

# Design in Technology Research Partnerships in action

A Design Council and EPSRC project

**EPSRC**

**The big picture**

### Design - who needs it?

The UK is a world leader in scientific discovery, but we lag behind global competitors when it comes to translating it into commercially successful products and services.

The Design Council believes the skills and thinking of designers can speed technology's journey from the laboratory to the marketplace, benefiting businesses and the UK's economy.

Design can make unique contributions to technology development. Its focus on the needs of end-users and its ability to anticipate how those needs may change can help pinpoint applications. Design methods can clarify and map development timetables and routes to market. And designers' ability to prototype and visualise possibilities can aid communication with key players in the commercialisation process, such as investors.

For these reasons, we also believe design has most value when it is deployed from the earliest stages of technological development.

We are already working directly with early-stage technology businesses to embed design into how companies think and work. Businesses have attracted vital investment funds, shortened time to market and cut risks as a result.

### Design in Technology Research – the project

We believe design can make an equally powerful contribution to technology research within our universities. To test this belief, we have run a pilot project - Design in Technology Research - with the Engineering and Physical Sciences Research Council (EPSRC).

### What did we do?

Over a three month period, six designers teamed up with six Engineering Advanced Fellows. Designers were briefed to:

- Identify opportunities for commercialising the technology
- Do preliminary design work
- Map out a development path for the

researcher's project

- Provide a written report on the work's results.

Our six researchers are at different stages in their projects. All are working on highly innovative and promising technologies. All of them chose to take part either because they were curious about design or because they wanted practical help in commercialising their technology.

We wanted to know how they worked with their designer and how the collaboration affected their research. We also wanted to know what they discovered about design as a discipline and what they thought about this project.

After the pilot, we held a debate for designers, researchers and others involved in commercialising research. They ranged from DTI representatives to staff from technology transfer offices - a full list appears at the end of this report. The aim was to share our findings and start a discussion on design's role in research going forward.

This report combines the results of the pilot with the key points from the debate.

### What did we find?

#### What's design's contribution?

The researchers were mostly surprised at how broad a contribution design could make. Even though the project was short, the designers' input exceeded their expectations. The researchers went into the project with the belief that design was mainly focused on shaping or styling industrial products. Instead, through the project, design input gave the researchers a clearer idea of the commercialisation process and fresh insight into potential applications. It also gave them a way to get their ideas across to others and it provided insight into users' needs and the value of market testing.



*'I have become a lot more focused in what I'm trying to do. User centred design was what I needed and having contact with designers means I understand more about the types of design available.'*

Andrew Davison, researcher

The researchers found designers could act as their mentors, a role they found particularly valuable because much of their work is highly focused, specific and often done in isolation. Designers introduced a completely new perspective which helped the researchers challenge and question their technologies.

Debate participants agreed on the breadth of designers' skills, but how unique is their contribution? Can't marketers, business strategists, production engineers or project managers provide the same help just as effectively?

University of Cambridge lecturer in Design, Innovation and New Product Development James Moultrie stressed the 'deeper skills' that made designers unique: 'They have a broad perspective but it's their divergent thinking, their people focus and their ability to visualise that gives what they offer a more powerful edge.'



James Moultrie, University of Cambridge

Design in Technology Research  
Partnerships in action

The big picture



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The big picture



brainstorming or market definition work that characterised this initiative. Design Council Design & Innovation Director Richard Eisermann acknowledged the point: 'Many designers have little interest in the type of work done in this project - they are too outcome focused. Unfortunately, these are often the designers that businesses are most comfortable working with.'

Stephen Elsby, EPSRC

The need to find the right designer for each research project was another key issue raised both by researchers, several of whom advocated making the choice themselves, and debators. Designer Pat Jordan thought some 'traditional' designers might restrict themselves to usability and functionality, preferring to side-step the roadmapping,



Jennifer Whyte, Imperial College London



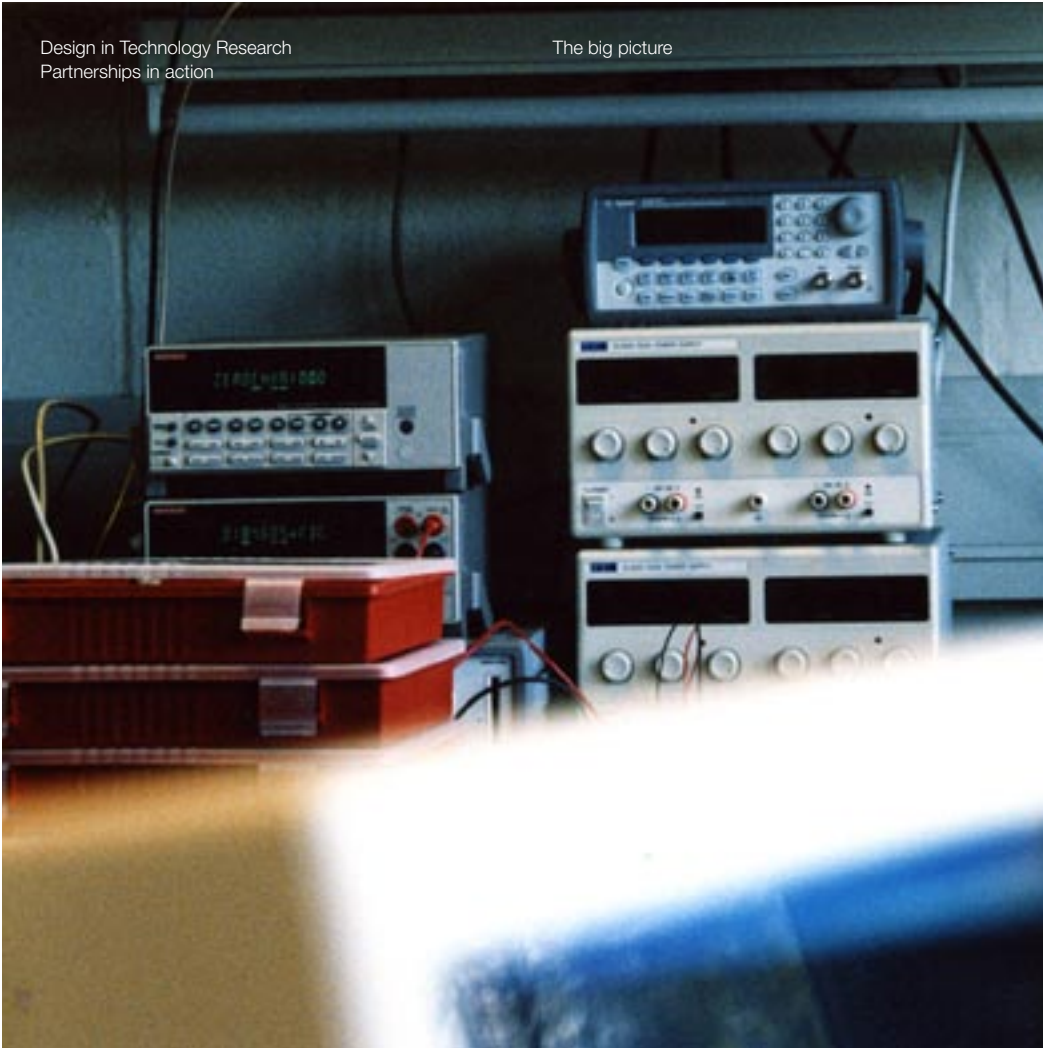
*'Investors are into words – if you show them a picture they get terribly excited. We do a little work on a raw piece of technology and they're ecstatic, thinking it's almost "done". It's not, but in the meantime they get to see potential.'*

Mike Pearson, designer

Half the researchers say design is now more important to them because of the project, while two say the work confirmed an already positive view of design.

The project also underlined some of the challenges inherent in combining research with design. The cultural differences between designers and researchers are significant, not least their ways of working – researchers generally work alone, while many design methods, such as brainstorming, are based on teamwork. But both the project and the debate uncovered common ground. Pat Jordan felt the two disciplines – exploratory in their different ways - could be complementary. EPSRC's Susan Morrell added that design input could help researchers realise the creativity in their own work, and that in turn could lead to new, broader ways of thinking about the research's potential.





### When is the right time for design?

Despite broadly positive experiences on the project, the researchers disagreed about the right time to introduce design. Some believed it was needed from the start of research, some thought it should be used 'when you need it' and others felt it was best deployed in the later stages of research. In two cases, researchers agreed with designers that their core research was 'too abstract' for design to have an impact, and the pairings chose other areas to work on as a result.

These differences could point to design being most effective in the early stages of applied research focused on tangible products and services, but in the later stages of fundamental, curiosity-driven research which investigates new methodologies.



*'On all my projects, I'd like to see a box I can tick to ask for a designer.'*

Steve Morgan, researcher

There was broad agreement on this in the debate, but the discussion raised fresh questions. For instance, could design have a role in the early stages of fundamental research, helping researchers communicate their ideas and activities beyond the tight circle of the research department? And how can researchers identify when they need design input, especially if, like some, they're solely focused on science, not its exploitation, and see commercialisation as 'somebody else's job?' Designer Matthew Grey said designers themselves could judge the right time for their input if they and other external advisors were brought in 'on day one' to help plan the project. University of Cambridge researcher Martyn Dade-Robertson added that design had to be made attractive to researchers: 'If they're given enough reasons for thinking there will be a positive outcome, they will engage with it.'



*'A designer can step in when the researcher is trying to communicate their ideas to people outside their immediate research area.'*

James Kelman, researcher

All the researchers said they would recommend similar initiatives to colleagues. And they agreed that design thinking should be taken on board as early as possible in needs-driven research centred on specific technologies.

The project also exposed the contradiction between the need for academics to publish their research and the need for business people to protect their intellectual property.



*'Researchers frequently value career over IP but funding bodies will not fund things without IP.'*

Mike Pearson, designer

**The details**

## Dr Philip Langley, University of Newcastle and Mike Pearson, Pearson Matthews

### The research

Philip's research could help to predict and detect the abnormal heart rhythms that lead to strokes and heart attacks, and it could reduce the need for surgery.

The research, currently at an early stage, is focused on how the heart's upper chambers, the atria, relax between beats, as this may be a significant factor in causing abnormal rhythms. Currently, this activity is difficult to measure, as electrocardiograms (ECGs) tend to be dominated by the larger signals generated by the lower chambers, the ventricles. So the research is aiming to find better ways to measure relaxation of the atria through new electrode placements and refined techniques for processing signals.

Philip, from the Medical Physics Department of the university's School of Clinical and Laboratory Sciences, is working with cardiologists at Newcastle's Freeman Hospital.

### The design

A chance remark by Philip led to Mike opening up new possibilities for applying his research. And the project has also created another commercial opportunity that could help accelerate the work.

Mike had pinpointed several product opportunities for the research, including an over-the-counter early warning device, a monitoring device capable of sending data to a medical centre via a mobile phone and a custom electrode set for self administration. These ideas were based on the main scenarios Mike envisaged for the use of any technology, which were based on regular screening of the over-50s. Mike also came up with alternative uses for the technology, including foetal monitoring and the detection of faint noises such as leaking pipes.

But Philip's remark that standard ECG monitoring through a toilet seat would make

a good design project was the spark for a full design brief. Mike and colleagues at Pearson Matthews set out to create an electrode set that needed no training, created effective contact with skin and could be used as part of a normal daily routine without demanding undue motivation from the user.

*'There should be continuous interaction between researchers and designers from the outset of projects to commercialisation of technologies.'*

Philip Langley, researcher

The result was six different concepts for electrodes, including suction caps which change colour in response to positive or negative signals, tightly fitting wearable fabric incorporating electrodes, and a silicon bathmat with integral electrodes.

Philip says the project has given him a clearer idea of the opportunities for his technology, with self-diagnosis equipment the most significant. Importantly, working with Pearson Matthews also opened up the possibility of developing a new measuring device, which, as well as having commercial potential, could help him gather research data. The two are now looking into ways of continuing this work beyond the project.

While design hadn't figured in Philip's research at all before the project, he says it now will, to the extent that future applications for funding will include a budget for designers.



**Dr Andrew Davison, Imperial College,  
London and Matt Marsh, firsthand.**

**The research**

Andrew is working on 'intelligent camera' technology which can generate real-time computerised 3d models of surrounding environments. The work combines programming, electronics and robotics. Wide ranging potential uses for the resulting technology include enabling robots to explore hazardous environments and enhancing 3d games by allowing virtual objects to be inserted into live video.

Andrew saw the project as a good way to get a commercial perspective on his 'already eye-catching technology' and where it could go.

**The design**

Matt immediately saw strong, low-cost potential for the technology in an emerging consumer robotics sector, where its affordability could lead to robots capable of anything from mowing the lawn to providing home security. As a result, Andrew focused solely on the domestic possibilities for his technology. Working with Matt led to new insights into users' needs and market testing, and it made Andrew concentrate on specific aspects of the technology as a result.

The input helped him clarify his ideas for presentations to two would-be research partners from Bristol University, and it also helped him put together an application to the university for seed funding.



*'Most technologies are bought by real people and have real benefits and real value. The designer can help with the proposition so people are prepared to invest in these technologies.'*

**Matt Marsh, designer**

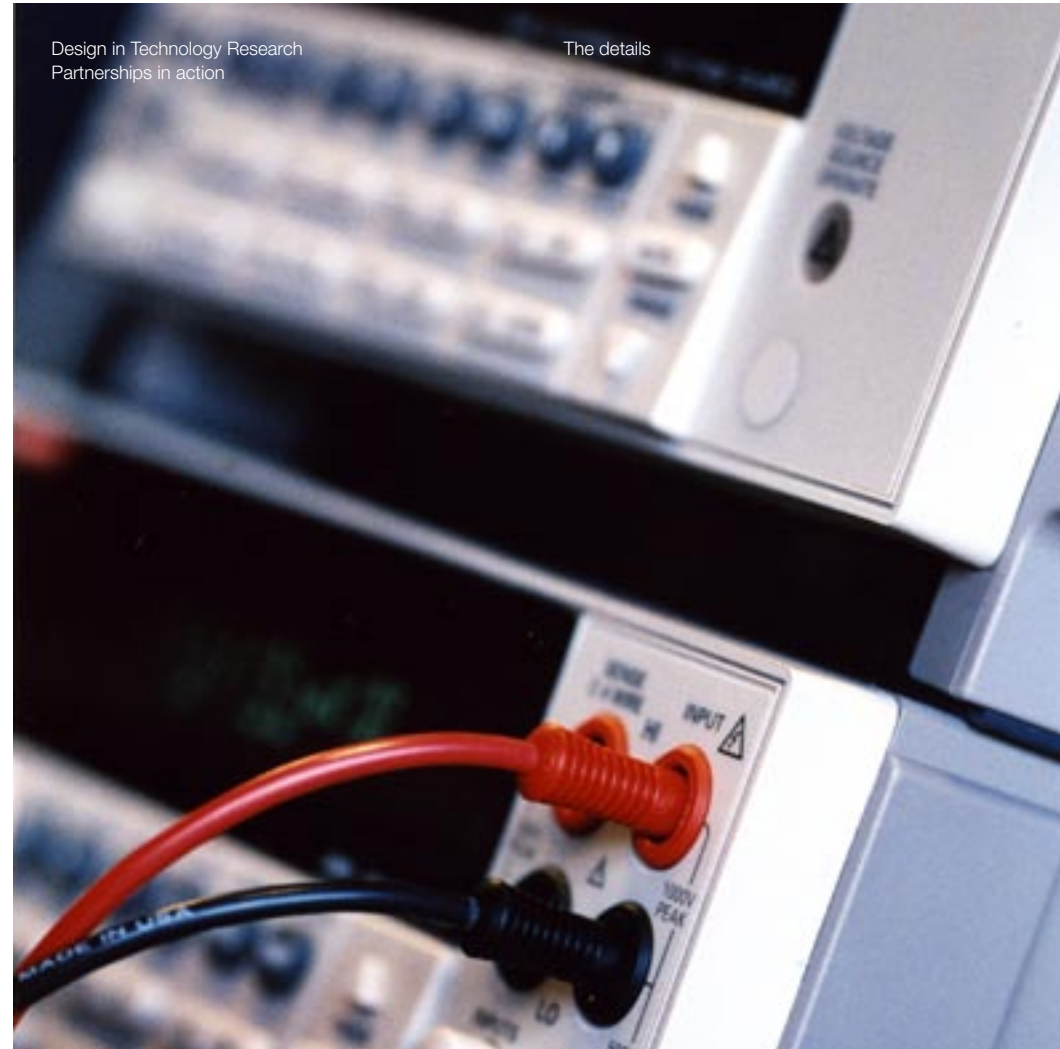
The project influenced Andrew's view of design's potential. With hindsight he would have liked design involvement from an earlier stage in his current work because, he said, design principles push researchers to think not just about the invention but the people who will use it and so help turn technology into saleable products. He valued the way Matt helped him narrow down markets and potential uses and dismiss unrealistic possibilities for his technology.

Andrew found that designers' contribution could go far beyond industrial design and said Matt's input led him into new territory. Andrew visualised a potential product and matched the design to its users' needs, while a roadmapping exercise with Matt helped him work out how to move on from the invention stage to setting up a business.



*'I would like to have brought in designers at an earlier stage... In future, I'd like flexible access to designers with different expertise.'*

Dr Andrew Davison, researcher



**Dr Steve Morgan, Nottingham University  
and Pat Jordan, Contemporary Trends  
Institute**

**The research**

Steve is developing an optical system to produce imaging of skin tissue. He has divided his work into two projects to pursue the main uses he foresees for the technology - imaging blood flow in the skin and imaging the movement of red blood cells in sickle cell patients. The technology is centred on a combination of conventional and 'smart' optical sensors (arrays of photodiodes with on-chip processing that can image signals which conventional technology cannot detect). There is already commercial interest in producing a device for skin imaging.

Steve embarked on the project to get practical support in designing a device as well as input into the wider issues of project design.

**The design**

Pat and Steve used workshop methods to define the uses of the technology and possible markets. This led Steve both to broaden the range of medical conditions it could monitor and to explore how to increase the technology's commercial viability by gearing it towards a portable device for patients as well as equipment for clinicians.

Steve expected to get help with the aesthetics and user interface design of a possible device, a view he now sees as 'narrow' in the light of Pat's more comprehensive, commercially orientated input, which helped to shape his overall thinking about the research.



**Pat Jordan, designer**

The project gave Steve a clearer idea of how to get his technology to the commercialisation stage and the most valuable outcome for him has been increased clarity about where his work is heading, particularly in terms of intellectual property protection and target markets.



*'Thinking about design from the start of a project is very important. If you get things right at the beginning you can avoid problems in the future.'*

Dr Steve Morgan, researcher

Steve is now convinced that design input would be valuable from the start of a project. He does foresee complexities in managing design and but believes they can be overcome through access to a team of designers which could help with planning the work itself.



**Dr James Kelman, Cranfield University  
and Matthew Grey**

**The research**

James is working on laser imaging technology to help monitor the shape of sails in response to wind. Initially, the focus was on helping yachtsmen trim sails more effectively at night by projecting a laser line on to a curved sail surface, so allowing them to see the sail more clearly.

**The design**

Matthew thought the technology could play a role in optimising performance of racing yachts. He emphasised the importance of identifying a precise market segment and presenting the technology in the right way, having first taken steps to identify and protect intellectual property.

The project led to a prototype being developed, but following industry feedback this was abandoned in favour of a more sophisticated version of the technology capable of measuring and recording sail shapes with a mixture of pulsed laser and photodiodes. The main challenge now is making a mast-mounted unit small and light enough or a deck-mounted unit that is sufficiently accurate.

*'Design has its place in product development but it shouldn't be left out of planning. Very often, industry (or research) feels it knows exactly what design is for and doesn't consult early on. The result is a technology plonked in front of a designer that could have been so much better had the designer seen it sooner.'*

Matthew Grey, designer

James said the design input had relatively little impact on the research itself, or on his understanding of design, which remains rooted in industrial design and functionality. He said design was embedded in his research from the start because of his background in design engineering.

James believes a researcher should seek design help when they 'get stuck' in turning the technology into a product, a problem he hasn't faced. Nevertheless, he said Matthew gave him useful insights into how to develop the technology, approach potential clients in the sailing industry and communicate the technology's potential. He would also recommend a scheme like this one to colleagues.

## Dr Bo Su, Bristol University and Ross Kinneir

### The research

Bo is developing a technology that will make it easier and cheaper to make very hard-wearing ceramic material. As he works in a medical department, he focused initially on medical applications including dental care and orthopaedics. He has since broadened his thinking to take in fine art, jewellery and craft products.

### The design

Work with Ross included a brainstorming session and a roadmapping exercise to plan steps towards commercialisation, as well as planning a collaboration with University of East Anglia researchers keen to use the technology in replicating ancient artefacts.

Bo says the most valuable aspect of Ross's input was the way it opened up more possibilities for his technology beyond the

medical uses he had envisaged. Ross also enabled the production of a prototype through the University of West England ahead of a meeting with the UEA researchers.

Bo feels it is important to work with a designer who is expert in the researcher's own field, though given the basic nature of his research he is most comfortable with design input at a later stage. Nevertheless, he did think the project would benefit research with a stronger engineering focus.

Although Bo had no prior experience of design, he says the input from the project has not changed his plans for commercialisation because he already has some knowledge of technology transfer. He added that he would probably have sought outside help to get the input he received from Ross, but would not have expected to get it from designers.



Ross Kinneir, designer

**Dr Matthew Wright, University of Southampton and John Boulton, Product First**

**The research**

Matthew is using quantum physics to get a new understanding of the vibration patterns of solid objects. But he and John agreed that while this was a feasible project for their collaboration, the more generic issue of design input into the culture and organisation of research departments might provoke an interesting debate. Matthew's department was used as the focus for the study.

**The design**

Matthew and John looked at how the department was organised and at how space in its building was used. They focused on issues including communications, culture and brand management as well as team interaction. The project became an investigation of how design could trigger new ways of thinking and working, with Matthew

and John devising posters that could raise debate on these issues. For instance, one asked whether better coffee would promote better informal meetings, while another asked whether better-lit, warmer corridors would lead to better interaction through 'constructive lingering'.

Matthew felt the work might contribute to a possible research project on the layout of engineering departments.

Matthew says he has a high degree of interest in using design and that it had already figured in his EPSRC fellowship because his research involves the development of technology that automates certain design processes. He believes the timing of design input into research depends on the nature of the technology and that much depends on the researcher's personal motivation to get external support.



John Boulton, designer

**Now what?**

The project and the debate that followed raised fundamental questions about design's role in research. There was broad consensus that design has a valuable contribution to make at certain stages in research, but that it's currently under-utilised, not least through lack of profile and funding. The initiative as a whole has pointed the way to steps that need to be taken for design to become part of the UK's academic technological research set-up.

Here are some of the issues we'll be investigating next:

**Evidence** – if design works, where's the proof? Case studies on successful tie-ups between designers and both technology businesses and researchers would help to show what design is for and create a demand for it.

**Access** – even if researchers want design, how do they get it? A service – possibly offered through technology transfer offices - that identifies researchers' needs and finds the right design expertise to meet those needs could be a key catalyst in starting successful collaborations.

**Visibility** – if researchers don't know design exists, how can they ask for it? Making design more visible in the process of planning research and applying for funding will be a key factor in helping researchers realise it is part of a range of support skills and services they could call on.



**Project and  
debate participants**

Fiona Bennie – Design Council

Max Bielenberg – Design Council

John Boulton – Product First Ltd

John Cass – Imperial College London

Andrew Clark – Engineering and Physical  
Sciences Research Council

Martyn Dade-Robertson –  
University of Cambridge

Andrew Davison – Imperial College London

Jan Dekker – Design Council

Richard Eisermann – Design Council

Stephen Elsby – Engineering and Physical  
Sciences Research Council

Matthew Grey – Designer

Georgina Jarvis – Design Council

Pat Jordan – Contemporary Trends Institute

James Kelman – Cranfield University

Ross Kinneir – Designer

Peter Leverkus – Cranfield University

Roger Lewis – University of Sheffield

Finbarr Livesey – Institute for Manufacturing,  
University of Cambridge

Maja Maricevic – London Development Agency

Matt Marsh – Designer, firsthand.

Steve Morgan – University of Nottingham

Susan Morrell – Engineering and Physical  
Sciences Research Council

Lesley Morris – Design Council

James Moultrie – University of Cambridge

Peter Munday – The Department of Trade  
and Industry

Alessandro Muscio – Technopolis Limited

Mike Pearson – Pearson Matthews Design

Ellie Runcie – Design Council

Ben Ryan – Engineering and Physical  
Sciences Research Council

Jennifer Whyte – Imperial College London

The Design Council improves prosperity and well-being in the UK by demonstrating and promoting the vital role of design.

The Engineering and Physical Sciences Research Council (EPSRC) is the UK Government's leading funding agency for research and training in engineering and the physical sciences.

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