MBSE

Air Logistics Complex Model-Based Systems Engineering (MBSE) Plan

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ABSTRACT

As the US Air Force utilizes digital engineering (DE) and model-based systems engineering (MBSE) to modernize operations, ManTech can serve as a trusted advisor to streamline transformation. ManTech offers a suite of DE Ecosystem Services to identify customer needs, define clear and achievable steps to attain goals, and execute incremental, value-adding solutions. We understand the challenge of implementing digital enhancements in logistics while keeping processing costs low for programs. We enable customers to incrementally improve targeted, priority areas with a clear vision of how the DE evolution puzzle pieces fit together. Working at the right level of scale and understanding, ManTech takes the anxiety out of DE implementation, helping customers implement contextually relevant improvements to achieve concrete results.

We traditionally use a three-phase approach. For Phase 1, ManTech works closely with stakeholderssystematically develop DE and MBSE situational awareness, identify needs, develop transformation requirements, and define a transformation roadmap with incremental, high-value, targeted opportunities. For Phase 2, ManTech uses Provision, Model, Integrate, and Sustain services to execute an initial high-value, targeted pilot opportunity to demonstrate return-on-investment and build confidence. For Phase 3, ManTech revisits activities to build on learning from the pilot project and refine the transformation roadmap to ensure a realistic, sustainable, ongoing approach. The overall benefit is assistance in strategically navigating DE and MBSE capability development in a methodical, practical manner that is properly sized to the contextual constraints of logistics operations.

PROBLEM STATEMENT

The United States Air Force is modernizing operations to maintain dominance and speed the pace of decision making. Digital needs of the entire acquisition and sustainment enterprise are being examined from a short- and long-term perspective. A key part of this is implementing DE and MBSE across commands and operations. The US Air Force is interested in utilizing DE and MBSE to improve operational efficiency and enhance value provided to programs. The mandate to modernize is challenged by an older plant, mature weapon systems, and a rate-based system where cost to modernize will drive rates. The focus is on speed, but this cannot be at the expense of quality.

BACKGROUND

ManTech meets customers where they are in their DE and MBSE transformation to clearly define the next steps to realize benefits and enhance program success. The DE consulting services offered cover five categories essential for sustainable DE and MBSE success:

Transform, Provision, Model, Integrate, and Sustain, as shown in Figure 1. This holistic view enables customers to incrementally improve targeted, priority areas with a clear vision of how the DE and MBSE evolution puzzle pieces fit together. Working at the right level of scale and understanding, state-of-the-art concepts are employed, or rudimentary functions supported. Most importantly, ManTech takes the anxiety out of DE implementation, helping customers implement contextually relevant improvements to achieve concrete results and value.

The primary challenge to successful DE and MBSE implementation is cultural transformation, which drives the importance of Transform services. With breadth of experience spanning the acquisition chain, including sustainment, ManTech's personnel understand first-hand the DE and MBSE concerns of a wide variety of stakeholders and provide external situational awareness to customers. Couple this vision with practical, proven tactics to drive change, and ManTech helps our customers identify the most strategic transformation roadmap, execute with efficiency, and apply data-driven adjustments as needed.
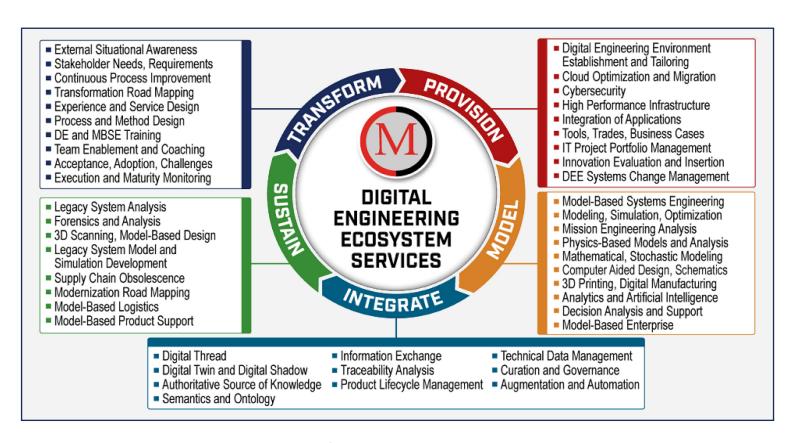

Figure 1: Digital Engineering Ecosystem Services

The first **Transform** service offered is *External Situational Awareness*, where ManTech helps customers comprehend the "bigger picture" for DE transformation, including customers' expectations, acquisition trends, current state-of-the-art, industry best practices, and emerging technological innovations. Depending on need, we translate terminology and abstract concepts into understandable, relevant language. We arrange benchmarking visits, facilitate technical information exchanges, and provide pertinent literature. ManTech helps customers cut through the hype to gather objective, relevant data for a data-driven foundation for DE transformation.

We systematically elicit *Stakeholder Needs and Requirements* and assist in formal documentation, validation, and baselining of that information, depending on the degree of formality required. These efforts could include facilitating interviews, documenting use cases, modeling contexts and needs, parsing documents, managing requirements, and striking baselines. This ensures that stakeholder expectations are addressed during the DE and MBSE transformation.

Using data gathered, ManTech assists customers in *Transformation Road Mapping*. A roadmap provides realistic, achievable milestones within situational time and resource constraints. The roadmap may be aligned with published maturity models (internal to USAF or external) to attain specific levels of maturity in designated timeframes, or it may be aligned with building needed capability for anticipated new projects. The transformation roadmap provides focus and visibility to ensure that DE and MBSE capability investments are addressing highest priority needs.

Experience Design and Service Design draw on users' needs, feelings, contexts, and mindsets to design experiences and services. In a DE and MBSE context, this type of analysis provides optimal user-tailored solutions, which boosts their adoption and cultural transformation. Experience design is a user-driven approach to creating experiences for people that solve a problem, elicit a positive emotional response, and drive usage and behavior. Instead of designing a technical DE and MBSE solution, imposing it on users, then encountering cultural resistance, our approach starts with users. Resistance to transformation is overcome by first understanding how end-users will use the solution, how it will fit in their lives, how it will solve current pain points, and how it will prompt a positive emotional response. ManTech supports our customers with both initial experience design and ongoing iterations as the solution evolves.

A central part of transformation is having the right processes and methods in place for the workforce to follow. ManTech assists customers with **Process and Method Design**, including evaluation of existing and development of new processes and methods, as well as analysis of contextual data.

Fundamental to DE transformation is **DE and MBSE Training**. ManTech helps our customers identify the domain, process, methodology and tool training needed. We point customers to corresponding third-party training, facilitate training delivery, or provide our own training if needed.

Within the **Provision** service, ManTech helps customers with optimized use of their Digital Engineering Environment (DEE). Staffed with premier architects with experience from industry leading organizations, ManTech personnel use proven practices to establish, tailor, and operate robust DEE infrastructure. We keep a pulse on the latest computational advances and implement advancements internally prior to recommending practices to customers.

In the **Model** service, ManTech provides direct MBSE support. Our detailed fleX-engineering™ approach combines the rigor of standards-based systems engineering (SE) with the ability to flex in multiple dimensions to provide speed with discipline and rigor. fleX-engineering™ has five dimensions of flexibility, each with a possible spectrum of implementation:

- **Life Cycle Scope:** Single SE process to all SE processes.
- **SE Scale:** Very small entity to large organization.
- **Technical Management Approach:** Waterfall to iterative/agile.
- **Formality:** Low ceremony to high ceremony.
- **Digital Maturity:** Document-based to model-based.

Model-based work instructions provide in-model guidance at the point of need to aid modelers. Automated validation is used to enhance model quality, and custom widgets aid modeling efficiency. As a well-established MBSE provider with US Navy, US Marine Corps, US Space Force and other customers, ManTech can also link MBSE modeling with cyber vulnerability assessments. One aspect which makes ManTech's MBSE approach unique is meeting customers where they are. We understand the importance of flexibility to mission need, and our processes are built to support flexibility with rigor. ManTech is also prepared to assist with other types of modeling, as identified during the initial needs assessment.

With the **Integrate** service, ManTech ensures improvements and digital artifacts connect across the lifecycle. Understanding that digital transformation is much more than Product Lifecycle Management, ManTech employs a semantic approach to integration. This enables tool connection to a digital thread, which is more robust and scalable than tool-to-tool connections. We also have a unique approach to model governance which maintains order as digital transformation evolves. ManTech can support multiple aspects of Integrate as needed.

Finally, the **Sustain** services help customers utilize a DE and MBE approach in later life cycle phases to lower total cost of ownership while maximizing system readiness. In *Legacy System Analysis*, historical artifacts are collected, connected, and evaluated to contemporary best practices. ManTech provides pragmatic advice for modernization.

Gathering of historical artifacts may reveal holes in the design record. ManTech provides **Forensics and Analysis** support for the reverse engineering required to fill design record gaps and provide analytical justification.

For historical programs where design documentation is lost or cannot be retrieved, existing parts are scanned, and the results pulled into model-based design artifacts. ManTech assists customers with *3D Scanning and Model-Based Design*.

If security auditing is needed, ManTech supports customers with *System and Network Fingerprinting* to correlate data sets to identify network services, operating system number and version, software applications, databases, configurations, and more.

For customers managing legacy systems, a sufficient business case may be made to develop models and simulations of the legacy system. ManTech assists with *Legacy System Model and Simulation Development*.

For systems in operation over an extended lifetime, such as those supported by the Ogden Air Logistics Complex, *Supply Chain Obsolescence* may be an issue. Using the Sustain services described, ManTech can help customers characterize existing component geometry, functionality, and interfaces, then identify sufficient alternatives. In addition, we help model the supply chain and run analytics to identify vulnerabilities.

ManTech aids customers with *Modernization Road Mapping*. DE transformation for entrenched legacy systems may be expensive and complicated, and modernization efforts must keep pace with rapidly changing technologies and threats. It is important to dynamically understand priorities and concerns to phase in modernization appropriately. Utilizing our modernization and technology planning expertise, ManTech guides customers in developing an affordable and impactful modernization roadmap, which may be better aligned with specific DE modernization frameworks as customers request.

ManTech is prepared to work with customers on *Model-Based Logistics and Model-Based Product Support* to improve or redesign outdated sustainment systems that drive up costs and cause unplanned outages. Digital Twins and model-based product logistics/support concepts lead to standards-based technical data packages that preserve "as-maintained" information and exchange information with readiness and maintenance models, to support enterprise logistic support analysis and maintenance task analysis and planning at the point of performance.

CONCLUSION

DE and MBSE transformation are challenging in the best of circumstances. As the Air Force continues to evolve the use of DE and MBSE, the challenges of an older plant, mature weapon systems, and a rate-based system where cost to modernize drives rates provide an increased challenge. The focus is on speed, but this cannot be at the expense of quality.

In this challenging context, ManTech can serve as a trusted advisor to streamline transformation. ManTech offers a suite of DE Ecosystem Services to identify customer needs, define clear and achievable steps to attain goals, and execute incremental, value-adding solutions. In addition to supporting customers, within ManTech, we have implemented a corporate DEE and routinely utilize DE-MBSE practices internally. We understand the challenge of implementing digital enhancements in logistics while keeping processing costs low for programs and maintaining execution velocity. With industry-leading experts and robust yet flexible process, we enable customers to incrementally improve targeted, priority areas with a clear vision of how the DE evolution puzzle pieces fit together. Working at the right level of scale and understanding, ManTech relieve the anxiety associated with DE and MBSE implementation to implement contextually relevant improvements to achieve concrete, sustainable results.

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