

Unlocking the Full Potential of Modelling and Simulation in your Organisation

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PHRONESIM

Modelling and Simulation (M&S)

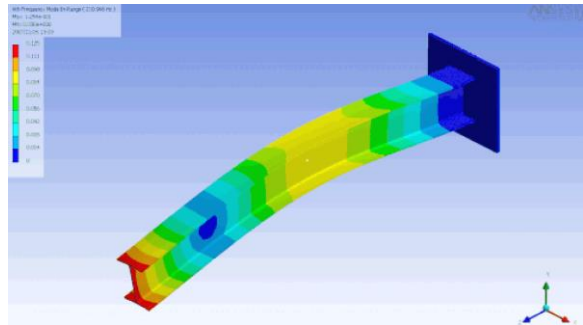
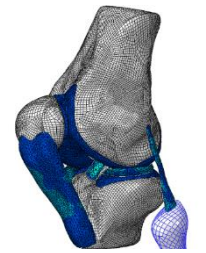
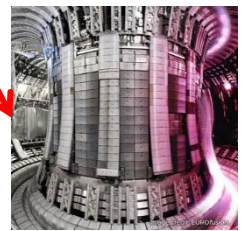


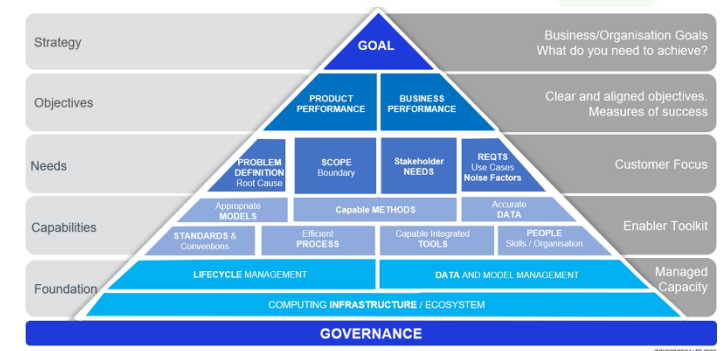
Image by Mohamed Hassan from Pixabay



Modelling and Simulation – The *Unsung Heros*

Content

- A Brief History of M&S
- Everything has Changed
- Is our M&S Achieving its Potential?
- A Framework for M&S
- Steps to Unlocking Potential
- The Practical Bit
- So What? The Key Messages
- How to Learn More



A Brief History of Modelling and Simulation

Modelling and Simulation



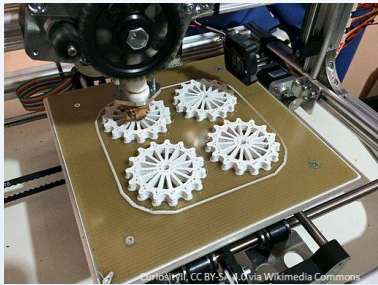
- 1950s** - FEA developed by **Boeing, Bell and Rolls Royce** in the UK.
- 1956** - Paper by **Turner, Clough, Martin & Top**.
- 1965** - **NASA** funded project lead by **Dick MacNeal** to develop a more capable FEA software program becoming NASTRAN.
- 1960s** - **Westinghouse** engineer **John Swanson**. FEA for nuclear reactor becoming ANSYS.
- 1978** - **Abaqus** Launch
- 80s-20s** - Steady **growth** in tools, physics, capabilities, vendors
- Today** - >\$10bn (2021). Growing at > 10%/annum



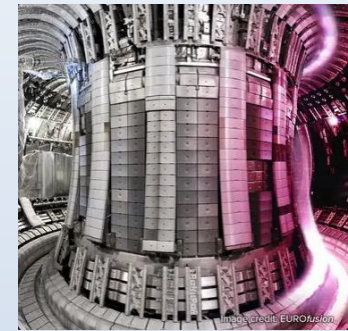
70 years of development and still going strong

**Its been a 70 year Journey
Everything has Changed!**

Products have Changed



- New **technology**
- New **materials**
- New **Manufacturing Methods**
- Increasing **complexity**
- Increasingly **connected**
- **Integration** of functional, electrical systems & software
- **Clean** technologies. Electrification
- Alternative **power** sources



M&S enabling Great Product Innovation. Driving need for new capability in M&S

Organisations have Changed



- Global and disruptive **competition**
- **Cost**
- **Innovation**
- **Speed** to market
- **Flexibility** / versatility / agility
- Delivering **more with less**
- **Reduced** dependency on physical **test**



Modelling and Simulation is a key enabler

The Role of M&S Has Changed



From the “*Supporting Act*”:

- Providing data for experts
- Supporting test
- Investigating post test failures
- Seen as supplemental to the main design process



To “*Leadership*”:

- Leading design
- Optimising product performance
- Reducing development cycle times
- Reducing sensitivity to noise factors
- Improving product robustness
- Enabling design and integration of complex systems



Trophy Flat Icon.svg from Wikimedia Commons by Videoplasty.com, CC-BY-SA 4.0

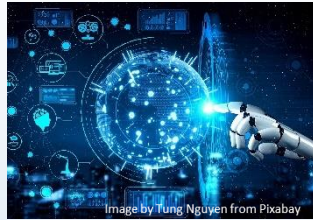


From “*Supporting Act*” to Leadership

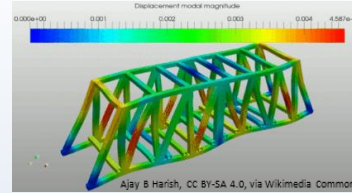
Recent Changes - Trends and Opportunities



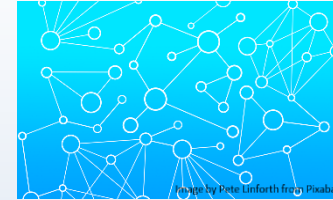
Data Analytics /
Artificial Intelligence



Democratization



RAPID (Non-FE)
Analysis Tools



Graph Technology



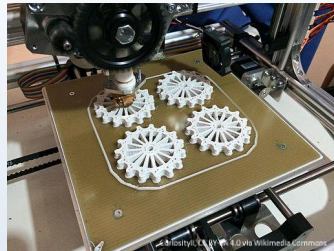
Open Source
Software



Remote Working



Digital Twins



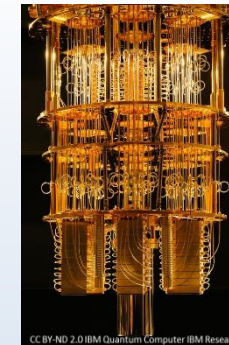
3D Printing



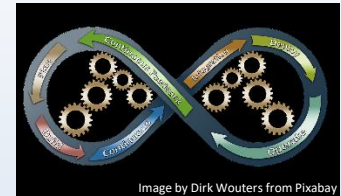
Industry 4.0



Cloud Computing



Quantum
Computing



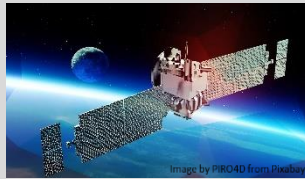
Agile Development

Many Industry Trends. Does business have a strategy?

“Is our M&S Achieving its Potential?”

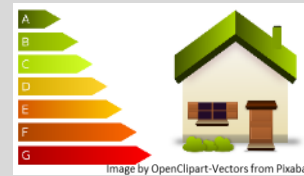
Start with Why? – Whats your Goal?

Improve my Product



- Concept
- Performance
- Capability
- Technology
- Functionality
- Versatility
- Cost
- Quality

Improve my Business



- Speed to Market
- Efficiency
- Reduce Cost
 - Development
 - Operating
- Skills and Knowledge
- Flexibility / Responsiveness
- Maximise Value

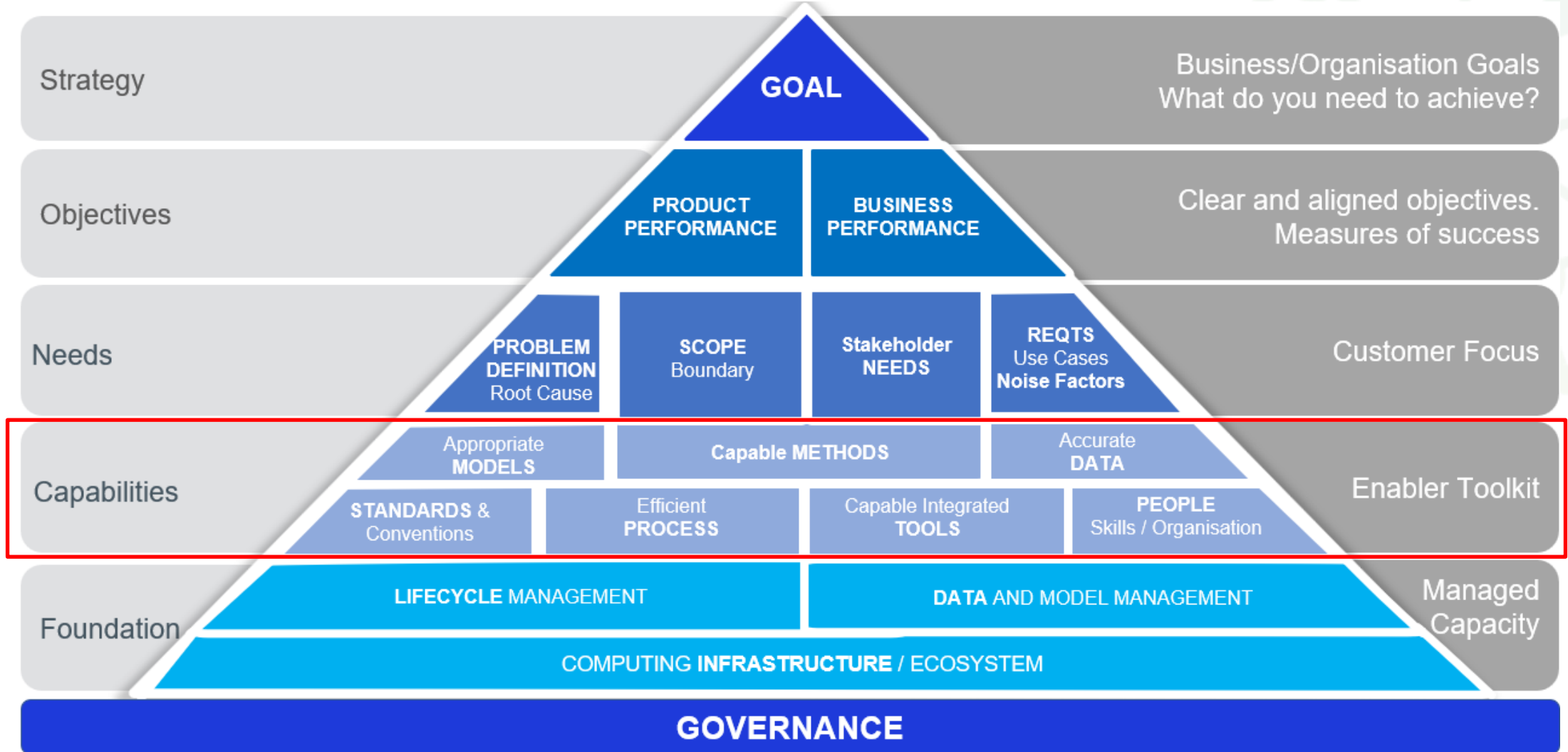
Whats your Organisations Goal? Whats Most Important?

Questions Leadership Should Ask

- What are our **Goals for M&S**?
- What do we **need** our M&S capability to do?
- Is our M&S capability **aligned** to our Goals? Are we aligned **across the organisation**?
- What is the **maturity** of our M&S capability? How are we measuring it?
 - How **effective** and **efficient** is it?
- What is **constraining** us in achieving our Goals?
- Has our progress **stalled**?
- Have we (still) got the **right** process, methods, tools, organisation, and infrastructure?
- Are we missing an **opportunity**?
- Do we have a **strategy for M&S**? What is it?
- Do we have an improvement **plan**?
- How do we **Govern** our M&S?

A Framework for Modelling and Simulation Capability

Strategy Framework



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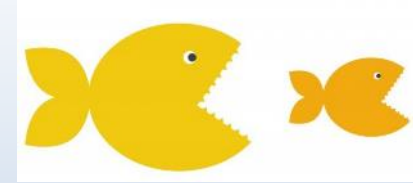
Framework with all the elements critical for an effective M&S Capability.

Tools

What's Happened?



- Massive increase in tool **vendors** and tools
- Increasing physics **capability** and functionality
- Tool vendor **consolidation**



What can go Wrong?



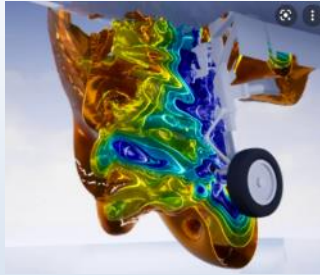
- Procurement based on **local needs**. *Needs have changed*
- Many tools **added**. *None removed*
- Lack of **alignment**. Increased **complexity**
- **Inflexible** licensing. Lack of **capacity**. Poor user behavior
- **Poor** connectivity and **interoperability**
- High **cost** of operation and maintenance
- Tool **lock-in**. High **cost** of change
- Increasing legacy / **obsolescence**



Do you have the right tools? How well do they work together?

Methods

What's Happened?



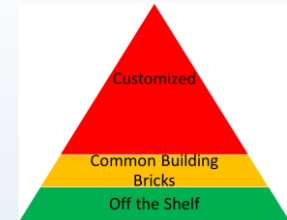
- New **technologies**. Increasing complex requirements
- Increased experience and **knowledge**
- Increased **sophistication** - capability and functionality
- Increased **expectations**
- Poor progress of industry **standardization**



What can go Wrong ?



- Incomplete **coverage** of requirements
- Lack of **confidence**. Relying on **un-verified** methods
- Lack of objective **maturity** / quality metric
- Highly **customized** methods. Unique to experts. Limited **sharing**
- Methods **dependent** on specific team members
- Lack of **documentation**. Limited **automation**
- **Quality** escapes despite simulation and modelling.



How good are your methods? How are they developed? How are they used?

People and Organisation

What's Happened?



- **Function** based organizations.
- **Separate** simulation teams
- Internal **politics**
- **Dependency** on a few key experts skills
- Increased need for **polymath** engineers/analysts



What can go Wrong?

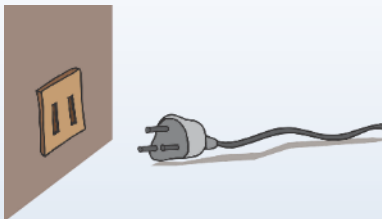


Image by Mote.Oo.Education from Pixabay

- No **overall lead for M&S?** Lack of **ownership**
- Lack of **collaboration**, sharing and reuse
- **Unaligned** solutions.
- Significant internal **customization**
- Uncertain **skills**. Skill misalignment



Image by Jazella from Pixabay

How is your M&S organised? How does it contribute?

Steps to Unlocking Potential

Steps to Unlocking Potential

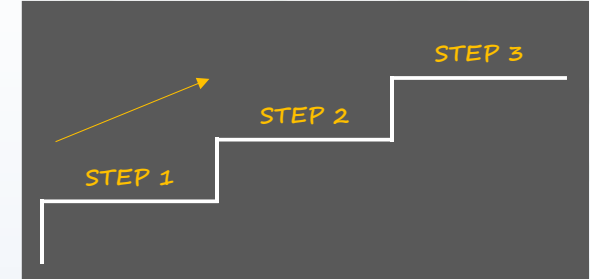
Goal / Needs

Measuring Maturity / Gap Analysis

Align / Prioritise Improvement Actions

Plan / Roadmap

Organise / Implementation / Governance



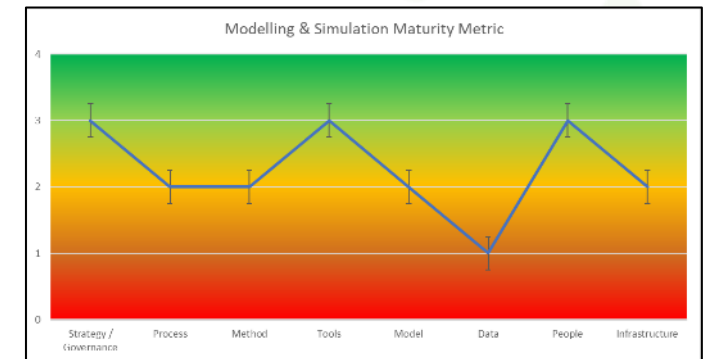
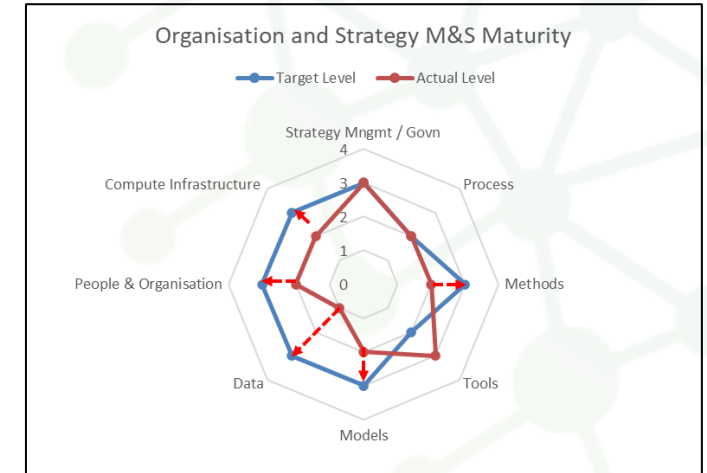
Every Organisation Needs a Strategy for Modelling & Simulation

Credibility and Maturity Metric

(**) M&S ORGANISATION STRATEGY & MANAGEMENT MATURITY

Level	Strategy	Process Methods Tools Models Data					Organisation	Infrastructure
	Strategy Management and Governance	Process (Workflow)	Methods	Tools	Models	Data	People and Organisation	Computing Infrastructure
	Comprehensive, aligned, championed, supported, funded, implemented.	Defined, Aligned, Shared, Effective, Flexible, Efficient, Fast, Managed	Aligned, Comprehensive Cover, Modular, Common, Connected, Efficient, Robust, Credible, Futured	Strategic, Capable, Aligned, Common, Min Complexity, Connected, Maintained, Verified, Reliable	Strategic, Aligned, Comprehensive, Common, Managed, Traceable, Maintained, Validated	Aligned, Complete, Accessible, Common, Standardised, Managed, Verified	Aligned, Defined, Capable, Shared, Managed, Flexible, Efficient	Capacity, performance, responsiveness, reliable, flexibility, cost effective.
4	Comprehensive Implemented, Governed.	""	""	""	""	""	""	""
3	Aligned Roadmap Non critical gaps only	Evidence	""	Evidence	""	""	Evidence	Evidence
2	Established In progress Some gaps	""	Evidence	""	Evidence	Evidence	""	""
1	Partial Significant gaps	""	""	""	""	""	""	""
0	No strategy No vision. Uncoordinated	""	""	""	""	""	""	""

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Measure Status and Gap to Target. Overall Capability is only as good as the weakest link

Best Practice Improvement Initiatives and Actions

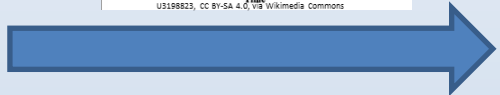
Strategy Element	Actions
Digital Engineering Strategy & Governance	<ul style="list-style-type: none"> • Agree Goals for M&S based on business needs. • Use a Framework. Measure Maturity. Develop a cross functional strategy. • Identify Improvement Actions Implement Key Performance Metrics. Implement a Governance framework.
Process	<ul style="list-style-type: none"> • Review current Simulation and Modelling processes across the whole organization. Assess alignment to PD process. • Assess Efficiency? Value stream analysis for key process to identify and reduce waste. Identify improvement actions. • Review common and bespoke process. Strategy for process management and automation*. (SPDM)
Methods	<ul style="list-style-type: none"> • Review requirements • Audit current capability. Introduce confidence metrics • Identify gaps, prioritize, improvement projects.
Modelling	<ul style="list-style-type: none"> • Audit Model requirements and usage. • Model Standards and Conventions • Opportunities for commonality and sharing. Model Management.
Tools	<ul style="list-style-type: none"> • Review requirements. Audit landscape. • Capability and efficiency metrics. • Assess tool chain connectivity status.
Organization	<ul style="list-style-type: none"> • Review M&S organization. Cross functional alignment. • Assess current and required skills. Qualification and experience status. Training and development needs.
Data	<ul style="list-style-type: none"> • Document data requirements per method and process. • Introduce standards for data types, formats, structure, use and management. • Consider data management options (SPDM)
Infrastructure and Computing	<ul style="list-style-type: none"> • Current and Future requirements. Current structure and capacity. Utilization and operating costs. • Review future technology options and opportunities (e.g. Cloud).

Identify BP Improvement Action Appropriate to Business Goals and Priority Gaps

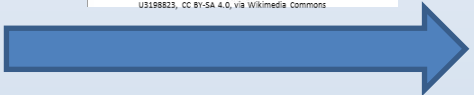
The Practical Bit

Some Practicalities

Leadership Support	Getting Everyone Onboard	How to do Capability Improvement	Realistic COSTS / BENEFITS	Delivery and Implementation
Conflicting Goals	Availability of Skills & Resources	Make or Buy	Getting Funding	Managing Change
Getting Alignment	Working with Suppliers	Delivery Speed	Managing Costs	Governance
Scale of Change Managing the Scope	Managing Legacy	Efficient Project Mngmt	Securing Benefits	Operation & Maintenance



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Change is Hard. Be prepared for the challenges.

So What!

The Key Messages

So What? – Key Messages

- A 70 year **journey** and still much to do
- Everything has **changed**
- M&S **IS critical** to our organisations
- **Can we be sure** our M&S capability achieving its potential?
- **Many elements** (*the Framework*) make up an M&S capability
- All these elements need to be **capable** AND in **balance**
- Organisations need a **strategy**
- **Assess** your organisations **maturity** to identify the gaps and opportunities
- **Align** improvement initiatives to goals and priorities
- Be prepared for the **practical challenges**



Get Organised. Take a Lead. Have a Strategy.

How to Learn More

How to Learn More



New eLearning Course:

How to Implement a Modelling & Simulation Strategy

Course Content:

- The need for a strategy
- Establishing business goals and stakeholder needs
- Assessing your current state - Maturity assessment and gap analysis
- Introducing the strategy framework
- The critical elements of a Modelling and Simulation capability
- Best Practices for building capability
- Strategy implementation and practicalities
- Costs benefits and the business case
- Organisation and governance

First Course Dates:

4th to 25th October 2022 (in 4 x 2.5 hour sessions)

Find out more at:

Quick Link: nafems.org/strategy

Conference attendee special discount code:

'NRCUK' (10% discount for Conference Attendees)

The screenshot shows the NAFEMS website interface. At the top, there is a search bar and navigation links for Membership, 2022 Regional Conferences, Training (highlighted), Events, Community, and Professional Development. The main heading is 'How to Implement a Modelling & Simulation Strategy'. Below this, there is a breadcrumb trail: Home > Training > E-Learning Courses > How to Implement a M... A red box contains the text 'Unlock the Full Potential of Modelling and Simulation in your Organisation'. The course title 'How to Implement a Modelling & Simulation Strategy' is prominently displayed. A 'Details' sidebar on the right lists 'Event Type', 'Member Price', 'Non-member Price', and 'Tutor:'. Below the title, there is introductory text: 'In recent years product technologies have advanced, and complexity increased massively. Businesses need to make sure they can engineer and deliver efficient and optimised products to lead and stay competitive.' This is followed by a paragraph: 'Maximising the opportunities and benefits gained from the latest digital engineering capabilities is critical. Adopting local optimum solutions is ineffective, so businesses must invest in a comprehensive and coordinated approach to achieve the global optimum and maximise the effectiveness of their digital engineering capability.' The final paragraph states: 'To achieve this, you need a Digital Engineering (Modelling and Simulation) Strategy that takes account of the tools and the processes, methods, models, data, organisation, and computing infrastructure.' The 'Dates' section shows 'Start Date' as '4 Oct 2022' and 'Session Times' as 'Europe/London'.



Thank You!

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Capability Maturity Assessment
Strategy Creation and Implementation
Capability Development
Organisation and Management
Training and Coaching

