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CATAPULT
High Value Manufacturing

Advanced Manufacturing for Shipbuilding

Dr Joe Darlington – Technology Director

OVERVIEW

High Value Manufacturing Catapult

Industrial Transformation

Transformation Use Cases

Shipyard of the Future

BACKGROUND

- Opened in 2011
- Independent RTO
- To bridge the valley of death
- Prove innovative manufacturing ideas
- Manufacturing system solutions
- Training & Skills

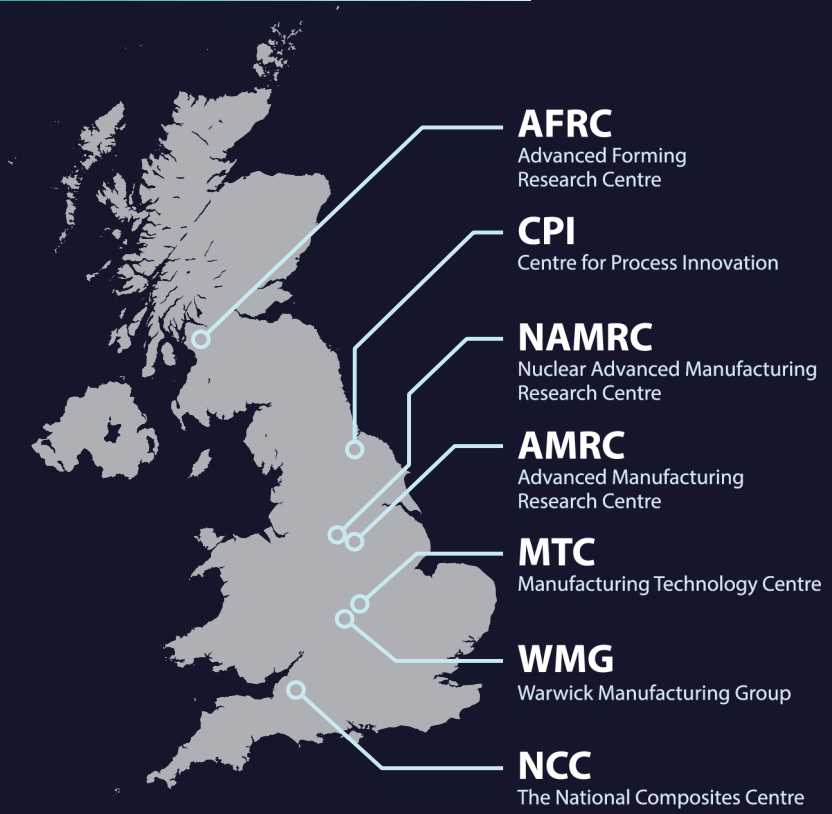
UNIVERSITY OF BIRMINGHAM

Loughborough University

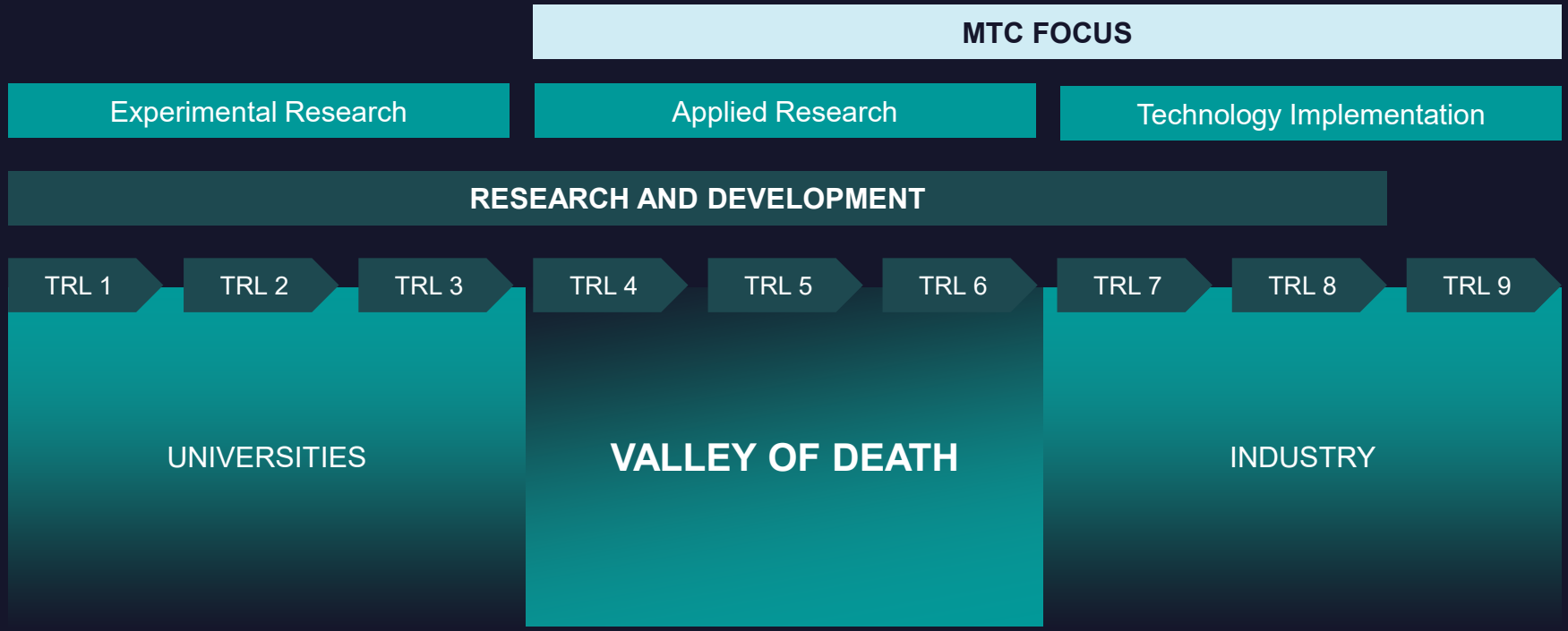
The University of Nottingham

TWI

HVM CATAPULT



INNOVATION LANSCAPE



HORIZONTAL INNOVATION

Aerospace

Defence & Security

Construction

Space

Infrastructure

Food & Drink

Healthcare

Power & Energy

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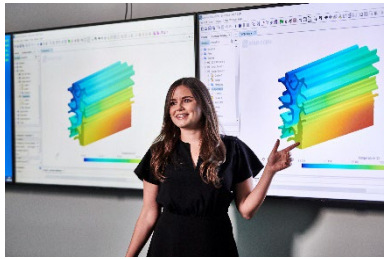
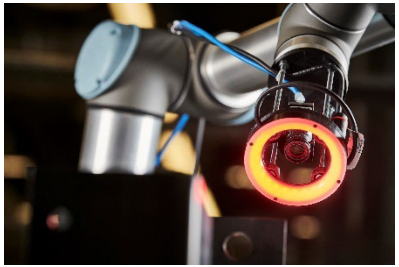
Industrial Transformations

EMERGING TRENDS

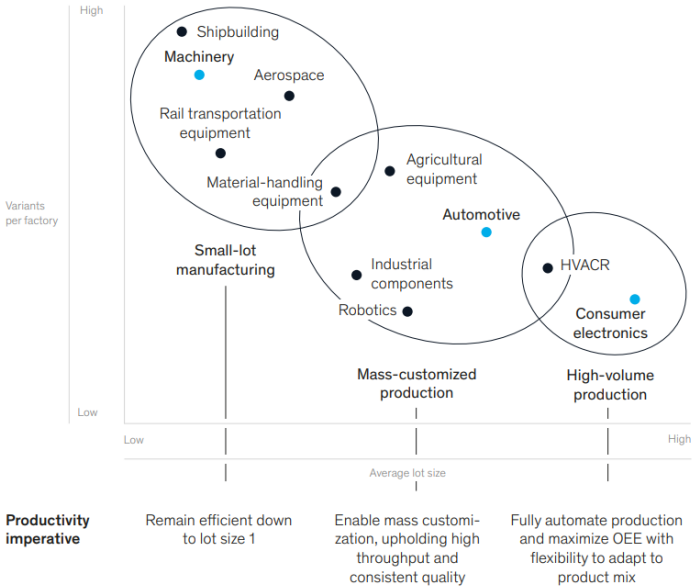




MANUFACTURING PARADIGMS

Exhibit 1

Overview of the 3 factory archetypes in discrete manufacturing, their productivity imperatives, and representative industries



Legacy Estates to Greenfield

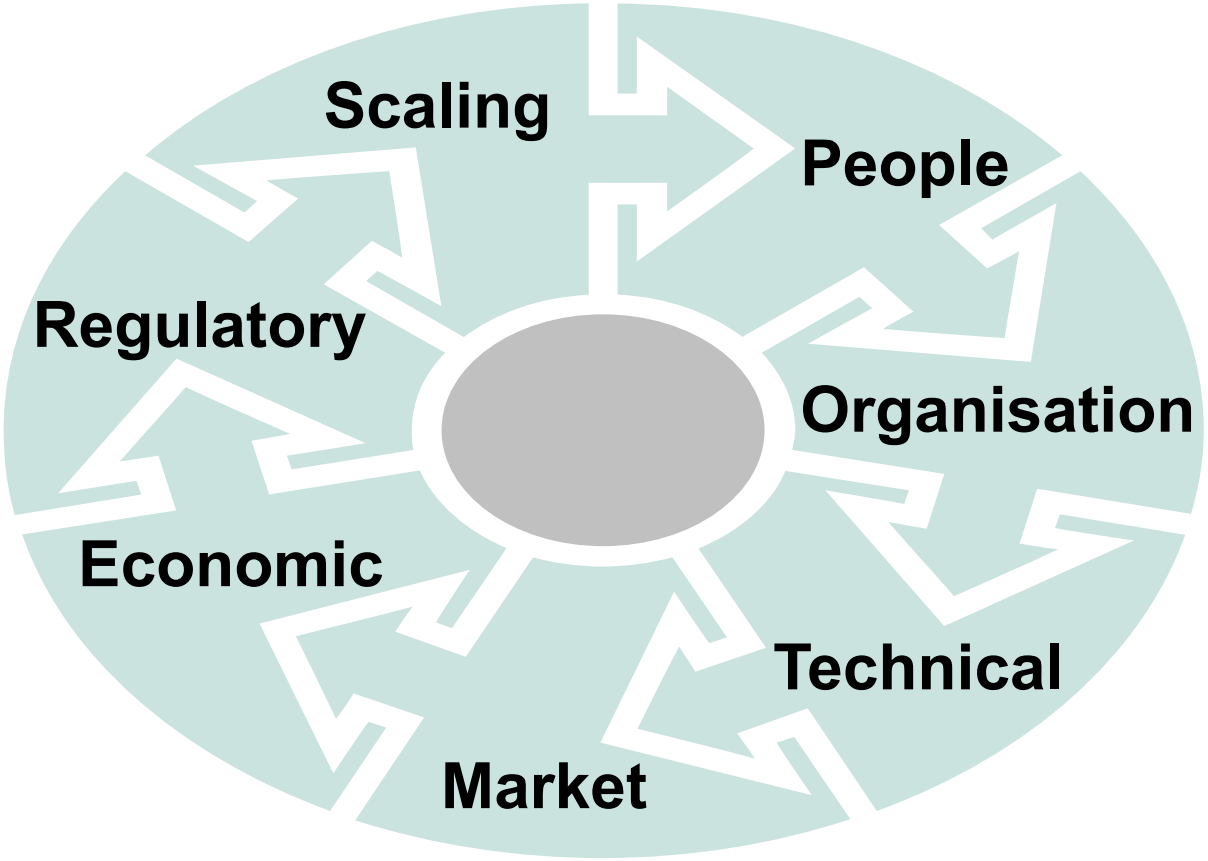
Technology v Value

Technology Selection & Change

Next Generation Skills

https://www.mckinsey.com/~/media/mckinsey/industries/advanced%20electronics/our%20insights/capturing%20value%20at%20scale%20in%20discrete%20manufacturing%20with%20industry%204%200/industry-4-0-capturing-value-at-scale-in-discrete-manufacturing-vf.pdf

ADOPTION CHALLENGES



DRIVERS OF INDUSTRIAL DIGITALISATION

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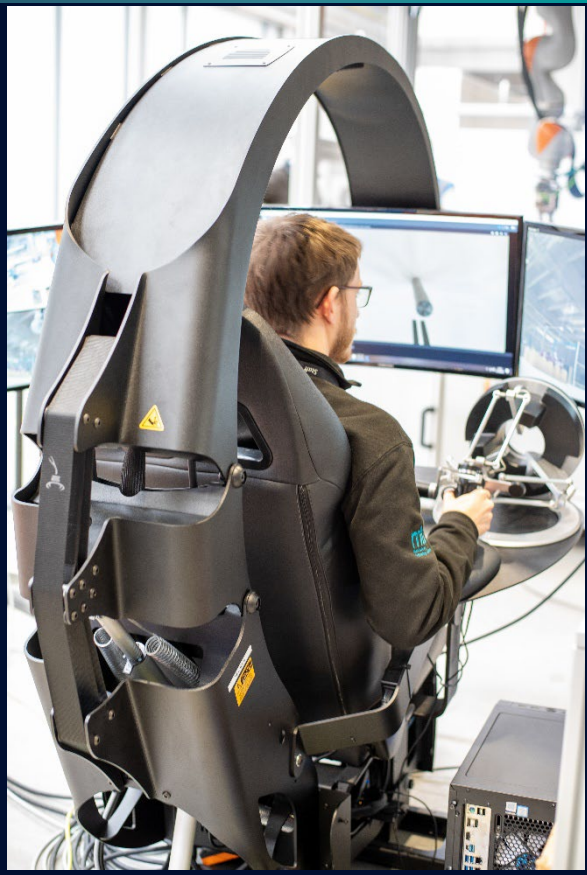
Workforce Capability	Speed to Market	Regulatory
Forecasting & Planning	Sustainability	Managing Risk
Efficiency and Output	Equipment Innovation	De-Risking Investment

ADVANCED ROBOTICS

98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species

- Scan crops and detect diseases or pests in the process.
- Chemicals only applied where and when required.

TELEOPERATION WITH HAPTIC FEEDBACK



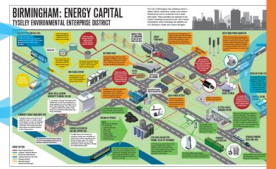
Perform complex operations from a safe, remote location.

FACTORY IN A BOX

ERA Energy Research Accelerator | Innovate UK | University of Birmingham | Loughborough University | mtc

Fundamental R&D

Demonstration and validation



Manufacturing and production

Provide critical enhancements to the thermal energy sector supply chain.

- Demonstrate how **Factory In A Box Manufacture** can unlock the ability of UK businesses to industrialise their products.
- How Industrial Digital Technologies can enable new business models for manufacturing and supply chain.
- £10m funding over 3 years, ending in March 2019.

Factory In A Box (FIAB) Manufacture

Rapidly deployable,
Remotely managed,
Modular,
Manufacturing supply chain network

Enabled by
Industrial digital technologies

FACTORY IN A BOX

Application:

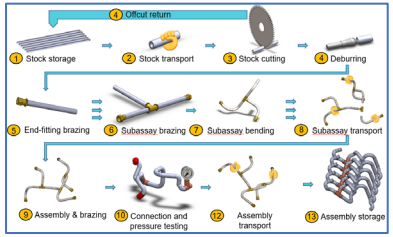
- “Plumbing” for Dearman transport refrigeration unit.
- A range of pipe geometries required to fit different vehicles.

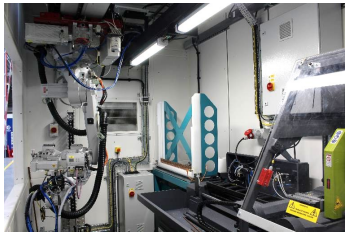
Manufacturing Challenge:

- Skills shortage.
- Stringent quality & safety requirements.
- Distributed customer base.

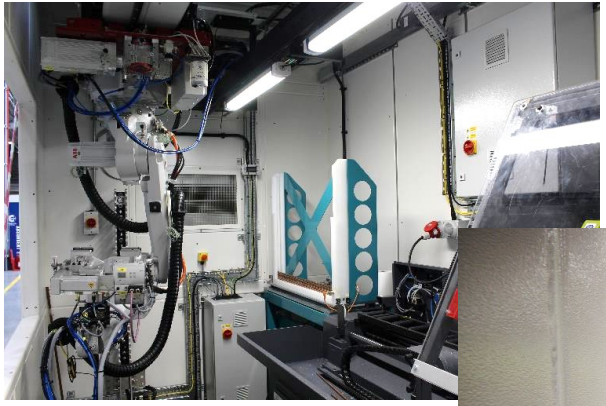
FIAB Benefits:

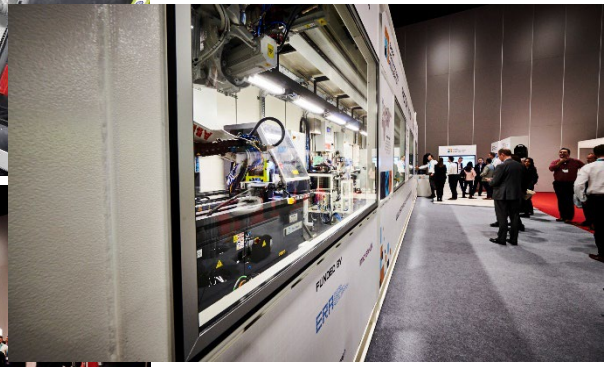
- Increased capacity to meet market requirements.
- Product & process traceability.
- Remote deployment & flexible production.

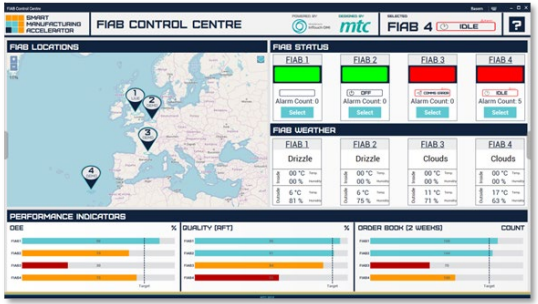


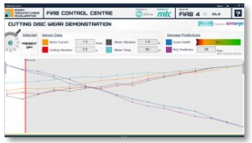


FACTORY IN A BOX









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Aerospace Industrial Transformation

Digital Propulsion (DIGIPROP)

Digital Propulsion (DigiProp) is a collaboration between Dowty Propellers, GE Aviation, MTC, AMRC and NCC.

The consortium is proving out new product designs and smart factory technologies using a new digital infrastructure that flows through design, manufacture, service and repair.

https://www.the-mtc.org/case-studies/digiprop/

Partners

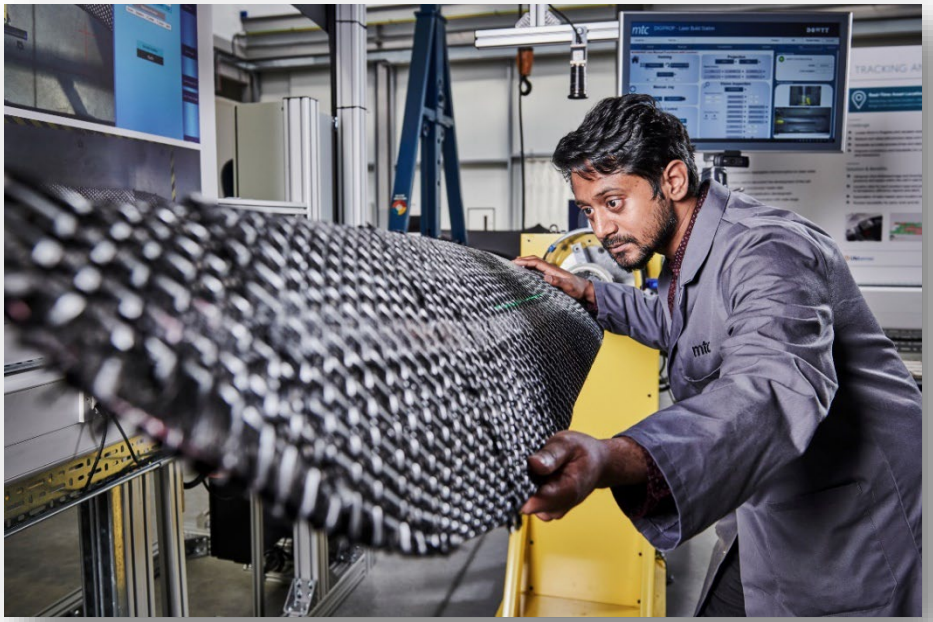
Funded by

Supported by

DIGIPROP

Challenge

Improvements in Overall Equipment Effectiveness and production lead time.



Reduced risk of implementation for new technologies

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Transforming Supply Chains

Catalyst for transformation in Construction

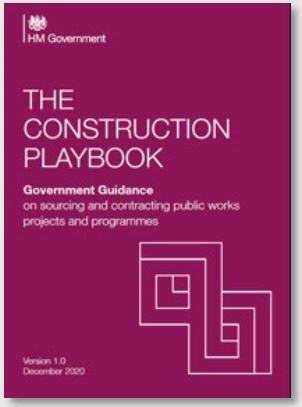
The Construction Innovation Hub formed a key part of UKRI's Industrial Strategy Challenge Fund (ISCF) with the ambition to reduce costs, time and carbon to support productive growth and transformation in the built environment.

The Hub brought together the scale and expertise of the High Value Manufacturing Catapult through the Manufacturing Technology Centre (MTC) together with the Building Research Establishment (BRE) and Cambridge University's Centre for Digitally Built Britain (CDBB) to deliver a £72m four year programme – part of the Transforming Construction Challenge.

https://constructioninnovationhub.org.uk/

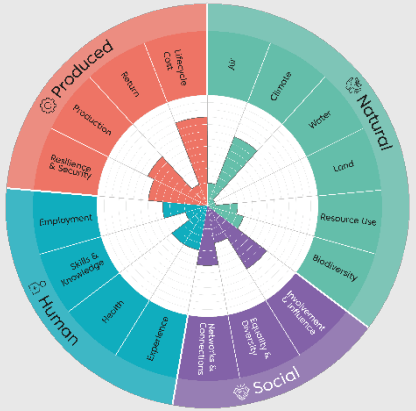
We will look to procure construction projects based on product platforms comprising of the kit of parts, production processes, knowledge, people and relationships required to deliver all or part of construction projects”

THE CONSTRUCTION PLAYBOOK



Construction Playbook (Dec 2020, updated 2022)

Transforming Infrastructure Performance (2017)



Value Toolkit (2022)

NATIONAL CENTRE ADDITIVE MANUFACTURING

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DRAMA

Digital Reconfigurable Additive Manufacturing facilities for Aerospace

CURRENT STATE – ADDITIVE IN AEROSPACE

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NATIONAL CENTRE ADDITIVE MANUFACTURING

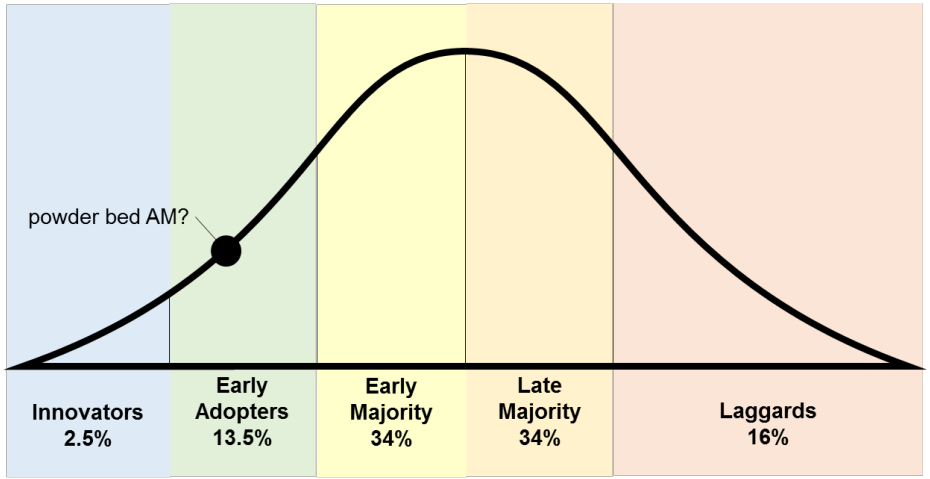
DRAMA

Supply chain

- Primes rapidly building AM capability within their businesses.
- Some Tier Ones rapidly developing AM capability. Other Tier Ones trying to decide whether to ‘dive in’.
- Long tail of the supply chain has varying levels of awareness AM. Unsure how it will affect them.
- Aerospace requirements to become approved supplier for AM now emerging.
- Cost of capital investment is a barrier.

Process development and approval

- Data, data everywhere.
- Process development highly iterative - many design-build loops.
- Methods for qualification and certification of AM products and processes developing.



Roger’s bell curve from *Diffusion of Innovation*

SUPPLY CHAIN ENGAGEMENT- CASE STUDIES

NATIONAL CENTRE ADDITIVE MANUFACTURING

- Working with the UK supply chain to advance their AM knowledge and capability.
- Three types of supply chain companies considered:
  1. Existing aerospace supply chain companies looking to adopt AM.
  2. Existing AM companies looking to move into aerospace
  3. AM Technology providers

ARROWSMITH

NATIONAL CENTRE ADDITIVE MANUFACTURING

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Company background:

- Aerospace machining experts

Engaged to understand:

- What products would be suitable for AM.
- How AM may disrupt their subtractive machining business.

What we did:

- Assessed product portfolio and methodically selected a demonstrator component.
- Undertook Business Case for AM training that inspired a phased adoption approach.

Outcome:

- Developed a clear strategy for entry into a new market.
- Identified post-build processing as point of entry into AM value chain.

Customer feedback quote:

The DRAMA programme provided us with a unique opportunity to develop a sound business strategy for entering the world of AM that allows us to build on our strengths. Working in partnership with a Tier 1 company and AM experts from NCAM has been truly game changing.

Jason Aldridge, MD, Arrowsmith.

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Shipyard of the Future

Shipyards of the Future

The MTC are actively playing a leading role in the Shipbuilding Enterprise Growth's "Shipyard of the Future Task and Finish Group".

Clive Hickman CEO is chairing the group, Gareth Drew Chief Engineer for Aerospace Defence and Security is leading the technology delivery activities.

The group will:

- Produce a model for how shipyards of the future must aim to operate;
- Identify the advanced manufacturing technologies (digital and physical);
- Give guidance as to how and where to they should be implemented;
- Provide an underlying body of evidence to support future investment programmes.

Department for Business & Trade

National Shipbuilding Office

BAE SYSTEMS

babcock

BIBBY MARINE LIMITED

FERGUSON marine

Malin Group

OCEA PARTNERS ALL THE WAY

PENDENNIS WORLDCLASS SUPERYACHTS

SMI Society of Maritime Industries

First Marine International

Maritime UK

The University Of Sheffield. AMRC Advanced Manufacturing Research Centre

mtc Manufacturing Technology Centre

NMIS National Manufacturing Institute Scotland

Task and Finish Group is made up of representatives from the organisations above


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