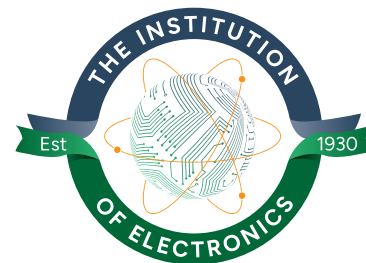


ELECTRON

THE QUARTERLY NEWSLETTER OF THE INSTITUTION OF ELECTRONICS



Spring / Summer - Aug 2026

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LEARNED AND PROFESSIONAL
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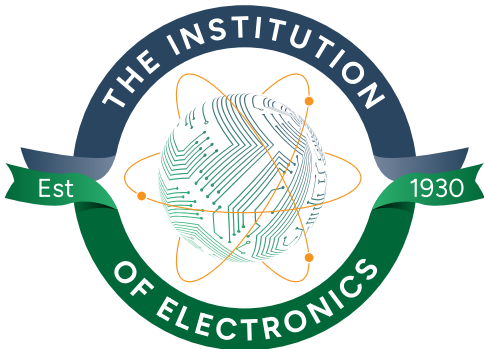
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SMART MANUFACTURING WEEK

Smart Manufacturing Week, researched and produced by The Manufacturer magazine, returned to The National Exhibition Centre, Birmingham, on 3rd. and 4th of June.

It was a four-in-one event consisting of four interconnected sub-exhibitions, namely Smart Manufacturing Expo (the largest with around 250 exhibitors and the UK's leading showcase for digital manufacturing and automation); Drives and Controls (with 31 exhibitors covering critical areas such as energy efficiency, machine safety, motion control and robotics); Design Engineering (17 exhibitors covering areas created for designers and engineering professionals to gain insights from pioneers pushing the boundaries of engineering); and Maintec (the longest-standing exhibition for predictive maintenance, reliability and asset management with 62 exhibitors).

In The Manufacturer, Vol.29 Issue 2, Q2 2026, Grace Gilling, Event Director said:

"All four of our co-located shows provide a complete 360 degree view of modern manufacturing. We're bringing The Manufacturer MX Awards reigning champions onto the keynote stage to share what's genuinely working inside their factories - so the ideas are grounded in real practice, not theory. We've also launched a brand new Meet the Buyer/Meet the Supplier programme designed to help visitors and exhibitors."

Another new feature for 2026 is The Factory of the Future, which consisted of an immersive virtual twin experience serving as a high-impact, digitally-led showcase illustrating how robotics, AI, digital twins and cyber security interact in a connected system. The Factory of the Future offered a guided journey through:

- Optimised production (connected efficient factory)

- Disruption events (machine failure and supply chain issues)
- Cyber attack scenario (breach detection, response and recovery)
- Sustainability (energy, waste and carbon visibility)

Innovation Alley returned showcasing fourteen promising start-ups and small businesses that fell into the categories of 'people' (highlighting advances in workforce management and training), 'product' (focusing on innovation in design and R and D), 'process' (productivity, resilience, AI and supply chain optimisation), and 'planet' (with an emphasis on sustainable manufacturing, energy management and net zero strategies).

On the AccuBots stand in the Drives and Controls sub-exhibition, FightFest involved robot battles that engaged students in competition with custom-made robots working with professional teams.

The Digitalisation Summit united senior digitalisation and technology leaders to overcome major industry challenges and unlock the potential of digital technologies.

Smart Manufacturing Week was structured around five 'pillars', namely:

- Innovation and smart manufacturing
- Digitalisation
- Sustainability
- People and skills
- Supply chain resilience

These were reflected in the seven Solutions theatres that took place at various locations at the event:

- Leadership and Strategy
- Digital Transformation

- Maintenance
- Connected Production
- AI and Industrial Data
- Design and Product Innovation
- Manufacturers and Engineers of the Future

The event was augmented with eight Visitor Trails dedicated to:

- Workforce Development and Upskilling
- SMEs
- Industrial Components and Maintenance
- Design and Engineering
- Sustainability and Circular Economy
- Supply Chain Resilience
- Digital Transformation
- Innovation and Smart Technologies

On each Trail various presentations were highlighted for visitors. Examples included:

- 'Making Manufacturers Superhuman - AI as a Teammate, not a Tool'
- 'Connected Worker - Why it matters and how it's transforming Manufacturing'
- 'Making Connectivity deliver real Operational Value'
- 'New Generation of Ultrasound: AI-assisted Analysis'
- 'Asset Tracking in Manufacturing with Airbus'
- 'From Concept to Creation : Accelerating Product Innovation and Development with Agentic AI Platform Accio Work by Alibaba.com'
- 'Future-ready Quality : Balancing Quality with Speed in the AI Age'
- 'Turning Data into Decarbonisation : The Digital Factory Story'
- 'From Data to Decisions : Agentic AI in Manufacturing and Energy'
- 'Same Outcome different Causes : Impacts of Business Interruption Risk from Cyber Attacks and Extreme Weather in Manufacturing Supply Chains'
- 'Architecting for Uncertainty : Building Digital Foundations that survive Volatility'
- 'Building a Connected Factory: Lessons from Fine Lady Bakeries'
- 'Beyond the Dashboard : Why your Manufacturing Data isn't working as hard as you are'
- 'Brains and Brawn : Why Physical AI needs Private 5G to succeed in the Factory'

In addition to The Manufacturer, the following journals have also included special features covering Smart Manufacturing Week:

- Controls, Drives and Automation, May 2026, p.2-14
- Plant and Works Engineering, Issue 492, April/May 2026, p.12-13
- Hydraulics and Pneumatics, April/May 2026, p.42-43
- Drives and Controls, May 2026, p.42-43
- MEPCA Magazine, May 2026, p.14-15
- Food and Drink Processing and Packaging, Issue 64, 2026, p.46
- Industrial Plant and Equipment, March/April 2026, p.3-17

The latter publication includes notably a feature specifically dedicated to Maintec, and in particular its official show partner Reliabilityweb, which has recently been acquired by Nineteen Group, the organiser of Smart Manufacturing Week. Reliabilityweb delivered its Certified Reliability Leader course in partnership with the Association of Asset Management. This had as its aim assisting organisations to shift away from reactive maintenance toward a proactive culture of reliability. The course leads to a Certified Reliability Leader examination administered by the Association of Asset Management Professionals, and over 4,000 professionals worldwide have so far completed it, the related Certified Maintenance Manager and similar programmes.

Terrence O'Hanlon, Founder of Reliabilityweb, comments:

"The Certified Reliability Leader programme is about equipping professionals to lead change, not just manage equipment. It provides a practical, cross-functional framework that connects maintenance, operations, engineering and leadership. When reliability becomes a shared responsibility across the organisation, performance follows."

Engineering Maintenance Solutions, Issue 130, April/May 2026, p.25-30, also includes a feature dedicated specifically to Maintec. This notably highlights three of the Maintec presentations, namely:

- 'Service Geeni - How to protect your Warehouse Automation Investment', highlighting maintenance blind spots that gradually erode reliability.
- 'Kluber Lubrication GB - The Future of Lubrication Condition Based and Automated', examining how advancements in sensor technology and automated lubrication systems enable real-time condition-based lubrication.(iii) 'Touchstone - Bringing disconnected Asset Data into a modern ready-to-use Platform', demonstrating proven strategies for migrating to a unified platform with minimal operational disruption.

There are also contributions from Maintec exhibitor Ultimo, which explains some of the latest AI announcement, and ShireSystem, who demonstrated how modern asset management systems support day-to-day operations.



SUPPORTING EXHIBITIONS

Subcon

Three journals, namely Machinery Market (28th. May), Production Engineering Solutions (May 2026), and The Engineer (May 2026) provided previews of Subcon, which was described as ‘the UK’s biggest manufacturing supply chain show’.

Machinery Market, the leading news magazine for new and used machinery, and a media partner for the event, states:

‘Recognising that for a modern manufacturing leader, time is the most valuable asset on the factory floor, for 2026 the traditional long-form workshops have been replaced with The Skills Sprint, a high-intensity conference stream designed for the time-poor professional. Every session in the Sprint is strictly curated to deliver a functional blueprint in 20-25 minutes and will include rapid-fire lead generation tactics for SMEs, live cybersecurity audits and agentic AI implementation guides’.

Amongst its exhibitor profiles Machinery Market includes most notably Cambridge Electronic Industries Limited, which highlights fibre optics as a sustainable, energy efficient alternative to copper.

Production Engineering Solutions, under the heading of ‘Subcon – The Manufacturing Solutions Show’, presents a list of Event Highlights, such as pro-motorsport simulators that provide an opportunity to compete in an interactive game zone; the networking hub ‘Pubcon’; tailored visitor trails across the automotive, aerospace, defence and medical sectors; and the VIP Buyers’ Programme for senior manufacturers, which offered exclusive networking opportunities.



The Production Engineering Solutions preview highlights, amongst others, the following conference themes:

- Cybersecurity and Physical Security in Manufacturing, addressing emerging digital threats and practical steps for securing connected factories.
- Smarter Supply Chain : Digital Logistics, Traceability and Transparency, revealing how real-time data, blockchain and logistics analytics are enabling ethical and efficient operations.
- Human-Robot Collaboration and Cobotics, exploring how cobots are reshaping shopfloor productivity and workplace engagement.
- Digital Validation and Virtual Commissioning,

illustrating how digital twins and AR/VR tools are transforming design, testing and commissioning.

Session picks from The Skills Sprint include:

- Building Confidence through Cyber Governance (IASME).
- The Collaborative Factory : Redefining Human-Robot Partnership in Industry (Phil Webb, RAEng and Airbus Professor of Industrial Robotics and Assembly, Cranfield University).
- The New Weak Link : Tackling Supply Chain Cyber Risk (Make UK).
- Digital Manufacturing – Should I? (Rolls-Royce, 3A Business Excellence Limited and Sempai).

In addition, the Subcon Showguide, which introduces Subcon as ‘UK Manufacturing’s Next Chapter’, provides speaker interviews which include presenter Faye Skelton, Head of Policy at Make UK, and co-presenter Alan Lothian, Director of 3A Business Excellence Limited.

Among the questions that were asked were: ‘What is the biggest disruptor you are seeing on UK factory floors?’ To this Faye Skelton answered:

“The gap between digital ambition and delivery. Many manufacturers are experimenting with AI, automation and digital tools, but struggle to move beyond pilots into scaled, embedded use on the factory floor. This creates a disconnect : the tech exists, but the capability, confidence and integration needed to deploy it at pace often does not.

Skills shortages, particularly in digital, data and engineering roles are intensifying this challenge. The result is that productivity gains are uneven, and smaller manufacturers risk being left behind unless we close the gap between innovation and implementation”.

Another question that was asked was: ‘We hear a lot about AI and automation, but where do you believe the human element remains most critical in modern manufacturing?’ Alan Lothian gave this answer:

“The human element remains most critical in problem-solving, judgement, and leadership behaviours. Technology can process data and automate tasks, but it cannot replace ownership, accountability or the ability to think systematically.

The biggest gains still come from engaged teams who understand their processes and are encouraged to improve them. AI can highlight issues, but people decide what matters and how to act. Sustainable improvement is fundamentally human”.

Subcon featured around 200 exhibitors, whilst The Skills Sprint featured 17 presentations. The Manufacturing Insights Theatre had 23 and the Innovation Zone 27.

TCT 3Sixty

In addition to its preview of Subcon, Production Engineering Solutions also incorporates a preview of the supporting TCT 3Sixty exhibition, the UK’s leading event for 3D-printing and additive manufacturing.



Under the heading of ‘TCT 3Sixty : From Possibility to Production’, Production Engineering Solutions (p.12) highlights the key theme of addressing the AM skills gap, with presentations including Aligning Education with Industry Needs, by Professor Robert Kay from Leeds University. The prominent role of defence is also highlighted with presentations on collaborative AI in defence and on using AM to preserve ceremonial equipment, whilst Ben O’ Brien of Rolls-Royce reflected on introducing AM within a major aerospace prime.

Med-Tech Expo

Med-Tech Expo 2026 adjoined TCT 3Sixty and is previewed in MEPCA Magazine (May 2026), p.84. Defined as ‘the UK’s dedicated event for medical device design and manufacturing’ there was an emphasis ‘concept to clinic’ with high-fidelity anatomical models being used to accelerate medical device development so as to bridge the gap between design, testing and clinical application. The latter was demonstrated by Jacqui O’ Connor of MedScan 3D.



Also highlighted was the future of ultrathin, sustainable Instructions for Use (IFUs), addressing both environmental impact and usability in medical products.

INTRODUCING THE HENRY ROYCE INSTITUTE

At TCT 3Sixty one of the notable exhibitors was the Henry Royce Institute based at the University of Manchester with a network that spans 11 leading institutions across the country, including the University of Cambridge, University of Liverpool, University of Leeds, University of Oxford, Imperial College London, Cranfield University, Strathclyde University, the UK National Nuclear Laboratory and the UK Atomic Energy Authority.

With a team of over 700 researchers, technical experts and support staff, the Henry Royce Institute delivers national programmes in materials science that extend beyond the capabilities of any one institution.

Four pillars support both industry and academia, namely:

- Enabling national materials research, collaboration and strategy
- Providing access to world-leading facilities and research expertise
- Catalysing industrial collaboration and accelerating translation
- Fostering materials science skills development, innovation training and outreach

Key facilities include:

- Equipment for fabrication of new battery structures, X-ray photoelectron spectroscopy, X-ray tomography and electrochemical characterisation.
- An Ambient Processing Cluster Tool consisting of a series of twelve custom-built 'gloveboxes' allowing for the design and fabrication of battery, PV, LED and other customised materials and devices at the Maxwell Centre in Cambridge.

- Production and characterisation of thin films and devices with 140 square metre clean room.
- An interdisciplinary laboratory space enabling the discovery, creation, characterisation, and exploitation of materials engineered at the atomic level at the Bragg Centre for Materials in Leeds, who were also exhibiting, and which houses the Royce Deposition System – a multi-chamber, multi-technique thin film deposition tool that allows a range of different materials and growth techniques to be combined.
- The Materials Innovation Factory in Liverpool, which has one of the largest concentrations of materials science robotics in the world.

The Centre for Energy Materials Research, Oxford, specialising in research into air-sensitive energy storage materials, and with facilities to provide an enhanced ability to synthesise, test and characterise air-sensitive materials for batteries.

Research areas include:

- Maintaining the UK's pioneering role in two-dimensional materials and nanomaterials composites and enabling new architectures and fabrication methods for electronic and optoelectronic devices.
- Atoms to Devices enabling the design of new devices and new technological solutions through the deposition of precisely controlled thin films, the engineering of interfaces and the ability to control doping on the nanoscale.
- Pioneering methods in computer-aided design, machine learning and robotics for materials discovery and characterisation.
- Materials systems for demanding environments.

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OMNIFACTORY DEFINES FUTURE OF AGILE MANUFACTURING

In The Manufacturer, Vol. 29, Issue 2 (Q2 2026), Daniel Symes, Head of Business and Knowledge Exchange at the University of Nottingham, introduces the Omnifactory, a £3.8 million national testbed designed to assist manufacturers with the navigation of uncertainty through reconfigurable, AI-driven automation.

Officially opened in 2023 at the University of Nottingham, the Omnifactory serves as a national demonstrator for smart robotic manufacturing. At its core is a bespoke reconfigurable production environment that integrates advanced robotics, autonomous material handling, machine vision, AI and digital connectivity across plant, system and device levels. Unlike traditional fixed automation, it enables robotic cells and processes to be dynamically reconfigured as product requirements change.

Robots are no longer locked into single tasks or static layouts. Instead intelligent sensing, real-time data and AI-driven controls allow systems to adapt to variable geometries, mixed-model production and late-stage design changes that ordinarily would halt or severely disrupt a traditional automated line. The result is a factory that is capable of 'plug-and-produce' automation, allowing for maximisation of asset utilisation, reduction of changeover times and a lowering of risk in automation investment in uncertain markets.

The emphasis is on sectors where robotics and automation are business-critical, such as aerospace, automotive, defence, construction, nuclear, medical, food manufacturing and the space sector.

The author illustrates the versatility of Omnifactory by referencing the Flexible Nacelle Manufacturing Assembly project (FLEXELLE) led by BAE Systems. This reimagined large-scale aerostructure assembly through the use of robotic systems combined with measurement-assisted determinate assembly, or

MADA. By replacing fixed jigs with robotic, sensor-rich assembly processes jig-less flexible automation was found to be highly effective.

Benefits included improved precision, reduced inspection and rework, automated validation of large structures in multiple orientations, and the ability to produce different variants on the same robotic equipment. There were also potential reductions of over 50 per cent in non-recurring costs associated with introducing new products.



NATIONAL ELECTRONICS COMPETITION

An exclusive competition for students of Arkwright affiliated Schools.

This competition will give the Institution the chance to champion the cause of young people pursuing electronics projects within the curriculum, extra-curricular and at home.

Applicants become student members of the Institution and will be invited to join the task-force that will plan the next phase of the Institution's development as an incubator for future leaders of the electronics industry.

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NEW SEARCH ROBOT DEVELOPED AT TECHNICAL UNIVERSITY OF MUNICH



Scientists at the Technical University of Munich Learning Systems and Robotics Laboratory have developed a robot that can locate lost items on command by combining knowledge from the internet with a spatial map of its surroundings. It is one of the first robots to integrate image understanding with application to a clearly defined task.

The camera initially provides two-dimensional images with pixels that also contain in-depth information to create a spatial map that can be constantly updated. A laptop is used to provide the robot with information about which objects are visible in the image. The objective is to develop robots that can navigate any environment independently.

Humanoid robots working in factories need this newly-developed basic understanding. Two-digit numbers appear on the three-dimensional map of the environment, constantly recalculating the likelihood that the object being sought is located

there. The robot then searches the probable locations almost 30 per cent more efficiently than if it searched randomly throughout the room.

Artificial intelligence is deployed for image recognition and through use of a language model. The robot remembers previous images which it can compare with new images of its surroundings such that if a new object suddenly appears it can recognise the change with a 95 per cent degree of certainty and mark it as a highly probable search location.

Professor Angela Schoellig, Head of the Robotics Lab at the Technical University of Munich's Chair of Safety, Performance and Reliability for Learning Systems, says:

"The language model captures the relationships between the objects and we convert this information into the robot's language".

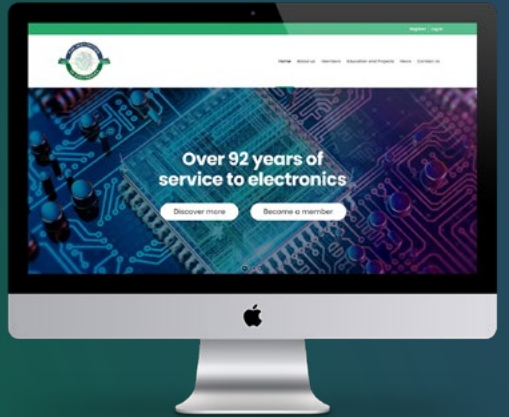
Reference: 'Search Robot "thinks" for itself', Controls, Drives and Automation, May 2026, p.38

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FIRST MODULAR ROBOTS WITH ATHLETIC INTELLIGENCE



Engineers at Northwestern University, Illinois, have developed the first ever modular robots with athletic intelligence.

They can be combined and recombined in wild settings and recover from injury. They are constructed from autonomous, Lego-like modules that snap together into an endless number of configurations, each module being a complete robot consisting of half-metre-long modular legs joined by a central sphere comprising a circuit board, battery and motor.

Each module is able to turn, roll and jump, with a greater agility and robustness being achieved when the modules combine. In order to design the most effective combinations, the engineers used AI to evolve novel body configurations that were effectively new 'species' of machine, as opposed to standard dog or human-like designs.

When connected to other modules, these 'metamachines' assume the capability to undulate like seals, bound like lizards and spring like kangaroos, and because each metamachine is essentially a robot composed of other robots it also has the ability to resist serious damage.

Reference: 'AI-designed Modular Robots can self-repair', Engineering Designer, April-June 2026, p.9

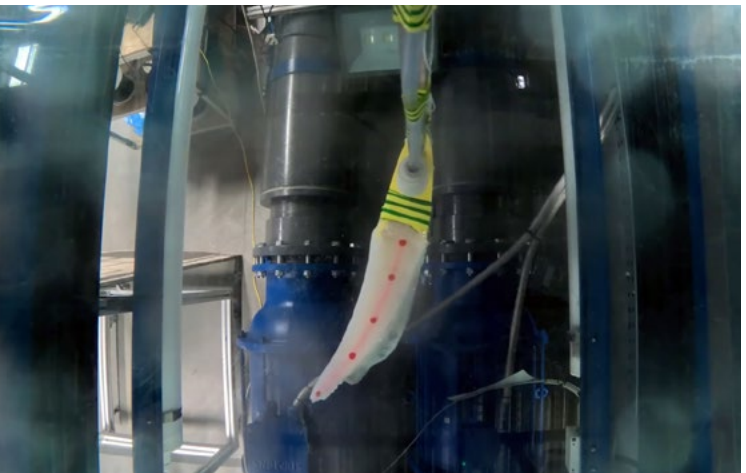




FLOW-SENSING ROBOTIC WING DEVELOPED AT SOUTHAMPTON

Researchers at the University of Southampton have developed a soft robotic underwater wing that can sense changing water conditions and adapt to them, potentially improving the stability and efficiency of autonomous underwater vehicles and enabling the development of new classes of bio-inspired underwater robots.

Inspiration was drawn from the concept of proprioception which enables animals to respond rapidly to disturbances, and at the core of the innovation is a flexible 'e-skin' of liquid metal wires embedded in silicone that act like artificial nerves. These detect subtle bending caused by water flow and feed signals back to the system. Two internal hydraulic tubes then automatically adjust the stiffness of the wing and its curvature in real-time so as to allow it to actively counter disturbances.



In testing the new robotic wing was found to reduce unwanted uplift impulse (the sudden upward jolt caused by underwater currents) by 87 per cent relative to the rigid wings used on today's AUVs. It also responded up to four times faster than comparable soft wing designs and used five times less energy than systems that rely on thermal actuation.

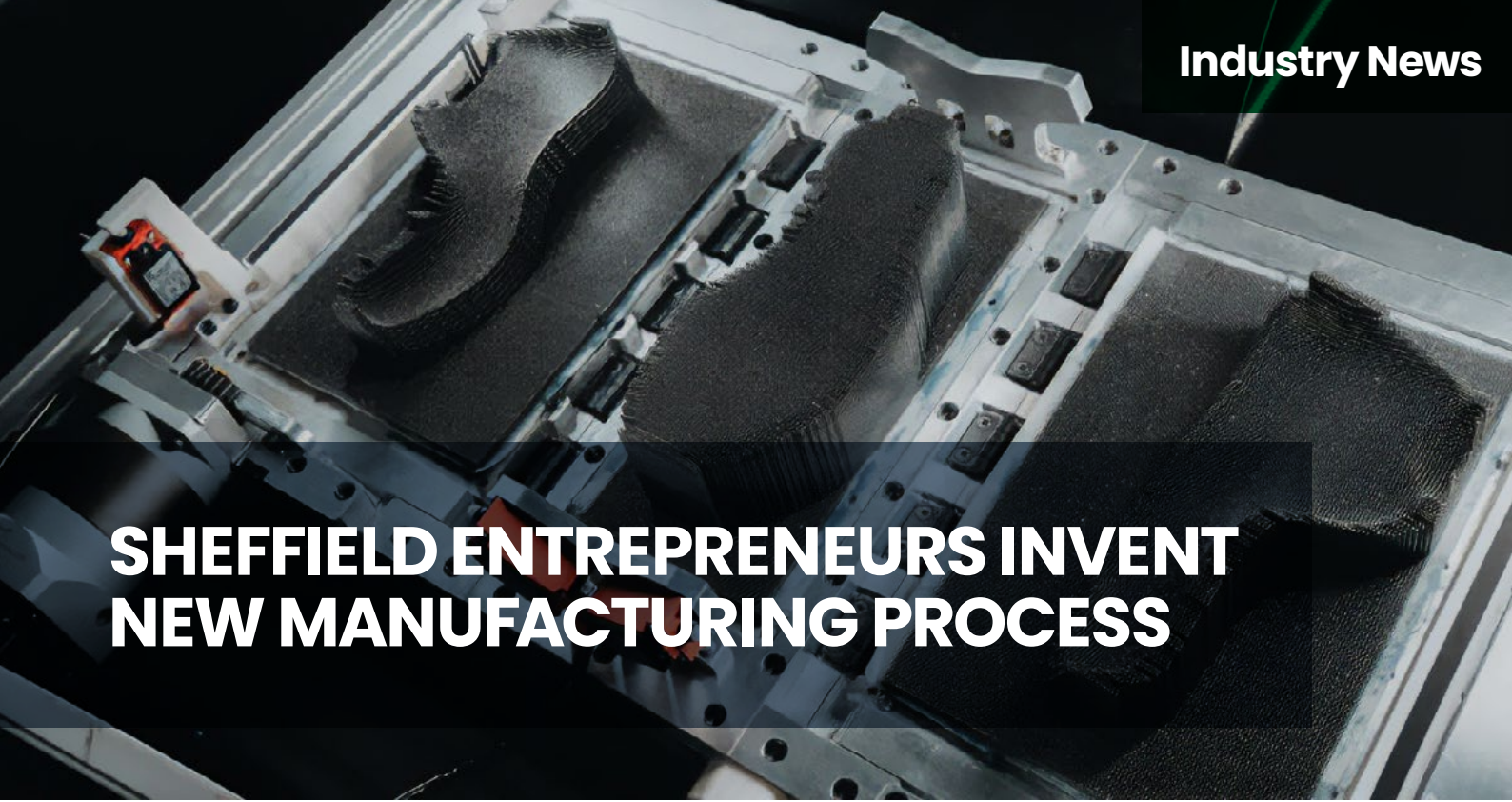
The biggest barrier to scaling the technology was found to be integration with existing vehicle systems.

Lead Researcher Leo Micklem states:

"For connection to current systems, rigid connector pieces would be required for interface between soft and rigid mediums, like we used in this work. Improvement in this area - to make the attachment more secure with the electrical connections protected - is the primary requirement.

Most AUVs also use an internal bladder for buoyancy control that could be used to actuate the system. However, we are more excited by the prospect of new underwater vehicles that could be mostly or fully soft and challenge biological swimmers in terms of efficiency and manoeuvrability."

Reference: Ford, J., 'UK Researchers develop flow-sensing Robotic Wing', The Engineer, May 2026, p.8



SHEFFIELD ENTREPRENEURS INVENT NEW MANUFACTURING PROCESS

Two entrepreneurs based in Sheffield - Joshua Shires, former CTO at phone case manufacturer Mons, and Thomas Bloomfield, formerly of the Rolls-Royce/Unipart joint venture MetLase - have come together under the banner of Fyous to pioneer a new method of manufacturing known as Polymorphic Manufacturing.

The core technology is a reconfigurable tooling method which deploys tens of thousands of digitally controlled pins in order to create temporary injection moulds, forming tools and work-holding fixtures. Now, a machine has been built that integrates injection moulding for footwear and dental applications.

Whilst the concept of 'practical pin tooling' has been in existence since 2013, having been researched at Massachusetts Institute of Technology, it has remained simply a concept. Now, however, innovations in which the tiny alloy pins used to control the mould and hold it in place, using a patent pending 'secret sauce', have made it a feasible commercial prospect.

The first step of the process is the creation of the polymorphic tool in which over 46,000 1.2mm diameter pins rise from the tool bed. These can be repositioned in about 20 minutes to provide a method of manufacture that is orders of magnitude faster than current methods - an hour versus half a day.

With the pins in place the tool bed slides forward into the injection moulding section of the machine, and a proprietary membrane is applied to the tool bed. This expands to fill the shape of the mould and prevent the polyurethane from being poured directly

onto the pins. The tool bed then folds from a flat configuration to form an enclosed volume and an automated injection process is used to fill the void with polyurethane resin. The part is then cured for ten minutes until safe to handle. The entire process takes just 45 minutes.

Polymorphic manufacturing is noted to be especially suitable for the dental market, in particular the production of retainers, which are custom-made, based on a precise mould of a patient's mouth and used to prevent teeth from shifting back to their original positions once braces are removed. They are typically produced by taking a scan of a patient's teeth and 3D-printing a mould. This is a costly and wasteful process that polymorphic manufacturing aims to replace by utilising a dedicated machine incorporating some 40,000 0.3mm diameter pins. When the dentist inputs a code into it, it will make a shape out of pins which can be vacuum formed directly onto.

Reference: Excell, J., 'Sheffield's Shape shifting Tooling Breakthrough', The Engineer, May 2026, p.42-43

ELECTRONICS NOW PRINTED DIRECTLY ONTO COMPONENTS

Connector and connectivity specialist Binder has unveiled a manufacturing approach that enables electronic functions to be printed directly onto component surfaces.

Sensors, circuit boards and contact elements typically require separate installation and occupy valuable space, while integrating electronics onto curved or irregular surfaces has proved troublesome.

The new process deposits functional layers directly onto substrates, including plastics, metals, glass and ceramics. Precision screen and pad printing techniques are used with conductive materials such as silver, copper, carbon and PEDOT:PSS, alongside dielectric pastes. Multiple layers can be printed so as to create conductive pathways, sensors and heating elements directly on three-dimensional or curved surfaces where conventional circuit boards may be impractical.

In industrial machinery, printed sensors can support condition monitoring and predictive maintenance, whilst printed touch and force sensors can be incorporated into user interfaces. Integrated heating elements can help maintain operating temperatures for critical components.

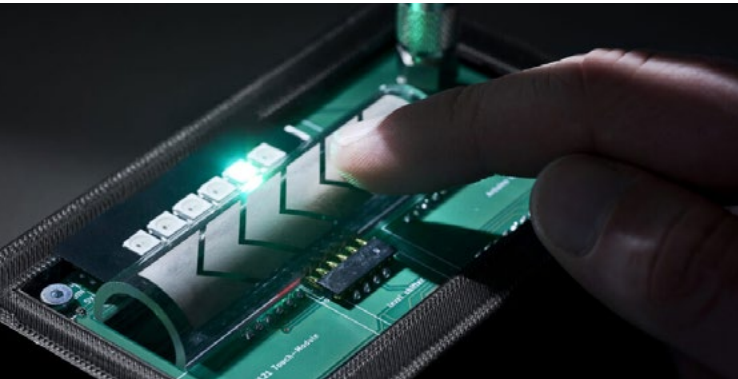
Through its vertically integrated manufacturing structure, printed functional layers can be combined with connectors and connection technologies to create complete systems tailored to customer requirements.

With this approach customers can move from prototype development to volume production within a single supplier network, supporting the growing demand for intelligent, space-efficient electronic devices.

Dr-Ing. Martin Ungerer, Team Leader for Printed Electronics at the Binder Innovation and Technology Center (ITZ) in Bad Rappenau, Germany, states:

"Printed electronics shifts the limit of what a single component can achieve. We apply conductor tracks, heating functions or sensor technology directly onto the surface, saving a whole range of individual parts and creating intelligent components."

Reference: 'Binder develops Technology to print Electronics directly onto Components', New Electronics, Vol.59, Issue 5, June/July 2026, p.9



3D-PRINTING ELECTRONICS WITH FOCUSED MICROWAVES

A major challenge in the 3D-printing of electronics has been the thermal processing stage in which printed electronic inks have to be heated in order to become functional. Conventional heating methods tend to damage the surrounding materials, especially in multimaterial structures, which has restricted printed electronics to a narrow set of materials and applications.

Now, scientists at Rice University have pioneered a new approach using focused microwave energy to heat just the printed electronic ink. By confining the microwaves to a region the width of a human hair, the team was able to selectively process the ink during printing without degrading temperature-sensitive substrates.

The new method allows electronics to be printed onto diverse materials, such as biopolymers and living

tissue, using just a desktop-scale printer.

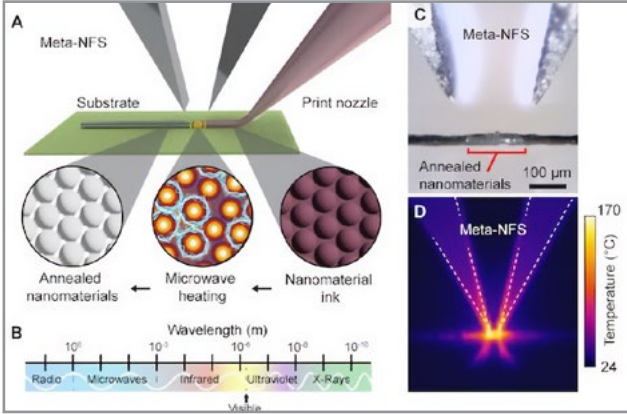
The technology deploys a device known as a metamaterial-inspired, near-field electromagnetic structure, or Meta-NFS, originally developed at the University of Singapore. Integrating this into a micro-extrusion 3D-printing process enables precise control of heating by tuning microwave parameters such that the microstructure and performance of printed electronics can be adjusted into a single build. Multifunctional electronic and mechanical properties can be programmed into complex, free-form architectures without having to switch materials or use manual assembly.

As proof of concept, the researchers printed wireless strain sensors onto ultrahigh-molecular weight polyethylene, a polymer used in joint replacements, and onto a bovine bone and a living leaf, suggesting possible applications in areas such as smart implants and soft robotics.

Yong Lin Kong, Assistant Professor of Mechanical Engineering at Rice University, states:

"Selectively heating the printed materials enables us to spatially program the ink's functional properties, even when surrounded by temperature-sensitive material."

Reference: 'Researchers redefine 3D-printing Electronics with focused Microwaves', New Electronics, Vol.59 Issue 4, April/May 2026, p.33



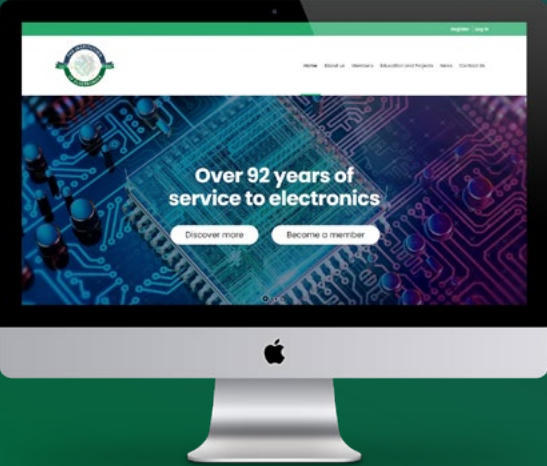
BACTERIAL CELLULOSE FOR SUSTAINABLE CIRCUIT BOARDS

MACHINES NOW HAVE SENSE OF TOUCH

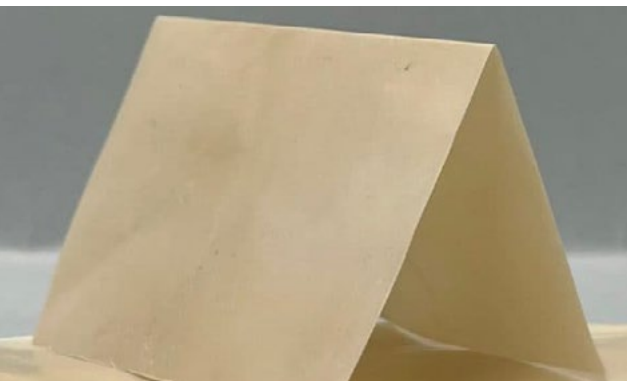
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A project in Germany is investigating the potential application of environmentally friendly alternatives to conventional electronic materials through the use of bacterial cellulose in printed circuit boards.

Wurthe Electronic Circuit Board Technology, The Institute for Materials Science at the University of Stuttgart, and the Hahn-Schickard-Gesellschaft fur angewandte Forcshung are together developing bio-based circuit carriers using bacterial cellulose. Through controlled microbial processes this raw material is transformed into durable, sheet-like substrates that could potentially replace the petroleum-based components used in electronics.

By using digital printing techniques, conductive pathways are applied directly onto the cellulose substrates with inkjet printing using copper and silver links allowing for precise placement of conductive traces. Greater flexibility in circuit design is thereby enabled.

A demonstrator is currently being constructed to showcase multilayer PCBs being produced using a combination of bacterial cellulose and digital printing techniques.

Reference: Tyler, N., 'Project explores Bacterial Cellulose for Sustainable Circuit Boards', New Electronics, 2nd. June

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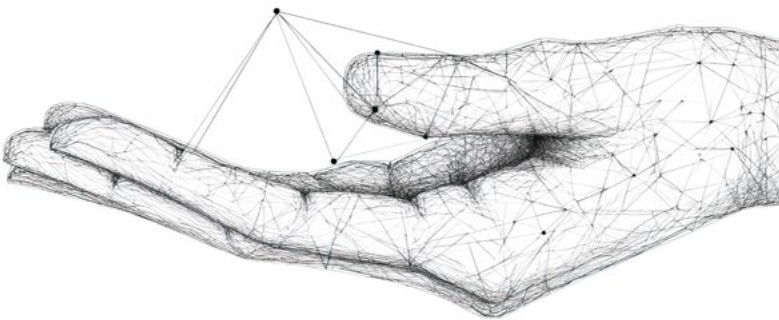
Researchers from imec/Hasselt University and Vrije Universiteit Brussel have developed an integration technology that embeds liquid metal conductors inside a soft, stretchable encapsulant, allowing circuits and sensors to deform, twist and recover from damage without losing functionality. Combining flexible electronics with advanced sensing capabilities, this pioneering development effectively provides machines with an artificial 'skin' that gives them a sense of touch.

The technology involves ultra-thin electronic layers being embedded in a soft, elastic material, allowing it to conform closely to surfaces like robotic arms. Within the structure are dense networks of micro-sensors that detect pressure, temperature and motion. These can be converted into electrical signals that are subsequently interpreted by processing systems.

The ability to stretch and bend without losing functionality is provided by rubber-like substrates

and specially designed interconnections that can expand and contract under strain. This enables it to be applied in areas where traditional rigid electronics would be unsuitable.

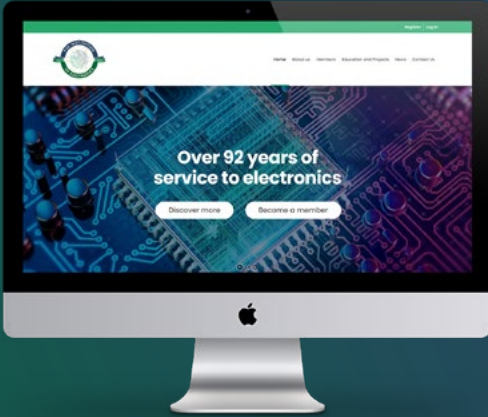
Reference: 'Researchers demonstrate artificial Skin for Machines', New Electronics, Vol. 59 Issue 5, June/July 2026, p.47



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ADVANCES IN QUANTUM TECHNOLOGY

Quantum Dot Qubit fabricated with High NA EUV Lithography

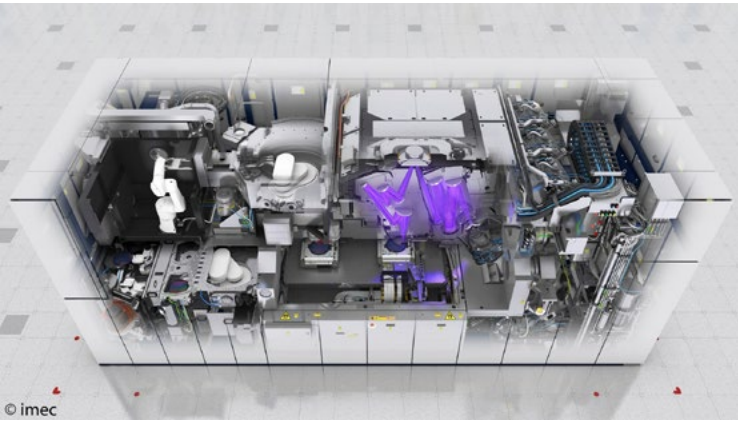
A first-of-its-kind quantum dot qubit device produced using High Numerical Aperture extreme ultraviolet lithography has been revealed by imec, marking a turning point towards the industrial scale manufacture of quantum computing hardware.

Silicon quantum dot qubits rely on confining individual electrons in nanoscale silicon structures with the electron's spin state used to represent quantum information. The fabrication process is largely compatible with conventional CMOS chip manufacturing, with High NA EUV lithography effectively shifting the focus from experimental demonstrations to reproducible fabrication using standard 300mm semiconductor manufacturing processes.

A key challenge is controlling the spacing between gate structures, as smaller gaps can reduce unwanted interference and improve qubit interactions. In this regard imec reported that it had successfully produced a functioning network of qubits with gaps of around 6 nanometres, making it possible to integrate millions of qubits onto a single chip.

Kristiaan De Greve, imec Fellow and Programme Director for Quantum Computing, states:

"High NA EUV enables the precise patterning of silicon quantum dot qubits. As the coupling strength between neighbouring quantum dots increases exponentially with the gap between them, we need to reliably pattern gaps of a few nanometres between the control electrodes of the quantum dots. This is a



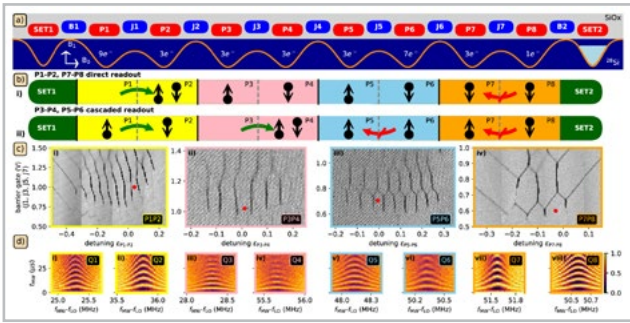
true engineering feat, thanks to our integration and patterning teams and ASML's outstanding High NA EUV technology."

Reference: Tyler, N., 'imec demonstrates Quantum Dot Qubit fabricated with High NA EUV Lithography', New Electronics, 19th. May

Eight-qubit Silicon Quantum Processor with CMOS Manufacturing

Another innovation from imec, this time with partner Diraq, is the first demonstration of coherent operation and readout of an eight-qubit MOS spin-qubit array using a 300mm CMOS-compatible semiconductor manufacturing process.

In 2025 imec and Diraq demonstrated that silicon spin qubits produced on an industrial manufacturing platform could achieve the fidelity levels required for



quantum error correction. This validated individual qubits and two-qubit systems. Now, this has been extended to include the larger eight-qubit linear array whilst at the same time maintaining the coherence and control required for quantum operations.

It was also found that expanding the architecture for the larger array did not require a proportional increase in sensor numbers, wiring complexity or thermal load.

Kristiaan De Greve comments:

"The future of quantum computing depends not only on qubit quality, but also on the ability to manufacture increasingly complex quantum processors with the reproducibility, yield and scale of the semiconductor industry.

This result demonstrates that industrial 300mm CMOS-compatible manufacturing can support quantum systems beyond isolated qubit pairs. By combining imec's advanced semiconductor process technology with quantum device engineering, we taking important steps toward realising scalable silicon-based quantum processors."

Reference: Tyler, N., 'Imec and Diraq demonstrate eight-qubit Silicon Quantum Processor using CMOS Manufacturing', New Electronics, 13th. July

Japanese Scientists rewrite Rules inside layered Quantum Material

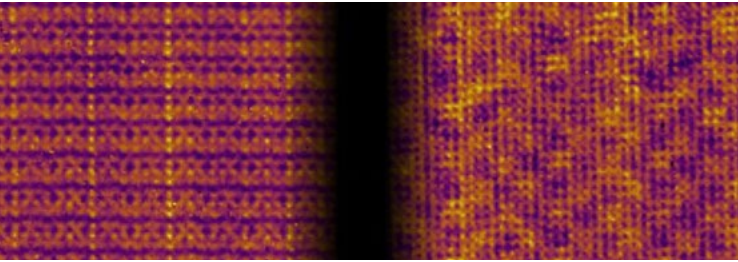
Researchers at the Okinawa Institute of Science and Technology and Hiroshima University have determined that a small magnetic nudge can be used to transform a whole electronic landscape from parallel stripes to a neat checkerboard in a layered sample of the quantum material cerium tritelluride (CeTe3), potentially illustrating how future spintronics and quantum computing architectures may control information at the atomic scale.

In materials such as copper, silver and silicon, electrons behave in predictable ways. By comparison, in quantum materials complex interactions give rise to collective electronic states. Consequently there is a goal in quantum materials research to understand how these emergent states develop so that they can be manipulated and controlled.

CeTe3 is similar to graphene in that it is a two-dimensional layered material with ultrafast mobile electrons. Unlike graphene, however, CeTe3 contains two types of atoms, namely tellurium and cerium.

The tellurium layers act as 'highways' in which mobile electrons move rapidly and naturally forming repeating wave-like patterns, whereas the cerium layers host stationary electrons that remain localised and do not move. The quantum property known as spin results in these fixed electrons acting like bar magnets in a fixed position.

The scientists used scanning tunnelling microscopy at



temperatures close to absolute zero to map the surface of the material at atomic resolution. It was observed that the mobile electrons formed clear parallel stripes. A magnetic field was then applied which resulted in 'electronic frustration' in which the electrons exhibited low-energy patterns without preferring any single one, and reformed into a chequered pattern.

A companion study used neutron scattering to probe the material's underlying magnetic core, and this revealed that the material developed an unexpectedly complex magnetic order that directly supports and drives these shifting electronic states at near absolute zero.

Yuita Fujisawa, co-first author of the study and assistant professor at Hiroshima University, says:

"CeTe3 offers a rare opportunity to watch mobile electrons and localised spins work together. We wanted to directly visualise how this cooperation gives rise to collective electronic states.

We were astonished because it is extremely rare for a material to host multiple competing electronic patterns that can be switched so dramatically by such a small magnetic field."

Reference: Dixit, M., 'Quantum Material's Electronic States can be flipped with Magnetic Field, Study finds', Interesting Engineering, 23rd. July

New Benchmark for Quantum safe Transatlantic Data Transmission

Colt Technology Services and Ciena have completed one of the fastest quantum safe data transmissions ever demonstrated and the fastest across a transatlantic route. Live data running was protected over 6,900km of Colt's subsea and terrestrial network between New York and London with Ciena's WaveLogic 6 Extreme (WL6e) encryption.

This trial proved that data can be securely transmitted at an 800Gb Ethernet (GbE) service rate, sufficient to move data centre scale volumes across the Atlantic in seconds, while also remaining protected against quantum threats. This is at a time when 69 per cent of organisations believe that quantum computing poses a real risk to current encryption.

Ciena’s WL6e 1.6T quantum-safe encryption solution on the Waveserver platform offers PQC algorithms that enable high capacity secure connectivity that can function at extreme bandwidths over any distance.

Buddy Bayer, Chief Operating Officer for Colt Technology Services, states:

“ Quantum computing is redefining the security challenge for global connectivity. This trial marks a significant step forward in protecting the world’s data as it moves across continents. It proves that quantum safe protection can be delivered at real world scale. ”

Dino Di Perna, Senior Vice-president, Global Research and Development for Ciena, adds:

“ As network demand surges, operators are raising the security bar to stay ahead of the threat posed by quantum computers. This Colt-Ciena trial shows how post-quantum cryptography and proven high-performance optical encryption can play an important role in protecting high-speed services over real-world long-haul and submarine networks, helping secure critical in-flight data across any distance. ”

Reference: Optical Connections News, June 19th.

World’s First Consumer-facing Quantum Product

A London start-up, known as Moth, has released a quantum-powered open-access game called Quantum Backrooms which uses real quantum hardware to generate gameplay.

The game draws inspiration from the online ‘Backrooms’ concept in which players exist in continually evolving maze-like environments shaped by the behaviour of quantum processing units. Individual qubits correspond to sections of the virtual space, while the connections between them define possible routes through the maze. The objective is to make quantum computing more accessible without the need for technical expertise such that by playing players indirectly engage with quantum processes in action.

The technology behind the game is part of a broader platform intended to enable creators and developers to build quantum based applications. When the game runs it sends instructions to a quantum processor, which executes circuits containing qubits, the fundamental units of quantum

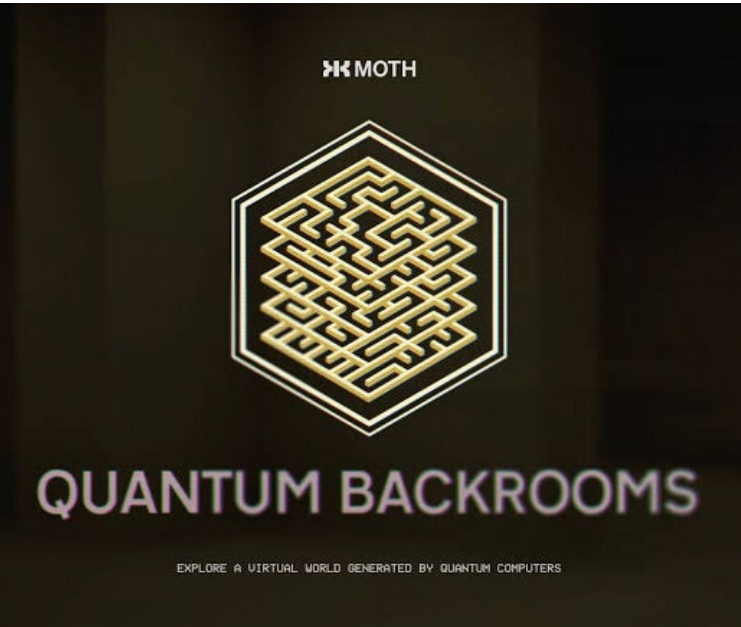
information. The outcomes produced by these qubits are inherently probabilistic, meaning that they cannot be predicted in the same way as results from conventional computers. These outputs are translated into the structure of the game, with each qubit corresponding to a portion of the maze-like environment. Connections between qubits define how different areas link together. As the outputs vary from execution to another, the environment can change unpredictably, creating a different experience each time the game is played.

The fact that the system relies on real quantum hardware as opposed to simulations means that the gameplay is influenced by physical quantum processes.

Founder of Moth and Chief Creative Officer Harry Kumar comments:

“ Our platform will catalyse a huge leap forward for the quantum sector, unlocking the kind of creative experimentation that historically supercharges adoption and innovation. The next step in quantum computing will not come from hardware alone. It will come when consumers start to engage with it and our collective imagination for new applications is unlocked. ”

Reference: Tyler, N., ‘London Startup launches Quantum-powered Game aimed at Consumers’, New Electronics, 2nd. June



AMPLIFYING ELECTRICAL SIGNALS WITH COLLECTIVE ELECTRON MOTION

Researchers at the UCLA Samueli School of Engineering have demonstrated how a small input signal can be used to generate a response over 100 times stronger than that previously recorded using conventional materials.

The principle involves utilisation of a charge-density wave in which electrons move together in a coordinated wave-like pattern as opposed to independently. This produces electrical properties that are different from those found in standard conductive materials.

The team fabricated prototype devices that were just a few nanometres thick, made out of tantalum trisulphide, which characteristically exhibits high charge-density waves. Advanced nanofabrication combined with radio frequency measurements enabled direct observation of how electrons move in unison and quantification of how strongly the material responded to an applied electric field.

A key achievement was being able to distinguish between the behaviour of individual electrons and that of the collective state. The device design was also similar to structures already found in existing silicon-based technologies, making it possible to integrate the

approach into current semiconductor manufacturing processes.

It is envisaged that the approach could offer a way forward for overcoming current limitations in chip design, such as size and energy consumption.

Alexander Balandin, Professor of Materials Science and Engineering at UCLA and co-corresponding author of the study, explains:

“ Our research reveals an unexpected amplification effect that emerges when electrons act collectively rather than individually. This suggests a new strategy for controlling electricity in future devices. ”

Lead Author and postdoctoral researcher Maedeh Taheri adds:

“ The similarities suggest that the newly discovered effect may not require an entirely new technological platform. It could potentially be adapted into device architectures already standard in the semiconductor industry. ”

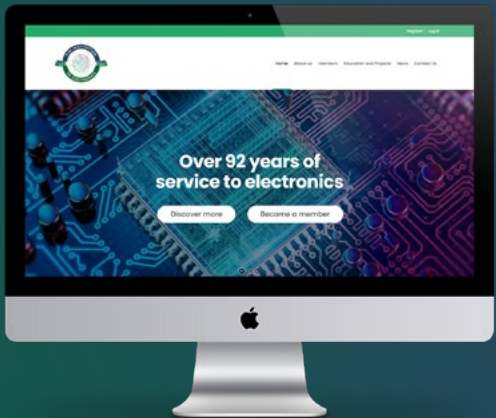
Reference: ‘Scientists amplify Electrical Signals using Collective Electron Motion’, New Electronics, Vol.59 Issue 5, June/July 2026, p.33

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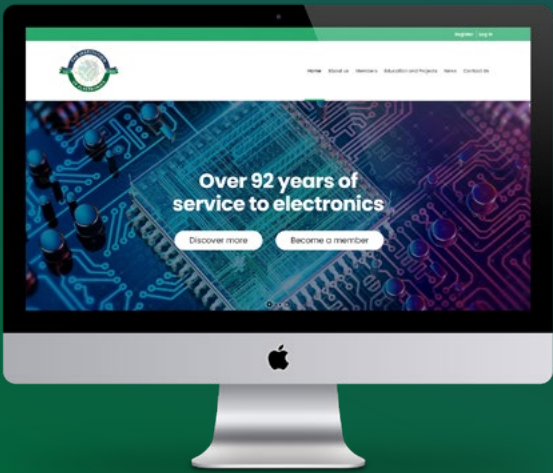
TRINITY COLLEGE DUBLIN MAKES CHIP-SCALE LIGHT TECH BREAKTHROUGH



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The Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN) at Trinity College Dublin has developed a new light-based technology on a tiny chip that has implications for data centres behind cloud computing, artificial intelligence and global internet services.

With collaboration from the University of Bath and the Swiss Federal Institute of Technology in Lausanne, the Dublin team pioneered a new method of generating extremely stable light signals using microscopic ring-shaped devices known as ‘microresonators’. These signals form ‘optical frequency combs’, also referred to as ‘optical rulers’, which produce a series of evenly spaced colours of light that can be applied to measure light with very high precision.

The research was augmented with the demonstration of a new type of light pulse, referred to as a ‘hyperparametric soliton’, which is a stable pulse that allows the comb signals to be produced in different colours of light from the laser that powers the device. This makes the technology especially useful for the high-speed optical communications that are used for data transfer in data centres.

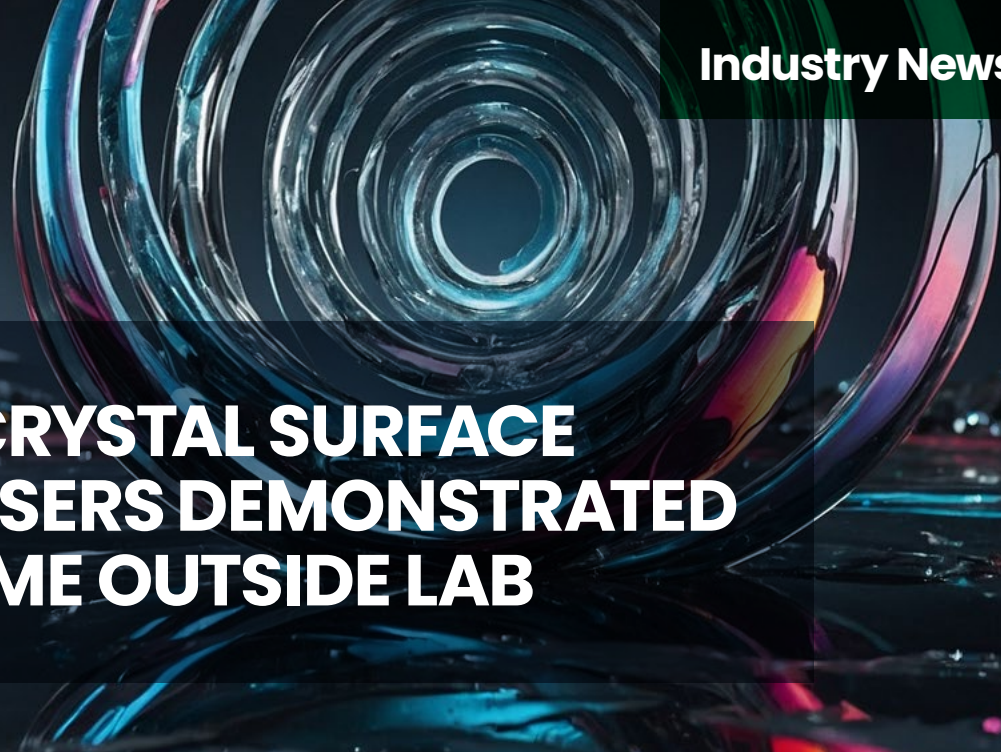
Professor John Donegan, Professor of Physics at Trinity College Dublin and Investigator at the CONNECT Research Ireland Centre for Future Networks, states:

“ We are very excited to have generated a new type of optical source that will be of strong interest to those working in optical communications and high-precision optical measurements. Working with an outstanding optical theorist at the University of Bath and the world-leading microresonator fabrication group in Switzerland, my group has been able demonstrate a new type of optical comb source. ”

Reference: Optical Communications News, 10th. April

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PHOTONIC CRYSTAL SURFACE EMITTING LASERS DEMONSTRATED FOR FIRST TIME OUTSIDE LAB



Vector Photonics, a Scottish start-up that is pioneering the use of photonic crystal surface emitting lasers, or PCSELS, has demonstrated the first successful application of the technology for optical communication outside of a laboratory.

Data was successfully transmitted across the River Clyde from the Glasgow Science Centre to the Clydesdale Distillery using a system designed and built by Fraunhofer UK. This has shown that the technology can perform successfully under different environmental conditions over a sizeable distance. Previously only lab experiments using ideal conditions and simulators have been attempted.

The PCSEL is a new type of laser that combines the high power of edge emitting lasers with the speed and surface emission of vertical cavity surface emitting lasers, or VCSELs. They are especially suitable for secure, free-space optical communications due to their ability to emit narrow, high-brightness beams with excellent beam quality and low divergence, which is critical for minimising signal loss over long distances. Unlike conventional laser sources, PCSELS combine the benefits of surface emission with coherent, single-mode output, enabling efficient coupling into free-space optics without the need for complex beam-shaping elements.

The PCSEL is envisaged as a next-generation laser source for compact free-space optical communication systems with faster, secure internet connections that no longer rely on cables or radio signals. With its wide wavelength flexibility spanning ultraviolet to the far infrared, applications are notably identified in AI data centres, Lidar and additive manufacturing/3D-printing.

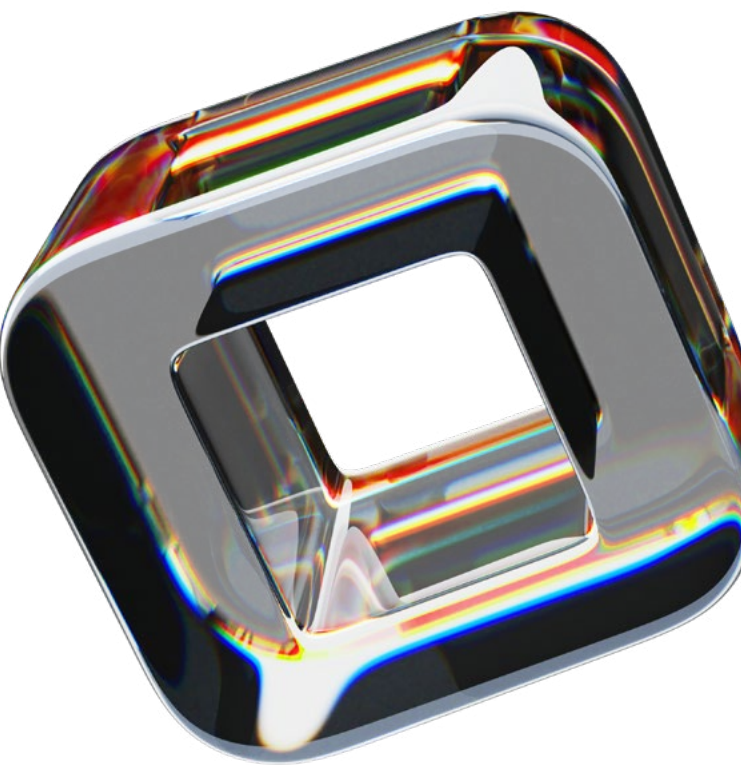
In the trial data transfer was achieved at 50Mbps over a distance of 500 metres, with error rates below

standard forward error correction thresholds. This was twice the system specification required for the experiment, but well below the figure achievable by PCSELS, which have a naturally high data rate.

Dr. Richard Taylor, Chief Executive Officer and Founder of Vector Photonics says:

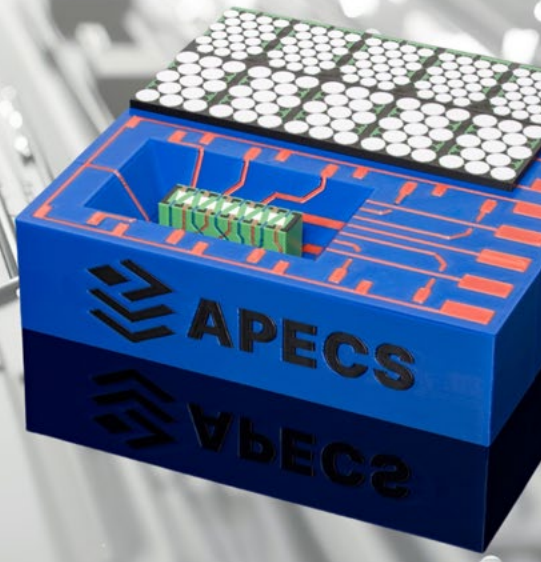
“ This is a major step forward for Vector Photonics, proving that our technology is a commercial reality in real-world applications. We believe that the demo is the most advanced application for a PCSEL to date, advancing it from a Technology Readiness Level of 4/5 to 6/7. ”

Article courtesy of LouVan Communications Inc.



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FRAUNHOFER IPMS DEVELOPS HIGH-DENSITY CHIPLET AT WAFER LEVEL



Researchers at the Fraunhofer Institute for Photonic Microsystems have developed a technique that allows different chip components to be fused almost seamlessly into a single unit. By precisely embedding small chiplets into specially structured silicon pockets the team successfully combined the advantages of a compact single chip with the flexibility of modular systems for the first time. This achievement demonstrates the feasibility of quasi-monolithic integration and bridges the gap between traditional chip packaging and cutting-edge semiconductor manufacturing. The aim is to integrate various chip components, such as control electronics, sensors and micromechanical systems (MEMS) at the wafer level, whilst at the same time retaining the benefits of a compact single chip.

Advantages are realised over conventional packaging processes due to the way chiplets are arranged on an active or passive wafer substrate with a shared interconnect stack. Since the interconnects are formed in the front-end-of-line process, much higher connection densities can be achieved than with traditional methods.

Quasi-monolithic integration is envisaged to be ideal for applications such as highly integrated system-on-chip solutions for artificial intelligence systems and high-bandwidth smart transceivers.

Dr. Lukas Lorenz, Group Leader at Fraunhofer IPMS, states:

"The basis of QMI is silicon wafers with structural recesses, or pockets. For the first time, dummy chiplets have been inserted into these pocket wafers and the surface has been levelled with a passivation layer in preparation for subsequent back-end-of-line wiring. This creates a nearly monolithic system architecture that combines the highest integration density with modular scalability."

Although the current demonstrator is based on dummy structures, the process chain can be transferred to real-world customer applications. This enables a scalable integration architecture for future heterogeneous system solutions."

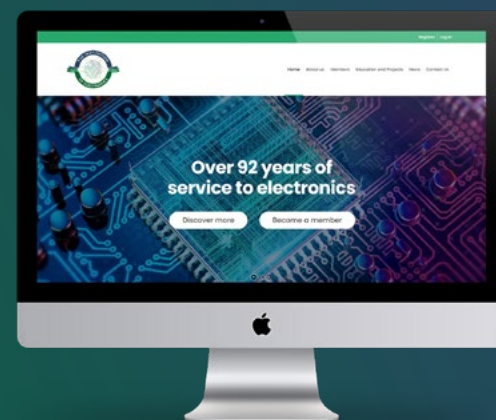
Reference: 'The Future of Chip Integration: Fraunhofer IPMS develops High-density Chiplet Systems at the Wafer Level', Commercial Micro Manufacturing International, 19th. May

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MED-TECH UPDATE

New implantable Device to improve Outcomes for Bladder Cancer

Engineers and scientists at the University of Glasgow have developed an implantable device which is hoped to improve outcomes for bladder cancer patients by maximising the effectiveness of light-sensitive drugs.

Wirelessly powered micro-LEDs are used to enhance the delivery of light through tissue-mimicking models in the lab.

The principle deployed is that of photodynamic therapy, which uses light-sensitive drugs called photosensitisers to selectively destroy cancer cells. It is commonly used in the treatment of skin cancer, but its effectiveness is currently constrained by the physical properties of body tissues. The tissues tend to absorb light, making it more challenging for doctors to access some types of tumours which grow deeper in the body, as, for example, in the bladder.

The new device is designed to be flexible and small enough to be implanted next to tumours so that light can reach treatment sites more directly, minimising the need for invasive procedures, whilst by drawing power from a wireless source the need for external power is removed.

The device is disc-shaped and 40mm wide. It was fabricated at the James Watt Nanofabrication Centre and uses four micro-LEDs on a flexible substrate of Parylene C, a biocompatible polymer used for medical implants. Using power drawn wirelessly via resonant inductive coupling, the LEDs can deliver optical outputs in excess of five megawatts.

In laboratory tests using materials designed to closely mimic human tissues, it was shown that light could be sent with minimal loss through slices of synthetic tissues up to 50mm thick. A photosensitiser solution was also used to test how the system could be used to generate singlet oxygen, which is a highly-reactive, cancer-destroying molecule that is produced by the interaction between photosensitisers and light. Findings showed that the solution reacted to light from the LEDs as

expected, reliably producing singlet oxygen on demand and confirming the potential for the system to be used as an implantable device to support photodynamic therapy.

Dr. Rolan Mansour of the James Watt School of Engineering at the University of Glasgow states:

"Today bladder cancers cause 16 deaths a day in the UK alone according to figures from Cancer Research UK. However, bladder cancer, like many others, is potentially curable if it is diagnosed and treated early, before metastatic spread or invasion into other organs. Given that photodynamic therapy has the potential for less side effects and could improve cancer treatment outcomes, our work is focused on improving the effectiveness of delivering light where it's most needed, to the photosensitisers which tackle and kill cancer cells."



Professor David Flynn, leader of the EPSRC PATIENT project at the James Watt School of Engineering, adds:

"These are very encouraging results, which demonstrate how flexible bioelectronics, wireless power delivery and photonics can be combined to create advanced, minimally invasive treatments, which could improve the clinical outcomes of photodynamic therapies."

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The cost-effective fabrication processes we used in this new technology also have the potential to deliver a scalable and affordable future treatment pathway which can be used in combination with other therapies.

Although there is still significant experimental work to be done before the system is ready to be used directly in patient treatments, the results represent a significant step toward next-generation wireless cancer therapies and implantable photonic medical devices."

Reference: 'Implantable Tech could cast new Light on Bladder Cancer Treatment', Electronic Specifier, 23rd. May

Imperial College London to develop new Brain Imaging System

Researchers at Imperial College London have been awarded £3.92 million by Wellcome to develop a brain imaging system that can capture the electrical activity of thousands of neurons simultaneously in three dimensions and in real-time.

The team will develop a high-throughput imaging platform based on light-field microscopy, which aims to overcome present day limits in scale and speed associated with current in vivo brain imaging techniques.



The present techniques struggle to record fast electrical signalling across large neural populations with the result that certain critical events in brain communication can be missed. The team aims to address this by combining light-field microscopy with AI-based image processing allowing the reconstruction of fast, three-dimensional voltage signals despite the heavy computational and optical challenges that this poses.

The new 'optical oscilloscope' will allow scientists to observe living neural circuits at a speed and resolution that is not currently possible. It will be used to investigate how dysfunction in the brain's neurovascular system

may contribute to Alzheimer's disease and whether targeted electrical stimulation can of specific neural circuits could provide therapeutic benefits.

Dr. Samuel Barnes, Associate Professor in Neural Plasticity at the Department of Brain Sciences at Imperial College, comments:

" This is an exciting new technology addressing many biological questions in a range of systems. We will first use it to how Alzheimer's disease-related pathology impacts neurovascular dynamics and circuit interactions that were previously inaccessible with conventional in vivo imaging approaches. "

Reference: 'Wellcome awards £3.82m to Imperial Team for real-time Brain Imaging Project', New Electronics, Vol.59 Issue 4, April/May 2026, p.47

New Device helps Parkinson's Patients to walk

A medtech entrepreneur, Jonathan Fisher, is using £120,000 from Cambridge University to accelerate the development of 'Peter', a wearable device that is designed to help people suffering from Parkinson's disease to walk.



A major symptom of Parkinson's disease is freezing of gait, or FOG, where there is sudden loss of the ability to walk for several minutes. The new device, consisting of a neckband and a sensor, has the neckband touching the patient's collarbone with the sensor attached to the patient's shoe. When walking, the sensor automatically detects when a leg stops and sends a signal to the neckband. With the aid of AI and real-time tracking, the sensor tells if the wearer has chosen to stop or if the leg is frozen.

Reference: Ford, J., 'Cambridge backs Parkinson's Walking Device', The Engineer, May 2026, p.9

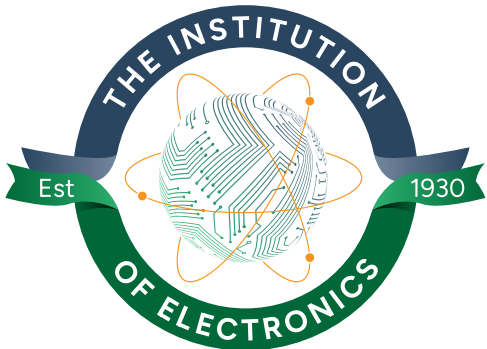
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LEARNED AND PROFESSIONAL SOCIETIES NEWSLETTER



EDITORIAL

Welcome to the Foundation for Science and Technology July newsletter.

In this edition, members will find the usual round-up of legislative changes, regulatory decisions, guidance, and pertinent news items. Key news items to be aware of include a slew of updates to Charity Commission guidance (including guidance on changing governing documents, conflicts of interest, land transfers and more), and changes arising from the Digital Markets, Competition and Consumers Act 2024, Data (Use and Access) Act 2025, and Crime and Policing Act 2026. We also want to hear your views on our new strategy for 2027, and your thoughts on the value of learned and professional societies.

A quick reminder that all Foundation guidance notes and previous editions of this newsletter are available in the members' area of the Foundation website. Comments on the newsletter and suggestions for items that you would like to see covered in future editions are always welcome. Please send these to me directly at lori.frecker@foundation.org.uk.

Foundation updates

FST Strategy 2027 – we want to hear from you!

With the FST's 50th anniversary coming up in 2027 we'll be launching a new strategy, alongside a new website. Our CEO, Dr Alex Rhys OBE, will be writing to members shortly to ask for your views on the draft strategy, and the impact we have, to ensure we continue to meet the evolving needs of the sector. Please do keep an eye out for his email and contribute your thoughts. The new website will help streamline how we share information with a new members' area.

The value of learned and professional societies – your views and evidence needed!

The Foundation's Chair, Lord Willetts, is contributing to a forthcoming online book on the role and value of learned and professional societies in the 21st century. Given the Foundation's wide-ranging and varied membership, Lord Willetts is keen to hear from you on this important and interesting topic. If you have any views or evidence

on the value of learned societies that you would like to share, and which could be cited in the piece, please email these to Lori directly by Tuesday 18 August. Lori will collate and share these with Lord Willetts.

Events coming up in 2026

The Foundation has an exciting programme of events coming up in 2026. You can find more details, including how to book, on the [Events page](#) of the Foundation website and on our social channels. In the meantime, you can catch up on our recent events online, including [Science Diplomacy – Can we help the world align through science?](#) at the House of Commons, [UK Space Policy and Supporting UK Space Industry – Past, Present and Future](#), and [In Conversation with Sir Ian Chapman, Chief Executive of UKRI](#).

Foundation Journal – latest issue now online

The latest edition of the Foundation Journal is now available on [our website](#). This issue covers: the life science sector and how it can become a leading force in the UK; AI and the future of work; the growing potential of natural hydrogen; how resilient the UK national infrastructure is in the face of cyber warfare and natural disasters; and science activism for the sake of the planet and humanity.

New podcast episodes

Don't forget that you can listen to the latest episodes of the Foundation's [podcast](#) online. Recent podcasts include [LGBTQ+ in STEM and meaningful allyship](#) with Professor Tyler Kelly of QMUL, [How does science shape policy?](#) with Jenny Chapman and Annie O'Brien from the Parliamentary Office of Science and Technology, and [What is AI for science?](#) with Liz Wainwright, Associate Director of Strategic Initiatives at Edinburgh Innovations, University of Edinburgh.

Getting involved with the Foundation's Journal, podcast and blog

We welcome ideas for blogs, podcasts and Journal articles on issues across science, technology, research and innovation. If you have an idea, or would like to get involved, please contact Charlotte Raynsford at communications@foundation.org.uk.

The Digital Markets, Competition and Consumers Act – what does this mean for professional societies?

I was recently asked if this newsletter could cover the implications of the Digital Markets, Competition and Consumers Act 2024 (DMCCA), and I am pleased to try to oblige! The DMCCA makes several changes to consumer regulation that are aimed improving consumer protection.

Subscription contracts are among the targets of the legislation. The DMCCA introduces requirements for, among other things, a 14-day 'cooling off' period at the start of a subscription, and after a 12-month contract renews.

This has led to concern among charities that rely on income from membership schemes, including the possibility of losing Gift Aid income if memberships become legally refundable. However, the Government has confirmed that some charity memberships, mainly relating to cultural and heritage organisations, will be exempt. This exclusion applies to contracts between a charity and a consumer that allow for attending performances, viewing collections, and visiting places related to the charity's purpose. Other types of commercial subscriptions offered by a charity may still be caught by the new rules. The Government has also confirmed that compliance with consumer law does not prohibit Gift Aid claims. The new regime for non-exempt subscriptions is expected to begin in spring 2027, and further guidance will be published to accompany this. In the meantime, professional and learned societies should review their current membership and subscription offerings to determine if they fall under the 'charitable purpose' exclusion in the new rules.

Read more: [Gov.uk](#); [ICAEW](#), [Mills & Reeve](#)

What policies does a charity need to have?

I am often asked about what sorts of policies a charity needs to have in place. The Charity Commission doesn't publish a list of policies required, but it does publish guidance on specific issues such as safeguarding, reserves, conflict of interest and risk management. The

Charity Commission will ask organisations to specify which of the following policies and procedures they have in place when they complete their annual return:

1. Internal charity financial controls policy and procedures
2. Safeguarding policy and procedures
3. Financial reserves policy and procedures
4. Complaints policy and procedures
5. Serious incident reporting policy and procedures
6. Internal risk management policy and procedures
7. Trustee expenses policy and procedures
8. Trustee conflicts of interest policy and procedures
9. Investing charity funds policy and procedures
10. Campaigns and political activity policy and procedures
11. Bullying and harassment policy and procedures
12. Social media policy and procedures
13. Engaging external speakers at charity events policy and procedures

Whether or not you need all of the above depends on the size, nature and activities of your organisation. The above list is also not exhaustive of all policies a charity may need; charities will also need to have a data protection and privacy policy, and relevant policies relating to employment law and discipline, health and safety and other legal obligations. Depending on their activities, charities may also wish to consider developing a code of conduct for volunteers, a campaigning policy, a grant-making policy, and others. Trustees should ensure their charity has the policies needed to comply with the law and regulatory guidance, and their obligations to ensure their charity is managed and run effectively.

What does 'independent' mean in relation to a Chair?

I have recently received a few enquiries about the meaning of 'independent' in the context of a committee or governing body that comprises representatives of different organisations, but which is required to have an 'independent Chair'. In the absence of a definition of 'independent' in an organisation's governing documents, I would treat 'independent chair' in this context as meaning someone who is not an office holder or member of any of the bodies that are part of the organisation. An independent chair should be able to be completely objective and unbiased i.e. free of any connections with the bodies that are part of the organisation, to avoid potential conflicts of interest/ perceptions of partiality.

Protecting professional titles

I was recently asked for guidance regarding misuse of post-nominals by individuals on social media. Misuse of post-nominals is a matter that comes up regularly. My colleague, Keith Lawrey, who many newsletter readers will know, wrote on the topic of misuse of post-nominals in a previous newsletter and I quote his excellent guidance:

"The position is clear in that societies by their constitutions have the power to grant certain membership descriptors and post-nominals to their members who meet the necessary criteria including undertaking to be bound by a code of professional conduct when practising the profession regulated by the society concerned. In effect, the society gives notice to the world that it will take legal action against any persons who hold themselves out as qualified members when they are not. A society's Charter or Articles of Association gives ownership of the titles to the society, and any misuse is a holding out by the misusers of titles to which they are not entitled. The fact that the society suffers no

financial loss by such misuse is immaterial: it is acting to protect the value of such titles in the public interest."

Whilst legal action against an individual who is misusing post-nominals may be appropriate in some cases, the first step in relation to misuse on social media should be to contact the individual concerned and ask them to cease using the post-nominals. It is appropriate for a learned or professional society to contact the individual directly because they are acting to protect the value of their title in the public interest.

Where to advertise senior executive vacancies

I was recently asked for suggestions for places to advertise senior executive vacancies.

An organisation's own website and social media channels are ideal places to advertise such positions. Organisations may also wish to place adverts on job boards such as Charityjobs, Escape the City and Guardian Jobs (note that this is not an exhaustive list).

Another option would be to use a specialised recruiter with expertise in sourcing candidates for senior roles. As I am asked this question with some regularity, I would be grateful for any other suggestions that members may have for platforms on which to advertise such vacancies, so that I can share these with Foundation member organisations as appropriate.



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Updated daily with hand-picked articles from around the web...

institutionofelectronics.ac.uk

NEWS

Charity Commission updates guidance on making changes to governing documents

The Charity Commission has updated its CC36 guidance, How to make changes to your charity's governing document. This has been updated to clarify some legal requirements and improve usability.

There is separate guidance for charitable companies, Charitable Incorporated Organisations (CIO), unincorporated associations, and trusts. The updated guidance for charitable companies provides more detail about managing conflicts of interest, giving notice of or consulting on changes, and benefits to trustees.

Read the updated guidance: [Charity Commission](#)

DCMS confirms charity audit threshold to rise to £1.5 million in October 2026

The Department for Culture, Media and Sport (DCMS) has confirmed that the audit threshold for charities in England and Wales will rise by 50% to £1.5m.

DCMS will also increase independent examination requirements from £25,000 to £40,000 to help alleviate burdens on smaller charities. The new thresholds will be introduced from 1 October 2026. DCMS will work with the Charity Commission to review guidance on independent examination and on the digitalisation of charity accounts. The changes follow a consultation earlier in 2025.

Read more: [Civil Society News](#)

ICO publishes internal AI use policy as a guide for others

The Information Commissioner's Office (ICO) has published its Internal AI Use Policy to assist others considering how to embed AI within their own organisation.

The ICO policy outlines clear requirements for staff, which include only using AI tools that have been approved for internal use, being transparent about when work includes AI-generated content, and ensuring all outputs

are subject to human review unless formally agreed otherwise by an appropriate approval body. The policy also requires individuals to avoid using AI in ways that could cause harm or infringe intellectual property rights, among other things. The policy applies to all ICO employees, secondees, and contractors, and sets out governance procedures for procuring or developing AI systems.

Read more: [ICO](#)

Changes resulting from the Data (Use and Access) Act 2025 (DUAA)

The DUAA amends several provisions in the UK GDPR, Data Protection Act 2018, and the Privacy and Electronic Communications Regulations.

From 19 June 2026, all organisations that control personal data (including charities) must have a clear process in place for handling data complaints. Charities must make it straightforward for people to understand how to make a data complaint. This process should be clearly set out in a data protection complaints policy, referenced in a privacy notice, and included in responses to information rights requests such as Data Subject Access Requests.

Read more: [Bates Wells](#); [Anthony Collins Solicitors](#)

New ICO guidance on 'soft opt-in' for charity marketing email

The ICO has issued new guidance confirming that the 'soft opt-in' marketing rule now applies to charities.

Charities no longer always need express consent to send e-marketing, as long as certain conditions are met. The new rule only applies to contact details collected after 5 February 2026.

The charitable purposes soft opt-in allows a charity to send electronic mail marketing without consent where the message furthers their charitable purposes, but only where all the following requirements are met:

- The organisation is a charity.
- The charity obtained the recipient's contact details.
- The charity did this through the person expressing an interest in, or offering or providing support for, its charitable purposes.
- The sole purpose of your direct marketing is to further the charity's charitable purposes.
- The recipient was provided with an opportunity to refuse or opt out when their contact details were collected.
- The recipient is given an opportunity to refuse or opt out in every subsequent communication.

The Fundraising Regulator has published complementary guidance designed to help charitable fundraising organisations follow the Code of Fundraising Practice and the law.

Read the guidance: [ICO](#); [Fundraising Regulator](#)

Criminal liability for offences by senior managers

Section 250 of the Crime and Policing Act 2026 (CAPA) came into force on 29 June 2026.

It introduces a new offence that affects corporates, partnerships and charities, and expands the senior manager provisions in the Economic Crime and Corporate Transparency Act 2023. Under CAPA, organisations will be criminally liable if a senior manager commits any criminal offence while acting within the actual or apparent scope of their authority. This does not mean the senior manager needs to have been authorised to carry out the criminal conduct. It is sufficient if the act was a type of act that the senior manager was authorised to undertake, or which would ordinarily be undertaken by someone in that position. A 'senior manager' is anyone who plays a significant role in:

- decision-making about how the whole or a substantial part of an organisation's activities are to be managed or organised; or
- the actual managing or organising of the whole or a substantial part of those activities.

Read more: [VWV](#)

Martyn's Law (The Terrorism (Protection of Premises) Act 2025)

Martyn's Law introduces new statutory duties that will impact charities that operate venues or host public events.

It puts a new duty on 'responsible persons' who are either in charge of certain premises to which the public

have access, or in charge of events open to the public, to consider how they would respond to a terrorist attack and put in place appropriate measures and procedures to limit the harm such an attack might cause. Charities that operate publicly accessible venues or events with capacity for 200 or more people will be required to assess, plan for, and mitigate, the risk of terrorism. What duties will be in place depends on the number of people expected to be present at a premises or event at the same time. Although Martyn's Law is not expected to come into force fully until April 2027, charities are being encouraged start preparing now – for example, by carrying out risk assessments, mapping premises and events, and developing practical, scalable procedures for evacuation, invacuation, lockdown, and communication.

Read more: [Mills & Reeve](#)

Draft Code of Practice on applying the Equality Act 2010 published

On 21 May, the Government published a draft Code of Practice for services, public functions and associations.

The Code provides statutory guidance on applying the Equality Act 2010 for service providers, associations and those exercising public functions in England, Scotland and Wales. The draft Code is not yet in force, but has been updated following the Supreme Court judgment in 2025 which held that, for the purposes of the Equality Act 2010: "sex means biological sex and that trans people are still protected by the Act under the protected characteristic of gender reassignment." The draft Code is intended to provide workable guidance to help providers make "practical, and ultimately sensible decisions for everyday scenarios, such as toilet provision." The Charity Commission has said it will publish its own guidance for charities on applying the new code in light of charity law, as quickly as possible after the draft Code clears parliament. Until then, it has advised charities to assess the implications of the draft Code for their activities and take any legal advice that might be needed.

Read the draft [Code of Practice](#): [Gov.uk](#)

Charity Commission Northern Ireland – registration threshold guidance

The Charity Commission Northern Ireland has published an information leaflet to help small charities prepare for upcoming changes to the financial threshold for registering with the Commission.

Once the registration threshold comes into effect, charities with annual income of £20,000 or less, and assets of £100,000 or less, will not have to register or submit annual reports and accounts to the Commission. Charities may still decide to register with the Commission, even if they are below the threshold. The threshold is not yet in force, so all charities must continue

to register as usual – the Commission is providing early guidance to help organisations prepare for the changes ahead.

[Read the leaflet](#)

Charity Commission publishes its first ever Charity Sector Risk Assessment

The Charity Commission has published its first-ever risk assessment for the charity sector.

It aims to identify systemic risks that could affect charities' ability to deliver their aims and/or public trust in the sector. Key risks identified include financial resilience, risks to public benefit (e.g. through deliberate abuse of charitable status or lack of knowledge among charity personnel), and risks relating to governance, safeguarding and fraud.

Read the assessment: [Gov.uk](#)

Changes to accounts filing requirements for charitable companies to come into force in 2028

The government has announced that delayed changes to accounts filing through Companies House, affecting charitable companies, will come into effect in 2028.

The changes require all organisations to file accounts in a digital format. This will apply to companies that file their own accounts and those that use third-party agents or accountants to file them. Small and micro companies will no longer be able to prepare and file abridged accounts. The changes will not affect charitable incorporated organisations (CIOs), which only file with sector regulators including the Charity Commission.

Read more: [Civil Society News](#)

UK Biobank refers itself to ICO after data found on Chinese consumer website

Health charity UK Biobank has referred itself to the ICO after de-identified participant data downloaded by three Chinese academic institutions was found advertised for sale on an e-commerce platform owned by Chinese company Alibaba.

UK Biobank notified the UK government, which worked with the Chinese government and Alibaba to ensure that the listings were quickly taken down. UK Biobank is putting additional security measures in place and conducting an investigation into the incident.

Read more: [Civil Society News](#)

Former charity treasurer jailed after £30k theft

A former treasurer and accountant of the Long Crendon Village Association, Charlotte Young, has been sentenced to three years' imprisonment after stealing

£30k as part of a wider £155k fraud.

She also stole £125k from the Long Crendon Community Social Club. Young had been recommended to the charity by a mutual friend. She had a previous fraud conviction, but this was not picked up as the charity did not carry out a background check.

Read more: [Civil Society News](#)



NATIONAL ELECTRONICS COMPETITION

An exclusive competition for students of Arkwright affiliated Schools.

This competition will give the Institution the chance to champion the cause of young people pursuing electronics projects within the curriculum, extra-curricular and at home.

Applicants become student members of the Institution and will be invited to join the task-force that will plan the next phase of the Institution's development as an incubator for future leaders of the electronics industry.

[LEARN MORE](#)



REGULATORY DECISIONS

Players Foundation case highlights risks of close connections with non-charities

The Players Foundation ('the charity'), formerly known as The Professional Footballers' Association Charity, had a long-standing close relationship with The Professional Footballers' Association ('PFA').

The PFA is a trade union for current and former footballers. The charity had an informal arrangement to pay 80% of the PFA's operating costs, as payment for services from them. The charity received £1.9m from the Football Association, which was transferred to the PFA without appropriate governance. The PFA had also been allowed to occupy the charity's properties rent-free for several years. The PFA CEO and Director of Finance were ex-officio trustees of the charity. A Charity Commission inquiry concluded that the trustees had failed to act in the best interests of the charity and manage its resources appropriately, and that, taken together, the failings constituted mismanagement in the administration of the charity. The case highlights the importance of trustees regularly managing and reviewing arrangements with non-charities, and having robust conflicts of interest policies in place. The Commission's [guidance](#) on connections to non-charities provides detailed information on managing and reviewing relationships with non-charity organisations.

Read more: [Charity Commission](#); [Stone King](#); [Civil Society News](#)

Commission disqualifies married trustees

A married couple have been disqualified from holding senior positions in charities after a Charity Commission investigation uncovered regulatory failings at two charities they managed.

The couple maintained overall control and administration of the finances of both charities they managed. The inquiry found that payments of £44k were made to one of the couple, who was also a CEO of one of the charities, as well as rental payments of over £20k to her parent for charity use of a property. The inquiry found several other instances of misappropriation or misapplication of funds, including payment to a gambling organisation. The inquiry concluded that there was serious misconduct and/or mismanagement in the administration of the charities due to the poor financial management and governance by the trustees. Both charities have been removed from the register.

Read more: [Charity Commission](#); [Civil Society News](#)

£1.39 million redistributed after charity founder sanctioned

Kantor Foundation and Kantor Charitable Foundation were dissolved and removed from the charity register on 30 May 2025 following their founder, Vitacheslav Kantor, being found responsible for misconduct and mismanagement.

Kantor was sanctioned by the UK government in 2022, prompting the Commission to investigate both charities. The inquiries concluded that both charities were no longer viable as Kantor was the sole donor and it was unlikely that either charity would be able to secure future funding, and there were no trustees to run it following resignations after Kantor being sanctioned. The inquiries also determined that reputational damage arising from the designation made the chance of resolving these matters through fundraising or recruitment unlikely. Following the conclusion of the investigations, £1.39m in gift aid funds recovered from the charities has been redistributed to several other organisations in the sector.

Read more: [Civil Society News](#); [Charity Commission](#)

Commission closes compliance case into City of Sanctuary UK

The Commission's inquiry into City of Sanctuary UK followed allegations by an MP that the charity had engaged in inappropriate political activity.

The inquiry found no evidence to support the allegations, and no evidence of inappropriate political activity. It also found that the charity's work complied with the Commission's guidance on political activity and campaigning, and was in line with the charity's objects regarding supporting refugees and asylum seekers. The Commission expressed concern that the charity had faced a misinformation campaign resulting in threats to trustees and staff. The case highlights the importance of trustees ensuring decisions are properly documented, having clear and up to date policies, and robust oversight of how activities might be perceived externally.

Read more: [Charity Commission](#)

REPORTS AND GUIDANCE

Charity Commission updates conflicts of interest guidance (CC29)

The Charity Commission has updated its guidance on conflicts of interest following an uptick in cases involving these.

Charity Commission analysis found that most unmanaged conflicts occur due to lack of awareness of when a conflict has occurred, and steps therefore not being taken to protect charity assets and reputation. The new guidance is intended to be shorter and clearer, and includes worked examples of situations when a conflict can arise.

Read more: [Charity Commission guidance](#); [Charity Commission blog](#); [Mills & Reeve](#); [Farrer & Co](#)

Charity Commission updates guidance on disposing of charity land (CC28)

The Charity Commission has updated its CC28 guidance to reflect changes brought in by the Renters' Rights Act, which came into force on 1 May 2026.

The key principles of the guidance are unchanged. Trustees must be satisfied that any sale or lease is in their charity's best interests, that appropriate advice has been taken where needed, and that the terms are fair. The reforms brought in under the Renters' Rights Act include greater tenant protections and changes to how possession and rent increases operate, all of which may affect charities that grant residential leases.

Read the guidance: [Charity Commission](#); [Anthony Collins Solicitors](#)

Charity Commission updates social media guidance

The Charity Commission has updated its guidance on charities and social media to refer to the Online Safety Act 2023, which places duties on social media platform providers and search engines to keep people safe online.

Charities should ensure they understand what online services they provide and whether they are regulated under the Online Safety Act. Ofcom, the online regulator, has guidance and a tool to help organisations work out if they are regulated. VVV has produced a helpful summary of the changes

and what charities should consider as a result. This includes that charities should identify what tools are available regarding each social media account they have, and develop a policy to guide them in identifying and dealing with inappropriate or illegal content posted to their pages by third parties.

Read more: [Charity Commission guidance](#); [VVV](#); [Ofcom guidance and online checker](#)

New government guidance for employers on equality action plans

The Employment Rights Act 2025 requires large employers (those with 250 or more employees) to develop and publish equality action plans.

Publishing these plans is currently voluntary, but will become mandatory from April 2027. Equality action plans must show what steps an organisation is taking in relation to achieving equality in the workforce, specifically regarding reducing gender pay gaps and supporting staff going through the menopause. The government has published guidance on the topic, and Bates Wells has written a helpful article outlining what is required.

Read more: [Gov.uk](#); [Bates Wells](#)

ICO guidance on handling FOI requests that involve use of AI

The ICO has published new guidance to help organisations handle Freedom of Information (FOI) requests that involve the use of AI.

The guidance covers practical issues including: managing requests generated using AI that misinterpret or misquote FOI legislation; dealing with higher volumes of requests that require clarification or refinement; and maintaining fair and consistent handling of requests. The guidance also includes examples of wording that can be used to encourage responsible use of AI by requesters.

Read the guidance: [ICO](#)

Fundraising Regulator updates data privacy guidance

The Fundraising Regulator has published new guidance to help charities and their partner organisations comply with its code of practice when processing personal data in fundraising.

Read the guidance: [Fundraising Regulator](#)

CGI publishes research into extended leave and governance risks

The Chartered Governance Institute UK & Ireland (CGI) has published research highlighting the governance risks that can occur when charity trustees, company directors and public appointees take extended periods of absence due to maternity leave, long-term illness, bereavement or caring responsibilities.

The report includes suggestions to help organisations manage extended leave arrangements and mitigate governance risks.

Read the report and guidance: [CGI](#)

Managing charity financial distress

Bates Wells has published a useful summary of its recent roundtable on Managing Financial Difficulties.

The roundtable examined the challenges facing charities in the current funding environment, with an emphasis on trustee duties in cases of financial distress, early warning signs of financial difficulty, and practical approaches to managing emerging issues.

Read more: [Bates Wells](#)

Charity Commission publishes research into trust in charities

The Charity Commission has published 'Public trust in charities 2026' and 'Research with trustees: 2026' (both prepared by BMG Research).

The research found that trust in charities remains high, with money reaching the end cause remaining the most important driver of trust. It also found a quarter of charities have experienced the impacts of a challenging social environment, including changes in support, changing or stopping some activities, vandalism, spread of misinformation, threats and protests.

Taking minutes: key points for trustees to consider

Stone King has recently refreshed its excellent article on key points for charity trustees to consider regarding minutes of meetings.

The article includes practical points on minute-keeping, considerations around minute-taking and AI, and other hints and tips.

Read more: [Stone King](#)



THE BENEFITS OF BECOMING A MEMBER OF THE INSTITUTION OF ELECTRONICS (INST.E)

The Institution of Electronics (Inst.E) offers a set of benefits aimed at supporting electronics students, apprentices, professionals, and enthusiasts. The core advantages fall into three categories: professional recognition, career and learning support, and community access.

Key Takeaway

The biggest benefit of joining the Institution of Electronics is gaining professional accreditation (post-nominal letters such as M.Inst.E or F.Inst.E) that formally recognises your standing as an electronics engineer, alongside access to a supportive community, resources, and opportunities for professional development.

Professional Recognition & Accreditation

- **Use of post-nominal letters:** Members can display M.Inst.E after their name, signalling professional credibility to employers and peers. Fellows may use F.Inst.E.
- **Global recognition:** Membership demonstrates commitment to the electronics profession and is recognised internationally.
- **Graduate pathway:** Students receive free membership and can later apply for Grad Inst E post-nominals upon graduation.

Learning, Publishing & Career Development

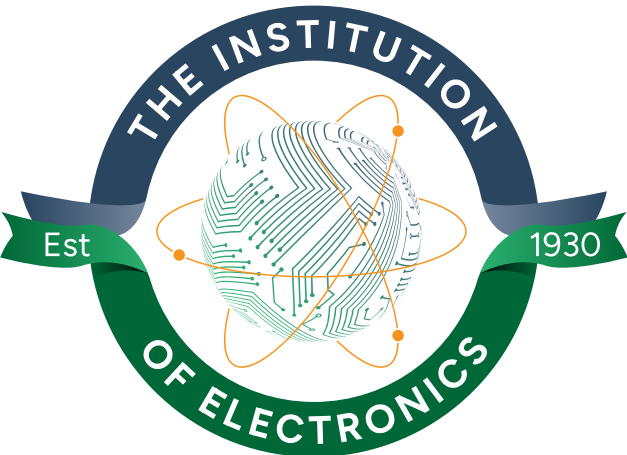
- **Quarterly magazine (Electron):** Members receive the Electron magazine, keeping them updated on developments in electronics.
- **Opportunity to publish:** Members can submit articles to Electron, building their professional profile.
- **Support for early-career engineers:** The Institution places particular focus on students and apprentices, offering free membership and development opportunities.

Community & Member Services

- **Access to members-only website areas:** Includes resources, archives, and community features.
- **Institution email address:** Members may request a personalised email such as name@institutionofelectronics.ac.uk or name@i-e.org.uk.
- **Free entry to the National Electronics Competition:** Encourages innovation and engagement with the wider electronics community.
- **Open to a wide range of people:** Students, apprentices, professionals, retirees, teachers, and enthusiasts are all welcome.

Who Benefits Most?

- **Students & apprentices:** Free membership, competition entry, and a clear path to professional accreditation.
- **Working engineers:** Recognition, networking, and opportunities to publish.
- **Retired professionals & enthusiasts:** Continued engagement with the field and access to community resources.



Office Space Available

Central London
(from 1 September)

The Society of Operations has a fantastic office space becoming available in Central London, as their current tenants in Office 2.3 will be vacating on 31 August.

This bright and well-proportioned office is ideal for a small team looking for a professional and well-connected workspace in a prime location. If you or someone in your network is looking for office space in Central London, the SOE would love to hear from you. Please contact Emma Thompson with any enquiries (Emma.Thompson@soe.org.uk).



Central London



48.95m² (527 ft²)

Institution of Electronics News

The Use of Gamma-Ray Level Detectors in the Chemical Industry

by E. W. JONES*, B.Sc., A.Inst.P.

(A lecture demonstration delivered at the Thirteenth Annual Electronics Exhibition and Convention of the Northern Division of the Institution of Electronics).

The conventional methods of level detection are outlined and the outstanding advantages of gamma-ray level detectors and switches are considered. The radiation safety aspects are discussed, and a typical installation of the detector to a glass-melting furnace is described.

INTRODUCTION

In almost all aspects of chemical manufacture, there is a need for indication or control of the level of vessel contents.

Where manufacture is carried out on a large scale, it is essential to have storage space in the form of bunkers, hoppers, or tanks, to receive the incoming raw materials and to hold the outgoing product before shipment. The operation of loading fairly large quantities of bulk materials into such storage vessels calls for some form of instrumentation to indicate contents level and the instruments can also give information which is essential for the planning and utilisation of storage capacity.

In continuous flow processes it is often necessary to employ reservoirs or surge tanks to take up short-term differences in flow rate between stages of the system, and it may be important to initiate an alarm or automatic control action when the content level in a surge tank exceeds the working limits. In the reaction vessel itself it may be desirable, in the interests of process efficiency, to control the contents level to fine limits by automatic regulation of the input or output flow rates in response to signals from a level detecting element.

Batch processes call for accurate measurement of ingredients by volume or by weight into the reaction vessel, and in the vessel itself it may be important to ensure that over-flow or boiling-over does not occur. At the end of the reaction, it may be useful to have automatic indication of the point at which the vessel is completely emptied ready for the next batch.

Apart from the normal raw materials of a process, it may be important to control the level of a continuously replenished or regenerated catalyst, e.g. in a cracking column or synthesis plant.

The vessels themselves vary enormously in size and construction and may range from glass-lined steel drums to refractory-walled furnace tanks or gasifiers. Different contents and chemical processes may give rise to a wide diversity of working conditions: for example, the contents may include corrosive chemicals under high pressure, slurries which set like cement on settling, molten metals or glass at temperatures above 1000°C, viscous liquids such as latex, tar, etc., abrasive lump solids, or powders which do not flow in a uniform manner. With such a wide range of conditions to be met, it is natural that a wide variety of level measuring techniques has been evolved. The more conventional methods include purely mechanical devices (such as

dipsticks or floats), hydrostatic systems measuring differences in pressure head or buoyancy, electrical conductivity detectors, electrical capacitance measuring systems, optical systems depending on the interruption of light beams, pneumatic systems which detect increases of back pressure as the liquid surface approaches an air jet, etc., etc. Each of these systems has its own peculiar advantages and disadvantages, and it is, of course, good practice to select the instrument best suited to the process conditions.

The outstanding property of the gamma-ray method, compared with all the other systems, is that it can operate entirely from outside the vessel and usually requires no special ports, diaphragms, windows, lenses, or probes to be fitted into the vessel walls. This implies at least four useful advantages:

1. The design and construction of the vessel can be simplified—an important consideration for high pressure vessels, glass-lined tanks, etc.
2. The installation of the measuring element on existing plant is simple, even under working conditions, so that the instrument units can, if necessary, be installed, and subsequently serviced, without causing any "down-time" to plant which is running.
3. Satisfactory instrument performance is almost entirely independent of the nature of the contents provided that they have sufficient mass to absorb an appreciable proportion of the gamma-rays. The system can, therefore, be used with very viscous fluids, bubbling or agitated liquids, froth, granular solids, fluidised powders, explosive materials, etc.
4. The instrument components themselves are not subjected to mechanical or chemical damage due to drastic conditions within the vessel, such as severe vibration, abrasion, corrosive action, high temperature, etc.

ESSENTIAL COMPONENTS

A gamma-ray level measuring or detection system consists of:

- (a) A long-lived radio-active source in a suitable shield. The isotope is usually Cobalt 60 (half-life 5.3 years), Caesium 137 (half-life 33 years) or Radium (half-life 1,600 years). The last-named is very expensive.
- (b) A gamma-ray detector. This is usually a Geiger Müller Tube but may be an Ionisation Chamber or a Scintillation Counter.

*Isotope Developments Ltd.

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50

(c) An Electronic Unit. This is usually mounted remote from the point of measurement and its purpose is to convert the detector output into a useful electrical signal for indication or control. In the case of Geiger Muller Tube detectors, the Electronic Unit comprises a Pulse Ratemeter, whose d.c. output can be displayed on a meter or recorder, can be used to operate relays, or can be fed into a proportional controller.

ON/OFF CONTROL

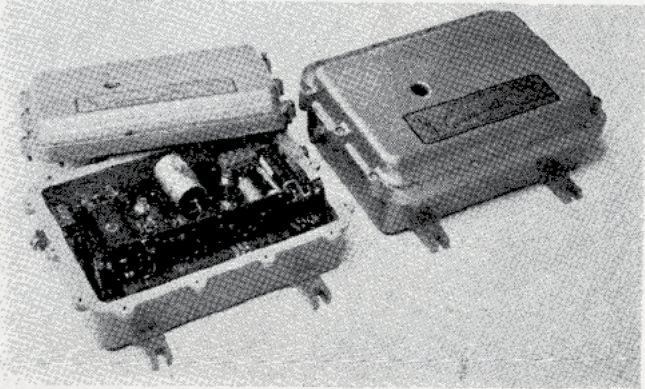


Fig. 1 (a). A simple Level Detector employing a Geiger-Müller Tube. (Weatherproof version).

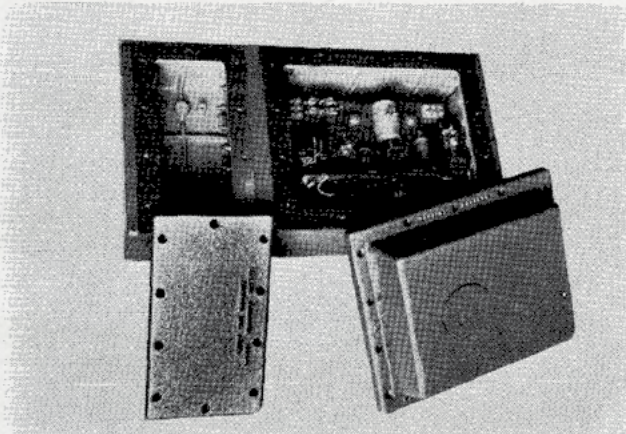


Fig. 1 (b). Flameproof Level Detector.

Owing to the physical size of the components, and the way in which gamma-rays are absorbed, the method is particularly suited to two-step or On/Off operation at a fixed level. For this purpose it is simply necessary to mount a "point" source and detector on opposite sides of the vessel at the critical level. The change in signal intensity as the contents fall below or rise above this level is usually more than sufficient for reliable operation of a control relay. Thus, the trip level of the relay can be set without further need for adjustment over the period of one source half-life. Recalibration is not required and no access to the contents is necessary in order to determine the level at which control is taking place. Generally, accuracy within $\pm \frac{1}{4}$ inch is easily achieved. Fig. 1 shows a typical self-contained detection system for On/Off control and Fig. 2 shows

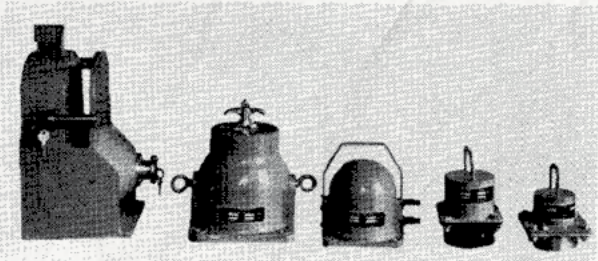


Fig. 2. Gamma Ray Source Holders for level detectionsystems.

a range of source holders which can be used with this type of detector. The detector can be built in weather-proof or certified flameproof form and contains, in addition to the Geiger Muller Tube, a simple Ratemeter circuit and control relay. The trip level can be set for operation at any intensity between 20 pulses/second and 200 pulses/second. The response time constant of the circuit is normally 8 seconds but can be adjusted from about 1 second upwards.

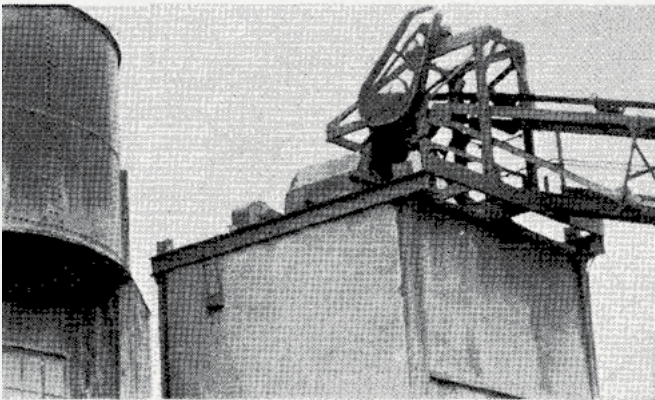


Fig. 3. On/Off Level Detector mounted on a Sand Hopper.

Detectors of this sort have been installed on hoppers of sand, coke, lime, wood-chips, etc., storage tanks for latex, acids, etc., catalyst vessels, plastics coating plant, etc. Fig. 3 shows a typical high level alarm installation on a hopper.

CONTINUOUS LEVEL INDICATION

Owing to the physical size of the components and the way in which the gamma-rays are absorbed, continuous level indication is generally limited to small ranges up to, say, 2 or 3 feet, and above this range the system becomes cumbersome or completely impracticable, depending on the type of vessel. Fig. 4 shows schemes which can be used for continuous level indication over a moderate range.

Method (a) uses a linear source and linear detector and this can be made to operate extremely well over ranges of up to 2 feet, provided that the vessel dimensions are not too large. The response can be made linear in most applications. This type of installation has been provided for certain types of Catalyst Towers and Storage Tanks for corrosive liquids.

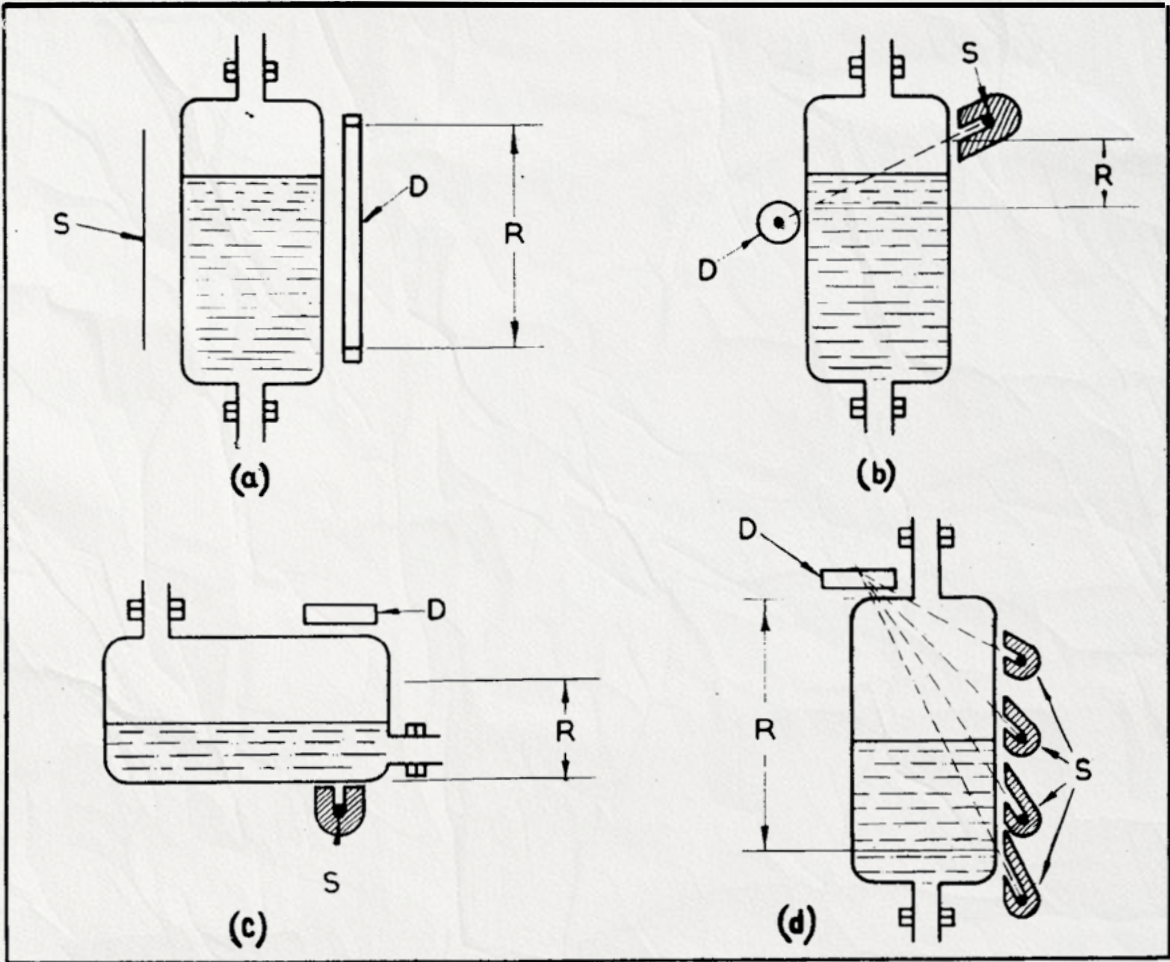


Fig. 4. Continuous Level Indication Systems [S = Source, D = Detector, R = Range].

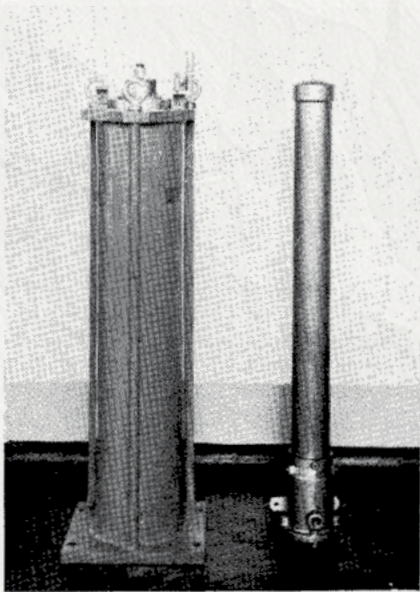


Fig. 5 (a). Linear Source and Detector for continuous level indication.

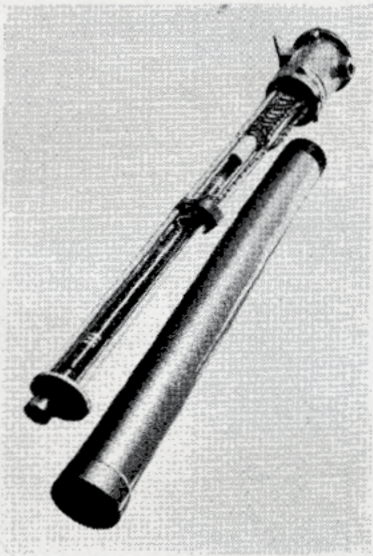


Fig. 5 (b). Linear Detector showing Geiger-Muller Tubes and Head Amplifier.

Method (b) is suitable for vessels of small diameter (up to about 15 inches) and gives a reasonably linear response over the middle portion of its range; the maximum range being about 10 inches. This type of installation has been highly successful on certain types of pulp manufacturing plant in the Paper Industry; the output being fed into a proportional control system..

Method (c) suffers from the disadvantage that the response curve is exponential and the maximum range is about 30 inches for most liquids. The response can be made more linear and the range extended by the modification shown in Method (d), a form of which has been used as a method of level indication for some bead catalyst towers.

One important limitation of these continuous indicating systems is that the calibration is affected by source decay. In the first instance the whole system must be calibrated by making absolute determinations of the contents level over the whole range, and thereafter adjustments must be made to the ratemeter sensitivity at intervals to compensate for the decay of the source. A Cobalt 60 source decays by 1% in about 24 days, while a Caesium 137 source decays by 1% in about 6 months. Since pulse ratemeters can be expected to operate with an accuracy of $\pm 1\%$, the overall accuracy on a continuous level indicator may be about $\pm 2\%$ of the range.

If it is essential to cover a large vertical range of level indication by the gamma-ray method, the best practical method is to employ an *On/Off* control system and arrange for both source and detector to be traversed vertically together. The traversing gear can be driven by a reversing motor controlled by the detector relay so that source and detector follow any changes in level and are always positioned in line with the liquid surface. For a large vessel, the main cost of such an installation would be in the mechanical hoisting gear and electrical drive.

RELIABILITY

The Geiger Muller tubes most commonly used as detectors for level measurements are of the low voltage Halogen-quenched type. These tubes, made almost entirely of metal, are extremely robust and have a working life which is independent of the number of pulses conducted. In practice a large number of them have been in continuous use for 4 or 5 years without showing any signs of deterioration. Their temperature rating is from -55°C to $+70^{\circ}\text{C}$ so that they may be operated at the outside of many industrial vessels without artificial cooling. Water-cooled detector units can, however, be provided where necessary. The maximum pulse rate of operation is about 1000 counts/second but, in practice, the tubes are normally operated at about 100 counts/second or less. Reliability and component life are thus comparable with the best types of equipment employing electronic valves.

There is always a small background level of radiation which is detected by a Geiger Muller tube and this can be used to operate a fail-safe system in many cases. For instance, if a ratemeter is used to indicate the level of liquid in a tank, the pulse signal can also be used to energise an alarm relay. Under normal working con-

ditions there will always be a signal fed to the ratemeter which will keep the relay energised but in the event of complete failure of the Geiger Muller tube (or any component or connection to the ratemeter) leading to complete signal failure, the relay will become de-energised and thus actuate an alarm or safety circuit. Such a system is built into many industrial level control equipments.

RADIATION SAFETY

In designing installations for level control by means of gamma-ray sources, care must be taken to ensure that there will be no radiation hazard to personnel responsible for operating the plant or maintaining the equipment. There are two types of hazard associated with radio-activity. Firstly there is a danger arising from ingestion or contamination should radio-active materials escape from the source container. This risk is virtually negligible if standard radio-graphic source capsules are used. These are supplied by the Atomic Energy Research Establishment, Harwell (Cobalt 60) or the Radiochemical Centre, Amersham (Caesium 137).

Secondly, there is the hazard due to direct exposure of the body to external gamma-radiation. This has been dealt with in the Preliminary Draft of Regulations under the Factory (Ionising Radiations) Act, which lays down maximum permissible levels for gamma-ray dose to be received in any working period by persons who may be exposed to radiation in the course of their work.

For certain categories of worker, the maximum permissible level corresponds to a dose-rate of 2.5 mR/hr. and for other workers the maximum permissible level is .75 mR/hr. Obviously, all steps should be taken to ensure that the actual dose received is below this maximum permissible level. A dose-rate of 2.5 mR/hr. corresponds to about 250 counts/second in a typical Geiger Muller Tube for gamma-rays from Cobalt 60 or Caesium 137. A level detector or level indicator can, therefore, operate satisfactorily with a dose-rate of about one tenth tolerance at the detector site.

Source holders are designed so as to surround the source pellet with a shielding material (usually lead) on all sides except for a radiation aperture directed towards the detector. Persons are not normally required to work within the "beam" from this aperture, except beyond the detector, where the intensity is well below maximum permissible level. Should it be necessary for persons to work inside the vessel for maintenance purposes, the "beam" can be attenuated drastically by closing a shutter on the radiation aperture. The lead filling in the source holder ensures that the radiation outside the "beam," around the sides and back of the holder is below the maximum permissible level at all points where operators may normally work or stand continuously.

In practice it is found that source strengths ranging from 0.5 to 250 mC are required, and the lead thickness necessary to shield these may range from 1 inch to 5 inches. The source holder, with its shutter closed, forms a suitable container for transit or storage of the radio-active source up to the time of installation.

Table 1
Source Strengths in millicuries

DISTANCE (feet) Source/Detector:		2	3	5	8	10	15	20	30
TOTAL WALL THICKNESS (IN TERMS OF STEEL)	3/4" Co60	1	1	3	10	10	20	40	80
	Cs137	2	4	10	30	40	90	160	360
	1 1/2" Co60	1	2	5	20	20	40	80	160
	Cs137	10	20	40	100	160	360	—	—
	2 1/4" Co60	2	4	10	30	40	80	150	—
	Cs137	30	60	160	—	—	—	—	—
	3" Co60	3	10	20	50	70	—	—	—
	Cs137	100	230	—	—	—	—	—	—
	4 1/2" Co60	20	30	70	180	—	—	—	—
	Cs137	—	—	—	—	—	—	—	—
	5 1/4" Co60	30	50	150	—	—	—	—	—
	Cs137	—	—	—	—	—	—	—	—
	6" Co60	50	100	—	—	—	—	—	—
	Cs137	—	—	—	—	—	—	—	—

N.B.—In each case, radiation through empty container is less than 1 tolerance at detector (calculated for each source strength and each application).

Table 2

To convert the thickness of any material to the equivalent thickness of steel, multiply by the conversion factor given below:

ALUMINIUM .. 0.35	LIMESTONE .. 0.35
ASBESTOS .. 0.31	MAGNESIUM .. 0.22
ASBESTOS SLATE 0.23	MONEL .. 1.14
ASPHALT .. 0.17	NICKEL .. 1.12
BRASS .. 1.09	PORCELAIN .. 0.31
BRICK .. 0.23	RUBBER .. 0.15
BRONZE .. 1.13	SANDSTONE .. 0.28
CARDBOARD .. 0.09	SILICON .. 0.31
CEMENT .. 0.36	SILLIMANITE .. 0.29
CLAY .. 0.28	SLAG .. 0.38
COAL .. 0.19	SLATE .. 0.38
COKE .. 0.18	STEEL .. 1.00
COPPER .. 1.13	TIN .. 0.91
CORK .. 0.03	WATER .. 0.13
GRANITE .. 0.35	WOOD (HARD) .. 0.10
GLASS .. 0.33	WOOD (SOFT) .. 0.06
IRON (CAST) .. 0.94	"ZAC" .. 0.45
IRON (WROUGHT) 1.00	ZINC .. 0.90
LEAD .. 1.41	

For any material not listed, the conversion factor is $x/7.8$ where x = density of material in gms/c.c.

The source activity required, depends of course on the diameter of the vessel, the material and thickness of the walls, and the signal strength required to give the desired accuracy and response speed.

Table 1 shows approximate source activities required for various vessel diameters and wall thicknesses. Wall thickness is given in terms of steel, but conversion for other materials can be made by reference to Table 2.

EXAMPLES

A well-established application of gamma-ray level detectors is the indication and control of molten glass level in the feeder channel of a furnace used for making glass bottles. Fig. 6 shows a sectional view of such an installation in which it can be seen that the vessel walls consist of a considerable thickness (about 9 inches) of refractory materials. The contents of course are at about 1100°C . Under typical operating conditions it is desirable to hold the level steady to within $\pm \frac{1}{8}$ inch throughout a production run, and to have indication of extreme deviations up to $\pm \frac{1}{2}$ inch. Control of level can only be achieved by regulating the supply of raw materials into the furnace tank.

For this type of application a single Geiger Muller tube in a water-cooled jacket is mounted on one side of the feeder, and a Cobalt 60 source of activity 150-250 mC on the other. The source is housed in a lead shield

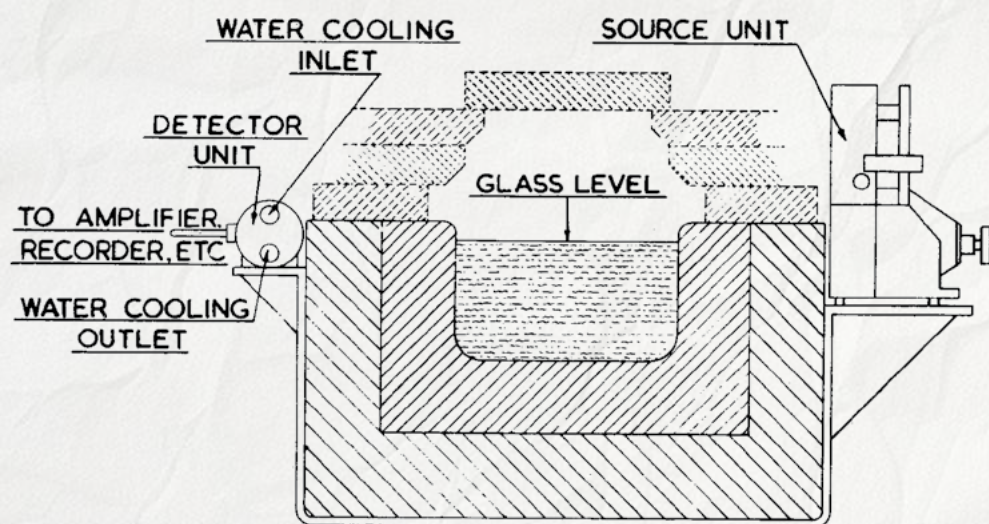


Fig. 6. Method of mounting Source and Detector Unit on Feeder.

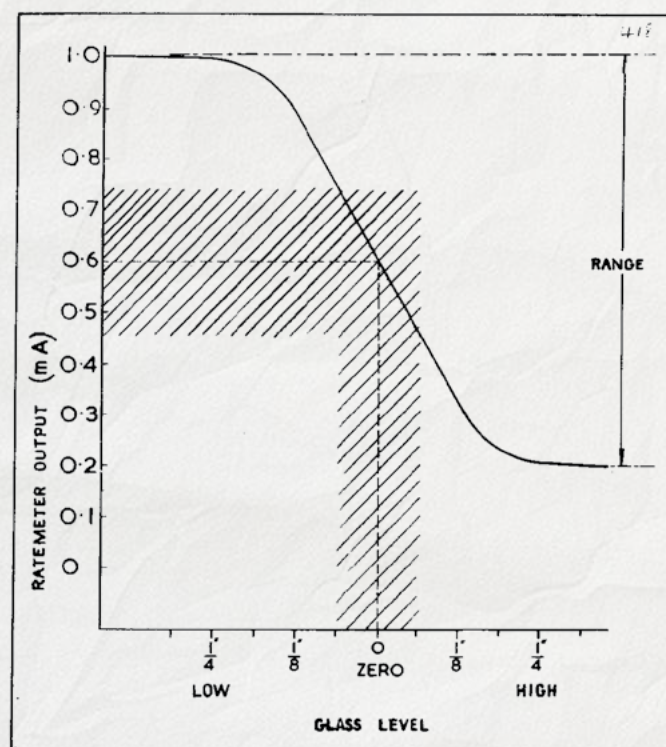


Fig. 7. Calibration Curve for Glass Level Controller.



Fig. 8. Portable Level Detector employing a Gamma Rag Source and Geiger-Müller Tube.

weighing about 170 lb. Fig. 7 shows a calibration curve for such an installation. In practice, the meter or recorder scale can be read to $\pm .010$ inch in most cases, which is more than adequate for normal requirements.

In contrast to this accurate installed gauge is the simple but effective portable gauge, illustrated in Fig. 8. Source and detector are mounted on the arms of a yoke

which can be moved up and down a cylinder. Sharp changes in the output meter reading indicate when the top surface of the contents is passed. The main application for this instrument is for CO₂ cylinders where it obviates the need for weighing. It has, however, possible applications for checking level or presence of contents in many types of sealed container or pipeline in the chemical industry.

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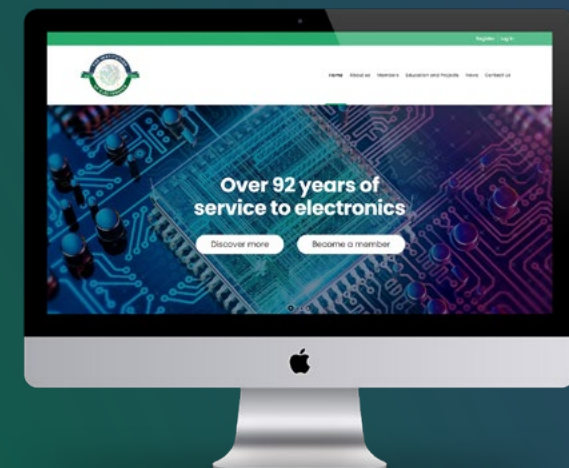


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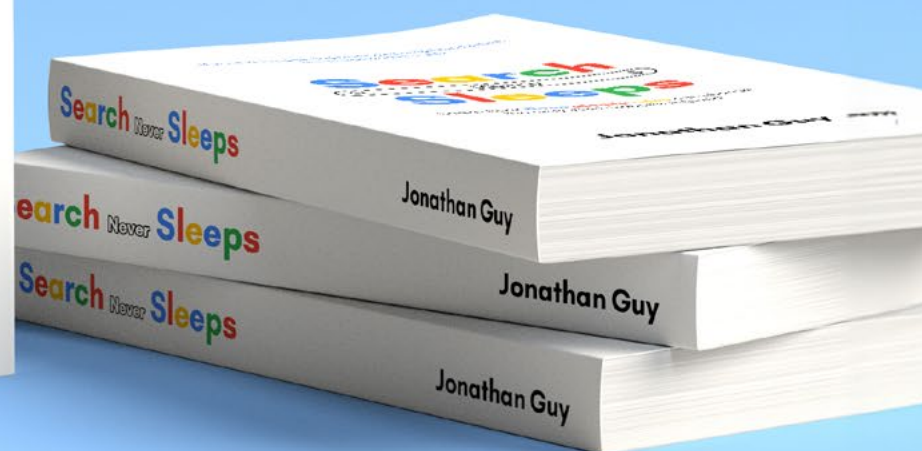
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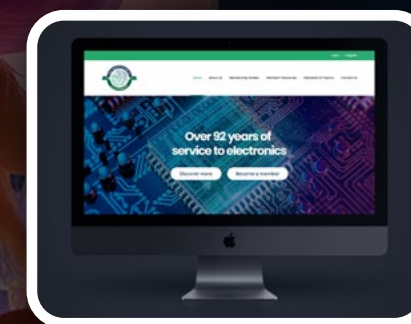
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