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SIMULATION AS A MISSION PLANNING AND REHEARSAL TOOL

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ABSTRACT

There has long been an understanding by all military services that simulation systems provide an effective means of training combat units and their command structure to prepare them for eventual combat situations. Simulation is well understood as a training tool – witness the large investment in the development of the next generation joint staff training tool, the Joint Simulation System (JSIMS).

However, the role of simulation systems in the staff planning process has not been exploited as fully as possible. With simulation's capability to control clock speed, quickly run through multiple scenarios, and do "what-if" planning, simulation systems are a natural support tool for the military commander and his staff to facilitate their planning in all phases of the staff planning process.

This paper proposes an expansion of simulation systems' role to support all levels of command and control functioning, especially staff planning after receipt of orders and mission rehearsal. Each of the steps in the staff planning process are discussed in terms of the role that simulation should play.

1 INTRODUCTION

The Marine Corps' modeling and simulation system, the Marine Air-Ground Task Force (MAGTF) Tactical Warfare Simulation (MTWS), has been used in a training setting since its fielding in 1995. MTWS is an advanced simulation system that models all aspects of combat (air, land, sea, and amphibious ship-to-shore activities). MTWS is comprised of the following functional components (for a detailed description of MTWS and its components, see Blais 1994):

- MTWS Application Network (MAN) – distributed workstations performing combat simulation (e.g., ground combat, fire support, air operations, combat service support, combat engineering, intelligence)
- MTWS System Control (MSC) – provides archival exercise data storage and retrieval, report generation, restart, and exercise clock management (the game clock can be regulated from 1/4 to 10 times normal time)
- MTWS Display System (MDS) – user workstations enabling command entry, report request, report display, map display, tactical data display, parametric data editing, batch file creation and maintenance, and batch file entry
- MTWS Aggregate Level Simulation Protocol (ALSP) Translator (MAT) – performs communications between MTWS and diverse simulation systems, including other service models, using ALSP
- MTWS Analysis and Review System (MARS) – provides analytical tools for display, reporting, and charting time-tagged exercise data during and after exercise conduct. MARS provides graphical and tabular display of exercise data which can be viewed in user defined time segments (for more information on MARS, see Blais 98).

Since its fielding, MTWS has been the backbone of the Marine Corps' simulated combat training environment. Its flexibility in that setting has been aptly demonstrated, supporting exercises that range in scope from classroom support at the Marine Corps' schools (Staff Non-Commissioned Officer [NCO] Academy, Amphibious Warfare School, and the Command and Staff College) to joint level exercises involving a confederation of other service simulations joined via the ALSP. In these venues, MTWS has proven its ability to model forces at various levels of fidelity and to adapt to a wide variety of scenarios.

There is, however, another practical and important use for simulation systems like MTWS: supporting staff planning and mission rehearsal activities.

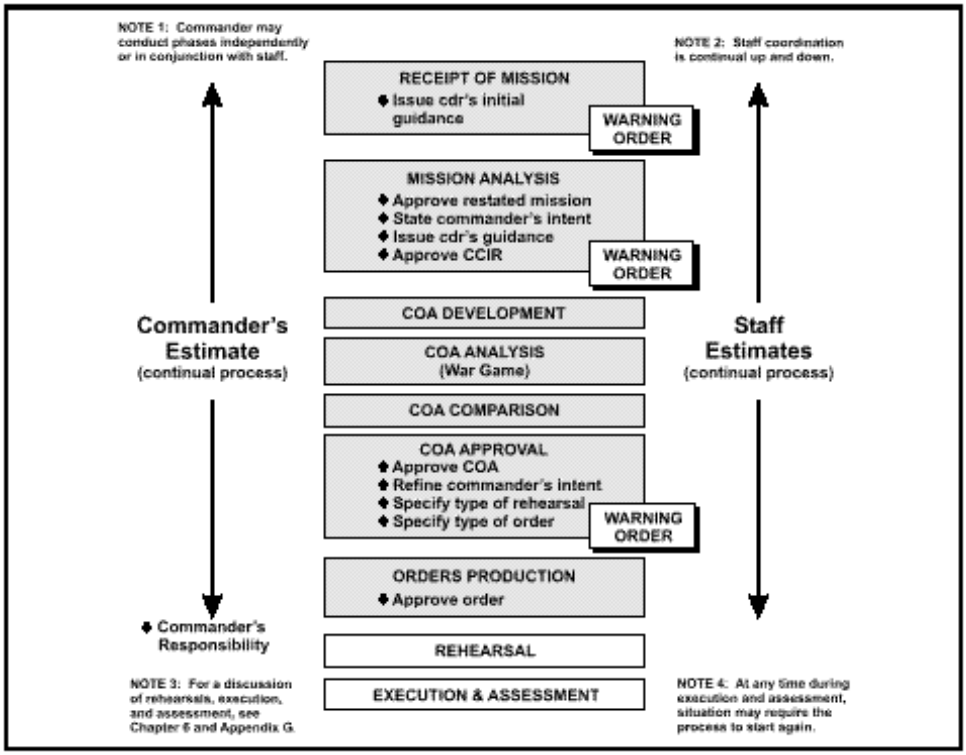

Figure 1: Commander's Decision-Making Process (FM 101-5)

2 THE PLANNING PROCESS

The Marine Corps Planning Process (MCPP) pamphlet describes the staff planning process as an overlapping, flexible, coherent method of solving problems from performing mission analysis to creating an approved plan. Field manual FM 101-5 (Staff Organization and Operations) further details the planning process after receipt of an order. It identifies staff actions from mission receipt to mission accomplishment (Figure 1), detailing activities for each of the staff members. MTWS, as a planning tool, will effectively support most of those activities. Each activity is examined below, noting how MTWS can support that activity.

In an operational setting, MTWS enables the MAGTF commander and his staff to accomplish:

- Intelligence Preparation of the Battlespace (IPB)
- Identification of Centers of Gravity (COG)
- Intelligence Briefings to Staff Members
- Course of Action (COA) Analysis and Selection
- Commander's Wargaming
- Mission Rehearsal
- Post-Operational Analysis

Every phase of the staff planning process can be supported by MTWS to enhance the decision-making process. Modeling and simulation, by its very nature gives the staff and the commander insight into the terrain, weather, and hostile forces arrayed against them that is difficult to obtain by static briefing slides. The following paragraphs describe the role MTWS can play in each phase of the Commander's Decision-Making process.

2.1 Receipt of Mission/Mission Analysis

During the "Mission Analysis" phase of the process, the assigned mission, specified, implied, and essential tasks and commander's intent are scrutinized. IPB is performed to gain an appreciation for all aspects of the battlespace, and assumptions and limitations are reviewed.

MTWS is employed in the initial IPB efforts. MTWS assists both the Intelligence Officer and the Operations Officer in analyzing the effects of terrain and weather on operations. Movement of troops, equipment, supplies, and aircraft for both friendly and enemy forces are studied on the MTWS Display System (MDS). The effects of the area of operations' infrastructure and demographics on movement and fire support can also be examined.

The results of this analysis are displayed on the MDS or MARS workstations and constitute detailed situational templates. Analysis of the templates is performed by the Intelligence Officer to determine the enemy's most likely and most dangerous courses of action. The commander and

staff are then briefed on the enemy COAs. Wargames are then prepared for future COA analysis. Intelligence briefings to the staff are conducted directly on the MTWS or the MARS workstations to provide a "live" presentation with animated unit depictions as opposed to a static briefing performed on a map and overlay. In essence, MTWS batch files that define initial enemy positions and their doctrinal movement on the battlefield become the formal situational overlay product from IPB. Screen captures of selected points in the MARS reviews are placed into presentation software for other briefing requirements.

Additionally, MARS data files are sent to subordinates, who may also have MARS, for their review along with the warning order. This would serve to inform the subordinate commanders and their staffs of the current analysis of the enemy situation.

The process of analyzing enemy course of action on MTWS will highlight gaps in intelligence that will aid the commander in identifying and articulating the Commander's Critical Information Requirements (CCIR). In addition, analysis of these information gaps will assist the Intelligence Officer in creating his initial reconnaissance and surveillance plan. Using MTWS, the Intelligence Officer can experiment with his reconnaissance and surveillance resources to determine the most effective resource(s) to employ in each gap to satisfy the CCIRs.

Another byproduct of visualizing the friendly and enemy situation as developed in MTWS is that it will aid the commander in identifying sources of the friendly and enemy strengths, power, and will (their centers of gravity (COGs). Identification of the COGs is acknowledged to be the single most important element of the commander's guidance to his staff.

2.2 Courses of Action Development

During this phase of the decision-making process, relative combat powers, critical capabilities, and critical requirements are determined and linked to COGs. COA narratives and sketches are developed to balance capabilities against vulnerabilities.

MTWS is utilized to conduct an analysis of the relative combat powers of friendly and enemy forces, determining various points of vulnerability of the enemy forces. As the COAs are developed, each is built as a scenario in MTWS. At least two enemy COAs should be scripted: the most likely enemy course of action, and the most dangerous enemy course of action. The depictions of these potential enemy options will be used to test the suitability and feasibility of the friendly COAs in the COA analysis phase.

A scheme of maneuver for each of the friendly COAs is scripted into MTWS for future analysis. The development of this scheme of maneuver in MTWS involves establishment of initial positions, movement plans, and fire support timing. As stored in MTWS, the sequence of commands, with time stamps, represents a synchronization matrix that can be used later for rehearsals and for actual coordination of forces on the ground.

2.3 Course of Action Analysis

COA Analysis seeks to evaluate the COA narratives and sketches for suitability, feasibility, flexibility, and acceptability. Wargaming is the principal source of analysis, with the final products of the phase being:

- Sequences (including branches) for each COA
- Critical decision points
- Event matrix and decision support templates for each COA
- Completed synchronization matrix

Each COA is run on MTWS with the Intelligence Officer functioning as the enemy commander. The activities of each unit and the combat results are captured in MARS for future evaluation and comparison while MTWS command entry files are time-stamped to build final synchronization matrixes for each COA. Using MTWS's inherent ability to accelerate time advance, scenarios can be run in a fraction of the time normally required to test a scenario. Time permitting, multiple runs of each COA are performed and results tabulated.

After each COA is run through on MTWS, each staff officer analyzes the advantages and disadvantages of each COA from his perspective based on their experiences during the wargaming. Staff officers can review each COA's results in MARS to make their determination of suitability, feasibility, flexibility, and supportability since MARS will depict not just the scheme of maneuver, but attrition, supply consumption, and timing. Briefings to the rest of the staff depicting critical decision points are conducted using the time-frame viewing capabilities in MARS and become visual event matrixes and decision support plans.

2.4 Course of Action Comparison/Decision

The process of COA Comparison is the most critical phase of the staff planning process. Here, each COA is compared against decision criteria to determine which best accomplishes the mission, minimizes friendly casualties, and positions the forces to retain the initiative for future operations. All results of the comparison are reviewed, and the commander decides on the COA to be used. The product of this phase is an approved COA with a concept of operations and a warning order.

The comparison of the COAs is best accomplished using MARS to graphically depict the event-by-event status of each COA. The data collected during the wargaming of the COAs is used to brief the Commander during the Commander's Decision Briefing. This briefing can be presented to the Commander as a "live" presentation using MTWS and MARS to describe the scheme of maneuver, synchronization issues, potential enemy actions, and combat results. Based on his visualization of the COAs, and after listening to the analysis of his staff, the Commander selects a COA.

2.5 Orders Development

During the "Orders Development" phase, supporting documentation for the approved plan is prepared and disseminated to subordinates for preparation for execution.

MTWS products from the COA analysis provide a significant portion of the desired documentation. The situational template (in the form of MTWS batch files to establish and maneuver enemy forces) provides subordinates with an excellent understanding of the enemy disposition and inclination. Command entry sequences from the wargame provides the synchronization matrix. And finally, the MARS output of the COA analysis gives the subordinate commanders excellent understanding of the scheme of maneuver and the commander's intent.

3 MISSION REHEARSAL

The "Mission Rehearsal" phase of the process is supported by MTWS by providing a tool for the subordinate commanders to gain insight into the terrain and weather factors that will influence their actions in the objective area. It also provides a means of rehearsing the timing issues relevant to the execution of the scheme of maneuver.

Figure 2, from FM 101-5 (Staff Organization and Operations), provides a graph indicating the increase in relative understanding of the personnel involved in a variety of rehearsal techniques. The closer to a full dress rehearsal of the scheme of maneuver, the greater the understanding by all involved personnel. Unfortunately, as rehearsal techniques become more complex, preparation time rises significantly. Time, the Commander's most precious asset (and normally in very short supply after receipt of orders) must be spent carefully.

The use of MTWS in the COA analysis phase of the planning process significantly reduces preparation time for an effective high-reward rehearsal. The initial friendly and enemy situation is already built in by virtue of having performed the COA analysis. The simulation is simply reset to the desired starting time, the participants (staff members and subordinate commanders) are issued their orders, and the rehearsal begins. Subordinate commanders sit at an MDS, observe their units in the maneuver, and issue commands to the MDS operator to coordinate their unit's activities with the plan and with adjacent units.

During the rehearsal, an opportunity to investigate branching of potential enemy reactions exists (time permitting). This would prepare subordinates for other eventualities during the course of the actual execution of the plan.

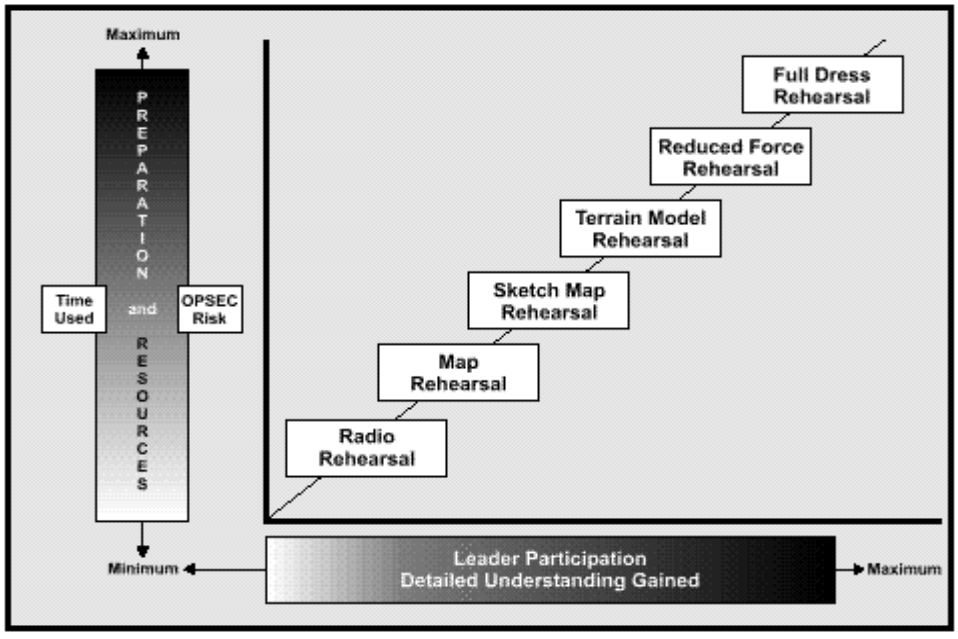

Figure 2 – Rehearsal Techniques Relative to Time and Understanding (FM 101-5)

The result is a highly informative, detailed rehearsal in which commanders at all levels receive area familiarization and are able to refine issues of synchronization of fire support, air, assault and ground movement before they have arrived in the objective area. Data captured by MARS can point out high priority targets where scheduled fires would be most beneficial and other matters relevant to ensuring the greatest opportunity for success.

4 POST-OPERATIONAL ANALYSIS

Although still in developmental stages, MTWS has established connectivity to C4I systems that could potentially allow C4I systems to feed actual operational data back into the simulation. This "backward" feed from the C4I system into MTWS would allow MTWS to record actual events in their proper timing and location. Then, following the operation, post-operational analysis would be possible through replay on MTWS or MARS.

5 CURRENT INITIATIVES

The Marine Corps Office of Science and Innovation (OSI), recognizing the potential that simulation systems offer in the mission planning role, is proposing a study to determine effective methods of using simulation to support analysis of courses of action (Bailey 1998). The OSI concept, similar to a concept under consideration at the Joint Training and Simulation Center (JTASC) in Suffolk, Virginia, is to utilize existing simulation centers with their expertise and staffing to provide a COA analysis service to deployed commanders.

Under the OSI concept, COAs would be developed and passed to the simulation facility. The facility, in turn, would run the COAs through the simulation at greatly accelerated rates (25:1), and provide the results back to the deployed commander for evaluation. The results would be returned to the commander in a form that could be reviewed in detail on an analysis and review system similar to MARS. The advantage of this approach is clear: the capability of the simulation centers like those at Quantico Virginia, Camp Lejeune North Carolina, and Camp Pendleton California are utilized to their fullest and the necessity to deploy simulation experts is avoided.

6 SUMMARY

As a result of its ability to represent terrain, weather, troops and equipment, to review scenarios, and to compress the representation of time, a simulation system like MTWS is a natural solution to the commander's need for a planning and rehearsal system to support his operational planning efforts. In a deployable configuration, simulation is an integral component of the commander's warfighting tool kit. Deployed commanders with access to a modeling and simulation system and its inherent ability to support planning for contingency operations or other assigned tasks will be more prepared to meet enemy forces and win in battle.

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