

Improving Capabilities Development and Acquisition through Wargames and Seminars

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ABSTRACT

The purpose of this paper is to demonstrate that the use of low cost, non-simulation-based wargames and seminars can provide credible Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel, Facilities, and Policy (DOTMLPF-P) input to the Capabilities Development Process and inform acquisition / lifecycle decisions. The Army Capabilities and Integration Center (ARCIC) and the Army's Maneuver Center of Excellence (MCoE) have used a variety of wargames and seminars to inform learning demands with regard to future force composition and doctrine development. This paper is a follow-up to the 2014 paper "Budgetary Implications of the Difference between Models and Simulations." That paper discussed the differences between models and simulations and that significant cost savings have been realized through the use of low fidelity models by ARCIC and MCoE. This paper contains new information and contributes to the management and acquisition body of knowledge in that it focuses on providing the methodologies that ARCIC and MCoE follow in their wargames and seminars that US and Foreign Service readers can adopt to accomplish their own requirements. Discussion will include: 1) past ARCIC and MCoE seminars and wargames techniques, methodologies used and results; 2) lessons learned from execution of the events and how correcting them improved subsequent wargames and seminars; and 3) a methodology to conduct of wargames or seminars that inform capabilities development and/or acquisition decisions. The methodologies include: 1) the use of command and control systems and collaboration software to depict operational and tactical scenarios in order to compare alternative cases; 2) methods for effectively depicting changes to the tactical or operational situation in the use case; and 3) how to document wargame participants' input concerning the learning demands of the capabilities development document or doctrine being proposed. The paper will conclude with future uses of the methodology and areas for continued research.

ABOUT THE AUTHOR

Tom Yanoschik is a graduate of the United States Military Academy and holds a Masters Degree from the University of Texas at Austin. He is retired from the United States Army where he served as a Field Artillery officer. His assignments included service in cannon artillery and multiple launched rocket system units, and as a Fire Support Officer in the 3rd Ranger Battalion. Tom currently serves as the SAIC Site Manager for the Experimentation Environments Branch (EEB) of the Maneuver Battle Lab (MBL), Fort Benning, Georgia. He has participated in virtual and constructive experimentation both locally at the MBL and also distributed through the Battle Lab Simulation Collaborative Environment (BLSCE). Tom is a certified Project Management Professional (PMP) and Modeling and Simulation Professional (CMSP).

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Introduction

The Capabilities Development and Integration Directorate (CDID) of the Maneuver Center of Excellence has the mission to “determine and develop future force capabilities and future Infantry and Armor requirements across the Doctrine, Organization, Training, Materiel, Leadership Development, Personnel, and Facilities (DOTMLPF-P) domains, resulting in a trained and ready maneuver force fully integrated into the Army, Combined and Joint Warfighter to maintain the battlefield supremacy of our Soldiers and the formations in which they fight.” The experimentation arm of the CDID is the Maneuver Battle Lab (MBL) which conducts live, virtual, and constructive experimentation in support of capabilities development and integration. Prior to 2012, CDID and the Army Training and Doctrine Command’s (TRADOC) Army Capabilities and Integration Center (ARCIC) use human in the loop simulations to conduct capabilities and doctrine development. Beginning in 2012, CDID and MBL augmented the human in the loop simulations with non-simulation based wargames and seminars that have produced findings and insights comparable to the simulation-based events at a substantial cost savings. The purpose of this paper is threefold. First, to summarize the wargames and seminars conducted over the past four years and describe the analytical tools and wargame methodologies used to develop insights and findings. Second, to describe the preferred methodologies and why they were successful. Third, to suggest methods and techniques with which this system can be used by other Services or Countries in the conduct of their own Capabilities Development.

Background

The mission statement of the Maneuver Center of Excellence (MCoE) is to prepare the Army's Maneuver Forces to “Win in a Complex World”. The CDID is responsible to determine how the Army’s maneuver forces will be manned and equipped in the future. This determination is made at all levels from the individual Soldier to the Brigade Combat Team. For the Soldier, the CDID determines what uniforms and standard equipment Soldiers will wear, what weapons they will employ and mission command systems they will use. At the other extreme, the Brigade Combat Team (BCT) echelon made up of thousands of Soldiers, the CDID determines how many battalions of Soldiers will make up the formation, how many and what type of vehicle will make up the formation. Additionally, they determine what the composition of combat enablers will be in terms of Combat Engineers, Medics, and other specialized personnel, as well as support equipment such as unmanned aircraft systems (UASs), ground robotics, and bridges. There are three types of maneuver units in the Army: the Infantry Brigade Combat Team (IBCT), the Armor Brigade Combat Team (ABCT), and the Stryker Brigade Combat Team (SBCT). At the MCoE, a TRADOC Capability Manager (TCM) provides comprehensive and enduring DOTMLPF-P oversight for each formation (TCM IBCT, for example). The TCM provides a TRADOC perspective for all capabilities contained within the formation and represents the user’s perspectives for all matters across the DOTMLPF-P. The TCM is also the single point of contact for users to provide feedback and issues for action.¹ These formation-based organizations, as well as organizations that focus on the individual Soldier and equipment, work with the Maneuver Battle Lab and utilize live testing and computer simulations to test various hypotheses and investigate what the future equipment and unit compositions should look like. The CDID composition is depicted below in Figure 1.

¹ TRADOC Regulation 71-12



Figure 1. MCoE CDID Organizations

Identification of Venues by the MCoE to Achieve Experimentation Objectives

In order to test the established priorities and develop mid- and long-range plans, the CDID, establishes an annual Experimentation Campaign Plan. This plan is nested under the ARCIC Campaign of Learning and seeks to synchronize the objectives of each event and, as much as possible, use common scenarios and frameworks to maximize not only resources, but experiment outcomes and findings, as well. Traditionally, this was done through the use of large-scale simulation-based experiments (SIMEXs) held annually or semiannually in which each of the TRADOC CoEs would participate. Each Center of Excellence would identify its experiment objectives and analysis plan which would focus its efforts for the SIMEX. The SIMEXs would normally consist of two, five day work weeks of six hour simulation runs which would provide approximately 30 hours of simulated combat during which analysts representing TCMs and other capability developers could focus on their particular formation’s requirements. In many cases, this provided an excellent venue to examine certain hypotheses; for others, a more focused look, or the ability to stop the simulation (battle) and re-fight certain portions of a particular battle would have been much more beneficial. Unfortunately, re-setting the clock would have numerous second order effects across the battle space.

In order to achieve the focused look which was required, experimenters had two options, a smaller scale SIMEX focused at one particular point of the battle or an environment which provided less fidelity, but the ability to research a more detailed aspect of the battle. If not well designed, the non-simulation based analysis runs the risk of being too opinion-based and lacking credibility. Even an actual seminar-type event to orally discuss capability gaps or the ability to employ science and technology enablers that lacks structure and analytical rigor runs the risk of being labeled a “BOGSAT”- a military term which stands for Bunch of Guys Sitting Around a Table. The

implication is that unfocused discussion characterized the event and little, if any, analytical outcomes are achieved since “considered” Military Judgment was basis for findings.

In order to avoid many of the pitfalls of a BOGSAT, the MCoE developed a wargame methodology which used mission command systems to model units’ movements in the battlespace rather than full simulations in order to research certain experimental objectives. The seminar wargames focused on analyzing the impacts of large scale changes to doctrine or the composition of unit formations which could be accomplished without the use of simulations. It uses the Action-Reaction-Counteraction wargame approach to provide a logical framework through which participants can develop a scenario. As an example, the facilitator could provide scenario background or the “road to war” to provide a common understanding of what strategic context the military operations are taking place. They then present the friendly action, to which Threat role players present their reaction, and each phase ends with the friendly counteraction to the Threat reaction.

The first seminar wargame was held by the MCoE in March 2013 the How to Fight the Reconnaissance and Security Brigade Combat Team (R&S BCT) Wargame. It was a wargame designed to compare R&S BCT design alternatives using a classified scenario in order to identify and assess advantages and disadvantages of each design. Additionally, it: Verified the Required Capabilities (RC) for each Warfighting Function (WfF); discussed the command and support relationships for subordinate elements; and analyzed and discussed capability gaps and solutions. Its desired outcome or end state was that for each course of action (COA): DOTMLPF-P assessment of R&S BCT design; answer what the R&S BCT mission effectiveness was at supporting echelons above brigade; and determine the ability to perform R&S BCT baseline missions.

In conducting the wargame, actions were those events initiated by the side with the initiative.² Reactions were the opposing side’s actions in response. Counteractions were the first side’s responses to reactions. For all Courses of Action (COA), the friendly forces were the side responsible for the actions and counteractions; the enemy forces provided the reaction. Tom Desrossier, the CDD lead for the wargame, developed the methodology and Figure 2 graphically depicts this cycle and the outputs.

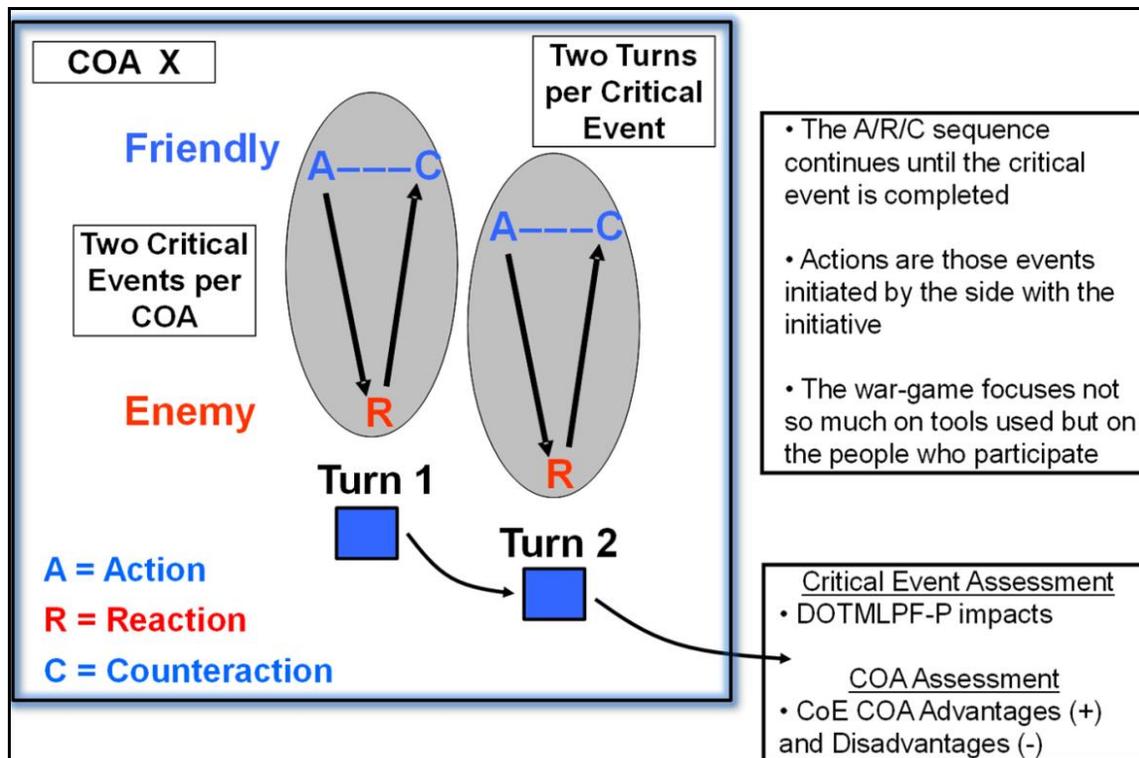


Figure 2. HTF the R&S BCT Wargame Technique.

² Yanoschik, p. 5

The facilitator for the wargame followed a detailed script to provide background and the current state of the battle to the participants. The event started with a “Road to War” brief that gave context to the scenario in terms of the timeframe, friendly capabilities and dispositions, threat forces capabilities and dispositions, and conditions at which the battle would begin.

During the HTF Wargame, the MCoE employed an analog record keeper who used a synchronization matrix during the execution of the event to record participant’s comments and observations. As the facilitator proceeded through the wargame orally describing the phase of the operation and showing the actions on a map displayed using a Mission Command System (Command Post of the Future), a synchronization matrix was used to record key observations or planning considerations of that phase of the battle, categorized by the Army’s Warfighting Functions (WfF). A sample a synchronization matrix is depicted below in Figure 3.

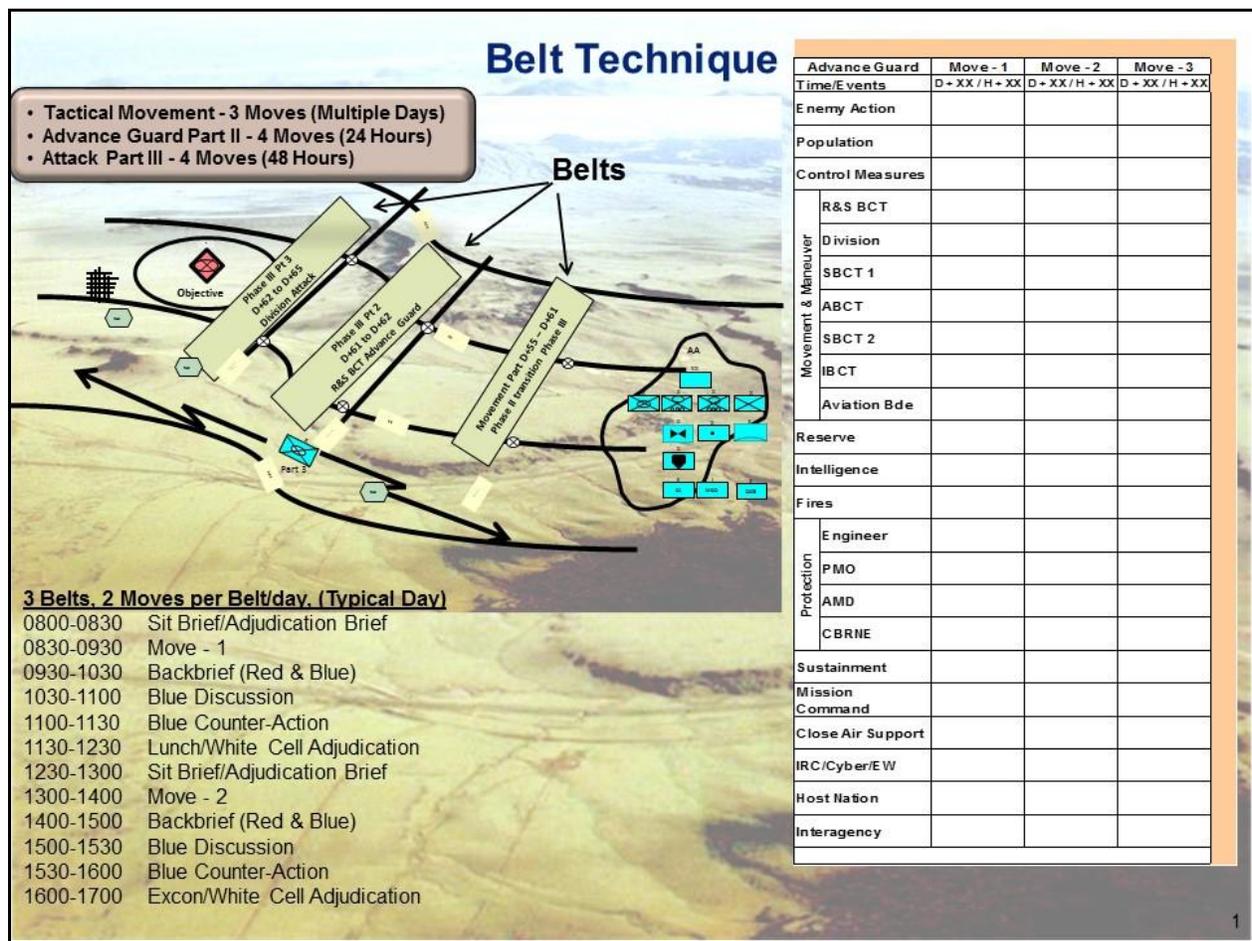


Figure 3. HTF the R&S BCT Wargame Synchronization Matrix

As each Warfighting Function or functional area (such as Joint enablers or Interagency experts) would comment on the event from their perspective, functional staff members could comment, but it was a case of one speaker at time and the input was only captured if they were acknowledged, the group achieved consensus and the recorder placed the comment in the synchronization matrix. Although a valuable tool for capturing insights and record the outcomes for each phase, the synchronization matrix format of recording was constrained by the speed at which the recorder could maintain pace with the facilitator and those making comments. Although generally successful, this methodology was slow and very rote. The event was successful; event analytical outcomes were achieved and organizers were satisfied with the event, as demonstrated by the fact that they felt the analytical rigor was sufficient to brief senior Army leadership and ultimately based the formation design on the outcomes of the event.

Evolution and improvement of the Seminar Wargame through Collaboration Tools

MCoE leaders conducted hotwashes to identify both administrative and technical methods to improve the methodology of using the seminar wargame to improve the Capabilities Development process. A significant improvement was made in the conduct of future wargames through the introduction of collaboration tools that allowed participants to simultaneously comment on the current phase of the operation, to agree or disagree with other subject matter experts, or provide an alternative to the course of action as briefed. Facilitate Pro ® was the initial collaboration tool used during execution of several of the MCoE Seminar Wargames.

Using this or other collaboration software, experiment participants enter comments into a dialog box which all participants can read and monitor. As comments are added, other participants add their comments or observations or can begin a new stream of ideas. The following example is shown for illustrative purposes. It reflects one participant's understanding of an operational concept (Counter Unmanned Aircraft System Operations) and another participant's additional comments on the same subject, followed by the first participant's feedback:

Topic: Air Ground Integration: Counter UAS capability was held at the Division Level. When CUAS aircraft jammed adversary UAVs, the effect is temporary. UAS will have a built in program to return to home station, or to hover at high altitude. Dispersed units may need organic CUAS capability that will destroy the aircraft. – Participant A

Comments (Replies):

I would think that this would depend on at what echelon the units are operating dispersed. If the dispersed units are Division or above, the current level of C-UAS support may work. If the units are dispersed at BCT level, the C-UAS capability may need to be allocated at that level. And even temporary effects achieved on Threat UAS can be useful - a UAS that goes RTB, or into high altitude loiter above the effectiveness of its sensors has been effectively neutralized for that period of time. – Participant B

I agree to a point; we must assume that situations may arise where decentralized control is required, I but believe that for most operations, it will always reside at the Division Level. - Participant A

This is just one observation and one reply. Some comments were simply to catalog comments made orally to the entire group and had no reply (for example “General Smith gave the guidance that....”). Other times, very animated discussion would start in the collaboration tool dialog, then transition to the oral discussion, or vice-versa. This provided several benefits over the synchronization matrix filled out by the event's recorder. It allowed simultaneous comments. Participants could ensure their own words became the record rather than the recorder's (not to fault the recorder, as they were forced to capture complex discussion in real time). It also allowed all participants to comment on all aspects of the discussion, as they did not need to be recognized to speak- they could simply record their observations in the collaboration tool.

During the course of the Seminar Wargames, the observations and comments/replies filled hundreds of pages when converted into a Microsoft Word document. This allowed analysts to then go back through comments and sort by Warfighting Function, identify common themes or easily extract exact quotations for executive summaries or reports. Although Facilitate Pro ® happened to be the collaboration tool used for several wargames, the “Discussion” function in Microsoft SharePoint has also been used successfully. Since many organizations use Windows-based computers and have access to the SharePoint program, this may provide a “no-cost” option for collaboration. Regardless of the collaboration tool chosen, one of the most important lessons learned by the MCoE and its experimentation partners throughout TRADOC is the benefit of pre-loading discussion topics into the collaboration tools. This not only saves time during event execution, but also focuses participants input towards the event's analytical objectives. Additionally, a technique employed by the Mission Command Battle Lab (MCBL) is to begin the event with a simple background / biographical survey to provide analysts and leaders critical information on the participants' experience, as well as important contact information which can be used for follow-up after the seminar wargame. Most events begin with an orientation to the collaboration tool, then confirmation that participants can use the tool is achieved through their completion of the biographical survey.

One last tool for recording the outcomes of Seminar Wargames was the use of Focus Papers. This technique was successfully used by TRADOC in 2014 during the second event of the Unified Challenge 2014 campaign of experiments (UC 14.2). During UC 14.2, in addition to the use of a collaboration tool to record results of tactical and operational vignettes, participants wrote focused papers 1-5 pages in length to capture key observations or outcomes of specific tactics, employment of science and technology enablers, or capability gaps encountered during the wargame. These Focus Papers served as annexes to the event final report, but could also serve as executive summaries for leaders of the WfF addressed in the paper or the proponent for technologies or military formations addressed in the paper. Given the nature of the time to properly write, staff, and edit a Focus Paper, it is best used in a multi-day event as opposed to a one day seminar.

Simulations versus Seminar Wargames: Determining the Venue

Given the two options for experimentation, human in the loop, simulation-based events and turn-based seminar wargames, one must first understand the experiment objectives and analytical focus to determine what venue would be appropriate. For example, if studying the impact of the introduction of vehicles into the IBCF (a light, rapidly deployable formation of Infantry Soldiers without vehicles) a full simulation is not required in order to gain insights into what large impacts would be to the unit in terms of improved mobility, increased logistics requirements due to fuel usage and spare parts, more aircraft required to deploy the unit inter and intra Theater, etc. Small, local simulations are still conducted in order to examine short, hour- to hour-and-a- half long battles focused on individual vehicles or weapons systems at the platoon or company echelon when experiment objectives involve improvements such as vehicle sensors, munitions with improved ranges, or new weapons with improved lethality. Given the two possible venues, it is critical to know which venue is best for which type of experiment. Over that past five years, the MBL and its CDID partners have developed guidelines to assist decision makers in that determination.

The critical decision of when to use a simulation versus a seminar / war game venue involves the data collection requirements and event objectives. If specific, engineering-based outcomes are required, a simulation venue is required. If outcomes involve general concepts or hypothesis testing, an analytics-based war game may be sufficient. How then does an organizer determine which venue to use? Here are some examples of questions to consider in determining the venue:

Event Requirements or Constraints	Preferred Venue	
	Simulation-Based Experiment	Seminar Wargame
Is there a short suspense for reporting outcomes?		X
Are there budget constraints?		X
Are engineering-level comparisons required?	X	
Are multiple runs of the same scenario required?	X	
Is there a requirement for strictly controlling variables?	X	
Is there a requirement for comparing performance or outcomes under different environmental variables?	X	
Does your focus include study issues that difficult or impossible to accurately model (socio-economic, political, religious reactions, for example)?		X
Is time for participants to contribute to actual event limited?		X
Is there limited knowledge of specific enemy capabilities?		X
Are you being asked to respond to a Black Swan which has components that are unknown or have no known response?		X

Figure 4. Considerations for Determining Venue.

There always are specific considerations to every situation; the answers to the questions in Figure 4 are rules of thumb. For example, the ability to strictly control variables which will be compared being answered in a simulation-based event does not mean that you cannot or should not strictly control variables in a seminar wargame. Limited knowledge of enemy of specific capabilities normally would steer the decision to a seminar wargame to begin the analysis or start a best/worst/most likely comparison; but leaders or experts may arrive at the conclusion that sufficient information exists to make assumptions, document them, and execute a simulation-based event. The intent is to provide the reader with a starting point from which to adjust for use with their organization and its unique requirements.

Perhaps the most important consideration (normally a constraint) is the availability of resources to support the event. Generally, the time available to plan, prepare, execute, conduct analysis, and prepare / report outcomes is a key consideration. Simulation-based events generally require more time and man-hours based on the integration, verification and validation, and scenario preparation. If a large federation is required that includes disparate simulations and the integration of mission command systems, the timeline becomes many months. The more complex the simulation requirements are, the more complex and expensive the computer and network infrastructure is. In some instances, funding for the event, whether simulation-based or a seminar wargame, is budgeted well in advance and leaders must simply manage the funds allocated to the event. In instances such as Black Swan events (a one in a million event which was unforeseen) or events that are called to respond to answer questions based on new intelligence on threat capabilities, funding is likely not programmed and must be allocated, likely at a constrained level. As mentioned earlier, this is part of the reason for the methodology used by TRADOC and the MCoE to develop annual campaigns of experimentation. In doing so, they can not only better predict resource requirements, but can, as much as possible, nest experiments and seminar wargames with each other in order to use common scenarios, but also to nest learning objectives from one event to the next.

When presented analytical requirements and experiment objectives, the modeling and simulation professional must lay out for the experiment proponent resource requirements and advantages such as the spectrum of fidelity, with a trade-off against the cost of the study outcome. At the most inexpensive end of the spectrum, the BOGSAT provides evaluation of the scenario using the Considered Military Judgment (CMJ) of experienced warfighting function experts, but lacks any analytical underpinnings to the resulting product. The opposite end of the spectrum is a human in the loop (HITL) simulation event which may include virtual manned systems as well as constructive simulations. This type of large scale event has credible, engineering-level analytical underpinnings and excellent databases for evaluation, but could cost upwards of several million dollars for roughly thirty six to forty eight hours of simulation time (fighting at the JTF or Division echelon with fidelity down to the individual combatant and vehicle level). In between these two extremes are closed loop (non-HITL) constructive simulations, scenario wargames, constructive simulation or serious wargame supported seminars, and low resolution level constructive simulation events. The key consideration, apart from resource availability, is determining what is the lowest level of cost/venue necessary to provide a valid product which meets the specific study requirement.

Given those areas for consideration, it may be helpful to show with specific examples how a venue would be selected in an unconstrained resource environment. Figure 5 (Page 9) reflects common categories of prototype or capabilities based assessments and which venue would be more appropriate.

Transferability of the MCoE Methodology for other Services, Countries, or Industry

Although the techniques described in this paper were developed for use by the MCoE and its TRADOC experimentation partners they are easily transferable. The easiest re-use would be by the Armies of other countries. Given specific threat scenarios, capability gaps, or required DOTMLPF-P analysis, the methodologies described could easily apply to answer their needs. Other services could adopt these techniques to the requirements of air or sea combat. For example, given the need to address the requirement to defeat an unforeseen threat air defense network, the same decision process would take place. One could see how the use of simulation-based experiments could address the requirements to defeat of specific threat air defense systems at the engineering level (sensor defeat, range of engagements, etc). This simulation-based experiment might take on a Base Case versus Advance Case approach which allocates different weapons and sensor mixes. At the operational level, a seminar wargame enabled by appropriate collaboration tools would address the general strategic and operational aspect of neutralizing or defeating the threat air defense (identifying a Joint solution, what range of enablers would be available, potential threat counteraction, etc). This seminar wargame could utilize the synchronization matrix to describe the environment and outputs from the collaboration tool and focus papers inform leadership on potential defeat

solutions, tactics, techniques and procedures for employment and way ahead to achieve the desired end state. The methodology could also be adopted for civilian industrial or law enforcement use. Several examples could be service centers and warehousing operations, commercial market place analysis, or vehicle check point operations. In the case of vehicle check point operations, this methodology could use simulation based experiments to analyze vehicle flow optimization while a seminar wargame could identify manning techniques and procedures for human performance in the conduct of the checkpoint.

Simulations Vs. Seminar Wargames	
Simulations	Seminar Wargames
Sensor performance	Doctrinal concepts
Fuel or ammunition usage	Potential Threat reactions to Friendly strategic maneuvers / actions
Determining the technical ability to defeat Threat radars or sensors	Positioning of Friendly weapons and radars to counter Threat detection systems
Combat loads (capacity)	Combat load (mix)
Testing the ability to overcome Threat obstacles	Developing TTPs to overcome enemy obstacles
Friendly munition lethality against Threat equipment	Identifying innovative methods to employ new Friendly munitions or systems

Figure 5. Examples of Venue Selection.

Lessons Learned and Steady State Operations

The MCoE and its experimentation partners have learned many lessons in the conduct of the simulation based experiments and the seminar wargames. The following are the most important from which other organizations can learn and not make the same mistakes. First and foremost, clearly identify the objectives and outcomes of the event from an analytical standpoint and then identify the venue. Too often, participants will decide on the venue, either to take advantage of an existing opportunity only to discover that it is either under resourced to achieve their objectives, does not include the necessary scenario to make it a valid venue, or is not to the required fidelity to answer their needs. Second, establishment of standard operating procedures for conducting the events allows for normalization from event to event. Many of the participants are often the same from event to event. As procedures for actions such as use of the collaboration tools, methods for adjudicating differences both technically and professionally, and knowledge management procedures become routine, the events become easier to plan and more efficient in execution. Finally, it is critical to nest as much as possible with other events, in terms of scenario, force structure, threat laydown, and unit configurations. This allows the reuse of numerous products such as tactical orders and configuration of mission command systems, as well as provides the ability to look for emerging trends that are consistent from event to event, regardless of venue.

ACKNOWLEDGEMENTS

The author would like to thank the following individuals for their assistance in reviewing the drafts of this document and providing technical and editorial assistance: Larry Rieger (for serving as the Birddog and reviewing the drafts and suggestions concerning the value discussion) and Kenneth M. Obermeyer (for reviewing the final draft) and Tom Desrosier (for his input on the Army's Maneuver BCTs and TCM roles, as well as reviewing the final draft).

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