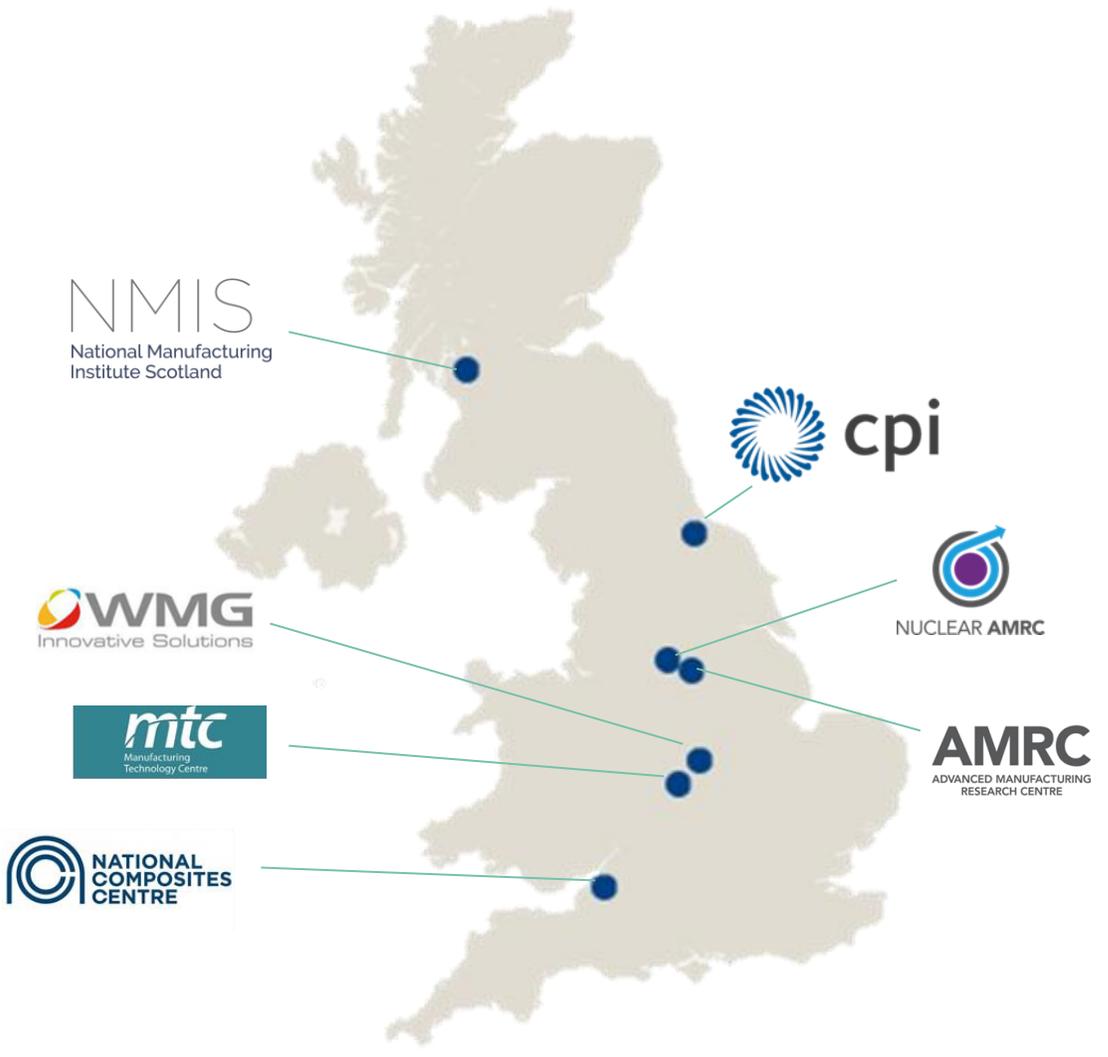


The High Value Manufacturing Catapult (HVMC)



HVMC is the biggest of the UK's 10 Catapult Networks

7 centres	27 technologies	3500 people
£1,000m assets	1/3 government 2/3 industry funded	c.2000 projects per year

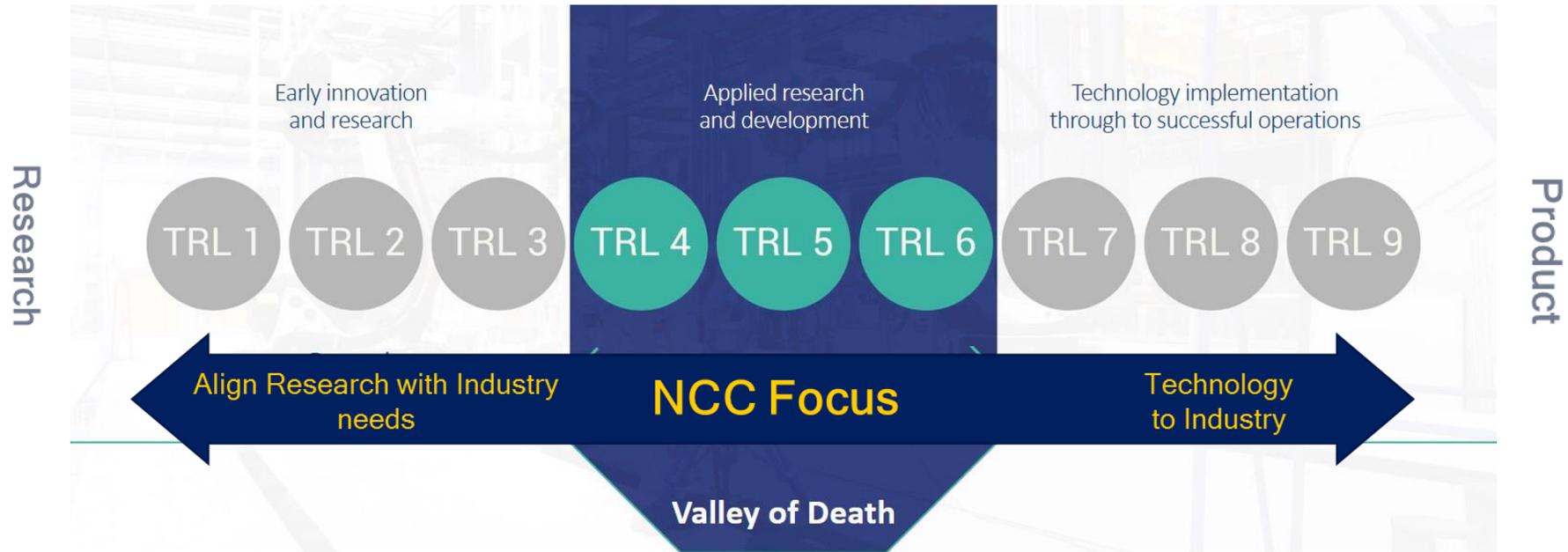
All key industry sectors covered

UK Catapult Network

- Cell and Gene Therapy
- Compound Semiconductor Applications
- Digital
- Energy Systems
- Future Cities
- **High Value Manufacturing**
- Medicines Discovery
- Offshore Renewable Energy
- Satellite Applications
- Transport Systems



Catapult mission: Bridging the Valley of Death

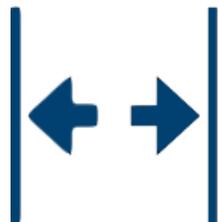


It is estimated that **80% of innovations fail** in this so-called Valley of Death. The NCC, a member of the UK's High Value Manufacturing catapult, fits in the transitional space.

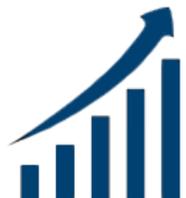




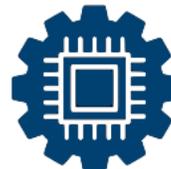
The National Composites Centre in numbers



2011
officially opened



£200m
invested in
capabilities



£36.7m
of the £200m
invested in 10
new capabilities



10
tailor-made,
world-leading
technologies



21,500m²
facility at NCC HQ



400
composites
engineers



150
engineers
at ACCIS



2
locations, NCC HQ
and NCC Filton



46+8
members + major
sectors supported



60+
university
partners



725
organisations
engaged



46%
of those are
SMEs





NCC: Route to Sustainable Composites

Develop "better" products using Composites

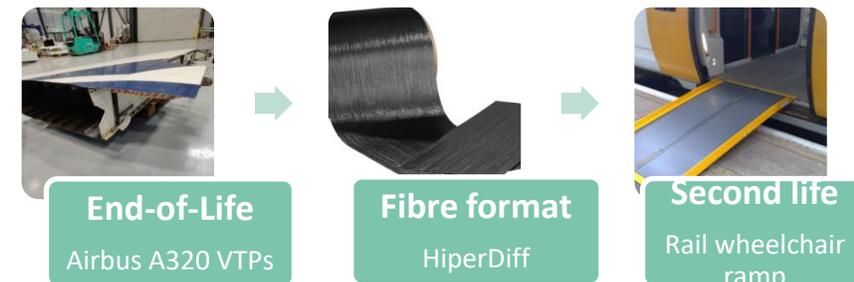
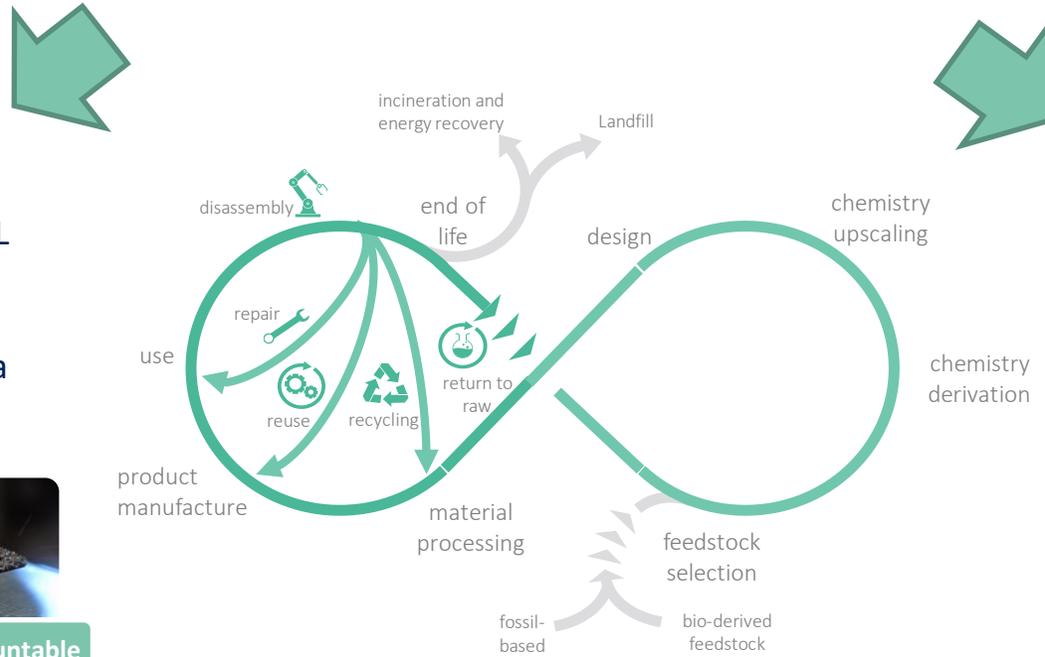
- Increased Performance
- Cost effective
- Improved design
- Efficient Manufacture

Improve Sustainable Composite Materials

- Performance driven bio-derived alternatives
- Materials developed for EOL
- Reduced toxicity
- Design for sustainability
- Materials sustainability data

Remove and reduce EOL cost and environmental burden

- Develop circular options at End of use phase
- Business models & Markets EOL focused
- Legislation informed by data
- Leading best practice





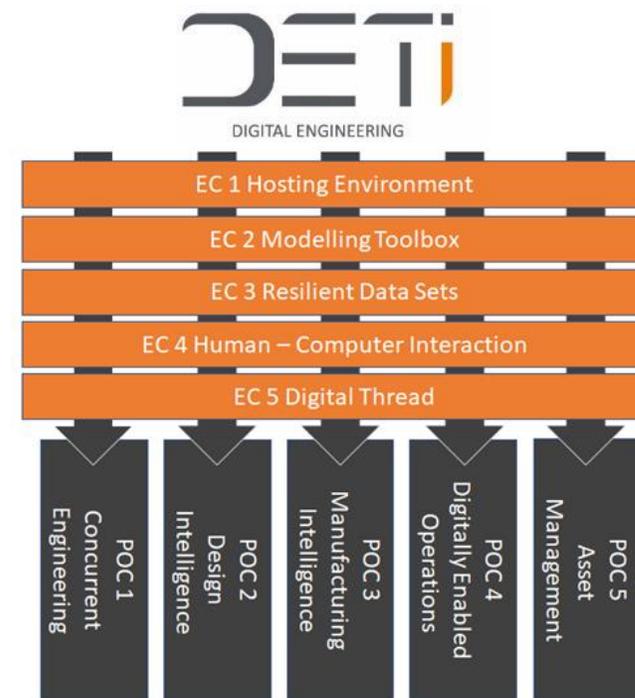
NCC: Digital Engineering

■ Digital Engineering Technology and Innovation

- 5 Enabling Capabilities, 4 Industrial Use Cases
- Skills Programme
- Concurrent Engineering Approach (vs Made Smarter)
- Made Smarter Innovation Hubs
- First results already showing great promise

■ 5G Encode

- UK's first industrial 5G test bed installed
- AR/VR to support design, manufacturing and training
- Monitoring and tracking of time sensitive assets
- Wireless real-time in-process monitoring and analytics









Well coordinated technology development across the UK

- Closest relationship with **BCI** and with **CIMCOMP**
 - 3 joint appointments with BCI
 - Technology Pull-Through already launched
 - Knowledge Exchange Committee
 - Technology Roadmaps
- **High Value Manufacturing**
 - NCC leading coordination of all Composites activity in the HVMC network
- **Industrial engagement**
 - Increased diversity of members as composites enter into new sectors
 - **Composites Leadership Forum** developing an updated, industry-led composites strategy



AIRBUS

BAE SYSTEMS

Baker Hughes



LEONARDO

NetworkRail

Rolls-Royce

aramco



subsea 7

SPIRIT
AEROSYSTEMS

'TORAY'

Toray Advanced Composites

Vestas



Meeting the Greatest Challenge

How the UK Composites Sector
will deliver Net Zero

Dr. Enrique J. Garcia
National Composites Centre



Introduction

- In April 2021, the UK government set in law some of the world's most ambitious climate change targets: a 78% reduction in carbon levels, compared to 1990, within fourteen years. 'Net Zero' by 2050.
- This requires us to re-imagine traditional engineering. Composites will help us get there. Their variety and versatility will unlock our creativity and help us reap the rewards of 'digital engineering', so we can make better products, more quickly, and with less waste. Products the world will want to buy.
- The UK has world-leading science, engineering and innovation skills. They come together in our composites sector: a vibrant ecosystem of large and small firms, regionally distributed, expert at tackling real-world problems.
- By controlling the engineering (design) function for the next generation of products, we can shape supply chains and anchor value here in the UK. We do this by helping the sector innovate and develop skills, prove new methodologies and set standards for the world. If we don't, the centre of gravity will shift elsewhere, and Britain will become a customer for high value goods and services, rather than a provider of them.
- Our composites industry is a Strategic National Asset, years in the making, but its advantages could quickly be lost. We need government to support this growing industry that supports 400,000 UK jobs (Lucintel 2021).

Opportunity to onshore carbon fibre production and grow UK supply chains

- As other nations invest in decarbonising their economies, demand for carbon fibre is predicted to exceed global production capacity within just a few years.
- Rather than Britain waiting in line for what supplies we can get, we can control our destiny and invest in onshore production and re-use to supply our domestic market, and for export.
- Composites are famously tough but this durability is a double-edged sword: they are difficult to recycle. This is another market opportunity for the UK: we have the science, engineering and composites knowhow to create innovative recycling processes and even invent new, more sustainable materials. Britain can be the architect of a circular composites economy worth billions.

UK Strategy to Deliver Global Composite Solutions

- The Composites Leadership Forum (CLF) was established as a result of the 2009 UK Composites Strategy, to bring independent leadership to the sector.
- It comprises representatives from across the UK's composite base who make up the backbone of the UK's engineering sector. Including:
 - National Composites Centre
 - Composites UK
 - Key industrial organisations of all sizes
- The CLF works to ensure the UK's continued global success.
- The 2016 CLF strategy identified the UK's need to develop higher rate, lower cost production technologies. It forecast a growth in value of UK-produced composites parts from £2.3bn in 2015, to £12.5bn in 2030.
- In 2021 CLF identified a second challenge which it has added to its strategy: the need to develop composite solutions to support the battle against climate change and decarbonise our economy.
- It will be working to understand how the UK composites industry can respond to, and capitalise upon, the new, overarching imperative of sustainability.

How big is the composites opportunity?

- The composites industry is forecast to resume growth at up to **9% per annum between 2021-2025**. (Lucintel 2021)
- Value of raw materials is significant circa \$78 billion in 2020 (JEC Observer 2021) but the products they help create are worth vastly more.
- This will only increase as sectors including **renewable energy, transport, defence, infrastructure and construction** ramp up their use of composites, in line with Net Zero goals.
- The UK is ideally positioned to benefit, thanks to its investment in a raft of high-tech and high value composite technologies and products.

Notes

¹ JEC OBSERVER: Current trends in the global composites industry 2020-2025
How big is the composites opportunity?

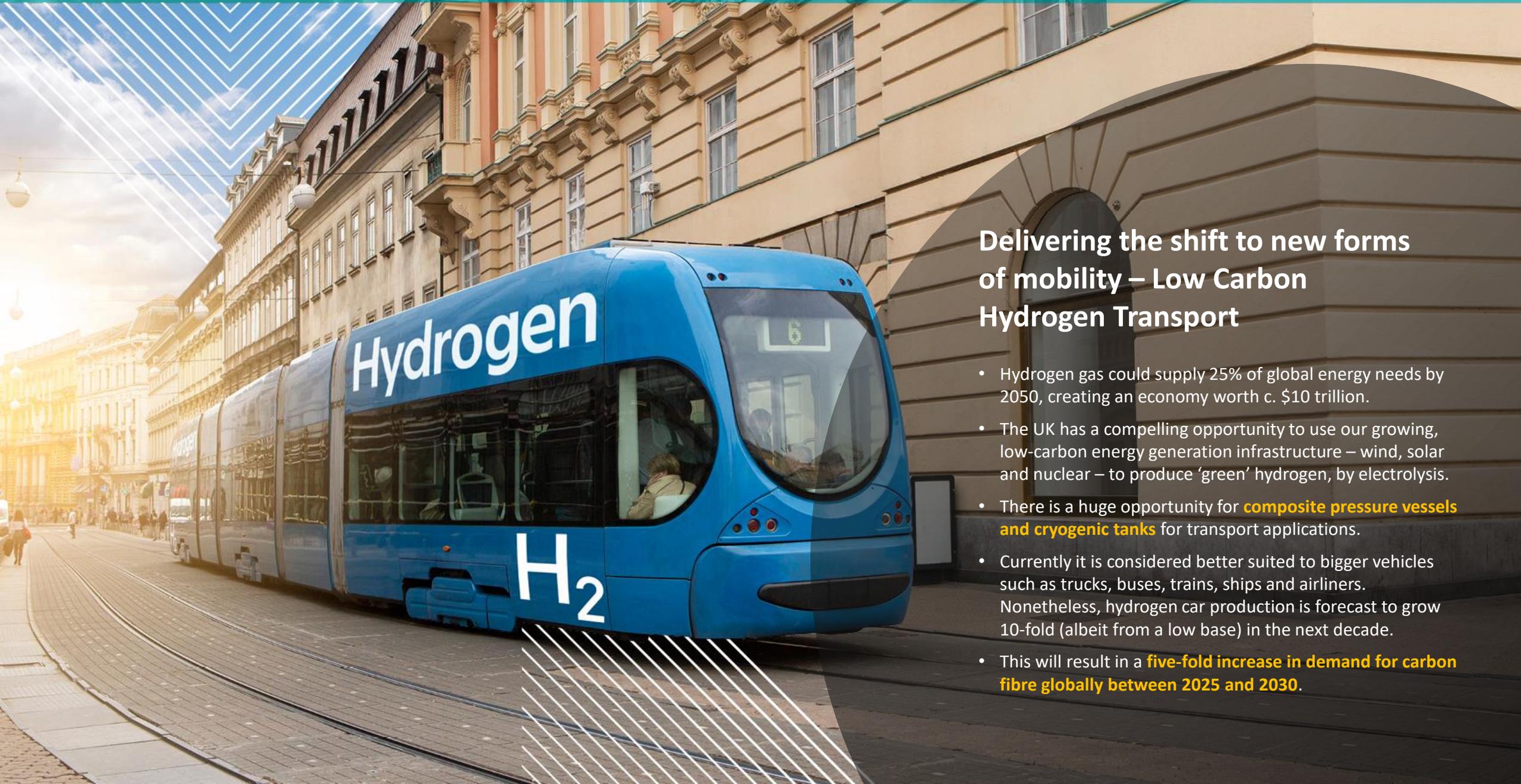


A new energy future – Wind

- The UK currently has the **world's largest fleet of offshore turbines**, with an installed capacity of over 10GW supplying c. 20% of our electricity need.
- The Government has committed to increasing this four-fold by 2030 and seven-fold by 2050.
- This coincides with an anticipated surge in demand to power electric vehicles, domestic heating and the production of green hydrogen.
- Offshore turbines are now nearly a quarter of a kilometre in diameter and are set to get bigger still and be deployed further from shore, on floating platforms.
- Offshore wind is attracting **significant foreign direct investment into the UK** with recent announcements of major, new blade factories contributing to the levelling up agenda.
- While wind energy is expanding globally, particularly in China and the US, the UK will remain one of the world's largest markets for offshore power until 2050 or beyond.
- By designing and manufacturing a new generation of materials and high-value components here, rather than import them, as currently happens, we can reach the aspiration of 60% domestic ratio and capture much more of the business value in the UK.

Nuclear

- To meet the demand for low carbon energy, UK scientists and engineers are developing a new generation of **Small Nuclear Reactors** (SNRs).
- Featuring **composites that withstand incredibly high temperatures**, these could enter service by 2030 and generate £52 billion of value to the UK economy by 2050.
- The technology could also open up a £250 billion export opportunity and generate up to 40,000 high-value jobs in communities across the UK .
- In parallel, the UK's research base is developing **fusion-reactors** that offer the prospect of virtually limitless clean electricity by replicating the processes that power the Sun.
- Once again, composites play a central role, with Ceramic Matrix Composites (CMCs) being used to contain the incredible temperatures involved.

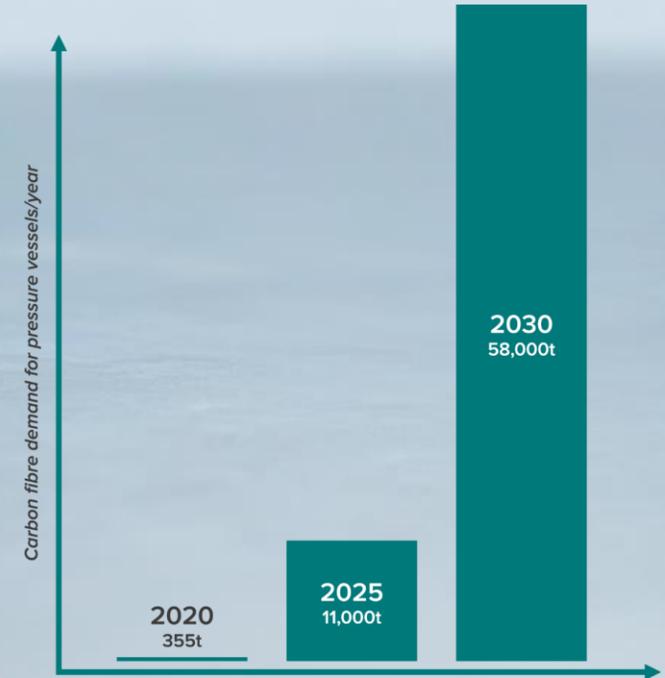


Delivering the shift to new forms of mobility – Low Carbon Hydrogen Transport

- Hydrogen gas could supply 25% of global energy needs by 2050, creating an economy worth c. \$10 trillion.
- The UK has a compelling opportunity to use our growing, low-carbon energy generation infrastructure – wind, solar and nuclear – to produce ‘green’ hydrogen, by electrolysis.
- There is a huge opportunity for **composite pressure vessels and cryogenic tanks** for transport applications.
- Currently it is considered better suited to bigger vehicles such as trucks, buses, trains, ships and airliners. Nonetheless, hydrogen car production is forecast to grow 10-fold (albeit from a low base) in the next decade.
- This will result in a **five-fold increase in demand for carbon fibre globally between 2025 and 2030**.

The future of mobility

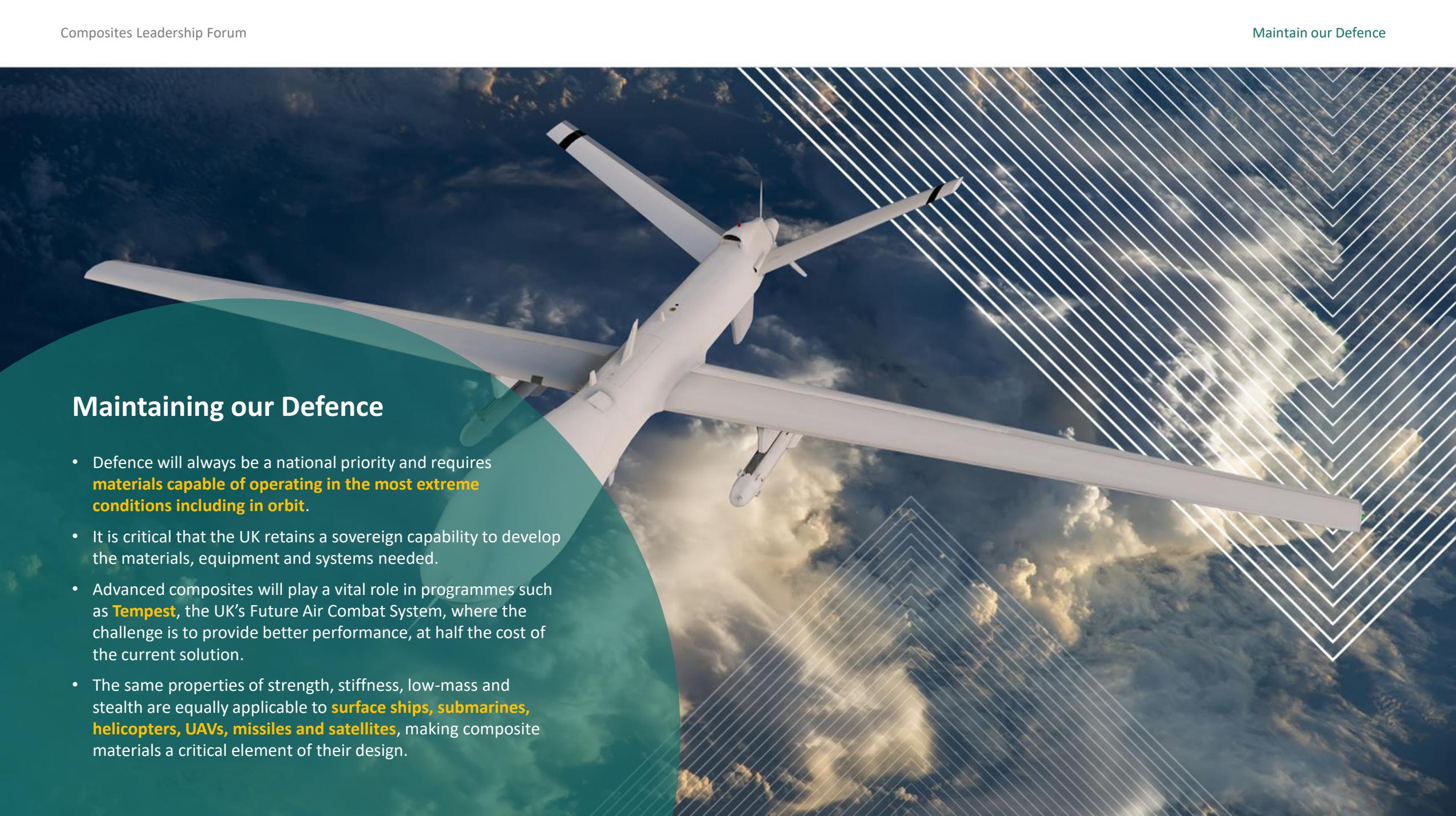
- In the next decade new petrol & diesel cars will be a thing of the past, public transport will be re-defined and personal mobility will be increasingly important.
- Composite technologies unlock these opportunities to revolutionise our personal mobility from **lightweighting electric vehicles** to offsetting the weight of the batteries to **increase the range of cars to enabling hydrogen powered buses & trains**.
- Bicycles already take advantage of composite materials with other forms of personal mobility being developed that will equally benefit. This rise of **new vehicles requiring composite solutions** will see a huge rise in demand.
- The UK must capitalise on its existing position and expertise in composites to secure the transportation supply chains of the future.





Allowing us to fly without emissions – Enabling Jet Zero

- The fourth generation of aerospace is upon us providing the pathway to achieving emission free flight.
- The **Jet Zero & Fly Zero** programmes are leading the way with composite technologies required to enable these aircraft of the future.
- The UK is already a **world leader in the application of composites for aerospace**, producing complex, high value components such as wings.
- Use of composites will only increase in future generations of aircraft while, new, smaller forms of air vehicles, such as delivery drones and air taxis, will be totally dependent on their unique power-to weight-to strength characteristics.
- Composites are even going into space, with **more sustainable space exploration** a major driver for continual uptake.



Maintaining our Defence

- Defence will always be a national priority and requires **materials capable of operating in the most extreme conditions including in orbit.**
- It is critical that the UK retains a sovereign capability to develop the materials, equipment and systems needed.
- Advanced composites will play a vital role in programmes such as **Tempest**, the UK's Future Air Combat System, where the challenge is to provide better performance, at half the cost of the current solution.
- The same properties of strength, stiffness, low-mass and stealth are equally applicable to **surface ships, submarines, helicopters, UAVs, missiles and satellites**, making composite materials a critical element of their design.

Build back better – Construction, infrastructure and utilities

- The global construction industry is one of the biggest emitters of carbon and the largest market for composite materials.
- Built environment contributes **42% of the UK's carbon emissions**, with the bulk of this coming from existing buildings that are poorly insulated and energy hungry. (UKGBC) **Composite solutions are light as well as strong**, an important consideration when retrofitting buildings with weak foundations.
- We not only need better homes, we need to build more of them, more quickly. **Composites lend themselves to modular, factory production**. With 30% of building materials often wasted or damaged on site, this alone can dramatically improve environmental performance.
- How we make buildings matters; re-thinking what we make them from matters even more. Like **concrete, gypsum** is one of the most widely used substances on Earth. It is also highly carbon intensive so UK composite experts are now developing – and selling – composite alternatives.
- The UK will need to invest significantly if the full benefits of advanced composite materials are to be realised in similar applications.

Sustainability

- One of the great strengths of composite materials is their **durability**. Whilst this enhances their in-service performance, it also makes them challenging to fully recycle.
- This is apparent to the wind energy sector, which has **thousands of turbine blades** coming towards the end of their useful life.
- In addition, 98% of the resins used for composites are derived from petroleum products, and 95% of the fibres are from non-renewable sources.
- These sustainability issues cry out for innovation.
- **The UK has the skills to rethink recycling for composites**, and to develop a market for cost competitive recycled feedstocks. Our world-class science sector can develop new, more sustainable fibres and resins, including alternatives such as bio-resins and natural fibres.
- Significant UK composites recycling capability will also onshore our material supply needs, increasing resilience going forward.
- With a global shortage of carbon fibre also on the horizon, a **truly 'circular economy' for composites** can't come soon enough.

COMPOSITES LEADERSHIP FORUM

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Summary

- The way we create and use products needs to be **fundamentally re-imagined**.
- There will be a need to **do more, with less**, in the face of ever-increasing international competition.
- The UK cannot meet its net zero targets without composites. They are both a **strategic asset and key differentiator** for the UK and will underpin government strategies around Hydrogen, innovation, industrial and transport decarbonisation, exports and Net Zero.
- Significant UK **composites recycling capability** will also onshore our material supply needs, increasing resilience going forward.
- **The UK must seize the opportunity to create the composite supply chain of the future**, developing the products and capabilities that will underpin the Green Industrial Revolution, ensuring the UK retains the jobs, economic value and technological leadership in these critical sectors for generations to come.

Supported by



A large blue industrial machine, possibly a textile loom or a similar textile manufacturing equipment, is shown in a factory setting. The machine has a prominent circular opening on the right side, revealing a complex internal mechanism. This mechanism includes several large spools of grey thread, various gears, and a central assembly with multiple parallel metal plates. The machine is mounted on a blue frame. In the background, other industrial equipment and a factory floor are visible.

Thank you.
Any questions?

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