

Overview of USMC Modeling and Simulation Office Policy Lessons Learned

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ABSTRACT

The United States (US) Department of Defense (DoD) has modeling and simulation (M&S) offices to manage M&S policies and coordinate complicated enterprise technologies across subordinate organizations such as live, virtual, and constructive (LVC). The US Marine Corps M&S Management Office (MCMSMO) operates under a Marine Corps Order that established the office but does not provide guidance and direction for effectively managing or coordinating diverse M&S communities across the Marine Corps. Since there are no unifying policies, individual commands and program managers develop unique and often competing policies which create both confusion at the senior leadership level and technical interoperability challenges at the engineering level. This paper will provide an overview of the current USMC governance and discuss the issues that have arisen from the lack of unifying policies, such as conflating LVC for training uses and M&S capabilities for analytic uses during formal requirements documents production, and individual program managers selecting technical standards that may not be compatible with an interoperability requirement of a future system of systems. This paper will then discuss the analysis that was performed to determine the policy required to effectively manage M&S across the Marine Corps. The analysis consisted of reviewing relevant DoD policies, interviews across the Marine Corps M&S communities, and conducting initial action officer review. This paper will describe the five lines of effort that are necessary to implement M&S enterprise management within the USMC, covering a wide range of topics including policy implementation, workforce management, and research coordination. Finally, this paper will provide an overview of the new draft USMCM&S policy. The merits of the draft policy have been well received by the USMC and DoD M&S communities, and several existing DoD level M&S challenges are beginning to reference the ideas within the Marine Corps draft policy as potential DoD solutions.

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BACKGROUND

USMC Modeling and Simulation (M&S) Management

Modeling & Simulation (M&S) has been used by military units since ancient times. As far back as the Roman Empire, commanders used sand tables with abstract icons to represent soldiers and units in battle in order to visualize and become familiar with the battlefield. Additionally, they could share their ideas with their subordinates, evaluate multiple avenues of attack, or practice the processes they would use to command their legions. In short basic M&S concepts were used to support the planning of their combat operations. As we all know the use of M&S to support military activities has not only continued but significantly expanded since the days of Caesar.

Per Marine Corps Order (MCO) 5200.28A the Deputy Commandant for Combat Development and Integration (DC CD&I) is the Marine Corps' M&S advocate. As the M&S advocate, DC, CD&I coordinates, integrates, and assures efficiencies that keep pace with technological progress and meet Marine Corps requirements. To perform this function, DC, CD&I leads a Marine Corps M&S Enterprise supported by four Marine Corps M&S communities, who are enabled by M&S: acquisition, analysis, experimentation, and training. Each community is led by a flag level officer (Headquarters, USMC 2014). These communities own the models and simulations used to support their mission sets and are the subject matter experts for what each of their respective community's needs for M&S to support.

The DC, CD&I action arm for M&S Enterprise activities is the Marine Corps M&S Management Office (MCMSMO). The MCMSMO chairs an Integrated Product Team (IPT) comprised of the Marine Corps M&S communities leads and other M&S stakeholders (Headquarters, USMC 2014). The M&S IPT seeks opportunities to identify common capability gaps, promote the use of interoperability standards, and leverage existing M&S capabilities across the Service¹ as resources permit. The Marine Corps M&S IPT helps DC, CD&I to lean forward and take necessary actions with respect to M&S requirements, technical considerations, and operational utility.

Currently there is no unifying strategic vision or policy for managing an integrated Marine Corps M&S enterprise. A Marine Corps enterprise approach to M&S will provide a means for the DC CD&I to influence the significant investment in M&S capabilities across the Marine Corps by spending a small fraction of that amount on the governance, technical framework, and common tools and services that promote M&S functional uses in the Marine Corps, as well as M&S interoperability and reuse. A Marine Corps M&S Enterprise approach allows for key community capabilities to be identified as having value across enterprise stakeholders; cooperatively resourced and utilized, these capabilities will make the Marine Corps more capable and efficient in its use of M&S. As the Marine Corps steps forward with significant investments supporting Live, Virtual, Constructive (LVC) integration as well as an expansion of its wargaming-analytic capabilities, taking an enterprise management approach will become even more important. The remainder of this paper discusses the problem facing DoD M&S management; cites an example of current efforts within the DoD that are results of the problem; describes the methodology and results that the MCMSMO conducted to correct the problem within the Marine Corps; provide a synopsis of the current draft policy being staffed within the Marine Corps; and concludes with a summary of lessons learned from the effort. The

¹ Capitalization of "Service" is meant to convey that the authors are referring to a DoD Service, such as the Marine Corps. "Services" is used to refer to all of the DoD components: Marine Corps, Navy, Army, and Air Force.

remainder of this paper contains information cited from the draft Marine Corps Order listed in the references unless otherwise cited by another source (Headquarters, USMC 2019).

Problem Statement

In the absence of a well-defined enterprise policy or M&S portfolio, the structure of the Marine Corps lends itself for each Deputy Commandant (DC) to establish policy within their span of control. An unfortunate side-effect of being a Service that is centered on a well-integrated Marine Air Ground Task Force (MAGTF) is those DC's spans of control overlap in key areas that directly affect M&S within the Marine Corps. Without a unified vision and consistent collaboration on M&S activities and capabilities, the Marine Corps risks well-meaning disparate efforts competing for limited resources, developing divergent capabilities, and creating obstacles to integration and interoperability. For example, a recent analysis of alternatives for a training capability received a clarification request from the Deputy Commandant level to explain the distinguishing difference with wargaming related M&S capabilities (J. Housley, personal communication, May 14, 2019). Several planning assumptions had been made that did not align with intended use of one over the other. The Marine Corps needs a unifying policy with the scope of a Marine Corps Service-level M&S enterprise effort and should cover individual M&S components; the integration and interoperability between components; and the enabling infrastructure (i.e., ranges, networks, data centers, etc.). An enterprise policy to enable the unified vision and strategy should establish the roles and responsibilities of the MCMSMO in providing oversight, coordination, and guidance of M&S throughout the Marine Corps as well as the role of other Marine Corps M&S stakeholders. MCMSMO's goals would be to manage efficiently the M&S technology's significant investments, determine risk mitigation, and remove barriers to accomplishing missions that are enabled or critically dependent upon M&S capabilities. As we have seen throughout DoD without a concerted effort to centrally manage activities such as M&S technical standards, infrastructure (architectures and networks), as well as workforce development and cooperative research, the ability to achieve Department or Service-level M&S interoperability, seamless integration with real world systems, and efficient use of resources is a pointless task.

A Department of Defense Example Demonstrates Need for Improvement

In January 2018 the then USD OSD, AT&L the honorable Ellen Lord, requested assistance in solving a U.S. Special Operations Command (USSOCOM) challenge that she believed was symptomatic of similar challenges across the Department of Defense (DoD). Specifically she stated in her memo to the Services and other DoD M&S stakeholders, "USSOCOM requires a synthetic distributed environment for training, tactics development, and mission rehearsal that is both operationally representative of, and consistent with, Special Operations Forces (SOF) combat operations. The current DoD process of producing and accrediting that environment is unacceptably long - months, instead of hours or days" (Under Secretary of Defense for Acquisition, Technology, and Logistics 2018).

In the same memo she directed the stand-up of a Flag-level Senior Steering Group (SSG) to address this issue. In addition, she directed the stand up of a SSG Working Group (SSG WG) and supporting Technical Capability Teams (TCTs) to develop proposed solutions, initially focused on three areas: Geospatial data, Cybersecurity, and Policy. In follow-on meetings a fourth TCT was identified to look at the role Conceptual Modeling plays in supporting interoperability. The coordination of the SSG WG TCTs is being provided by the Defense M&S Coordination Office (DMSCO). Each TCT is chaired by a DMSCO representative and populated by members from each of the Services and DoD M&S communities. The goal of each TCT is to identify specific actions needing to take place to close the interoperability gaps the USSOCOM challenge has identified.

As the SSG WG and supporting TCT efforts progressed, some progress was made. Specifically, in the area of Geospatial Standards, National Geospatial Intelligence Agency (NGA) is providing a set of curated geospatial data layers in a scalable structure that may can be used for the development of run-time simulation data. This effort should be helpful addressing some of the interoperability challenges facing SOCOM. The DoD Services will work with NGA to conduct integration efforts and determine how best to access NGA data using cloud-based technologies (Creel and Hopkins 2019).

However, while this is a recognized and agreed challenge area, it is yet unclear whether the overall effort will be successful in making progress in closing all the interoperability challenges facing the Department. While DMSCO has been dutifully setting up SSGWG and TCT meetings, in the end they are a coordination office. Coordination is important, but it is not enough in helping to bridge the interoperability gaps that have been identified. This will require

a sustained effort that is resourced with a DoD M&S office empowered to not just coordinate actions, but oversee their implementation. This is particularly true in the areas of cyber security and conceptual modeling. In the area of cyber security, the DoD CIO is still trying to determine if policy on the reciprocal acceptance of Authority to Connect/Authority to Operate to support the integration of the DoD Service provided sims, as well as the persistent connectivity needed by SOCOM to support its mission rehearsal requirements, can be created (B. Telford, personal communication, Jun 10, 2019). If DoD CIO policy can be developed, there is still the question of resources to pay for it and how best to conduct the oversight needed to ensure Service program managers (PMs) are positioned to deliver the needed capabilities. The Conceptual Modeling TCT is still in its infancy, but it seems clear that to address the interoperability issues that accompany the disparate representations of the operational environment from each of the DoD Services that actions will have to be downward directed.

The problems faced by DMSCO, while acting as the Department's action office to address M&S interoperability issues, are significant. These issues cannot be addressed by coordination alone or through a reorganization that further dilutes a need for a single office responsible for improving the way the Department uses M&S. They can only be addressed by an office that is resourced and empowered to not only create policy, but oversee its implementation. An office that is accountable for supporting specific leadership directed actions. It is a problem that the Service-level M&S offices also face. Offices that do not directly own or operate any models or simulations, but exist to help their Service M&S stakeholders use them better. The MCMSMO believes it has a policy framework for DoD and Service-level M&S offices that will enable them to be address M&S issues and challenges, develop a strong M&S workforce, and synchronize investments in M&S related S&T. It is a framework that seeks to address challenges that go beyond the support of one set of M&S users, but if resolved will support all M&S users.

MISSION ANALYSIS OF MCMSMO

Methodology

The MCMSMO conducted several IPTs to build from the "bottom up" what the individual communities wanted or needed a MCMSMO to do for improving the state of USMC M&S. These IPTs were followed up with stakeholder interviews to garner the details behind problem sets that they needed assistance from a MCMSMO at the enterprise level. During the interviews, the individual policy documents that were relevant to an individual community and policies that applied across multiple communities, were identified for analysis. The MCMSMO conducted a review of these policy documents to help form the basis for the action items needed to mitigate the problems sets identified by the communities. The policy analysis consisted of actions needed at the Deputy Commandant echelons through individual Officer-In-Charge (OIC) echelons. The activities were categorized along lines of effort and staffed at the IPT action officer level for comments and concurrence. Most communities agreed with the content and structure of the recommendations, however, there was some feedback that the tasking represented a significant increased requirement that the responsible command was currently under-resourced to support. While MCMSMO agreed with the estimate of "current under-resourcing," the new draft policy is proceeding with formal staffing in order to establish the requirement that can serve as a basis for potentially requesting increased staffing and resourcing levels. The premise is that if these are the actions that need to be accomplished to manage M&S as an enterprise capability, then the policy document should state the requirement for an improved future condition that is independent of current conditions.

Five Lines of Effort

To support the move towards an M&S enterprise management, the MCMSMO is proposing draft policy that will unify Marine Corps M&S efforts towards common goals. The draft policy consolidates inputs and the analytic results into five broad lines of effort (LoE) that address common challenges to all four Marine Corps M&S communities and is consistent with mitigating the issues across all elements of the Marine Corps Total Force. This new draft policy will enable the Marine Corps to field robust M&S capabilities across the fleet that support the diverse set of modeling, simulation, and analysis requirements from the full complement of Marine Corps activities, operations, and decision makers. The Marine Corps M&S five lines of effort are:

- Develop and implement M&S policy
- Establish and maintain enterprise technical frameworks

- Improve the use of M&S across the Service
- Shape the M&S workforce
- Synchronize M&S research

LoE 1: Develop and Implement M&S Policy

LoE 1 sets the “left and right lateral limits” of what a Marine Corps M&S enterprise should accomplish. The draft policy that this paper is discussing is meant to be the enterprise level policy in support of LoE 1. Within the draft policy is direction and guidance from external DoD requirements and internal HQMC that is intended to support Marine Corps M&S management of capabilities for Service-level requirements as well as Joint and Coalition requirements. Each community will be required to develop and implement subordinate policies to specifically describe internal efforts to minimize duplication and encourage reuse. One of the main gaps within subordinate community existing policy is to clearly articulate the intended purpose of M&S capabilities to support the specific community and unambiguously outline distinct roles and responsibilities of organizations within the community. In addition, the subordinate policies can identify unique LoEs but must include coverage of the five enterprise LoEs. The community policies will need to specify guidance for supporting research and development and prescribe limits to proprietary solutions and data. The policy LoE must be endorsed by the most senior levels of Marine Corps leadership or the entire enterprise management effort will fail.

LoE 2: Establish and Maintain Enterprise Technical Frameworks

This LoE is the most tangible effort that historically engineers have accomplished in several independent, and non-connected manners. Under the new draft policy technical standards, architectures, networks, and simulation environments will begin to be unified at the enterprise level. Legacy policy has hinted at the need to share tools, data, and information across the Marine Corps M&S Enterprise. LoE 2 outlines the specific actions that must take place to develop and use interoperability standards, require increased visibility of data, and verify the reuse of M&S capabilities. The actions within this LoE direct the communities to leverage M&S capabilities that already exist or are under development across DoD, other government agencies, industry, and academia as applicable. Moreover, to effectively manage and synchronize M&S as an enterprise technical capability, the business architectures and governance approaches must be united under an informed portfolio management initiative. The framework LoE will have significant interactions between enterprise network and service providers and the operational communities that are the user community of M&S capabilities. Prior to this draft policy effort, M&S capabilities have typically been implemented in isolated enclaves that were never designed as a reusable enterprise capability. Actions within this LoE will include exploratory analysis efforts that will examine the impacts of future cloud and network migration efforts with the operational needs of the M&S communities. Without an effective enterprise framework, the Marine Corps risks consolidating M&S capabilities into data centers that are compliant with policies but disconnected from the intended users—essentially creating safe and secure “shelfware.”

LoE 3: Improve the Use of M&S Across the Service

M&S is used in pockets across the Marine Corps that do not currently gain the benefits that one pocket might develop, which causes redundancies for each community pocket redeveloping the benefits. Moreover, the lack of efficiencies are more pronounced for communities that are unaware of solutions and continue to report “gaps” in capabilities. To improve the use of M&S, the draft policy begins by mandating the development and implementation of technical standards and standardized data from approved authoritative data sources. To the external audience, “mandatory” standards within the DoD Information Technology Standards Registry (DISR) might imply “mandated usage,” but that is not the case. LoE 3 requires the development of an M&S technical standards profile (TSP) at the enterprise level and further requires new and legacy updates to implement the standards listed in the TSP. In addition, on-demand net-centricity is required for new M&S capabilities that will have documented, transparent, and operationally validated conceptual models. The Marine Corps is implementing a conceptual modeling working group to define in precise operational terms what the elements of a “realistic simulation environment” are required as a superset of each community’s requirements. The intent is to ensure that each “pocket” is using standardized tools, data, and information which will dramatically improve the Marine Corps’ ability to conduct M&S Verification, Validation, and Accreditation. The actions within LoE 3 will improve the M&S impacts within individual communities while greatly improving the cross-community impacts to break the “isolated pockets of excellence” paradigm that is impeding Marine Corps M&S capability evolution.

LoE 4: Shape the M&S Workforce

All of the policy, enterprise frameworks, and data standardization will be for naught without a properly educated, positioned, and resourced workforce. In essence, M&S does not run itself. LoE 4 provides M&S users access to expertise and information at the desired location of need. In addition, education and training content must be developed or located and then delivered to increase the workforce's ability to plan, prepare, execute, and assess M&S capabilities. This includes efforts to ensure personnel support the development, sustainment, and uses of M&S in support of Marine Corps missions across all the communities. Once the active duty, government civilian, and contractor workforce have access to the necessary educational content, the force structure will identify gaps of personnel and skills sets required across the Marine Corps. The positioning of the correct workforce is critical to improving the visibility and knowledge of government, industry, and academic M&S opportunities. Moreover, the draft policy directs exploring if M&S certification is required and establishes activities to ensure best practices are utilized for a potentially much larger M&S workforce. Without the dedication to shaping the M&S workforce, nuances of the complexities that enterprise M&S brings will be poorly implemented and continue to contribute to ongoing challenges such as contracting for M&S and cyber security of M&S systems.

LoE 5: Synchronize M&S Research

All communities have "unknown unknowns." For the M&S community within the Marine Corps, science and technology research is the focus of effort meant to explore the current "known unknowns" and is the center of LoE 5. The Marine Corps develops science and technology objectives (STOs) independently across the MAGTF and M&S related research areas creep into various MAGTF STOs. In addition, there are several research communities with competing priorities and potential solution sets that do not have formal information exchange or research collaboration agreements. This LoE begins to direct the various internal Marine Corps research efforts to synchronize research topics, funded research efforts, and possible solution applications across the various MAGTF gaps. The research will be directed to integrate with the capabilities-based approach that the Marine Corps implemented to develop future warfighting capabilities. Marine Corps effort in this area needs to leverage research activity taking places across DoD, industry, and academia to maximize a unity of effort with the limited research funding that exists within the Marine Corps. Ultimately some of the Marine Corps' challenges are being research by similar organizations, and it is much easier to "join" someone's research team to provide guidance (as applicable) than it is to acquire additional funding.

DRAFT POLICY OVERVIEW

The previous but still existing policy is limited to establishing the commander's intent of managing M&S via a MCMSMO and a four community IPT. It includes tasks that cover the active duty M&S officer graduate education and M&S standards, but does not provide sufficient guidance—beyond directing the development and implementation of a Marine Corps M&S enterprise strategy—to implement specific actions sufficient to manage M&S as an enterprise, cross-community capability. The new draft policy continues the existing tasking and establishment of the MCMSMO with a four community IPT, but also defines an expanded role for MCMSMO.

The current draft mission statement of the Marine Corps Order (MCO) is: "Establishes the role of the Marine Corps M&S Management Office (MCMSMO) in providing oversight and coordination of M&S throughout the Marine Corps and provides Service-level guidance for the development and implementation of M&S capabilities across the Marine Corps, in order to efficiently manage the significant investment in M&S technologies, mitigate risks, and eliminate barriers to mission accomplishment for the Marine Corps."

The new policy establishes five areas of focus to ensure enterprise M&S management:

- Maximize the reuse of technical solutions across the entire Marine Corps for Service-level solutions that are consistent across both active and reserve forces.
- Ensure existing development cycles are efficiently using resources and better linkage with the Marine Corps Enterprise Integration Plan (MCEIP) for future requirements.
- Deliver capabilities to wherever and whenever Marines need the capability to include the tactical ashore or afloat deployed environment across all elements of the MAGTF and echelons.
- Maximize commonality across M&S communities to improve interoperability between communities with the most effective and efficient solutions.
- Critically analyze compliance with other Service-level initiatives and policies that affect the M&S enterprise while ensuring M&S initiatives are coordinated and institutionalized.

In addition, the five LoEs above are established to govern the various activities across the DCs and elements of the MAGTF. Each LoE follows a specific pattern to begin implementing an enterprise management process. For a given desired end-state, the community leads are responsible for polling their subordinate communities for feedback from the ground up. The community leads then provide the MCMSMO recommendations via the IPT. At the IPT the MCMSMO ensures cross-DC interests are coordinated and resolved. Once resolved, MCMSMO consolidates the final recommendations into an authoritative product that is submitted to DC, CD&I for signature to establish it as a Marine Corps enterprise management document. For future years, the IPT is established as the process vehicle for recommended changes to any enterprise management document. This pattern for developing “top down” policy documentation via a “bottoms up” approach is repeated across each LoE and has been endorsed as a valid pattern by the M&S communities.

Lastly, the draft policy document provides the guidance and establishes the LoE, but without specific actions assigned to specific organizations, the risk is that the status quo will not change. Therefore, the draft policy also contains an enclosure that expands upon each LoE by organization. The enclosure tasks the community leads to conduct activities within the scope of their individual community and then communicate results to DC, CD&I. In addition, the DCs that have policy that crosses into the M&S domain are tasked with reviewing said policies with DC, CD&I for areas of conflict or adjustment that may need mitigation to be effective. In addition, organizations with unique mission sets are given tasks to help advance the state of the M&S domain. For example, the Marine Corps Warfighting Lab (MCWL) is the Marine Corps lead for experimentation. Within the new draft policy, MCWL is tasked with conducting experiments to identify areas where M&S standardization can be enhanced. Moreover, since M&S permeates the entire Marine Corps at all echelons of command, the draft policy outlines tasks for all Commanding Generals, Commanding Officers, and Officers-in-Charge of the Operating Forces and Supporting Establishment. These extremely detailed taskings will ensure that the M&S enterprises management can be rapidly and effectively implemented across the Marine Corps.

LESSONS LEARNED

MCMSMO began the effort to revamp its Service M&S policy initially focused on how best to implement LVC technologies across the Marine Corps. As our analysis moved forward we realized we needed to take a broader look at how M&S in general supports the Marine Corps and specifically how our office could best be used to help our stakeholders access the tools, people, data, and research they needed to support their specific use of M&S. What we quickly discovered is there is no appetite for “more coordination.” Coordination is necessary, but it is only a part of what any office does in the conduct of its mission. Coordination is not a substitute for action or a replacement for a solid set of useful deliverables.

A Service-level M&S office needs to provide value in the form of deliverables that help each set of Service M&S stakeholders perform their functions better. The value needs to be based on leading efforts that all Service M&S users benefit from, but no single user is responsible. Examples include M&S technical standards, reference architectures, workforce development, and synchronized S&T efforts. While MCMSMO is already leading some of these efforts for the Marine Corps, like the other Service M&S offices and DMSCO, it is neither resourced nor empowered to oversee the full complement of activities proposed in this paper.

If the Department and Marine Corps move forward with resourcing and empowering a centralized M&S office to lead the full complement of identified enterprise-level activities it will encounter resistance. During the initial staffing, one organization resisted endorsing the change because their organization was being assigned tasking that would require its own additional resourcing just as MCMSMO would require (B. Telford, personal communication Nov 17, 2016). In general organizations are resistant to change, and will naturally resist modifications to the status quo. Yet this should not stop the Services and DoD from making some fundamental changes in the way their M&S offices are organized and used. The framework proposed in this paper demonstrates how a centralized office can provide value with specific deliverables that support multiple M&S stakeholders. The leads for these offices should be resourced and empowered the identified challenges, and be held accountable for closing specific gaps.

The ideas summarized in this paper and documented in the draft USMC policy have been briefed to the DoD and Service M&S offices as potential solutions to the issues being brought up at the department level. These briefs have been well received and spawned several follow-on discussions to try to advance the state of the problem. However,

tangible action items allude the effort, and the Marine Corps' policy recommendations remain recommendations instead of solved problems.

Accountability is the key. It is the authors' belief that the proposed framework offers the Department and Services a means to establish centralized M&S offices that are responsible for the delivery of specific actions. In doing this the M&S office can provide direct value to the stakeholders they are tasked to support, and overcome initial fears that the office is going to take an authoritarian approach for all things M&S. A resourced, centralized M&S office cannot solve "world hunger" but it can be used effectively as a means to address Department or Service-level challenges with products that enable all its stakeholders to use their specific sets of M&S tools, applications, and data more effectively. Until such a time is realized, the Marine Corps and DoD will persist to re-identify well-known, interoperability challenges and continue to admire the problem, while the cycle continues.

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