

Developing U.S. Service M&S Professionals: Inter-Service Differences in the Education, Training, and Management of Uniform and Government M&S Personnel

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ABSTRACT

It is said time and time again: "We are only as good as our people." It is critical to have uniformed officers and government service personnel significantly involved in properly shaping modeling and simulation (M&S) programs as the services increasingly adopt M&S; live, virtual, and constructive (LVC) simulations, virtual environments (VEs) and digital engineering (DE) solutions that address training, acquisition, and assessment missions. Yet, investment by the defense establishment and the military services in recruiting, educating, promoting, retaining and utilizing uniformed and government M&S professionals is mixed at best. Each service designates these officers and civilians differently, with the Army having a functional area (57) and career program (36), the Navy a subspecialty (6202), the Marine Corps a military occupational specialty (8825), and the Air Force identifies three special experience identifiers for M&S that cover positions that require awareness, management or senior leadership skills. However, these differences are more than semantics. The differences between the Army and Navy show just how dissimilar different service approaches can be. For example, the Army has scores of billets requiring an FA-57, and once Army officers become FA-57s they will almost always fill an M&S billet. In contrast, the Navy has significantly reduced the number of billets requiring an M&S subspecialty code, and Navy officers who receive that designation may never serve in an M&S position during the remainder of their careers. This paper describes the education, training and workforce management of uniformed and government M&S professionals in the U.S. military services. It then presents applicable insights and lessons learned, looking specifically at similarities and differences in how the services recruit, educate, train and manage their M&S workforces. The goal is to better educate and empower warfighting simulation professionals.

ABOUT THE AUTHORS

COL Joseph Nolan serves as the Deputy Director of U.S. Army Modeling and Simulation Office which includes Army enterprise-level M&S policy and strategy (Strategy and Resource Division), and M&S workforce development and management (Simulation Proponent Division). COL Nolan has over 23 years of military service, most recently as the Chief of Simulations, U.S. Air Force Central Command's Integrated Air and Missile Defense Center, Al Dhafra Air Base, United Arab Emirates. He has served in various operational assignments including infantry platoon leader, mortar platoon leader and battalion logistics officer in Panama, Brigade Logistics Officer, Infantry & Headquarters Company Commands at Fort Benning, GA. His staff assignments include U.S. Joint Forces Command where he served

as an exercise planner and Chief of the Joint Advanced Training Technology Laboratory in Suffolk, VA and Army Staff as the Simulation Operations (FA57) Proponent Officer at Fort Belvoir, VA. His awards and decorations include Bronze Star Medal, Expert Infantry Badge, Basic Parachutist and Air Assault badges, and the Ranger Tab. He holds a Bachelors of Arts from the University of Detroit-Mercy and a Masters of Modeling, Virtual Environments and Simulation from the Naval Postgraduate School. He is a graduate of the U.S. Army Infantry Basic and Advance Courses, the U.S. Command and General Staff Course, the U.S. Army War College as an Old Dominion University Fellow, and Functional Area 57 Qualification and Advanced courses.

Brett Telford is the Director of the Marine Corps M&S Office. He began working for the Marine Corps in 2007 following a 20-year career in the United States Air Force. In this capacity, he acts as the Marine Corps point of contact for the development of Joint and service level M&S policy. In addition, he leads the Marine Corps M&S Integrated Process Team (IPT) that seeks to leverage activities across the fleet and improve the use of M&S throughout the Marine Corps.

Dr. Imre Balogh is the Director of the Naval Postgraduate School Modeling, Virtual Environments and Simulation (MOVES) Institute and has been working in the area of combat M&S for the past 23 years. He is currently doing research on dynamic behavior modeling in high resolution, agent based combat simulations. Prior to joining the MOVES Institute, Dr. Balogh was the chief architect of the Combined Arms Analysis Tool for the 21st Century (COMBATXXI).

Perry McDowell was a naval officer from 1988-2000 and earned a M&S degree in computer science at the Naval Postgraduate School, where he was awarded the Grace Murray Hopper Award as outstanding computer science student. In 2000, he returned to NPS and joined the faculty in the computer science department and was a founding member of the MOVES Institute. From 2003-2012 he worked primarily as the executive director for the Delta3D open source game engine. From 2012 to the present, he has taught courses in simulation and performed research and development in training effectiveness and the creation of systems to improve warfighter performance.

Dr. Edward Degnan has worked M&S in the military, academia, industry and government. Dr. Degnan is retired from the military where he spent nine years working on design, application and analysis of interactive computer simulations for both the Army and the Air Force. Currently, Dr. Degnan is the Division Chief for M&S Foundations at the Air Force Agency for Modeling and Simulation (AFAMS). His division is responsible for establishing an Integrated Architecture that supports the Air and Space Live-Virtual-Constructive Environment (IA-ASLVCE) and for the establishment of an AF M&S Workforce.

Dr. Ivar Oswald is a Senior M&S Analyst for the Alion Science and Technology Corporation. He defines M&S requirements, assesses their value, proposes design and development concepts, and evaluates their application. He has also defined measures of merit that reflect M&S effectiveness and return on investment. Currently, he supports the Navy's M&S Office and the Naval Research Laboratory in policy, planning, analysis, and M&S Verification, Validation, & Accreditation (VV&A).

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INTRODUCTION

It is hard to overstate the importance of modeling and simulation (M&S) to both the United States and its military. A decade ago the House of Representatives passed House Resolution 487 (2007) which recognized “modeling and simulation as a National Critical Technology.” The resolution specifically touted the benefits M&S provided in nuclear weapons testing, homeland security exercises, simulated training, healthcare, weather forecasting, environmental modeling, critical infrastructure development, and space exploration. It also recognized that having a superior workforce was essential to maintain the United States’ edge in M&S, calling for education in the technical subjects needed to populate the M&S disciplines, expanding M&S in higher education, and supporting the development and implementation of specific codes for M&S occupations to better manage the workforce. The military services have also been strong advocates for using M&S to improve the warfighting ability of troops, as shown by senior leadership quotes in Table 1. . Despite statements from a past president and the unanimity of the services’ recognition of the importance of M&S to maintain the U.S military’s superiority, which requires the best workforce to produce, there are vast differences in how each service addresses hiring, promotions, career path management, training, education and retention of their uniformed and government M&S professionals. Likewise, there are significant differences between how each service utilizes its civilian M&S workforce. This paper describes how each service performs these tasks and then discusses commonalities and differences between the services’ approaches.

Table 1. Importance of M&S to the Military

NCA - “Orlando Florida has 100 computer simulation companies. Why? Because it’s Disney World, Universal Studios, entertainment arts, video games, sports games, and The Pentagon. What do they all have in Common? They need computer simulation.” – *President Bill Clinton (Clinton, 2011)*

USA - “The use of training simulations and technology is an integral part of the Army Force Generation process.” – *Lt. Gen. Mick Bednarek, Commanding General, First Army (Command Profile, 2012)*

USMC - “We have a moral obligation as leaders to make sure that those soldiers, sailors, airmen and Marines that we send forward are ready... [Simulation] is the one key to get us there at the best bang for the buck, no doubt in my mind.” – *U.S. Marine Corps Maj. Gen. Glenn Walters, (Insinna, 2012)*

USN - “We must sustain judicious and stable investments to preserve the advantages we hold in this dynamic and increasingly complex environment. Examples include... investments in modeling and simulation...” – *Statement of Admiral C. D. Haney, Commander, United States Strategic Command (U.S. Strategic Command, U.S. Transportation Command, and U.S. Cyber Command, 2015)*

USAF - When I look at the change in simulation and the difference between F-22 and F-35, my expectation is I will be able to do more in the F-35 in a simulator... That change in the capability of simulation - and concurrent increase in the ability for us to make use of it - will continue.” – *Gen. Edward Rice Jr., Joint Base San Antonio-Randolph, Texas. (Biron, 2012)*

U.S. MILITARY SERVICE APPROACHES

U.S. Army

M&S is a core enabler across all domains supporting Army operations. From training to test and evaluation, experimentation to analysis, and including intelligence and acquisition, M&S serves as a critical capability to help prepare Soldiers for combat, determine future force structure, drive portfolio investment strategies and validate new concepts. But M&S technology is only part of the equation. The Army needs a trained and educated workforce whose role is to serve as the commander's interface between operations and technology. Recognizing this need, the Army developed two separate and mutually supporting M&S career fields: the Functional Area 57 - Simulation Operations Military Officer program (FA57) and the Career Field 36 – Analysis, Modeling & Simulation for Department of the Army Civilians (CP36). Both the FA57 and CP36 provide the Army with a cadre of professionals who can not only get the most out of M&S, but also help navigate the constantly changing world of technology to ensure the Army maintains technical superiority in M&S.

The FA57 program began in 1995 as an initiative to establish a critically needed capability to manage and exploit simulation environments for training (Shinseki, 2001). The initial goal of the program was to assist commanders in integrating LVC simulations into training programs and military operations. Officers equally adept at military operations and simulations, FA57s initially served at operational units providing M&S capability. Today, FA57s have expanded to the wide range of M&S enabled activities at the enterprise level. As the Army has weathered over a decade of conflicts across the globe, FA57s have changed to meet increasing demands from the field. As most formations at company and above fight using mission command systems, the FA57s had to become subject matter experts on not only stimulating these systems with appropriate simulations, but also on how to manage the information these systems provide to drive decision-making. During this time, FA57s developed two additional core competencies beyond simulation operations for the Army: mission command systems integration and operational knowledge management. By serving as the nexus for linking people, process and technology, today's FA57s serve as a true technical enabler for the Army by increasing readiness, throughput, analysis, productivity and other critical needs (Army Modeling and Simulation Office, 2017). The FA-57 career path is shown in Figure 1. (A larger version can be seen at http://www.ms.army.mil/sp-div2/fa57/career_path.html.)

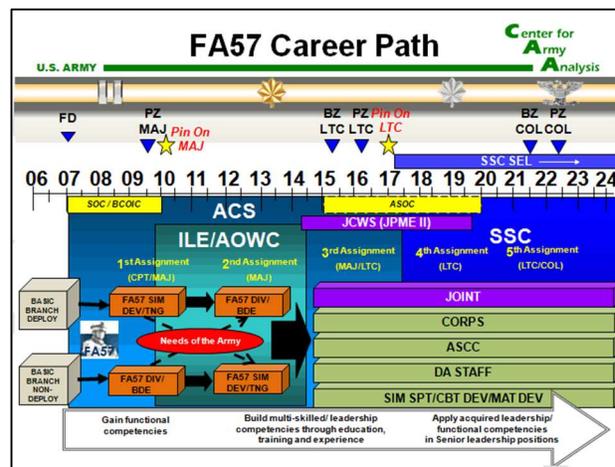


Figure 1. Army M&S Officer Career Path

FA57s are mid-career Army officers that voluntarily select to change their primary military occupational specialty to Simulation Operations. These officers are evaluated for operational performance, academic focus areas and strength of career. Once selected, these officers will only serve in FA57 coded billets and will be career managed and promoted within this military specialty (Department of the Army, 2010). This means that FA57 officers only compete for promotion against other FA57s. FA57s attend an 8-week Simulation Operations Course at Fort Belvoir, VA, where they learn the fundamentals of M&S as well as how to use this capability using a hands-on technical application. Based upon subsequent assignments, FA57s will attend follow-on training on knowledge management and mission command systems at Fort Leavenworth, KS. Upon completion of these courses, FA57s report to their first unit. The Army Modeling and Simulation Office (AMSO) offers a continuum of education for FA57s which includes both Intermediate and Advanced Simulation Operations Courses designed to provide “just in time” training and education linked to officer promotion. These courses focus on executive-level management of M&S for senior leaders.

FA57s training is complemented by education opportunities which include fully-funded advanced degree programs to obtain a MS in an M&S discipline, and a PhD in an applied science within the M&S domain. FA57s selected for graduate programs are expected to complete a rigorous multi-year education program and complete either a thesis or directed project addressing an Army M&S capability gap or need. Currently, FA57s attend advanced education at the Naval Postgraduate School (NPS), University of Central Florida, Old Dominion University and Columbus State

University. FA57s who do not have the opportunity to attend a fully funded graduate program are encouraged to continue their professional development through numerous online certificate and degree programs that are free or at minimal costs to the Soldier. In order to facilitate this requirement, AMSO maintains an updated repository of education and academic institutions providing these types of M&S services.

In addition to the training and education opportunities previously discussed, FA57 officers can serve in a “training with industry” assignment where they serve on a 1-year assignment as an Army officer embedded with an industry partner learning how the business community operates to best inform M&S strategy and portfolio decisions. FA57s also have the opportunity to complete both academic fellowships as well as ones with organizations such as the Defense Advanced Research Projects Agency. Although these opportunities may be little known, AMSO constantly makes efforts to ensure the field has awareness of these unique assignments.

In May of 2001, the Army’s Deputy Chief of Staff for Operations, LTG Ellis, identified a requirement to establish an M&S Department of the Army (DA) Civilian program to complement the FA57 military specialty, and the Army fully approved the CP36 field in 2005 (Denning, 2005). Today, CP36, which includes analysis, modeling and simulation associated job series, provides educational funding for individuals who develop, use, manage and/or integrate M&S throughout the Army (Department of the Army, 2016). Careerists can select and attend analysis, M&S (AM&S) professional development opportunities described in the Army Civilian Training, Education and Development System (ACTEDS) (Army Modeling and Simulation Office, 2013). ACTEDS not only provides funding resources and information on academic programs that support AM&S, but also informs careerists on developmental gates for self-improvement, provides career guides and assists with building a path towards success that is unique to the career civilian.

CP36 civilians work in a wide variety of organizations including program offices, research labs, technology development and engineering facilities, analysis centers, test ranges, logistics hubs, training centers and ranges. These careerists support AM&S activities throughout the acquisition process from requirement analysis through concept development, developmental test, operational test, fielding and sustainment. These CP36 professionals help commanders apply live, virtual, gaming and constructive simulations to a myriad of applications that support Army operations. The CP36 careerists serve as the continuity for commanders and staff on how to leverage this technology to improve Army analysis and readiness.

CP36 recruitment is a critical personnel lifecycle function performed by AMSO. This takes the form of a tailored CP36 intern program managed by AMSO’s Simulation (personnel) Proponent and School. AMSO participates in college job fairs and directly engages new candidates for government service to recruit the best and brightest for this critical career field. Once identified, applicants who are selected by the rigorous screening process enter a training process similar to the FA57s, after which they enter a two-year internship program as a GS-7. After each successful year within the assignment, the intern advances two pay grades, finishing as a GS-11 who is then placed into a permanent position, normally at the same command at which they completed their internship.

Both the FA57 and CP36 programs continue to succeed in meeting the Army’s requirement for providing modeling, simulation and analysis (CP36 only) expertise, but challenges remain for the future. First, the M&S and analysis workforces need to continue to tell their Army story simply and consistently in order to help commanders and staffs understand this critical capability. Oftentimes, the complexity of M&S technology or level of detail in an analytical product clouds the original question that leadership is seeking to answer. FA57s and CP36s need to use their strength and depth of understanding of technology to help commanders make more informed decisions. This is also critical to ensure both civilian and military programs maintain access to resources for training, education and workforce development. Second, the Army needs to continue to recruit and retain both successful officers and talented civilians to work in this much-in-demand career field. For CP36 in particular, it is critical that it continues to engage with colleges and universities to encourage graduates to consider a career as a CP36 DA Civilian. Lastly, the Army needs to ensure that workforce training and education programs constantly assess themselves to ensure it can provide quality developmental programs that are current and meet current and emerging requirements. AMSO conducts cyclical workforce analyses to ensure its products continue to meet the needs from the field, but it must remain vigilant to stay current lest it falls behind and becomes dated. Despite these concerns, the FA57 – Simulation Operations military program and the CP36 – AM&S DA civilian program remain strong examples of how the Army is meeting the need to provide commanders, staffs and organizations with the ability to properly leverage technology and analysis to improve the Army’s number one priority - readiness.

U.S. Marine Corps

In 1974, Commandant of the Marine Corps, General Robert Cushman, said, “I still need Marines who can shoot and salute. But I need Marines who can fix jet engines and man sophisticated radar sets as well.” This observation acknowledged that in a world driven by advanced technology, which now includes M&S, military professionals have an obligation to understand how to use modern tools relevant to current and future mission requirements.

The core of the Marine Corps M&S expertise can be found in the 8825 military occupational specialty (MOS) positions, also known as M&S officers. Currently there are sixteen 8825 billets spread across the Marine Corps. These billets support all aspects of Marine Corps activities, from training to systems engineering to analysis. Additionally, a limited number of billets support joint activities at Joint Staff (J7), the Expeditionary Warfare Training Groups, and the Office of Naval Research. Over the past several years they have proven extremely valuable in helping the Marine Corps take full advantage of M&S capabilities. Specifically, in his 2017 CMC Institutional-Level Task List for Deputy Commandants and Commanders, the Commandant directs, “we will add a simulation billet to each of the MAGTF training commands and MEF staffs. These Marines will be responsible for advising commanders on the incorporation of simulation and emerging technology into MAGTF exercises.” (Neller 2017)

While the Marine Corps is now moving towards having M&S capabilities that the modern world requires, this is a relatively recent development. Prior to the last twenty years, the Marine Corps had no active duty M&S workforce, despite having procured and applied computer-driven simulation systems since the early 1970s. In 1999, the first Marine officer enrolled in a new M&S curriculum at NPS entitled Modeling, Virtual Environments and Simulation (MOVES). Upon graduation in 2001, this officer became the first and sole Marine with a secondary MOS of 8825 and conducted an M&S officer tour at Training and Education Command (TECOM) developing training system requirements. After a three year “payback” tour, he returned to his primary MOS for the remainder of his career. This established the pattern for how the Marine Corps utilizes 8825 officers – graduate M&S education and a three-year payback tour in an 8825 billet followed by returning to the officer’s primary MOS.

By 2007, because of the importance of M&S, 13 billets had been established throughout the Marine Corps that required 8825 qualified officers. However, at the time only four of these were filled due to a lack of qualified officers. This was due to the difficulty of getting officers qualified. The stringent academic requirements of the MOVES degree program along with Marine officers not understanding the value of this education resulted in very few choosing to enroll in the program. A consequence of this was an annual graduation rate between one and three officers which was not sufficient to keep all of the billets filled. In 2007, the Marine Corps M&S Management Office (MCMSMO) moved from TECOM to a direct reporting office to Deputy Commandant, Combat Development & Integration (DC, CD&I). At this time, MCMSMO was directed to act as the 8825 MOS occupational field manager. This made MCMSMO responsible for developing the MOS qualification requirements, working with 8825 billet owners to understand their specific needs, making recommendations on M&S officer placements, and ensuring the MOVES curriculum met the needs of the Marine Corps. Until this time, little formal management of the 8825 MOS had taken place and filling the gaps in needed active duty M&S manpower became a priority for MCMSMO.

In 2008, MCMSMO began its effort to expand the number of M&S officers available to the Marine Corps. To better understand the needs of the various commands, MCMSMO sent out a service wide data call to collect information on how M&S is used throughout the Corps. This information was used to refine policy, define new billets for M&S officers and to update the active duty M&S officer core skills set. At this time, the M&S MOS Manual, which describes the skills, education, and duties of a Marine Corps M&S Officer, was revised using the insights gained in this process along with input from the officers who were filling the 8825 coded billets. The final version of this manual was synchronized with the enterprise guidance from Marine Corps leadership. A critical element to the success of this effort was the inclusion of active duty 8825 officers who helped by being able to reach out to fellow Marines and by also ensuring that the operational perspective was accurately represented. By performing this mission analysis, MCMSMO laid a solid foundation for the M&S officer community.

During that same time, MCMSMO embarked on a strategic communications plan to increase the number of qualified Marine officer applicants to the MOVES program. This effort included identifying all officers who were eligible for permanent change of station orders and who met the technical requirements. MCMSMO and the NPS Alumni Office coordinated the development of informational material about the M&S degree program, M&S usage across the Marine

Corps, and various M&S officers' personal feedback. This informational package, which included material like that shown in Figure 2, was then emailed to the high potential candidate officers. The results of this communication effort increased the qualified applicant pool from three to seventeen officers in one year. Because of this outreach, the USMC

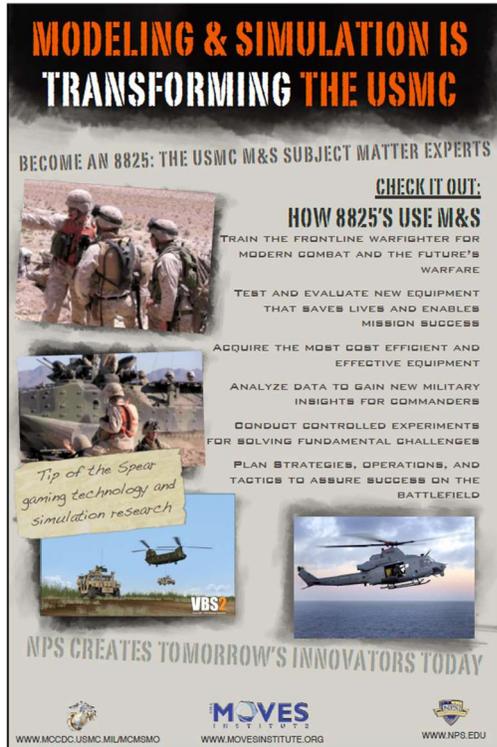


Figure 2. Promotional Information for Potential 8825 Officers

Special Education Program selection board was able to more than double the quota of students sent to NPS from three to seven officers to attend the MOVES program.

MCMSMO also began to reach out to major commands to explain the capabilities an active duty M&S officer could provide. Up to this point, the typical Marine Corps command did not have an adequate understanding of M&S officer capabilities. In addition, the formal process to administratively change billets so that they could be designated as 8825 billets was cumbersome and not widely known. Therefore, MCMSMO began facilitating changes of billet designations. MCMSMO assisted in completing the documentation required for billet changes to minimize the administrative burden on the gaining command. This proved to be a critical role that MCMSMO still fills. MCMSMO continues to work with the Marines at NPS and the officer assignments office to match a graduating Marine's skills and expertise with the billet requirements. This role has proved to be an invaluable tool to ensure the "right Marine for the right job."

In 2015, DC, CD&I became the MOVES curriculum sponsor with MCMSO¹ providing oversight of curriculum requirements and coordination for the degree program. In May 2016, DC, CD&I and NPS completed a MOVES curriculum review. The review was based on a broad MCMSO-led analysis of M&S officer operational requirements, emerging issues, and the existing curriculum. This detailed input from the curriculum sponsors ensures that the educational content of the program meets the operational needs of

the Corps while maintaining the academic rigor required of top quality graduate education in M&S. Working with the MOVES faculty, AMSO, and the Navy M&S Office (NMSO). MCMSO developed a plan to revise the MOVES curriculum to reflect the recommendations of the review which is currently being implemented.

Unlike the Army, the Marine Corps does not have a career professional program that seeks to improve civilian workforce M&S skill sets. Instead, the Marine Corps has community of interest (COI) leads based on specific civilian job series that have limited resources for use in maintaining job series specific skills. While nothing precludes these COI leads from making M&S education available to their members, most do not know of the opportunities that exist. A next step for MCMSO will be to reach out to the COI leads and make them aware of the numerous training and education opportunities available to their community. Finally, while there is currently no such thing as an M&S civilian job series, it has been suggested that MCMSO should work with Marine Corps M&S stakeholders to determine if specific civilian billets may benefit from establishment of M&S "oriented" requirements in knowledge, skills and abilities that could be included in future position descriptions.

While the Marine Corps will never have the number of M&S personnel that the larger services have, it has come a long way. This effort will continue to increase as the expansion of M&S applications and the technology's ability to support mission requirements across the Marine Corps continues to grow. To take full advantage of what M&S can offer requires having the right people, in the right place, at the right time. That is why full time active management of an M&S workforce is required, and why MCMSO makes it a priority. Active management of M&S officers will ensure that not only can the Corps fix jet engines and operate radar systems, but it will be able to simulate them also.

¹ The official title of MCMSMO was changed to Marine Corps Modeling and Simulation Office (MCMSO) in 2016, but the personnel and responsibilities have remained largely the same.

U.S. Navy

M&S education, training and workforce management in the U.S. Navy are decidedly mixed. While there have been some significant recent successes, especially regarding the education of civilian workforce personnel at Naval Air Systems Command, there has been a dramatic decrease in the number of uniformed officers achieving the relevant subspecialty designation (6202), to the point that the subspecialty may be eliminated entirely.

In the Navy, officers are divided into general categories (e.g., unrestricted line, restricted line, staff corps), and further divided into sub-groups based upon their primary warfighting specialty (e.g., surface line, aviation, submarines) Officers who have received additional education or served in specific billets can earn a subspecialty designation to reflect their additional skills. Subspecialty codes, as well as the requirements for officers to receive one, are described in Part B of the Navy Officer and Manpower Classifications Manual. This reference designates M&S subspecialists as having code 6202, and these officers are commonly referred to as “6202s.” Similar to the Marine Corps, the most common path for a Navy officer to be designated with a 6202 subspecialty code is to earn an MS degree from MOVES at NPS.² NMSO is the Navy office identified for oversight of the 6202 subspecialty (Department of the Navy, 2017).

“Managing the workforce must evolve from industrial age practices aimed at simply filling vacancies to ensuring personal career interests, professional development needs and mission demands are all considered throughout the various phases of a Naval career.”

*Mr. Ray Mabus, Secretary of the Navy, DON
Innovation Vision, April 2015*

In 2012, a DON M&S Education and Training (E&T) thrust area was initiated that broadened the focus to include government service (GS) personnel, especially within the acquisition systems commands. This initiative recognized that the acquisition and employment of increasingly complex systems, combined with significant advancements in software technology, necessitates the modernization of Naval E&T, especially in the discipline of M&S. Figure 3 shows associated E&T requirements that arise from the expanded role M&S plays in acquisition.

As a result of this thrust area, a Naval M&S E&T Working Group was created that meets bi-monthly and provides M&S requirements, products and suggested M&S efforts and lessons learned. A career model was developed and associated with a core course structure and coordination was conducted with academia (NPS, UMD, ODU, UCF, GT, etc.). A NAVAIR School of M&S was established with an associated certification and master’s program, through Old Dominion University, and there is an ongoing effort to identify and compile lessons learned.

Regarding the School of M&S: “M&S education is a critical component for maintaining a qualified and knowledgeable workforce capable of supporting the needs of DoD and NAVAIR Programs. The goals are to identify education and training needs and to offer courses that both provide overall understanding of M&S and demonstrate the value of using M&S throughout the acquisition life-cycle. The courses will deliver an essential understanding of M&S methodologies as well as best practices for use of advanced M&S technologies.” (Markowich, 2014) However, there is currently no government service equivalent in the Navy to the Army’s CP36 program.

To update the Navy’s understanding of its uniform officer personnel, in 2015 MCMSO and NMSO commissioned a study by Johns Hopkins/APL. The study identified:

- 20 billets that are currently identified as M&S subspecialty related, 16 billets that perform M&S duties but are not identified as M&S subspecialty related, and 35 billets that were at one time in the past 5 years classified as an M&S subspecialty requirement.
- 51 major commands and subordinate commands that are directed to perform M&S duties and tasks by 55 Navy M&S policy documents.
- 24 other candidate commands to be investigated for Navy M&S subspecialty applicability based upon similar USMC requirements.
- 77 commands that may have need of a Navy M&S subspecialty billet. (Whittington, 2015)

² More specifically, this earns the 6202P code. Other codes for M&S officers are 6202D (for PhD), 6202Q (MS plus 18+ months in an M&S billet), and 6202S (no MS degree, but 18+ months in M&S billet.)

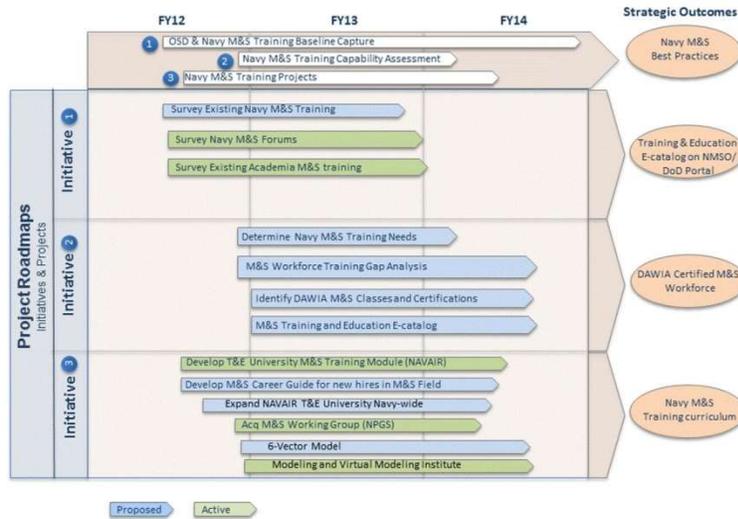


Figure 3. DON Strategic Thrust: M&S Capability for E&T

These resulted in a total of 97 commands within DoN/DoD/joint commands that have potential M&S subspecialty requirements. However, this report also noted that currently there are less than a dozen billets that are coded in the Navy as 6202P. In the previous three years (2015-2017), only one Navy officer graduated from MOVES. Currently, only one officer is scheduled to graduate MOVES in each of the next two years.

The importance of the education, training, and workforce management of Navy M&S professionals has long been recognized. The Navy’s Draft M&S Master Plan included: The goal of the human infrastructure enabling support area is to create and maintain a robust community of Navy officers and federal civilian workers by developing and maintaining career-long professional education opportunities and viable career paths that attract and retain talented and committed persons (Jones, 2003). It also included the following objectives:

- Ensure the NPS MOVES Institute remains the DON’s means of providing education in the field of M&S.
- Develop the M&S subspecialty code, with associated subspecialty career path, to attract and professionally reward talented naval officers in the M&S field.
- Ensure the proper billets are coded for 6202 throughout the fleet and shore establishment.
- Develop a means to track and monitor the health of the Navy M&S subspecialty community.

Over the years, there have been many challenges identified in Navy M&S human capital management, including:

- There is a need for both M&S professionals who know acquisition, analysis, training, etc., and professionals who know M&S and how to use it. The M&S workforce is weak on both sides.
- What aspects of M&S require uniformed expertise and what aspects require civilian or contractor M&S expertise? The Navy needs to take a closer look at the CP36 in the Army.
- Need to find M&S homes for university grads, both civilian and military, provide upper mobility in the M&S career field for civilians, and figure out how to get the SMEs the needed certs.
- The 2-3 year “non-observed” fitness report during graduate school can adversely affect an officer’s career. The Navy needs to reverse this immediately by changing the way graduate education is viewed, or it will continue to bleed its best and brightest in M&S (Department of Defense, 2010).

Relative to the first bullet, the commercial world has been actively trying to create a new type of support person they call the DEVOPs (AWS, 2017) (CMU/SEI, 2014). These are educated, trained and experienced developers who are now being educated and trained, as best they can, in operations. While industry believes this is the answer to their difficulties in getting needed solutions that work as they should to the operator, a few years of education cannot replace decades of operational experience. What the Navy could benefit from are OPDEVs - experienced operators who are then educated in the technical and logical uses and implementations of M&S and information technology.

U.S. Air Force

The vision of the USAF is to integrate LVC capabilities to support the warfighter in full-spectrum multi-domain operations. This vision was formally codified as a requirement for the USAF in an initial capabilities document (ICD) for integrating architecture for air & space - live, virtual and constructive environments (IA-ASLVCE) - JROCM 161-11. One of the key capabilities identified in the ICD was the need to develop a dedicated military and civilian workforce that will provide both an operational perspective and long term continuity to develop, maintain, integrate and operate M&S in functional and operational environments. To that end, the AF has been working on the development of the M&S force structure strategy along with associated training and education opportunities for AF M&S military officers and government civilians.

In 2006, the AF completed an initial M&S workforce analysis study. The purpose of the study was to determine whether the current M&S workforce and management structure, or a modification of that structure, would ensure that M&S technology/capabilities are effectively integrated into the various AF organizations and M&S user communities. Of particular interest the study was to provide answers to the following three questions:

- Is there a need for an AF M&S workforce?
- If so, what is the size and makeup of the workforce?
- How would an M&S workforce support the AF user communities?

One of the findings of that study was, “To meet the current and future challenges... there is a need for officers who will provide relevant and current operational experiences while the GS civilians will provide continuity, stability, and long-term job knowledge.” Only through an identified and trained group of M&S experts will the full potential of LVC be realized in order to achieve increased readiness for the USAF.

In 2009, the USAF developed and began to execute the Air Force Modeling and Simulation Workforce Implementation Plan. This plan lays out commitment for the establishment of the M&S workforce and a strategy to promote awareness throughout the Air Force. It was updated in 2016 and gives the vision for an M&S workforce:

- Building a professional workforce that can maximize the capabilities of M&S across all functional domains
- Infusing M&S concepts into the Air Force culture to achieve radical changes in future
- Establishing a professional M&S workforce and education program for the US Air Force
 - Develop officers (Active, Air National Guard and Reserve) with M&S skills
 - Establish M&S special experience identifiers (SEIs)
 - Identify and code specific organizational lines with the M&S SEIs
 - Establish an AF program for preparing officers with appropriate M&S skills
- Developing government civilian employees with M&S Skills
- Establishing and formalizing the Air Force M&S government civilian workforce
 - Examine organizational structure to ensure continuity
 - Identify specific M&S organizations that require government civilian employees with M&S skills
 - Develop a civilian M&S career path with proper training/education/ professional development

In the plan, four core assumptions, along with the vision of the future, serve to unify the focus on establishing an M&S Workforce. The four assumptions are:

- **Operations** - Future LVC will focus on the full gamut of AF operations. Institutionally and operationally, LVC will continue to be a significant enabler of air, space and cyber power. The AF and associated M&S community must ensure its workforce stays relevant to the operational needs of the warfighter.
- **M&S Technology** - Despite advances in technology, LVC will still function as limited abstractions of reality. The LVC community must be articulate about the applicability of specific models and associated simulation results to the accurate depiction of air, space and cyber power.
- **Management Trends** - The LVC community must provide a dynamic, capabilities-based learning environment that promotes continuous growth and exceeds expectations for ease and effectiveness.
- **Resources** - The ability to meet capability requirements generated by the AF will continue to be constrained by the availability of resources. The LVC community must closely scrutinize workforce development programs to ensure efficient support of the AF mission.

A key aspect of the plan is to recruit and maintain individuals with professional competencies in the field of M&S for the USAF as a whole. While the current LVC workforce is small and has primarily been developed in an *ad hoc* manner, the impact is felt across all functional domains of the Air Force. Without a formal process to develop M&S professionals, as workers retire the USAF will continue to face a critical shortage of individuals with the requisite expertise. To address this issue, the USAF has designated the Air Force Agency for Modeling and Simulation (AFAMS) as the proponent to formalize the structure of M&S professional expertise to obtain an M&S workforce capable of achieving reliable and credible results through the application of M&S concepts.

The initial focus of the plan was to establish the baseline for defining the optimal workforce and the associated structure needed to achieve Air Force strategic objectives. This resulted in establishing both fundamental organizational structure and the associated workforce development tenets; e.g., core and non-core competencies, job/task descriptions, potential divestitures and leveraging opportunities, and outsourcing. Further, it defined the unique and customized management and training programs needed to sustain the required levels of competency and institutionalize an efficient M&S knowledge management environment. These activities provided the foundational research necessary to provide a baseline for establishing an Air Force M&S workforce development program. Documents that resulted from these activities were:

OFFICER EXPERIENCE SETS		
Exp Set	Title	Explanation
OS	Modeling and Simulation (M&S) Awareness	Requires completion of the on-line AF M&S Introductory Course (PDS Code K6I) and either (1) 4 months of experience in a valid M&S position overseas (e.g. Korea Air Simulation Center) or (2) 6 months of experience in a valid M&S position in the CONUS.
OW	Modeling and Simulation (M&S) Manager Level	Requires (1) successful completion of either the AF M&S Manager's Course or Army FA57 Course; and (2) personnel must be assigned to a designated M&S position for one year or as determined by the AFPC Development Team.
OX	Modeling and Simulation (M&S) Senior Leader	Requires (1) successful completion of the AF M&S Senior Leader seminar, and (2) personnel must be assigned to a designated M&S position for one year or as determined by the AFPC Development Team.

Figure 4. USAF Officer SEIs

- Air Force M&S workforce review document, which was a two-part study:
 - Workforce performance analysis, to describe the optimal future M&S workforce, document the current situation and define solutions to achieve optimal results.
 - A training needs assessment, which validated the need for instructional intervention and delineated the content and cost of an M&S professional development program. This review established the analytic underpinning of a way-ahead strategy.
- An M&S requirements matrix and an investment strategy plan were developed documenting the findings and serving as the basis to establish a funding baseline for an Air Force Workforce Development Program.

Once the baseline was established, the AF began to take actions required to create a select cadre of M&S experts and establish programs needed to sustain a professional cadre equipped with the requisite simulation expertise to advance M&S technologies to their fullest potential. On the officer side, organizational positions and individuals were identified through one of three SEIs for M&S. Figure 4 shows the three established officer's SEIs. To ensure long term continuity of LVC initiatives, GS civilian positions were formalized and M&S position descriptions are currently being developed, standardized and aligned to the civilian organizational structure. Also underway is an initiative to develop a civilian M&S career path with appropriate training/education/professional development in order to manage M&S resources and utilize M&S tools effectively and efficiently to support the current and future AF strategic and operational objectives. Figure 5 presents the vision of an AF M&S workforce life-cycle that can be applied to a government civilian population.

Of equal importance is the focus to provide M&S education and training for others; warfighters need to be educated and understand LVC well enough to lead the Air Force through an environment that increasingly relies on LVC. Air Force culture has begun to embrace M&S concepts to fully exploit the power of M&S in many areas, including: conducting experimentation; concept exploration; doctrine development; weapon systems design and evaluation; and mission rehearsal, leadership and skills training. Many factors contribute to the gap between the potential of M&S and today's reality, but one of the largest roadblocks to widespread adoption of M&S is uncertainty over how to develop, use and incorporate M&S successfully into existing environments. Increased comprehension and understanding of M&S relationships, concepts and abstractions across functional domains encourages growth of a culture that attaches worth to M&S and promotes acceptance of its value. By pursuing strategies that instruct and convince the warfighter



Figure 5. USAF Civilian Workforce Lifecycle

to recognize instinctively when military proficiency is dependent upon appropriate employment of M&S, acceptance of LVC M&S will become second nature.

While it has taken time, the establishment of the M&S workforce is a formal capability as identified in the IA-ASLVCE ICD. The results of the AF M&S workforce assessment clearly support the need for establishing an AF M&S workforce that is a mix of military, government civilian employees and contractor personnel. The results also support the need for establishing standardized M&S educational/training competencies and associated instructional programs that foster clear communication within and across services and M&S functional areas, as well as enhance critical strategic and operational decision-making throughout the AF. The AF M&S Workforce Implementation Plan, when completed, will reduce costs by improving how M&S resources are developed and utilized, to include promoting re-use of resources and reducing workforce redundancies, while ensuring AF M&S leadership is available and adequately trained to provide programmatic oversight and guidance.

LESSONS LEARNED

One item that the services agree upon is the need to develop and balance the employment of U.S. uniform personnel and government civilians. This requires a strong government civilian M&S workforce, since there is too much to be done by service personnel or contractors alone. Additionally, civilians do not routinely change jobs every two to four years as military personnel do, so they provide “organizational memory” that is key to maintaining continuity over time. Finally, there are many tasks that are designed to be inherently governmental, and cannot be performed by contractors by law (Federal Acquisition Regulations [FAR], 2017). Currently, the civilian M&S workforce is not large enough to handle their required tasks. Given the expected increase in M&S requirements, and the ramp-up time required to add government civilians, the workforce needs to be increased to handle this larger workload.

Another point upon which the services agree, is that one of the key tasks for the services’ M&S enterprises is to communicate both internally and externally. Regarding internal communication, this means:

- Ensuring that leadership at all levels knows of the M&S capabilities available and how best to utilize these to maximize warfighting capability.
- Informing commands of the benefits adding an M&S billet brings. In these discussions, quite often commanders will claim to not have any need for an M&S officer. However, after hearing the value such officers have provided other commands and how that billet could address that command’s specific needs, most strongly support adding an M&S billet.
- Increasing the number and quality of applicants for the M&S communities by informing junior officers considering career moves that becoming an M&S professional is an option.

The external communications are to those outside the service. This means letting civilian leadership, contractors and others know the service capabilities and requirements so that they can provide resources and potential solutions to the services’ future needs. It also means helping to ensure that the DoD and Joint force understand the balance of M&S capabilities across the services.

One commonality between the services is an acknowledged need for M&S professional human capital management. That is, more than making sure that the graduate of a program or one who achieves an M&S designation is assigned to one (often their next) M&S billet (although that is critical), but that their career is managed in its entirety – with an effective mix of meeting service warfare area needs along with service M&S priorities. To do this, it is acknowledged that an office, with designated and dedicated personnel, is required. These personnel would define and update job

requirements, oversee billeting, provide mentoring, assist in tailoring assignments and perform similar key functions that match service requirements to satisfied service personnel.

One area in which the services have significant differences is in the officers' career paths after being designated as an M&S specialist. Army officers will serve only in designated FA-57 billets for the remainder of their careers. Their careers will be managed by the FA-57 proponent, who will oversee their education and assignments until retirement, and they will be competing only against other FA-57's for promotion. Marine Corps and Air Force officers will generally serve a single two- to three-year M&S tour, and then return to their primary specialty, which will oversee their assignments for the remainder of their careers. A few of these officers may be able to return to an M&S billet after at least one tour in their primary area, but a second M&S tour likely will harm their ability to remain competitive for advancement. They will be competing for promotion with officers in their primary area, and experience shows that such promotion boards generally prefer officers who follow more traditional career paths. The Navy sends new 6602 officers back to sea in their warfare areas for one or two tours; including the training required before these tours, so it is generally at least 4 ½ to 5 years before an M&S-qualified officer can serve in an M&S billet. That is the earliest it might occur, and most officers are not required to ever utilize their M&S knowledge.

There are also differences in how the services educate and train their M&S professionals. The Army is the only service which does not routinely require officers to earn a graduate degree before serving in an M&S job. Instead, upon transitioning to the FA-57 community, all officers attend an 8-week basic simulation operations course, which trains them for the tasks that they will perform in their day to day job. Some are then sent to those jobs, while others attend graduate school. Additionally, since the Army is the only service where officers work in M&S for the remainder of their careers, it is the only one to offer additional career training.

The split between training and education that an M&S professional should receive, and what level of technical acumen is required to do the job, is a long-standing discussion among those in the M&S community. This is not broken down between services, but is often an intra-service debate. It is possible for an officer or civilian to graduate with a degree in M&S and be completely unable to perform the tasks their next job entails. For example, in graduate school they may have studied the intricacies of wargaming theory, but never received any training on how to put one together, and therefore require on the job training to become effective in their jobs. On the other hand, if simply trained in how to operate a specific wargame, it is difficult to transition to another type of wargame or conduct an analysis for the requirements of the next generation wargame without the theory that comes from formal education.

Another way in which the Army differs from the other services is in the operational reach of the M&S officers. While all Army units at the brigade level and higher have had at least one FA-57 billet for quite a while, this is not the case with the other services. The Marine Corps has recently added the first operational 8825 billet at II Marine Expeditionary Force (MEF), with plans to expand to the other two MEFs in the future, while there are no such billets in the Navy or Air Force. Having officers in operational billets like this has several advantages for both the service and its M&S community. It helps the unit by improving its warfighting ability by providing M&S to achieve the unit's mission, often in ways that wouldn't be considered without the officer's presence. It helps the community by making it obvious how much M&S officers bring to the fight, which both gains support from senior leadership as well as makes the community more attractive to officers considering transitioning from their current community.

Finally, it is important to note that this discussion of U.S. service officer and government service personnel takes place in a broader context. This context includes enlisted personnel, contractors, academia, and others who provide M&S skills, advice, and technological capabilities to the services. To truly maximize the effectiveness of M&S within the services requires balancing the many, differing, capabilities and limitations of this set of people.

CONCLUSIONS

The U.S. services must have a robust M&S workforce to meet the challenges of the changing world. This requires an effective blend of uniformed officers and GS personnel who are able to properly shape M&S programs that the services increasingly rely upon that are designed to meeting training, acquisition, and assessment missions. While the investment by the U.S. defense establishment and the military services in recruiting, educating, utilizing, promoting, and retaining uniformed and government M&S professionals has been significant, much more needs to be done. They need to efficiently and effectively mix and match investments, processes, organizations and infrastructure to best address their requirements along with the needs of individual service members, or they will lose out in an extremely competitive commercial, industrial and academic marketplace. The processes and results described here, and the

associated lessons learned, are essential steps. Yet, critical analysis and implementation approaches are being developed – and will be further reported upon – to meet the challenges of tomorrow and to more fully develop warfighting simulation professionals.

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