

Driving manufacturing innovation to commercial reality



High Value Manufacturing Catapult

Annual Review 2014-2015



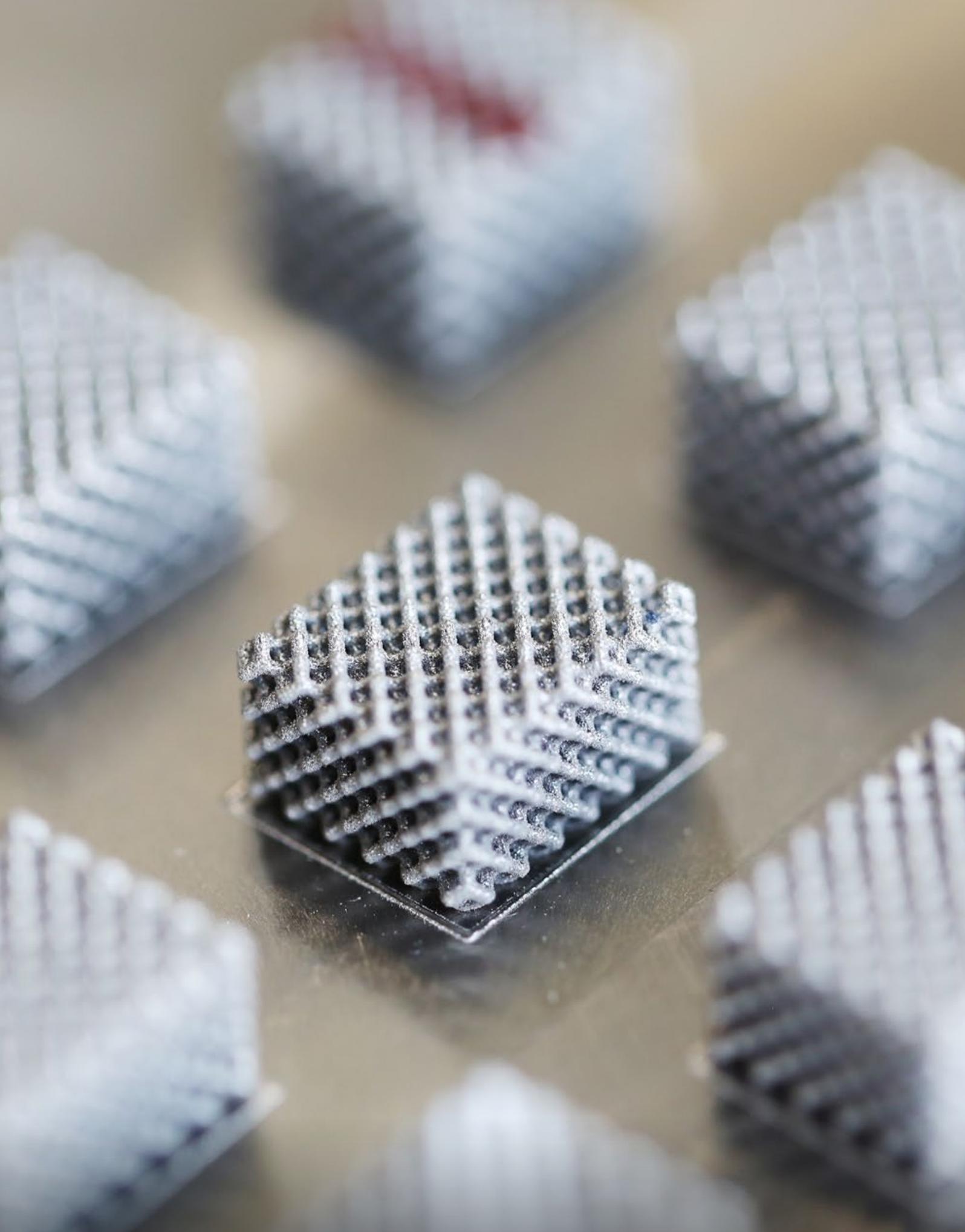
The High Value Manufacturing Catapult is one of the best industrialisation models in the world. These centres translate early ideas into proven ones, from the lab to a successful solution. You get 50, 60 companies together in one space creating ideas which spill down into the supply chain.

Dr Hamid Mughal OBE
Director of Global Manufacturing, Rolls-Royce

Cover image: The NCC tri-robot cell enables process automation for composites components manufacturing



Above: The Nuclear AMRC Dörries Contumat vertical turning/milling lathe, one of the largest machining centres available for collaborative R&D in the world



Lattice structures for implant bone ingrowth – produced by the Renishaw AM250 laser melting additive manufacturing process

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Our centres

AFRC:	Advanced Forming Research Centre
AMRC:	Advanced Manufacturing Research Centre
CPI:	Centre for Process Innovation
MTC:	Manufacturing Technology Centre
NCC:	National Composites Centre
NAMRC:	Nuclear Advanced Manufacturing Research Centre
WMG:	Warwick Manufacturing Group



I am confident that, with continued government support for our mixed funded delivery model, UK advanced manufacturing will continue to develop, improve and grow in years to come.

Bob Gilbert
Chair, High Value Manufacturing Catapult

Chairman's statement

With an increase in factory output of 2.7% in 2014, UK manufacturing companies look to be in a better position than most to weather the ongoing turmoil in the global economy and the Eurozone in particular.



Maintaining our strong performance in times of challenging global trade conditions requires a long-term approach and ongoing commitment from the manufacturing industry, as well as UK government and our research base.

The 2014 Autumn Statement, which announced £61m additional core funding for the High Value Manufacturing (HVM) Catapult over a two-year period, shows that manufacturing is now fully recognised as being key to addressing the national deficit and achieving a truly balanced economy in the UK.

After only three full years of operation, the HVM Catapult has already proven to be an unqualified success. We bridge the gap between research and commercialisation, thus supporting a successful and sustainable future for high value manufacturing in the UK. We take much of the risk out of innovation by offering open access, world-class, industrial scale equipment and expertise across all aspects of advanced manufacturing. The overwhelming industry demand and financial contribution for our services shows us we've got our offer right.

With over £450m of assets and over 1,500 specialist staff, we make a real and significant difference. Multinationals work with us to develop new technologies which can result in major production investment. Examples of this are the two Rolls-Royce factories that were opened in Yorkshire and the North East in 2014. Smaller companies, such as PolyPhotonix, used our expertise and facilities to help to develop their optical eye mask which is predicted to save the NHS £1bn a year.

This is an exciting time for us. We are competing with other nations who also covet high value manufacturing. With our world class ability to create the ideas from our research base and our new capability to deliver them through the Catapult, we are pleased with the results achieved to date and confident about further success in the future.

The new government has already shown its commitment to our work and I am confident that, with continued government support for our mixed funded delivery model, UK advanced manufacturing will continue to develop, improve and grow in years to come.

A handwritten signature in black ink that reads "Bob Gilbert". The signature is written in a cursive style and is positioned above a horizontal line.

Bob Gilbert
Chair
High Value Manufacturing Catapult

Chief Executive's statement

The High Value Manufacturing Catapult looks back on another year of strong achievements and growth across its seven centres – working with government, academia and industry to bridge the gap between the UK's great technology research, and commercial industrial scale production in this country.



Solid performance and impact

Our performance figures in 2014-15 show a continued trend of growth and of ever strengthening industry engagement. With commercial income making up 48% of our total income, it is clear that businesses value what we have to offer. I am particularly pleased to see that SMEs make up over 40% of our customer base, and I am committed to increasing their participation with us further over years to come. It is absolutely fundamental, however, that the contribution from UK government keeps up with our growth, to avoid losing the high end innovative nature of our work and defaulting to a more conventional 'vanilla flavoured' offer.

Outcomes and impact

It takes time for innovation to show measurable results. Only three and a half years into our existence, however, we are seeing evidence of very significant economic impact of projects we are involved in and businesses we work with. Throughout this report, we show powerful examples and case studies. A recent evaluation study into our economic impact shows that we have to date generated an impressive £15 net benefits to the UK economy, for every £1 of public core funding received. The study shows that we have to date generated £1.6bn economic impact, with the potential to generate a further £6.1bn by 2020, subject to ongoing UK government support. As one business told the study: "It has been dramatic... we are getting rewards from our involvement that far exceeded our expectations".

Skills agenda

Developing the skilled workforce of tomorrow, equipped with the knowledge and understanding of emerging technologies, is essential to enabling UK industry to compete in global markets. I therefore welcome the Government's announcement to work with the HVM Catapult and with EEF, the manufacturers' organisation, to establish a National College for Advanced Manufacturing which will identify the needs of industry and develop training provision to meet those needs.

A broader role

We have been active this year in establishing collaborative arrangements with a number of the major banks in the UK. As they seek to lend to manufacturing businesses to support growth, the Catapult's 'de-risking' model is seen to be a valuable tool to support high quality bank lending. We are also developing partnerships with the Business Growth Service to be able to present a firmer offer to high growth manufacturing SMEs.

Influencing policy

Our track record of working with industry, translating technology innovation into value add for the UK economy, gives us invaluable insight and understanding of the issues and opportunities facing UK manufacturing. We actively engage with UK strategy development, both through the submission of responses to key enquiries such as the remanufacturing report, as well as through participation in consultations such as the Dowling review and in strategic forums such as the Automotive Council and the Aerospace Growth Partnership. Our role in helping to shape policies and strategy relevant to UK manufacturing has grown this past year and I intend to strengthen this further going forward.

Outlook

The cross-party support we receive is encouraging. Provided this support translates into sustained funding commitments, this gives us the confidence to be ambitious and plan for growth.

Going forward we will particularly increase our focus on innovation hungry SMEs where we see real opportunity to help to embed new value in the UK. We also plan to reach out to broader parts of the manufacturing sector, such as construction and food and drink – which have not yet fully exploited the competitive benefits they could derive from working with us.

I look back on a successful year and am confident about the future. A future in which the HVM Catapult further strengthens its position as the "go-to" place for advanced manufacturing, with the commitment, credibility, capability and capacity to stimulate high value manufacturing in the UK – helping to create jobs, improve skills and secure investment for economic growth.



Dick Elsy

Chief Executive

High Value Manufacturing Catapult

Performance highlights 2014-2015

Total value of our assets

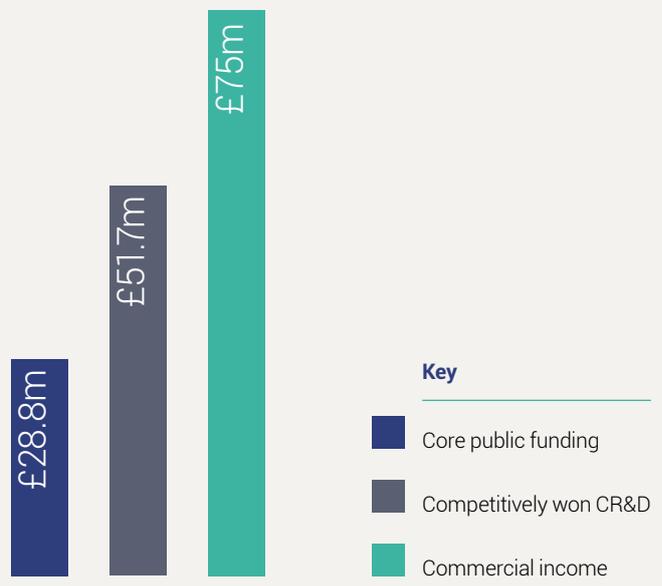
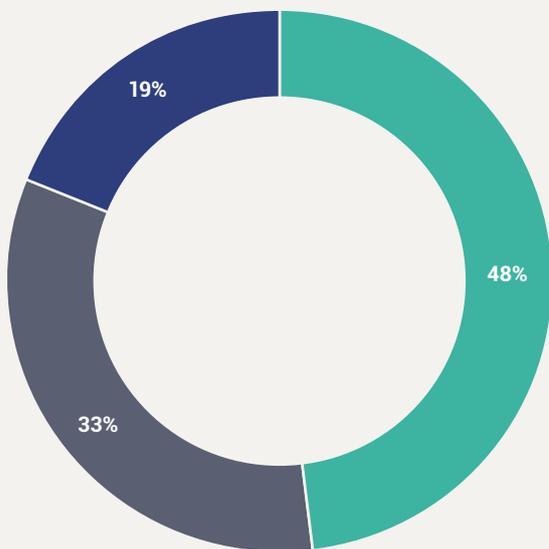
£474m

↑ Up 28% from 2013-14

Investment in large capital projects

£69.4m

Funding breakdown



Number of employees

1,577

Number of projects

1,259

Size of order book

£183m

→ Over 66% of which came from CR&D

Private sector clients

1,514

→ Over 41% of whom (629) were SMEs

£m Collaborative R&D funding accessed by SMEs



HVM Catapult economic impact to date



Source: WECD Economic Impact Evaluation study

Key milestones

Apr

May

Jun

Jul

Aug

Sep

The Centre for Process Innovation, CPI, celebrates its 10 year anniversary with a high profile reception at the Palace of Westminster. Speakers include Andrew Miller – Chair of the Science and Technology Committee, Lord Selborne – Chair of the foundation for Science and Technology and Steve Bagshaw – Chair of the Industrial Biotechnology Leadership Forum. Established in 2004, CPI now has over 225 staff and over £15m turnover. CPI have delivered more than 350 public and private projects with a value in excess of £300m in innovation in areas including Hydrogen Fuel Cell applications, Advanced Processing Chemistries and more recently in Industrial Biotechnology, Printable Electronics and Biopharmaceuticals.

The Advanced Manufacturing Research Centre, AMRC, secures £7m government funding for a new large titanium castings facility at its sister centre Castings Technology International (CTI), a world-leading provider of technology, expertise and services to the cast metals sector. The new facility will allow companies within the aerospace industry to develop the capability to melt and manufacture the largest aircraft castings in the UK instead of this work being carried out abroad. With up to 27,000 new planes needed between now and 2030, this represents a huge potential growth area for the UK.

AMRC Training Centre officially opens. His Royal Highness the Duke of York opens the centre and meets some of the centre's 260 current trainees, their employers and training centre staff. The centre, on the Advanced Manufacturing Park, trains highly skilled apprentices who are essential to UK manufacturing's future. It will eventually provide places for 750 young people, aged 16 and upwards.

Hermann Hauser presents the findings of his review of the Catapult Network and makes recommendations on the future shape, scope and ambition of the programme. He concludes that the UK needs a 'translational infrastructure' of the size and scale seen in competing nations. He calls for long term industrial strategies and public funding, recognising that this will be a long term endeavour requiring commitment by the current Government and successive Governments to come. He urges the Government to maintain the 1/3 funding model and to expand the Catapult network in a measured way.

Oct

Nov

Dec

Jan

Feb

Mar

Chancellor George Osborne announces £89m further government support for the HVM Catapult. The announcement includes £61m additional government investment to provide the HVM Catapult with the capability to reach out to a wider range of manufacturing sectors and engage more smaller and medium sized businesses, and £28m investment for the creation of a National Formulation Centre with the CPI.

Dr Vince Cable, then Secretary of State, announces the Government's intention to work with the HVM Catapult and with EEF, the manufacturers' organisation, to establish a National College for Advanced Manufacturing – NCAM – which will identify the needs of industry and develop training provision to meet those needs. The first hubs of the NCAM will be the training centres at the AMRC and the MTC.

Rolls-Royce marks the official opening of its new £110m Advanced Blade Casting Facility (ABCF). When fully operational in 2017, the 150,000 sq ft (14,000 sq m) facility in Rotherham will employ 150 people and have the capacity to manufacture more than 100,000 single crystal turbine blades a year. The ABCF uses automated manufacturing techniques which have helped reduce the time it takes to manufacture a turbine blade by 50% while producing a step-change in component performance. This state of the art facility makes use of manufacturing methods developed by Rolls-Royce with the MTC.

Bank of England Governor Mark Carney visits the Nuclear AMRC to see how the University of Sheffield's AMRC cluster plays a key role in economic growth. Mr Carney says: "I have come to realise the crucial role organisations such as the AMRC play in supporting both regional and national economies". Mr Carney is given an overview of the AMRC cluster, and he meets apprentices at the AMRC Training Centre, which provides the practical and theoretical skills that manufacturing companies need to compete globally.

Key technology capabilities

Through its seven centres the HVM Catapult offers technology innovation and scale-up capabilities across the spectrum of process and discrete manufacturing industries.

These technologies are available:

1

At an industrial scale on an open-access basis so companies of all sizes can develop their processes, products and services, on state of the art equipment.

2

To allow companies to test alternative approaches to innovation so they can lower risk without incurring significant capital costs.

3

So academia and university spin-outs can scale-up their research in a way that prepares them for commercial markets.

4

Along with extensive experience available through the highly skilled technology development teams in the centres.

The Chief Technology Officers (CTOs) of the HVM Catapult centres work closely together to integrate the HVM Catapult's technology capabilities driving technology advances within the Catapult, and developing and delivering large-scale cross-centre projects such as the Large Composites Project.

The CTOs have undertaken a comprehensive exercise to map out the HVM Catapult's 900+ technology capabilities. To make them more accessible these have been grouped into 27 key technologies. Most are supported by several centres, and they are led by Technology Capability Forums that are increasingly integrated into the UK manufacturing landscape. Going forward, these Forums will become an ever more important route for us to further develop our capabilities and to share insights with relevant audiences from industry and academia. Ultimately leading to more cross-sector and cross-supply chain innovation projects that create value for UK based manufacturing.

Graham Hillier

Chief Technology Officer, 2012 – May 2015,
High Value Manufacturing Catapult

27

key technology groups



Additive Manufacturing

Additive manufacturing (AM) (or 3D printing) uses primarily additive processes, in which successive layers of material are laid down under computer control. This results in objects that can be of almost any shape or geometry, and are produced from a 3D model or other relevant data source, with little or no waste.



Advanced Assembly

Assembly is the general term for applications that assemble and inspect the fundamental parts to form a final product or sub-component. Industry is increasingly seeking to automate complex manual assembly tasks in order to improve manufacturing flexibility, speed and quality, while also reducing costs.



Automation

Automation is the use of various control systems for operating equipment such as machinery, processes in factories, and other applications with minimal or reduced human intervention. Some processes have been completely automated.



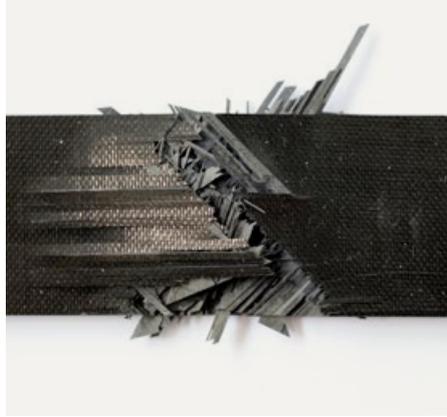
Biologics

Biologics are preparations, such as a drug, a vaccine, or an antitoxin, that are synthesized from living organisms or their products and used as a diagnostic, preventive, or therapeutic agent.



Biotechnology

Biotechnology uses microorganisms, such as bacteria or yeasts, or biological substances, such as enzymes, to perform specific industrial or manufacturing processes. Biorefining is the sustainable processing of biomass into a spectrum of bio-based products and bioenergy (biofuels, power and/or heat).



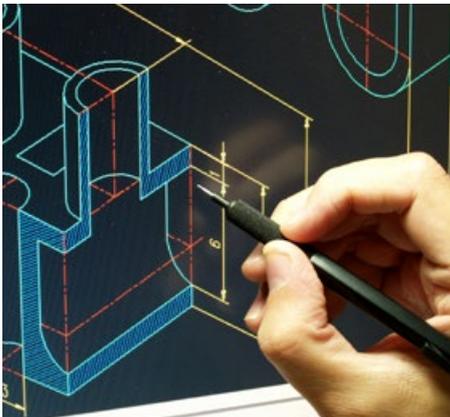
Characterisation

Characterisation and testing of materials refers to the broad and general process by which a material's structure and properties are probed, measured and tested.



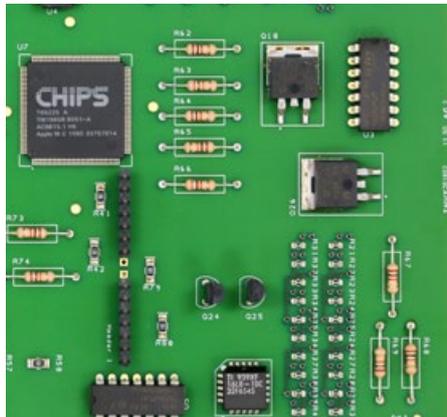
Composites

Composite materials are materials made from two or more constituent materials with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual components.



Design

Design for manufacture is a term used to describe the process of designing products/ parts/components in a way that optimises all the manufacturing functions (fabrication, assembly, test) as well as ensuring that design supports the optimisation of cost, quality and regulatory compliance.



Electronics

Electronics deals with electrical circuits that involve active electrical components such as vacuum tubes, transistors, diodes and integrated circuits, and associated passive electrical components and interconnection technologies.



Flexible Manufacturing

A method for producing goods that is readily adaptable to changes in the product being manufactured, in which machines are able to manufacture parts and with the ability to handle varying levels of production.



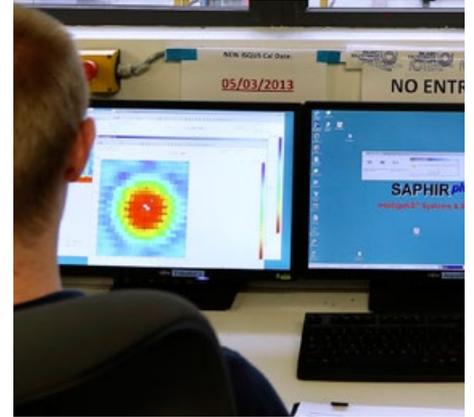
Formulations

Formulations refer to the putting together of components in appropriate relationships or structures, according to a formula. Formulations are commercially produced for drugs, coatings, dyes, alloys, cleaning agents, foods, lubricants, fuels, and many others.



High Temperature Processing

Forming of metallic components by use of carefully controlled combinations of temperature and pressure to effect viscoelastic flow and/or plastic deformation.



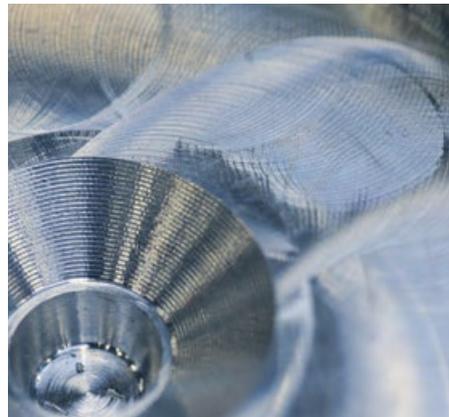
IT for Manufacturing

Advanced manufacturing is a highly knowledge intensive sector where advances in IT systems have a huge role to play in improving manufacturing intelligence; capturing, sharing and managing big data; supporting collaboration; increasing efficiency; speeding up innovation; and enabling new business models and technologies.



Joining

Joining technology is fundamental to engineering and manufacturing. Without the ability to make strong and durable connections between materials it would not be possible to produce the many different items upon which industry rely, and we all rely on in our everyday lives.



Machining

Machining is any of various processes in which a piece of raw material is cut into a desired final shape and size by a controlled material-removal process.



Metal Casting

Casting is a manufacturing process by which a liquid material is usually poured into a mould, which contains a hollow cavity of the desired shape, and then allowed to solidify.



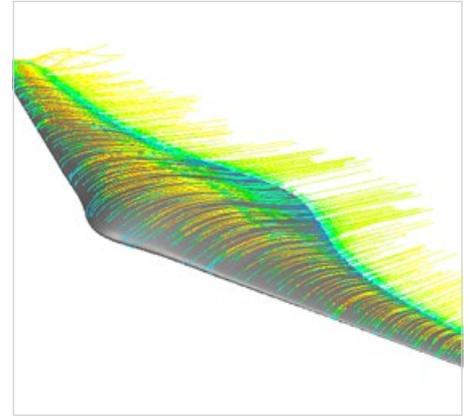
Metal Forming and Forging

Forging is a manufacturing process involving the shaping of metal using localized compressive forces. Forging is often classified according to the temperature at which it is performed: "cold", "warm", or "hot" forging.



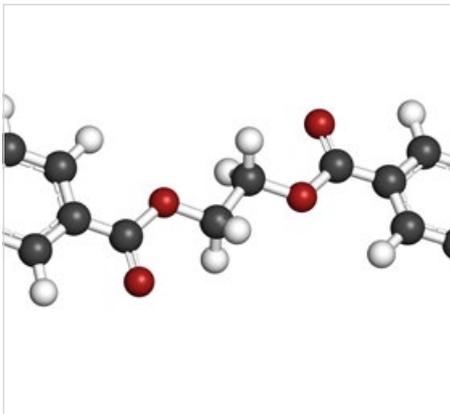
Metrology

Metrology (the science of measurement) provides critical quality assurance for manufacturing processes.



Modelling and Simulation

Modelling and simulation is getting information about how something will behave without actually testing it in real life. Models, including emulators, prototypes and simulators, either statically or over time, are used to develop data to inform managerial or technical decisions.



Polymers

Polymeric materials are created via polymerisation of many small molecules. Their consequently large molecular mass relative to small molecule compounds produces unique physical properties, including toughness, viscoelasticity, and a tendency to form glasses and semicrystalline structures rather than crystals.



Powder Metallurgy

Many of the emerging production methods that produce net shape components (components close to final geometry without the need for extensive machining) begin with powdered metals. The powder metallurgy industry has witnessed a steady expansion since the 1980s and continues to reinvent itself, introducing new materials, products and services.



Power and Energy

Environmental legislation is creating a significant demand for electrochemical storage solutions for both static (grid balancing and storage of renewable energy) and mobile application (low carbon vehicles).



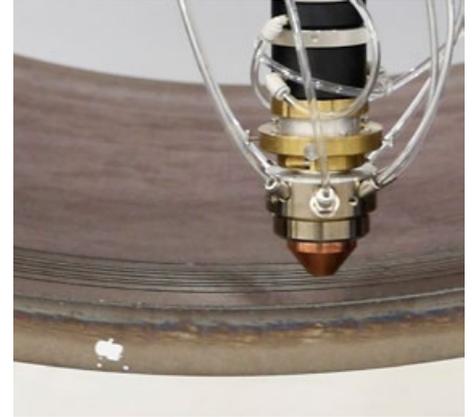
Printable Electronics

Printable electronics refers to the methods used to create electrical devices on various substrates including thin film, textiles and paper. Development of printable electronics technology provides benefits for end-users across sectors and has the potential to enable products to be lower cost, lighter in weight, and to provide more integrated functionality and lower energy consumption both in manufacture and use.



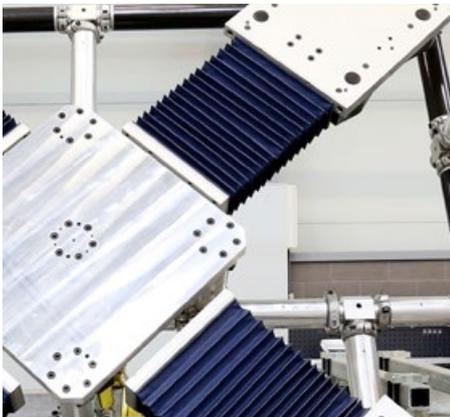
Resource Efficient and Sustainable Manufacturing

The efficient use of resources in manufacturing processes coupled with low carbon and low energy manufacturing processes is a major target across the whole of the manufacturing industry.



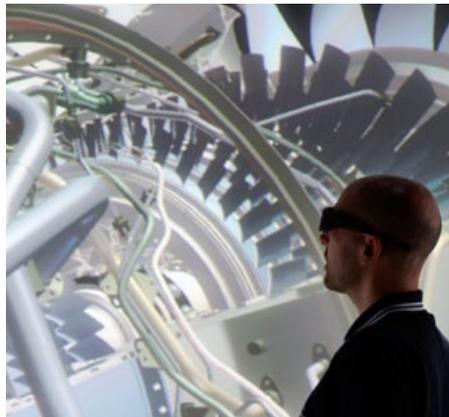
Surface Engineering

Surface engineering refers to a wide range of technologies designed to modify the surface properties of metallic and non-metallic components for decorative and/or functional purposes. Examples include improving corrosion and wear resistance to extend component life; making items more visually attractive; and giving special properties such as lubricity enhancement, non-stick surfaces, etc.



Tooling and Fixtures

Tooling refers to working or specialist manufacturing aids which are usually limited in use to a specific production line or the performance of a specific contract or job. Fixtures are work holdings, used to securely position, hold and support the work to maintain conformity.



Visualisation

Virtual reality refers to a set of techniques in which one interacts with a synthetic ("virtual") environment that exists solely in the computer. A variant of virtual reality is often called "Visualisation". This involves presentation of 3D structures (such as anatomy or molecular structure) in ways that maximize learning.

Cross centre collaboration

Cross-centre collaboration adds real value and helps generate an overall impact which is significantly bigger than the sum of the impact of the seven individual HVM Catapult centres.

The increasing strength of the collaboration between the HVM Catapult centres is now generating demonstrable value through a wide variety of innovative cross-centre activities that serve to harness the complementary capabilities of each centre.

The bi-monthly Chief Technology Officers Forum is a catalyst for engagement and action across the HVM Catapult, on a range of strategic and tactical issues.

Technology Forums

The CTO Forum has initiated a series of 'Technology Capability Forums' each of which brings together expertise from the relevant centres in a variety of activities to raise the awareness, and promote best practise. During 2014-15, eight Forums were operational in the capability areas listed in the table below.

Further Forums are at the planning stage, with the intent to encompass all the HVM Catapult capabilities, in due course.

ID No.	Forums
1	Automation
2	Additive Manufacture
3	IT for manufacture
4	Joining
5	Knowledge Management
6	Metrology
7	Modelling and simulation
8	Visualisation and VR



The AMRC and many others have excelled because they have invested continuously in their most precious resource: their people. It is these people and the innovation they foster that will secure Britain's continuing place at the forefront of global manufacturing.

Mark Carney
Governor, Bank of England

The NCC short upstroke press with 36,000 kN of press reduces production cycle times from hours to minutes



Examples of cross centre projects include:

Composites Large Scale Project

The global market for fibre reinforced composites is growing at a rate of 7%-15% per year and is predicted to continue at that rate to 2020. Working together, the seven centres have completed a comprehensive study of the UK Composites sector, identifying key activities that will support UK industry to capitalise in the growing market. The findings are already being utilised in the development of a business case for consideration as part of the upcoming Comprehensive Spending Review and in the execution of a follow-on HVM Catapult activity during 2015-16 to begin the strengthening of the UK supply chain.

EPSRC HVM Catapult Fellowship Scheme

A major challenge for the UK is to improve the means by which research ideas are transitioned from academia to a level that begins to attract industrial pull. In recognition of this, the Engineering and Physical Sciences Research Council (EPSRC) – through its Manufacturing Research Team – has provided HVM Catapult with £1m of funding in the form of EPSRC HVM Catapult Fellowships for award to academics with the desire to work in partnership with one or more HVM Catapult centres. The scheme has been launched successfully, via open calls to UK academia for proposal submissions, a peer review and a joint (EPSRC/HVM Catapult) selection panel. 10 EPSRC HVM Catapult Fellows have been appointed via two tranches and with a third to follow during 2015-16.

Metrology Outreach

The Metrology Forum has been addressing the importance of accurate, reliable and auditable metrology techniques which is a critical capability gap within the UK supply chain at present. Initial activities have been focused on promoting and establishing a measurement best practise community within the HVM Catapult. An outreach program (in collaboration with the National Physical Laboratory, NPL) is now underway via a series of awareness and training events at each HVM Catapult centre that bring together OEM's, manufacturing supply chain companies, and metrology equipment suppliers.

The lack of maturity in auditable metrology techniques for large components (>5m in dimension, eg aircraft wing structures) is a current industrial challenge. Building on the HVM Catapult investment in large dimension Coordinate Measurement Machines the Forum is developing a series of 'large structure artefacts' to explore and develop best practise guidelines that will resolve this pressing industrial challenge.

Visualisation Project

The Visualisation and VR Forum has been active at the national level, acting as the catalyst towards the creation of a UK body to promote best practice across a wide range of industrial sectors in this rapidly evolving domain. The Forum has also been addressing a current real world issue which is the practicality of interoperability across geographically dispersed visualisation suites from differing mixes of hardware and software vendors. The investment in this technology by four of the HVM Catapult centres provides an ideal learning environment to explore such practicalities, thereby assisting software and hardware vendors to improve their offerings to industry whilst also generating valuable guidelines for current and potential industrial users.



Being able to test our new tooling systems on the large-scale machining centres at the AMRC has allowed us to prove their value to the most demanding clients.

Mark Kirby
CEO, Technicut



01

Increasing the scale and speed of commercialisation

With the support of the AMRC, Yorkshire-based tooling company Technicut developed a cutting tool that speeds up the cutting of tough alloys such as titanium. Initial tests found that the tool was too powerful for existing tool holders and machine systems. The AMRC put the company in touch with Japanese owned fittings specialist Nikken.

They collaboratively developed a new tooling system – the TiTan X-Treme – which is now manufactured in the UK and is being deployed at major titanium machine shops worldwide.

Nikken have been so pleased with the benefits of collaboration that they are building their European R&D Centre on the Advanced Manufacturing Park in Rotherham.

The TiTan X-Treme was one of the key innovations adopted by the combined team of AMRC and Rolls Royce, looking to reduce the time involved in machining fan discs for a wide range of Trent aero engines. The manufacturing methods developed at the AMRC reduced the time it takes to manufacture a disc by 50% while producing a step-change in component performance. These techniques are now used in the new £100m Rolls-Royce Advanced Aerospace Disc Manufacturing facility, which was opened in Washington, Tyne and Wear in June 2014, creating many valuable jobs in that part of the country.

Tony Wood, President of Aerospace at Rolls-Royce, said: "Rolls-Royce is committed to investing for future growth in order to deliver for our customers. This facility will use ground breaking manufacturing techniques to produce discs for our Trent engines including the world's most efficient aero engine, the Trent XWB."

This is a good example of "sticky technology" – an SME enjoying global recognition, a major inward investment in R&D by a Japanese company and a major new manufacturing facility in this country.

"Being able to test our new tooling systems on the large-scale machining centres at the AMRC has allowed us to prove their value to the most demanding clients... we have won new business and grown our workforce as a result of the collaborative research and networking opportunities here."
Mark Kirby, CEO, Technicut.

Success stories

02

Incremental Sheet Forming of Cranial Implants

Pascoe Engineering collaborates with AFRC and the Greater Glasgow and Clyde Health Board to manufacture titanium cranial implants applying incremental sheet forming; a technique where a metal sheet is formed by a series of small incremental deformations made by a small round tipped tool.

This approach can reduce the manufacturing cycle time from six to eight weeks to five to ten days, thus reducing waiting times and improving patient outcome.

The project is at a stage where several prototypes are being tested. Once successful, the intention is for Pascoe Engineering to provide the implants to the Greater Glasgow and Clyde Health Board. The national market is the obvious next step.

"The Cranial implant project allows Pascoe Engineering to look at new markets for the new skills that the company has developed in Incremental Sheet forming"
Bob Smith, Managing Director, Pascoe Engineering Ltd.

"This is an attractive technology as it takes advantage of 3D scanning and digital fabrication to provide accurate, patient specific, implants in a much shorter time frame than is possible using current methods."
Fraser Walker, Consultant Maxillofacial Prosthetist, Southern General Maxillofacial Laboratory.

03

Nuclear AMRC helps EU manufacturers take a global lead

The Nuclear AMRC is leading two new NUGENIA European research projects to develop advanced manufacturing technologies for the civil nuclear industry.

The projects will develop machining techniques to reduce the risk of component failure over a reactor's lifetime, and investigate processes to create high-integrity reactor components from metal powder.

The 'McScamp' project aims to understand the causes of stress corrosion cracking, which shorten the useful life of reactor components, and investigate machining techniques to improve surface integrity. This should help extend the life and reduce shutdown rates in the current reactor fleet, as well as improve the quality and performance of parts produced for new reactors.

The 'PowderWay' project will investigate powder metallurgy techniques that are used in industries such as aerospace, assess their potential for the civil nuclear sector, and establish a strategy to move the most promising techniques into commercial production.

"These two projects will apply cutting-edge machining and materials technologies to the civil nuclear industry, to drive up quality and lifetime performance for reactor operators, and help European manufacturers take a global lead in the sector."

Alan McLelland, Projects Director, Nuclear AMRC.

04

Continued success for PolyPhotonix medical eyemask

CPI start-up company PolyPhotonix pioneers the application of organic LED technology to develop their revolutionary Noctura sleep mask, which provides a non-invasive and highly effective treatment for Diabetic Retinopathy, which is a common cause of blindness. PolyPhotonix uses the CPI facilities, expertise and network and has gone from strength to strength, with clinical trials now well underway. The NHS has claimed the device could save them £1bn per annum. This year, the company saw further success, including receiving the first ever grant from the SBRI Healthcare Phase 3 programme, which will help accelerate the adoption of the device and will result in the care pathway development being shortened by several years. The company also won a series of awards, including the National Business Award, the IET Innovation Award 2014, National Business Award and the ICheMe Global Award.

"Remaining lean and responsive has given us the freedom and flexibility to react to new opportunities. We are able to book time and space in the clean room and to use the equipment we need when we need it. Although we operate as a private company, CPI's extensive resources and support have enabled us to grow at a realistic pace. Quite honestly, without CPI and the HVM Catapult we wouldn't be here – that's the bottom line."
Richard Kirk, CEO, PolyPhotonix.

05

A novel cooling solution for high performance applications

Since 2012, thermal management systems company Koolkwic has been developing ideas for new types of cooling systems. With the help of the Energy Innovation Centre at WMG Catapult, Koolkwic were able to demonstrate that this concept had huge potential for use in a range of industries including automotive, motorsport and aerospace with further potential for the beverage and facilities management industries, where thermal control is a critical issue. With continuing support from the Energy Innovation Centre, early performance evaluation work on a novel cooling solution has now led to the successful creation of a European Regional Development Fund funded collaborative research project aimed at delivering a fully characterised battery pack cooling solution for automotive applications. This work has helped to highlight the potential of a novel technology which in turn is now generating enquiries for Koolkwic from globally recognised high performance motorsport, automotive and aerospace companies.



Quite honestly, without CPI and the HVM Catapult we wouldn't be here – that's the bottom line.

Richard Kirk, CEO, PolyPhotonix

06

PragmatIC – spin out supported to scale-up

University spin-out company PragmatIC develops imprinted ultra-thin flexible microcircuits which are cost-effective enough to be incorporated into disposable items, ranging from intelligent packaging to wirelessly traceable documents.

Working and co-locating with CPI enabled the company to access dedicated engineering support, a controlled operating environment, access to collaboration partners and instant credibility with customers and investors.

"... the public access facility provided by CPI was perfect for us. We needed to scale up, and we were not in a position to do this on our own. ...[The] de-risking element, the access to world class facilities without huge capital investment, is a crucial part of the journey from concept to commercialisation."

Scott White, CEO, PragmatIC.

In January 2015, the company announced a £5.4m investment from ARM, venture capital business Cambridge Innovation Capital (CIC), and existing PragmatIC investors. The funding will be available immediately and will enable the company to scale up its manufacturing of flexible electronic logic to 100 million later this year.

07

Composite materials transfers from planes to trains

The NCC worked with a consortium led by Transport for London (TfL), on a project to replace the doors on the existing Central line tubes with thermoplastic doors. The novel light weight door, manufactured at the NCC, was tested to validate the exacting performance standards required, and went on to win the prestigious Stephenson Award for Engineering Innovation at the 2014 National Rail Awards.

The project took advantage of the NCC remit to cross pollinate technologies from different sectors. Using materials used in an aerospace application and processing them in a novel manner, resulted in an end product that has the potential to improve public transport for generations to come.

"Composite materials potentially offer advantages to many rail sectors, in infrastructure as well as rolling stock. The through-life cost reduction that composites bring to installation and maintenance can often only be fully realised through new design solutions, reducing part count, and new supply chain models. The NCC is actively engaging with all major stakeholders in the sector to identify these opportunities and help knock down barriers to implementation."

Paul Gallen, Business Support Engineer, NCC.

08

Hybrid Manufacturing Technologies win largest 3D printing award in history

Remanufacturing involves rebuilding, repairing and restoring an end-of-life product to meet or exceed its original performance specifications, with a warranty to match. Although the UK's remanufacturing market is valued at £2.4bn, with the potential to increase to £5.6bn, it is still a fledgling industry.

Hybrid Manufacturing Technologies (HMT) – a company set up following a research project funded by the then Technology Strategy Board and involving a partnership including MTC – provides solutions for seamlessly combining different technologies for the remanufacturing of high value metal parts. The company's system combines additive manufacturing, axis machining, and in-process part-inspection. The new approach took the machine world by storm. The company recently won the \$100,000 International Additive Manufacturing Award, the largest 3D printing award in history, sponsored by the Association for Manufacturing Technology and The German Machine Tool Builders Association.

09

Rolls-Royce to create Composite Technology Hub in Bristol

In March 2015, Rolls-Royce announced that they will develop a centre of advanced fan system composite technology development in Bristol, creating a hub of composite knowledge in the UK and securing 120 jobs in the city by the end of 2019. The pre-production facility will be developed alongside Rolls-Royce's new facility for carbon-fibre electrical harness rafts. Both facilities will benefit from manufacturing techniques being developed in partnership with the NCC.

This advanced manufacturing facility will be at the forefront of developing the next generation of fan blades and fan cases, made of carbon-fibre composite materials.

The Rolls-Royce CTi (carbon/titanium) blades are a key feature of the new Advance engine design, which will offer at least 20% less fuel burn and CO2 emissions than the first generation of the Trent aero-engine. The new CTi fan system that could reduce weight by up to 1,500lb per aircraft, the equivalent of carrying seven more passengers and their luggage.

"This state-of-the-art facility will give us the opportunity to further develop our world-leading composite technology and manufacturing techniques for our next generation of engine design."
Tony Wood, President – Aerospace, Rolls-Royce.



The CTi fan system on the Advanced Low Pressure System engine demonstrator
©Rolls-Royce



To innovate, we need open centres where academia and business can get together and drive forward great ideas into manufactured products. And that's what the Catapults are delivering for us.

Juergen Maier
Chief Executive, Siemens UK

Centre expansions

Advanced Manufacturing Research Centre



Centre for Process Innovation



AMRC Factory 2050

The Factory 2050 project is a state-of-the-art research facility to meet the future needs of aerospace and other high value manufacturing industries. This fully reconfigurable assembly and component manufacturing demonstrator facility, will integrate research in manufacturing technology and systems. The term 'reconfigurable' is a general term used to describe a wide range of initiatives including highly adaptive, self-aware manufacturing systems, which will use automated self-learning, adaptive control, dynamic knowledge sharing, highly integrated sensor networks, innovative human-machine interaction mechanisms, process modelling, virtual reality and modelling, plug and play robotics and machining systems and intelligent fixturing.

The 7,023m² Factory 2050 building comprises of workshop / assembly hall areas, an atrium, an exhibition room and flexible meeting spaces with staff offices leading straight from the assembly hall.

The creation of the new facility is supported by the Research Partnership Investment Fund, managed by the Higher Education Funding Council for England (HEFCE), the European Regional Development Fund and the private sector.



Milestones achieved in 2014-15:

- Grant funding achieved from HEFCE/ERDF
- Main Contractor and support team appointed
- Planning achieved
- Ground Breaking
- Equipment procured
- Structural Steel erected

Forthcoming milestones:

- Completion of build in November 2015
- Official opening in 2016

National Biologics Manufacturing Centre

Funded by the Department for Business Innovation and Skills (BIS), the £38m centre, based in Darlington, has been established to support the growth of the UK's biologics industry with open access facilities to support the development and commercialisation of biologic products and process technologies.

Due to open summer 2015, the facility has been designed to handle mammalian, microbial and next generation biologic platforms, with the ability to scale up from millilitres to 200 litres and demonstrate innovative new process technologies. Additionally, the facility will have an extensive analytical suite and high throughput development capabilities, so clients can fully characterise their product and optimise their process.



Milestones achieved in 2014-15:

- Official ground breaking
- First Biologics specific collaboration project announced

Forthcoming milestones:

- Official opening planned for September 2016



Advanced Forming Research Centre



Nuclear Advanced Manufacturing Research Centre

AFRC2 Expansion

The AFRC more than doubled the size of its facility from 2560m² to approximately 5368m².

The extension – which is due to be officially opened in late 2015 – houses workshops, laboratories, and office space, as well as a full range of additional equipment.

The extension allowed the procurement of specific equipment designed to address the needs of a broader range of industrial sectors; in particular, automotive, marine and energy. The new equipment, including flow forming and sheet forming capability, will enable the AFRC to become involved in an additional range of experimentation and manufacturing development to address industry needs. This will help achieve the goal of not only supporting leading edge suppliers in areas that they are not set up to do internally but also flowing the resulting innovation and productivity down the UK's manufacturing supply chains.



Milestones achieved in 2014-15:

- The world's largest research dedicated 1200 tonne Super Plastic Forming press commissioned
- The largest Flow Former machine in the UK, installed and commissioned
- The Rotary Forge, one of its kind in the world, installed and commissioned
- Completion of the building extension and informal opening

Forthcoming milestones:

- Official opening planned for late 2015

Expansion to machining capabilities

The Nuclear AMRC expanded its machining capabilities with a number of new machines which are the biggest of their kind available for collaborative research.

In particular:

The Soraluce FX12000 floor-type horizontal milling and boring centre, capable of five-sided machining of complex parts of up to 12 metres in length and 5 metres diameter.

The Dörries Contumat vertical turning/milling lathe (VTL), capable of working on parts of up to 5 metres diameter and 3 metres height. It offers full turning, milling and deep hole drilling capabilities for the largest high-value components for the nuclear industry.

The Hexagon DEA Delta, which can measure parts of 6 metres length and 3 metres width, and weighing up to 15 tonnes, to a precision of 5-25 microns depending on measurement range. The CMM extension to the main Nuclear AMRC workshop is vibration-isolated and temperature-controlled, allowing it to work to its optimum performance and deliver the highest standards of dimensional measurement. Large parts can be carried from the main workshop on a 4 metre air table.



Milestones achieved in 2014-15:

- Completion of groundwork, installation and commissioning

Centre expansions

Manufacturing Technology Centre



Aerospace Research Centre

The £30m Aerospace Research Centre is part of an ambitious expansion plan for the MTC, as it embarks on a strategy to lead and establish cultural changes in developing and nurturing the skills needed for future technologies.

The centre, on the MTC's Ansty Park site, is set to provide a national facility for ground-breaking aerospace research in the heart of the UK. MTC engineers will work with experts from the world's major aerospace companies on projects which will define aerospace technology for the future.

The Aerospace Technology Institute (ATI) has provided £15.2m funding for the new 8,000m² aerospace facility. This investment has been matched by funding from industry.



Milestones achieved in 2014-15:

- Formal hand-over of the building
- The centre becomes operational

Advanced Manufacturing Training Centre (AMTC)

The £36m AMTC will address the manufacturing skills shortage by training engineering apprentices on a sponsored or part-sponsored basis, up-skilling manufacturing engineers, and developing graduate engineers and industrial designers.

The AMTC is being developed at Ansty Park with the support of Lloyds Bank. It will be a hub of the National College for Advanced Manufacturing.

The AMTC will significantly contribute towards solving the UK's manufacturing skills shortages. Apprentices will learn the latest technology in areas such as intelligent automation, additive layer manufacture, welding and laser machining. They will test and develop their skills in sponsored placements, as well as in international assignments.



Milestones achieved in 2014-15:

- Roof installed and internal blockwork complete

Forthcoming milestones:

- Building completion
- Opening in September 2015

National Centre for Net Shape and Additive Manufacturing (NSAM)

Chancellor George Osborne announced initial funding of £15m for NSAM in January 2014.

The NSAM will develop processes such as 3D printing for metallic and alloy components for aerospace, automotive and medical products.

The centre will develop innovative, production ready solutions to address the key challenges that prevent widespread adoption of net shape and additive manufacturing processes. The key aims of the centre are to:

- provide a production test bed enabling industry to assess and develop the manufacturing capability readiness level of NSAM processes
- help fast track new processes, material and applications into production
- encompass every stage of NSAM processes so that robust, production ready solutions are delivered to industry, where the entire supply chain has been proven.



Milestones achieved in 2014-15:

- Building completion

Forthcoming milestones:

- Opening in June 2015 by Anna Soubry, Minister for Small Business, Industry and Enterprise

National Composites Centre



WMG Catapult



NCC Extension

£28m of Government funding was announced in December 2012 to enhance the capabilities and capacity of the NCC. The new building houses the latest composites technology, including the world's largest openly accessible high rate manufacturing press for composites manufacturing. This is aimed at supporting sectors such as Automotive, where developing high rate, low cost manufacture of composite components is critical. Even in its first weeks of facility factory trial, the press was already producing parts within just six minutes. In addition, part of the building is being utilised to ensure a sustainable future for the composites manufacturing skills in the UK workforce by bringing together leading businesses, colleges and universities at a world-class facility.



Milestones achieved in 2014-15:

- Building officially opened

Energy Innovation Centre

This £13m facility is funded by the Department of Business, Innovation & Skills. The centre enables electrochemists to create full-size prototype battery cells using novel chemistries without having to rely on battery manufacturers to make the larger cells.

The climate-controlled facility allows WMG's technologists to manufacture, for detailed evaluation and characterisation, pouch cells intended for high density energy storage in electric and hybrid vehicle applications. Pouch cells are contained in flexible, heat-sealable foils that allow them to be tailored to specific shapes and sizes. The new facility also makes high reliability battery electrodes.

The combination of the new Battery Materials Pilot Line with the recently commissioned battery characterisation laboratory and established electric/hybrid drives test facility in WMG's Energy Innovation Centre provides a one-stop-shop for the development of new battery chemistries from concept to fully proven traction batteries, available in sufficient quantities for industrial-scale testing. The post-test facilities will help researchers understand the changes that occur in materials as a battery ages from use or testing.



Milestones achieved in 2014-15:

- Opening of the facility

Hauser review



The success of the HVM Catapult demonstrates the value in building on existing investments in the research base to deliver economic and other impacts, particularly in a time of very limited public funding.

Evidence to the Hauser Review
Russell Group of leading universities

Dr Herman Hauser meets Dr Pamela Anderson, Knowledge Exchange Fellow, at the AFRC

Technology entrepreneur Dr Hermann Hauser was the author of the 2010 report *The Current and Future Role of Technology and Innovation Centres in the UK*, which led to the establishment of the Catapult programme.

Four years later, Dr Hauser was commissioned to review progress made to date, and consider the medium-term scale and scope of an expanded Catapult network of technology and innovation centres over the next 10 to 15 years.

The 2014 Hauser review included an external online consultation, a series of regional stakeholder consultation events and visits by the review team to the current Catapults.

Dr Hauser visited the Advanced Manufacturing Research Centre (AMRC) in June and the Advanced Forming Research Centre (AFRC) in July. He took a tour of both facilities and met a number of businesses who shared their experiences of working with HVM Catapult.

The Hauser review acknowledges the significant levels of industrial demand for HVM Catapult, and the collaborative work between the centres which ensures the impact made by HVM Catapult is greater than the sum of its parts.

Dr Hauser recognises the impact of the HVM Catapult, "There are a diverse range of examples where both small and large companies have undertaken work with HVM Catapult, delivering a commercial benefit that could not have otherwise been achieved, because they do not have access to the equipment and expertise..."

The review notes that the current funding model is key to maintaining a critical mass of activity and leading-edge capability at individual centres and that the significant forecast value add of the HVM Catapult could continue to grow, provided that additional core public funding is secured to match this.

The review's first recommendation is for the UK to maintain its focus and commitment to investing in the existing Catapults, subject to effective performance and relevance, over the long term.



Small and large companies have undertaken work with HVM, delivering a commercial benefit that could not have otherwise been achieved.

Dr Hermann Hauser
Review of the Catapult Network (2014)

Influencing strategy, informing policy

Our track record of success has raised our profile not only among the business community, but also among decision makers.

Our direct interaction with industry on areas of critical importance to technology innovation gives us a unique understanding of the immediate and longer term challenges and opportunities facing UK manufacturing. We share our insights and help to shape strategies to support the future growth and success of UK manufacturing, and we use our collective experience and expertise to inform policy.

We regularly accommodate visits by senior politicians and decision makers at the HVM Catapult centres. In 2014-15, our visitors included the Chancellor of the Exchequer George Osborne, the then Business Secretary Dr Vince Cable, the then Shadow Business Secretary Chukka Umuna, Governor of the Bank of England Mark Carney, the then Director General of Knowledge and Innovation at BIS Sir John O'Reilly and senior Civil Servants from the Department of Business Innovation and Skills and HM Treasury.

We respond to relevant strategic enquiries and consultations. In 2014-15, these included the Wright Review of Advanced Manufacturing in the UK and its Supply Chain, the Dowling Review of Business-University Research Collaborations, the All Party Parliamentary enquiry on the social, economic, and environmental case for remanufacturing, the Manufacturing Landscape study refresh and the Science and Innovation Strategy consultation.

Strategic forums in which we participate include:

All party Manufacturing Group	Member
Advanced Materials Leadership Council	Member
Aerospace Growth Partnership Board	Member
Aerospace Growth Partnership Manufacturing Working Group	Chair
Automotive Council Manufacturing Group	Chair
Automotive Council Technology group	Member
BIS Composites Leadership Forum	Chair
Chemistry Growth Partnership Accelerating Innovation sub-group	Member
Dowling Review of Business and University Interaction	Member
EPSRC Centre for Innovative Manufacturing in Composites Advisory Board	Chair
EPSRC Manufacturing the Future Advisory Team	Chair
Graphene Engineering Innovation Centre Industry Advisory Panel	Member
Industrial Biotechnology Leadership Forum	Member
Metals Forum Metals Strategy Steering Group	Dep Chair
Metals Forum R&D and Innovation sub-group	Chair
Nuclear Industries Council	Member
Nuclear Innovation and Research Advisory Group	Member
Nuclear Decommissioning Authority	Member
Royal Academy of Engineering Awards Committee	Chair



Thanks to the Catapult network, and the progress made by Innovate UK through its various programmes, we now have the innovation infrastructure capable of helping us scaling up our public and business investment.

HM Treasury and Department for Business
Innovation and Skills
Our Plan for Growth: Science and Innovation (2014)

The AMRC Dorner double rapier weaving loom, manufactured specifically to handle carbon fibre, but capable of weaving many reinforcing fibres and of producing single and double layer cellular structures

What's being said about HVM Catapult?



The network of Catapult centres therefore offer a real opportunity for SMEs to increase the success of their innovation strategies by providing access to cutting-edge equipment and highly skilled researchers. As the catapult centres represent a partnership between researchers and industry, they will also produce research that is focused specifically to meeting industrial needs. Reflecting their value to the sector, already 1,500 manufacturers have engaged with the High Value Manufacturing Catapult.

EEF, *Manufacturing Britain's Future* report, 2014



Britain is historically very good at making scientific discoveries but not turning these ideas into businesses. The NCC is part of the network of Catapult Centres across the country that is helping us to do just that – providing jobs and a stronger economy.

Dr Vince Cable, then Secretary of State for Business Innovation and Skills, at the NCC



...These (the Advanced Manufacturing Research Centre) and other catapults can make a real difference by backing the revival of manufacturing in our country.

Prime Minister David Cameron, in response to a question by Andrew Jones MP



We welcome the Chancellor's announcement of extra funding for the High Value Manufacturing Catapult to meet additional demand and crucially to provide outreach and technical support to SMEs. That was a key 'ask' of the MTA's Autumn Statement submission and we believe is necessary to help unlock the potential of the UK's SME manufacturers.

James Selka, CEO, Manufacturing Technologies Association



We will provide £61 million funding to the High Value Manufacturing Catapult to meet increasing demand and provide outreach and technical support to SMEs.

HVM and BIS Plan for Growth; Science and Innovation (2014)



...this [HVM Catapult] is such an important part of the industrial landscape now in Britain that it would be madness now for any future government [...] to undermine it or change it...

Then Deputy Prime Minister Nick Clegg at Farnborough Airshow



Unite believes the High Value Manufacturing Catapult is a catalyst for the future growth and success of manufacturing in the UK. The Catapult brings a number of research centres together to develop manufacturing technologies and as such bridges the gap between early innovation, where the UK has traditionally been strong and industrial scale manufacturing, where the real wealth is created and growth in the economy is driven.

Unite the Union, submission to the Wright review



Shared access to expensive capital equipment is useful. But the real promise of Catapults is their ability to bring researchers and business people together, so that we can realise more value from the strengths of both.

The Wright Review of Advanced Manufacturing in the UK and its Supply Chain, 2014



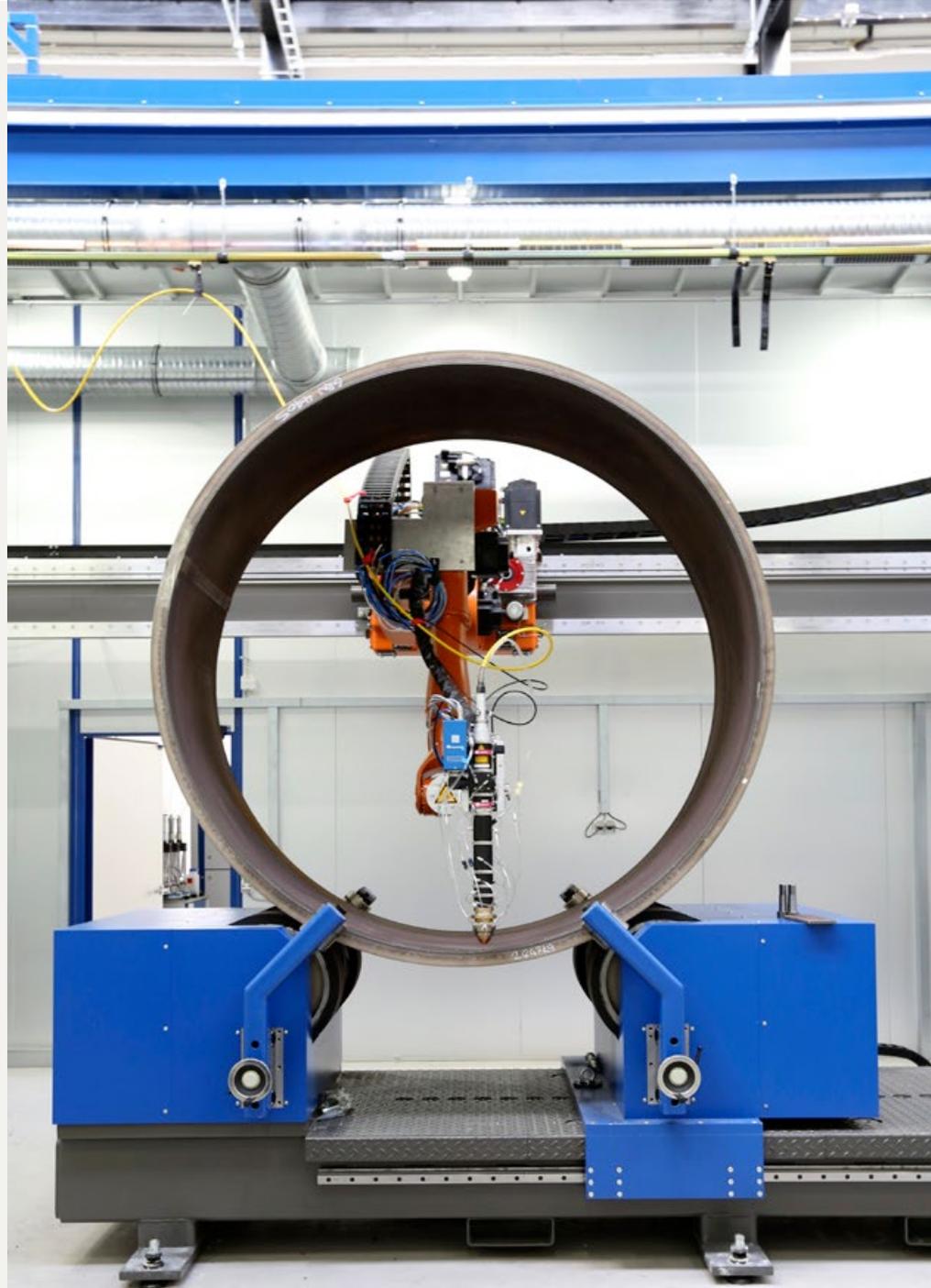
Agenda 2030 will put Britain at the vanguard of innovation, with new ideas and new solutions to the problems of tomorrow and today. We must make it a priority to invest in our science base and in our national system of innovation, in the Technology Strategy Board, and the Catapult centres.

Chukka Umuna at the Global Manufacturing Festival, Sheffield



I hope that support for the existing Catapult centres will be enhanced to make sure they stay at the cutting edge of technology and keep Britain at the forefront of manufacturing excellence.

Terry Scuoler, Chief Executive, Engineering Employers Federation



The Nuclear AMRC Diode laser cell, with 15kW laser, used for high-quality cladding of safety-critical parts

International engagement

In response to the opportunities and challenges of an increasingly globalised manufacturing environment, international engagement forms an important part of HVM Catapult's work to grow the contribution that manufacturing makes to the UK economy.

International engagement during 2014-15 has been mainly focused on the European Union and HVM Catapult has undertaken a broad range of activities in order to:

- Raise the profile of HVM Catapult in Europe;
- Influence manufacturing related policy and work programmes;
- Develop beneficial partnerships for future collaborative R&D; and
- Secure EU funding to deliver HVM Catapult objectives.

These activities included:

- Maintaining an understanding of the landscape – innovation mechanisms and actors;
- Targeted stakeholder engagement and networking – both directly and via an extended enterprise;
- Identification and membership of key boards and forums;
- Membership of and participation within relevant EU associations i.e. EARTO and EFFRA; and
- Participation in EU funding programmes such as Horizon 2020 including project development and delivery with industry EU consortia.

As a result of the work done this year, HVM Catapult is now an established and well respected organisation on the European stage. In spite of intense competition and unprecedented levels of oversubscription, HVM Catapult centres have been successful in securing collaborative projects from the Horizon 2020 programme. For the longer term, effective stakeholder engagement has ensured that the HVM Catapult is increasingly well positioned to perform strongly in the international arena.

HVM Catapult has also turned its attention to international engagement beyond Europe and has been actively engaged in the Government funded Manufacturing Landscape study in order to better understand which international countries and regions might be suitable for collaboration and in turn helping indigenous UK manufacturing to grow and be more profitable and supporting inward investment into the UK.



Did you know?

In 2014 the UK secured 25% more manufacturing FDI projects than Germany.



The High Value Manufacturing Catapult is a valued member of EARTO. They are a very active participant in our network and have made great contributions to the efforts of EARTO presenting RTOs as key actors in innovation ecosystems contributing significantly to a competitive European economy.

Muriel Attané
Secretary General, European Association
of Research and Technology Organisations



Events

The HVM Catapult centres held numerous events throughout the year, ranging from showcase events aimed at businesses, training workshops, seminars, lectures and exhibitions. In addition, the HVM Catapult participated in a range of large industry shows and provided keynote speeches at major manufacturing related conferences and events. This chapter presents a selection of the events we took part in during the review period.

Apr

May

Jun

Jul

Aug

Sep

MACH 14 – the UK's premier manufacturing technologies show

HVM Catapult had a stand presence in the trade zone, as well as the education zone of the show. With over 600 companies exhibiting, and over 6,500 tonnes of live working machinery on display, MACH 14 attracted over 23,000 visitors across diverse sectors of UK Manufacturing.

National Manufacturing Debate, Cranfield University

HVM Catapult CEO Dick Elsy, was on the discussion panel at the Debate, which focused on the issue of manufacturing productivity in the UK. Cranfield University, jointly with the ERA Foundation, carried out a national survey into manufacturing productivity in the UK, the results of which were published as a White Paper.

The Royal Academy of Engineering summer soiree

The Royal Academy of Engineer annual summer soiree was held at the MTC, in the presence of HRH The Duke of Kent, Royal Fellow of the Academy. In addition to networking opportunities, high level delegates enjoyed an interactive exhibition showcasing the inspiring and innovative research that will ensure a bright future for UK manufacturing.

Farnborough International Airshow

The HVM Catapult had a large corporate presence alongside Innovate UK at the show's Innovation Zone, organised by ADS group. Throughout the show, HVM Catapult staff engaged with industry delegates from the UK and overseas, HVM Catapult technical experts led technology seminars and hosted a visit by then Deputy Prime Minister Nick Clegg to the stand.

CENEX Low Carbon Vehicle Event

HVM Catapult exhibited alongside the other Catapults at this event, which is the UK's premier low carbon vehicle event, hosted at Millbrook. LCV2014 had a record attendance, with 2,451 visitors, 181 exhibitors and 952 organisations represented. Both WMG and MTC showcased their specific capabilities at the show, and MTC provided a seminar presentation.

EPSRC Manufacturing the Future Conference

The AFRC exhibited and spoke at this event, as well as showcasing a video on the way AFRC involved local schoolchildren in the centre. The conference provided a national forum where the community involved in manufacturing research, innovation and training in the UK could come together to share experience, progress and challenges in progressing UK manufacturing.



The HVM Catapult hosted 'Advanced Engineering In Action' feature stand has been at the heart of the 'Advanced Engineering UK' show for two years running, showcasing each time an exciting array of feature examples from UK innovation-based programmes that have benefited directly from 'Catapult' input. We know visitors of the show are enthused and inspired by how well UK manufacturing is doing, and the Catapult is clearly instrumental in helping to make this happen.

Ian Stone, Managing Director, UK Tech Events

Organisers of: *The Advanced Engineering UK* group of events



Dick Elsy at the National Manufacturing Debate



Professor Sir Mike Gregory at CPI Conference: From Innovation to Commercialisation

Oct

Nov

Dec

Jan

Feb

Mar

Building the Future for Composites

Dr Vince Cable, then Secretary of State for Business, Innovation and Skills, formally opened the new NCC facilities at the Building the Future for Composites event in Bristol. More than 400 delegates attending the event and enjoyed demonstrations of cutting-edge manufacturing capability, including the new High Volume Manufacturing Composite Press.

CPI Conference: From Innovation to Commercialisation

CPI hosted the 'From Innovation to Commercialisation' conference with the aim of reviewing and evaluating the current status of the UK process and manufacturing industries. Chaired by the BBC's Steph McGovern, the 120 partners, customers, stakeholders, civil servants, and academics in attendance heard key contributions from leading industrialists and policy makers, including a keynote address from Dr Vince Cable, then Secretary of State for Business, Innovation and Skills.

Low Carbon Racing & Automotive Show (part of Autosport International)

WMG exhibited at this new international trade and business event at Autosport International – Europe's largest indoor pre-season motorsport event, creating value for companies and professionals in the low carbon automotive technology sector.

Factory 2050 Conference

AMRC and Nuclear AMRC hosted the Factory 2050 Conference, focusing on the world's first totally reconfigurable factory and soon to be the AMRC Integrated Manufacturing Group's new home. The programme included presentations from academics and industrial end users, exhibitions and demonstrations, as well as networking opportunities. The conference focused on the technologies and systems which will feature in Factory 2050.

Earto Policy Event, Brussels

The European Association of Research and Technology Organisations – EARTO – held its 2014 Policy Event in the presence of some 200 participants. Highlights of the event included the publication of EARTO recommendations for future EU innovation policy as well as a keynote address from European Commission's Director-General for R&I, Robert-Jan Smits, who welcomed the paper and the European Commission's long standing history of cooperation with EARTO. HVM Catapult were panellists representing EARTO at the event.

Innovate UK 2014

HVM Catapult exhibited alongside the other Catapults at the annual Innovate conference and exhibition, putting the global spotlight on UK innovation. With over 3,325 delegates attending the event, 5,000 people watching the live stream, 140 exhibitors, 1,000 facilitated One to One meetings with buyers and experts, 6 live stages and 269 speakers, this year was the biggest event to date.

Advanced Engineering Show

With a record total attendance of approximately 13,000 from all parts of the advanced engineering supply chain, this year's 'Advanced Engineering UK group of events' cemented its position as the UK's largest annual event for the advanced engineering sector. For the second time, HVM Catapult organised the central Advanced Engineering in Action feature stand, showcasing the best of UK manufacturing and highlighting the technology capabilities on offer in the HVM Catapult centres.

EEF National Manufacturing Conference

This flagship event brought together the 'who's who' of manufacturing, politics and media. High-profile speakers at the event included Prime Minister David Cameron and Ed Miliband MP. Dick Elsy took part in the panel debate on 'sustaining the renaissance, 20 years on'.



An industrial revolution that begins in a sandpit.

The Catapult programme offers businesses from start-ups to Rolls-Royce the chance to 'develop technology in a world-class environment'

The Times, 19 August 2014



Cutting edge fibre placement technology at the AMRC

HVM Catapult in the media

2014-15 media features

2,065

↑ Up 15% from 2013-14

Percentage outside of the UK

51%

↑ Up 58% from 2013-14

Most publicised news story of 2014-15 – CPI Windowless plane:

Hits on YouTube:

4.46m

Shares:

5,000

Retweets:

4.92m

Twitter reach:

98m

Media events:

12,300+

Including: CNN, The New York Times,
BBC News, The Telegraph, The Independent
The most visited story in the Guardian business section.

HVM Catapult in the media

THE Manufacturer
www.themanufacturer.com

"That is why the Catapult centres are so important for securing future economic growth, and ensuring that not only can we seize new global opportunities, but more importantly that we can leave the competition trailing in our wake."

Daily Mail

"'Catapult' network aims to harness Britain's technological knowhow and convert it into commercial success."


THE SUNDAY TIMES

"Britain's efforts, meanwhile, are focused on its network of seven high-value manufacturing technology centres around the country, established to bridge the gap between Britain's world-class universities and industry. The centres have received £100m of funding since 2011, more than matched in the past year by £65m from industry and £44m in research and development grants."

newelectronics

"Magnificent Seven ride to the UK's rescue"
"This was Rolls-Royce doing key product and process development in a Catapult Centre, then building a factory to put the technology, developed in the Advanced Manufacturing Research Centre in Rotherham, into a production environment."

The Mail
ON SUNDAY

"High Value Manufacturing Catapult, [which] is aimed at spurring development in new and emerging technologies."

theguardian

"Companies use machines which would normally be dedicated to jobs in their own facilities to test new ideas and resolve bottlenecks in production with the factory staff without interrupting production..."



THE TIMES

"The high-value manufacturing catapult is the most established of the seven and will receive £30 million a year of government funding. It is focused on using technology to produce dramatic improvements in the productivity and efficiency of Britain's factories."

theguardian

"Part of the way the CPI operates is to identify challenges in industry – such as the windowless plane – and develop ways to overcome them."

FINANCIAL TIMES

"Industry is enthusiastic about the £528m devoted to funding the so-called Catapult centres, which aim to speed up the commercialisation of innovative research."

The Telegraph

"Embracing the Catapult's output could be key to ensuring Britain keeps its standing – or improves it – in manufacturing"

THE SUNDAY TIMES

"These [HVM Catapult] centres are crucial because they provide a bridge between university funding, research grants and the private sector."

THE Manufacturer

www.themanufacturer.com

"CPI and the Catapult centres are making rapid progress in helping UK businesses to accelerate the commercialisation of new and innovative technologies such as graphene."

newelectronics

"The Catapult Network is set to propel UK industry into a new era of prosperity."
" Early success, particularly at the High Value Manufacturing Catapult, indicate that it is a strategy with huge promise."

THE TIMES

"The decision to build the factory in the UK was a result of Rolls-Royce's work with the high-value manufacturing Catapult to develop processes that cut the time to make a disc by half."

OLED display technology in the windowless aircraft
© Centre for Process Innovation Limited

National College for Advanced Manufacturing

The HVM Catapult's 'foresight' of tomorrow's production scale technologies in its specialist centres gives it a unique opportunity to contribute to the challenge the UK faces of providing sufficient skilled technicians and engineers to meet the needs of a re-emerging and expanding manufacturing sector.

The HVM Catapult centres all work on ground-breaking process and technology innovations that will become common place on the manufacturing shopfloors of tomorrow. Industry will only fully exploit the potential of these innovations if there are enough UK engineers and technicians who fully understand the technology, its capability and its potential. Much of this 'new knowledge' comes from the learning that takes place as these new technologies progress from prototype to production proven concepts within our centres, long before industry has started implementing them.

Our HVM Catapult Skills Group links up the training activities across the centres and has developed a plan for the future role of HVM Catapult in skills delivery. After extensive dialogue with BIS in 2014, then Business Secretary Dr Vince Cable announced the concept of employer-focused National Colleges, which would combine academic knowledge with practical application.

His announcement was followed by the publication of a Call for Engagement (CfE) to which HVM Catapult responded, proposing a UK wide network of advanced manufacturing training capability centred on the HVM Catapult's centres of innovation. We took the opportunity to link up with the Engineering Employers Federation (EEF) and in December 2014, the then Secretary of State formally announced that the Government intended to work with the HVM Catapult and with EEF to establish a National College for Advanced Manufacturing (NCAM).

NCAM will build on the already established training capabilities of the HVM Catapult centres, link this to other centres of innovation in manufacturing and work with the best established education and training delivery organisations to create a UK-wide network of advanced manufacturing training delivery.

In partnership with the EEF, who will work with their membership and the Industrial Strategy groups, we will understand the advanced manufacturing skills needs of UK industry. We will put in place the necessary facilities, training staff and curriculum in to which we will add the HVM Catapult 'foresight' of emerging technologies to create a nationally recognised programme of level four to seven higher vocational engineering training that will carry the NCAM excellence kitemark. It is expected that the National College for Advanced Manufacturing will commence pilot operations in September 2015 and be fully operational from September 2017.

This is an ambitious but essential undertaking if the UK is to achieve a rebalanced economy over the long term and both HVM Catapult and EEF are committed to making it a success.



Did you know?
Average starting salaries for engineering graduates are >10% higher than other graduates



Emergency Contact & Safe Mode Procedures



Evidence demonstrates that skills shortages – where businesses cannot recruit the skilled people they need – hinder productivity performance.

UK Commission for Employment and Skills
Growth through People, 2014

Innovate friction welding techniques for future manufacturing at the MTC

HVM Catapult
The Oracle Building
Blythe Valley Park
Shirley, Solihull
B90 8AD

hvm.catapult.org.uk
+44 (0) 121 506 9780
@HVM_Catapult

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