Key Stakeholders

Marine Corps Stakeholders

Within the Marine Corps, MCOTEA is a direct report to the Assistant Commandant of the Marine Corps. MCOTEA also provides feedback to the Deputy Commandant for Combat Development and Integration on their required capabilities, and various levels of milestone decision authorities and non-acquisition stakeholders on specific systems. Most importantly, MCOTEA and all the other Marine Corps stakeholders described in the following paragraphs are oriented towards one goal: defining, developing, and testing capabilities for the operational users.

Operational Users

Operational Users are the recipients of the systems undergoing test and evaluation and the force providers for operational testing. There are three key entities that MCOTEA interfaces with for operating force support for operational test and evaluation. The three entities are Plans, Policies, and Operations, Headquarters Marine Corps (PP&O); Marine Forces Command (MARFORCOM); and Marine Forces Pacific (MARFORPAC) (see figure 1). Support from the operating forces is requested via Feasibility of Support message and/or the Force Synchronization Conference.

Assistant Commandant of the Marine Corps (ACMC)

The ACMC is the second highest-ranking officer in the United States Marine Corps and serves as the second-in-command for the Commandant of the Marine Corps (CMC). MCOTEA is an *independent* organization under the operational control of the ACMC. All MCOTEA reports are provided to the ACMC. MCOTEA functions independently by conducting its own planning, execution, and reporting of evaluations. Stakeholders are encouraged to provide input, but are never allowed to directly participate in decision making.

Deputy Commandant, Combat Development & Integration (DC, CD&I)

CD&I Force development activities Plan, Design, and Implement the translation of Strategic and Service Guidance into an organized, trained, educated, and equipped Marine Corps. Two subordinate organizations within CD&I that MCOTEA supports are the Capabilities Development Directorate and the Marine Corps Warfighting Laboratory.

Capabilities Development Directorate (CDD)

CDD develops and integrates warfighting capabilities solutions that provide for an effective, integrated Marine Air-Ground Task Force (MAGTF) capability—current and future—that anticipates strategic challenges and opportunities for the nation’s defense. MCOTEA’s reports on the effectiveness, suitability, and survivability are direct feedback by providing a look at required capabilities versus actual capabilities.

Marine Corps Warfighting Laboratory (MCWL)

The MCWL generates and examines threat-informed, operating concepts and capabilities and provides analytically supported recommendations to inform subsequent force design and development activities. MCOTEA supports MCWL’s Rapid Capabilities Office efforts to accelerate the identification, development, and assessment of emergent and disruptive technology as they rapidly develop and deliver operational prototypes.

Milestone Decision Authority (MDA)

Each acquisition program has an MDA. The MDA is responsible for tailoring program strategies and oversight. Tailoring also encompasses the program information, acquisition-phase content, the timing and scope of decision reviews, and decision levels based on the specifics of the product being acquired, including complexity, risk factors, and required timelines to satisfy validated capability requirements. What follows is a top to bottom description of key milestone decision authorities from the department level all the way down to the program manager.

Defense Acquisition Executive (DAE)

The DAE is the Under Secretary of Defense for Acquisition and Sustainment (USD(A&S)). The DAE will act as the MDA for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) programs. The DAE may delegate authority to act as the MDA to the head of a DoD Component, who may further delegate the authority to the Component Acquisition Executive (CAE).

Component Acquisition Executive (CAE)

The Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RDA) serves as the Navy Acquisition Executive. The Assistant Secretary has authority, responsibility, and accountability for all acquisition functions and programs, and for enforcement of Under Secretary of Defense for Acquisition, Technology, and Logistics procedures. The Assistant Secretary represents the Department of the Navy to USD(A&S) and to Congress on all matters relating to acquisition policy and programs. The Assistant Secretary establishes policies and procedures and manages the Navy's Research, Development, and Acquisition activities per DoD 5000 Series Directives. The Assistant Secretary serves as Program (Milestone) Decision Authority on programs at or below ACAT IC and recommends decisions on ACAT ID programs. For ACAT III, IV, and Abbreviated Acquisition Programs (AAPs), ASN(RDA) delegates MDA and program decision authority (PDA) to Program Executive Officers (PEOs), commanders of systems commands (SYSCOM).

Program Executive Officer (PEO) Land Systems (LS)

PEO LS is the Marine Corps' only PEO. PEO LS is a separate command, reporting directly to the ASN(RDA). PEO LS' integral relationship with Marine Corps Systems Command (MARCORSYSCOM) leverages infrastructure, competencies, and technical authority.

Marine Corps Systems Command (MCSC)

MCSC serves as the Department of the Navy's systems command for Marine Corps ground weapon and information technology system programs to equip and sustain Marine forces with full-spectrum, current, and future expeditionary and crisis-response capabilities. For research, development, and acquisition matters, MCSC reports directly to the ASN(RDA).

Program Managers (PM)

Program Managers design acquisition programs, prepare programs for decisions, and execute approved program plans. What this means, in practical terms, is that Program Managers are also decision makers, and, therefore, customers of MCOTEA reports. Because PMs are responsible for preparing programs for decisions and execution, MCOTEA must

work with PMs to ensure all plans and reports are shared in the most expeditious manner possible to afford PMs the maximum opportunity to understand and react to findings in Operational Test and Evaluation (OT&E) reports.

Non-Acquisition Marine Corps Stakeholders

A historic portion of the work we do supports decision makers who need credible information for programs or projects that may only be indirectly or even unrelated to acquisitions. As an element of Headquarters Marine Corps, MCOTEA has done work to support Manpower and Reserve Affairs; various Weapons Training Battalions; Training and Education Command; Marine Corps Warfighting Laboratory; Operations Analysis Directorate (OAD), and operational units. The common denominator with all of these decision makers is the need for information that has been generated, gathered, analyzed, and reported using the rigorous methods common to the MCOTEA process and projects.

External Marine Corps Stakeholders

External to the Marine Corps, MCOTEA maintains working relationships with the operational test and evaluation activities from the other services and DoD. In addition, select programs that MCOTEA tests are under oversight from the Office of the Secretary of Defense's Director for Operational Test and Evaluation. The following is a brief description of specific External Marine Corps Stakeholders.

Other Service Operational Test Agencies

Each Branch of the Armed Services has its own Operational Test Agency (OTA) (see figure 1). Joint Interoperability Test Command (JITC), while included in the list, is not a Service-level OTA. JITC is a single, Joint agency at the DoD level that MCOTEA interfaces with for interoperability testing.

- Navy – Operational Test and Evaluation Force (OPTEVFOR)
- Army – Army Test and Evaluation Command (ATEC)
- Air Force – Air Force Operational Test and Evaluation Center (AFOTEC)
- DoD – Joint Interoperability Test Command (JITC)

MCOTEA works with other Service OTAs on programs where there is joint interest in the capability under development. Working relationships with other Service OTAs are governed by a Memorandum of Agreement between the agencies.

Director of Operational Test and Evaluation

The Director, Operational Test and Evaluation (DOT&E) is the principal staff assistant and senior advisor to the Secretary of Defense on OT&E in the DoD (see figure 1). DOT&E is responsible for issuing DoD OT&E policy and procedures; reviewing and analyzing the results of OT&E conducted for each major DoD acquisition program; providing independent assessments to Secretary of Defense, the Under Secretary of Defense for Acquisition and Sustainment (USD(A&S)), and Congress; making budgetary and financial recommendations to the Secretary of Defense regarding OT&E; and overseeing major DoD acquisition programs to ensure OT&E is adequate to confirm operational effectiveness and suitability of the defense system in combat use.

For programs on the DOT&E Oversight List, MCOTEA obtains approval of Test and Evaluation Master Plans, Operational Test Plans, and Integrated Test Plans prior to implementation.

How MCOTEA Accomplishes the Mission

How MCOTEA is Organized

Task Organized Support

MCOTEA operates with a task-organized structure that supports our mission through the development and deployment of a highly skilled and adaptable workforce. At the center of each project is the OTPO who serves as the focal point for support. The hierachal structure is illustrated in figure 2.

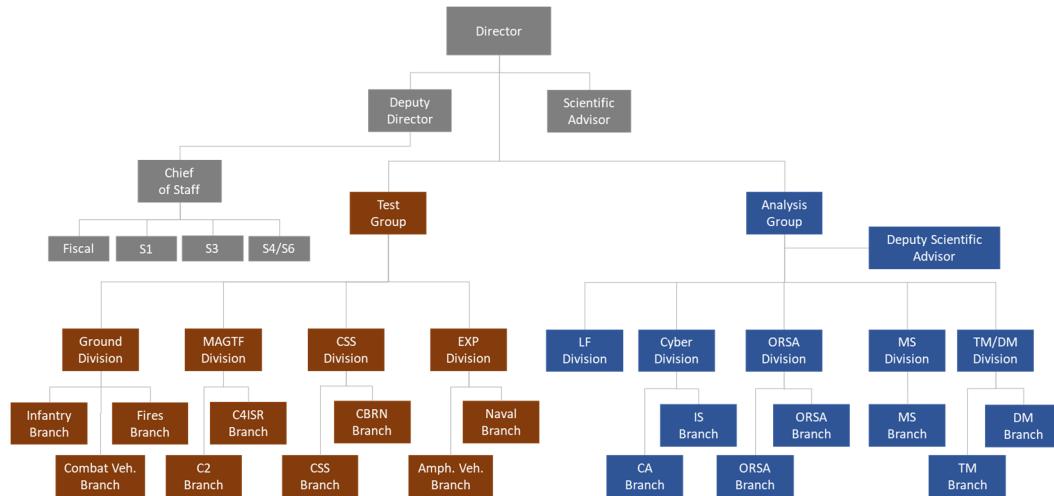


Figure 1. MCOTEA Organization in Hierachal Structure

Chain of Command

As with all military organizations, MCOTEA operates under the principle of unity of command. There is only one chain of command, descending from the ACMC to the Director. The chain of command extends from the Director to the Group Heads, Division Heads, Branch Heads, and OTPOs.

Director

The Director is responsible for independent OT&E of assigned Navy, Marine Corps, and Joint acquisition programs that require OT&E. The Director establishes prioritization of efforts based on the needs of the Marine Corps and will resource the groups to ensure mission success.

Groups

Testing and evaluation is accomplished in MCOTEA's two functionally aligned groups: Test and Analysis. The two groups are led by a group head and composed of functional area divisions and branches. The groups ensure that sufficient and qualified personnel are assigned to each test program and that MCOTEA testing is well planned, well-coordinated, and has sufficient materiel support.

The groups provide services to the Marine Corps, Multi-Service, and Joint Service organizations and perform various levels of testing depending on system complexities and

the decision maker's needs. The groups work in close coordination with the lead OTA for programs requiring MOT&E. The test and analysis groups each bring their unique perspectives and experience to bear on a project to produce the highest quality relevant product that strikes the optimal balance of operational realism and supportability with analytical rigor to support the information needs of decision makers.

The two groups also provide a unique perspective that—when merged together—ensure the highest quality and most relevant information possible is provided to decision makers.

Test Group Head

The Test Group Head's focus is on planning, developing and tailoring products, executing test events, and reporting. The goal is to support the unique cost, schedule, and information needs of each program or project in the portfolio. The Test Group Head is responsible for maintaining external communication links with their counterparts at CDD, MCWL, MCSC, PEO/LS, and DOT&E. Internal to MCOTEA, the Test Group Head is responsible for resourcing divisions and test teams. The Test Group Head must maintain communication and coordination of effort with Analysis Group and internal communication and coordination with the subordinate divisions. The four divisions of Test Group and subordinate branches are subdivided according to warfare capabilities.

Test Group Divisions:

Each group is composed of divisions lead by a division head charged with leading divisions with operational or technical expertise. Each division head is responsible for communication and coordination with external stakeholders at CDD, MCWL, MCSC, PEO/LS, other Service OTAs, and DOT&E; and internal communication and coordination of subordinate branches. Test Group is composed of four divisions functionally aligned to areas of the Marine Corps.

Ground Combat Division

Ground Combat Division (GCD) monitors and tests programs associated with infantry weapon systems, infantry combat equipment, anti-armor systems, and non-lethal systems (Infantry Branch); artillery and artillery support equipment (Fires Branch); and light armored vehicles (Combat Vehicles Branch).

Combat Service Support Division

Combat Service Support Division (CSSD) monitors and tests programs associated with personnel combat survivability, motor transport, medical assets, combat engineering equipment and robotics (Combat Service Support Branch); and Chemical, Biological, Radiological, and Nuclear equipment (CBRN Branch).

Marine Air-Ground Task Force Division

The Marine Air-Ground Task Force (MAGTF) Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance Division (MC4ISR Division) monitors and tests programs associated with Marine Corps information, command, control, and intelligence systems (C4ISR Branch); command and control systems (MAGTF Command and Control (C2) Branch).

Expeditionary Division

Expeditionary Division (ED) monitors and tests programs associated with USMC amphibious vehicles (Amphibious Vehicle Branch) and Navy ship and ship-to-shore connector programs (Naval Branch).

Analysis Group Head

The Analysis Group Head's focus is on ensuring each program or project has the scientific, analytics, and technical methodologies applied to ensure each program has uniform rigor, as well as quality and credible data to inform decision makers. The Analysis Group Head is responsible for maintaining external communication links with their counterparts at OAD, MCWL, MCSC, PEO/LS, and DOT&E. Internal to MCOTEA, the Analysis Group Head is responsible for resourcing divisions and test teams. The Analysis Group Head must maintain communication and coordination of effort with Test Group and internal communication and coordination with the subordinate divisions.

Analysis Group Divisions:

Analysis Group is composed of divisions lead by a division head charged with leading a division with technical expertise. Each division head is responsible for communication and coordination with external stakeholders at OAD, CDD, MCWL, MCSC, PEO/LS, other Service OTA's and DOT&E; and, internal communication and coordination of subordinate branches. Analysis Group is organized into five technically aligned divisions and subdivided by specialty branches.

Operations Research/Systems Analysis Division

Operations Research/Systems Analysis (ORSA) Division directly supports each team with analytic support provided by the two branches. This support includes decision science capabilities in evaluation strategy, analysis, and evaluation reporting.

Mathematical Statistics Division

Mathematical Statistics (MS) Division directly supports each team with statistical support provided by the single branch. This support includes analytical test design, test concept development, and data analysis.

Test and Data Management Division

Test and Data Management (TDM) Division directly supports each team with support from the Test Management Branch and Data Management Branch. Combined, these two branches provide test design, test concept development, test and data management, and logistical support for test event conduct.

Cyber Division

Cyber Division is divided into Cyber Assessments Branch and Information Systems Branch, which directly supports each team with cyber test design, cyber test event conduct, and analysis of cyber vulnerabilities.

Live Fire Division

Live Fire (LF) Division directly supports each team with ballistic and lethality event designs, planning, and analysis.

MCOTEA Staff

MCOTEA staff plays a vital role – to inform and focus the Director and reduce the Director's tasking to a manageable level. The staff supports the decision-making process by gathering and processing information into usable form. The staff is divided into principle staff, special staff, and functional staff.

Principle Staff

The Principle Staff consists of the Deputy Director and Chief of Staff.

Deputy Director

The Deputy Director fills in for the Director in his/her absence and is responsible for the Chief of Staff and Functional Staff. The Deputy Director is a strategic leader guiding the workforce towards the Director's mission, intent, and priorities. The Deputy Director maintains an enterprise-wide view of Marine Corps and Joint acquisition programs that require OT&E.

Chief of Staff

The Chief of Staff (COS) serves as the overall staff lead under the cognizance of the Deputy Director. The COS ensures that the staff executes the Director's guidance in a coordinated and integrated manner. The COS also ensures timely, efficient, and effective coordination of staff efforts in support of the divisions. The COS is responsible for implementing the MCOTEA Safety Program.

Special Staff

Special staff consists of direct report leaders who advise and assist the Director, chain of command, and supported groups, divisions, branches, teams, and staff on matters pertaining to a particular specialty.

Scientific Advisor (SA)

The SA is a special staff member working under the direct supervision of the Director. The Scientific Advisor provides technical advice on evaluation strategies, test planning, and test execution, and provides quality assurance for MCOTEA products.

The SA tracks Department of Defense (DOD) and Department of the Navy (DON) policies and interprets their effect on MCOTEA. In addition, the SA assists the Director in determining MCOTEA's future direction. The SA investigates new testing and evaluation methodologies and instrumentation of use to MCOTEA. The SA also interfaces with external organizations in various forums.

Finally, the SA leads MCOTEA's efforts in technical process improvement and recommends any changes to the Director.

Functional Staff Sections

Functional staff sections provide the necessary supporting infrastructure and direct support to OTPOs to ensure mission success. The functional staff sections are led by the Chief of Staff and consist of the S1, S3, S4/S6, and Fiscal sections. Staff Section numbering and functions reflect common MAGTF usage where possible to facilitate communication with

Marine Corps organizations. Each Staff Section is run by a Staff Lead, responsible for functions within their area and for coordination across Groups and other Staff Sections.

Human Capital Management Section (S1)

The S1 is responsible for all civilian and military personnel matters, and maintains accountability of all personnel. The S1 also provides editorial, template, records management, workforce planning, and performance management functions within MCOTEA. The S1 maintains configuration control of all standard MCOTEA document templates and final documents for staffing for Director's signature. The S1 is also responsible for general Administrative functions at MCOTEA, such as conference room scheduling, assignment of serial numbers, and handling of MCOTEA business mail.

Operations Section (S3)

The S3 is responsible for coordinating and managing MCOTEA's external operational-unit support for current and future operations. This includes, but is not limited to, the coordination of ranges and all facets of external support expected from the host unit following submission of the FoS, transitions detailed coordination to the OTPO for direct liaison. The S3 requests and coordinates amphibious shipping through the Unclassified Test and Evaluation Support (UTES) system. The S3 coordinates MCOTEA's attendance and participation at the Force Synchronization Conference to ensure that training and support requirements for the OTPOs in support of Operational Test (OT)/Developmental Test (DT) are identified and deconflicted with the MARFORCOM G3/5/7. The S3 serves as MCOTEA's central point of contact for coordinating test schedules and test range usage via Feasibility of Support messages to MARFORCOM and MARFORPAC G3/5/7. The S3 is responsible for organizing and tracking personnel training requirements.

Logistics and Information Technology Section (S4/S6)

S4 (Logistics) and S6 (Information Technology (IT)) are a combined section at MCOTEA, working closely with the other staff sections and divisions in support of OT.

The S4 personnel are responsible for providing and overseeing logistics policies, limited procurement functions, supply, transportation, maintenance, and OT support that enable information-operations support throughout MCOTEA. The S4 personnel are responsible for the test facilities at Twentynine Palms Marine Air Ground Combat Center (MAGCC) and Camp Pendleton, providing site coordination for all support requirements during OT.

The S6 personnel are responsible for the management, planning, coordination, installation, and maintenance of communications and automated systems; ensuring communications, computers, and data are available in support of daily operations and OT. The S6 personnel are also responsible for the organization's public and SharePoint websites.

Fiscal Section

The Fiscal Section is responsible for advising and assisting the Director, Deputy Director, groups, and staff on all financial and business-related matters. The Fiscal Section manages all funds received throughout the year for Research, Development, Test, and Evaluation (RDT&E) and other customer funds, and oversees the organizational Defense Travel System program. The Fiscal Section develops Program Objective Memorandum (POM) briefs for

consideration in the overall RDT&E POM submissions, and submits POM and budget exhibits justifying the request for resources. Additionally, the Fiscal Section is responsible for identifying and acquiring Other Government Agency (OGA) support when additional labor or specialized skills are required and for contract actions requiring external contract agency support for goods and services.

Other Government Agency Support

When MCOTEA doesn't have sufficient quantity or the specific or unique skill sets or technical capabilities to conduct the required tasks, those personnel are supplied by other Government agencies. Test and Analysis Groups work with MCOTEA's Fiscal Section to obtain this support.

Who Does the Work in MCOTEA

Task-organized teams of Marines and government civilians with diverse backgrounds ranging from experience and specialties in military operations to math, science, and engineering do MCOTEA's work. At the center of each team is the Operational Test Project Officer. Figure 3 is an illustration of how MCOTEA task organizes from the top down from the group, division, and branch level to support a team.

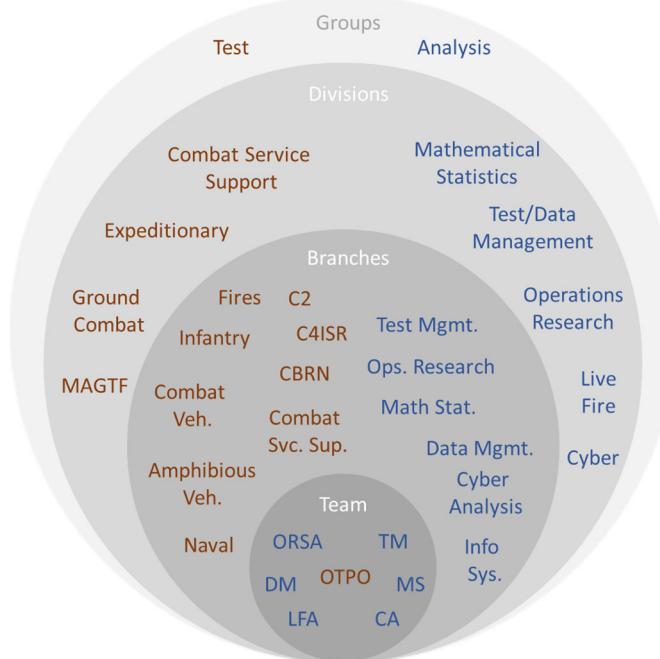


Figure 3. MCOTEA Task Organization to Support Teams Lead by the OTPO.

Teams

MCOTEA's teams are functionally aligned to provide technical support to the OTPO. The teams generally consist of Operations Research/Systems Analysts (ORSA), Mathematical Statisticians (MS), Data Managers (DM), Test Managers (TM), Cyber Analysts (CA), and Live Fire Analysts (LFA).

Operational Test Project Officer (OTPO)

OTPOs are the focus of main effort and the embodiment of the mission. Their job is to lead test teams. As such, OTPOs must communicate, task organize, and manage a cross-functional team to provide evaluations of operational effectiveness, suitability, and survivability of assigned systems. It is imperative they apply operational knowledge, tactical expertise, and sound military judgment, and proactive communication to provide complete and accurate system evaluations for Milestone Decision Authorities.

Operations Research/Systems Analyst (ORSA)

The ORSA plans for and conducts evaluation of test data. This is done by developing the System Evaluation or System Assessment Plan. In evaluation and assessment planning, the ORSA works with the OTPO to identify and translate operational mission effects into scientific terms that are observable, measurable, testable, and valuable using a variety of applied mathematical techniques. The ORSA also assists with the Test Concept development, test execution, data collection, and evaluation of test data.

Mathematical Statistician (MS)

The MS plans for and conducts analysis of test data. In planning for the analysis of test data, the MS works with the OTPO to create scientific test designs and analysis methods using the science of test design (e.g., Design of Experiments) to ensure tests are rigorous and defensible. This is done by developing the Test Concept and the Test Data Report. The MS also assists with the development of Evaluation (or Assessment) Plans, Test Plans, Developmental Test Plan reviews, Data Collection Verification & Validation, test execution, and data collection.

Data Manager (DM)

The DM plans data collection methods and storage. The DM coordinates with the S4 to arrange and schedule the equipment necessary to implement data collection during test conduct. The DM is responsible for the verification and validation of data collection plans in support of test planning. The DM implements data collection plans and methods during test execution. Posttest, the DM assists the MS with preparation of the Test Data Report and associated data queries required for posttest analysis in support of evaluations and assessments.

Test Manager (TM)

The TM assists the OTPO with plans, execution, and reports for operational test events. In addition to writing the test plan with the OTPO, the TM helps coordinate the test team, coordinates with the S3 to make logistical arrangements for the test site, and remains at the test site throughout test execution.

Cyber Analyst (CA)

When required, the CA plans, conducts, and reports cybersecurity testing to ensure that operationally relevant data are available to determine operational survivability.

Live Fire Analyst (LFA)

When required, the LFA plans, conducts, and reports ballistic and lethality requirements for programs with a survivability and/or lethality requirement.

Process and Policies

Test and Evaluation Defined

Testing

Testing involves the physical exercise (i.e., a trial use or examination) of a component, system, concept, or approach for the sole purpose of gathering data and information. To ensure credibility in the results, the tests must be objective, unbiased, and operationally and statistically significant, as well as operationally realistic. (Giadrosich 1995)

Evaluation

Evaluation is the process by which one examines the test data and statements, as well as any other influencing factors, to arrive at a judgment of the significance or worth of the component, system, or concept. There is an implied premise that MCOTEA's evaluations will be *objective*, in other words, based on the data and information derived from the test when determining effectiveness, suitability, and survivability of systems undergoing evaluation. In most cases, the evaluation involves an inferential process where one extrapolates from the limited test results in some manner to a real-world (operational) problem of interest. (Giadrosich 1995)

Test and Evaluation Continuum

The evaluation of a system is the result of the accumulation of data and facts about the system obtained during the entire acquisition cycle (SECNAV 2019). At the center of the test and evaluation continuum is the T&E Working-level Integrated Product Team (T&E WIPT). The T&E WIPT guides the development of a program's Test and Evaluation Strategy (TES) and guides the execution of the Test and Evaluation (T&E) program. It should be established as early as possible during Material Solutions Analysis (MSA), and it should be chaired by a program office representative with membership consisting of all stakeholder organizations that require test data. Integrated Testing and early assessments can contribute important contextual information, result in enhanced understanding of system capabilities, and make significant contributions to satisfying the requirement to examine the extent to which Capability Development Document/Capabilities Production Document thresholds have been satisfied. Each test event and subsequent evaluation either shapes our questions and assumptions or answers our questions. Ultimately, the accumulation of knowledge through the test and evaluation continuum shapes our understanding of what remains to be learned about a system under development as we approach a fielding decision.

Origins of the MCOTEA Six-step Process

The need for independent, operationally relevant evaluations with appropriate scientific rigor necessitates an organization like MCOTEA. MCOTEA maintains its *independence* by being removed from the acquisition pressures faced by a PM, namely the often conflicting pressures that necessitate cost, schedule, and performance tradeoffs.

MCOTEA is an organization, which at its heart is operational *and* scientific. It is the combination of these characteristics within one organization that distinguishes MCOTEA apart from other organizations within the Marine Corps. MCOTEA's Six-step process traces its origins to the operational world of the Marine Corps and the Scientific Method. MCOTEA

uses this process for the implementation of all test and evaluation activities performed by the organization.

From the operational perspective, MCOTEA's operational tests are military operations aimed at achieving specified mission effects while employing a specific capability. With this aim in mind, MCOTEA's operational tests and evaluations follow the general concepts of the Marine Corps Planning Process. Unlike a true military operation or exercise, the specified mission effects are not being planned to win a specific battle, or war, but are instead being used to determine the generalizability of the capability being evaluated to win future battles and wars. Because we intend to generalize the findings of our military operation, we employ the Scientific Method.

The Scientific Method is the process by which scientific study is carried out. The Scientific Method brings with it the disciplined process of investigation and rigor needed for generalizability of our findings related to the specified mission effects. MCOTEA's application of the Scientific Method for evaluations is important because the evaluations must be based on information that is sufficiently credible under scientific standards to provide a confident basis for action and to withstand criticism aimed at discrediting the results (Rossi, Lipsey, Freeman 2004).

The figure that follows presents a comparison of the Marine Corps Planning Process, MCOTEA Six-step Process, and the Scientific Method. In the figure, the Marine Corps Planning Process has been adapted and condensed in areas (e.g., Courses of Action) to show where commonality exists with the MCOTEA Six-step process. As illustrated figure 4, each process can be separated into a planning phase, execution phase, and a reporting phase. The vertical alignment of the steps illustrates activities in each of the processes and phases that have significant similarities.

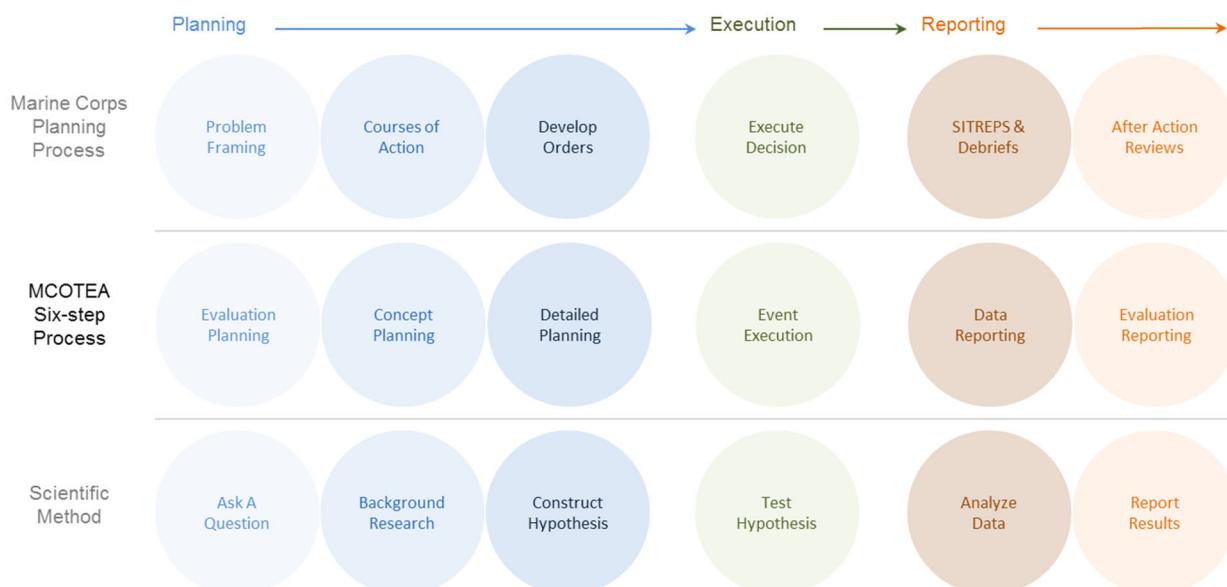


Figure 4. Marine Corps Planning Process, MCOTEA Six-Step Process, and Scientific Method

Explanation of the MCOTEA Six-step Process

Step 1 - Evaluation and Assessment Planning

MCOTEA's evaluations and assessments start with questions and measurements. The questions developed ultimately get answered at the end of the test program. Generally speaking, the questions should focus on the objective of the program. The evaluation questions give structure to the evaluation or assessment, which in turn leads to appropriate and thoughtful planning (Rossi, Lipsey, Freeman 2004). In the case of Operational Test and Evaluation, the questions should focus on military effects that operators can achieve when employing a specified capability.

Measures are needed to gather data to satisfy the questions. The Measures dictate, at least in part, the data that need to be gathered as part of the test event. The Measures will also be used later in the test design process to determine what factors (also called variables) will be varied and controlled in the testing process.

Evaluation and assessment are often used as interchangeable terms, but there is a subtle difference in their use when it comes to operational test and evaluation. Where evaluations and assessments differ deals with the summative or formative nature of the program goal.

MCOTEA's evaluations are summative, meaning the intent is to render a summary judgement about the outcome of a program or system (Scriven). MCOTEA typically conducts evaluations for systems that undergo Initial, Follow-on, or Multi-Service Operational Test and Evaluation. For evaluations, MCOTEA defines its methods for analysis and aggregation of information to render the summary judgments (i.e., Operational Effectiveness (OE), Operational Suitability (OS), and Operational Survivability (OSur)).

MCOTEA's assessments are considered formative, meaning they assess progress or characterize the capability during the development of a system with the intent to improve (Scriven). Assessments performed by MCOTEA can apply to a wide range of activities to include operational assessments, experimentation, and assessments of developmental testing. MCOTEA's assessments include analysis methods, but omit aggregation methods because there is no intent to render a summary judgment of OE, OS, and OSur at the conclusion of the program.

Step 2 - Test and Event Concept Planning

MCOTEA develops a Test or Event Concept for each event intended to supply data for a question in Step 1. Development of a test or event concept is a MCOTEA working-level effort meant to convey the overarching details and thought process of a particular test or event before developing detailed planning documents. A MCOTEA test or event concept normally includes a definition of the system, objectives of the event (e.g., questions being addressed), and details of the event conduct (e.g., event process and conduct, time requirements, key resources, locations, personnel). This type of information is usually presented to decision makers to enable confirmation that the scope of the tests or events are suitable for satisfying the programs information objectives.

When Step 1 and Step 2 are complete for acquisition programs, inputs can be provided to Test and Evaluation Master Plans. Depending upon the timing of programmatic needs (e.g., pre-milestone A TEMP), some tailoring of Step 1 and Step 2 may be required early in the process.

Step 3 - Detailed Test and Event Planning

Detailed Test and Event Planning involves planning the execution of a test or event with sufficient detail to make it executable, transparent, and repeatable. This detailed planning requires coordination within and external to MCOTEA to ensure objectives, schedules, resources, and personnel needs are satisfied. Detailed Test and Event Planning is a continuation of evaluation planning and concept development. At this stage of planning, teams develop more detailed information about logistical requirements, daily schedules, trial conduct, sample size, data requirements, data collection methods, data reduction, and analysis methods.

Step 4 - Test and Event Execution

The execution of a test or event exercises a system in a specified manner and collects the appropriate data for the follow-on evaluation or assessment. The test or event is the culmination of all the preceding planning efforts and is typically a complex military operation involving operational units with appropriate combat equipment and supplies. The execution of a test or event often begins with operator and data collector training, site setup, data collection rehearsals, and pilot (practice) runs of the plan. Once the team has determined that all elements of the test or event are in place and ready, the record phase begins. This is the formal phase where data are collected for analysis and evaluation. At the conclusion of the record phase, the team conducts posttest activities to close out the site, clean up equipment, and turn in gear.

Step 5 - Data Reporting

Data Reporting begins with reducing raw data at the beginning of the pilot phase and continues until the completion of the test or event. Data reporting is complete when all data from a test or event have been reduced from its original form with extraneous material removed or filtered out, checked for accuracy, and arranged in convenient order for handling.

Step 6 - Analysis and Evaluation or Assessment Reporting

Analysis is breaking things apart to gain a better understanding, while evaluation is using that information to determine worth or value. Analysis and evaluation are two distinct, yet complementary, processes that combine to provide the necessary information for decision makers. Analysis and evaluation take place after the data reporting is complete.

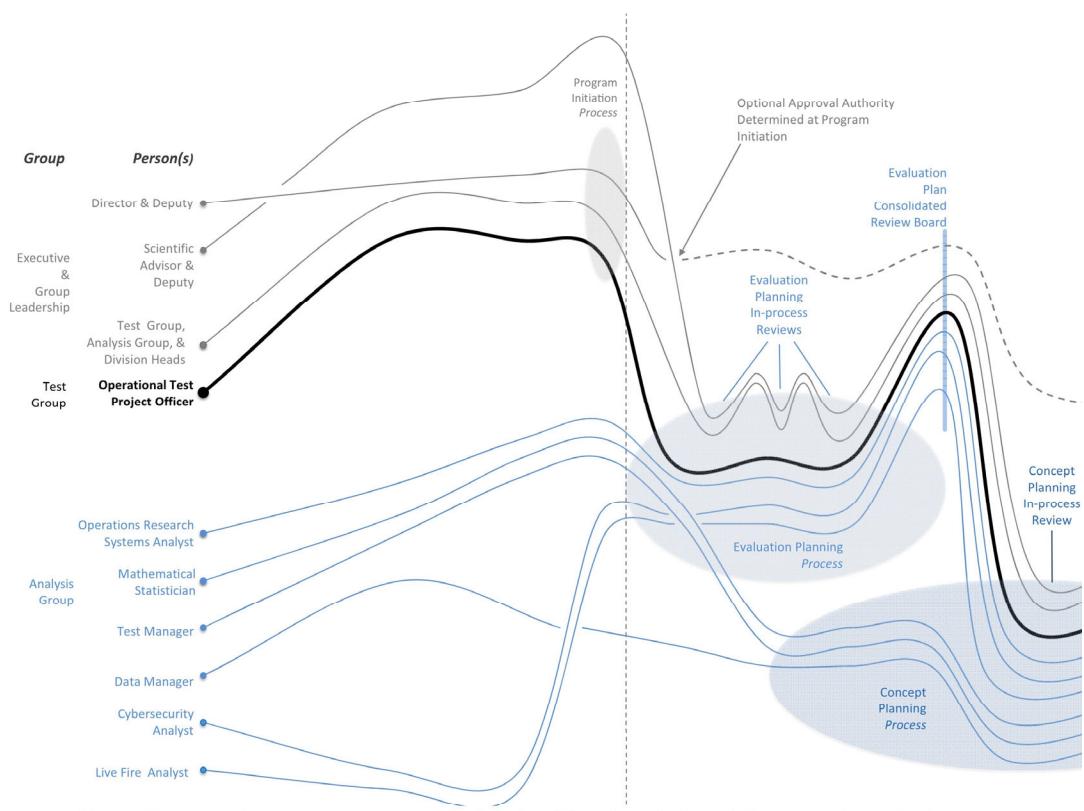
During analysis and evaluation, the goal is to answer the questions derived during evaluation planning, thereby providing useful information to decision makers and PMs that are making system design and tradeoff decisions.

Integrating Task Organized People and Processes

The map that follows shows how people (represented by flowing lines) from different parts of our organization interact with each other over time as they execute the core MCOTEA Six-step Process (represented by colored ovals).

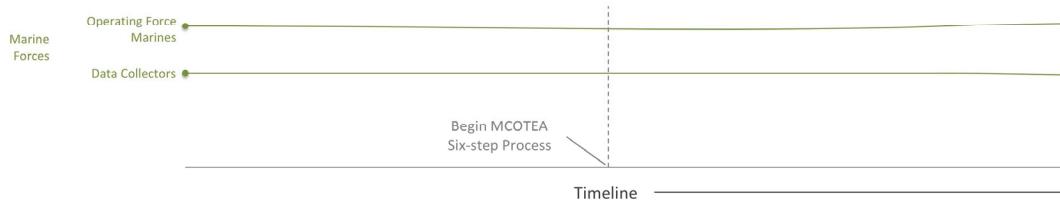
As depicted in the illustration, the process is not completely linear. Each step in the MCOTEA Six-step Process feeds into the next, but some overlap occurs in practice. As an example, there is significant overlap between evaluation planning and concept planning, as well as data reporting and evaluation reporting. For programs that undergo continual upgrades, the process can be repeated as many times as necessary to support each upgrade. The timeline for completion of the process varies from days to months, and in the case of long development items like ships, even years. The principle factors determining the speed of the process application are program complexity, scope, and the timing of the information needs.

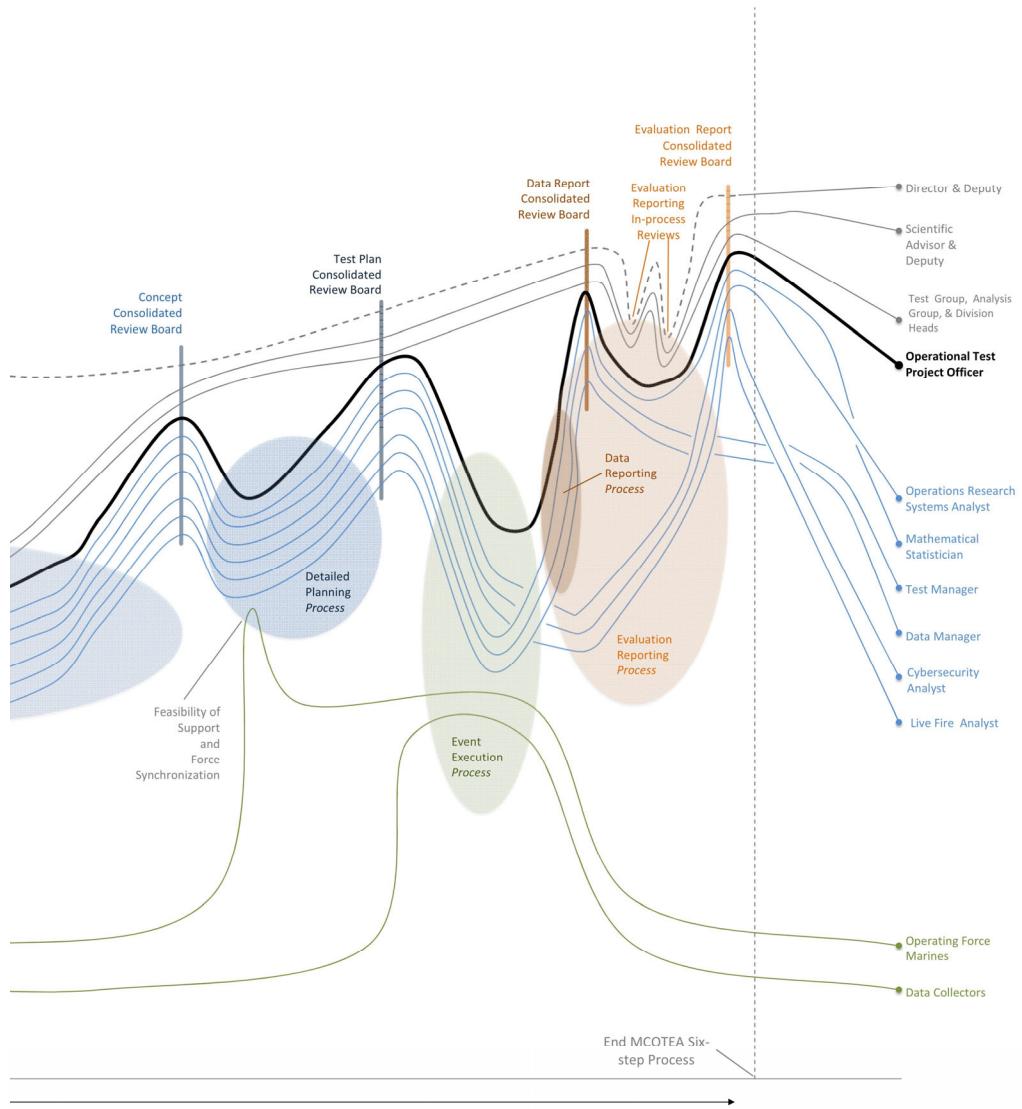
The illustration also shows how task organization works over time. People flow into, and out of, the processes based on their roles specific to a program they are supporting, and not all people are involved in all process steps. The one exception is the OTPO: The OTPO's pathway is bolded in black because the OTPO is central to all of the MCOTEA process steps.



To use this map, select a group or person on the left, then follow the path through the process by tracing the line from left to right. Paths that overlap oval processes indicate some level of participation in that process.

When the path of the Executive & Group Leadership overlaps an oval from one of the Six-step processes, it indicates that one or more in-process reviews will take place. When division personnel flow out of a process and cross a vertical bar at the conclusion of a process, it indicates that a consolidated review board will take place for the final output of a process (i.e., a plan or report).





Tailoring the MCOTEA Six-step Process

The MCOTEA Six-step Process is flexible and tailorable. It is flexible because the basic principles in the process can be applied to just about any program or system that requires test, experimentation, assessment, or evaluation.

The process is tailorable because MCOTEA can apply only those steps necessary to support a program's goals. The decision on the level of MCOTEA involvement and tailoring of the MCOTEA Six-step Process is determined at Step 0. If all that is required is for MCOTEA to plan and conduct a test event and report out data, then only Step 3, Step 4, and Step 5 apply. That said, tailoring of the MCOTEA Six-step Process comes with some assumptions. Any steps omitted by MCOTEA are assumed to be performed by someone else. As an example, if you were to develop a test (Step 3), but hadn't figured out what question it answers (Step 1), then you would have a test with no purpose. Careful consideration should be given to tailoring the process to ensure that MCOTEA does not engage in any activity that would tarnish the reputation of rigor that is the hallmark of MCOTEA or the Marine Corps.

The following table provides examples of tailoring to support unique program goals for Test and Evaluation or Assessment. Activities not performed solely for an OT&E project, where the activities and project meet the definition of OT&E, may be subject to additional procedures to comply with the Human Research Protection Program.

Tailored Options for the MCOTEA Six-step Process

Tailored Option	Plan			Test Step 4	Report	
	Step 1	Step 2	Step 3		Step 5	Step 6
Participate in the test conduct for another agency				X		
Assist another agency with test design		X				
Plan, execute, and report test data based on another agency's evaluation plan and test concept			X	X	X	
Design, plan, execute, and report test data based on another agency's evaluation needs		X	X	X	X	
Plan and evaluate data from another agency's test event, or existing source of data	X					X
MCOTEA's Operational Test and Evaluation (i.e., IOT&E, MOT&E, FOT&E)	X	X	X	X	X	X

Integrated Testing

Integral to the tailoring process is Integrated Testing. Integrated Testing is the collaborative planning and execution of test phases and events to provide shared data in support of independent analysis, evaluation, and reporting by all stakeholders, particularly the developmental (contractor and government) and operational test and evaluation communities. It requires the active participation by MCOTEA in planning the integrated tests with the program office so that the operational objectives are understood, the testing is conducted in an operationally realistic manner, and the resultant data are relevant for use in operational evaluations.

External and Internal Policy

MCOTEA is required to comply with policies that originate at the Department, Component, and Service Level. Internal MCOTEA policies direct the activities of the organization towards the fulfillment of its mission.

External Policies

When conducting OT&E of acquisition programs, MCOTEA follows the policies and guidance described in the following instructions:

DODI 5000.89, Test and Evaluation, establishes policy, assigns responsibilities, and provides procedures for test and evaluation (T&E) programs across five of the six pathways of the adaptive acquisition framework: urgent capability acquisition, middle tier of acquisition (MTA), major capability acquisition, software acquisition, and defense business systems (DBS).

SECNAVINST 5000.2 is the Department of Navy implementation and operation of the Defense Acquisition System and the Joint Capabilities Integration and Development System. This document describes mandatory procedures for implementation for major and non-major defense acquisition programs and non-major information technology acquisition programs.

Internal Policies

In addition to external policies, MCOTEA has several internal policies governing implementation of the organization's mission. MCOTEA's internal SharePoint site catalogues all MCOTEA's policies, processes, procedures, and work instructions necessary to execute the mission.

What MCOTEA Does to Accomplish the Mission

MCOTEA performs three basic tasks in the fulfillment of its mission to provide information to decision makers: *plan, test, and report*. For each task, MCOTEA produces specific products or conducts specific events. Each product or event is the output of one of the steps in the MCOTEA Six-step Process and are described in the following sections.

Planning Products

MCOTEA produces planning documents for evaluations, assessments, test events, and observation of other agency events. In addition to these plans, MCOTEA also provides input to Test and Evaluation Master Plans to support overarching testing goals for programs. Each plan is briefly described in the following sections.

Evaluation Plans

Evaluation Plans, also called System Evaluation Plans (SEP), are used to create a framework and methodology for evaluating the entirety of program data obtained from assessments and through Initial Operational Testing. Evaluation Plans are intended to provide a transparent, repeatable, and defensible approach to evaluation.

MCOTEA actively solicits suggestions from stakeholders pertaining to Evaluation Plans. MCOTEA shares Evaluation Plans and solicits input from combat and material developers to provide transparency and identify potential problem areas.

Assessment Plans

Assessment Plans are similar to Evaluation Plans by serving as a framework and methodology for performing the assessment. Ultimately, Assessment Plans provide the basis for eventual analysis of assessment data from tests and events. MCOTEA performs a variety of assessments to include system assessments, intermediate assessments, and quick-reaction assessments. When MCOTEA is the lead for an assessment, MCOTEA produces one of the following types of assessment plans:

- System Assessment Plan (SAP)
- Quick-Reaction Assessment Plan (QRAP)

Similar to Evaluation Plans, MCOTEA welcomes suggestions from stakeholders pertaining to Assessment Plans.

Test Plans

Test Plans take test concepts and turns them into action plans for test or event execution. Test Plans must be written with enough detail to allow anyone with appropriate knowledge and skills to execute the test, more than once if necessary. The concept of repeatability is essential to good testing, and repeatability can only occur if the plan was sufficiently detailed in the first place. The most common Test Plans produced by MCOTEA include Initial Operational Test Plans, Multi-service Test Plans, Follow-on Test Plans; Operational Assessment Test Plans; and System Assessment Test Plans.

Observation Plans

Observation Plans document what MCOTEA will do when attending test events conducted by other test agencies (e.g., Developmental Test Event). Typically, MCOTEA observes other agency test events because that event could potentially be the source for data in a MCOTEA evaluation or assessment. In other words, test events performed by other agencies can often be the data source for questions in MCOTEA Evaluation or Assessment Plans. Observation Plans are focused on the conduct of the event, not the performance of the system. If MCOTEA is interested in using data from another agency event then we are focused on how well the event is conducted to determine the pedigree of the data (i.e., quality and usability).

Accreditation Plans

Accreditation Plans document the specific intended uses and accreditation criteria for modeling and simulation used by MCOTEA in OT&E. Accreditation Plans define the methodology for conducting the accreditation assessment; define the resources needed for the assessment; and identify issues or concerns associated with performing the assessment.

Event Design Plans

An Event Design Plan (EDP) defines the overall scope of analysis and Live Fire (LF) testing for system undergoing live fire test and evaluation. EDPs identify key data requirements, evaluation objectives, and initial conditions for the specified analysis and DT/LF testing.

Test and Evaluation Master Plans (TEMP)

A TEMP documents the overall structure and objectives of a test and evaluation program for a system. It provides a framework within which to generate detailed test plans and documents schedule and resource implications associated with the program. Unlike the previously mentioned plans, MCOTEA is not solely responsible for the TEMP or its approval. Instead, the final responsibility for the TEMP resides with the Program Manager and MCOTEA is responsible for providing input to the sections dealing with OT&E, as well as resources and schedule.

Testing Events

The planning products produced by MCOTEA are execution documents leading to specific events. The most common events are operational test and operational assessment events. MCOTEA also has the capability to perform other types of operational events and observe events conducted by other agencies. Each event type is described in the following sections.

Initial, Follow-on, and Multi-service Operational Test Events

Initial, Follow-on, and Multi-service Operational Test events are test events (i.e., field tests), under realistic combat conditions, of any item of (or key component of) weapons, equipment, or munitions for use in combat by typical military users to determine whether systems are operationally effective and suitable. Operational tests are subject to specific restrictions, which differentiates them from other types of MCOTEA events. The restrictions prohibit contractors developing the system under test from being involved in the operation or maintenance of the system during initial operational test (IOT) unless the contractor will be involved in the same functions when the system is deployed in combat. The restrictions also

require that operational testing be conducted on production, or production-representative, systems. (10 U.S.C. 139(a)(2)(A))

MCOTEA uses a mission-oriented context in operational testing to relate evaluation results to the impact on the Warfighter's ability to execute missions. Focusing on the mission context during operational test planning and execution provides a more robust operational test environment and facilitates evaluation goals.

Operational Assessments (OA)

An OA is a test event conducted to inform initial production decisions that incorporate substantial operational realism. (DODI 5000.02) An OA is not subject to the same restrictions outlined for IOT, Follow-on Operational Test (FOT), or Multi-Service Operational Test (MOT) regarding production representativeness or contractor participation.

Other Operational Events

At times, MCOTEA is required to conduct operational test events that do not fall neatly into prescribed definitions. These events can be characterized as field-user events, field experiments, operational exercises, or quick-reaction events. These events, like other test events, are data sources tailored to meet specific assessment objectives.

Observation Events

MCOTEA normally observes DT events to verify that the DT event was executed according to plan and to verify DT data results after receiving the DT report. Properly performed DT enables MCOTEA to use DT data in overall system evaluation. In addition, MCOTEA's participation gives the PM insight into the system's developmental progress, materiel maturity, and readiness to enter a MCOTEA-led assessment or operational testing phase.

Reporting Products

MCOTEA's reporting products act as book ends to the planning products. Each report is paired with a specific MCOTEA planning document. MCOTEA produces four basic types of reports, outlined in the following sections.

Evaluation Reports

Evaluation Reports satisfy the *objectives* (i.e., answer the questions) spelled out in evaluation plans. When MCOTEA is the lead OTA, MCOTEA produces the following types of evaluation reports:

- Operational Test Activity Evaluation Report (OER)
- Operational Test Activity Follow-on Evaluation Report (OFER).

Each report includes a determination of OE, OS, and OSur and an assessment of the system's impact to combat operations.

Assessment Reports

Assessment Reports satisfy the objectives (i.e., answer the questions) spelled out in assessment plans. When MCOTEA is the lead for an assessment, MCOTEA produces one of the following types of assessment reports:

- Operational Assessment Report (OAR)
- Operational Milestone Assessment Report (OMAR)
- System Assessment Report (SAR)
- Intermediate Assessment Report (IAR)
- Quick-Reaction Assessment Report (QRAR).

Assessment reports, specifically OARs and OMARs, may comment on a system's progress towards meeting OE, OS, and OSur, but do not levy a final determination.

Test Data Reports

The outcome of a test or event is the data set, which can be quite large, containing numerous columns and rows of information. The Test Data Report's purpose is to package these data and formally record any deviations from the Test Plan. Formal packaging and reporting of data is necessary to ensure data sharing (e.g., with oversight organization and program managers) and for archival purposes.

The data in the Test Data Report are unanalyzed and do not provide any evaluative conclusions or results. At a minimum, Test Data Reports should include data that are in its original form (i.e., raw data). Test data may be reduced from raw form and consolidated with invalid or unnecessary data points identified to aid in future analysis. The TDR may also include data that have been checked for accuracy and arranged in convenient order for handling, which includes limited counting and elementary arithmetic.

Observation Reports

Observation Reports satisfy the objectives spelled out in Observation Plans and comment on the pedigree of the test event. Observation Reports document the adequacy of test execution and test deviations for tests conducted by other agencies. Observation Reports *explicitly avoid providing judgments or conclusions about the systems* undergoing test. Observers must refrain from commenting on system performance in Observation Reports because many preliminary conclusions levied at test sites are often later found to be erroneous. Without actual test data in hand, conclusions about system performance remain opinion, not fact. More investigation into causality is required than can usually be provided on the test site.

Accreditation Reports

The Accreditation Report summarizes all data, information, and activity, explicitly or by reference, used in the accreditation assessment of modeling and simulation intended for use in operational testing. To enable informed accreditation decisions, the Accreditation Report provides insight into M&S capabilities, limitations, and any uncertainties about M&S capabilities related to the specific intended uses for the M&S.

Live Fire Test and Evaluation (LFT&E) Service Report

The LFT&E Service Report documents the live fire vulnerability/lethality evaluation and contains the assessment of the critical issues and conclusions concerning the vulnerability/lethality and battlefield damage assessment and system repair.

Summary

MCOTEA exists to provide decision makers with information. MCOTEA fulfills this mission with teams of Marines and government civilians with diverse backgrounds and specialties who work within and external to the Marine Corps to plan, test, and report using the MCOTEA Six-step Process. The result is information that is *independent, objective, operational, and defensible* to support resource decisions.

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