

Role Based Matrix Area	Model-Based Capability Name	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4
1. Workforce/ culture	MBSE Use Strategy	No documented MBSE use strategy, or the strategy is described for ad hoc efforts. Each MBSE effort is stand-alone to address specific concerns.	Organization MBSE use strategy is documented as part of its overall organizational strategy at the system level. The strategy is related to the overall risk strategy.	Organization MBSE use strategy is documented as part of the organization's overall strategy at the system level. The strategy is related to the overall risk strategy. Modeling results used to inform systems engineers across system engineering phases and for all disciplines.	Organization MBSE use strategy is documented as part of the organization's overall strategy at the enterprise level. The strategy is related to the overall risk strategy. Modeling is integrated with business information tools and results used to inform systems engineers, program management, and all staff across the enterprise.	Organization MBSE use strategy is documented as part of the organization's overall strategy at the enterprise level. The strategy is related to the overall risk strategy. Modeling is integrated with business information tools and results are used to inform systems engineers, program management, and all staff across the enterprise. It manages a full range of business concerns.
1. Workforce/ culture	Common DE and MBSE Terminology	Appropriate terminology defined for the project or program.	Common Glossary/Data Dictionary.	Top Tier terminology is defined for the enterprise.	Discipline and engineering specialty terminology is added to cover lower level models.	Common, tiered taxonomies are defined and consistent across enterprises and consistent with accepted community standards.
1. Workforce/ culture	Modeling Roles and Responsibilities	Modeling roles and responsibilities are not identified.	Modeling roles and responsibilities are identified.	Modeling roles and responsibilities are characterized by model-based Knowledge, Skills, and Abilities (KSAs).	Modeling roles are provided the permissions necessary to perform their responsibilities.	People who need to be active are identified and involved. Sufficient staffing and staffing plan ensures all roles are fulfilled.
1. Workforce/ culture	Modeling Development Skills	Model-based Knowledge, Skills, and Abilities (KSAs) are undefined and unknown. None, or ad hoc for all staff.	Model-based Knowledge, Skills, and Abilities (KSAs) are defined for modelers. Modeling of components of the Enterprise or System.	Model-based Knowledge, Skills, and Abilities (KSAs) are defined for roles involved with modeling; Enterprise Architect, SE, PM, IT, modelers, etc.... Novice Modelers on full Enterprise or System -subsystem models.	Model-based Knowledge, Skills, and Abilities (KSAs) are defined for roles involved with enterprise management. Expert model development lead with experience practicing modeling on at least 1 project that successfully completed at least 3 major technical reviews that used models in support of the review.	Expert model development lead that sets modeling standards and evaluates the model product quality of other modelers.
1. Workforce/ culture	Modeling Use skills	None, or ad hoc for all staff.	Can generate tool standard digital artifacts as needed to evaluate the Enterprise or System.	Can generate tool custom digital artifacts as needed to evaluate the Enterprise or System.	Can generate custom digital artifacts across tools, models, and data sets to evaluate the Enterprise or System.	Can contribute to defining the enterprise, system, and other data needed by the complete team to perform analysis for IPTs, reviews, audits, and other technical and programmatic decisions.
1. Workforce/ culture	Modeling-related Training/KSA development	No training or development activities.	Tool familiarity training completed. Initial experience to perform their modeler or user roles.	Modeling or model users experience on specific tools with respect to their role as a user or modeler.	Demonstrating role capabilities using the models, coaching, and instructing others.	Provide leadership in proposing, designing, and delivering training that is appropriate for the modeling and user roles.
2. SE Processes/ Methodology	SE Agreement Process	Modeling is not incorporated as part of the agreement processes.	Given a clear business case, modeling is applied in an ad hoc manner across projects or programs.	Given a clear business case, modeling is applied in a consistent manner across projects or programs.	Consistent model business case descriptions are being practiced across an enterprise.	Consistent model business case driven planning guidance is in place and is being practiced across an enterprise.
2. SE Processes/ Methodology	SE Organizational Project-Enabling Processes	Modeling is not incorporated as part of the Organizational Project Enabling processes.	Given a clear business case, modeling is applied in an ad hoc manner across projects or programs.	Given a clear business case, modeling is applied in a consistent manner across projects or programs.	Consistent model business case descriptions are being practiced across an enterprise.	Consistent model business case driven planning guidance is in place and is being practiced across an enterprise.
2. SE Processes/ Methodology	SE Technical Management Processes	Modeling is not incorporated as part of the Technical Management processes.	Modeling is part of the processes to improve quality and models contribute to the authoritative source of truth.	Modeling is the basis for the processes. Digital artifacts are used to make SE Technical Management decisions.	Modeling is the basis for the processes and is used to optimize results across the project or program.	Modeling is the basis for the processes and is used to optimize results across the enterprise.
2. SE Processes/ Methodology	Model Configuration Management	Model Configuration management is ad hoc.	Model configuration management is an assigned role.	Model configuration management adheres to a standard.	Model configuration management is applied to all models for a system.	Model configuration management is applied to all models for an enterprise.
2. SE Processes/ Methodology	Model Data Management	Model Data Management is ad hoc.	Model data management is an assigned role.	Model data management adheres to a standard.	Model data management is applied to all models for a system.	Model data management is applied to all models for an enterprise.
2. SE Processes/ Methodology	SE Technical Processes	Modeling is not incorporated as part of the Technical processes.	Modeling is part of the processes to improve quality and models contribute to the authoritative source of truth.	Modeling is the basis for the processes with digital threads covering some of the processes. Digital artifacts are used to make SE decisions.	Modeling is the basis for the processes with digital threads covering all selected processes. Digital artifacts and digital twins are used to make SE decisions.	Modeling is the basis for the processes with digital threads covering all processes. Digital artifacts, and digital twins are used to make SE decisions.
2. SE Processes/ Methodology	Modeling Stakeholder Requirements	Stakeholder requirements are not modeled.	Stakeholder requirements are in a requirements management tool.	Stakeholder requirements in a management tool are linked to enterprise and system models and are bi directional traceable. The requirements are linked model data that provide digital artifacts spanning the life cycle and depth of design information.	Enterprise and system stakeholder requirements are bi directional traceable.	Stakeholder requirements are traceable across enterprises.
2. SE Processes/ Methodology	Model-Based Verification and Validation	No plan for verifying or validating requirements in the models.	Plan for verifying and validating requirements in the models.	Verification and validation plan relies on model contents and analysis via requirements "analysis."	Modeling development processes have been established, modeling patterns, styles, and standards have been defined, and standard V&V procedures and programs have been formulated.	Modeling development processes have been established, modeling patterns, styles, and standards have been defined, and standard V&V procedures and programs have been formulated (including associated automated scripts and tools).
3. Program/ Project Processes Methodology	SE-driven Model Plan	No documented MBSE plan.	Models are developed for parts of the system engineering or enterprise engineering processes or for only parts of the life cycle. Appropriate tools, environments, methods, and resources are provided.	Full System/Enterprise Models are developed and applied variously across the product life cycle and across Systems Engineering organizations. Appropriate tools, environments, methods, and resources are provided.	Multiple System Models are integrated for the enterprise. Consistent tool coverage and use within separate Systems Engineering Organizations. Appropriate tools, environments, methods, and resources are provided.	Consistent tool coverage within separate Systems Engineering Organizations across the enterprise. Multiple enterprise models are interfaced within or across mission areas. Appropriate tools, environments, methods, and resources are provided.
3. Program/ Project Processes Methodology	Model Based Reviews; Management Program Reviews /MPR(s), Milestone reviews, program reviews, technical reviews, audits	Reviews are not model based. Review and audit is set by calendar date against a contract event such as contract award. Digital artifacts aren't planned for use to satisfy entry/exit criteria.	Identification of model-based digital artifacts to satisfy entry/exit criteria. Model results called out explicitly as products with defined product quality. Use of digital artifacts allow for some criteria items to be addressed prior to the event.	Review process is still a scheduled event with known entrance and exit criteria as well as frozen baselines. Use of digital artifacts allow for some criteria items to be addressed prior to the event. Model-based digital artifacts to satisfy criteria along with linked narrative. Model content is identified that satisfies criteria are linked to external list of criteria (e.g., hyperlink to Word doc).	Review and audit is set by model data and information availability. Review process allows for more flexible reviews so that some criteria are acknowledged and accomplished before the scheduled review. Predominantly model-based digital artifacts with as-needed documents to satisfy criteria with linked narrative.	Enterprise organizations coordinate on common review criteria application, tailoring, and the use of specific digital artifacts to meet specific criteria. Models record the acceptance of criteria items. Rolling, frequent reviews of model contents of identified "Knowledge Points" allow stakeholders to accept that the review is complete for that knowledge point whenever the exit criteria is met.
3. Program/ Project Processes Methodology	Model Metrics	Metrics are not used to manage the model development, quality, or effectiveness.	Available metrics are reported from the various modeling tools used.	Metrics, beyond those available from the tool configuration, are reported to address model development, quality, and effectiveness needs.	Metrics are used to manage the model development, quality, or effectiveness for a system or enterprise.	Consistent metrics are used across the enterprise to manage the model development, quality, or effectiveness with trend information kept and decision making thresholds established.
4. Model Based Effectiveness	Modeling Integration	Elements within a model are not integrated.	Elements within a model follow a structured approach (such as OOSEM).	Model elements not needed and that don't fit within the structured approach are removed. Model constraints are identified and model blocks structures are created.	Integration across systems models for a project/program use the same structured approach. A Library of reusable SysML blocks is created and used.	Integration across systems models for an enterprise use the same structured approach. A Library of reusable SysML blocks is created and used.

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4. Model Based Effectiveness	Verification and Validation of Models	The organization has not stated model objectives -- no basis for verification and validation of the models.	The organization has stated model objectives but not model requirements. Partial V&V evaluation of the resultant model is possible.	Model objectives and some general model requirements have been stated. Plans for V&V evaluation of the model traceable to the model requirements have been made.	Model objectives and some detailed model requirements for specific models have been stated. V&V evaluation of the models traceable to the model requirements is planned and includes V&V of modeling patterns, styles and standards, as well as having defined procedures.	Modeling development processes have been established, modeling patterns, styles, and standards have been defined, and standard V&V procedures and programs have been formulated (including associated automated scripts and tools). V&V of the models is performed and updates to the models made.
4. Model Based Effectiveness	Modeling Assurance	Model Assurance is not considered.	Model assurance is defined with known scales and methods.	Model assurance targets are identified in association with the effort schedule and cost.	Model assurance measurement and corrective actions are conducted for projects/programs.	Model assurance measurement and corrective actions are conducted for the enterprise.
4. Model Based Effectiveness	Authoritative Source of Truth (ASOT)	Data and information hasn't been identified to contribute to the authoritative source of truth.	Necessary data and information has been identified to contribute to the authoritative source of truth.	Data and Information are discoverable from specific models to address specific queries across parts of the enterprise.	Data and information provide knowledge to specific decision makers across parts of the life cycle and across parts of the enterprise.	Data and information are discoverable to provide knowledge to strategic to near real-time decision makers across the life cycle and across the enterprise.
4. Model Based Effectiveness	Digital Threads	Digital threads have not been identified.	Digital threads have been identified.	Digital threads have been established for limited program/projects across the enterprise.	Digital threads have been established contributing to the authoritative source of truth for limited programs/projects across the enterprise.	Digital threads have been established contributing to the authoritative source of truth for an enterprise.
4. Model Based Effectiveness	Digital Twin	Digital twins have not been identified or established.	Digital twin (DT) types have been identified; E.g., (DT Prototype, DT Instance, DT Aggregate, DT Environment).	Digital twin types have been established; E.g., (DT Prototype, DT Instance, DT Aggregate, DT Environment).	Digital twin types are effectively used to make decisions for limited programs/projects across an enterprise.	Digital twin types are effectively used for an enterprise.
4. Model Based Effectiveness	Digital Artifacts	Hardcopy or business application (e.g., MS Word) generated documents are not based on digital artifacts.	Documents incorporate digital artifacts such as model generated views.	Program/Project uses a mix of documents and digital artifacts to make decisions.	Program/Project uses digital artifacts to make decisions.	Enterprise decisions are based on tool and user defined digital artifacts to make decisions.
5. Information Technology Infrastructure	Modeling Tool Access	Model access is based on desktop access.	Access to models are based on IT login.	Access to models are based on role-based permissions.	Model access permissions are shared within a project/program.	Model access permissions are shared within an enterprise.
5. Information Technology Infrastructure	Model Based Tool Licensing & Access	None or Unmanaged.	Tool licenses and access address specific project or program needs.	Tool licenses and access are considered for new projects or programs.	Center-wide license access for commonly used tools.	License count appropriate to the role, and access-controlled by role.
5. Information Technology Infrastructure	Collaboration capabilities	Collaboration by business tool applications (e.g., E-mail, telecom.).	System Model File Exchange is identified and used.	Various organizations working on different parts of model. Models are integrated by a single organization.	On-line, real-time collaboration amongst distributed project/program teams.	On-line, real-time collaboration amongst distributed teams for an enterprise.
6. Modeling Tool Construction	Model Management	Model management is ad hoc.	Model management is an assigned role.	Model management adheres to a standard or to a defined approach.	Model management is applied to all models for a system.	Model management is applied to all models for an enterprise.
6. Modeling Tool Construction	Distributed Database/Tool interoperability	No interoperability between model based tools.	Model Based Tool-to-Tool has ad hoc interoperability.	Partial Federated Database Management System (FDBMS).	Main tools interoperable. Supporting tools interact through file transfer.	Fully Federated with standard "plug-and-play" interfaces. Data is interchanged among tools.
6. Modeling Tool Construction	Model Based Data/Tool Independences	Data/Tool independences are not considered and data is usually resident in the tool or tool directed default directories.	Data/Tool independences are considered and planned to enhance data independence from tools.	Data/Tool implementations independences are managed to allow data to be independent from tools.	Data/Tool implementations independences are managed to allow data to be independent from tools and allow import/export to foster data portability.	Data is independent of tools and allows for portability.
6. Modeling Tool Construction	Inter-Database/Tool Data Item Associations	Databases/tools are independent.	Inter-Database/Tool Data Item associations defined.	Inter-Database/Tool Data Item associations defined, captured, managed.	Inter-Database/Tool Data Item associations among all data items defined, captured, managed, and traceable.	Inter-Database/Tool Data Item associations among all data items defined, captured, managed, and traceable where changes in one data source alerts owners of other data sources of intended updates.
6. Modeling Tool Construction	Modeling Methods	Models use any method to solve specific problems. The overall approach is not structured for consistency.	Modeling methods are planned for efforts within a project. Some structure is applied.	Modeling methods are planned for efforts within a portfolio and are consistent as possible for each project/program. Best practices are evolving; structuring patterns emerge.	Modeling methods are planned for efforts within a portfolio and are consistent as possible across projects/programs within an enterprise. Best practices converge; patterns are captured and reused.	Structured methods are planned and reused.
6. Modeling Tool Construction	Model Languages	Model languages are used ad hoc to solve specific problems, but there is no plan to ensure consistency across a program/project.	Model languages are used ad hoc to solve specific problems, with a plan to ensure consistency across a program/project.	Model languages are consistent across a program/project.	Model languages are carefully chosen to unify the program/project, enable libraries, and enable reuse.	Model languages are carefully chosen to unify the enterprise, enable libraries, and enable reuse.
6. Modeling Tool Construction	Model Libraries	Model libraries have not been identified.	Project specific model libraries are established.	Cross project model libraries are established.	Plan to leverage Project model libraries to establish curated and shared libraries for an enterprise.	Project model libraries are established and shared across an enterprise in a curated manner.
6. Modeling Tool Construction	User Interface (UI), Viewpoint/Views, and visualization	Models are not used to identify or define the user interface or view/viewpoints.	Models allow the definition of the user interface, document generation, generation of views/viewpoints.	Models allow the definition of the user interface, document generation, generation of views/viewpoints and custom visualization.	UI supports Interrogation across the federated system's Authoritative source of truth and provides visualizations for decision making.	UI supports Interrogation across the federated enterprise Authoritative source of truth and provides visualizations for decision making.
6. Modeling Tool Construction	Simulation Capability	Simulation level of value to the project not considered.	Value of simulation capability considered but not explored.	Where appropriate, simulation capability utilized on a small scale but not fully utilized.	Where appropriate, simulation capability utilized but not fully exploited.	All aspects of simulation are being utilized where appropriate including both simulation capabilities embedded in the tool and external simulations linked to MBSE artifacts.
6. Modeling Tool Construction	Modeling Process quality	Modeling processes have not been identified/established.	Modeling is a parallel process to engineering processes and is used to demonstrate potential modeling benefits.	Modeling is the basis-of and integral-to engineering processes quality.	Modeling enables processes to be re-engineered to minimize steps, increasing timeliness, while preserving product quality.	Re-engineered modeling processes provide measurable improvements across the enterprise.
7. Model Use	MBSE Institutional Adoption (e.g., agency, service, center, business unit) for Digital Engineering	Some parts of the institution have adopted MBSE (e.g., new programs/initiative, pilot programs, and business case driven) for a segment of the enterprise work: e.g. requirements management architecture, design, manufacturing, ...	MBSE adoption by the Systems Engineering or Enterprise Organization.	Common implementation basis across institution with the intent to apply enterprise and system models.	Consistent institutional approach across organizations with variations as appropriate for specific needs. Consistent tool coverage and use across organizations.	Consistent institutional approach is driven by policy, practices and methods across organizations. Variations are allowed as appropriate for specific needs. Consistent tool coverage and use across organizations.
7. Model Use	MBSE Technical Innovation Process	Organization only upgrades tools, environment, and methods as driven by vendors and as standards are created or updated.	Organization commissions work to review its technology with the purpose to set direction and adopt new technologies.	Organization has a defined role for technology innovation to research and propose new technology adoption.	Organization has a defined role for technology innovation to research and propose new technology adoption. Goals are set, budgets allocated, and roadmaps are created and conducted to adopt new technologies.	Organization participates in tool vendor improvement forums, setting technological innovation through research, and involvement with standards setting bodies.
7. Model Use	Enabling Technologies	IT Infrastructure is static and not aware.	IT conducts ad hoc research and application of enabling tools and technologies.	IT aware of current trends/practices and uses roadmaps to enhance capabilities.	Applying processes to examine and anticipate how technology can be used and solve problems.	Mature process to continuously examine and anticipate how technology can be used to solve problems.
8. Modeling Policy	Intellectual Property (IP)	There is no policy covering the IP of model content.	There is policy covering the IP of model content.	The IP policy is applied to the model content.	Models across an project/program apply the IP policy to model content in the same way.	Models across enterprises apply a common IP policy to model contents in the same way.
8. Modeling Policy	Tool Governance	There is no tool governance policy.	There is tool governance policy.	Programs/projects apply the tool governance policy.	Program/projects within an enterprise consistently apply the same tool governance policy.	Program/projects across related enterprises consistently apply the same tool governance policy.