Implementing MBSE Organizational Change at the USAF Simulators Division

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ABSTRACT

Implementing Model-Based Systems Engineering (MBSE) throughout an organization is significant change from previous practices. This paper explores the efforts of the Air Force Life Cycle Management Center (AFLCMC) Simulators Division (WNS) MBSE team to develop, implement, and sustain a Digital-First Culture at WNS. The strategies employed to overcome challenges faced by a sustainment-focused organization are discussed. The Simulators Division is primarily involved in sustainment efforts rather than system development. The benefits of MBSE and Digital Engineering are more readily apparent in the system development and procurement phases of a product life cycle. However, there is still significant benefit to be realized using MBSE in the sustainment phase. This paper also investigates other external efforts aimed at promoting the adoption and advancement of Digital Engineering principles. The paper concludes with a summary of lessons learned and recommendations on implementing effective organization change management for MBSE and Digital Engineering.

ABOUT THE AUTHORS

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I. INTRODUCTION

The Air Force Life Cycle Management Center (AFLCMC) Agile Combat Support Directorate Simulators Division (WNS) mission is "Acquire, modernize, and sustain training systems to enhance lethality and readiness by growing a talented, workforce motivated to sharpen the warfighter's bite." The WNS vision is "To provide the premier warfighting digital twin - real, ready, and lethal; capability delivered at the speed of relevance."[1] The WNS Model Based Systems Engineering (MBSE) group brings Digital Engineering practices to WNS in support of the division's mission and vision by instituting Digital Engineering standards, practices, and guidance.

MBSE is an approach to systems engineering that utilizes models to support the entire lifecycle of a system. This method contrasts with traditional document-based systems engineering (DBSE) by focusing on the creation, management, and utilization of domain models as the primary means of information exchange. The sustainment phase of the system lifecycle is critical for ensuring the continued operation, maintenance, and improvement of a system after it has been deployed. This phase is crucial for maximizing the value and efficiency of a system over its lifespan.

MBSE offers a structured methodology for managing the lifecycle of complex systems, from design through retirement, to ensure their continued operational effectiveness. The Air Force Materiel Command recently released Digital Materiel Management (DMM) strategy white paper[2] describes in more detail how the USAF's current capabilities development processes are no longer sufficient to stay in a long-term competitive posture. A transformation must occur that changes the engrained culture of siloed functions utilizing yester-decade's technology and methods for developing and sustaining the nation's future weapon systems, their training devices, and supporting infrastructure. The white paper goes on to identify six key initiatives for executing the DMM strategy: Instilling a digital-first culture, developing digital strategies, structuring, and securing our data, providing access to DMM tools, training our digital workforce, and modernizing IT infrastructure.

A review of documented efforts relevant to implementing MBSE for systems sustainment, such as Crane, et al.[3] and Malek, et al.[4], highlights important advantages of MBSE, which include improved knowledge capture, enhanced stakeholder engagement, and the standardization of processes. They also discuss the integration of risk management with MBSE, which helps in creating more consistent and objective risk assessment processes. These technical and procedural improvements are necessary for the sustainment phase of complex systems.

However, while these literatures illustrate significant benefits related to system sustainment, they do not explicitly address the use of a methodical Organizational Change Management (OCM) framework. This perceived absence of a structured OCM framework, which is essential for managing change across complex organizations, highlights a notable gap. These papers tend to focus on the lower operational layer, emphasizing immediate technical solutions without considering a higher-level strategic approach. This omission indicates a need for a comprehensive strategy

[1] (Air Force Life Cycle Management Center, 2024)
[2] (Air Force Materiel Command, 2023)
[3] (Crane, Sundaram, Malek, & Brownlow, 2017)
[4] (Malek, Dennison, Crane, & Brownlow, 2018)

that facilitates a seamless transition from the strategic layer of the organization down to the operational and tactical layers.

II. OCM CHALLENGES AND CONSIDERATIONS

OCM involves the strategies and processes used to prepare, support, as well as help individuals, teams, and organizations in making organizational change. Its goal is to ensure that changes are implemented smoothly and successfully, and that the benefits of the changes are sustained over the long term. The digital transformation processes that are being implemented are a major change in how the division does business. Thus, there are some considerations that need to be made for these changes to realize their potential. In a 1998 survey of Chief Information Officers, Deloitte and Touche report several common barriers to successful transformation.[5] These aspects are related to both the technical challenges of the desired change and the management of the change, Figure 1. Initial efforts by the MBSE Implementation Project encountered several of these barriers.

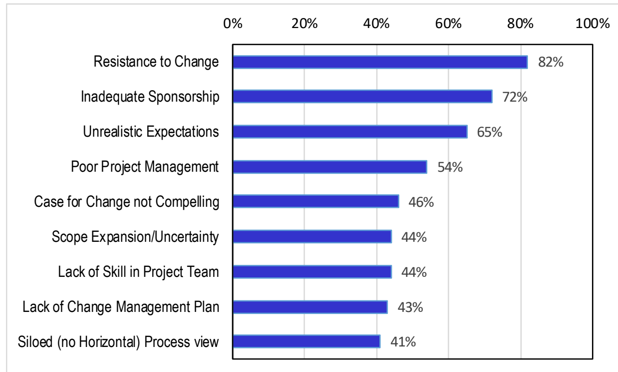

Figure 1 - Deloitte and Touche report of common barriers for successful transformation (Deloitte & Touche, 1998)

Implementing Model-Based Systems Engineering (MBSE) in the sustainment phase presents several organizational change management challenges, including cultural resistance, workforce skill development needs, integration of incompatible tools, unstructured and ununiformed data management, leadership support, hefty implementation costs, and effective communication needs. Cultural resistance is significant, as transitioning to MBSE requires a mindset shift from established, document-centric processes. Additionally, securing buy-in from all organizational levels can be difficult, particularly from those who do not immediately see the benefits. Skill and training requirements pose another challenge, as staff need to be proficient in specific modeling languages (like SysML) and tools, necessitating substantial investment in training. Tool integration and infrastructure upgrades are crucial yet potentially disruptive and costly. Meanwhile, data management and interoperability issues arise from migrating data from legacy systems to new models, requiring careful handling to ensure data integrity and seamless interaction with existing systems. Furthermore, effective management and governance require strong leadership support and well-defined governance structures to oversee MBSE implementation and ongoing management. The transition to MBSE involves significant upfront and ongoing costs for tools, training, and maintenance. Finally, communication and collaboration are essential, necessitating clear stakeholder engagement and fostering cross-disciplinary collaboration to ensure all parties understand the benefits and implications of MBSE.

When considering a system's lifecycle, with either the DOD Acquisition Lifecycle or the System Engineering V model, the MBSE discipline spans the entirety of the lifecycle, with the majority of its benefit lies in the early development phase. WNS, as a sustainment organization, must deal with the challenge of justifying the cost of building models for systems already in sustainment. For some older programs, this will mean that costs of implementing MBSE may outweigh the benefits. However, due to the long lifespan of aircraft and the regular updates that their systems undergo, many of the programs in WNS will still see significant value for investing in MBSE in the form of increased process efficiency. Assessing the cost and potential benefits of implementing MBSE is a challenge and is susceptible to factors unique to each program.

Another consideration is in understanding the role of MBSE in the engineering process and the sustainment phase of the lifecycle. MBSE has a lot of benefits for sustaining systems, but there are limitations with some of the tools used. For example, the systems modeling tool used by WNS is limited in its ability to perform analyses on different system designs. Although instances can be used to generate system design alternatives, this is not an ideal method to analyze cost vs. benefits. For such instances, it might be advised to use a dedicated analysis tool to perform the trade studies. Similarly, the modeling tool is somewhat limited in lifecycle management capabilities. Of course, you can use tables

[5] (Deloitte & Touche, 1998)

to keep track of components and some of their properties including system availability, mean between failure, etc. However, there are product lifecycle management tools that are better suited for those tasks. MBSE has many benefits for systems engineers, but limitations may require the use of other tools to accomplish certain tasks.

The selection and implementation of an appropriate framework is an important element in developing an organizational change management plan. Three widely recognized frameworks are:

- **Lewin's Model**[6]: Simple and focuses on preparing for change, transitioning, and solidifying the new state. Best for straightforward changes but may lack detail for complex changes.
- **ADKAR Model**[7]: Focuses on individual changes and provides a clear framework for individual-level transformation. It is useful for understanding personal transitions but may need supplementation for organizational-wide changes.
- **Kotter's Model**[8]: Detailed and comprehensive, emphasizing urgency, vision, and sustained momentum. Ideal for large-scale change initiatives but requires significant time and leadership commitment.

These models offer different strengths and can sometimes be used complementarily to address various aspects of organizational change. To transition from DBSE to MBSE for the sustainment of simulator systems at WNS, the team has chosen to implement the Kotter model for effectively managing this change on the organization level, and ADKAR for managing individual change. The decision was driven by the Kotter model's strength in facilitating change from the strategic level of the organization down to the tactical and operational levels in a seamless continuum and recognizing that organizations don't change unless individuals change.[9] For this paper, we will be focusing on the Kotter model and how it guides our OCM strategy. The following section will introduce the Kotter model in more detail and explain how it was applied to manage this transformation.

III. 8-STEPS OF KOTTER MODEL FOR EFFECTIVE OCM

Kotter's 8-Step Change Model is a comprehensive approach to implementing change in organizations, developed by John Kotter, a professor at Harvard Business School. This model focuses on helping leaders and managers understand the phases of change and the critical success factors needed to drive successful transformations. The Kotter model has been proven effective in managing change for large and complex organizations. This model provides a structured framework to guide organizations through the change process, helping to ensure that changes are implemented effectively and sustained over time. In this section of the paper, we will discuss this model in detail, demonstrating how the Simulator Division utilized it to implement MBSE for the sustainment of simulator systems. This section is organized according to the 8 steps of the Kotter model, providing a step-by-step explanation of its application in this context.

1. Create Sense of Urgency

To motivate the organization to act quickly, it is essential to demonstrate the need for change. This involves highlighting potential threats and opportunities, as well as using data and evidence to build a compelling case. Communicating the importance of immediate action is crucial to prevent future crises and galvanize the organization into movement.

The 2017 National Defense Authorization Act (NDAA)[10] mandates that all major systems programs adopt a modular open systems approach. This requirement aims to prevent vendor lock-in to alleviate the pressure of committing to a single vendor for the system's entire lifespan, thereby providing the flexibility necessary to meet future needs. This

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[6] (Lewin, 1936)
[7] (Prosci, n.d.)
[8] (Kotter Inc., 2024)
[9] (Baggio, Digentiki, & Varma, 2019)
[10] (United States, 2016)

approach is important for sustainment as changes in vendors longevity can significantly impact the availability and cost of various system components.

Meanwhile, the Department of Defense's 2018 Digital Engineering Strategy[11] emphasized the use of models throughout the system lifecycle to enhance the communication of technical information, thereby improving overall process efficiency. Effective communication of authoritative data fosters a deeper understanding of system architectures, improves engineering process efficiencies, enhances collaboration among all stakeholders, and supports better decision-making.

Moreover, Dr. Will Roper's There is no Spoon[12] introduced many in the Air Force to the concepts of Digital Twins, Digital Threads, and the Tech Stack. He urged the department to take ownership of the data tools, models, and infrastructure necessary to embrace the digital approach to systems acquisition and apply it across the system lifecycle. As he put it, "Rather than just building better systems, it builds systems better."

Following this initiative, recent revisions of the Department of Defense Instructions (DODI) 5000.88[13] have integrated digital processes into all phases of systems acquisition. Many centers, directorates, and divisions within the Air Force Materiel Command (AFMC) have incorporated digitally enabled processes within their strategic plans. WNS has chosen to implement the use of models as a foundational step towards broader process modernization.

Given the purpose of the WNS, which is to quickly add new capabilities to existing legacy simulator systems, it has become imperative to maintain technological parity with America's peer and near-peer adversaries. WNS achieves rapid training system capability upgrades by developing new subsystems that integrate simulators and sustain legacy training systems through constant upgrades.

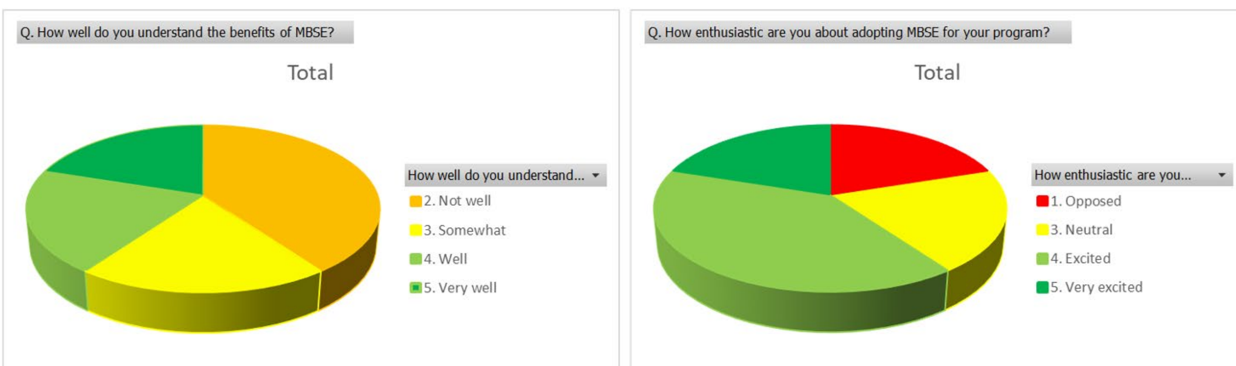

Figure 2 - Grasping the Benefits of MBSE and inspiring Enthusiasm within WNS

Results from a survey of MBSE use within WNS programs, Figure 2, shows that while the full benefits of MBSE are somewhat unknown, there is sense of enthusiasm for its implementation. This enthusiasm suggests that, despite the need for better training, the advantages of MBSE are evident enough to generate excitement. However, one program gave a neutral response, potentially indicating the need for further education about MBSE benefits. Additionally, only two programs reported a strong understanding of its benefits, with others showing partial or poor understanding. Some programs might struggle to realize the full benefits due to information being locked in older formats and resistance to change. Moreover, MBSE may not be equally applicable to all programs. This analysis underscores the necessity for a comprehensive change management strategy. Implementing a structured OCM framework like Kotter's 8-Step Model can facilitate a seamless transition from high-level strategic planning to operational and tactical execution, ensuring the successful adoption of MBSE across the organization.

[11] (Office of the Deputy Assistant Secretary of Defense for Systems Engineering, 2018)
[12] (Roper, 2020)
[13] (Office of the Under Secretary of Defense for Research and Engineering, 18 November 2020)

2. Build A Guiding Coalition

Assembling a powerful group requires identifying key stakeholders and influential leaders within the organization who possess diverse skills and perspectives. Strong and visible support from leadership is essential to effect significant change. A strong coalition ensures that the team works well together and remains committed to driving the change forward. Regrettably, this step was incomplete because the case for using MBSE, while persuasive to some programs within WNS, was not strong enough to compel the entire division to support the effort. The recent push for creating a DMM capability with the division has brought renewed attention to the benefits of MBSE and is anticipated to lower the resistance to adoption.

3. Form A Strategic Vision

Creating a clear vision that directs the change effort and developing strategies to achieve it are vital. This involves crafting a compelling vision that aligns with the organization's core values and establishing initiatives and strategies that support this vision. Ensuring that the vision is easily communicable and understandable is key to guiding the organization through the change.

In 2017, WNS leadership recognized the value of incorporating digital engineering concepts into a new program under development.[14] The program team conducted thorough research to identify the most effective digital engineering approach, ultimately deciding to implement MBSE using the Object Management Group (OMG) Systems Modeling Language (SysML). MBSE was chosen for its compatibility with a Modular Open Systems Approach and its ability to utilize common architectures down to the configuration item level. The selection of SysML was beneficial due to its status as a well-documented industry standard, already in use or readily adoptable by WNS contractors. As the benefits of MBSE for the new program became evident, interest in MBSE spread throughout the WNS enterprise.

Consequently, the WNS MBSE Implementation Project was officially launched in 2019, building on the initial research and chosen language of the program team. The project commenced with the development of a high-level model of the Operational Training Infrastructure (OTI) Enterprise System Model (ESM)[15], which was later rename to the Operational Test and Training Infrastructure (OTTI) ESM. The main purpose of this model was to provide an understanding of the enterprise's scope and serve as a foundation for a more detailed model. The early stages of OTTI ESM modeling efforts documented in the paper represent a significant cultural shift in engineering practices within AFLCMC/WNS. The development of the OTTI ESM project began with five project lines of effort (LOE), briefly described in Table 1. Detailed descriptions and information on these LOEs are provided in our previous papers.[16]

Table 1 - MBSE Implementation Project Lines of Effort

LOE	Description	Deliverables
1 – Modeling Environment	Create and provision a collaborative modeling environment to support the access, sustainment, and use of the OTTI ESM	• Collaborative environment • Tools • Language
2 – Style Guide	Create and manage a style guide to support modeling efforts and facilitate the integration of constitutive models into the OTTI ESM	• Style guide • Global Reference Library • Bidder's Library Items • Administrative process for sustainment
3 – Training Program	Training personnel to create, sustain, and use the constitutive models of the OTTI ESM	• Training plan • Classes
4 – Modeling Support	Create and manage example models, support modeling of the constitutive models, and develop model capabilities	• Example Models • Modeling Support for Other LOE • Modeling Support for WNS
5 – Systems Engineering	Modify systems engineering processes and plans, facilitate organizational change management efforts, and create necessary documentation to support MBSE efforts in contract actions	• OSEP Revisions • DIDs and suggested language supporting the use of models

[14] (Smith, 2018)
[15] (Reed, 2019)
[16] (Ayers, et al., 2020)

4. Enlist A Volunteer Army

Broad communication of the vision and strategy is necessary to garner widespread support within the organization. Utilizing various communication channels, it is important to encourage and inspire employees at all levels to support and participate in the change. Storytelling and personal appeals can make the vision relatable and engaging. The MBSE team worked on building alliances with various groups and enlisting champions of change from different Integrated Project Teams (IPTs), including members from engineering, configuration management, and software research and development. While the progress in this area has been significant, there is still room for improvement.

5. Enable Action by Removing Barriers

Removing obstacles that hinder the change process is essential for progress. This involves identifying and addressing structural and procedural barriers, as well as empowering employees to take action and make decisions. Changing systems or structures that undermine the vision is crucial to enable seamless implementation. A key strategy for overcoming change barriers is through tailored training.

The first step was to properly train the WNS MBSE Team. This training served as an entry point into the field of MBSE, allowing newcomers to familiarize themselves with its concepts and enabling those already acquainted with MBSE to deepen their knowledge. As the MBSE team spearheaded the MBSE initiative within WNS and became a key knowledge resource, the need for more role-based training across the entire division emerged. To address this, the MBSE team collaborated with the Air Force Institute of Technology (AFIT) to develop a multi-tier role-based training program consisting of four levels. The first level, dubbed MBSE 101, is a 2-hour introductory session designed to pique interest in the subject. The second level, MBSE 201, targets non-modeler roles, teaching them how to interpret and interrogate models. The third level, MBSE 301, focuses on instructing participants on how to model using SysML. And the fourth level, MBSE 401, provides advanced modeling skills for intricate analyses such as Monte Carlo simulations. These training courses were tailored to consider simulator processes and contract lifecycle to enable an optimal learning environment for the target audience.

The survey results depicted in Figure 3, illustrate the varying levels of understanding of MBSE across WNS programs. Although most personnel have received some training, the overall comprehension of MBSE appears to be somewhat inadequate. Randall Satterthwaite[17], Figure 4, indicates that a company's ideal mixture of MBSE expertise include at least 50% of the population be at an intermediate level, while only less than 5% need to be experts. This effectively reduces the cost and time needed for expertly training the population and still ensures that in-house expertise resources are available. While significant progress has been made, WNS is still in process of achieving these ratios.

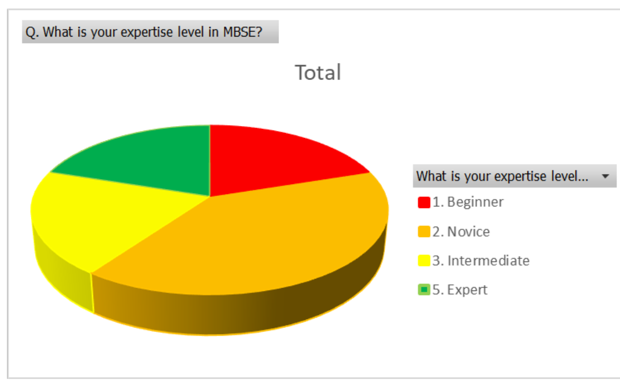

Figure 3 - Expertise level of IPT representatives in WNS

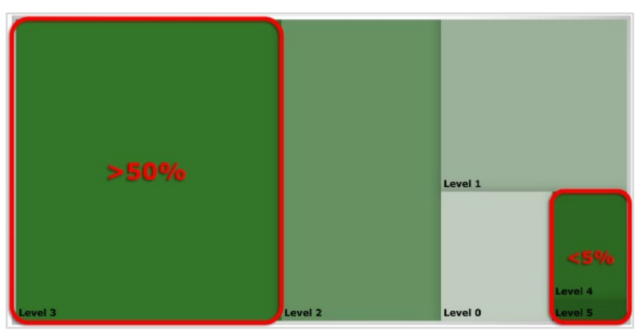

Figure 4 - Ideal MBSE expertise ratios (Satterthwaite, 2023)

While offering traditional MBSE training is an important first-step to overcome resistance, it is imperative for newly trained personnel to have frequent training opportunities and access to MBSE experts. Currently, the only training available consists of two to four-day long form classes offered once per quarter. To ensure the continued use of MBSE, it has been identified that implementing incremental training offerings is essential[18]. Given resource and student schedule limitations, we are adopting a more frequent and flexible approach to keep new modelers informed of updates to

[17] (Satterthwaite, 2023)
[18] Ibid.

the WNS MBSE modeling guidance, provide refresher training on essential modeling techniques, aid in knowledge retention, and facilitate direct access to MBSE experts.

6. Generate Short-Term Wins

Creating visible, early successes helps build momentum for the change effort. Planning for and achieving short-term goals that are meaningful and visible, recognizing, and rewarding contributions to these early wins, and using these successes to validate the change effort and build credibility are key strategies.

To date, the primary benefits of developing system models for WNS center around two main aspects: gaining a better understanding of the training devices program and having a clear overview of the supported systems and their installations. The first aspect is a core benefit of MBSE, while the latter is typically managed via an Excel spreadsheet or, if budget allows a Product Lifecycle Management (PLM) system. Utilizing MBSE for this purpose integrates the front-end development of Systems Engineering with the backend of product lifecycle management, enhancing traceability in system designs and deployed systems. This approach also reduces the number of tools needed and the associated training costs. While PLM systems are beneficial and often worth their cost, this demonstrates the sustainment capabilities within MBSE.

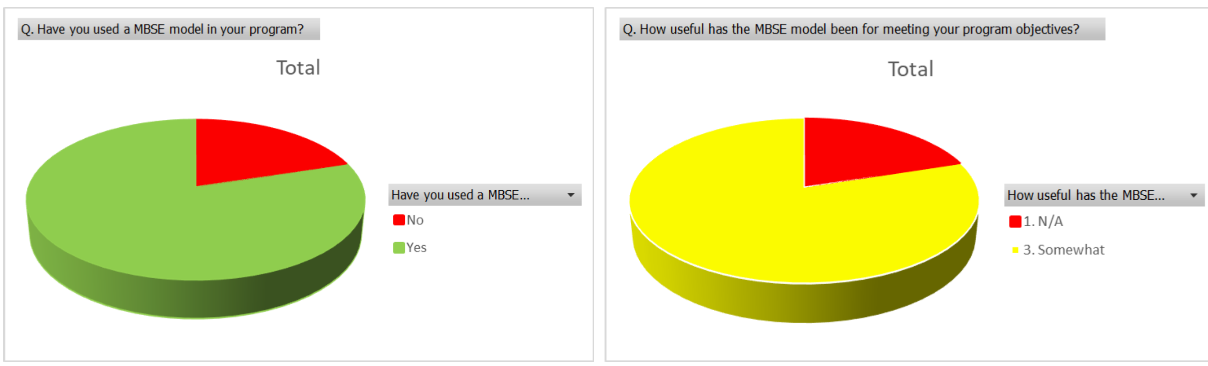

Figure 5 - Usage and usefulness of models for various programs at WNS

Another significant achievement is the positive feedback regarding the usage of MBSE models. As shown in Figure 5, most programs have utilized an MBSE model. The exception is a legacy program for a platform nearing its end of life, where investing in MBSE would not yield long-term benefits. This underscores the importance of establishing MBSE early to realize its benefits throughout the program's lifecycle.

Of the WNS programs that are using MBSE models, all of them have found MBSE models to be somewhat useful. Programs provided feedback on the effectiveness of their respective MBSE models. For instance, one program reported that their MBSE model helped consolidate disparate information, identifying miscommunications and gaps in requirements. Another program noted that the model aided in understanding and managing different system configurations. Additionally, another program highlighted the model's role in improving communication between stakeholders, as it serves as a single repository of relevant data that can be easily shared.

Overall, MBSE is benefiting these programs. However, there is potential to further enhance the usefulness of MBSE models for various WNS programs. To this end, the MBSE team will continue researching additional capabilities within MBSE to explore further applications in sustainment programs.

7. Sustain Acceleration

Building on the momentum from early wins involves continuously pushing for more change. Credibility gained from early successes can fuel efforts to tackle bigger and more complex change initiatives, continuously look for improvements and opportunities, and maintain a sense of urgency to avoid complacency.

The survey results in Figure 6 reveal resistance by programs to frequently use their MBSE models. Although the interviewed programs currently do not extensively use their models, there is still interest and intention to increase usage frequency over time. A well-constructed MBSE model should ideally be used on a regular basis to inform various decisions regarding system development and sustainment throughout its lifecycle. To demonstrate model utility, the team plans to incorporate additional capabilities into example models, showcasing its application in design decisions, sustainment activities, and Contract Data Requirements Lists (CDRLs) deliverables.

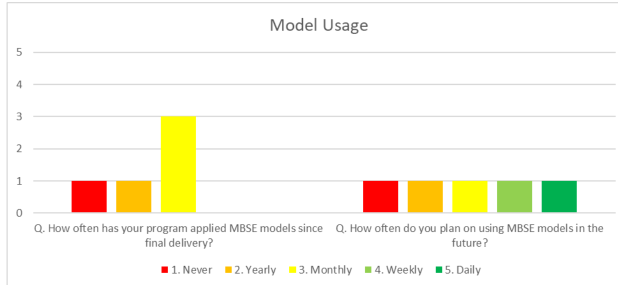

Figure 6 - How often different WNS programs use their respective MBSE models

The team created a style guide to standardize modeling conventions and style to maintain data coherency and modeling consistency across the various organizations producing models for WNS. This guide has positively affected WNS modeling efforts by ensuring a consistent appearance and organization across all contracted programs. Such consistency facilitates integration of models into a unified, query-able model of the enterprise that is easy to navigate for users with limited modeling experience. Recently, the WNS MBSE Style Guide evolved into the comprehensive WNS MBSE modeling guide[19]. This guide now includes a metamodel section (lexicon, taxonomy, and ontology), methodology, and style guidelines, along with supplemental materials to aid model comprehension. This development has enabled the MBSE team to clearly define and communicate their desired modeling ontology and methodology for WNS models.

A key aspect of the WNS modeling methodology is the WNS Modelverse, which consists of a set of six types of system models spanning from the top-level enterprise layer to the operational systems layer, as presented in Table 2. Figure 7 depicts the relationships and information-flows between the models that comprise the WNS MBSE Modelverse. Information flows top-down for development, initially conveying high-level organizational and strategic needs to the system mode. Meanwhile the bottom-up information flow for sustainment provides system details for programmatic purposes. Each model serves a specific purpose in meeting the evolving needs of the enterprise and supporting the system lifecycle from acquisition to operation.

Table 2 - Description of MBSE models in the WNS MBSE Modelverse

Model Name	Description
Program Development Model	Purpose is to develop and decompose requirements. May be combined with the Program sustainment model.
System Development Model	Purpose is to develop system architecture and baseline configurations
Deployed System Model	Purpose is to capture sustainment details for installed system sustainment and as-maintained systems; traced to the baseline configuration of the system model. May be combined with the Systems Site Model if there a few devices installed at the site. Alternate non-MBSE solutions may exist for capturing and maintaining this data.
Systems Site Model	Purpose is to aid in sustainment of site infrastructure
Program Sustainment Model	Purpose is to assist the program team in their sustainment activities
OTTI ESM	Enterprise level Model of Models that provides an entire enterprise view.

[19] (Simulators Division, 2024)

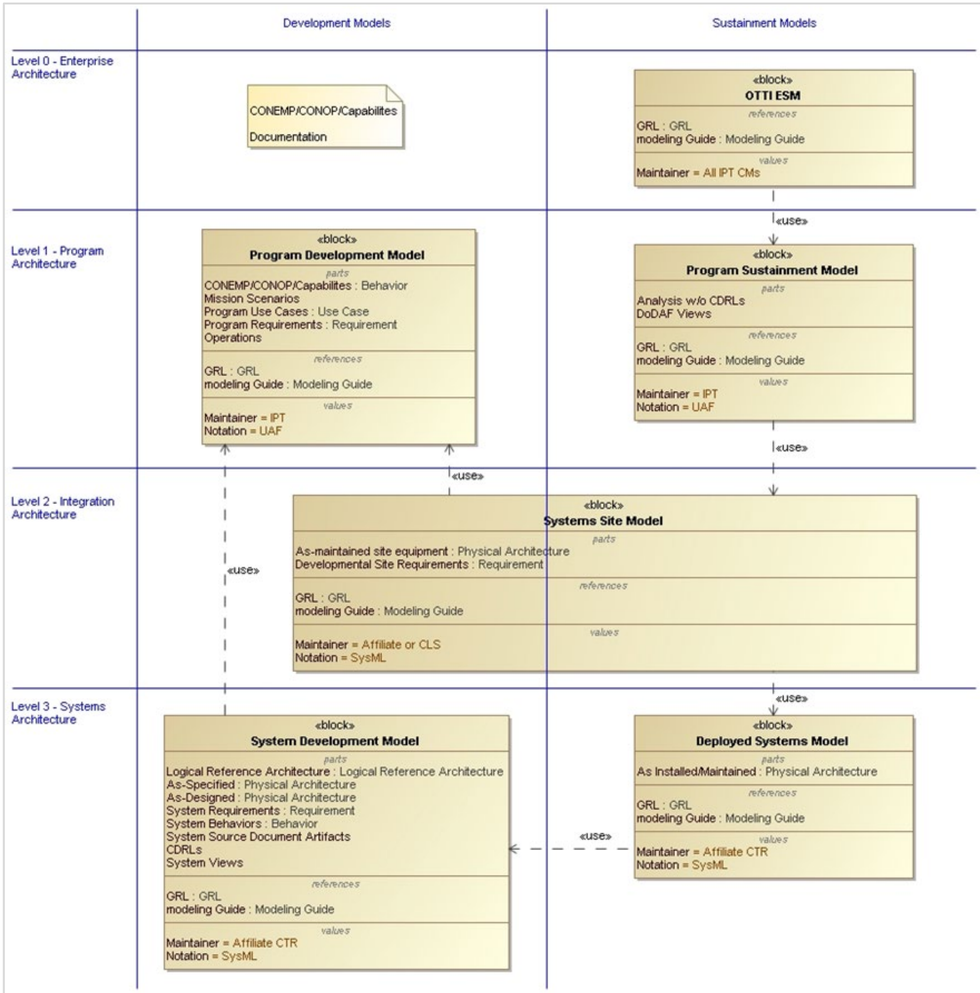

Figure 7 - WNS MBSE Modelverse: Types of MBSE models relevant to sustainment efforts within WNS.

8. Institute Change

Anchoring new approaches in the organization's culture is essential for lasting change. This involves ensuring that the changes are deeply rooted in the organizational culture, reinforcing them through policies, procedures, and norms, highlighting the connections between the new behaviors and the organization's success, and promoting and developing leaders who can continue to drive the change.

Our goal is for the Integrated Product Teams (IPTs) within WNS to utilize system models for activities such as evaluating Engineering Change Proposals (ECPs), performing logistics management, and conducting audits. Using models to fulfill the CDRLs instead of traditional documents, as shown in the modeling analysis package diagram, will enhance traceability and understanding of change points, ultimately resulting in cost and time savings. Our long-term objective is to employ system models within WNS to manage the training systems in the portfolio providing a comprehensive enterprise system view.

The WNS Organization Systems Engineering Plan (OSEP) has been updated to include Digital Engineering and MBSE, mandating that all programs adopt MBSE. WNS has developed standard Performance Work Statement (PWS) language that specifies the delivery of MBSE artifacts as part of contract deliverables, and this language is now used in all new contract actions.

In addition to the new WNS PWS language, we have leveraged other developments across the DOD to create digital-based Data Item Descriptions (DID) and CDRLs to eliminate ambiguity in digital-based contract language.

IV. LESSONS LEARNED

A complete and efficient transition from DBSE to MBSE for system sustainment requires all 8 steps of the Kotter model to be implemented. Currently, WNS has not made a full transition as there is still some resistance to adopting MBSE due to unresolved barriers such as adequate financial backing and full leadership buy-in.

There were also several lessons learned from going through the 8-steps Kotter framework:

1. A lack of support from leadership will make adoption significantly more difficult.
2. Single long-form training sessions, if not followed by continuous practice, will result in knowledge atrophy.
3. Demonstrating capabilities with example models is far more effective in building excitement and confidence than merely discussing them.
4. Modeling Guidance needs to be consistent throughout an organization. This guidance can be either adopted or developed, but standards should be set and disseminated.

V. CONCLUSION

Implementation of MBSE in the sustainment phase encounters several OCM challenges. As WNS is a sustainment organization, there is a challenge of justifying the cost of building models for systems already in sustainment. Some of the widely recognized frameworks that have proven effective for OCM were presented in the paper including Kotter model for effectively managing the critical change at the organization level, and ADKAR for managing individual change. The Kotter model 8-steps for effective OCM were applied to manage the transformation for WNS. The work illustrated how Kotter model can also be effective for other teams to implement OCM.

The survey of WNS programs using MBSE indicated that there is a sense of enthusiasm for its implementation and there is still a need for further education about MBSE benefits. The analysis of the survey data further underscores the necessity for a comprehensive change management strategy. Implementation of a structured OCM framework like Kotter's 8-step model can further facilitate a successful adoption of MBSE across the organization.

Identifying the needs of key stakeholders within WNS is important for driving meaningful change. WNS leadership recognized the importance of digital engineering and the pilot project transformed into a larger WNS MBSE implementation project launched in 2019. The project tasks were categorized into five lines of effort. The early stages of OTTI ESM modeling efforts represented a significant cultural shift in engineering practices within the division. The MBSE team worked well in building alliances with different IPTs but there is still room for improvement.

The MBSE team established a training program to educate WNS personnel on the benefits of MBSE, building and utilizing MBSE models for engineering milestones. While this was a good start, the MBSE team has decided that offering an additional, shorter training option is necessary to improve learning retention. Several programs have started adopting MBSE and producing models of the systems they manage, seeing benefits in their engineering processes.

To sustain acceleration, the WNS MBSE team developed modeling guidance to help WNS programs create models to specific specifications. The team also enhanced modeling practices to introduce more capabilities and standardization. The MBSE team instituted change by tailoring the language of the OSEP and PWS to include digital engineering as a core component of the engineering process.

While the WNS MBSE team has imperfectly followed the Kotter 8-step Model for change, some of its many benefits have been recognized. Plans to apply this model more-rigorously have been identified. It is anticipated that a more complete implementation will yield additional benefits to the Simulators Division, particularly in their efforts to create a digital materiel management capability.

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