

PHRONESIM

Organisation Simulation Capability Maturity Assessment Service

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- Why Conduct an M&S Maturity Assessment?



Why do we do Modelling and Simulation?

Deliver **more**, and **better**, products

- Develop New Product Technology
- Improve Product Capability and Functionality
- Optimise Product Performance across Attributes
- Deliver More Product Variants in the Same Time

Deliver products **faster**

- Develop and Deliver Product to Market Faster
- Reduce Failure Modes and Error States (Find issues earlier)
- Faster to Final Release and Sign-Off

Reduce **development costs**

- Improve Efficiency of the Product Development Process
- Reduce overall time and resources (Faster & fewer design cycles)
- Reduce or eliminate prototype build and testing

Reduce **product & operating cost**

- Minimise Complexity
- Optimise for Material and overall Product Cost
- Increase re-use and commonality
- Minimise Production and Operating Cost

Reduce error states:
Improve product **quality**

- Improve Robustness to Real Use Noise Factors
- Reduce Quality Escapes and in-service failures
- Reduce Warranty Costs and Improve Customer Satisfaction

We use Modelling and Simulation to Deliver Product and Business Goals
How Effective & Efficient is our M&S in Delivering these Goals? How do we know?

Essential Elements for Modelling and Simulation

ESSENTIAL ELEMENT	DESCRIPTION
PROCESS	<i>Efficient</i> processes that define the simulation workflows and <i>aligned</i> to the overall development processes.
METHODS	<i>Capable</i> and <i>effective</i> methods to define how to model the specific physics required to deliver the product requirements.
TOOLS	<i>Capable</i> and <i>connected</i> tools to model the correct physics accurately.
MODELS	<i>Representative</i> and <i>accurate</i> models that reflect the latest design intent
DATA	<i>Reliable</i> and <i>accessible</i> technical data to define material properties, technical specifications, modelling parameters, and use cases.
PEOPLE & ORGANISATION	<i>Skilled</i> and <i>experienced</i> people with product knowledge and experience of the tools and methods, organised effectively to maximise collaboration and efficiency.
COMPUTE INFRASTRUCTURE	<i>Sufficient, reliable</i> and <i>flexible</i> computing infrastructure and resources to execute the complex and large scale simulations.

Organisation Simulation Capability Maturity (OSCM)

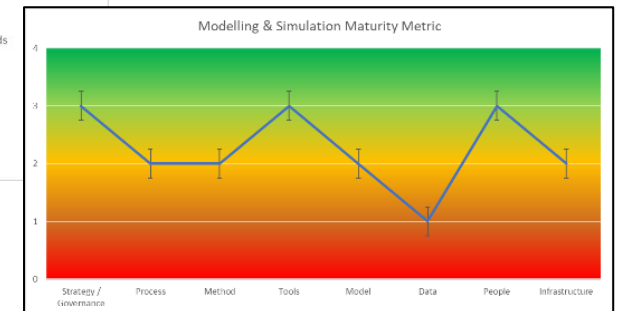
Aspect	Key Criteria	Maturity Level				
		0	1	2	3	4
		Insufficient Poor Confidence Limited Coverage (<25%) Ad-hoc No Plan No KPI	Needs Reviewed Low Confidence Partial Coverage (25-50%) Partially Applied Actions Identified Improvement Started	Comprehensive Medium Confidence Established/Aligned (50-75%) Fully Applied Improvement Plan In progress - On track	Embedded High Confidence Fully Implemented (75-90%) KPI Monitored Actions Complete Goals Achieved	Systemic/Innovator Certification Level Governed (90-100%) Maintained Continuously Improved Futured
Strategy	Comprehensive Aligned		ASSESSMENT			Target
Process	Efficient Aligned			ASSESSMENT		Target
Methods	Modular Capable Validated			ASSESSMENT		Target
Models	Appropriate Representative Accurate Aligned Shared Planned Managed		ASSESSMENT			Target
Tools	Capable Connected				ASSESSMENT	Target
Data	Validated Traceable		ASSESSMENT			Target
People and Organisation	Ownership Skilled Certified			ASSESSMENT		Target
Computing Infrastructure	Capacity Flexibility				ASSESSMENT	Target

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What is the Maturity Assessment Service ?

- An **independent assessment** of ALL aspects of your Modelling and Simulation capability
- Aligned to your product and business **goals**
- Uses an established **framework (OSCM)** to assess the strength and weaknesses of each of the core elements of an effective and efficient M&S capability
- Provides a **standardised** score reflecting the level of maturity of each of the core elements of your M&S capability compared with key criteria
- Identifies areas the organisation should **target and prioritise** improvement action to achieve goals
- Provides a summary of potential **improvement** approaches and **options**

Aspect	Key Criteria	Maturity Level				
		0	1	2	3	4
		Insufficient Poor Confidence Limited Coverage (<25%) Ad-hoc No Plan No KPI	Needs Reviewed Low Confidence Partial Coverage (25-50%) Partially Applied Actions Identified Improvement Started	Comprehensive Medium Confidence Established/Aligned (50-75%) Fully Applied Improvement Plan In progress - On track	Embedded High Confidence Fully Implemented (75-90%) KPI Monitored Actions Complete Goals Achieved	Systemic/Innovator Certification Level Governed (90-100%) Maintained Continuously Improved Futured
Strategy	Comprehensive Aligned		ASSESSMENT →			
Process	Efficient Aligned			ASSESSMENT →		
Methods	Modular Validated			ASSESSMENT →		
Models	Appropriate Managed		ASSESSMENT →			
Tools	Capable Connected				ASSESSMENT →	
Data	Validated Traceable		ASSESSMENT →			
People and Organisation	Ownership Enabled			ASSESSMENT →		
Computing Infrastructure	Capable Flexible				ASSESSMENT →	



OSCM Assessment Process



Questionnaire



Sample Documents,
Data and Metrics



Discussion
Follow-up

Aspect	Key Metric	Maturity Level				
		1	2	3	4	5
Strategy	Strategic Alignment	Initial/Partial	Developing	Established	Optimised	Advanced
Process	Process Efficiency	Initial/Partial	Developing	Established	Optimised	Advanced
Methods	Methodology	Initial/Partial	Developing	Established	Optimised	Advanced
Tools	Tool Usage	Initial/Partial	Developing	Established	Optimised	Advanced
Data	Data Quality	Initial/Partial	Developing	Established	Optimised	Advanced
People and Organisation	Team Capability	Initial/Partial	Developing	Established	Optimised	Advanced
Supporting Infrastructure	IT Infrastructure	Initial/Partial	Developing	Established	Optimised	Advanced

Review and
Assessment

Core Simulation Capability	Potential Opportunities
Process	Identify and address bottlenecks Reduce resources Improve speed Improve process robustness
Methods	Expand coverage and confidence Improve product performance Reduce testing. Reduce error states Modularise and improve automation
Tools	Align tools to needs Reduce complexity number and costs of tools Improve tool chain connectivity to improve quality and efficiency
Models	Improve quality Improve planning Improve sharing and re-use. Reduce duplication
Data	Improve data quality Improve data findability and usability Improve data traceability
Organisation	Improve collaboration and sharing Better align skills to current and future needs
Compute Infrastructure	Ensure appropriate capacity Ensure efficient flexibility

Improvement
Opportunities



Essential Elements Questions

Essential Element	Question Reference [RAG]	Include (P/O/D)?	Topic	Question	Info / Evidence (CORE)	KPI Metric (CORE)	Question Response	Information Documents (Filename/Link/Location)
Process	PS1-2	D	Specific M&S Processes	What does the M&S	Example of M&S Processes for Met owned by the Team			
	PS2	O	Process Ownership	Who owns and develops M&S processes for the team?	Description			
	PS3	O	Process Development	How are processes developed, defined, and documented?	Description			
	PS4-1	D	Process Use	How are processes used? (e.g. manual, integrated, automated)	Description			
	PS4-2	D	Who are Users	Who uses the processes? (e.g. engineers, analysts, M&S specialists)	Description			
	PS5-1	D	M&S Deliverables	What M&S deliverables and output are the team responsible for?	List			
	PS7	D	Process Efficiency	Have process efficiency reviews been conducted (e.g. VSM)?	M&S Process Efficiency Review Report Example output	Process Efficiency (Value Add / Non-Value Add) Metric		
	PS8-3	D	Timing	Is the M&S Process timing on the Product Development Critical Path?	Process timing doc	M&S Process Cycle Time (Typical / Critical Path)		
Methods	ME2-1	D	Requirements / Use cases	What are the Reqs / Use cases for Methods for product development and delivery types for the system attribute owned by the team e.g. stds, performance, customer, mnfg	Product and System Requirement list / types Goal for Reqs / Use cases with a Method	Number of Reqs / Use cases (Total) % Coverage target		
	ME2-2	D	Reqs with Methods	How well do the current M&S Methods cover these Reqs / Use cases?	Document aligning Methods to Requirements. M&S Method Documents (List of Methods, Best Practice Example and Typical Example)	% Requirements with a Virtual Method		
	ME3	D	Standards Conventions	Are external or internal standards, conventions, and best practices used for development and use of M&S Methods in the organisation? What are these?	Examples of incorporated Stds, Conventions, or Best Practices			
	ME6	D	Method Quality	Is a Method Quality and/or Verification and Validation process routinely used in the team?	-Examples of Integrated Quality controls/checks -V&V process -Examples of V&V Application	% Methods with Integrated Quality Checks % Methods Verified % Methods Validated		
	ME7-2	D	Confidence Achieved	What is the Method confidence for identified Reqs / Use cases? Are results reported with confidence interval?	List of Methods with Confidence Rating	% Methods with High Confidence (3, 4) % Results reported with a Confidence Interval		
	ME10	D	Noise Factors	Do, how do, Methods take account of Noise Factors?	Examples of Incorporation of Noise Factors			

Questions Cover

- Process
- Methods
- Tools
- Models
- Data
- People
- Computing

Supporting Information Requested

Supporting KPI / Metrics Data Requested

Short Question Responses

Links to copy of requested Documents

Note: Approx 40 Questions and Information Requests

Separate Question and Information requests file for each Team

Typical Assessment Output

Essential Element	Topic	Organisation Capability Maturity Metric					OSCM	Overall Assessment	Opportunity
		0	1	2	3	4			
		Insufficient Poor Confidence Limited Coverage (<25%) Ad-hoc No Plan No KPI	Needs Reviewed Low Confidence Partial Coverage (25-50%) Partially Applied Actions Identified Improvement Started	Comprehensive Medium Confidence Established/Aligned (50-75%) Fully Applied Improvement Plan In progress - On track	Embedded High Confidence Fully Implemented (75-90%) KPI Monitored Actions Complete Goals Achieved	Systemic/Innovator Certification Level Governed (90-100%) Maintained Continuously Improved Futured			
Methods	Methods Strategy			✓			2	Method Strategy in Place. Improvement Plan in Progress	Introduce Governance and conduct regular strategy review.
	Requirements				✓		3	Requirements defined. Overall target defined . Variable team status.	Identify and prioritise gaps.
	Reqs with Methods			✓			2	50% Target Requirements with a Method	Identify target for Method confidence. Identify priority requirements requiring methods. Link to confidence metric.
	Standards Conventions			✓			2	50% Methods adopt internal standards.	Review Standards applicability to Methods. Identify gaps and concerns.
	Method Development		✓				1	Inconsistent process for Method Development	Agree consistent process for Method Development and verification. Roll out across all teams. Identify and prioritise requirement gaps for development. Agree a roadmap.
	Method Ownership		✓				1	Some Method Owners identified. Unclear Responsibilities of Method Ownership	Identify assign and communicate ownership for all methods.
	Method Quality		✓				1	25% with Integrated Quality Checks 50% Methods Verified and Validated	Agree a consistent approach to Method Quality including integrated quality checks. Align to verification process and confidence metric
	Confidence Metric		✓				1	25% with Confidence Rating, but variation in metric used. Some simply by peer review using High. Medium, low rating.	Review options and adopt a consistent Confidence metric for all virtual Verification Methods. .
	Confidence Achieved		✓				1	25% High Confidence	Conduct a review of confidence levels. Are these appropriate for the required purpose. Identify priority improvement requirements. Introduce confidence reporting with results.
	Method Use			✓			2	Good Method Usage. Some sharing but no central library or communication.	Introduce a register for methods including key parameters such as; description, purpose, scope, and confidence. Communicate new and updated methods to all stakeholders.
	Sharing Achieved				✓		3	No central Portal for Method sharing across teams	Conduct a review of sharing potential. Are methods developed to be suitable for multiple purpose
	Data Analytics	✓					0	No routine approach for use of Data Analytics for M&S Data Input or output.	Identify experts in the organisation. Review data availability. Conduct a review of opportunities from data analytics.
	Noise Factors			✓			2	Noise Factors considered for some Methods but not routinely integrated into process	Ensure a review of Noise Factors is taken into account for all methods. Identify those that may be significant. Consider sensitivity analysis to address these.

Output - Organisation SWOT Highlights

Element	Strengths	Weaknesses	Opportunities	Threats
Process	Simulation processes well aligned to overall PD process	Simulation cycle time. Significant ad-hoc and manual processes	Efficiency review Automation	Complexity Faster Competitors
Methods	Well established methods to model many product requirements	Lack routine confidence metric Tool dependency	Apply confidence metric to all methods and results output.	Readiness to model new product technologies
Tools	Tools to address most physics	Tool landscape complexity Tool to tool connectivity	Reduce tool duplication	Tool obsolescence Maintaining customised code
Models	Well established local modelling processes	Duplication Lack of integrated quality checks	Modelling plan Increased sharing Increased automation	Change management
Data	Data library for some data	Overhead sourcing data Unverified data pedigree	Data Standards Data Management Data maturity metric	Unknown impact of poor data
People	Highly experienced and skilled	Lack of collaboration and knowledge sharing	Simulation community to share best practice	Loss of critical skills
Compute Infrastructure	Adequate capacity to support routine analysis	Increased future demand Inflexible	Use of cloud computing to support peaks	Resilience plan

Example Typical Initial SWOT

Potential Opportunities from Maturity Assessment

Core Simulation Capability	Potential Opportunities
Process	Identify and address bottlenecks Reduce resources Improve speed Improve process robustness
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Organisation	Improve collaboration and sharing Better align skills to current and future needs
Compute Infrastructure	Ensure appropriate capacity Ensure efficient flexibility

Why Conduct an M&S Maturity Assessment?

- Assess **readiness** to achieve Business Goals
- Provides a metric to **quantify** current status for the core M&S elements
- **Assess** your organisation against key criteria
- **Identify** strengths, constraints, weaknesses, and opportunities affecting your M&S
- **Build** confidence in, and expand, your M&S capability
- **Maximise** collaboration and sharing
- **Improve** development efficiency and speed
- **Reduce** development, tool, and product costs
- **Target** and prioritise investment and improvement actions
- **Measure impact** and progress
- **Prepare** for changing future needs



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ENGINEERING SIMULATION STRATEGY SOLUTIONS

Thank You

