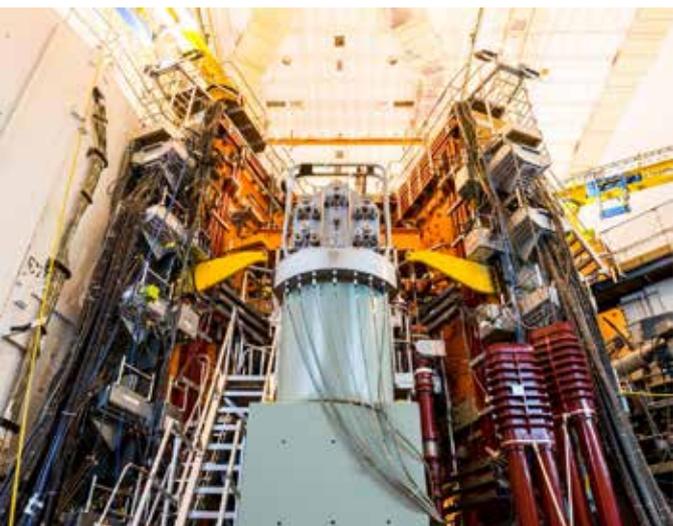
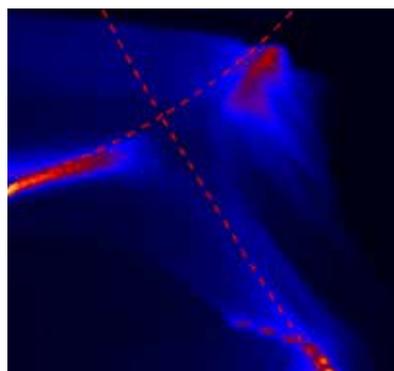


UKAEA

Mission and Goals



UK Atomic
Energy
Authority

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“The hard work of scientists, academics and apprentices here in Culham is a prime example of why the UK is a world-leader in scientific discovery.”

Jo Johnson MP, Universities and Science Minister, Visit to Culham May 2016

Introduction

Mission: To lead the commercial development of fusion power and related technology, and position the UK as a leader in sustainable nuclear energy.

This mission reflects national needs and covers both fusion and research relevant to the resurgence of UK fission, and other spin-off and growth technologies.

Increasing energy demands, concerns over climate change and limited supplies of fossil fuels mean that we need to find new, cleaner ways of powering the planet. Nuclear fusion – the process that drives the sun – could play a big part in our sustainable energy future.

In a fusion reaction, energy is produced when light atoms are fused together to form heavier atoms. To utilise this process on Earth, gas is heated to extreme temperatures (150 million degrees Centigrade) when it becomes a plasma. At these temperatures, the nuclei are energetic enough to fuse together and release large amounts of energy that a future power station can use to generate electricity.

At UKAEA, we aim to maintain our status as a world-class fusion lab and expand our technology-based R&D to progress key technology issues for the next steps in fusion reactor design. We will work with national laboratories, academia and industry to improve the UK's wider nuclear capability and exploit synergies in areas such as advanced nuclear materials, modelling, remote operations, integrated systems and virtual engineering.

Our mission and vision for UKAEA are encapsulated in five headline goals:

- 1.** Maintain the UK's position as a world leader in fusion research
 - 2.** Realise jobs and skills through growth in UK industry
 - 3.** Grow the UK's nuclear materials and technology capability
 - 4.** Design the first fusion power plant
 - 5.** Develop Harwell and Culham sites as Science and Innovation Centres
-

Goal 1. Maintain the UK's position as a world leader in fusion research

The Culham Centre for Fusion Energy (CCFE) is recognised internationally as a world-leading fusion lab. We operate JET, the world's largest fusion experimental device and lead large parts of the scientific campaigns. The MAST Upgrade project will provide a unique capability, especially for plasma exhaust, which is already attracting international interest. It also offers a potential route to smaller and cheaper fusion reactors.

Our impact in terms of papers, citations and invited talks are comparable with the best international labs, with whom we have strong collaborations, as well as with UK Universities.

Realising fusion as a future energy source will take an international effort, and we want to ensure that the UK remains at the forefront.

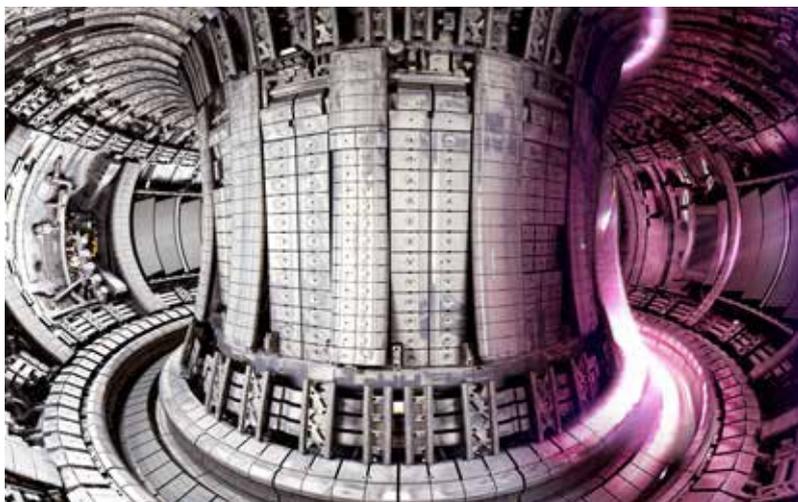
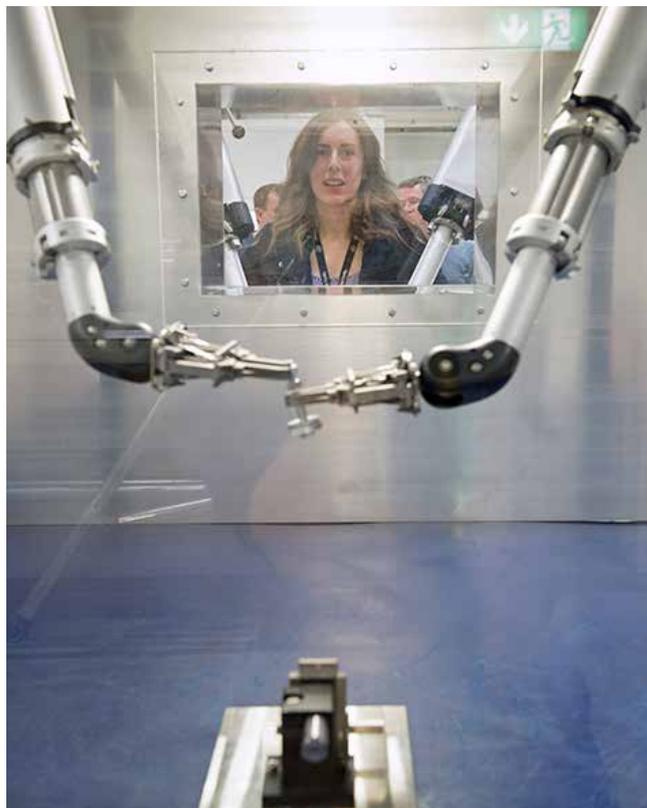
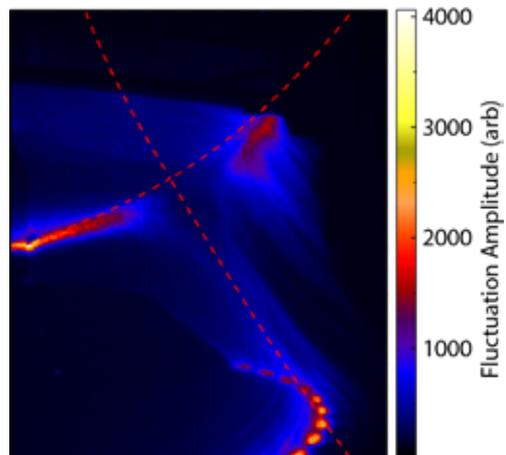
To achieve this goal we aim to:

- **Successfully complete the MAST Upgrade project and realise its scientific potential.**
- **Secure a JET extension to 2020 and support preparations for ITER.**
- **Drive the Tokamak Science programme towards a fully predictive capability.**
- **Maintain the role of the Technology Programme towards DEMO, resolving key technological challenges and operating at the heart of the EU Programme.**
- **Work at the forefront of material science and technology together with UK and international collaborators.**
- **Apply our unique computational and modelling capability to support fusion research programmes.**

“The current magnetic confinement fusion programme in the UK is of world-class quality, in facilities, people and impact.”

EPSRC Independent review of fission and fusion research in the UK, March 2016

www.gov.uk/government/news/independent-review-backs-world-class-uk-fusion-programme



Photos - clockwise from top
 UKAEA CEO Professor Ian Chapman on the new MAST-U vessel
 Image showing fluctuations from the Scrape-Off Layer and
 Private Flux Region during MAST's final experimental campaign
 MEP Clare Moody visits Culham - January 2016
 MAST-U lower end plate assembly - October 2015
 Inside JET vessel
 MRF Master Slave Manipulator practice rig

Goal 2. Realise jobs and skills through growth in UK industry

Our specialist skills and fusion experience can help make ITER a success. We can also act as a catalyst for UK economic growth - at end of 2015, UK companies had secured in excess of £300 million in ITER contracts.

Our capability (skills and technology) also have synergies with other business sectors including wider nuclear and hazardous application markets. UKAEA has a role to play in enhancing the UK's nuclear capability.

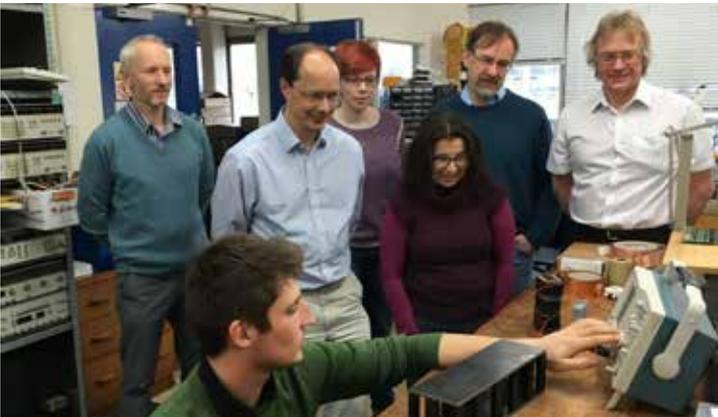
The Government is investing to grow our award winning apprentice scheme with a new centre Oxford Advanced Skills (OAS), launched in September 2016.

To achieve this goal we aim to:

- Secure crucial ITER contracts to grow UK business.
- Exploit the potential of RACE to secure business for the UK by selling unique operational know-how.
- Deploy multi-disciplinary expertise towards fusion design challenges, bringing about the successful completion of ITER.
- Provide operational knowledge and insight into the commissioning and operation of ITER from the perspective of the only D-T tokamak operator.
- Foster academic networks to develop graduates and doctoral students to ensure the next generation(s) of scientists and engineers.
- Set up OAS to deliver around 100 apprentices with high tech skills to the local supply chain.

“There are several critical areas where the fusion expertise developed by the UKAEA can be of value to ITER, in particular, the science and technology programmes being carried out at JET can make a significant contribution to the preparations for ITER Operations.”

Bernard Bigot, Director General, ITER, letter to UKAEA Chairman, January 2016



Photos - clockwise from top

ITER site showing assembly hall - April 2016

New tritium handling facility on site - September 2015

Artist's impression of new OAS building

New RACE facility building

Work on the prototyping the ITER magnetic diagnostics integrator system

Goal 3. Grow the UK's nuclear materials and technology capability

Over the past few years we have been transitioning from a focus on plasma physics research to expanding our technology and engineering programme. This transition will continue with a view to solving technological challenges required to deliver fusion, and also exploiting potential spin-off opportunities.

The new Materials Research Facility (MRF) will aid the development and testing of new materials for nuclear (fusion and fission) together with other applications. This work is part of the National Nuclear Users Facility (NNUF) and the Sir Henry Royce Institute of Advanced Materials.

Our new Remote Applications in Challenging Environments (RACE) centre has already won, with industry, major ITER contracts, and a contract to deliver the hot-cell for the European Spallation Source (ESS) - a major European science facility being built in Sweden.

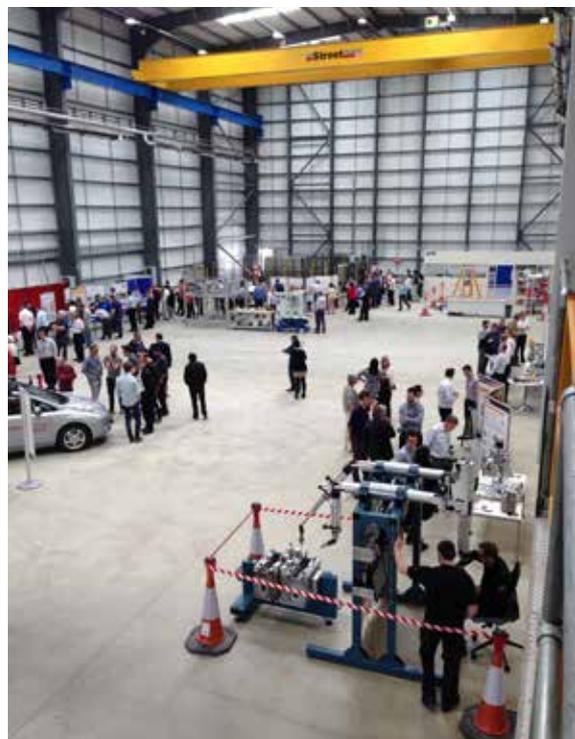
To achieve this goal we aim to:

- Develop RACE and MRF to fulfil their technology, scientific and commercial potentials.
- Increasingly apply our strengths in modelling nuclear materials damage, activation and radiation transport to fields other than fusion.
- Meet near term technology challenges such as managing tritium in a power plant environment.
- Win contracts from outside fusion to augment our portfolio of technology work.
- Work with industry to exploit synergies and unlock potential.
- Strengthen our links with UK and international academic networks, and foster innovation.

“Recently, UK expertise has been expanding into areas of fusion technology and materials science – a wise development as fusion progresses toward the goal of energy production.”

EPSRC Independent review of fission and fusion research in the UK, March 2016

www.epsrc.ac.uk/newsevents/pubs/indrevfissionfusion/



Photos - clockwise from top

Staff celebrate MRF opening – March 2016

MRF exterior – May 2016

RACE building – main hall during staff Show and Tell staff event – May 2016

RACE Director Rob Buckingham talks to visitors in the Control Room

Goal 4. Design the first fusion power plant

A fusion power plant is a complex system requiring a wide range of plasma and materials science, innovation, technology and engineering systems integration at an unprecedented level.

UKAEA is one of the few organisations in Europe that has the skills base to conduct integrated nuclear design. We already play a key role in EUROfusion's DEMO activities and further development of our technology facilities and businesses (Goal 3) will help strengthen our capability. We will also work with our partners in academia and industry to provide the UK with the full range of skills and expertise to design and realise power plants.

Many of the challenges for a fusion plant, such as virtual engineering, integrated design, safety regimes and remote operations, are also applicable to other areas for example the next generation of nuclear reactors. There will be opportunities to exploit these synergies and bring practical experience to the design process.

To achieve this goal we aim to:

- Open an integrated multidisciplinary design office at Culham.
- Continue to play a central role in the integrated design of DEMO through skills, knowledge, facilities and networks.
- Partner with industry to bring best industrial practice to fusion and inform the design work requiring the gamut of expertise a power plant will need.
- Apply and develop cutting edge techniques to nuclear design.

“The safe and effective development of nuclear power requires nuclear engineers and nuclear research; if this capability and capacity are lacking then the nation cannot work effectively.”

Sir Paul Nurse, Ensuring a successful UK research endeavour, 2015

www.ucml.ac.uk/sites/default/files/pages/131/UCML%20BIS%20Nurse%20review.pdf

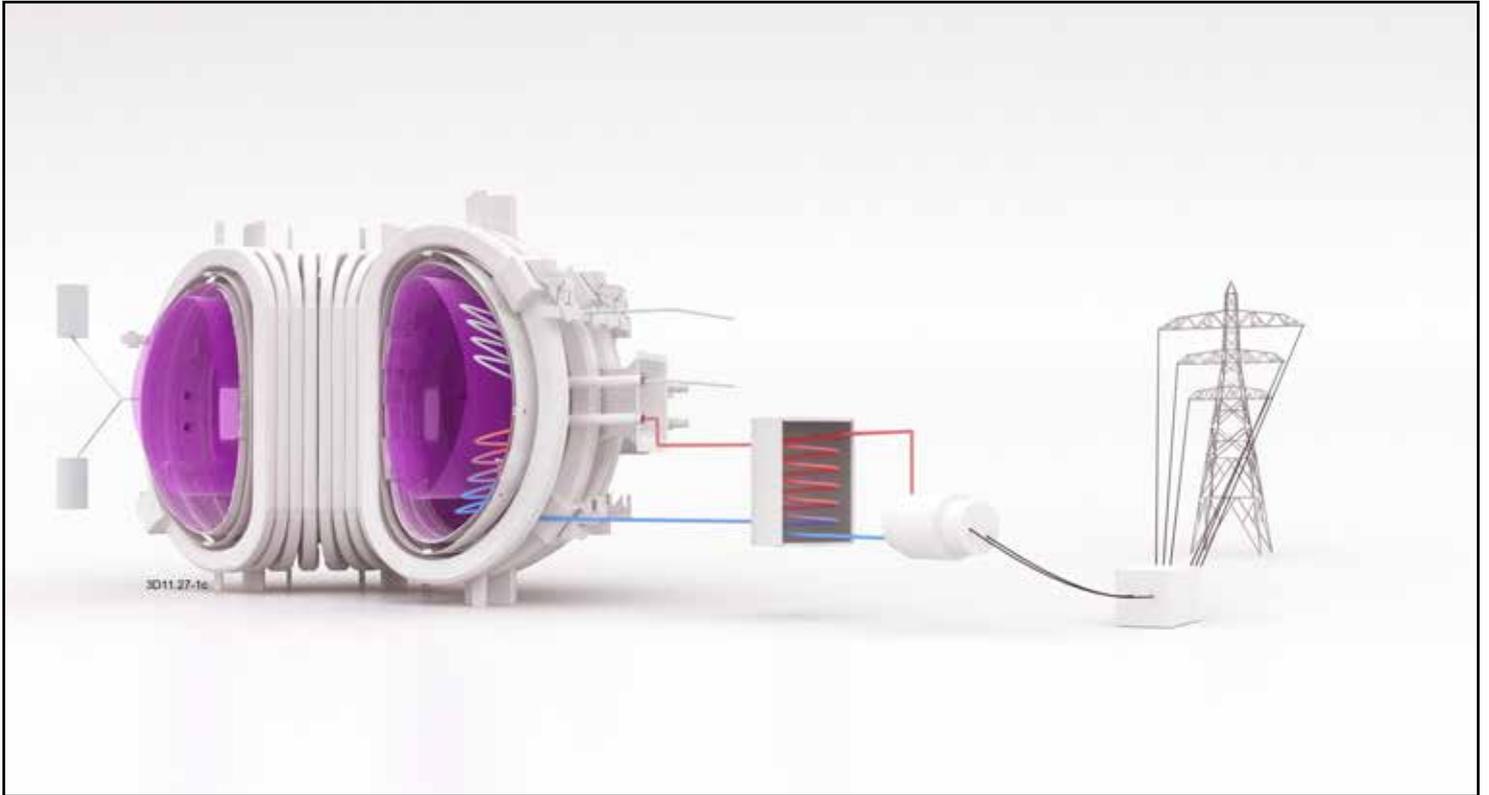


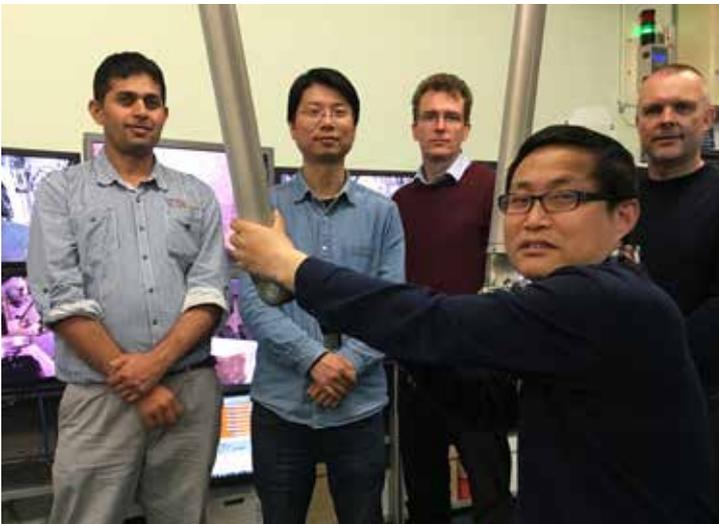
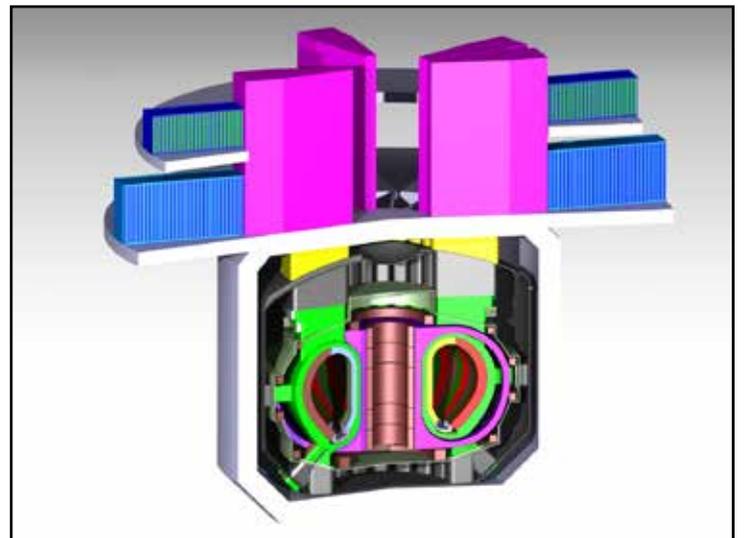
Photo details:

Top: Graphics image of generating electricity from fusion power

Right: A section through the EU DEMO Remote Maintenance Baseline model showing remote maintenance casks deployed on the top of the machine for replacement of the blankets through the vertical ports.

Below left: Collaboration with engineers from the Chinese plasma physics academy and the DEMO design team

Below right: Collaboration with Idaho National Lab, USA using MELCOR computer code for safety studies of DEMO design.



Goal 5. Develop Harwell and Culham sites as Science and Innovation Centres

Culham Science Centre and Harwell Campus are already thriving science, innovation and business centres. They are important employment centres in Oxfordshire, and these have scope for further development.

South Oxfordshire District Council has agreed a 50% expansion in the number of jobs at Culham to bring it to 3,000. We are engaging with potential investors about commercial development opportunities. In addition, there are a number of potential new facilities in the pipeline to deliver Goals 3 & 4.

Harwell Campus is managed by a joint-venture between UKAEA, Science & Technology Facilities Council (STFC) and a private sector partner. Over 5,000 people work at Harwell in more than 200 organisations. Recent new developments include the European Space Agency building, RAL Space Centre, Element 6 expansion and the Genesis Building offering business incubation space.

To achieve this goal we aim to:

- Promote visions for the Culham Science Centre and Harwell campus.
- Attract businesses to the Culham Science Centre, particularly those in synergetic technologies and sectors.
- Attract private sector investment and involvement in the development of the Culham Science Centre.
- Attract funding that supports the development of Culham Science Centre and the Harwell Campus, exploiting our land interest.

“I am in no doubt that science parks are an important part of the research infrastructure in the UK - and an important part of our ambitions to be the best place in the world to do science... it also matters because it drives innovation. Which means it is absolutely key to our economic future...We want to be sure that we exploit our brilliant research to create a better future for our country.”

Rt Hon David Willetts, speech to the UK Science Parks Association

www.gov.uk/government/speeches/speech-by-david-willetts-to-the-uk-science-park-association

Photo details:

Right: Aerial photo of Culham site - 2015

Below left: RAL Space Centre, Harwell

Below right: Rt Hon Greg Clark (2nd right) during his visit to UKAEA – December 2014

Bottom: Artist's impression of future Culham site development



UKAEA

An enabling environment

In order for our goals to be fulfilled, the following enabling areas of focus are crucial.

1. Stakeholder engagement

To ensure that UKAEA optimises opportunities to attract funding, collaborates with other partners and promotes our reputation for excellent science and technology.

- Continue to implement the stakeholder engagement plan, strengthening links with government, academia and industry to maximise our future opportunities.
- Listen and work with stakeholder expectations and opinion on the external drivers that will shape our horizon.
- Showcase our world class research to continuously remind those of influence that we are a key component in delivering the UK's nuclear strategy.



Jo Johnson MP Minister of State for Universities and Science in the JET Torus Hall with JET Exploitation Unit Leader Lorne Horton and Professor Steve Cowley



Photos - clockwise from top

Tweet by visitor to Culham open evening

Waste management visitors outside the new MRF building – April 2016

UKAEA graduate RIFT outreach project

Culham 50th anniversary exhibition at Abingdon museum – summer 2015

Culham Summer School organisers and students - summer 2015

Primary School Sun Dome activity

2. Capability

To ensure UKAEA has the right people at the right time to achieve our goals.

- Resolve UKAEA's skills requirements and plan to fulfil our needs whilst also contributing to national STEM skill demands.
- Identify and pursue key future facility requirements that maximise our ability to deliver our goals.
- Employ best practice in the way we manage projects across the organisation.
- Replace aging and obsolete systems to improve our effectiveness and competitiveness.
- Ensure that the organisation structure and governance is fit for purpose.

3. Culture

Nurture a culture that promotes research, innovation and leading edge technological excellence, through a highly motivated, valued and diverse workforce.

- Maintain a safety conscious approach to all we do in the workplace as promoted through the Behavioural Based Safety programme.
- Take ownership for our own performance and working together to deliver on our commitments.
- Embrace UKAEA's culture of Passion, Innovation, Accountability, Business-minded, Leadership and Delivery.



“Congratulations to our staff on our fifth consecutive gold medal award. Let’s continue to make sure that not only do we get the award next year but every day we observe safety regulations to the letter.”

Former UKAEA CEO Steve Cowley

“I have been delighted by the enthusiasm for improving gender balance at UKAEA. Achieving the Athena SWAN Bronze award is the first step to making a better environment for everyone and we must strive to do even more in the future. Recruiting, retaining and inspiring more women in STEMM subjects is not just vital for UKAEA but important for the UK more broadly.”

UKAEA CEO Professor Ian Chapman





Photos - clockwise from top

*UKAEA Apprentice Emily Swatton is presented with her scholarship award by HRH The Princess Royal - November 2015
MAST- U vessel lift – May 2015
UKAEA and NNL Board meeting – RACE March 2016*

*Accurate pipette work in the Health Physics Laboratory
MRF Show and Tell - April 2016
DTE2 Project Management team*

UKAEA Performance Measures 2016/17

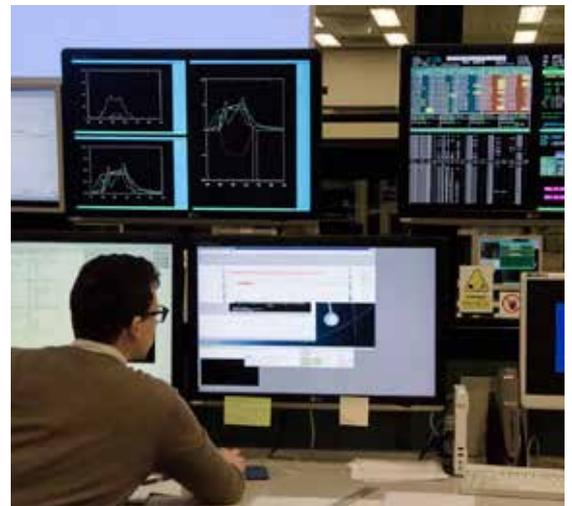
Science & technology

JET

Deliverables cover operation and maintenance of JET. This includes preparations for DT – a key campaign for international fusion development and crucial for ITER.

UK Fusion Programme

Deliverables are agreed with EPSRC and include tokamak science, technology, materials research, modelling and outreach. EPSRC is also used to leverage EUROfusion funding.



MAST Upgrade

The critical milestones to deliver the upgraded machine in time for a physics campaign in late 2017. The new divertor design will allow us to test new fusion designs.

Technology & nuclear capability

New measure to support UKAEA Goals 2-4. Deliverables are aimed at developing future energy technologies & capabilities and enabling UK growth.

Images

Right: JET Control Room

Left: installation of MAST-U coils

Financial measures

RACE

Focus on making RACE sustainable.

MRF

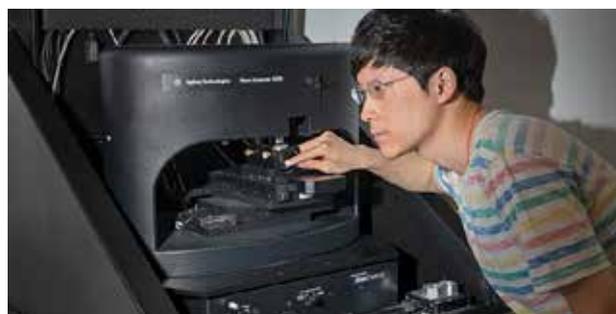
Focus on making MRF sustainable.

Business Development

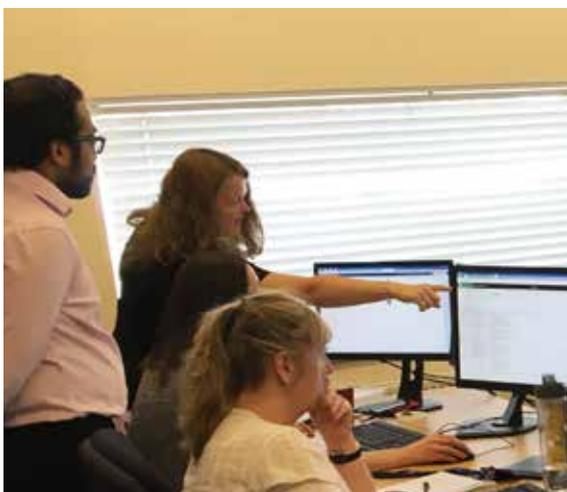
Income from commercial work.

Culham Property

Profit from commercial tenants, which can be reinvested back into the site.



Process & cultural measures



Safety & Assurance

Improvement programme, including preparation for new certification.

Process

U4BW implementation and project management improvements.

Capability

Deliver capability programme.

Images

Right top: RACE staff outside their new building

Right bottom: Nano-indenter machine in new MRF

Above: Staff during key UNIT4 testing phase

UKAEA Culture

Passion

Nurturing science and technological excellence, remaining determined, flexible and positive to the challenges we face. Open to new ways of working. Proud of who we are and enthusiastic about the pursuit of our mission.

Innovation

Seeking creative ways to change, solve problems and push scientific & technical boundaries. Working at the frontier of knowledge, being curious, building on ideas and challenging status quo.

Accountability

Taking ownership to achieve quality outcomes. Fostering a sense of urgency in delivering against our commitments. Dedicated to our work, working safely, admitting mistakes and learning from them. Honest and always acting in the best interest of UKAEA.

Business-minded

Commercially astute, seeking out new business opportunities and managing potential risks. Being cost conscious, acting with integrity doing what we say we will do and challenging what doesn't add value.

Leadership

Setting direction, supporting and encouraging our people to do great work. Developing and sharing knowledge, ideas and expertise. Embracing change and constructively driving performance improvement.

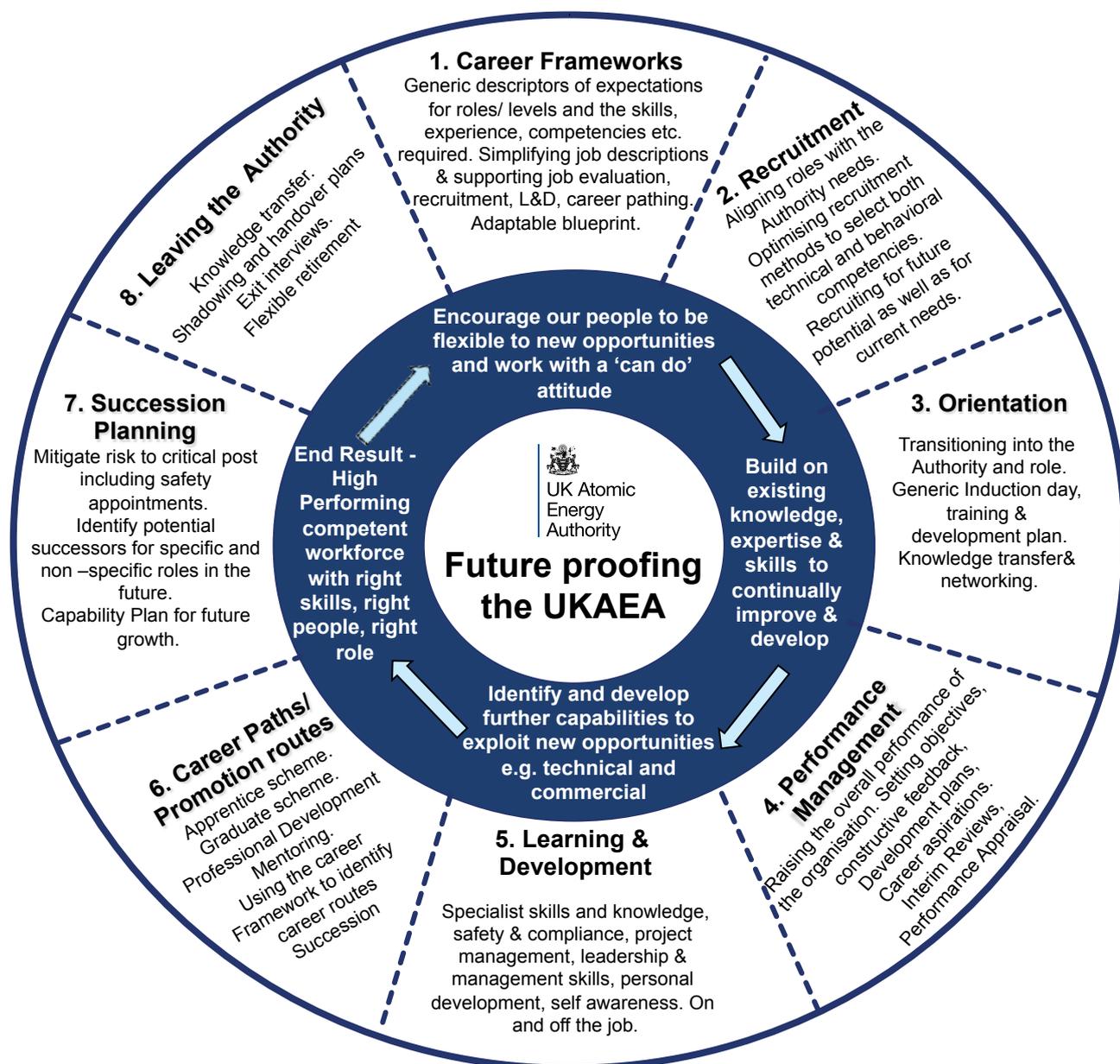
Delivery

Working together cooperatively to achieve the best possible result. Demonstrating a 'can do' approach which delivers 'fit for purpose' quality in all that we do. Following the process, and responding positively to change and continuous improvement.

Future proofing UKAEA

As the UKAEA moves from its current state through to the future, it is a priority to expand our activities into areas - both technical and commercial – where we can supply expertise and skills, whilst maintaining our world class status as a science, engineering and technology R&D organisation and centre of excellence for fusion and the wider research community. This requires the organisation to retain its present skill base as well as building up skills in key growth areas including exploiting the synergies between fusion and fission.

The diagram below demonstrates the UKAEA's commitment to supporting its people throughout their employment life-cycle to enable individuals to reach their potential within their current role and pursuing their careers, but being insightful of the organisational needs.





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