

Photonics delivering growth and security

The technologies of light

Photonics underpins UK innovation and economic strength, enabling advanced manufacturing, defence, healthcare, communications, AI and quantum technologies. With global competition accelerating and integrated photonics transforming capability, rapid government action is essential to secure UK leadership, unlock private investment and protect long-term national resilience.



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Photonics is the science and technology of light. It includes light from any source; from sunlight to lasers and LEDs; of any colour from ultraviolet through all the colours of the rainbow, to the infrared. It spans every power level from single photons used in quantum entanglement, to the kilowatt lasers that cut or weld metal and drive fusion.

Photonics covers how light is generated, transmitted, detected and how it interacts with the world around us. Photonic products range from cameras and displays, lasers to lighting, optical fibres to contact lenses, the smallest microscopes to the biggest telescopes.

The UK has an exceptional pedigree of excellence in photonics research, stretching back James Clark Maxwell's pioneering theories of the 1860's. We also have a long history of translating that scientific excellence into impactful products, exemplified by Barr and Stroud's delivery of the first periscope to the Royal Navy 1917.

That combination of scientific and engineering excellence means the UK photonics industry generates more than £18.5 billion in annual revenues and employees over 85,000 people across 1,400 firms across the country. Photonics is one of the UK's most productive manufacturing industries and, unlike many higher-profile sectors, continues to grow strongly, with growth rates significantly ahead of the rest of manufacturing and the wider economy.

Yet despite its significant successes, highlighted in the Council of Science and Technology's (CST) advice letter to the Prime Minister in February 2026,

photonics often remains hidden from view. Photonics is the ultimate enabling technology, quietly delivering capability and enabling growth in markets from healthcare to advanced manufacturing, quantum computing, communications, autonomous transport, digital agriculture and, in particular defence, and AI.

AI and data

Photonics sits at the heart of the AI and data economy. Whether across oceans or continents, from 5G towers, or between the racks inside a datacentre, light travelling through optical fibres is the basis of all digital connectivity. The latest, UK-manufactured, advances in data storage are now being deployed in globally to store more data using less energy in less physical space. Optical interconnects are already transforming datacentre performance, reducing energy use.

Increasingly, photonics is becoming central to computation itself with emerging optical processors promising breakthroughs in speed and efficiency. As the digital economy expands and accelerates through the adoption of AI, only photonics can deliver the bandwidth and energy efficiency needed to move, store and process data at scale with sustainable energy use.

As the UK seeks to lead in AI, quantum and next-generation digital infrastructure, photonics provides the enabling technology. Without strong domestic capability in photonics, the UK risks falling behind in the very systems that will define economic strength and national resilience in the decades ahead.

Defence and security

As defence becomes increasingly data-driven and autonomous, photonics is becoming a critical part of the strategic infrastructure underpinning military capabilities.

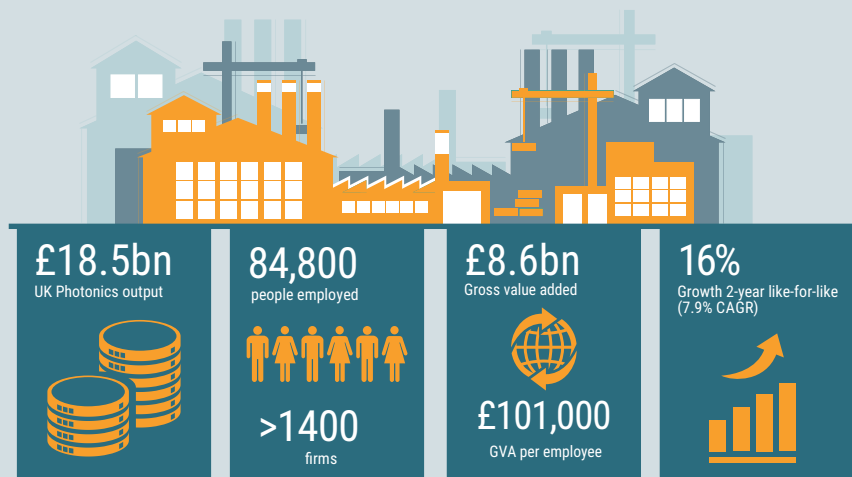
Remote and autonomous systems need refined navigation and positioning capabilities, as well as a significant reduction in size, weight, and power. Accelerating photonics development and deployment to meet this need is therefore critical.

Situational awareness drives modern decision making and is reliant on photonics. Extending visions and sensing beyond human limits, communicating data effectively and executing precise actions requires the accuracy only photonics can deliver.

The UK has world-leading photonics science, an innovative business base, strong international partnership and hosts photonics divisions of some of the world's leading defence primes. Yet challenges remain; emerging supply-chain vulnerabilities, a need for a broader skills pipeline and, critically, a longer-term funding horizon that supports defence sector development and implementations cycles that extend far beyond current government programmes.

The revolution, risk and opportunity

The manufacturing of photonics systems, particularly the high value systems in which the UK excels, has long been dominated by the assembly of discrete components, e.g. lenses, mirrors etc.



The scale of the UK photonics industry in 2025

Updates due in 2027 are likely to show the industry exceeding £20 billion in output.

The UK can capture the potential of this once-in-a-generation technology shift for both economic advantage and national resilience.

The size, cost and in many cases, end functionality have all been constrained by this traditional approach.

We are now, on the cusp of a revolution. Integrated photonics uses manufacturing techniques from the semiconductor industry to fabricate thousands of functional optical elements into photonics integrated circuits (PICs). The impact is comparable to how integrated circuits and transistors transformed electronics in the 1960's. This is a once-in-a-generation step change in technology that will revolutionise what is possible and reshape traditional value chains. Bulk photonics will still be required around the optical chip, and will remain vital for creating end products, but increasingly an optical chip will sit at the core, driving product functionality and differentiation.

If integrated photonics chips are to sit at the heart of future optical systems, the UK needs a domestic supply chain for these PICs to maintain and grow a resilient and secure economy. This is an emerging field, unlike electronic semiconductors, and remains an area where the UK can excel from design to manufacturing. With rapid global development and intensifying international competition, everything is still to play for, and time is of the essence.

Unlike silicon electronics, the integrated photonics revolution relies on many more materials from germanium and gallium arsenide to indium phosphide and lithium niobate as well as silicon. This both presents both a risk, in securing critical mineral supply chains and an opportunity for UK manufacturing. The UK already has a strong base in compound semiconductors fabrication, exemplified

by companies like IQE and Siivers Photonics. And in areas where silicon fabrication is required, we need domestic facilities capable of supporting rapid product development, keeping design IP in the UK, whilst working with government to secure international partnerships with high-volume silicon foundries worldwide.

As with any technology revolution early access is essential for users to test, refine designs and unlocking early adoption. Whether you make cell counters, agricultural sensors, micro satellites, quantum positioning systems, or AI processors, integrated photonics will impact your product design. Early access to UK-based integrated photonics pilot lines will allow industry to quantify the potential, harness the advantages and stay ahead of the competition.

Parliamentary action

The CST's letter to the Prime Minister in February 2026 called for a National Photonics Roadmaps as early as April 2026. Although substantial work has gone into its development, we urge parliament to press for the roadmap's publication without further delay.

The national roadmap will likely recommend investment in infrastructure and skills to ensure the UK captures the opportunities arising from the integrated photonics revolution. Such investment is vital to crowd in the significant private capital now looking to invest in photonics hardware, given its breadth of impact across the economy.

We call on parliamentarians to ensure that the roadmap's recommendations are fully funded and immediately actioned. There will always be risks and

uncertainties in technology; these cannot be eliminated. Indeed, that very uncertainty is often the source of opportunity. Clear signalling of confidence through government commitment will unlock far greater investment from industry. Industry is looking for is action. Without is capital will flow elsewhere, to countries where the support, timing and confidence in backing national strengths are stronger.

Our domestic market will never be the biggest in the world, but we have talent, ingenuity, flexibility, and a proven capability to turn scientific excellence into globally competitive products. With clear parliamentary backing, the UK can secure its position as a world leader in photonics for decades to come.

Conclusion

The 21st century is the century of the photon. The power of light is diving manufacturing productive, enabling effective defence and security, supporting modern healthcare and drug discovery, forming the core of digital communications and underpinning efficient AI and quantum technologies. As every sector of the economy increasingly leverages light, the UK cannot afford to be left behind in this critical technology.

Huge opportunities, and significant risks, are now visible as we stand on the cusp of the integrated photonics revolution. With coordinated, focused government action, working in partnership with industry, the UK can capture the potential of this once-in-a-generation technology shift for both economic advantage and national resilience. But time is of the essence. We cannot delay; time, technology and light wait for no one.