

MCWL/FD Experiment Process and Observer/Controller Handbook



UNITED STATES MARINE CORPS
MARINE CORPS WARFIGHTING LABORATORY
FUTURES DIRECTORATE
COMBAT DEVELOPMENT AND INTEGRATION
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Experiment Defined.

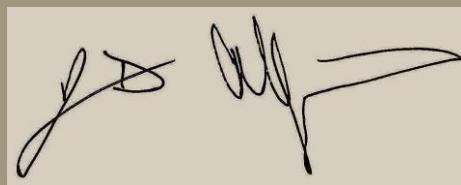
1. *A test under controlled conditions that is made to demonstrate a known truth, examine the validity of a hypothesis, or determine the efficacy of something previously untried. The process of conducting such a test; experimentation.*
2. *An innovative act or procedure.*
3. *The result of experimentation.*

Source: The American Heritage Dictionary, Third Edition; Houghton Mifflin Company ©1997

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FOREWORD

1. PURPOSE: This handbook is provided to inform Marine Corps Warfighting Lab personnel and Experiment observer/controllers (O/Cs) and other personnel interested in the MCWL/FD experiment process to better understand, guide and more effectively support the collection of essential data to facilitate the analysis, assessment, and synthesis of experiment results. This handbook supersedes X-file 5-12X, Experimentation Procedures, dated December 2008.
2. CLASSIFICATION. This document is unclassified.
3. FEEDBACK. We want to know how units and individual Marines use this Synthesis Report. Please submit any user feedback and suggestions to the above address or submit recommendations electronically to the Synthesis Center central email address:
syncenter@usmc.mil
This handbook can be located on the Marine Corps Center for Lessons Learned website under the Marine Corps Warfighting Laboratory portal.
(<https://www.mccll.usmc.mil>)
4. CERTIFICATION. Reviewed and approved this date 15 January 2017.

A handwritten signature in black ink, appearing to read "Julian Dale Alford", is written over a white rectangular background.

Julian Dale Alford
Brigadier General
Commanding General

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Section I – Introduction to the Experiment Process

If the Corps is to ride the “dragon of change” into the 21st Century, it must make a commitment to innovation.

General Charles Krulak, 31st CMC

Experiment History

The Marine Corps Warfighting Laboratory was established on 1 October 1995. The lab was originally titled the Commandant’s Warfighting Laboratory and was later changed to the Marine Corps Warfighting Laboratory. The Lab began its experimentation process with its “testbed” called Sea Dragon. The Sea Dragon series was established by General Charles Krulak, 31st Commandant of the Marine Corps. A quote from a Marine Corps Gazette article written by General Krulak in 1996 states:

“Sea Dragon is not one particular innovation or idea, but rather a commitment to innovation. It is not a predetermined force structure and predetermined operational technique, but a method for evaluating potential structures and techniques.”

The initial MCWL/FD experiments—called *Hunter Warrior*—examined a number of concepts and issues related to sea-based power projection using emerging information technology, precision indirect fire weapons, and distributed ground units in an extended battlespace. In 1997, the Lab began the *Urban Warrior* experiment phase that shifted the focus to employment of the combined arms team of the MAGTF during military operations on urbanized terrain (MOUT). This series of experiments proved both prophetic and timely as the output of these experiments identified better ways to fight and win on the urban battlespace. In

1999, the Lab formed *Project Metropolis* (ProMet) to exploit the knowledge gleaned during *Urban Warrior*.

ProMet identified, refined, and developed effective tactics, techniques and procedures (TTPs) and technology enablers that became mainstays of MOUT training in the operating forces. These were effectively employed in *Operation Enduring Freedom* (OEF) in Afghanistan and *Operation Iraqi Freedom* (OIF) in Iraq.

MCWL/FD developed and clarified these TTPs in a Basic Urban Skills Training (BUST) program and TECOM institutionalized them. At the unclassified level, these include, but are not limited to:

- Satellite Patrolling
- Integration of Infantry and Mechanized Operations in MOUT
- Combined Arms in MOUT
- Stability and Support Operations (SASO)
- Operation of personnel and vehicle checkpoints

Concurrent with ProMet, MCWL/FD continued its Warrior Series with Capable Warrior. This included the Lab's participation in two major USJFCOM experiments, Millennium Challenge 00 and Millennium Challenge 02. After Capable Warrior, the concept for Distributed Operations (DO) effort was started. These experiments centered on enhancements in the areas of intelligence, surveillance and reconnaissance (ISR), over the horizon (OTH) communications, and C2 systems in the context of ship to objective maneuver (STOM). One of the Lab's successful transitions of experimental technology occurred during this period in the form of the Dragon Eye Unmanned Aerial Vehicle (UAV) which was used by Marines in OIF and eventually became a Program Of Record (POR) when replaced with the WASP and then with Raven B Unmanned Aerial System (UAS). This period also saw the development

of a viable hand held, on-the-move, OTH radio originally called Expeditionary Tactical Communications Systems. Now called the Distributed Tactical Communications System (DTCS), this radio is in use today by the operating forces and has transitioned as a POR under the Defense Information Systems Agency (DISA).

From 2004-2007, MCWL/FD conducted a series of experiments to develop and refine tactical capabilities which directly reflected an emerging operational requirement and, ultimately, associated with the CMC-approved Concept for Distributed Operations (DO) and CG MCCDC CONOPS in Complex and Distributed Environments. Follow-on experimentation continued. An example of this is *Combat Hunter*, initiated in response to increased Marine casualties to snipers and IEDs. The TTPs developed during *Combat Hunter* experiments are now fully integrated in Marine Corps formal school training at all levels. Additional focus areas for DO-related experiments include CLIC/CLOC, Squad Fires, Infantry Skills Simulation Working Group, and Lighten the Load. All of these projects were designed to enhance Marine Corps tactical operations in support of Marine Corps 21st century operational concepts, while simultaneously supporting Marines engaged in ongoing combat operations.

MCWL/FD Distributed Operations (DO)

The MCWL/FD “DO Program” and related efforts of the Distributed Operations Implementation Working Group (DOIWG) manifested themselves in a \$19M enhancement to the infantry battalion Table of Equipment (T/E), numerous improvements to enlisted infantry training, and increased manpower focus on the infantry small unit.

DO experimentation evolved into the Enhanced Company Operations (ECO) series of experiments culminating in an experiment conducted as part of the combined and joint

exercise Rim of the Pacific 2010 (RIMPAC 2010). ECO experimentation tackled challenges at the infantry company level dealing with an expanded operating area and a persistent irregular threat. Results of CLIC experimentation and training standardization led to the Company-Level Operations Center (CLOC) project. This was designed to expand the company's operational capability across planning, logistics, and fires warfighting functions. Ultimately, ECO experiments tested the idea of a Company Landing Team (CLT) and the associated changes to training, organization and equipment that would enable a sea-based MAGTF to employ and sustain a landing force built around suitably task organized infantry companies from at sea and over the horizon.

The next series of experiments were based on the Enhanced MAGTF Operations (EMO) concept. This effort examined challenges to other elements of sea-based MAGTF conducting operations with multiple CLTs operating ashore. EMO experimentation delved further into fires, logistics, expeditionary medicine, alternate shipping, and network centric C4ISR.

Currently the MCWL/FD overarching strategic guidance exists within the Marine Corps Operating Concept (MOC) that describes in broad terms how Marine Corps forces will conduct a range of military operations in accordance with the Marine Corps' Title 10 responsibilities out to 2025. The MOC provides the foundation and context for concepts, guides analysis, wargaming, experimentation, capability development and budget programming decisions.

MCWL/FD experiments have successfully identified and exploited some key unclassified TTPs and technology enablers that are now in everyday use by the operating forces. These include:

- Fusion Optics
- Moving Target Engagement Techniques
- Distributed Tactical Communication System
- T-AKE Support for Small Scale Operations
- Technical Networked Sensor Suite
- ME-L Phase III
- Shrike Block I
- Small unit surveillance and reconnaissance asset
- Combat Hunter advanced training, TTPs and equipment
- Manned and Unmanned Vehicles
- Unmanned Aerial Systems (UAS)
- Robotics
- Alternative Shipping

The MCWL/FD Experiment Process

Who does experiments? For the past two decades, the majority of the experiments in the Marine Corps have been conducted by MCWL/FD. However, the dynamic nature of today's operating environment along with the reality of limited resources necessitates that innovation and experimentation expand beyond the bounds of Quantico to organizations and units around the Marine Corps.

What is an experiment? Experiments support the process of innovation, a process that can lead to evolutionary or revolutionary change. (Institute for Defense Analyses *"Defining Military Experiments"*, 1999).

When does the Marine Corps conduct experiments?

Though experiments have traditionally been viewed as an activity reserved for the interwar periods, the rapidly changing operating environment coupled with unprecedented technological advancement and the

emergence of new warfighting domains has created a necessity for experimentation to be a continuous endeavor.

Where does the Marine Corps conduct experiments?

The primary venue for experiments has been in conjunction with scheduled exercises. Since there is no dedicated experiment force MCWL/FD relies on operating force units to use as an experiment force. Specific exercises are chosen based on their ability to provide the forces and environments necessary to achieve the objectives of the experiment and confirm or refute the hypothesis. Consequently, experiments take place at locations within CONUS and at venues around the world where Marines conduct training.

Why does the Marine Corps conduct experiments? The Marine Corps conducts military experiments to assess whether or not a new concept, organizational design, or technology will give us a demonstrable increase in desired combat capability.

How do experiments originate? The seed of an experiment can come from a wide array of sources, for example:

- It can be based on a formal concept developed to meet future warfighting challenges or based on a perceived warfighting deficiency.
- It could come as a request from the operating forces to find a way to meet a new or emerging threat capability.
- It could be based on a good idea generated as a result of new technology.

Types of Observations/Assessments/ Experiments

Experiments are approved through the Initiative Review Board (IRB) and funded through the Budget Review Board process. Experiments are prioritized based on published

priorities and senior leader guidance. A number of factors including timing, funding required and operational utility are taken into consideration during the approval process. The Commanding General is the final approval authority. The next question is: what type of experiment is appropriate to employ? MCWL develops a hypothesis and objective for an experiment that often comes at the request of an outside organization. For example EF-21 Limited Objective Experiment (LOE) examined the requirements for a future ITV to support an infantry battalion. There are six types of observations, assessments or experiments MCWL/FD conducts or facilitates:

1. Capability Development Team (CDT). A CDT is not an experiment. Rather a CDT is an observation of a military exercise or joint military experiment that a team of MCWL/FD experiment planners and analysts will observe to explore new concepts and/or emerging capabilities. Often these teams will also seek to identify capability gaps that might serve as the foundation for future experiment efforts.

2. Limited Technical Assessment (LTA). An LTA is not an experiment. It is an assessment and focused on the technical performance of a particular piece of equipment or technology. An LTA, usually with an attendant full/functional systems test (FST), determines whether or not a technology achieved its intended purpose. Once it is determined the technical requirements have been achieved, it is then introduced into a live-force experiment such as a limited objective experiment (LOE), advanced warfighting experiment (AWE), or MAGTF Integrated Experiment (MIX) to assess its impact on the overarching concept.

3. Limited Objective Experiment (LOE). An LOE is focused on the utility of experimental TTPs, equipment, or new Manning schemes in the context of a tactical scenario. The key word for this type experiment is “limited.” An LOE

should be restricted to just one or a few innovations to be tested. This enables a design that can be tailored to fully examine a particular area of concern.

4. Advanced Warfighting Experiment (AWE). A larger-scale experiment that is generally embedded within a large-scale operating force exercise such as exercise BOLD ALLIGATOR or exercise RIM OF THE PACIFIC (RIMPAC). AWE typically involves multiple combinations of experimental concepts, technologies and TTPs.

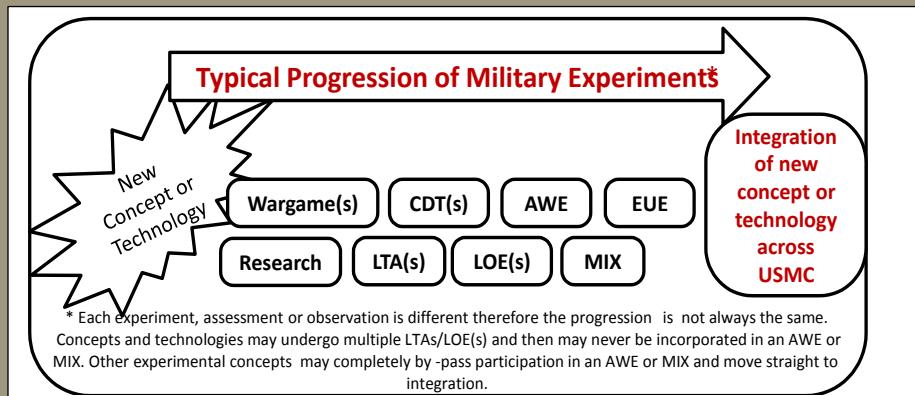
5. MAGTF Integrated Experiment (MIX). Similar to AWE in that it involves multiple combinations of experimental concepts, technologies, and TTPs. A MIX is distinguished in that it places emphasis on including all four elements of the MAGTF and then assesses the impacts of proposed changes to one or more elements of the MAGTF.

6. Extended User Evaluation (EUE). A EUE requires an innovation to be used and applied by a fleet unit without the restrictive design and controls characteristic of other types of experiments. Like a CDT, a EUE is not necessarily a military experiment; however, it can be very useful in gaining additional insights about a concept or technology that has already been experimented with and can play a critical role in setting the stage for future integration efforts.

7. Wargame(s). Wargames fulfill two functions: (1) refine planning within the experiment process so that the output of the wargame feeds into experiment planning that eventually leads to a live-force experiment or LTA and (2) a wargame can also be a stand-alone event that provides sufficient information to answer the hypothesis/question but may not lead to further experiments.

All experiments require a data collection and analysis plan (DCAP). How DCAP are used are explained in detail on pages 25-29.

The following figure illustrates the various types of experiments in a continuum. It is important to note that while this figure displays a logical progression of experimentation, it is certainly not prescriptive as a new concept or technology may only undergo limited experimentation before being considered for wider integration.



When is a CDT Appropriate?

- A CDT is appropriate when a unit is developing new TTPs and would like to showcase its development efforts in a training exercise.
- CDTs are also useful when a unit believes it has identified and would like to communicate a perceived capability gap for which it believes a new concept or technology should be developed.
- CDTs should be utilized to observe joint military experiments or experiments conducted by our sister services. Such events can be utilized to help the Marine Corps stay abreast of emerging concepts and technologies that are *perceived to be relevant and that may eventually be adopted and or modified for use in the Marine Corps.*

When is an LTA Appropriate?

An LTA is appropriate if actual hardware is available to be tested. When this is the case, we are trying to learn or assess how a technology performs—relative to our experimental objectives—or to verify claims made by the manufacturer. Sometimes we are comparing the performance of several pieces of gear that perform the same function.

- It is important to note that an LTA does not necessarily need to take place in the context of a tactical scenario.
- An LTA, in order to be effective, has to be a methodical test of specific capabilities of a technology with numerous iterations of each capability.
- From a scientific standpoint, LTAs tend to be more objective than LOEs because they often look at a single measurement under several sets of conditions and can achieve larger sample sizes than LOEs.

When is an LOE Appropriate?

If we want to experiment with a new TTP, or if we want to learn about the value of a technology whose performance has already been verified, an LOE is the proper venue. LOEs examine whether some change to the current way of operating will help Marines perform their tactical tasks better. Operational integration underpins LOEs, so there is generally an underlying scenario in which Marines utilize a new capability. In order to assess whether the new capability is useful, the experiment participants must be allowed to employ the TTPs or technologies in a tactical scenario to complete their mission, rather than being forced to execute a fixed set of tasks that may or may not relate to the mission.

- An LOE may involve weeks of training and iterative tactical experimentation rather than a single experimentation event.

When is an AWE Appropriate?

AWEs are large-scale LOEs and usually involve multiple combinations of experimental gear, technologies, and TTPs. We use AWEs at the Lab as culminating events to mark the completion of a series of experiments or campaign to showcase what has been achieved, and to uncover meaningful relationships between the experimental variables.

When is a MIX Appropriate?

A MAGTF Integrated Experiment (MIX) utilizes an experiment force that contains a CE, GCE, ACE and LCE representative in size, scale and capability of the MAGTF (SPMAGTF, MEU, MEB, and MEF) identified as necessary for the experiment. This type of experiment is used when it is critical to observe the interrelationship of the MAGTF elements with one another or when a concept, objective(s) or technology relies on the ability of the MAGTF to function as a combined whole in order to make a comprehensive assessment. A MIX can be executed in the course of an exercise relying on MAGTF elements associated with that exercise. It is not necessary that the MAGTF be completely dedicated to the experiment alone but must be able to provide support and capabilities necessary to the experiment. A MIX may include experimental technologies, new organizational structures, new methodologies and other modifications or alterations to the EXFOR. Depending on the number and significance of these changes there may be a need for EXFOR tactical and technical training prior to the experiment.

When is an EUA Appropriate?

EUEs rely on extensive exposure of an innovation with an Operating Force unit without the restrictive design and controls characteristic of other types of experiments.

- Allows MCWL to capture comprehensive user feedback from Marines who use or experience the innovation while they conduct training or combat operations
- EUA duration / prescribed trial period can vary from as short as a couple of weeks to periods in excess of a year if the participating force wants to retain the experimental capability
- Best used as a validation tool to temporarily fielded technology that has a broader use throughout the USMC and is considered acceptable for direct transition to POR.

When is a Wargame Appropriate?

Wargaming is not an experimental technique as it embraces too many variables to produce the precision expected in a focused test designed to resolve an uncertainty. However, wargaming is a proper prelude to experimentation because it develops solution space, considers possibilities, shapes the naval expeditionary culture, and is an engine for innovation and disruptive thought. Thus, wargaming can both define an experimental program by revealing the need for a functional concept and it can support an experimental program by assisting in defining parameters, isolating issues, and suggesting methodologies. This permits a solution space to be defined to the extent that investment of time and resources outside that space may be judged as unproductive. In a word, wargaming can save money and time by initiating or supporting an active and extensive experimentation program and allied S&T efforts in an effective and cost efficient manner.

Experiment vs. Training Exercise

While in many ways an experiment looks very much like a training exercise, and many of the same planning and logistics considerations are similar, the goal of an experiment is fundamentally different from that of an exercise.

To a large extent, the goal of a training exercise is to gain proficiency in prescribed mission essential tasks (METs) or Training and Readiness (T&R) Standards. The desired outcome is therefore already known. An experiment is different because we are injecting something new into how we operate with an unknown outcome, the results of which allow us to evaluate new methods of training, manning, or equipping the force.

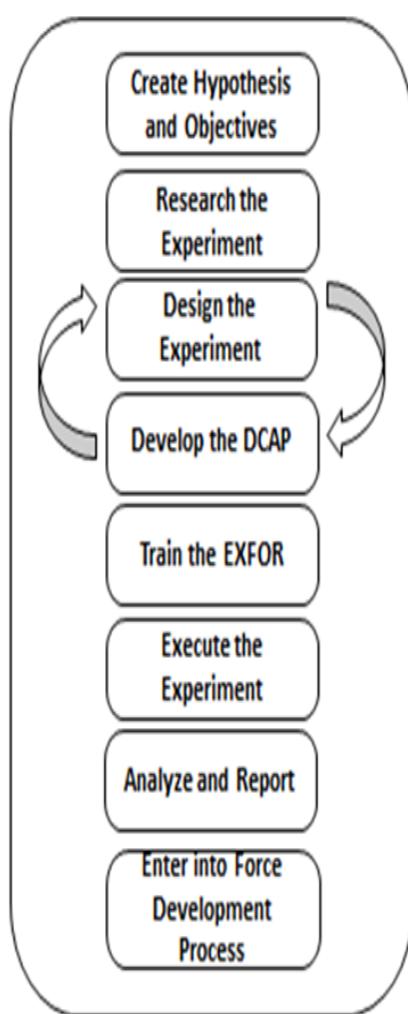
Data collection requirements also differentiate training and experimentation. Depending on the data needed this can include instrumentation of the force, extra time in the schedule to fill out questionnaires, and extensive debriefs. An experiment also requires that observer/ controllers (O/Cs), and possibly dedicated analysts be imbedded among the force. One thing we have learned at MCWL/FD is that data must be collected as the experiment occurs. While after action reports (AARs) are a good source of data, the memory of the participants is always selective and often biased for or against the thing being examined.

Another fundamental difference between an experiment and a training exercise is that in an experiment, tactical or mission failure does not necessarily imply failure of the experiment. If we learn that an experimental technology or TTP does not work — or is not useful — the experiment still provides useful feedback to concept and technology developers.

On the other hand, if an experiment goes smoothly, the experimental systems work, the participants win the battle, and achieve their objective, the experiment might still be deemed a failure if there is insufficient data for analysis to prove or disprove the objectives.

Data collection is not an interruption of the experiment's routine—it is the reason for it.

The Experiment Process



a. Generate a Hypothesis and Objectives

Generally, the first step in the experiment planning and design process is to generate the experiment hypothesis and objectives. However, not every experiment requires a formal hypothesis. Occasionally, even a null-hypothesis, one which predicts no difference from an experimental variable or between two populations, may be used on the design.

Writing the objectives usually means articulating the existing hypothesis clearly and adding sufficient detail so that an experiment can be designed around it. Objectives are usually restatements of the new desired capabilities/ Adjustments or stated gaps, etc. For example:

Example of original idea: There is a capability gap at the company level for intelligence functions and more situational awareness. The increase of asymmetric threats and focus on small unit operations require an intelligence capability at the company level that higher headquarters cannot provide. A company level intelligence cell (CLIC) may support that capability.

Example Hypothesis: If a Marine infantry company is manned, equipped and provided an intelligence capability (CLIC) then they will have the level of detail and situational awareness required to execute their mission.

Example Objectives:

- Evaluate the effectiveness of CLIC training to support ELT operations.
- Determine how the addition of a CLIC with an infantry company supported the company mission.
- Determine if the manning of the CLIC allowed for successful intelligence gathering and allow for

sufficient situational awareness for the company commander.

b. Developing a Hypothesis

The hypothesis above has these two key components:

1. Cause & 2. Effect

The hypothesis identifies a cause (CLIC capability) and effect (greater combat effectiveness). The cause and effect are sometimes referred to as the independent and dependent variables, respectively.

In this case, the cause, or independent variable is the concept or technology with which we are attempting to include in an experiment. The effect, or dependent variable, is specified in terms of things that can be observed. In the case of the example above, combat effectiveness is difficult to quantify; however, it is feasible to objectively measure amount of information received, communication capability and equipment use.

Developing Objectives

In theory, the experiment objectives are derived from the hypothesis statement or desired end state. In reality these are developed concurrently or even in reverse order. Most military planners tend to originate experiment ideas that are more closely related to objectives vice hypothesis statements. It has been the experience of the MCWL/FD that the single most important step in the process is to accurately express the experiment objectives. While the

hypothesis statement captures the idea or concept, the objectives drive experiment design, data collection and hence the results.

Elements of a good objective. All objectives have two parts. One part specifies the subject area being examined and the second part should include an action word that states what you want to learn.

Observing a measurable and attributable change in capabilities is crucial to validating the experimental concept, technology, or TTPs. The goal should always be to attain objective measurements, yet the complex nature of warfare and the presence of endless variables often result in experimenters defaulting to the more subjective measurements and observations of subject matter experts. In the absence of measurable and attributable change, be it objective or subjective in nature, the event cannot be classified as an experiment and instead becomes a demonstration or exploration. These events, while not considered experiments, are still of some utility and will be discussed later in this X-File.

c. Research the Experiment. The Experiment process includes a period of research (studies, investigations, TTP development, modeling and simulation of the variety of Courses of Action, TTPs or structures and possibly one or more wargames.

d. Design the Experiment

Every experiment is different but this X-File will cover some of the basic elements that typically must be accounted for when designing an experiment. It is also important to note that the experiment design and development of the DCAP is an iterative process as the experiment design will shape elements of the DCAP, yet the DCAP will also impact the experiment design.

Note: a smaller, more focused experiment such as a LOE is easier to design than an AWE or MIX due to the ability to control the variables.

- **Experiment Phases.** Each experiment goes through four phases:
- Phase I (Preparation) includes design, objectives, requirements, scenarios, and task development to support experimentation. It may also include studies, wargames and modeling and simulation efforts. Additionally, coordination with the Operating Forces and support/buy in from key stake holders will be required.
- Phase II (Training) involves pre-experiment training and final preparations for experiment execution. Throughout the conduct of Phase II, multiple parties will be focused on observing the training for the purpose of collecting data.
- Phase III (Execution) is the actual execution of the experiment. The experiment will be managed to collect all necessary data in order to satisfy all experiment objectives.

- Phase IV (Reporting) consists of data analysis, report writing, and recommendations for future force development, further experimentation, etc.

MCWL/FD Experiment Control Elements

Experiment Control (EXCON)

Experiment control would look quite familiar to those accustomed to conducting field exercises. Working from a master scenario event list (MSEL) which contains scheduled inputs or “injects” to push the course of events onto a desired path, EXCON controls the experiment as it unfolds. Roles and responsibilities include:

- Control the overall experiment.
- Publish the daily battle rhythm and data management plan.
- Monitor the MSEL; ensure the experiment is on track.
- Adjust the MSEL and scenario as necessary to ensure experiment objectives are met.
- Serve as the primary coordination point for all experiment issues and activities.
- Ensure the safety of all personnel in conjunction with the range officer in charge (OIC) and range safety officer (RSO).
- Maintain communications with range safety in accordance with range regulations.
- Manage all observer/controllers (O/Cs) and assigned personnel work schedules.
- Maintain accountability for all personnel and equipment.
- Manage and monitor data collection.

Observer/Controllers

Those individuals specifically assigned as experiment O/Cs to observe, collect, and report the specified data called out for collection in the DCAP. O/Cs also control the experiment force (EXFOR) and opposition force (OPFOR) in the

execution of the MSELs that have been developed for the experiment.

O/Cs are the linchpin in the experiment effort to accomplish the objectives. They are organized into teams and assigned by their team leader as required down to the appropriate level be it platoon, squad, or fire team. O/C responsibilities include, but are not limited to:

- Receive experiment orientation, attend O/C training.
- Follow assigned element through combat prep cycle.
- Accompany assigned element throughout the event.
- Control experiment IAW the MSEL/scenario schedule.
- Adjudicate force-on-force engagements.
- Supervise debriefs and data collection effort.
- Collect data in accordance with the data collection plan to support analysis requirements.

NOTE

- **O/Cs are neither tactical advisors nor evaluators.**
- **O/Cs are not training the EXFOR during experiment execution.**
- **O/Cs are responsible for ensuring the safe execution of all operations.**

Support Detachment

The support detachment is responsible for planning, coordinating, supervising, and executing all logistical support for the conduct of the experiment. The support detachment is generally led by MCWL/FD logistics representatives and augmented by personnel from the host unit. Roles and responsibilities include:

- Facilitate the transport and staging of sustainment supporting the EXFOR during the experiment per the scenario.
- Provide an enhanced field-level maintenance capability beyond the capability of crew and operator. Capabilities will include:
 - Preventive maintenance
 - Minor repair
 - Recovery and transport of vehicles
- Building of sustainment packages (water, field rations, ammunition and fuel) to deliver to the EXFOR during the experiment scenario.
- Coordinate daily experiment support requirements per the logistics officer or assigned EXCON OIC: (examples)
 - Facility (tent or building)
 - Power
 - Water
 - Ammo (w/ support of host unit)
 - Support vehicles
 - Transportation of things/personnel
 - Batteries
 - Printers
- Ensure accountability of MCWL/FD and host unit equipment loaned to MCWL/FD.
- Record lessons learned and populate data collection sites as required.

Higher Headquarters, Adjacent, and Supporting Units (White Cell/Response Cell)

To ensure realism and to provide needed interaction with the EXFOR, it is often necessary to provide the functions of a higher headquarters, an adjacent unit or a supporting unit when the actual units are not part of the EXFOR. This can be accomplished using two approaches. The first is a white cell which can be formed with appropriate personnel and C2

systems. A white cell is so named because this cell has full knowledge of both the EXFOR and the OPFOR. Typically, white cell play is directed by EXCON as needed to achieve the experiment objectives. Alternatively, the play of the higher headquarters, adjacent or supporting units can be provided by a response cell. The difference being that a response cell does not have knowledge of the OPFOR beyond what is provided in the scenario materials or through live-force play.

Experiment Force

The EXFOR is the force that is using the experimental equipment, tactics, doctrine, training, etc. The Commander of the EXFOR has the responsibility for the safety and overall conduct of their Marines during the course of the experiment.

Opposing Force

The OPFOR is the force that opposes the experiment force. Typically, it would be configured to represent an adversary that American forces might encounter in a real-world situation. It is controlled by EXCON to ensure its actions facilitate EXFOR activities to support experiment objectives.

Role Players

Role players are used to represent a civilian populace that fits within the scenario and to create “atmospherics.” To the greatest extent possible, role players will be dressed to play the part, and trained on how to behave.

Controlling the Experiment

MCWL/FD will control the experiment cycle using a doctrinal, mission-type order as the foundation and a MSEL. The experiment plan, scenario and MSEL have been developed to provide general tactical situations that enable O/Cs to collect data that when analyzed, address the experiment

objectives both quantitatively and qualitatively. The EXFOR must be allowed maximum tactical freedom to achieve their assigned tactical objectives within the MSEL-driven, force-on-force, continuous-operations event, or more structured “lanes” as appropriate.

EXCON controls the experiment

- Scenarios are monitored and coordinated through EXCON. This includes coordinating any issues that would affect the other experiment sites.
- Individual O/Cs (normally located near the unit in the field) execute their specific portions of the experiment MSELs.
- Each O/C and/or O/C team will be assigned to a specific site to coordinate all localized MSEL events using the EXCON radio net.
- In all cases, deviation from the MSEL will be coordinated through an EXCON agency. O/Cs are not at liberty to diverge from the experiment MSEL items without coordination and approval from his/her higher EXCON.

For most experiments, each day will begin and end with a review of the experiment’s progress by debrief between EXCON and the O/C teams. Adjustments will be made to the plan as necessary based on the experiment leads’ assessments.

Necessity or Pre-Experiment Training

If the EXFOR and O/Cs are not confident in experimental gear and/or experimental TTPs or the intent of the experiment, they will not realistically employ it during the experiment. This renders the resulting data unreliable. Success in assessing the impact of the experiment on an individual or a unit is only achieved after a period of time during which the users become intimately

familiar with the experimental gear, technology or TTP and integrate its use into their standing operating procedures.

On the other hand, if we are not careful, training can become a source of artificiality. To avoid this, the following actions should occur:

- Conduct familiarization training for unit leaders and operators.
- Test operator proficiency and unit leader employment TTPs.
- Exercise the capabilities in a variety of tactical vignettes or situations.
- Conduct follow-on training to correct deficiencies or modify operator procedures or TTPs for employment based on lessons learned during training.
 - Before beginning the experiment

Only after reaching an adequate level of training proficiency should there be any attempt to assess the military utility of a new technology using an LOE or AWE. We know that when we try to do this without adequate training and formulation of effective TTPs, we fail to get reliable data.

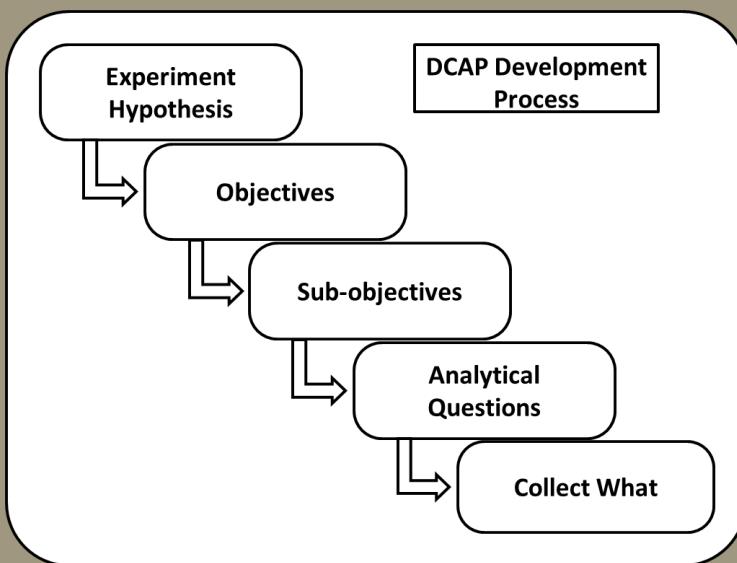


Section II – Data Collection and Analysis Plan (DCAP)

What is a DCAP?

The DCAP is the tool experiment planners use to methodically identify what questions need to be answered, whether O/Cs will be collecting objective data or subjective observations, and how O/Cs will ultimately go about capturing data to answer questions in the DCAP.

The DCAP begins with reviewing the hypothesis and objectives. The development of the DCAP is created through a process of distilling the objective(s) into specific data elements that can be observed or collected by O/Cs and experiment participants. MCWL/FD uses a building block approach to perform this process whereby objectives are broken down into sub-objectives, which are then used to derive analytical questions, and finally to identify the data needed to answer those questions.



Aside from just identifying what questions need to be answered and what events must be observed, the DCAP also outlines where and when events should be observed, who is responsible for observing the event (observing O/C), and how the event is supposed to be recorded or collected on (collection method). This information is then populated in a matrix format that effectively illustrates the entire DCAP. An example DCAP matrix from a recent experiment is provided on the following page.



No.	Objective	Sub-Objective	Analytical Question	Collect What when/where/triggers	Observing O/C Collection Method	MSEL #	SURVEY/AAR
1.0	Determine the quantity and potential variants of ITVs required to enhance the combat effectiveness of foot mobile (air assault) infantry.						
1.1	Evaluate the benefit of the C2 variant to the CLT.						
1.1.1		Did the C2 variant contribute to mission success or otherwise benefit the CLT?					
1.1.1.1			1. Exact numbers and types of radios and other C2 systems used by the CLT COC.	Prior to each experiment event - CLT HQ Comm O/C record all equipment to be employed by the CLT COC during the scenario to include all radios, computers, etc., and note whether manpack or on the CLT ITV.	O/C notes - dictated onto device if possible - otherwise written - imagery		
1.1.1.2			2. Periods when the CLT COC was unable to communicate with either subordinate units or higher.	Record all observed comm outages in CLT COC to include what radio, what net, and how long out - also note resolution of problem and cause.	All CLT HQ O/Cs	O/C notes - dictated onto device if possible - otherwise written	
1.1.1.3			3. Instances when manpack or handheld radios were unable to communicate but the vehicle radios were.	Highlight above data [1.1.1.2] where manpack radios fail but TV mounted radios don't.	All CLT HQ O/Cs	O/C notes - dictated onto device if possible - otherwise written	
1.1.1.4			4. Numbers and types of computer work stations on C2 variant.	Note all computer workstations operated from the C2 variant - Note use of each workstation and primary operator by name/rank/MOS/billet List all non-electronic C2 related equipment (battle boards, maps, etc.) located in the CLT COC.	All CLT HQ O/Cs	O/C notes - dictated onto device if possible - otherwise written - imagery	

DCAP Relationship to MSEL

The DCAP is a structured, sequential progression of tasks and questions to be addressed during the execution of the prescribed events found in the MSEL. The MSEL establishes the necessary conditions for the EXFOR to generate responses to address the questions to be answered from the DCAP and meet the objectives of the experiment.

Data Collection Methods

Data collection is primarily conducted by embedding O/C teams with the EXFOR role players and OPFOR during every tactical event. Each O/C team will focus on specific areas in accordance with the DCAP. These teams are comprised of subject matter experts (SMEs) from MCWL/FD, key stake holders, augments from the Operating Forces, and Center for Naval Analyses (CNA) analysts. In-depth O/C training will be conducted by MCWL/FD personnel prior to beginning the experiment training. Data collection begins with EXFOR training, and continues through subsequent technical and tactical training events, the actual experiment, and the unit's debrief.

NOTE

To understand exactly what data should be collected, each O/C must become familiar with the overall DCAP and MSEL items.

O/Cs must gather as much useful and pertinent information as possible, however, subjective input from SMEs is every bit as important as completing data collection forms.

Therefore, each O/C is expected to provide a detailed timeline and factual explanation of events observed, as well

as subjective comments and impressions. Data collection can be accomplished through a variety of means including but not limited to:

- Printed Data Collection Forms (Example on pg. 14)
- Printed MSEL Cards (Example on pg. 15)
- Note Books
- Tablets
- Audio Recording Devices
- Cameras
- Video Recorders

Aside from O/C observations, data collection can also be accomplished through instrumentation (e.g., I-TESS II, RAV Track, GPS Track Sticks, etc.) as well as through using debriefs, after-action reviews (AAR's), and surveys.

NOTE

The use of instrumentation has become more prevalent in recent experiments as newer technologies continue to emerge that have the ability to collect position location information (PLI) as well as atmospheric data. Instrumentation is particularly useful in that it provides objective data that aids analysts in the process of reconstructing the experiment during the post-experiment analysis phase.

Specific O/C data collection responsibilities are covered in greater depth in Section III of this X-File.

Location:	
MSEL#:	
O/C NAME:	
DATE:	

TIME / LOCATION / EVENT / NOTES / OBSERVATIONS

Example Data Collection Form

	25-Aug-15		
Line Numb	MSEL #	Y-1-001	Comments
1		OPFOR CFF on CLT HQ.	
2	When:	0800	
3	Who:	CLTHQ.	
4	What:	EN CFF 3RD S I/A 1ORDS FFE	
5	Where:	105 FE 60047270	
6	Purpose (Why):	IOT evaluate displacement time and function of C2 and HQ ITVs in CLT operations	
7	When/Ends:	Upon mobile load of C2 vehicle and displacement from the IDF Impact area	
8	Initiator (event lead):	OPFOR launches UAS, EXFOR O/C initiates CFF	
9	How:	CLTHQ and Scout Section identified by OPFOR UAS, CFF conducted on their location	
10	Expected Response:	CLTHQ and scout section displace out of immediate IDF Impact area, re-establish ORP and continue C2 of CLT flow of force	
11	Other responses and O/C or White Cell corrective action:	1. EXFOR remains in place, drop more arty simms 2. EXFOR continues to remain in place, O/C tells CLT Cmdr to displace 200m	
12	Indications/simulation methods:	Enemy UAS as USMC Raven (or notional), (13) arty simms as 82mm IDF	
13	Requirements:	ALL O/C: Observe/note per DCAP, record time standard. 1. EXFOR O/C: Determine if CLT has been exposed to En UAS, paint detection to CLT Cmdr, employ arty simms 2. OPFOR O/C: Communicate with EXFOR O/C if CLT is detected with UAS 3. TECH O/C: Observe vehicle employment and COC configuration 4. EXCON: Monitor, record time	
1.1.1.9	C2 ITV Mobility	Impact of the C2 vehicle on mobility of the CLT COC.	

Example of MSEL Card

The Importance of Data Collection

As mentioned above, data will be collected during training, the experiment, and during post-event/deployment debriefs/interviews. Once the final interviews have been conducted and all data analyzed, MCWL/FD will report relevant tactics, techniques, and procedures (TTPs), create appropriate X-Files, and make appropriate DOTMLPF recommendations. MCWL/FD will forward applicable concepts, data, training, etc., to DC, CD&I, for possible implementation or other action. These recommendations are ultimately the reason for conducting the entire experiment; however, recommendations can only be made based off documented observations. Because proper data collection is so important, O/Cs must abide by three main rules when conducting their duties:

3 Rules of Data Collection

- 1. DOCUMENT EVERYTHING! If it is not documented, it didn't happen.**
- 2. Always capture the 5 Ws (who, what, when, where, & why).**
- 3. If in doubt ... document it.**

Section III – Observer/Controller Duties

NOTE

While specific duties / procedures will vary by experiment, the sections below outline what is typically required of O/Cs throughout the course of an experiment.

O/C Sequence of Events

O/Cs are typically organized into teams based on EXFOR task organization, MOS and experiment requirements. As the primary data collectors, O/Cs will be trained on data collection procedures, data collection forms, weapon effects adjudication, and if necessary, given an orientation to the TTPs and technologies being used in the experiment. In general, O/C battle rhythm/procedures include:

- Team leader makes assignments prior to each event.
- Check out O/C radios and conduct comm check with EXCON.
- Conduct review of scenario/event and MSEL items prior to joining the EXFOR.
- Link up with assigned element during mission prep.
 - Listen to operation order, mission brief.
 - Record names, billets and equipment load.
 - Document operational environment and conditions.
- Move with the unit during the event observing, recording activities/locations, and adjudicating engagements as required.
- Keep team leader/EXCON informed on status of all activities.
- Participate in the mission tactical debrief.

- When possible after tactical debrief, guide the unit through a detailed data collection debrief as follows:
 - Mission commander states what mission was, critiques the mission, and states what he would have done differently, what worked well, and what significant influencers to success/failure were encountered.
 - O/Cs assigned to observe a specific technology will conduct further debriefs with Marines employing the tech item to answer specific DCAP questions.
- Participate in O/C debrief/synch meeting at the end of the day.
- Collect messages, sketches, radio logs, records, etc.
- Compile all collected information into a "data package" consisting of activity logs.
- Deliver data package to O/C team leader/data collection manager.

O/C Judgment Calls and Coordination

When O/Cs face a situation that they are not sure of but can make a reasonable call, they should go with their best judgment. This is the best way to keep the event moving. Things often only get more confusing and tactical tempo is adversely affected if a decision is delayed while the action continues. If necessary, or if a senior controller is immediately available, O/Cs can ask for help on a decision from a senior controller (squad, platoon, HQ, etc.) or EXCON.

Sometimes O/Cs must coordinate with each other to achieve the desired results. For example, EXFOR O/Cs call OPFOR O/Cs (on EXCON net) to assist in adjudicating an engagement, simulate fires landing on a target, assess casualties, and inform participants of events when it is not otherwise available to them. Sections IV and V of this X-file

provide detailed guidance on the adjudication of casualties and weapons effects.

O/C Data Collection Responsibilites

O/C Responsibilities

O/Cs are the primary means for data collection to support analysis of the unit's ability to perform the tasks associated with the selected missions.

MCWL/FD will provide training to all participants to ensure they understand the experiment goals and objectives, rules of play, the scenario, their roles and responsibilities, data collection tools, and MSEL as appropriate. In addition to training, this O/C Handbook is provided to all participants to assist ALCON in conducting their duties.

O/C specific data collection responsibilities are:

- Use checklists/forms to assist in recording activities.
- Record element locations periodically using GPS.
- Make detailed records for EXFOR, OPFOR and noncombatant activities, location, timings of events, numbers of individuals, weapons, clothing, vehicles, etc., to create *ground truth* for comparison to reports from the EXFOR.
- Document event sequences pictorially when necessary to describing reconstruction(s).

Section IV – Casualty Adjudication

WARNING

This section concerns both actual and simulated casualties (*cherry pickers*). Serious actual injuries are reported immediately using the brevity code: **“ACTUAL.”**

Actual serious casualties will be evacuated from the play box during a stop in action.

ACTUAL Casualties

During the experiment, participants may encounter minor or serious injuries. The following outlines how to handle *actual* and simulated casualties.

- If a participant has a **serious** injury:
 - Stop play in local area.
 - Call for a corpsman, if available.
 - Contact EXCON for further instructions per the safety brief.
- Minor EXFOR or OPFOR **actual** injuries should be played as event casualties and handled IAW unit SOP.

Simulated Casualties (Cherry Pickers)

Any participant can become a cherry picker when assessed as such by an O/C. When a participant becomes a simulated casualty, they must immediately stop in place and cease firing or doing whatever other job they were performing, and assess the effect of the simulated injury.

Handling EXFOR and Role Player Cherry Pickers

- Follow unit SOP in handling unless otherwise instructed by an O/C for experimental purposes.
- Killed in action (KIA), once evacuated by unit to CLT HQ, may be “reprocessed” as instructed by an O/C.

- O/Cs may also assess casualties based on EXCON direction.

Handling OPFOR Cherry Pickers

- They will be considered “dead” and remain in place until told otherwise.

Simulated Wounded in Action (WIA)

Participants who are WIA may continue to move or function, consistent with the location and type of wound.

- WIA personnel should act as wounded and call for assistance as appropriate.
- O/Cs will observe and correct as required.

Simulated Killed in Action

Participants that are KIA will lie down and remain where they were “killed” until moved by other participants, unless in a dangerous position. For example, participants must move themselves to the side of a building or out of the middle of a road to avoid being run over by vehicles. Dead participants do not walk or talk — they are dead. If simulated WIA and KIA participants are in the way of either vehicle or foot traffic, they must move themselves to make sure they are not actually injured.

Casualty Evacuation Procedures (CASEVAC)

During the play of each event, casualties will be generated through multiple methods including O/C assessment, I-TESS, fires, or other instrumentation methods.

- The EXFOR will follow their unit SOP for evacuating casualties unless there is some special procedure established for experiment purposes which is linked to an experiment objective.

- Minor actual injuries will be played as event casualties and handled IAW unit SOP.
- O/Cs should make note of unit casualty handling procedures - record how long it took to receive treatment.
- O/Cs will ensure that casualty evacuations are conducted in a safe manner.
- For actual night CASEVACs, all injured Marines will be moved as expeditiously as possible via the safest means based on EXCON direction.
 - EXCON will coordinate CASEVAC out of the training area via the most capable means (radio, cell phone, telephone).
- The lead O/Cs at each location will ensure a casualty collection point and procedures are reviewed daily at the evening synchronization meeting.

Enemy Prisoners of War (EPWs)

During the events, either force may take prisoners. O/Cs will ensure that prisoners are not abused in any way.

- EPWs may not be secured or restrained, but may be ordered to move and be interrogated.
- Only the left breast pocket of OPFOR EPW utility jacket can be searched.
- OPFOR and role player search parameters will be briefed prior to each event.
- EPW weapons are put in condition 4.
 - Personal weapons will remain in the EPW's possession at all times (unless it is a "rubber weapon") and will be slung across the chest with the barrel pointing downward.
- EPWs will behave in a docile and compliant manner.
- EPWs will not attempt escape and will be released when directed by the O/C.
- The EXFOR will not take personal items from EPWs.

Section V – Weapons Effects Adjudication

Direct Fire Weapons

Participants must have ammunition or there is no effect.

- No Ammo — No Shot.

Cannibalizing Blank Ammo, Pyrotechnics or Equipment

It is acceptable for participants to use any live blue body grenade, smoke grenade, and serviceable blank ammunition found in the battlespace.

- EXFOR and OPFOR will not take equipment from the "dead" or captured without O/C approval.
- Neither OPFOR nor EXFOR will take radios from opposing forces and listen in or use them in any way - unless specifically authorized by an O/C.

Using Other Participant's Weapons

- Trade-outs among like forces only; i.e.
 - EXFOR can only use EXFOR.
 - OPFOR can only use OPFOR.

Unless "destroyed" in combat, all weapons remain in play until the experiment is over.

Cache Sites

- EXFOR or OPFOR can use items found in cache sites.
- Can have O/C mark them as destroyed, but must go through process of "destruction" IAW rules of the game for employing demolitions.

Direct Fire Weapons that Do Not Have Blanks

- Includes MK19, Expendable AT4, M72 LAAM, and SMAW
- Engaging unit O/C contacts opposing unit O/C when these are to be fired
 - O/C "calls" the accuracy and effects.
 - O/C coordinates follow-up action with opposing O/C.

Grenades/Booby Traps/IEDs

Blue Body Grenades

These produce an audible pop when the fuse assembly detonates. The O/C controls casualty generation and ensures that the shock effects are played out to the maximum extent possible. Other guidelines include:

- Five (5) meter effective casualty radius.
- No jumping on grenades.
- No throwing blue body grenades directly at individuals or in an otherwise unsafe manner.
- No throwing grenades into any vehicle.
- Participants in room that were under cover must remain in place as if stunned for 10 seconds.
- For stun grenades, even unprotected participants must remain in place as if stunned for 10 seconds.
- On-scene O/C makes the call on casualties.

How to Play Grenade Effects

When a hand grenade is employed against either EXFOR or OPFOR, the players may take any tactical action necessary to avoid the impact, but once the grenade goes off, all players within 5 meters outside must freeze in place.

Booby Traps

- Grenade rules apply.
- Cannot use blue body grenade fuses without blue body.
- Must be placed below the knee.
- No prepped simulated charge — No DEMO effects.
- O/C makes the call on casualties.

Improvised Explosive Devices (IEDs)

This section covers O/C adjudication procedures for OPFOR IEDs, whether they are employed on a roadside against convoys, on a trail in an ambush, or in a vehicle. O/Cs will record unit's actions/reaction to IED discovery/engagement in his/her activity log.

- OPFOR will inform OPFOR O/C of type, size, and triggering method the IED uses to replicate, and explain the method of employment.
- O/C will determine effective casualty radius. This will be based on his/her best judgment.
- The OPFOR must place a replication of the IED and employ some actual triggering method for the IED and the IED must create some aural (sound) stimulus to the EXFOR that an IED has been initiated – e.g., flash-bang pyrotechnic.
- EXFOR should use unit SOP and go through the motions to deal with suspected or confirmed IEDs as required by the situation.
- If individuals or vehicles hit a mine, O/Cs assess effects.
- O/C will adjudicate the engagement and assess personnel casualties as appropriate. Participants designated as casualties will follow standard experiment casualty adjudication IAW Section IV.
- O/C will assess/adjudicate vehicle casualties - minor damage, mobility kill, or catastrophic kill (destroyed).
- O/C will employ smoke to indicate a vehicle is destroyed.
 - Personnel in vehicle will execute react drills IAW unit SOP.
- If vehicle is assessed as damaged, personnel will continue to operate the vehicle within the situation or conduct repairs as appropriate.

Marking Out of Play

- Admin or “destroyed” areas will be marked with white engineer tape.
 - VIP/press viewing areas.
 - Parking/staging areas.
 - EXCON area.
- Admin vehicles will be marked with:
 - Day – white duct tape “X” (front, sides, rear).

- Night – green chem lights (front and rear of roofline).

Indirect Fire Weapons

Both OPFOR and EXFOR may be able to call for indirect fires if available. This requires detailed coordination between EXCON and O/Cs during the call-for-fire (CFF) process. In order to assess the results of these fires, the O/Cs must follow these steps:

- The unit employing indirect fires will contact the on-scene O/C who will inform EXCON that they are requesting fires and relays the basics of the 9-line or CFF – who, what, where, and when.
- Unit then goes through procedures to engage target with fires asset.
- On-scene O/Cs or site EXCON determines who the closest O/C is to the target or will dispatch an O/C to the target area to adjudicate.
- The O/C at the point of impact (POI) informs EXCON if and how many personnel are in the target area.
- EXCON will provide instructions as to how many casualties to assess.
- The O/C at the POI uses the artillery simulator to indicate impact and assess the casualties based on estimated impact location and time.

DTG:	Requesting Unit:	TGT #	
Mission:	FFE P / S / G SEAD: CONT:	Imm Supp FPP Illum INT: Target Location: Series #:	Cont. Supp _____ to _____ Cont. Illum _____ to _____ Nonstan: _____ / _____ M/S
Target Description:	Priority Tgt#:	8	
Method of Engagement:	HE: PD / VT / Delay # of Rds	Illum Platoon / Section STD	Smoke DPICM Excalibur AMC CANNOT OBSERVE
Control:	TOT:	TOF:	
MTO:	TGT#	I/A	/E
	MaxOrd:		
	GTL:	Rmks:	
B	EOM Time:	Location	
D	Results:	Suppressed / Neutralized / Destroyed	%
A		Remaining	

M M

A M D

Figure 1 - Mortar Fires Request Form

Close Air Support (CAS) Missions

Depending on the play of the experiment, the EXFOR will be able to call in both fixed-wing and rotary-wing CAS missions. Both rotary-wing and fixed-wing CAS missions could be either a mix of:

- Constructive — no aircraft involved.
- Simulated — live aircraft, but no ordnance dropped.

Standard CAS attacks using 9-Lines, 6-Lines and the forms below will normally only be briefed by the JTAC as depicted in Figure 2. All other CAS attacks will be considered emergency CAS to be executed via an observer who has communications with the aircraft.

Adjudication of Standard CAS with JTAC

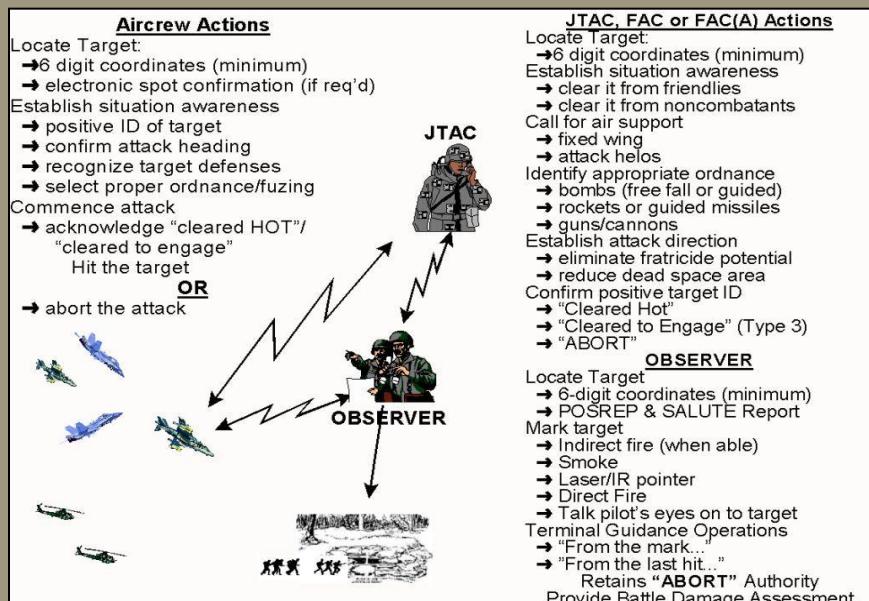


Figure 2 Overview of CAS Activities

Live ordnance may or not be used depending on the type of experiment and intended outcome.

- O/C with company operations center (COC O/C) will copy attack information from JTAC's request (9-Line, 6-Line, etc.).
- COC O/C will relay to O/C with supported unit/observer details of request, at a minimum:
 - Type and location of target.
 - Time on Target (TOT) requested.
 - Munitions (or damage effects) requested.
- EXCON determines who the closest O/C is to the target or will dispatch an O/C to the target area to adjudicate.
- COC O/C will plot the actual location of the point of impact (POI) based on attack brief and talk on with aircraft.
- COC O/C will forward POI to O/C in the target area.
- The O/C at the target uses the artillery simulator at TOT to indicate impact.
- Based on POI, munition used, and tactical situation, EXCON determines casualties.
- EXCON informs O/C at the POI who in turn informs the EXFOR and assesses casualties.
- COC O/C, O/C with the observer, and O/C in the target area will copy BDA for each element.

For Emergency CAS *without* JTAC:

- O/C with observer who has communications with aircraft will copy all information passed to aircraft.
- O/C with observer contacts EXCON with target location.
- EXCON then determines the closest O/C to the target or will dispatch an O/C to the target area to adjudicate.
- O/C with observer will determine location of the point of impact (POI) based on attack brief and talk on with aircraft.
- O/C with observer will relay to the O/C in the target area the following information:
 - POI
 - Type and location of actual target

- TOT
- Munitions (or damage effects)
- The O/C at the target uses the artillery simulator or smoke grenade at TOT to indicate impact.
- Based on POI, munition used, and tactical-situation site, EXCON determines casualties.
- EXCON informs O/C at the POI who in turn informs the EXFOR and assesses casualties.
- O/C with the observer and O/C in the target area will copy BDA for each element.

NOTE

The O/C with the ACE assists with keeping EXCON informed of potential CAS and assault support missions.

Requesting Unit:		Auth: Y / N	
		F W C A S	
A/C Call Sign:		1 IP (Initial Point)	
Mission #:		2 Heading (MAG)	
# and Type:		3 Distance (NM)	
Position:		4 Elevation (MSL)	
Altitude:		5 Description	
Ordnance:		6 Location (Grid)	
TOT:		7 Mark (Code/TL)	
Arrive:		8 Friendly ORDNST	
RTT:		9 Express (ORDNEST)	
Abort Code:		FAH	
Laser:	Y / N	STAY ABOVE	
		STAY BELOW	
		GTl	
		TOT:	
		APPROVE	MODIFY DENY

Figure 3 – Fixed-Wing CAS Request Form

DTG:	Requesting Unit: <input type="text"/>		AUFR: <input type="text"/> Y / N
A/C Call Sign:	1	AFP (Firing Point)	
Mission #:	2	Heading (MAG)	
# and Type:	3	Distance (Meters)	
Position:	4	Elevation (M&L)	
Altitude:	5	Description	
Ordnance:	6	Location (Grid)	
TOS:	7	Mark (Code/LTL)	
Arrive:	8	Friendly DIR/DIST	
RTAC:	9	GRESS (DIR/DEST)	
Abort Code:		FAH	
Laser:	<input type="text"/> Y / N	STAY ABOVE	
		STAY BELOW	
TOT:		OTL	
		DENY	
		MODIFY	
		APPROVE	

Figure 4 – Rotary-Wing CAS Request Form

Circular Error Probable Kill/Destroy Distances for Fire Support

Rules of Thumb (CEP):

20mm-	5 meters
25mm-	5 meters
30mm-	10 meters
40mm-	10 meters
60mm mortar-	10 meters
81mm mortar-	15 meters
120mm mortar-	25 meters
155mm HE -	25 meters
2.75" HE rocket-	10 meters
5" HE rocket-	25 meters
ATACMs-	30 meters
Hellfire missile-	20 meters
TOW missile-	15 meters
Mk-82 bomb-	100 meters
Mk-83 bomb-	150 meters
Mk-84 bomb-	200 meters

ORDNANCE	TRAINING	10% PI(*)	0.1% PI (*)
60mm mortars	400m	60-65m	100-175m
81mm mortars	600m	75-80m	165-230m
Artillery (M777)	1000m	100-125m	200-450m
Rockets(2.75)	1000m	145m	240m
NGF	750m	210-250m	450-600m
Mk 82 (LD)	1500m	250m	325m
Mk 83 (LD/HD)	2000m	175/130m	385/330m
Mk 84 (LD/HD)	3000m	175/115m	430/350m

Figure 5 - Risk Estimate Distances for Selected Ordnance

RISK ESTIMATE (DANGER CLOSE)

DISTANCES FOR CAS ORDNANCE

(COMBAT USE ONLY)

WEAPON	DESCRIPTION	RISK EST DIST. (METERS)	
		10%PI	.1% PI
Mk-82	500LB BOMB	145	325
Mk-83	1000LB BOMB	175	385
Mk-84	2000LB BOMB	175	430
Mk-20	ROCKEYE CBU	100	145
2.75" RKT	VAR. WARHEADS	145	240
5" RKT	VAR. WARHEADS	220	340
HELLFIRE	AGM-114 (AH-1)	40	105
MAVERICK	AGM-65 (F-18, A-10, F-16, AV-8)	25	95
GUNS	20MM, 25MM, 30MM GATLING GUNS (MISC A/C)	80	125
AC-130	25MM, 40MM	100	125
AC-130	105MM CANNON	80	200
GBU-10	2000LB LGB	90	340
GBU-12	500LB LGB	95	300
GBU-16	1000LB LGB	105	350
GBU-31	2000LB JDAM	90	340
GBU-32	1000LB JDAM	105	350
CBU-87/89	CEM/GATOR	165	220
WCMD	CBU-87/89 W/KIT	100	145
JSOW	BLU-97	125	225

SOURCE: MCRP 3-16.6A, J-FIRE, Oct 2004

RISK ESTIMATE DISTANCES

Warning: Risk Estimate Distances (REDs) are for combat use and are not minimum safe distances (MSDs) for peacetime livefire training.

Ref: Joint TTPs for CAS Joint Pub 3-09.3 1 Dec 95 Appendix G and *Risk Estimate Distances for Indirect Fires in Combat* FA Journal Mar-Apr 97.

Item/ System	Description	Risk Estimate Distances(meters)					
		10% PI			0.1 % PI		
		1/3	2/3	max range	1/3	2/3	max range
M224	60mm mortar	60	65	65	100	150	175
M29/ M29A	81mm mortar	75	80	80	165	185	230
M102/ M119	105mm howitzer	85	85	90	175	200	275
M109/ M198	155mm howitzer	100	100	125	200	280	450
M109/ M198	155mm DPICM	150	180	200	280	300	475
NSFS MK-45	5"/ 54 gun	210	225	250	450	450	600
2.75" FFAR	rockets	160			200		
AC-130	20/ 25/ 40mm cannons	35			125		
AC-130	105mm cannon	80			200		
M-4, M-112, SUU-23, M-61	20mm cannon	100			150		
GAU-8	30mm Gatling gun	100			150		
AGM-65	Maverick	25			100		
MK-82 LD/ LGB	500lb. bombs	250			425		
MK-83 LD/ HD/	1000lb. bombs	275			475		
LGB	2000lb. bombs	325			500		
MK-84 LD / HD		figure 3					

Annex A – SAFETY BRIEF

A safety brief will be given by the RSO to all participants before they participate in the experiment. This includes EXFOR, OPFOR, EXCON, O/Cs, and guests. **No one should participate in the event without a safety brief.**

Script for the Non-Live Fire Safety Brief

Good morning, I am _____, and I am the senior safety officer for the _____. Additionally, everyone out here is a range safety officer.

Safety is the by-product of professionalism during the conduct of these operations. We do not want anyone injured. If at any time you witness an unsafe act or see one developing, call for a safety timeout and operations will cease until the situation is corrected and can continue in a safe manner. You will not be criticized for calling a safety timeout.

I will be located at: _____. I will be assisted by other safety officers at each experiment site. There will be a corpsman and safety vehicle located at each site's EXCON.

Weapons Handling

Ensure that you follow all standard weapons handling procedures.

- Treat every weapon as if it were loaded.
- Keep your weapon on safe until you intend to fire.
- Keep your finger off the trigger until you intend to fire.
- Do not point your weapon at anything you do not intend to shoot.
- Do not shoot at an individual's head within 10 feet with blanks.
- At ENDEX, ensure your weapon is in condition 4.

Safety Gear

- Wear safety gear while driving/riding in a tactical vehicle.
 - Use safety belts (if equipped).
- Wear designated safety gear when riding on helicopters.
- Personnel riding in helicopters will have conducted dunker training or have a waiver.

Pyrotechnics/Grenades/Booby Traps

Booby traps will be placed at knee level or lower.

- No field expedient booby traps will be used at any time.
- Trip flares, parachute flares, etc., that have open flames, are not to be used.
- Do not use blue body grenade fuses without a grenade body.
- Do not throw blue body grenades, smoke, or paint grenades directly at an individual.
- Do not employ smoke grenades within confined spaces such as buildings/drainage systems.
- O/Cs and participants will ensure that the back blast area is and remains clear when firing a SMAW or AT4-type simulator.

Handling of Actual Casualties

- "ACTUAL" call will be made over both tactical and O/C nets.
- EXCON will determine if there is a requirement to stop experiment / tactical activities.
- If a "stop" in action is necessary, details will be passed via both EXCON and the tactical net as appropriate.
- Participants in the area will stop in place and keep all safety gear on.
 - Only those involved in evacuation will remove safety gear.
- Event will not resume until the "continue event" is passed (and confirmed) over EXCON and the tactical net.

- Minor actual injuries (cut fingers, sprained ankles, etc.) will be played as event casualties and handled IAW unit SOPs.

Annex B – ACRONYMS

AAR - After-Action Review
ACE - Air Combat Element
ALCON - All Concerned
AO - Area of Operations
AWE - Advanced Warfighting Experiment
BDA - Bomb Damage Assessment
C2 - Command and Control
CAS - Close Air Support
CASEVAC – Casualty Evacuation
CD&I - Combat Development and Integration
CDT – Capability Development Team
CE - Command Element
CEP - Circular Error Probable
CFF - Call for Fire
CG - Commanding General
CNA - Center for Naval Analyses
COC - Company Operations Center
COP - Common Operational Picture
COTS - Commercial off the Shelf
CTP - Common Tactical Picture
DOTMLPF - Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities
DTCS - Distributed Tactical Communications System
ECR - Effective Casualty Radius
EPW - Enemy Prisoner of War
EUE – Extended User Evaluation
EXCON - Experiment Control
EXFOR - Experiment Force
FD - Futures Directorate
FDC - Fire Direction Center
FFE - Fire for Effect
FSCC - Fire Support Coordination Center
FW - Fixed Wing
GCE - Ground Combat Element

HHQ - Higher HQ
HQ - Headquarters
HQMC - Headquarters Marine Corps
IED - Improvised Explosive Device
ISR - Intelligence, Surveillance and Reconnaissance
JFO - Joint Forward Observer
JTAC - Joint Terminal Attack Controller
KIA - Killed in Action
LCE - Logistics Combat Element (MAGTF)
LOE – Limited Objective Experiment
LOI - Letter of Instruction
LTA – Limited Technical Assessment
MAGTF - Marine Air-Ground Task Force
MCCDC - Marine Corps Combat Development Command
MCFDS - Marine Corps Force Development System
MCWL/FD - Marine Corps Warfighting Laboratory
MIX – MAGTF Integrated Experiment
MSEL - Master Scenario Event List
O/C - Observer/Controller
OPFOR - Opposition Force
PLI - Position Location Information
POI - Point of Impact
POR – Program of Record
RP - Role Player
RSO - Range Safety Officer
RW - Rotary Wing
SMAW - Shoulder-Launched Multipurpose Assault Weapon
SME - Subject Matter Expert
TOT - Time on Target
TTP - Tactics, Techniques and Procedures
UAS - Unmanned Aerial System
WIA - Wounded in Action

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