Digital Sustainment, A Strategy For Success

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ABSTRACT

Digital transformation within the Agile Combat Support Directorate Simulators Division (WNS) is a strategic endeavor in line with the Air Force Materiel Command's (AFMC) initiatives for Digital Materiel Management (DMM) and the United States Air Force's (USAF) overarching reoptimization agenda for Great Power Competition (GPC). This paper examines the ongoing digital transformation efforts within WNS, which commenced with the Model-Based Systems Engineering (MBSE) Implementation Project, underpinned by the pursuit of a modular open systems approach (MOSA) to acquisition. Through this project, stakeholders and processes conducive to model-based support in sustainment endeavors were identified, catalyzing a broader digital transformation within the division. Models have proven instrumental in informing various decision-making processes, such as source selection and system design evaluation, while also identifying common architectural elements across simulators. These endeavors, primarily supporting the Simulation Common Architecture, Requirements, and Standards (SCARS) initiative and the Joint Simulation Environment (JSE) Program, exemplify the potential of models and digital artifacts to streamline training systems sustainment programs and foster enterprise-level portfolio management within WNS.

Expanding upon these foundational efforts, this paper outlines WNS's planned efforts to address key DMM initiative from a data-driven perspective, including fostering a digital-first culture, devising digital strategies, fortifying data structures and security, enhancing tool accessibility, bolstering workforce training, and modernizing Information Technology (IT) infrastructure. Through this comprehensive approach, WNS endeavors to align with AFMC's DMM goals and contribute meaningfully to the USAF's broader digital engineering strategy, ultimately enhancing warfighter readiness and operational agility in the era of great power competition.

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INTRODUCTION

The drive to modernize and improve processes within the Department of Defense (DOD) predate the establishment of the Department of the Air Force. As weapons systems grow ever more complex, the drive to efficiently manage development efforts has strived to keep pace with the scale of this complexity. Building on accepted industrial practices, the DOD formulated a digital engineering strategy aimed at modernizing processes and improving the speed of delivery of new capabilities.[1] This strategy articulated five goals that leverage digital (model-based) engineering practices to improve the efficiency of communicating technical information, streamline processes, support advanced analytics, and inform decision making.

The recent DOD focus on Great Power Competition (GPC) is a continuation (albeit with more urgency) of previous efforts to adapt to current geopolitical circumstances.[2] The Air Force Chief of Staff, Gen. David Allvin, defined GPC as nations competing for influence, preservation of values, and economic prosperity and that the role of the USAF is to be a deterrence for any other nations considering using military force as a feasible strategic option in advancing their nations policies. In response to more countries becoming near-peers and peers of The United States in the GPC, the USAF is reoptimizing it's processes to better compete with the ever-accelerating pace of development and acquisition activities. Twenty-four department wide changes have recently been announced to properly confront the GPC focusing on "… developing people, generating readiness, projecting power, and developing capabilities …"[3]

Current efforts to reoptimize how the Air Force are categorized in four core areas.[4] The first of these, Develop People, is focused on training personnel. This is done not only by improving training of skills for specific roles but also in how this training is developed, delivered, and assessed. The second is Generate Readiness, which focuses on mission readiness in addition to functional readiness – increasing the scope and scale of operational capabilities. The third area, Project Power, emphasizes the operational and tactical aspects of the combined force by streamlining responsibilities and enhancing focus on mission. The fourth area, Develop Capabilities, seeks to improve the flexibility, agility, and responsiveness of processes used to deliver new or improved capabilities to the warfighter.

In line with this GPC reoptimization effort is the recently released Digital Materiel Management (DMM) Strategy. The white paper introducing this strategy[5] describes in more detail how the USAF's current capabilities development processes are no longer sufficient to stay in a long-term competitive posture. Information does not flow between where it originates to where it is needed due to technical and cultural obstacles. The paper proposes that the application of digital practices in the world of defense acquisition, where all functionals use digital artifacts, tools, and processes across the lifecycle, is a likely means of shortening the time required to bring new capabilities to the field. Leveraging the six key initiatives of the DMM effort, the Air Force can become better stewards of limited resources. By structuring and securing data, modernizing Information Technology (IT) infrastructure, and providing access to DMM tools, the Air Force can optimize resource allocation. Additionally, training the digital workforce and instilling a digital-first culture will enhance efficiency. Developing comprehensive digital strategies ensures effective implementation.

[1] (Office of the Deputy Assistant Secretary of Defense for Systems Engineering, 2018)
[2] (Kendall, 2022)
[3] (Allvin, 2024)
[4] Ibid.
[5] (Air Force Materiel Command, 2023)

Overall, embracing these principles empowers the Air Force to achieve its mission with greater effectiveness and resource utilization. This approach promises to revolutionize the materiel management cycle and ensure that the United States remains at the forefront of warfighting capability.

The mission of Agile Combat Support Directorate, Simulators Program Office (WNS). is to provide the best training systems to enhance warfighter readiness, and to deliver training capabilities at the speed of relevance. This is primarily accomplished through acquisition and sustainment efforts, which have historically followed serialized process with limited capabilities for digital collaboration. The reoptimization for GPC will require significant changes in how divisions like WNS operate. It amplifies the need for advanced training capabilities to ensure our forces remain agile, adaptable, and well-prepared to face any mission. WNS's digital vision aligns with this imperative, emphasizing the importance of staying at the forefront of technology and talent development to maintain an edge in the global arena.

DIGITAL FIRST CULTURE

The first initiative that supports a DMM capability is instilling a digital-first culture. Through this WNS would, through access to live digital artifacts, change the mode of communication with partners. As the AFMC white paper puts it, we would "make a cultural shift to collaboration versus review."[6] Through this collaboration, WNS would be able to get the information it needs, in the way it needs it, much faster than the current mode. It is important to note that "digital-first" is not "digital-only" since there are many artifacts that simply should not be purely digital.

Digitization is more than converting analog content into a digital format. True digital transformation goes beyond this – it fundamentally changes how we approach processes by leveraging technology. Instead of merely replicating analog workflows in a digital form, it involves using digital tools, data, and models to improve efficiency, agility, and innovation. Instead of referring to supplemental data and documents, it creates the digital threads among data, tools and processes that automate access to the right data in the right place as needed.[7] The DOD aims to improve the efficiency and pace of capabilities development through digital engineering and the larger digital transformation.[8] This approach establishes an authoritative source of truth for engineering data, enhances collaboration, and improves decision-making. By adopting digital practices, the DOD streamlines acquisition processes, enables agile development, and enhances national defense capabilities.

One of the benefits to using digital artifacts and processes is improved collaboration. Throughout the entire lifecycle of a system, stakeholders have access to digital models and tools. Real-time tracking ensures transparency in system creation, design, and maintenance. Users can collaborate effectively from initial concept development to system sustainment. This leads to better informed decisions through the life of the project since decision-makers have access to the most current and accurate information. A second benefit to DMM is enhanced quality. digital engineering improves overall quality by mapping artifacts to system components and tracing requirements to fulfilling processes. Unlike traditional document-centric approaches, where errors and inconsistencies can arise due to manual processes, digital models provide a clearer understanding of system components and their connections.[9] Real-time changes allow immediate views of their effects, avoiding the need to sift through documents. This ensures that the system meets its desired purpose and performance requirements. Lastly, tracking changes in real time reduces labor-hours as the project progresses. Early detection of mistakes prevents costly rework and improves production time. The ability to simulate system behavior, assess designs, and refine them in a virtual environment before building physical prototypes improves efficiency. This in turn saves money over the life of the project.

Digital artifacts play a crucial role in facilitating accessibility and information flow across different disciplines. Engineers and other functionals can make swift decisions when they have access to authoritative real-time data. For example, this visibility allows engineers to assess the quantity of available items, enabling logisticians to stock the correct parts with confidence in the accuracy of these digital artifacts. If requirements are linked to content within the model, real-time data becomes available to verify whether the requirements are still met when content changes. This approach is clearly more efficient than manually searching files or documents. With a realized DMM capability,

[6] (Air Force Materiel Command, 2023)
[7] (Roper, 2020)
[8] (Office of the Deputy Assistant Secretary of Defense for Systems Engineering, 2018), (Air Force Materiel Command, 2023)
[9] (Henderson & Salado, 2021)

administrative and technical reviews take on a new form. Rather than sifting through documents and presentations, stakeholders collaboratively engage with models that make relationships between artifacts, requirements, and other elements more visible. This will allow for a more efficient communication and discussion, ultimately condensing the time required for these processes.

Two programs in the WNS portfolio, Simulator Common Architecture, Requirements, and Standards (SCARS) and the Joint Simulation Environment (JSE), are using a digital-first mindset across their processes and artifacts. WNS has developed a bidders' library that defines the expectations for contractors when bidding on a project, specifying the type of models they are expected to deliver. By initiating the project with such guidance, a digital-first engineering approach is established from the beginning.

SCARS, while not quite "born digital," has used digital artifacts in source selection and design reviews. The program has begun major shifts towards a wider digital engineering mindset. Examples of SCARS artifacts that have gone digital include system models (created by the prime contractor) that are representative of the systems being developed. Design reviews that would have included weeks of document review have been reduced to a matter of days with the use of models to clearly trace requirements satisfaction to components and systems. These models of a design baseline can be used to inform a model representative of the specific systems installed to support the initiative. Procedurally, SCARS is moving towards a model-based review process of other contract deliverables intended to reap the benefits previously discussed.

In contrast, JSE has been more fully digital since before 2017. This joint program is currently the largest software development pathway program within the Air Force and has used models to communicate technical and administrative information. Activity diagrams are used to define and refine key processes for the program, facilitating understanding of the how requirements are gathered, approved, decomposed, and assigned for action. SysML diagrams help program managers to understand how partner organizations are participating in the enterprise. Models of the different systems help to manage the physical and virtual interfaces, ensuring products created by the participating software developers are efficiently integrated into the baseline. Refence architectures are used to communicate the requirements for program-acquired hardware and define for program offices what they need for their training systems to be "JSE-compatible." Models of installed systems and locations (currently in-work) are intended to be used to manage sustainment of systems at the enterprise level. A collaborative space for model creation and use has been set up so that all partners can use models and other digital artifacts to support the program.

As WNS works to improve efficiency in managing training systems and programs, models will play a vital role. These models provide a structured framework for understanding complex systems, predicting behavior, and optimizing resource allocation. Ultimately, WNS desires to manage its portfolio at an enterprise level rather than program by program. By so doing, it can achieve consistency in process, develop flexibility to address emergent circumstances, and increase efficiency in execution. By leveraging models, WNS can make informed decisions, streamline processes, and enhance overall efficiency. Whether it is assessing maintenance schedules, supply chain logistics, or mission planning, models offer valuable insights that empower effective management.

DIGITAL STRATEGIES

The second DMM-enabling initiative is developing digital strategies. The intent of this initiative is to share a common vision of using digital artifacts and processes across all functional areas, throughout the product lifecycle. The digital-first mindset must be a fundamental part how every functional discipline of the organization works. With most of their work performed using documents and SharePoint, much of the workforce is unaware of how much their workflows could be improved with a digital mindset. Understandably, there can be resistance to changing a process that is currently working. Change can be uncomfortable and is difficult to achieve without proper incentive. A full strategy to develop, implement, and sustain a Digital-First culture must be created, implemented, and frequently updated to adhere to the ever-changing needs of a digital organization.

The WNS Digital Strategy begins with the vision of how we will operate in the future. Put succinctly, WNS personnel will use digital artifacts and tools from their normal workstation to support their regular activities in managing the Enterprise. To support this vision, we must consider how key data is created and used, and work to ensuring that the infrastructure and processes that facilitate the digital WNS of the near future are provisioned and planned. Our infrastructure must support data mobility, collaboration with partners, and access to live data. We must identify key

data (including sources, users, and formats), ensure interchange vectors work, and codify data standards (using established standards where possible). We must identify best practices by function, standardize where possible, and encourage as much commonality of tools and processes as is prudent. We must ensure that organizational guidance, in the form of policies and instructions, accommodate and encourage the digital-first mindset. None of this works well without providing necessary knowledge and skills to our personnel. Since this is a significant change from the current standard processes and practices, some resources must be given to formal Organizational Change Management planning. The enterprise must be considered from both a macro and micro point of view; identifying the needs of both internal and external stakeholders and converting those needs into actionable plans that will deliver real value.

DATA STRUCTURE AND SECURITY

The third DMM-supporting initiative is to structure and secure data. The use of digital artifacts and processes during product lifecycles is enabled by deploying data standards, formats, and reference architectures. Data is the currency of a digital organization and effective information flow is vital to successfully accelerate capabilities development. In the realm of digital transformation, the structure and security of data are pivotal. Ensuring that data is timely, accurate, and relevant is crucial for informed decision-making and efficient operations. Effective data management relies on standardized formats and robust architectures to ensure seamless data exchange and security. This includes the use of standardized data formats and protocols to ensure interoperability between different systems.

A robust data strategy is essential for leveraging data as a strategic asset. An effective data strategy includes several key elements and processes that guide the management, utilization, and security of data. First, organizations need to establish clear data governance policies that define roles, responsibilities, and procedures for data management. This includes data stewardship, quality management, and compliance with regulatory requirements. Second, a data architecture is a critical component of the data strategy. This architecture should support scalability, flexibility, and interoperability to accommodate the evolving needs of the organization. Third, organizations must focus on data integration and interoperability. This involves developing frameworks and protocols for seamless data exchange between different systems and platforms. Ensuring that data moves seamlessly from its origin to consumers requires robust data management practices. Leveraging APIs and middleware solutions can facilitate this integration, ensuring that data flows smoothly across the enterprise. Additionally, data analytics and insights are vital. Organizations should invest in advanced analytics tools and techniques to extract valuable insights from their data. This enables informed decision-making and drives business innovation. Finally, continuous monitoring and improvement are crucial. Regular audits, performance evaluations, and feedback mechanisms help organizations refine their data strategies and address emerging challenges.

Data governance frameworks must be established to define the rules and procedures for data handling, ensuring consistency and reliability. Diverse data formats can lead to incompatibilities, data loss, and inefficiencies. To mitigate these issues, organizations must adopt standardized data models and transformation protocols. This harmonization is essential for maintaining data integrity and enabling effective communication between disparate systems. Data standards and formats form the backbone of efficient data management. They provide a consistent structure that facilitates interoperability and data exchange across different systems and platforms. However, the diversity of data standards and formats can pose significant challenges. In ecosystems where data is generated and consumed by various stakeholders, achieving seamless data exchange can be daunting. An example of this are the networks used for distributed combat training exercises and training. In these exercises, participants with varied security levels are in the same virtual space but can only share some of their data with other participants. Information flow can be facilitated by using data integration platforms that consolidate data from various sources and make it accessible to users through a centralized interface. Reference architectures play a crucial role in this context, offering a blueprint for system interoperability and data integration. These architectures provide guidelines and best practices for structuring data and ensuring compatibility across different systems.

Data strategies that have been implemented within WNS include utilizing common data storage locations, increasing requirements for common standards, and the integration of more efficient digital engineering tools. SharePoint is currently the most used data storage medium within the simulators division, and it provides a single location for accessing data and controlling permissions across the enterprise. The SCARS effort within WNS is identifying common data architectures and standards to create more consistency across digital artifacts. A part of this effort includes the WNS MBSE Modeling Guide, which institutes guidance for model style, methods, and meta modeling.

Finally, using plug-ins and a collaborative virtual environment, data integration between digital assets is becoming more feasible.

Cybersecurity is an important aspect of data management. Ensuring the security and integrity of data is important to protect sensitive information and maintain operational continuity. Digital models play a significant role in the process leading to an Authorization to Operate (ATO). These models provide a virtual representation of the system, capturing its architecture, components, and security controls. Model viewpoints can be constructed to create required network topology diagrams necessary to the process. Organizations can conduct comprehensive risk assessments and identify potential vulnerabilities using system models. This approach enables timely implementation of security measures and mitigates risks before they can be exploited. Moreover, digital models facilitate continuous monitoring and real-time updates. They allow organizations to track changes in the system, assess the impact on security, and ensure compliance with regulatory standards. This further enhances the resilience of information systems and ensures that they remain secure in the face of evolving threats.

To gain a better understanding of the data strategy needs in WNS, the MBSE team identified key stakeholders and conducted interviews with them to see how collecting, storing, and sharing data across the enterprise could be done in the most efficient and effective ways. Various capability requests were captured for each stakeholder, clearly showing how they were hopeful that utilizing MBSE models would be beneficial for their roles. Doing this provided a basis to focus capability development efforts when initiating guidance on styles and procedures for modeling. This is a fundamental part of developing a data strategy that avoids wasting resources and inhibiting productivity. It is important to identify stakeholder needs early and reassess them often to support both capability development and organizational change management efforts. Having identified user capability requests, use cases were developed and analyzed for applicability to the modeling effort. Those capabilities that could not be accommodated in models were reserved for further action as the digital transformation efforts within the division progressed. Simply having capabilities in models appropriate to user roles is insufficient. It is important to reach back to the users and train them on the new capabilities that your organization will be using.

DMM TOOLS AND PROCESSES

The fourth supporting initiative is to ensure access to tools and processes necessary for the DMM capability. Of particular interest are tools that enable Product Lifecycle Management (PLM), design, analysis, system modeling, and process modeling. Processes that facilitate efficient workflow management, seamless information flow, and robust tool integration are important to successfully using digital artifacts.

The AFMC Digital Transformation Office (DTO) provides comprehensive guidance on approved software tools available for the technology stack and integrated digital environment.[10] These software tools are essential for generating various digital twins that can be seamlessly integrated through the implementation of a Digital Thread. The DTO has categorized these tools into six essential types needed for every program's Integrated Digital Environment. These categories include MBSE tools, architecture tools, analysis tools, cybersecurity tools, visualization tools, and additional supporting tools. Each category is crucial for different aspects of digital transformation and system integration. Additionally, the DTO offers guidance on the Digital Environment necessary for the effective deployment and utilization of these tools, ensuring that all programs have the foundational resources required to achieve their digital transformation goals.

The WNS MBSE team evaluated the recommended software tools and digital environments for suitability to the needs of the division. Their assessment of collaborative environments revealed a significant issue: common environments often suffer from debilitating latency problems. This latency negatively impacts productivity and increases downtime, hindering the team's efficiency. To address this, the team decided to pursue an alternative, non-common environment that still complies with our cybersecurity requirements. This choice was aimed at enhancing productivity and ensuring smoother operations while maintaining the necessary security protocols.[11]

The team conducted a thorough and systematic evaluation of the software listed in the Digital Guide. First, the team identified a significant overlap between the MBSE and architecture tools categories, leading them to merge these two

[10] (Air Force Materiel Command, 2023)
[11] (Ayers, et al., 2020)

categories to simplify the analysis process. Second, they created a SysML ontological diagram to illustrate the interrelationships between the various tool categories. This diagram helped the team focus on the desired digital ecosystem for tool selection and the associated plugins to be implemented. Third, each tool option was methodically assessed based on its features and utility to the division, with the pros and cons of each option carefully listed. This comprehensive evaluation enabled the team to make informed recommendations on which tools should be adopted for their ecosystem. The outcome of this analysis was to trial new software and conduct further assessments, ideally comparing these new tools against those currently in use.

To enhance tool accessibility, organizations must implement secure access protocols and ensure that only authorized personnel can use these tools. This includes the use of multi-factor authentication, role-based access controls, and encrypted communication channels. Furthermore, providing cloud-based access to these tools can significantly enhance their availability, allowing stakeholders to collaborate from separate locations seamlessly. Integrating various DMM tools and implementing middleware solutions present both challenges and opportunities. Middleware acts as a bridge between different applications, enabling them to communicate and share data seamlessly. Implementation challenges include ensuring compatibility between different systems, managing integration costs, and maintaining data security. Data security is a critical consideration in tool integration. Ensuring secure data transmission and storage, implementing strong authentication and authorization mechanisms, and continuously monitoring for security threats are essential practices. Adopting best practices in cybersecurity, such as encryption and intrusion detection systems, helps safeguard sensitive information.

PLM tools are fundamental in managing the entire lifecycle of a product, from inception through design, manufacturing, and disposal. Access to these tools must be carefully managed to ensure security while providing necessary functionality to various stakeholders. These tools facilitate collaborative design, real-time analysis, and comprehensive system modeling, ensuring that all aspects of product development are efficiently managed. Efficient workflow management is essential for the success of DMM initiatives. Setting up and tracking workflows involves several key steps. First, it is crucial to map out the entire process, identifying all tasks, their sequence, and dependencies. Additionally, PLM tools also feature the capability to manage workflow. Once the workflow is defined, it is necessary to assign responsibilities and deadlines to ensure accountability. Automated notifications and reminders help keep the workflow on track. Continuous monitoring and real-time tracking of progress are essential, allowing for the identification and resolution of bottlenecks. Analytics and reporting tools provide insights into workflow efficiency, enabling continuous improvement.

Despite these challenges, the benefits of tool integration are substantial. It leads to improved data consistency, streamlined operations, and enhanced collaboration across different teams. The cost savings from reduced manual data entry and error correction can be significant. Middleware solutions, such as Apache Camel, MuleSoft, and IBM Integration Bus, offer robust frameworks for integrating diverse applications.

WORKFORCE DEVELOPMENT

While access to digital tools, processes, and artifacts is important, access is more valuable if personnel have the knowledge and skills necessary to use them. The fifth DMM-supporting initiative is to train the digital workforce. Taskforce training must continually evolve to address emerging needs and challenges, particularly when adapting to new skill sets. As technology and operational environments rapidly change, taskforces require up-to-date training to maintain effectiveness and readiness. The need for continuous learning is driven by advancements in technology, revised processes, and improved software capabilities. Challenges include the logistical complexities of organizing frequent training sessions, ensuring the relevance and quality of training materials, and overcoming resistance to change among personnel.

Some tools have a limited scope of applicability and capability. Training for these types of tools does not need to (and in many cases cannot) be tailored much. Other tools have a wider range of uses. When customizing training to make it appropriate to specific roles which use the tool in different ways, it is essential to tailor training programs that reflect the different sets of responsibilities and tasks that define these roles. This can best be achieved after conducting thorough job analyses to identify the critical skills and knowledge required for each role. Overall training programs should then be designed to address these specific needs, incorporating realistic scenarios and practical exercises that mimic actual job conditions. Training for specific tools follows a similar process. After identifying what types of personnel use the tool, a training program that emphasizes the knowledge and skills appropriate to using the tool in

that role can be developed for use. By aligning training content closely with job duties, personnel can better understand how to apply new skills in their daily operations, leading to more effective performance and higher operational readiness.

Ensuring that training is accessible to all who are interested involves addressing several key factors. Training schedules should be flexible, offering sessions at various times and locations to accommodate diverse work shifts and geographical constraints. Online training platforms can play a crucial role in this, providing on-demand access to training materials and courses regardless of physical location. Additionally, the training materials should be available in multiple formats, including videos, interactive modules, and written guides, to cater to different learning preferences and abilities. To further enhance accessibility, organizations should foster an inclusive learning environment that encourages participation from all members of the taskforce. This can be achieved by promoting a culture of continuous learning and professional development, where seeking new knowledge and skills is valued and supported. Providing incentives for completing training programs, such as certification, career advancement opportunities, or recognition awards, can also motivate personnel to engage in training activities. Finally, removing barriers to training access is critical. This includes offering support services, such as tutoring or mentorship programs, to help individuals who may struggle with certain aspects of the training. By implementing these strategies, training can be made appropriate to specific duties and accessible to all interested personnel, enhancing the capability and readiness of the workforce.

Training WNS personnel to use the modeling tools initially had the same training for everyone. This was somewhat appropriate as the target audience consisted primarily of personnel with the same role, systems engineers.[12] As the WNS MBSE Implementation project progressed to include other functionals, the training program needed to be adapted to suit the distinct roles. To this end, a set of three classes were developed to address the needs of three roles: model creators, model users, and personnel who simply needed to know how model-based capabilities benefitted the enterprise.

To further enhance training efficiency, the MBSE team is currently exploring how to support functional training plans that focus on specific digital skills relevant to each member of an Integrated Project Team (IPT). These functional training plans aim to provide a granular approach to bridging the knowledge gap for each IPT member. However, this approach presents challenges, including the need for additional training on inter-functional tools and managing data migration between these tools. Furthermore, the specific analysis requirements of each IPT must be addressed to ensure effective job performance. It is also deemed necessary to adopt an enterprise-focused approach for disseminating and managing these functional training plans to scale them across the entire organization, beyond just the program or division level. This strategy aims to create a comprehensive and cohesive training environment that supports the entire organization's growth and adaptability.

IT INFRASTRUCTURE

The sixth DMM-supporting initiative is to modernize the IT infrastructure to improve speed, connectivity, and accessibility – thereby providing a foundation for the DMM capability. In the current hybrid work environment, the ability to access data and work collaboratively is essential for efficient and effective operations. Cloud-based access to data and tools facilitates this capability. However, implementing a collaborative virtual environment comes with challenges such as security, accessibility, capability/infrastructure, cost, management, and consistency.

A simplified and well-defined procedure to access the environment should be used to reduce the resistance that comes with a change to digital processes and the use of virtual workspaces. Easing the processes of establishing an account and gaining initial admittance can also reduce the barriers to use. As mentioned previously, all new users must meet the security requirements to collectively maintain a safe and collaborative environment. Site visit requests and document submission may be out of the hands of the individual and thus, this portion of the process is often time consuming and may deter people from taking first steps. Making the environment accessible via a normal workstation and providing concise documentation to advise on the many new procedures can also be beneficial.

Meeting necessary capability requirements is significant among the consideration for establishing a collaborative virtual environment and providing access to users. Consideration should also be given to future desired capabilities. The required infrastructure will vary depending on software, hardware, capacity, and network capabilities. Since there

[12] (Ayers, et al., 2020)

can be great variance in infrastructure, an understanding of stakeholder needs early in the process of establishing environment capability is necessary. Communication should occur frequently between stakeholders and those responsible for implementation.

Maintenance and sustainability efforts will likely require significant amount of labor hours for the virtual environment. ATOs need to be renewed annually to maintain security compliance for HW and SW and involve several actors. Maintaining consistent performance of a virtual environment means considering network outages and other issues, including the issues that are unique to individual users. These impact time, efficiency, commitment to digital, and ultimately, success. Precautionary steps can be taken to help reduce interruptions in service, but complete avoidance will be impossible.

Administrators of the environment need to be able to adapt and react to provide the best experience for the users. Onboarding new users is only a portion of the administrators' responsibilities. Managing accessibility for new and existing users can be a frequent responsibility. Those responsible for onboarding new users and supporting existing users have a particularly important role. As said previously, this digital transformation will come as an uncomfortable change to many, therefore supporting users while they learn how to effectively adapt, is going to keep those users' job capable and continue the evolution of digital in the workplace. Managing the day to day needs of users means helping users navigate their new workspace, trouble shoot technical difficulties, update permissions for digital tools, and general guidance. All of these are important in maintaining a positive user experience.

Infrastructure is always changing – hardware and software become outdated or obsolete, requiring constant updates and review. As software tools change, they may also require different hardware performance capabilities and data management processes. This will influence funding issues. Embracing a digital-first mindset may require significant initial capital investment, and this may cause resistance if the benefits are not readily obvious.

In addition to the many challenges previously discussed, procuring, and managing digital engineering tools for a virtual collaborative environment is a crucial element to maintain digital success. Within WNS, many digital engineering tools are used across the functional teams every day. Procuring new digital engineering tools is a multi-step process, especially when adhering to the funding and security requirements within the DOD. The quantity of licenses may shift up or down as a new project becomes more established and digital tool usage metrics are tracked. Of course, this means working the entire process from budget to procurement to re-establish a more accurate quantity. Finally, many digital tools have plug-ins that extend the tools capabilities to meet more specific user requirements. Because of this, plug-ins are often procured out of sequence from initial SW purchasing. There is utility in pursuing uniformity of toolsets used by the different functionals across the division, but administrative and contractual issues preclude swift adoption of homogeneous toolsets.

Programs within WNS use multiple digital work environments. These capabilities if these environments vary based on the needs of specific programs and funding sources. Generally, materials can be freely shared and collaboratively accessed by department members within each environment. While individuals can have their own designated digital sections on the server, files are also easily accessible to others through local drives or data repositories such as Cameo's Teamwork Cloud. Although having these dedicated environments has been beneficial within the organization, moving data between environments can be somewhat cumbersome. Sometimes individuals must manually move digital materials through processes like using DOD Safe or by downloading a copy of the materials to their local machines then uploading them to the other environment. Data mobility will only become more challenging with the introduction of classified materials.

The cost of these virtual environments, while not negligible, can leverage different strategies for significant cost savings. The use of floating licenses in a cloud environment has a lower financial and administrative burden compared to installing modeling software or other tools on other Government Furnished Equipment. Additionally, the benefits of multiple people working collaboratively within a single model simultaneously with the assurance that data is backed up safely can lower the administrative resistance to using virtual work environments. Such environments allow for large-scale modeling and other digital efforts to grow very quickly without worry.

The current WNS collaborative digital environment is managed by WNS personnel through a contract with the service provider. The WNS team focuses on establishing an environment for WNS personnel, defining stakeholder needs, ensuring the acquisition of necessary software for daily tasks, and managing the contract with the vendor. The contractor team executes the operation, maintenance, security, data storage, and all IT requirements for the

environment. It, and other cloud-based environments, can permit secure access to all relevant stakeholders and be expanded to support digital processes to replace current non-digital ones.

SUMMARY

In this paper, we have discussed the aspects of the AFMC Digital Materiel Management capability in the context of the current period of Great Power Competition and previous efforts to use digital artifacts in defense systems acquisition. The six key initiatives that enable the DMM capability were examined from the perspective of what WNS has done in the past, and what it expects to do in the future.

Instilling a digital-first culture requires WNS to make a cultural shift to preferential use of digital artifacts and processes to facilitate more-effective communication between government and industry. Although they are in early stages, the SCARS initiative and the JSE program have served as useful examples of what can be done with this mindset. Developing digital strategies reinforces the digital-first mindset through use of the digital artifacts and tools. This helps to reduce the barriers to acceptance of a new way of working through an articulation of the vision for the future and the demonstration of the benefits of being digital. WNS is in the process of developing digital processes in addition to those used in the SCARS initiative and the JSE program.

Since data is the currency with which the future is acquired, structuring and securing the data is important. An understanding of how the data is used informs choices for standardized data structures in an overall data strategy facilitating the flow of information between source and user. WNS will build on earlier work that identified how members of IPTs could use models to inform models of information flows and develop new processes to take advantage of digital artifacts. Instituting a DMM capability requires both access to tools and the knowledge and skills necessary to use them. Since one size rarely fits all users, access and training should both be appropriate to the distinct roles within the enterprise. The established WNS role-based MBSE training approach will be expanded to additional digital tools and new digital processes.

A strong IT infrastructure is the foundation for using digital artifacts and processes. A robust, secure, collaborative environment will facilitate the flow of information and enhance the new digital processes. The current WNS digital environments are suitable for the current need and can be expanded to meet anticipated future needs. Professionally managed, these environments can concurrently accommodate government and commercial users, further advancing the DMM capability.

WNS has made significant efforts to develop digital capabilities to support enterprise-level portfolio management within the division. Expanding these efforts to support digital process in all functional areas across the lifecycle of simulators and training systems will both increase the efficiency of system sustainment and accelerate the pace of training system capability acquisition. This will result in reduced costs and faster capabilities development, enabling WNS to more-effectively “Sharpen the Warfighter’s Bite.”

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