Composites engineering

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Connect with us

Matt Scott, NCC
matt.scott@nccuk.com

Composites engineering

Advanced materials that blend different material types to achieve superior strength, reduced weight and enhanced performance.

Only by using advanced composites engineering will the UK unlock opportunities in next-generation aerospace, energy, transport and defence. HVM Catapult is determined to maintain the UK's position as a global leader in composite solutions. This means supporting a resilient supply chain in adopting and exploiting new technologies like digitally-connected engineering, high-temperature materials, automated production processes and sustainable industrial approaches.

Why: Demand drivers

- Improved productivity through enhanced quality, rate and cost of manufacture
- Enhanced UK supply chain resilience and reconfigurability in imperative materials and products
- Reduced embodied carbon of materials and products, and reduced waste
- Emergence of new generation products with increased size and/or complexity
- Materials and products tailored for harsher environments.

What: Priority industry capability needs

- Deploy highly automated manufacturing processes for scalable, cost-effective production with composites
- Adopt new fibres and matrix materials with secure supply that optimise properties and performance
- Employ technologies and products that avail and use reclaimed composites
- Install tooling systems with advanced materials, integrated sensing and rapid fabrication
- Exploit tailored composite structural concepts for step-change performance enhancement.

How: Priority innovation requirements

- Industrialise next-generation manufacturing systems and factories that prioritise production rate at required quality and increasing scale
- Accelerate ceramic matrix composites for breakthrough performance in extreme environments
- Mature recycling technologies, especially in service of establishing circular supply chains and business models
- Design and manufacture functionalised tooling systems, considering heating, sensing, reconfigurability and more
- Design and manufacture with non-conventional laminates including tow shearing and 3D architectures.

Key HVM Catapult capabilities in composites engineering

National centre of excellence for composite technologies, NCC (Bristol)

World-leading, open-access composites R&D, providing cutting-edge technologies, expert engineering support and broad innovation capabilities to accelerate high-performance, end-to-end composite development and industrial adoption across aerospace, automotive and energy sectors.

Composites centre, AMRC (South Yorkshire)

Wide-ranging composites capability with in-house weaving, moulding, curing and new thermoplastic tape research. Includes AMRC's COMPASS facility, which leverages high-rate composite processing, robotic assembly, in-process inspection and digital twins to optimise accuracy, throughput and large-scale production.

Centre for polymers and composites, WMG (Coventry)

Focuses on simulation, testing, high-volume manufacturing and shredding and compounding for recycling, to enable sustainable, multifunctional polymer and composite solutions from fundamental to full-scale industrial validation.

Large Structures Innovation Centre, NCC (Isle of Wight)

New opportunity for a dedicated, open-access environment to de-risk and validate full-scale manufacturing of massive composite components. Focuses on automation, digital twins and sustainable recycling for sectors like wind energy and maritime.

Composites centre, NMIS (Renfrew)

Low-cost, lightweight, high-rate manufacture of material agnostic products with maximum value retention enabling resilience through the product life cycle developing the future of composite repair and industrial scale continuous feed recycling and reformatting verified and validated through testing facilities.

Carbon fibre development, NCC (Northwich) and CPI (Wilton)

Co-developed end-to-end capabilities, specialising in the chemistry, formulation and scale for carbon fibre precursors and dope (CPI), through spinning to oxidisation and carbonisation and sizing application of carbon fibre (NCC) for specialist composite manufacturing.

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Connected technology platforms

Through cross-domain analysis, eight connected technology platforms have been identified. They underpin both the core advanced manufacturing process technologies and the cross-cutting enabling technologies set out in this strategy.

They provide a shared foundation of insight and collective capability, showing where coordinated effort across our domains can best strengthen, connect and accelerate the technologies that matter most to UK industry.

An industrial AI for advanced manufacturing UK adoption plan is now being developed in partnership between Made Smarter, Make UK, HVM Catapult and the Department for Business and Trade, led by the AI Champion for Advanced Manufacturing.

Priority: Artificial intelligence enabled advanced manufacturing

Enhancing human capabilities with industrial AI technologies applied across the product development and operational lifecycle

Harmonised life-cycle assessment

Standardising assessment methods and data ontologies to consistently measure environmental impact across a product's lifecycle

Value retention

Preserving the life of products, components and materials through recycling, repair, remanufacturing etc (Re-x)

Manufacturing with advanced materials

Accelerating the deployment of next generation materials across the full value chain, and supporting the development of an agile and responsive UK supply base

Capability development

Advanced and interconnected process modelling

Integrating detailed simulations and enabling interoperability across the value chain to optimise manufacturing performance

Automation of processes and digital integration

Streamlining manufacturing processes through digitally connected systems and interoperability

Digital thread

A seamless flow of data connecting design, production and operations across a product's life cycle

Intelligent manufacturing assurance and regulatory engagement

Leveraging smart systems to ensure quality and compliance, and early-stage dialogue to decrease barriers and accelerate validation and verification

Interpreting our roadmaps

The strategy structure

Why: Demand drivers
External pressures or opportunities that create the need for new or improved manufacturing capabilities.

What: Industry capability needs and priorities
The practical abilities industry must have to remain competitive in the future and the priorities for HVM Catapult.

How: Innovation requirements and priorities
The specific technologies, tools, processes, data, skills or system enablers that must be developed, improved or integrated to meet future industry capability needs, and the priorities for HVM Catapult.

Connected technology platforms
Highlight where coordinated effort across our domains can best strengthen, connect and accelerate the technologies that matter most to UK industry

Priority industry capability needs
The most critical capability gaps identified through industry consultation that must be addressed first to deliver impact.

Roadmap activity examples

Establish test beds to develop, integrate and validate novel inspection, measurement and test techniques and processes. → Demonstrated the trustworthy comparative robustness of emerging inspection, measurement and test technologies

The above 'what' items are linked and dependent – denoted by the overlapping boxes

Deployment of increased mechanization to remove variability and increase standardization linked to respective process specifications → Standardised digital weld procedures, reusable qualification libraries, harmonised standards

The above 'how' discreet items that are not linked and occur in different time horizons

IUK Strategic imperatives

Alignment with the Innovate UK vision
Each demand driver is colour-coded to align with the four imperatives of the Innovate UK materials and manufacturing vision 2050.

Innovative and digital
Businesses drive continuous and transformative innovation and create, adopt and export advanced digital technologies

Resilient and responsive
Mitigating risks from supply chain disruptions, national/global crises, and climate change.

Resource-efficient and regenerative
Sectors maximise circularity of materials, energy and water and aim for a net positive impact on the environment

Skilled and empowered
Workforces are highly skilled in executing advanced tasks and are empowered by configurable, open technology stacks

Composites engineering

Further details of the **demand drivers, industry capability needs** and **innovation requirements** are available online. Follow the QR code or click here.

Vision

Maintain the UK's global position in composites by advancing high-performing, rapid, and sustainable engineering and production for resilient, high-performance solutions across transport, energy and defence.

2026	2030	2035	2040
Materials and products tailored for harsher environments	Install tooling systems with advanced materials, integrated sensing and rapid fabrication	Adopt new fibres and matrix materials with secure supply that optimise properties and performance	Use materials discovery through advanced computational and experimental methodologies
Emergence of new generation products with increased size and complexity	Employ joining techniques for composites to similar and dissimilar material systems	Execute integrated, through-life digital twin systems for design, manufacturing and operational performance	Implement methods to robustly measure and use environmental impact data of materials and processes
Enhanced UK supply chain resilience and reconfigurability in imperative materials and products	Apply advanced testing and assurance methods and equipment for accelerated design	Employ technologies and products that avail and use reclaimed composites	Exploit tailored composite structural concepts for step-change performance enhancement
Improved productivity through enhanced quality, rate and cost of manufacture	Deploy highly automated manufacturing processes for scalable, cost-effective production with composites	Use methods for concurrent, accelerated product development and certification	
Reduced embodied carbon of materials and products and reducing waste	Engineer solutions with mixed-material integration, including co-curing and overmoulding	Design and manufacture functionalised tooling systems, considering heating, sensing, reconfigurability etc.	Mature technologies for new tapes, intermediates and matrix materials
	Industrialise next-generation manufacturing systems and factories that prioritise production rate at required quality and increasing scale	Mature recycling technologies, especially in service of establishing circular supply chains and business models	Design and manufacture with non-conventional laminates, tow shearing, etc.
	Drive concurrent engineering with fully integrated, intelligent digital platforms	Establish cutting-edge UK carbon fibre development facilities to support sovereign production	Accelerate ceramic matrix composites for breakthrough performance in extreme environments
			Embed trusted LCA approaches and standards into supply chain activity

Key

Demand drivers
Why change is needed.

Industry capability needs
What capabilities industry needs to respond to these changes.

Innovation requirements
How capabilities must develop.

Priority industry capability needs
The most critical capability gaps identified through industry consultation that must be addressed first to deliver impact.

Composites Engineering – demand drivers

Enhanced UK supply chain resilience and reconfigurability in essential materials and products

Dynamic supply chain adaptability -
Building flexible networks that can rapidly respond to disruptions and changing market demands.

Strategic material security -
Ensuring access to essential raw materials through diversified sourcing and robust domestic capabilities.

Collaborative innovation ecosystems -
Creating integrated partnerships across industry, academia, and government to accelerate technology adoption and resilience.

Materials and products tailored for harsher environments

Extreme-condition performance -
Designing composites that maintain strength, durability, and functionality in severe operating environments.

Advanced material engineering -
Developing fibres, matrices, and coatings to resist high temperatures, corrosion, and mechanical stress.

Adaptive structural concepts -
Creating innovative composite architectures that deliver reliability and efficiency under unpredictable conditions.

Improved productivity through enhanced quality, rate and cost of manufacture

High-speed, high-quality production -
Industrialise advanced composite manufacturing for rapid throughput without compromising precision.

Smart process optimization -
Harness automation, data-driven control, and adaptive tooling to cut cost and cycle time.

Scalable manufacturing systems -
Deploy flexible, next-generation factories capable of meeting future demand at global scale.

Reduced embodied carbon of materials and products and reducing waste

Resource-efficient production -
Minimising material wastage and energy usage to improve manufacturing productivity – crucial for affordability.

Design for sustainability -
Using relevant, detailed and shareable lifecycle information to drive ongoing improvement of products and systems, including approaches that lead to a net positive environmental impact.

Closed-loop material systems -
Restoring and retaining the value of materials so they can be reused multiple times without losing performance, supporting business models built around a circular economy.

Increased size and complexity of products

Large-scale structural capability -
Develop composite solutions that enable bigger, more complex components without compromising performance.

Advanced design and manufacturing methods -
Introduce innovative processes and tooling to handle intricate geometries and integrated systems.

High-assurance testing and validation -
Establish rigorous, accelerated certification and reliability approaches for large, complex composite structures.

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NCC
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Innovate UK

Strategic summary

The UK holds a leading global position in the design, production and use of products made with composite materials – across transport, defence and energy. HVM Catapult's role is to maintain that, and propel it towards resilient productivity through rapid production, sustainable materials, and brand-new markets.

IUK Strategic imperatives

Innovative and digital

Resource-efficient and regenerative

Resilient and responsive

Skilled and empowered

Composites Engineering – Industry capability needs

Composites Engineering – Innovation requirements

	2026	2030	2035	2040
Technology domain specific	Deploy robust, temperature-stable, cost-effective tooling solutions	Design and manufacture functionalised tooling systems, considering heating, sensing, reconfigurability etc.		
		Design and manufacture with non-conventional laminates, rapid tow shearing, etc.		
Digital Thread		Develop and use next-gen adhesives and bonding processes, including high-temperature and disbondable		
		Machine learning to support materials discovery		
Manufacturing with advanced materials	Engineer solutions considering mixed-material integration, including co-curing and overmoulding	Establish cutting-edge UK carbon fibre development facilities to support production		
		Develop tapes, intermediates and matrix materials capabilities		
	Mature ceramic matrix composites towards applications in a range of environments			
	Industrialise novel manufacturing systems and factories that prioritise production rate at required quality and increasing scale			
Value retention	Mature recycling technologies, especially in service of establishing circular supply chains and business models			
Advanced and interconnected process modelling	Integrate digital workflows that can function across organisations in the supply chain for tracking materials, product and process data			
	Facilitate concurrent engineering through joined-up software solutions			
Harmonised life cycle analysis	Embed trusted LCA approaches and standards into supply chain activity			
Intelligent manufacturing assurance & regulatory engagement	Reduce time and cost burden using certification by analysis structures, methods and procedures			
	Use sensors in production together with analytics to self-adapt manufacturing processes			

Composites Engineering: priority pathways

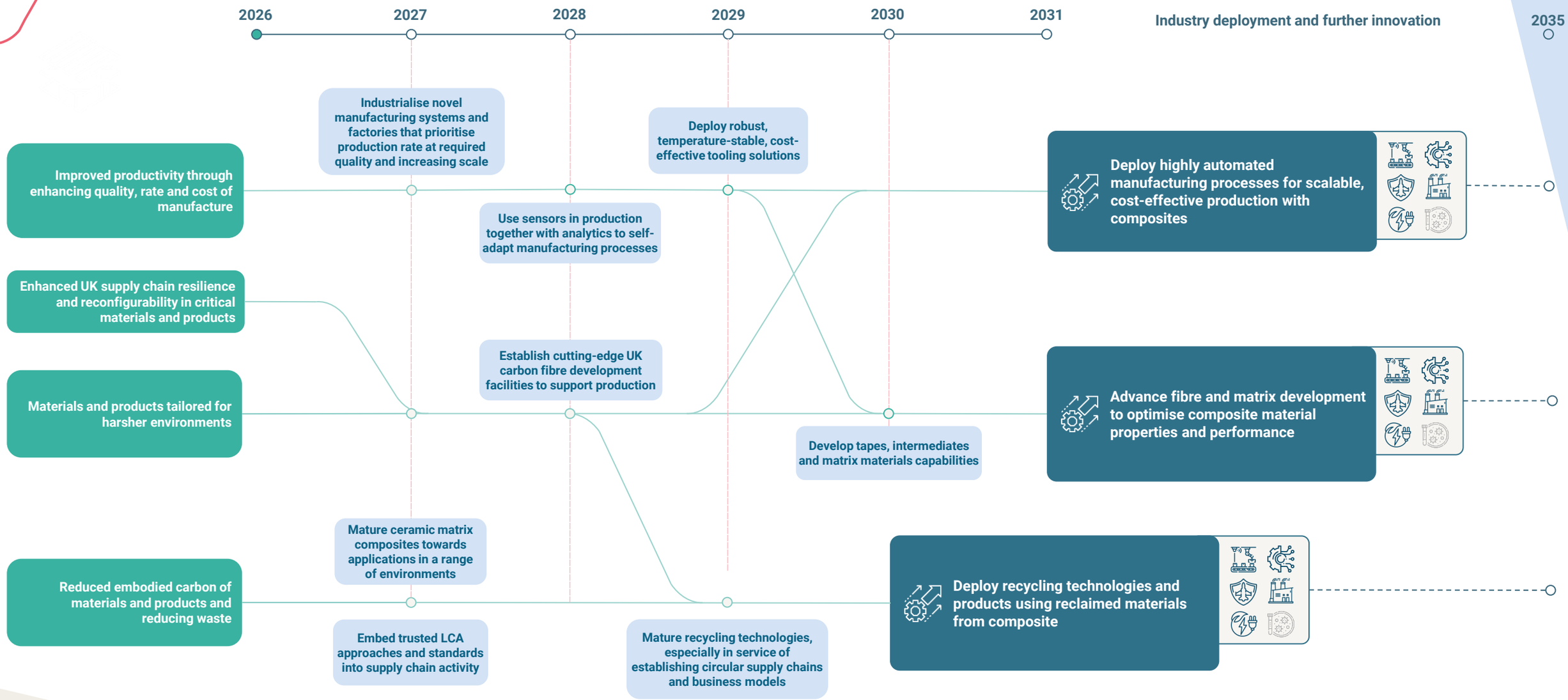

Diagram Legend

Demand drivers
Why change is needed

Industry capability needs
What capabilities industry needs to respond to these challenges

Innovation requirements
How capabilities must develop

Priority industry capability needs
The most critical capability gaps identified through industry consultation that be addressed first to deliver impact

Industrial strategy growth-driving sectors

Department for Business & Trade

- Foundation Industries
- Clean Energy Industries
- Digital & Technologies
- Life Sciences
- Advanced Manufacturing
- Defence