

United Kingdom Atomic Energy Authority  
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United Kingdom



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# Annual Report and Accounts 2017/18

United Kingdom Atomic Energy Authority  
Annual Report and Accounts 2017/18



HC 1449

CPS18.210  
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CCS 0718075590  
978-1-5286-0712-4





United Kingdom Atomic Energy Authority  
**Annual Report and Accounts**  
**2017/18**

Presented to Parliament pursuant to Sections 3(5)  
and 4(3) of the Atomic Energy Act 1954

Ordered by the House of Commons  
to be printed on 19 July 2018

HC 1449





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This publication is available at <https://www.gov.uk/government/publications>

ISBN 978-1-5286-0712-4

CCS CCS0718075590

07/18

Printed on paper containing 75% recycled fibre content minimum

Printed in the UK by the APS Group on behalf of the Controller of Her Majesty's Stationery Office



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# Chair's Statement

I am coming to the end of my eight years as Chair of the UK Atomic Energy Authority (UKAEA) and will step down at the end of July 2018.

Our mission is a noble one, to harness fusion, the process that powers the sun. This was recognised by the late Stephen Hawking as one of the grand technical challenges for mankind, producing an almost inexhaustible supply of energy with little pollution or global warming.

During my tenure I have witnessed UKAEA going through a period of great change successfully expanding from a fusion and plasma science research programme to one with increasing technology strands and industrial involvement. This is in line with the Board's vision to further the technology and engineering challenges in order to deliver fusion as a future energy source.

The organisation has grown from a revenue of £90M and 568 full time equivalents when I joined to a revenue of £102M and a total of 874 employees at the end of 2017/18. With recent government investments, the organisation is set for a further period of significant growth.

In May 2011, JET had completed a major upgrade which saw the inside of the machine replaced with new beryllium and tungsten tiles to mimic the conditions inside ITER. This is now enabling scientists to refine the operating conditions in this all metal environment whilst ITER is being constructed and will help in facilitating and de-risking the start of this vital international experiment.

In March 2013, the government announced funding for a Materials Research Facility (MRF) at Culham to help exploit synergies between fusion and fission research. Further funding has since been received for new equipment as part of the Henry Royce Institute. Producing and understanding the materials that can withstand the

bombardment by high energy neutrons is key to any future fusion power plant.

In September 2013, MAST stopped operations to enable a £50M upgrade to take place. The project may be late, but it provides us with a brand-new machine with the innovative Super-X divertor which will allow scientists and engineers to research the challenge of plasma exhausts and compare with theoretical modelling. This is another major area of importance to be dealt with for future commercial fusion power plants.

In January 2015, Greg Clark joined us to break the ground for another new facility, the Remote Applications in Challenging Environments (RACE). Both MRF and RACE were officially opened by Jo Johnson in May 2016. Remote handling is an essential ingredient to the long-term operation of any fusion or indeed any nuclear power plant. Since then, RACE has grown even more rapidly than we expected, and an extension to the building will be constructed next year. By working with universities and industry it has obtained £54m of funding for robotics and autonomous systems R&D. This is in addition to the UKAEA helping UK companies secure over £500M in ITER contracts.

In September 2016, we opened the first phase of Oxfordshire Advanced Skills, a new apprentice training facility which expanded our award-winning scheme for the benefit of UK industry. Phase 2 will provide up to 125 apprentices per year. Also, in 2016, the UKAEA Apprentice team won the Brathay challenge, a testament to the quality of our apprentices.

In November 2017, the government announced £86M for two more new facilities at UKAEA, the Fusion Technology Facility (FTF) and the Hydrogen-3 Advanced Technology (H3AT) facility. These will help keep the UK at the forefront of fusion technology development, secure further

ITER contracts for UK industry and again pave the way for power plants of the future. This year has certainly been a very exciting and busy time for everyone.

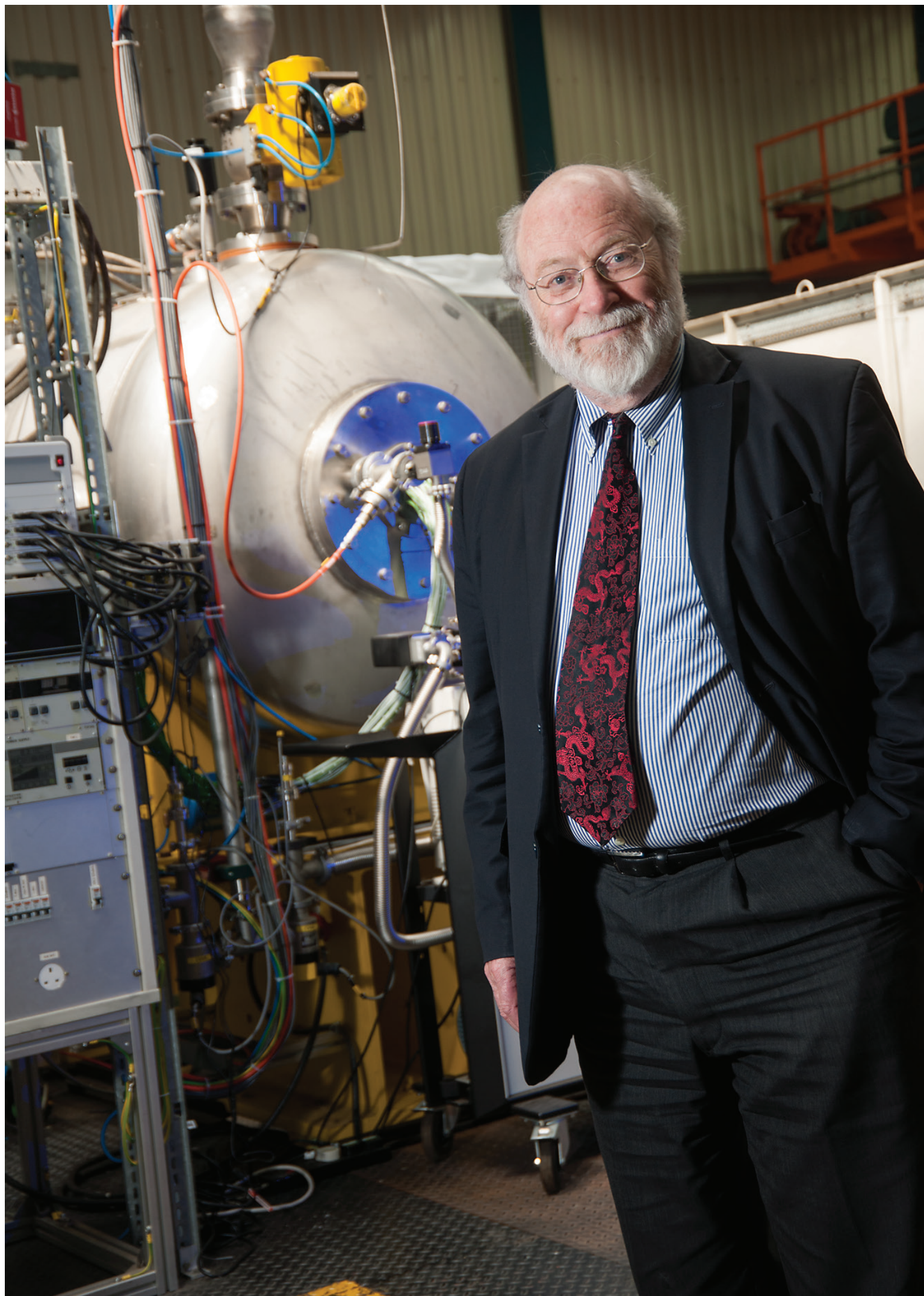
Over the past eight years the Harwell Campus has flourished too and is now one of the fastest growing science and innovation centres in the UK. It provides employment for over 6,000 people in 225 organisations and boasts over £2Bn in world-leading research infrastructure.

As I leave, I would like to take this opportunity to thank my fellow non-executives Professor Sir Keith Burnett and Peter Jones, who also joined in 2010 and stepped down earlier this year, for all their contributions to UKAEA. It was a pleasure to welcome Shrinivas Honap, Sue Scane and Professor Sir Adrian Smith as new non-executive directors at the start of 2018/19; they are a valuable addition to the Board.

I would also like to thank the Executive for their support over the last eight years, in particular Professor Sir Steve Cowley, our former CEO and Professor Ian Chapman, our current CEO, who I have no doubt will lead UKAEA through a challenging but rewarding future.

Finally, it has been a real pleasure to work with all the staff at Culham, through this period of great change. I would like to express my sincere wishes for an exciting and successful future, a future that can be even more successful than the last eight years.

**Professor Roger Cashmore, CMG, FRS**  
**Chair**  
**11 July 2018**



# Performance Report Overview

## Chief Executive's Statement

We began this year with uncertainty after the UK government declared its intention to leave the Euratom treaty, but we end it on the front foot, with over £250M UK funding committed to UKAEA over the next four years. I firmly believe that UKAEA is a jewel in the crown of UK science and innovation and can be at the forefront of driving UK growth and prosperity at the heart of the industrial strategy. We are delivering ever more for the UK supply chain, having reached £500M won by UK industry from ITER during the year and targeting £1Bn by the time ITER begins in 2025.

What makes UKAEA unique globally is the breadth of our capability. Achievement of fusion power is reliant upon an integrated reactor design that must simultaneously solve six key challenges:

- (1) creation and sustainment of a fuel hotter than the Sun over long timescales;
- (2) materials constitution and fabrication of the vessel which will confine the most intense neutron source on Earth;
- (3) an holistic integrated design with capability to test and qualify components for a nuclear safety environment;
- (4) an ability to breed, handle and recirculate tritium fuel;
- (5) exhaust of heat flux levels well above those experienced by a re-entrant space shuttle; and
- (6) requisite availability of the machine to produce a viable cost of electricity through robotic maintenance schemes.

We have a portfolio of facilities and capabilities to address all of these.

From 2021, UKAEA will expand this portfolio with two new centres of excellence in fusion technology: The Hydrogen-3 Advanced Technology (H3AT, pronounced 'HEAT') will research how to process and store tritium, whilst the Fusion Technology Facilities (FTF) will carry out thermal, mechanical, hydraulic and electromagnetic tests on prototype components under the conditions experienced inside fusion reactors. The investment of £86M made this year into

these two new facilities demonstrates the UK Government's commitment to fusion and recognises the central role UKAEA plays in the international fusion programme.

As well as the investment in these future capabilities, our recently-opened facilities continue to go from strength to strength. Our robotics centre, RACE, is growing rapidly and delivering a broad portfolio of activities for the UK, now including the design of the hot cell of the European Spallation Source, testing of autonomous vehicles, and as a partner in an EPSRC hub for Robotics and Artificial Intelligence in Nuclear. Our Materials Research Facility – as part of the Henry Royce Institute – is now receiving radioactive materials samples to improve our understanding of materials properties under irradiation for fusion, for fission, and even for other applications too.

This year has seen us preparing for operating JET with deuterium-tritium fuel mixtures needed for maximum fusion power. JET is now back into commissioning after this successful project to install various enhancements and prepare for tritium operations. JET remains the best fusion facility in the world, and we hope to break world records for fusion energy by 2020. The centrality of JET in the global fusion community is evidenced by this year's shortlist for the Nuclear Fusion journal prize, where 6 of the ten papers report on experiments from JET. We have also begun the commissioning of MAST Upgrade this year. MAST Upgrade will be an internationally unique facility for understanding how to exhaust heat from fusion reactors, with unparalleled flexibility and diagnostics. Both the EU and US have now committed funds to participate in the MAST Upgrade physics campaign which we eagerly await towards the end of 2018.

Both JET and MAST Upgrade are key elements of the European fusion programme. On 11th January, the Secretary of State for the Department of Business, Energy and Industrial Strategy stated that

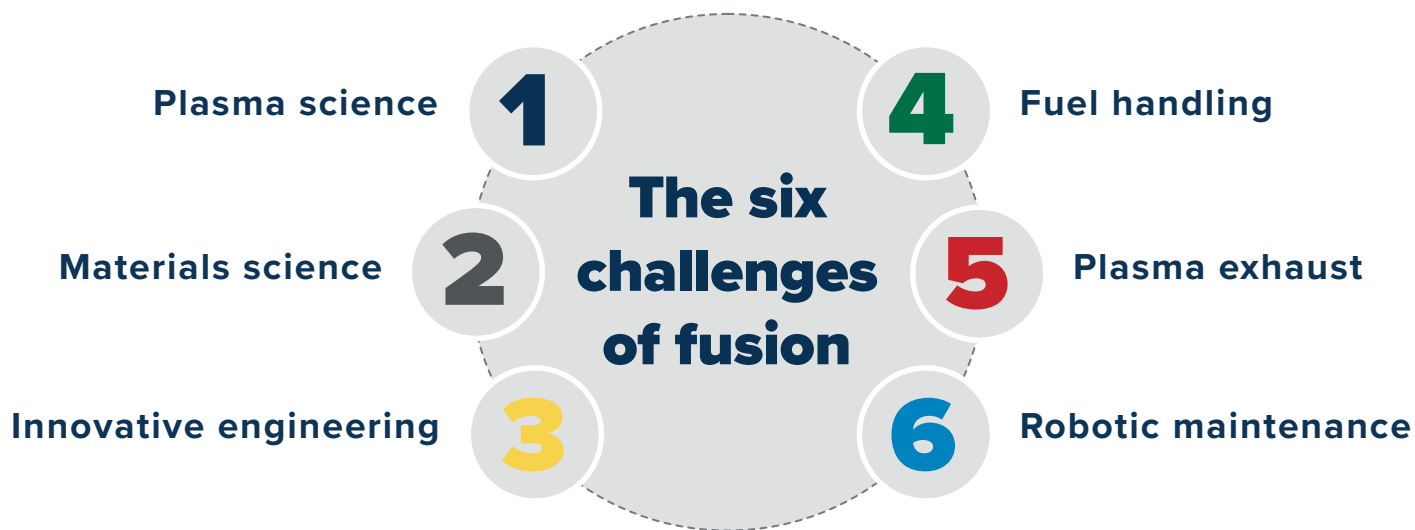
"The UK's specific objectives in respect of the future relationship are to seek a close association with the Euratom Research and Training Programme, including the JET and ITER projects". Together with clarity that the UK is eligible to participate in Euratom programmes until December 2020 during the Implementation Period, this bodes well for a continued close collaboration with our EU partners.

One of the overarching goals of the UK Industrial Strategy is 'prospering from the energy revolution'. The world needs fusion power. With the increasing electrification of transport, the exponential increase in global demand, and the need for deep decarbonisation, we need to be bold and really tackle these problems. Fusion requires multi-disciplinary solutions in areas in which the UK has key strength and are emerging priorities for Industrial Strategy Challenge Fund, namely: Robotics and Artificial Intelligence; Digital Technologies; Advanced Materials and Manufacturing, and of course, Clean Energy. The UK is positioned to provide world leadership in fusion and deliver the carbon-free energy we really need.

Finally, I would like to pay testament to the hard work of our chair, Roger Cashmore, who will be stepping down this summer. He has provided great leadership of the UKAEA Board and has been very engaged and committed to advancing the Authority. On a personal level, he has taught me a lot, showed patience with an occasionally headstrong CEO and supported me through my first full year.

**Professor Ian Chapman**  
**Chief Executive and Accounting Officer**  
**11 July 2018**





# Purpose

The United Kingdom Atomic Energy Authority's (UKAEA's) principal mission is to lead the commercial development of fusion power and related technology and position the UK as a leader in sustainable nuclear energy. This is encapsulated by five goals:

- Goal 1** Maintain the UK's position as a world leader in fusion research & development (R&D)
- Goal 2** Enable economic growth & new high-tech jobs in UK industry
- Goal 3** Grow the UK's nuclear technology capability
- Goal 4** Design the first fusion power plants
- Goal 5** Develop Harwell and Culham sites as Science and Innovation Centres

UKAEA has been successfully undertaking nuclear research for 64 years since being established by the UK government in the 1954 Energy Act. It is a non-departmental public body (NDPB), under the Department for Business, Energy and Industrial Strategy (BEIS).

UKAEA activities are centred around the following entities:

- **Culham Centre for Fusion Energy (CCFE)** – the UK's national fusion laboratory, which operates the world's largest fusion facility, Joint European Torus (JET), on behalf of the European Commission and operates the UK's flagship fusion device, the Mega Amp Spherical Tokamak Upgrade (MAST-U).
- **Materials Research Facility (MRF)** – researching materials for nuclear reactors of the future. MRF is part of the National Nuclear Users Facilities (NNUF) and the Henry Royce Institute for Advanced Materials.
- **Remote Applications in Challenging Environments (RACE)** – developing robotics and applied artificial intelligence (AI) technology for fusion and other challenging environments.
- **Fusion Technology Facility (FTF)** – expanding UKAEA's existing programme to develop and test components for fusion power plants.
- **Hydrogen-3 Advanced Technology (H3AT)** – expanding UKAEA's tritium capability to create a world leading centre for the fusion fuel cycle.
- **Oxfordshire Advance Skills (OAS)** – providing high-quality apprenticeship training for high-technology industries.

## Key Risks

External factors beyond the UKAEA's immediate control continue to influence the risk landscape. The UK's plan to exit the European Union and Euratom agreements has created uncertainty within the fusion community although the Government has made clear its intention to retain the closest possible association. The current contract between UKAEA and the Commission for the operation of JET covers the period to 31 December 2018. There is a risk that a delayed extension will result in short term cash flow issues, until a new contract is agreed. The UKAEA and BEIS are working closely on mitigations for this risk and to seek solutions for future collaborations/funding for the longer term.

Attracting and maintaining specialist expertise in the organisation as it continues to grow is one of UKAEA's highest risks. A particular challenge is the recruitment and retention of people with scarcity skills where there are national shortages and UKAEA is competing in a local area with exceptionally high employment. This is compounded by uncertainty surrounding the impact of the exit from the EU. The combination is affecting UKAEA's ability to deliver its goals, however, there has been significant success in recruitment over the year and attrition rates have only marginally increased.

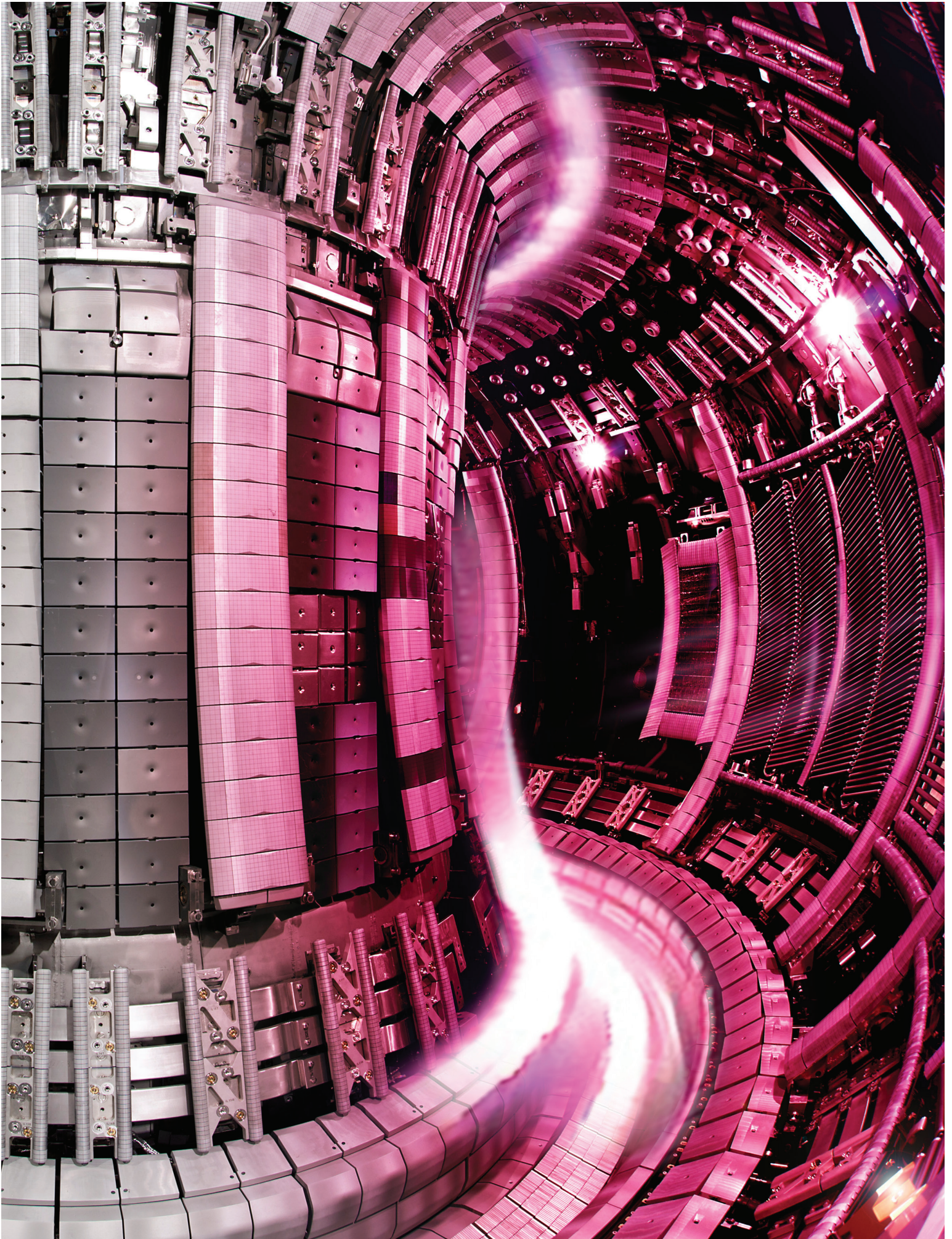
UKAEA is undertaking novel scientific research and cutting-edge design and engineering work which creates inherent technical risks. In particular, the MAST-U construction has proved more technically challenging than anticipated and has been exacerbated by having insufficient skilled staff. Now that MAST-U is working towards operations, most of the technical risks have been or are about to be retired. Lessons learnt from the issues encountered have been built into project management processes and guidance.

UKAEA's business development strategy promotes technology growth in the UK, with new enterprises acting as a catalyst for UK industry and enabling broader utilisation of skills now and in the longer term. This strategy is informed by the opportunity and risk identification, assessment and mitigation process and is actively tracked by the Executive Committee. The UKAEA has secured funding from a number of areas including the Government's Industrial Strategy Challenge Fund.

UKAEA continues to manage risks and opportunities proactively and interfaces with BEIS risk management processes. These are assessed in accordance with the appetite for risk agreed by the Board and, where reasonably practicable, effective mitigations are put in place if threats exist. Further information on the management and governance of risk is provided in the Governance Statement.



## Performance Report Overview



# Performance Summary

Recent achievements against the corporate goals include:

- Goal 1 **£50M** MAST Upgrade has been constructed and a further **£21M** of enhancements started.
- Goal 2 **£500M** of ITER contracts have been won to date by UK industry. RACE has secured a further **£54M** of collaborative robotics R&D with industry and academia.
- Goal 3 **£86M** awarded to UKAEA to provide world-class fusion technology platform, consisting of FTF and H3AT.
- Goal 4 **25%** of the EUROfusion DEMO design team is provided by UKAEA.
- Goal 5 Harwell is one of the fastest growing science and innovation environments nationally and Culham continues expanding with construction of several new buildings planned.

UKAEA has a balanced scorecard for its corporate performance measures, which encompasses all the main activities and supports the five corporate goals. The measures have a threshold target set in accordance with the basis for the programmes and budgets. In addition, stretch targets are set to promote exceptional performance. A summary of performance is provided in Table 1.

The technical issues experienced on the JET and MAST-U programmes during the year have resulted in the performance measures for these being missed. However, there was good performance on the EPSRC and Technology programmes and both areas more than met their threshold targets.

RACE had a strong year with income up over 30% compared with last year. MRF missed its target for external income due to some delays in moving to nuclear operations, but this did not affect the bottom line. Income from other business development activities was below target, but up 10% on last year. Profits from Commercial Property at Culham were very healthy due to occupancy levels being maintained at over 95% of capacity.

Performance on capability and recruitment was very strong and generally there has been good performance on the Continuous Improvement Measures. However, there were some issues over timely completion of audit actions.

2017/18 Corporate performance measures

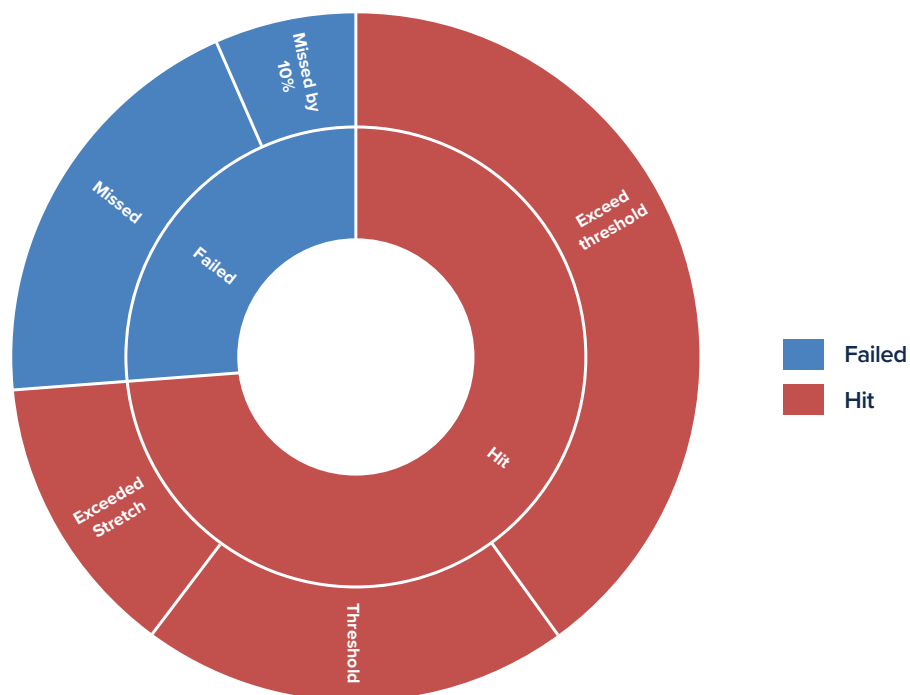


Table 1 – Outturn against the corporate performance measures

Performance Measures	Goal	Target	Provisional Outturn
<b>Key Scientific and Engineering Measures</b>			
Deliver the UK Fusion Programme milestones agreed with EPSRC	1, 3, 4	70-100%	30 out of 38 (79%) milestones achieved on time
Deliver the JET Operations milestone targets agreed with the European Commission	1	70-100%	24 out of 41 (59%) milestones achieved on time
Deliver the MAST-U project milestones	1, 3, 4	70-100%	No milestones achieved on time
Deliver the Technology & UK nuclear capability milestones	2, 3, 4	70-100%	9 out of 11 (82%) milestones achieved on time
<b>Key Business and Financial Measures</b>			
Achieve income target and operating balance (loss) for MRF	1-5	Budget figures	Achieved upper target for operating balance, but missed income target
Achieve income target and operating balance (loss) for RACE	1-5	Budget figures	Met the budget target
Achieve the income target for external business development work	2, 3	Budget figure	Missed the budget target
Achieve the operating profit targets from commercial property management at Culham	5	Budget figure	Exceeded the upper target
<b>Key Process and Cultural Measures</b>			
Deliver the capability programme	1-4	Individual targets	All 5 measures were met, with 4 close to/exceeding the stretch target.
Deliver the safety, health, environment, quality & security improvement programme	1-5	70-100%	7 out of 9 (78%) milestones achieved on time
Deliver project management process improvements	1-4	70-100%	8 out of 10 (80%) milestones achieved on time
Deliver the comprehensive spending review project	2-5	Individual targets	OAS and impact targets were achieved, but one of the IT projects was late.
Complete audit actions on time	1	Individual targets	36 out of 40 actions completed on time, but an additional 10 were overdue at year end.

More detail on specific activities and achievements during the year are provided in the Performance Analysis.



# Performance Report Performance Analysis

## Tokamak Science Programme

The tokamak science area uses a combination of experiments, theory and computer modelling to improve understanding of the plasma physics processes that govern the performance of existing and future tokamaks. The programme is focused on the following issues that are key to successful operation of ITER and future fusion power stations:

- Developing integrated operating scenarios that optimise fusion performance and plasma stability, carrying out world-leading integrated modelling in support of JET and ITER;
- Exploring innovative solutions that allow power and particle exhaust to be safely removed from the plasma core;
- Studying fast particles, heating and current drive to maximise plasma heating and avoid or minimise instabilities; and
- Optimising the performance of the pressure pedestal at the edge of the confined plasma - the interface between the burning core and exhaust region.

ITER has the aim of producing high performance plasmas that yield 10 times more fusion power than the applied heating power to the plasma. To achieve this goal, an important prerequisite is to ensure that the plasma fuelling and seeding with impurity ions are simultaneously optimised to achieve the required fusion power output while minimising the heat loads to the wall. This optimisation is particularly sensitive during the phase where the fusion burn is initiated. To predict these fuelling requirements, Integrated Modelling is used to capture the relevant processes governing the introduction and transport of deuterium and tritium fuel and aspects of plasma exhaust. The JINTRAC Integrated Modelling suite was benchmarked against experiments on JET with an ITER-like wall,

and applied to model complete ITER pulses, including the ramp up to high performance. This modelling allows fuelling approaches to be studied with the aim of maintaining performance throughout the heating phase and ending the pulse in a controlled manner.

To achieve high performance tokamak plasmas, strong auxiliary heating is applied through the injection of highly energetic neutral particle beams, microwaves and radiofrequency waves into the plasma. Many of these heating schemes give rise to a population of energetic “fast” particles that provide the plasma heating. Under certain conditions, these fast particles also give rise to instabilities that lead to the redistribution of the fast particles themselves. The fast particles can be transported from the plasma core and even lost to the wall or exhaust region, leading to reduced fusion performance and increased heat loads. A state-of-the art computer model, HALO, is being developed with support from EUROfusion to predict the way these instabilities are generated and their impact on plasma heating and wall power loads. It has recently been applied to high performance JET plasmas to study the effect on fast particles produced by fusion reactions.

The isotope composition of the plasma has a significant impact on fusion performance and is a key consideration in predicting the performance of mixed deuterium-tritium fusion experiments that are a key deliverable of the JET campaign. Experiments carried out on JET led by UKAEA scientists demonstrated that the performance of plasmas comprised of hydrogen have lower performance compared with deuterium for otherwise similar operating conditions, such as magnetic field strength and applied

auxiliary heating. There is strong evidence to suggest the change in performance originates in the pedestal. The threshold auxiliary heating power required to reach high performance regimes is found to vary inversely with the isotope mass, suggesting that the addition of tritium in future JET experiments will lower this threshold.

Plasma exhaust is one of the most significant challenges facing the development of fusion energy. The heat that leaves the plasma core remains well confined by the magnetic field and becomes concentrated into a thin layer, typically mm-cm wide. This can result in power loads in the plasma exhaust region that exceed the level experienced by a space shuttle re-entering the earth’s atmosphere. The width of this thin layer is governed by plasma turbulence and other processes that have been studied intensively in both experiments and simulations. These transport processes have recently been reproduced in sophisticated numerical simulations of plasma turbulence in a 3D computational domain and realistic geometry. The STORM module has been developed in close collaboration with the University of York. This new tool will be applied extensively to better understand the influence of geometry on the width of the plasma channel in this region, and hence the concentration of power, to allow predictions to be tested against future experiments on MAST Upgrade.





# Performance Report Performance Analysis



# JET Operations

## Preparations for DT

During this reporting period JET undertook a final shutdown before a Deuterium-Tritium (DT) campaign in 2020. The main purpose of this was to implement a range of DT-relevant and refurbishment work packages including the following:

- Installation of five new torus Tritium Introduction Modules;
- Carrying out in-vessel diagnostic calibrations, including neutron diagnostics using an in-situ 14MeV neutron source manipulated entirely by remote handling;
- Completion of implementation actions arising out of extensive fitness-for-purpose studies in support of the DT safety case;
- Relocation of the plasma and infra-red vessel viewing cameras outside the biological shield making use of specially developed long-range relay optics, essential for DT operation as cameras in the previous locations would be 'blinded' by the 14MeV neutrons;
- Replacement of some neutral beam actively cooled components to ensure compatibility with the 34MW, 20s pulse length requirement for DT plasma scenarios;
- Refurbishment of neutral beam high voltage transmission system and modifications to the infrastructure required to eliminate the use of sulphur hexafluoride as an insulating medium;
- Remote repair and remedial work on some key plasma-facing and other in-vessel components;
- Removal and replacement of various in-vessel samples and test-pieces for ex-situ analysis; and

- Implementation of refurbishment actions including all those agreed at the 2016 independent panel review of JET reliability.

The shutdown was formally completed, the vacuum vessel pumped down and restart commissioning underway, by the end of the reporting period; however, there were a number of challenges in particular in the dismantling and refurbishment of the neutral beam high voltage systems, which had not been attempted before. In addition, a small in-vacuo water leak developed in one of the neutral beam systems and, whilst no damage was done to any of the surrounding infrastructure, the only way to repair this was to extract the main central column assembly of the beamline. This has delayed the start of operations into 2018/19.

## Shattered Pellet Injector

The Shattered Pellet Injector (SPI) is a Disruption Mitigation System developed by Oak Ridge National Laboratory in the USA on behalf of ITER, who consider disruptions as their highest operational risk. Testing the effectiveness of the SPI will be a key part of the forthcoming deuterium campaign on JET and be used to inform the ITER programme.

Installation and commissioning of this system on the JET machine is funded by US-ITER domestic agency under contract with UKAEA. A significant fraction of the hardware has been installed onto the tokamak, sufficient to allow 70% of the commissioning to be completed in parallel with the JET restart.

## Exhaust Detritiation System

The Exhaust Detritiation System (EDS) is part of the Active Gas Handling System and designed to capture tritium from the JET exhaust. It is a key safety system for JET operations with tritium, although is not an essential system for the forthcoming deuterium campaigns.

At some time prior to or during the last shutdown, the EDS was exposed to gases containing fluorine and chlorine. The process used to capture the tritium has also resulted in halogenated hydrocarbons being converted into acids, which have caused corrosion in the system. A project is underway to procure a new system and put in place additional monitoring to prevent any recurrence. UKAEA's approach to the EDS replacement, both technical and managerial, was reviewed and endorsed by an independent panel of external experts in March 2018.

## Radioactive waste processing

The scope of the JET Operating Contract includes the processing and disposal of radioactive wastes arising out of the operation and interventions on the JET facilities, including dealing with legacy wastes. A Water Detritiation System was completed in April 2017 and is now fully commissioned, however, routine active operation is dependent upon the availability of the full EDS. A Materials Detritiation Facility was also constructed, but flaws were discovered in the baking oven during early stages of commissioning. This has required significant remedial work and the facility is now expected to come on line in summer 2018.





# MAST Upgrade

The MAST Upgrade (MAST-U) machine is now effectively complete with more than 130,000 new in-vessel components. The construction project has transitioned to commissioning the machine ready for operations. Key achievements include:

- The centre column assembly, which includes the air-side poloidal field coils, and solenoid have been installed and all electrical connections completed;
  - The vessel heating system, which is required to bake the machine to ~ 160 °C and hence improve the vacuum conditions, has been installed and commissioned;
  - The gas fuelling system, which includes 48 individual valves and 2km of pipework, has been fitted;
  - The cooling systems required to keep the coils cool during bake and operations have been installed and tested;
  - 120 km of new cabling has been installed which, along with the significant increase in number of coils and associated support structures, has increased the weight of the load assembly to 105T (up from 30 T before the upgrade);
  - All in vessel diagnostics have been successfully installed and wired back to their data acquisition systems, including the Thomson Scattering systems (for electron temperature and density measurements), Beam Emission Spectroscopy (for measurement of density fluctuations and turbulence) and Charge Exchange Recombination Spectroscopy (for measuring impurity ion temperature and density);
  - A new fibre optics communications network has been installed along with upgrades to the data acquisition system;
- The two neutral beam heating sources have been installed and the beam lines completed;
  - The power supplies are now fully installed and connected to the in-vessel coils, and are ready for integrated commissioning; and
  - The key safety related equipment including a new state-of-the-art Personnel Access Safety System (PASS), has been installed and the systems are being commissioned to allow the machine to progress to an operating state.

During the year a number of technical challenges were encountered. One of the most significant ones was the Centre Column sliding joint installation where tight angular tolerances required each of the 48 sliding joints to be precision machined to sub-millimetre accuracy.

More concerning was evidence that some of the graphite tiles were contaminated with a high mass hydrocarbon residue. A R&D programme was launched to understand the nature of the contamination and optimise the cleaning process. This has resulted in development of a glow discharge cleaning and baking cycle to ensure the tiles are ready for MAST operations.

The machine has been under vacuum for 9 months with a baseline pressure of 1e-6 mbar achieved. Extensive leak checking has been performed which shows that further improvements will only be made following a bake of the vessel.

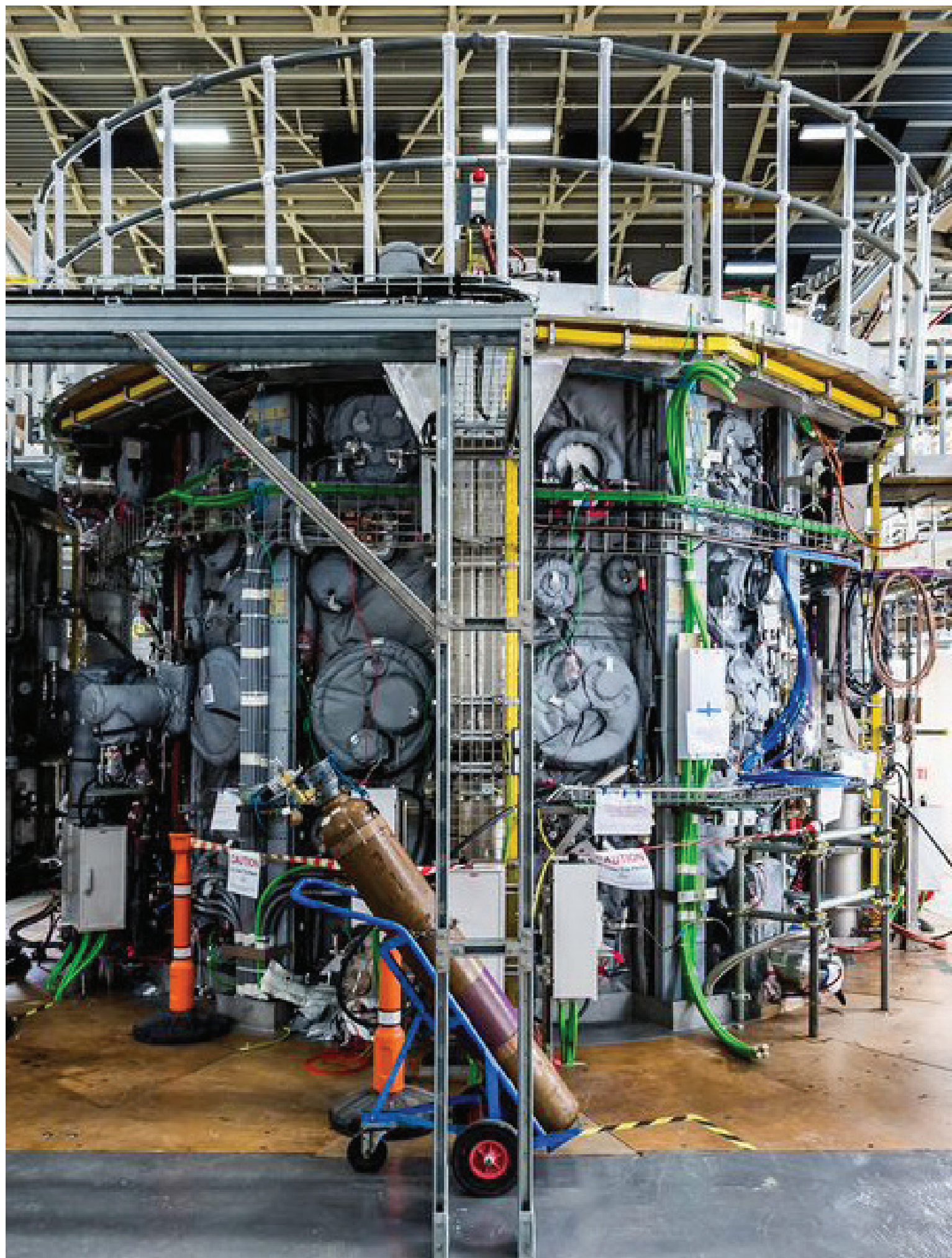
A system for handover of equipment from construction to operations has been implemented, which is both lightweight and robust in bringing the equipment on line in a controlled and safe manner for both people and plant.

Preparations for machine operations have been progressing, including developing plasma start-up scenarios and models for the full plasma performance and control. Part of the campaign on MAST-U will be funded by EUROfusion and a first call for expressions of interest was substantially over subscribed.

In addition, the UK government and Euratom are funding £21M of enhancements to improve functionality of the heating and plasma exhaust systems on MAST-U. The enhancement project has progressed with a number of diagnostics procured and calibrated ready for installation on the machine. Contracts have been placed for a Helium liquefier and recovery plant and for a cryogenic pellet injector. The preliminary design review for the upgrade to the heating system was completed and approval granted for progressing to the detailed design stage.



Performance Report Performance Analysis





# Technology Programme

Government funding, as part of the Industrial Strategy, has created opportunities to expand existing projects and facilities. UKAEA is investing in H3AT and FTF, which will enable the development of advanced, and lower cost, ways of handling Tritium and also the ability to test prototype materials and components in conditions similar to those in a fusion reactor.

H3AT will provide a unique opportunity for academia, industry and partners to benefit from a world-class tritium technology centre. In addition to state-of-the-art tritium systems and infrastructure, H3AT users will benefit from a high level of technical expertise available to provide training and support R&D. UKAEA will continue to grow a tritium capability in MRF. This will provide interim facilities and will enable the study of tritiated materials using the suite of analytical tools available within MRF by the end of 2018.

Meanwhile FTF will comprise of three facilities, namely:

- **Module Testing Facility** – a new facility which will offer a unique multi-load testing capability for metre scale components combining high heat flux (continuous and variable), static and dynamic magnetic loads in a thermohydraulic test facility. This will enable testing of fusion prototypes such as a tritium breeding blanket and so will be a source of extensive data to support virtual engineering and the development of digital twinning. Discussions are ongoing with the various initiatives in the big data arena through the UKAEA High Power Computing group.
- **Joining and Advanced Manufacturing Laboratory** – expansion of an existing facility, which will focus on techniques including additive manufacture, laser

and electron beam welding and functionally graded materials, together with non-destructive testing techniques and lifetime monitoring. It also includes the radio frequency induction test facility HIVE (Heating by Induction for Verifying Extremes) for testing small samples made by novel techniques. The lab will work closely with industry and Catapults to enable an interchange of modern practice and fusion expertise that will be crucial in projects such as the manufacture of the ITER Test Blanket Modules and the design of EU-DEMO blankets and divertors.

- **Materials Technology Laboratory** – expansion of an existing facility, which will focus on the development of small sample testing techniques to support the MRF, reduce waste and support the development of testing techniques relevant to specialised fusion materials. It is an extension of an existing facility to include additional equipment and improved diagnostic capability.

A stakeholder and requirement capture exercise was undertaken with industry, Catapults, national laboratories and universities to ensure the facilities are relevant to the widest possible user groups. Although intended mainly for fusion applications, it is a principle of the facilities specifications that non-fusion applications will be accommodated. Positive discussions with key EUROfusion personnel have indicated the interest in using the facilities within the ITER and DEMO programmes. Design activities are underway and will be complete by the end of 2018. Construction will start in 2019 with the facilities becoming operational by 2021.

UKAEA has continued to make a strong contribution to the EUROfusion programme with increased participation in the Engineering Design Data Integration

project within the Materials Programme.

This project, which UKAEA leads, involves the collation and authentication of material property data and the development of structural design codes. A key activity is the creation of structural design codes based on plastic analysis, rather than elastic analysis as used in fission systems and so reflect the different failure mechanisms and component dimensions of fusion machines.

Consultancy and collaboration work has increased via the establishment of new projects with the European Spallation Source and EPSRC partnerships in projects on fast neutron detection and nuclear access management with Lancaster and Manchester Universities. We have also improved the efficiency of the data handling tools used for radiation transport and activation analysis. Historically, this analysis has been time consuming due to the problems of translating computer-generated models into the radiation transport codes. A suite of new tools has reduced the time taken to perform parts of this analysis from a day to a few seconds.





Performance Report Performance Analysis





# Materials Science Programme

An important part of fusion research is the development of structural and plasma-facing materials that can withstand years of intense fluxes of neutrons and plasma exhaust heat. The overarching objective of UKAEA's materials science research is to generate the fundamental understanding of how materials behave in this hostile fusion environment that is needed to underpin choices for the design of fusion technology components. Much of this research is part of EUROfusion and other international collaborations (e.g. with the US, Japan and IAEA), and there is input from several UK universities. The research increasingly exploits UKAEA's new MRF.

Modelling materials damage requires understanding of microstructural evolution, magnetic properties of steels, generation and thermal recovery of defect and dislocation structures, hydrogen isotope retention, and embrittlement mechanisms. When modelling the high temperature performance of steels, it is very important to treat magnetism properly and to do this UKAEA has pioneered "spin lattice dynamics" theory which is used in simulations of millions of atoms. Spin lattice dynamics is now being adopted by Sandia National Laboratory in the US in its LAMMPS open source code which is used across the globe for a wide range of metallurgy applications.

The FISPACT-II nuclear data software (<http://fispact.ukaea.uk/>) is used by UKAEA for a range of work and is provided to other organisations for fusion and other applications that require calculations of radioactive inventories & radiation transport. A new version of FISPACT-II was released in February 2018.

UKAEA has measured the effects of plasma on tiles in JET, both tungsten and beryllium, concentrating on erosion and deposition of material and on absorption of gases used to fuel the plasma. During the year, further understanding has been gained on how these effects vary with their position inside JET. This will inform projections to ITER which will have the same combination of plasma-facing materials.

UKAEA has also used the MRF to examine materials that have been irradiated with ions and neutrons to understand radiation damage processes and develop improved techniques for these experiments.

Equipment has been successfully built, tested and now deployed (with Croatian colleagues on their beamline at the Ruđer Bošković Institute) that enables materials to be irradiated at a range of temperatures simultaneously. This will greatly speed up the experiments to get data on irradiation damage; doing irradiations at a wide range of temperatures is very important as the damage that results depends greatly on how hot the material is.

The MRF has been built to allow scientists, mainly from universities, to process and analyse samples far too radioactive for university premises but not requiring the facilities of a nuclear licensed site. It is used for both fission and fusion energy programmes, and for other research including materials used in particle accelerators. The MRF has had funding from the Government's National Nuclear User Facility (NNUF) and Henry Royce Institute initiatives. The MRF has hot cells to cut up radioactive material to samples that are small enough for microstructural, mechanical and thermophysical analysis.

During the year, many investments in new equipment and facilities were made, mainly funded by £2M from the Henry Royce Institute. To date experiments have been restricted to materials with low or no radioactivity, but at the end of 2017/18 analysis equipment was moved into new shielded rooms which will allow analysis of much more active material to commence in 2018/19. An important function of the MRF is to help train the next generation of nuclear materials researchers, and much of the use of MRF involves students working on research projects.





# Performance Report Performance Analysis



# RACE

RACE continues to build a diversified portfolio of activities and revenue streams from both commercial contracts and grant funded research. In addition to operating JET remote handling systems at Culham and supporting UK industry on ITER capital equipment projects, RACE's capabilities are also now supporting UK industry and research in decommissioning, hot cell technology, autonomous inspection and maintenance and driverless car testing.

Over the course of the year, RACE has grown by more than 30%. It has 150 robotics engineers and has won £21M of funding as part of £54M of collaborative R&D with industry and academia.

Key successes include:

- £9M program jointly funded with ITER called the ITER Robotics Test Facility - several full-scale fusion system mock-up designs are being built in the RACE hall to perform remote handling compatibility assessments;
- £12.5M program with seven leading universities called RAIN (Robotics and AI for Nuclear) - RACE is carrying out research in inter-operable robotics, system-of-systems control, manipulator control, haptics, artificial intelligence and human-robotics-interfaces. This work is relevant to fusion, fission and decommissioning challenges;
- £8M for the DRIVEN project being led by RACE tenant Oxbotica – the project is to develop and operate autonomous vehicles, which will culminate in these vehicles travelling autonomously from London to Oxford; and
- £12M program with Millbrook for autonomous vehicle testing as part of the UK's national testbed infrastructure for connected and autonomous vehicles.

Robotics and AI was given prominence in the Industrial Strategy and RACE is a leading actor in this burgeoning market. In January 2018, RACE partnered with Oxford Investment Opportunity Network to hold a Robotics and AI event at Culham, bringing together investors, entrepreneurs and academics to highlight the importance of robotics in driving UK growth and to enable ideas to be pitched to potential investors.

In 2017/18, several UK manufacturers used the NIST (National Institute for Standards and Technology) robotics test facilities at RACE to validate Unmanned Ground Vehicles (UGVs) to international standards. Next year additional test facilities will be made available to support development and export. Test and evaluation facilities and technical support at RACE are also aiding UK robotic system suppliers in decommissioning. RACE continues to lead delivery of the Active Cell Facility for the European Spallation Source.

Early 2018 saw the completion of the first stage refurbishment of the Telescopic Articulated Remote Mast now in position in the RACE work hall and ready for its commissioning. This will offer UKAEA a highly adaptable robotics test rig for developing remote maintenance technologies for DEMO. Software engineers at RACE have developed new software to simultaneously operate multiple different remotely controlled devices from the same user interface including ground vehicles, drones, manipulators and their associated sensors and tools. In addition, following the recent successful tests, in collaboration with industry, RACE will be designing and further testing a novel tooling for cutting and welding of DEMO pipes.

In 2017, the government's Science and Innovation Audit found that Oxfordshire is playing a world leading role in developing four transformative technologies, one of which is autonomous vehicles. UKAEA is supporting industry in the rapid development of driverless cars, using the Culham site as a test centre and hosting pre-road trials. In addition to the collaborative projects, UKAEA has been awarded £2M of funding from the Oxfordshire Local Enterprise Partnership to improve facilities and capabilities in this area. The technology used for autonomous vehicles has fusion applications and the technology used by Oxbotica has been used by RACE to produce a 3-D point cloud map of the JET vessel, enhancing remote handling operations.





Performance Report Performance Analysis



# Property Development

Founded on its assets and UKAEA's mission to support the government's Industrial Strategy, one of UKAEA's five goals is to develop the Harwell Campus and Culham Science Centre as significant centres for science and innovation, thereby supporting UK economic growth and generating high-tech jobs.



## Culham Science Centre

Culham Science Centre is one of the three large internationally significant science and business centres in southern Oxfordshire which underpin the County's economic growth. It is owned and exclusively managed by UKAEA. UKAEA is already well on the way to achieving the further 1,000 jobs targeted in South Oxfordshire's Core Strategy with the site now supporting approaching 2,500 jobs in over fifty organisations. Looking to the future, Culham Science Centre is earmarked for significant further growth in the emerging Local Plan.

UKAEA's vision for Culham Science Centre is to be a leading global hub for innovation in fusion energy and related technology, engineering and design, supporting regional and national growth. In pursuing this vision, the aims are to provide UKAEA with a suitable environment to meet its mission and to enable significant growth in economic activity and high-tech jobs. Both aims will require investment and property development.

To support its own programmes, UKAEA has already completed and commissioned three new facilities during the last 2 years – RACE, MRF and the Materials Detritiation Facility. These signalled UKAEA's ambitions both in relation to the future of fusion work but also regarding economic impact and collaboration with industry and academia. Further new investments are planned. Funding has already been secured for a further two facilities, H3AT and FTF, and planning work for these is underway. Already in procurement is a new OAS building. This is due to open in 2019 and will house and accommodate the growth of the apprentice training programme.

UKAEA continues to maintain a consistently high level of occupancy in tenanted space, not least because of the high-quality working environment which benefits from a range of amenities and facilities. Accordingly, significant growth will require the development of new accommodation for commercial activity as well as for UKAEA's own operations. To enable this, planning permission has been secured for a first phase of new development and the UKAEA has been working with government and potential investors to identify delivery options. Of particular interest is the scope to attract companies that partner with UKAEA and can contribute to an advanced engineering cluster at the site.





### Harwell Campus

The Harwell Campus is now one of the fastest growing science and innovation environments nationally. Employment on the Campus has increased from 4,700, in 2014 to over 6,000, working in 225 organisations, in 2018.

In 2017/18, the Partners launched a new Campus Strategy setting out their Vision for the Harwell Campus as a world-renowned location for innovation, high technology industry and research. Together with STFC, UKAEA holds and manages the public sector's share in the joint venture Partnership that has been established to develop the Campus. UKAEA also leases land to the Nuclear Decommissioning Authority for decommissioning thereby providing for further land to be made available for development.

During the year, a series of projects were completed, consisting of new builds Quad One, Zephyr and Runway and the refurbishment of the old head quarters building, all of which are already occupied or let. The construction phase was also instigated for two new pre-let buildings. The Partnership has significantly raised the national and international profile of the campus and is both developing and seeding new technology clusters, notably the Space Cluster. Further reinforcing the Campus' significance nationally and internationally, government is investing, through STFC, in the new Rosalind Franklin Institute, the Faraday Challenge headquarters and the National Space Test Facility.

The integrated mixed-use masterplan for the Campus also provides for residential development to help with the development of a vibrant work/life environment at the Campus. Work is underway to secure an exceptional planning allocation for this type of development and to consider how the Partnership might deliver a viable, manageable scheme using UKAEA land.



# People

## Capability

UKAEA's continued world class reputation relies on the ability to attract, retain and develop first-class talent. 2017/18 has seen another year where employee numbers have increased with recruitment of 105 new permanent posts and an additional 23 fixed term appointments. Acute shortage areas such as control & instrumentation technicians, engineers (cryogenic, electrical, systems, process, mechanical, design), technical project managers and nuclear specialists are being addressed through a variety of recruitment campaigns.

There are a range of programmes to develop staff. This includes a highly valued two-year graduate scheme certified by the Institution of Mechanical Engineers, Institution of Engineering and Technology (IET) and the Institute of Physics (IoP). Similarly accredited continuous professional development schemes encourage employees from all disciplines to become professionally recognised and PhD and MSc opportunities are offered. A mentoring scheme operates to support staff with their career development and targeted professional coaching is also provided.

UKAEA continues to nurture a culture that promotes research, innovation and leading edge technological excellence and is committed to investing in its people, by striving to create a working environment where people are given challenging and interesting work, frequently required to think innovatively about new problems.

UKAEA is also committed to supporting diversity and inclusion and creating an environment that is welcoming, inclusive and supportive to all. The Athena Swan initiative is helping to make gender equality part of UKAEA's overall strategy. The 2017 staff culture survey identifies some good practice in place but also that there is still some progress to be made in order to further attract and support women within UKAEA. Activity is underway to eradicate non-inclusive language and behaviours and to continue to promote a fair and flexible workplace for all, including the launch of Inclusion Ambassadors embedded within Departments and employee support groups such as the LGBT+ Network.

## Apprenticeships & OAS

A record number of 15 apprentices were recruited for the UKAEA Apprenticeship Scheme, starting in September 2017. In September 2018, this will rise to 23 new starters, putting UKAEA well on track to achieve the public-sector target of 2.3% of new apprenticeships in the workforce for 2018/19. During the year a number of the apprentices won awards, including an electrical advanced engineering apprentice, who secured the Engineering Horizons Bursary accolade from the IET.

UKAEA also hosts the OAS skills training centre, which was established in 2016 in existing buildings on site, and in 2017 expanded to train thirty-two apprentices for high-tech local employers. Recruitment for 2018 has commenced with tentative requirements from employers totalling 67 apprenticeship and HNC places. In parallel, work continued on Phase 2 of OAS which will train up to 125 apprentices per year. The design for the new building is undergoing planning consent and tenders for building construction and for the Phase 2 training provider have been issued.





# Stakeholder Engagement

## Outreach and Public Engagement

Brexit was the main focus of UKAEA's public affairs programme during 2017/18. The UK's departure from the Euratom treaty has major implications for the future of JET and for the UK's participation in ITER. Consequently, we have invested significant effort in working with officials and ministers in the UK and the European Commission to ensure that UKAEA's activities can continue after the UK leaves Euratom. Aside from this, general awareness of fusion and the progress in UK research among politicians was increased by the formation of an All-Party Parliamentary Group on fusion in October 2017, instigated by UKAEA.

UKAEA hosted a succession of visits to Culham by key stakeholders, for example politicians, civil servants, funding agencies, industrial partners and scientific collaborators. Among notable visitors to the site in 2017/18 were HRH The Duke of York, who toured JET in March 2018 and met a cross-section of UKAEA staff. Others included Jesse Norman MP (then Energy Minister), John Manzonei (Chief Executive of the Civil Service and the Permanent Secretary of the Cabinet Office), Rachel Reeves (Chair of the Business, Energy and Industrial Strategy Committee), Alex Chisholm (BEIS Permanent Secretary), Grigory Trubnikov (Russian Science Minister); Richard Harrington (BEIS Minister for Business and Industry), Rt Hon Liz Truss (Chief Secretary to the Treasury) and the House of Lords EU Energy and Environment Sub-Committee.

Brexit was one reason for an extremely busy year in the media for UKAEA. The organisation appeared in over 500 stories during the 2017 calendar year, as the national press picked up on the Euratom issue – Culham was mentioned in stories by the BBC, Sky News, Guardian, Financial Times, and the Express to name but a few;

almost all were sympathetic to the need to find a positive solution. The amount of media coverage also reflects increasing interest in fusion, with ITER construction over 50% complete and more private sector companies entering the stage. Furthermore, it is partly due to the variety of different projects and collaborations UKAEA is now involved in, from fusion to robotics, nuclear materials and autonomous vehicles.

UKAEA's 2017/18 education and outreach programme enabled almost 3,000 young people to either see fusion research at first hand at Culham or to experience it through the Sun Dome school workshop. In addition, many hundreds more met UKAEA staff at science festivals – notably the New Scientist Live event in London, where Ian Chapman gave a keynote talk. The long-running series of Open Evenings and Open Days continued throughout the year, giving around 1,000 members of the public the opportunity to visit Culham. From the feedback received it is clear these events are as popular as ever.

## University Collaborations

University collaborations have continued to grow and to expand into new areas of research encompassing not only plasma physics but materials science, advanced computing, technology and engineering. There are presently collaborative links with over 25 UK universities and with a far greater number of university departments. This gives universities an opportunity to leverage EUROfusion funding for Enabling Research, Research on JET and Medium Sized Tokamaks, for Educational Support and for post-doctoral fellowships. They also have access to other facilities at Culham such as MRF, RACE and the ADRIANA facility. Several universities have EPSRC grants of their own for research projects with UKAEA as a collaborator.

This year has also seen the appointment of a new Research Programme Director at UKAEA, which is joint appointment with the University of York.

UKAEA has links to several Fusion and Nuclear Masters courses and has established strong and effective relationships with several Centres for Doctoral Training (CDTs), most notably the Fusion CDT led by the University of York which also involves the universities of Durham, Liverpool, Manchester and Oxford. UKAEA provided lectures to students at the Fusion CDT and in support of many of the Masters courses. UKAEA also provided one of the 3 keynote speakers at a Joint Nuclear CDT Event at York. At the last census there was 162 PhD students working in fusion in the UK.

In 2017, UKAEA hosted 42 undergraduate and masters students from 19 universities, representing a 60% increase in the number of students compared with the previous year. Student placement durations ranged from a few months to a year (year-in-industry projects). Tokamak Science projects were the most popular, but projects linked to RACE, Tritium Science & Engineering and the Power Academy accounted for a third of the total.

UKAEA helps to fund key professorships in a number of universities and PhD studentships at 16 UK universities, including 18 PhD students who started in 2017/18. UKAEA hosted an annual summer event showcasing the work of PhD students and a PhD recruitment event in December 2017, which was attended by over 50 potential PhD students and 20 university staff from 11 different university departments.



# Assurance

## Health & Safety

UKAEA was once again awarded a prestigious Gold Medal by the Royal Society for the Prevention of Accidents (RoSPA) in recognition of its sustained commitment to accident and ill-health prevention. The RoSPA Gold Medal is presented following five or more consecutive RoSPA Gold Awards, and recognises the achievement of all on site delivering on safety.

The UKAEA continues to monitor and measure its safety performance through leading and lagging metrics, identifying areas for improvement based on the results. Efforts continue to mature the safety culture among both employees and contractors which is achieved via proactive programmes of monitoring and training such as the Zero Injury Programme tours, management walkabouts, a highly effective near-miss and incident reporting system and a peer-led behavioural safety programme.

Health and wellbeing remains a strong focus for the UKAEA and for the fourth year running a calendar of initiatives were undertaken, aligning with national programmes such as 'National Heart Month' and 'Cancer Awareness'. In addition, there have been activity-based programmes including two 'fun-runs' that encourage people to get out and exercising as well as raise money for local charities.

The UKAEA continues to have a good health and safety record. The accident frequency rate (defined as the ratio of work related lost time injuries per 100,000 hours worked averaged over the year) is 0.29 (for employees and contractors combined). This is an increase of 0.13 from the previous financial year but still compare very favourably when benchmarked with other similar organisations. The root cause behind the increase has been analysed and

actions identified as part of the continuous improvement programme.

All radiation exposures can be considered as low as reasonably practicable (ALARP). The average radiation dose to the monitored/classified workers during 2017/18 was 0.007mSv (UKAEA employees) and 0.01mSv (contractors) which is less than 1% of both the legal limit (20mSv/ year), the site dose constraint (5mSv/year) and average background radioactive dose received by members of the public (2.7mSv). The highest individual cumulative radiation dose this year was 0.21mSv, which was a result of a campaign of work in June 2017 which involved entry into the Torus vessel. This dose is approx. 4% of the site dose constraint and 1% of statutory limits.

## Environment and Sustainability

Table 2 – Summary of financial and non-financial sustainability information for 2016/17

Area		2014/15	2015/16	2016/17	2017/18
Greenhouse gas emissions (1,000 tCO <sub>2</sub> e)		67.2	31.0	25.4	15.4
Estate Energy	Consumption (mill kWh)	65.8	65.8	59.9	36.1
	Expenditure (£k)	4,560	5,669	5,418	4,055
Estate Waste	Amount (tonnes)	693.1	693.5	626.5	503.04
	Expenditure (£k)	110	241	190	345.5
Estate Water	Consumption ('000 m <sup>3</sup> )	110.5	79.8	97.52	62.7
	Expenditure (£k)	217	126	165	144

Note:

1. More detail is provided in Tables 3-5. The information has been prepared in accordance with guidelines laid down by HM Treasury

UKAEA's annual carbon footprint has continued to decrease in 2017/18, primarily due to JET being in shutdown during this period. Energy and water consumption and waste disposal volumes all vary year on year due to changes in plant operations, and this therefore affects the total greenhouse gas emissions. During operational periods, electricity and water use increase. During periods of plant shutdown, waste production and staff numbers increase. However, during 2017/18 total waste disposal volumes were 20% lower than the previous year due to wider improved segregation and higher awareness across site about waste reduction. One of the initiatives that led to this was the introduction of a consistent colour coding scheme for recycling bins.

The planned transition of the Environmental Management System to the new ISO 14001:2015 standard is progressing and is in line with the timescale for recertification in June 2018.



Table 3 – Greenhouse gas emissions

Greenhouse gas emissions		2014/15	2015/16	2016/17	2017/18
Non-financial indicators (1,000 tCO <sub>2</sub> e)	Total emissions (Scope 1-3)	6717	31.04	25.40	15.37
	Gross emissions Scope 1 (direct)	41.22	3.95	1.67	1.45
	Gross emissions Scope 2 & 3 (indirect)	25.95	27.09	23.73	13.92
Related energy consumption (million kWh)	Electricity: Non-Renewable	45.78	54.03	52.70	29.80
	Electricity: Renewable	–	–	–	–
	Gas	14.22	11.76	7.24	6,33
	LPG	–	–	–	–
	Other	–	–	–	–
Financial indicators (£k)	Expenditure on Energy	4,560	5,669	5,418	4,055
	CRC Licence expenditure	402	465	438	<b>294</b>
	Expenditure on accredited offsets	–	–	–	–
	Expenditure on official business travel	509	394	445	569

Note:

2. The greenhouse gas emissions were calculated (from the raw data) using DEFRA/DECC conversion factors: <https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>
3. Figures which have been partially or entirely estimated or revised are in bold italics. Explanations of each estimate follow:
  - i. CRC Licence Expenditure – The 2017/18 figure is an estimate.



**Table 4: Waste Disposal**

Waste		2014/15	2015/16	2016/17	2017/18	
Non-financial indicators (tonnes)	Total waste disposed of	693.07	693.50	626.48	503.04	
	Hazardous waste	Total	36.83	50.99	32.34	24.48
		Non-hazardous waste	Landfill	52.98	14.96	21.11
	Reused/Recycled		434.62	422.56	377.23	270.94
	Composted		27.04	37.44	39.32	37.36
	Incinerated (energy recovery)		115.90	97.30	99.5	100.1
	Incinerated (no energy recovery)		0.05	26.14	4.06	0.07
	Total non-hazardous waste		630.59	598.41	541.22	421.83
	Radioactive	Produced	46.89	31.05	39.44	40.94
		Disposed	18.66	44.10	52.92	56.73
	OSR (see note below)	Produced	13.19	10.90	10.18	36.49
Incinerated (no energy recovery)		6.99	–	–	–	
Total Radioactive / OSR waste disposed of		25.65	44.10	52.92	56.73	
Financial Indicators (£k)	Total disposal cost	110	241	190	345.5	
	Hazardous waste disposal cost		22	92	15	24
	Non-hazardous waste disposal costs	Landfill	7	9	10	2
		Reused/recycled	(81)	28	25	5
		Composted	2	2	3	1.5
		Incinerated (energy recovery)	10	11	20	21
		Incinerated (no energy recovery)	–	–	–	–
	Radioactive	Disposed	138	99	117	256
OSR	Incinerated (no energy recovery)	13	–	–	–	

Note:

- The figure for 'Compost' is food waste sent for anaerobic digestion. Negative financial figures for 'Reused/Recycled' reflect rebates received from scrap metals.
- Out of Scope of Regulations (OSR) waste is material where the activity is low enough to fall below the threshold set by the Environmental Permitting Regulations to be classified as radioactive waste.

**Table 5: Finite Resource Consumption**

Finite resource consumption		2014/15	2015/16	2016/17	2017/18	
Non-financial indicators ('000m <sup>3</sup> )	Water consumption (whole site)	Supplied	110.54	79.79	97.52	62.7
		Abstracted	N/A	N/A	N/A	N/A
		Supply per FTE	0.10	0.07	0.09	0.06
	Average number FTE staff/contractors		1,090	1,080	1,046	1,130
	A4 paper reams equivalent		8,200	5,600	4,300	4,800
Financial indicators (£k)	Water supply costs (whole site)		217	126	165	144
	Paper supply cost		17	11	8	7

**Management Systems and Quality**

UKAEA operates an integrated management system and is certified to the internationally recognised core ISO Management Standards. The UKAEA successfully maintains combined certification to ISO 9001, 14001 and OHSAS 18001, which is subject to independent audit by AFNOR. In addition, Health Physics Group is accredited to ISO17025, the international standard for testing laboratories.

The internal audit programme provides assurance to management and stakeholders that the required standards are being maintained and where areas requiring improvement are identified these are actively tracked and reported to management.

The quality management system is subject to a programme of continuous improvement which has included transition to a new Electronic Document Management System and a review of top level policies. Planning for a new intranet platform offers an opportunity to further

improve the accessibility and function of the management system.

The launch of a new Integrated Delivery Process aims to streamline and strengthen the way we manage projects across the organisation. The purpose is to create ‘One lifecycle management framework that allows competent people to deliver value effectively’.

**Security**

The UKAEA maintains an effective level of security at Culham Science Centre aligning closely with the BEIS Security Strategy.

The annual Department Security Health Check continues to show that the security standards are being maintained.

The Security Policy framework provides a balanced set of security requirements and a number of improvements have been delivered including access control, CCTV monitoring and the roll out of Security Computer Based Training, which is mandatory for staff. In addition, a number of security related emergency exercises have been undertaken demonstrating that arrangements are robust.

Information security and related risks are actively managed and monitored by the Information Assurance Steering Committee. Ongoing behavioural education for users remains key in the protection against ever present cyber threat and also to ensure compliance with the new General Data Protection Regulation. Investment is also being made to improve UKAEA’s IT resilience and business continuity plans have been developed.



# Financial Review

## Operating Performance

UKAEA's operating performance in 2017/18 is summarised in the table below:

Finite resource consumption	2017/18 £k	2016/17 £k	Variance year on year £k	Comment on variance where significant
Revenue	101,627	98,632	2,995	Increase mainly in the Fusion operating segment.
Operating (loss)/profit	(1,317)	(1,467)	150	Operating loss mainly due to the impact of increases in provisions and revaluation adjustments
Retained profit for the year after financing but before taxation	10,942	632	10,310	Largely due to UKAEA's £12,168k share of profits in the HSIC Joint Venture (2017: £1,980k).
Profit for the year after taxation	13,660	5,125	8,535	Mainly because of the increased share of profit in the Joint Venture above

## Taxation

### Current Tax

UKAEA has adopted the Research and Development Expenditure Credit ("RDEC"), which replaced the previous R&D tax relief regime and became mandatory from 1 April 2016. The RDEC generates extra income for UKAEA and offsets any non-trading profits from property and other activities. A tax credit of £3,865k has been recognised in the Accounts. Further details are at note 10 of the Accounts.

### Deferred Tax

The total deferred tax charge in the income statement is £1,204k, largely owing to a reduction in the deferred tax asset recognised. Further details are in Note 19.

### Site restoration provision

The estimated cost of decommissioning and environmentally restoring the JET facilities at UKAEA's Culham site is £313,281k (2016/17: £305,106k). This cost is in 2017/18 money values after discounting at rates and using the methodology advised by HM Treasury, as at the date of the Statement of Financial Position. It is expected that the part of the Culham site on which the facilities are located will be designated to the NDA after the current research programme has ended and the liabilities will be transferred to NDA at that time. Further details of the provision, and the effect of certain key factors on the estimate, are disclosed in Note 20. A corresponding reimbursement receivable has been recognised in the Accounts on the basis of assurances received from BEIS (Notes 15 and 20).

As further described in Note 20, the current Lifetime Plan for the decommissioning of JET was drawn up in 2007/08. The NDA have agreed to undertake a full review of the current Lifetime Plan during 2018/19. An initial resourcing meeting was held on 2 May 2018; the aim is to complete this review during 2018/19.

**Professor Ian Chapman**  
**Chief Executive and Accounting Officer**  
**11 July 2018**



# Accountability Report

# Corporate Governance Report

## Directors' Report

The Directors of the Board, and where appropriate the period for which they served during the year, are set out below.

### Chair

Professor Roger Cashmore, CMG, FRS

### Executive Directors

Professor Ian Chapman, Chief Executive Officer (CEO)

### Non-Executive Directors

Professor Sir Keith Burnett, CBE, FRS (to 31st January 2018)

Norman Harrison

Dr Jim Hutchins

Peter Jones, FCCA (to 31st January 2018)

Chris Theobald

Shrinivas Honap (from 1 April 2018)

### Authority Secretary

Catherine Pridham, ACA

Biographical details of the Directors are included on pages 34 to 35. The responsibilities of the Directors are included on page 39.

### The Executive Team

Professor Ian Chapman, Chief Executive Officer (CEO)

Martin Cox, Director

David Martin, Chief Operating Officer

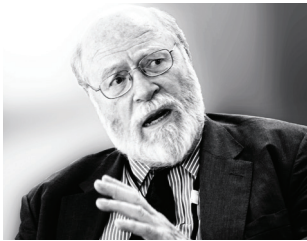
Catherine Pridham, Chief Financial Officer and Director of Corporate Affairs and Authority Secretary

The Executive Team listed above are members of the wider UKAEA Executive Committee which comprises UKAEA senior managers.

Biographical details of the Executive team members above are included on pages 36 to 37. Their remuneration has been included in the Remuneration Report.

# Chairman and Non-Executives

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## 1 Professor Roger Cashmore, CMG, FRS

Appointed Chair of the UK Atomic Energy Authority on 30 July 2010. He is a Fellow of the Royal Society and in 2010 led the Royal Society working group on Nuclear Proliferation. He is a former Principal of Brasenose College in Oxford, and is a Professor of Experimental Physics in Oxford.

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## 2 Professor Sir Keith Burnett, CBE, FRS

Appointed to the UKAEA Board on 1 November 2010 and his term came to an end on 31 January 2018. He is Vice-Chancellor of the University of Sheffield (since 2007). Previously he was Head of the Division of Mathematical, Physical and Life Sciences at the University of Oxford. Before this he was Chair of the Physics department at Oxford.

Before returning to Oxford, he was Director of Research and Deputy Director General of CERN, the European high energy physics laboratory in Geneva, Switzerland, where he was responsible for the experimental programme at the Large Hadron Collider. Before leaving for CERN he was Chair of Physics in Oxford and during his teaching and research career he has more than 200 publications in learned journals. He has been a Visiting Professor in Tsukuba in Japan, Brussels, Padua, Fermilab in the United States and holds an Honorary

Doctorate from the Joint Institute of Nuclear Research in Dubna, Russia. He was awarded the C V Boys Prize of the Institute of Physics (IOP) and a Research Award by the Alexander von Humboldt Foundation in Germany.

His research is in the area of ultra-cold atomic physics. His direct involvement in fusion science policy started when he was head of Physics at Oxford and chaired the review of fusion science for the DTI. This report led to EPSRC taking up the funding role for the UK effort in fusion research. He was from 2001 to 2007 Chair of the Fusion Advisory Board which advised EPSRC, and hence the UKAEA, on fusion strategy. He later chaired the expert group that helped develop the Research Councils UK Fusion strategy, and had the opportunity to assess the UK's programme for the years ahead.

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In 2004, he was made a Companion of the Order of St Michael and St George (CMG) for services to international particle physics.

Keith is a member of the Prime Minister's Council for Science and Technology. He was knighted for services to science and Higher Education in 2013. He is a member of the Higher Education Funding Council for England Board.

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**3 Norman Harrison**

Appointed to the UKAEA Board on 1 March 2016. He is currently a Trustee and Director of the Nuclear Liabilities Fund and the Deputy Chair of the Board of Governors at Manchester Metropolitan University. He also runs his own consultancy business.

He has 35 years' experience in the power and nuclear power sector. He has a long track record of successfully running nuclear power stations including Heysham 1 and Sizewell B. He delivered a major change programme at Dounreay and was CEO of UKAEA from 2006 to 2010 and led on the privatisation programme for UKAEA.

Norman is a Chartered Chemist and holds Fellowships with Nuclear Institute, Royal Society of Chemistry and Royal Society of Arts.

**4 Dr Jim Hutchins**

Appointed to the UKAEA Board on 1 March 2016. He was recently a Non-executive Director and chair of the Technology Advisory Board of Keronite Ltd, a member of the Oxfordshire Local Enterprise Partnership and Chair of Science Vale.

He is an experienced senior manager from the high technology sector, with a track record of converting R&D into marketable and profitable income streams. From 1991 to 2013 he held senior roles in Oxford Instruments, his most recent as Chief Technical Officer where he was responsible for the technical and R&D functions and helped grow it from an SME to a FTSE 250 listed company with 2000 employees worldwide.

Jim has a DPhil in Experimental Physics and is a Fellow of the Institute of Physics

**5 Peter Jones, FCCA**

Appointed to the UKAEA Board on 1 November 2010 and his term came to an end on 31 January 2018. He was a non-executive director of NNL and Chair of its Audit Committee from 2009 to 2014. He was a Reporting Panel member of the Competition Commission from 2005 to 2013. He was appointed a non-executive director of a start-up company developing a customer loyalty product using financial technology in February 2017.

His previous roles have included: Principal Private Secretary to the Chair of the National Coal Board, and during a subsequent 19 year career in Corporate Finance at Samuel Montagu & Co. Limited and HSBC Investment Banking, as a senior adviser to the Department of Trade and Industry during the 2003-4 strategic review of BNFL, as a senior adviser to Scottish Power and British Coal during their respective restructurings and privatisations and to British Nuclear Fuels Ltd during the implementation of the strategic review and also as a consultant to the Shareholder Executive and Department of Trade and Industry during the final preparations for the restructuring of the civil nuclear clean-up sector in 2004-2005.

Peter is also a qualified Chartered Certified Accountant and has had exposure to a wide range of financial management and planning issues in a variety of sectors varying from financial services to electricity production.

**6 Chris Theobald**

Appointed to the UKAEA Board on 1 March 2016. He is a senior executive from the nuclear, energy and defence markets. During the last 15 years he has held leadership roles including MD of Serco's nuclear consulting business and Divisional MD at a joint venture between BAE Systems and Finmeccanica. Previously he held senior roles in BAE Systems Avionics and GEC-Marconi. He led the £140m sale of Serco's nuclear consulting business to AMEC in 2012. He served as a board director for the UK Low Level Waste Repository at Drigg, Cumbria and was a founding member of the board for the National Skills Academy for Nuclear. He was recently Vice- President UK/Europe for BWXT Inc (formerly Babcock and Wilcox) leading business development in the civil nuclear market.

Chris has a degree in Aeronautical Engineering and is a Member of the Royal College for Defence Studies.

**7 Shrinivas Honap**

Appointed to the UKAEA Board on 1 April 2018, Shrinivas took over the position as Chair of the UKAEA Audit Committee, which oversaw the production of this document. Previously he has held senior roles at Vodafone and Capita and as a non-executive within the NHS. He brings a wealth of experience focused particularly on major system development, customer management, regulation and finance.

He currently holds non-executive roles on the following organisations: British Transport Police Authority; Registers of Scotland; Lay Member of the Speakers Committee on IPSA; Driver and Vehicle Standards Authority; and Office of the Public Guardian. He is also Chair of the Audit Committee for the latter two organisations.

# Executive Team



## 1 Professor Ian Chapman

Appointed Chief Executive Officer and Accounting Officer for the UKAEA on 1 October 2016. He joined in 2004, becoming Head of Tokamak Science in 2014. He has also held a number of international roles in fusion. He was a Task Force Leader for JET from 2012 to 2014. He was appointed a member of the programme advisory committee for US experiment NSTX-U in 2013. He has chaired international working groups for ITER and led work packages within the EU fusion programme. He has published over 110 journal papers and given 30 invited lead-author presentations at international conferences.



## 2 Catherine Pridham, ACA

Appointed as Chief Financial Officer, Director of Support Division and Secretary of the United Kingdom Atomic Energy Authority in January 2014, she previously held the role of Head of Finance, Contracts and Integrated Planning, from 2012. She was appointed Director of Finance and Corporate Affairs in December 2014. She qualified as a chartered accountant with Arthur Andersen and has worked in the pharmaceutical sector for SmithKline Beecham, Amersham PLC and GE Healthcare, where she supported a number of different business areas including a commercial clinical trials business, a large R&D portfolio and a Joint Venture looking to exploit research capabilities commercially with large pharmaceutical companies. Prior to joining the UKAEA she completed several finance restructuring and process improvement projects for the Ministry of Justice and Department of Transport.



He has won a number of international awards, including the European Physical Society Early Career Prize in 2014, the Institute of Physics Paterson Medal in 2013, the IUPAP Plasma Physics Young Scientist Prize in 2012 and the Cavendish Medal for Best early-career UK physicist awarded by SET for Britain in 2011.



He was made a Fellow of the Institute of Physics in 2013 and became a visiting Professor at Durham University in 2015.



**3 David Martin**

Appointed Chief Operating Officer in March 2016. He is a Chartered Mechanical Engineer and Fellow of the Institution of Mechanical Engineers who joined Culham after completing an apprenticeship at Harwell in 1979. Following a role in the build and operation of the Neutral Beam Testbed on JET, he joined the Engineering Group in Neutral Beams before establishing the Engineering Analysis Section. He became Engineering Group Leader and then Department Manager in 2008. In 2011 he was appointed Head of Physics and Engineering Development Division. He has held other senior engineering posts such as Engineer in Charge and Deputy Chief Engineer. In 2013 he was appointed Operations Director.

David is committed to staff development and has initiated many of the training schemes presently being run at CCFE – including the apprentice and graduate programmes – helping to achieve accreditation by IET, IMechE and the Power Academy.

**4 Martin Cox**

Appointed Director and Project Sponsor for the MAST Upgrade Project in 2015, his main responsibility was for ensuring the successful delivery of MAST-U. He also has a key role regarding the contract with the EU Commission to operate JET on behalf of Europe. He was previously appointed to the UKAEA Board as Chief Operating Officer on 1 November 2010, when he was responsible for the day-to-day running of the UK's fusion research programme, and for the operation of JET on behalf of EURATOM and fusion laboratories across Europe.

Martin is a theoretical physicist who joined Culham upon graduating, working on plasma modelling. He then became involved in the operation of the experimental facilities. In 1994 he was appointed the Project Manager for the design and construction of the MAST device. From 2000, when the UKAEA assumed responsibility for the operation of JET on behalf of the European Fusion community, he became manager of the Machine Operations Department, overseeing the operation of most of the JET facilities as well as MAST. In 2007 he was appointed Senior Manager for all aspects of JET operation and in 2008 was appointed Assistant Director (Operations). He was appointed Operations Director on 1 November 2009.



# Statement of Accounting Officer's Responsibility

Section 4(3) of the Atomic Energy Authority Act 1954 requires the United Kingdom Atomic Energy Authority to prepare a statement of accounts for each financial year in the form and on the basis set out in the Accounts Direction. The financial statements are prepared on an accruals basis and must give a true and fair view of the state of affairs of the Authority and of its net resource outturn, application of resources, change in taxpayers' equity and cash flows for the financial year.

In preparing those financial statements, the Accounting Officer is required to comply with the requirements of the Government Financial Reporting Manual and in particular to:

- observe the Accounts Direction issued by HM Treasury, including the relevant accounting and disclosure requirements, and apply suitable accounting policies on a consistent basis;
- make judgements and estimates that are reasonable and prudent;
- state whether applicable accounting standards as set out in the Government Financial Reporting Manual have been followed, and disclose and explain any material departures in the financial statements; and
- prepare the financial statements on a going concern basis.

The Accounting Officer of the Department for Business, Energy and Industrial Strategy (BEIS) has appointed the Chief Executive as Accounting Officer of the United Kingdom Atomic Energy Authority. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding the Authority's assets, are set out in Managing Public Money published by HM Treasury.

The Accounting Officer confirms that:

- the Annual Report and Accounts as a whole are fair, balanced and understandable; and
- as Accounting Officer he takes personal responsibility for the Annual Report and Accounts and the judgements required for determining that they are fair, balanced and understandable.

## External audit

The Accounting Officer and Directors also confirm that:

- there is no relevant audit information of which the auditors are unaware;
- all relevant steps have been taken to ensure that they are aware of relevant audit information; and
- all steps have been taken to establish that the auditors are aware of the information.

Details of the remuneration of the Group's auditors are set out in Note 7.

# Governance Statement

## Scope of Responsibility

As Accounting Officer, I have responsibility for maintaining a sound system of governance and internal control that supports the achievement of the United Kingdom Atomic Energy Authority's policies, aims and objectives, whilst safeguarding the public funds and assets for which I am personally responsible, in accordance with the responsibilities assigned to me in Managing Public Money. I am assisted in this across the Authority (UKAEA) Group as a whole by the Chief Financial Officer and Director of Corporate Affairs.

## Purpose of the Governance Statement

The Governance Statement, for which I am personally responsible, sets out how I have discharged my responsibility to manage and control UKAEA's resources during the year. It also sets out the governance framework and control structure of UKAEA, its stewardship and corporate governance, and the framework for and effectiveness of the risk management process in place.

## The Authority's Governance Framework and Structure

### The Board

The United Kingdom Atomic Energy Authority is controlled through its Board of Directors, who are appointed by the Secretary of State of BEIS. The Board's main role is to establish UKAEA's vision, mission and values, set strategy and structure, and exercise accountability to UKAEA's stakeholders.

The Board, which met five times during the year, has a schedule of matters reserved for its approval. This includes: establishing the overall strategic direction of UKAEA within the policy and resources framework agreed with the responsible Government Minister; reviewing UKAEA's corporate objectives and goals; approving the annual accounts, budget and corporate plan; reviewing and approving proposals to start new activities or to discontinue existing activities; ensuring that high standards of corporate governance are observed at all times; and reviewing the safety, environmental and security performance of UKAEA.

The Board delegates responsibility for day-to-day and business management control to the Chief Executive who is assisted by key senior managers comprising the Executive Committee. The Executive Committee meets monthly. Specific responsibilities delegated to the Executive Committee include: development of UKAEA performance measures; implementation of the strategies and policies as determined by the Board; monitoring of the operating and financial results against plans and budgets; developing and implementing risk management systems and reviewing progress on major projects.

### The roles of the Chair and Chief Executive

The division of responsibilities between the Chair of the Board and the Chief Executive is clearly defined and has been approved by the Board. The Chair leads the Board in the determination of its strategy and in monitoring the achievement of its objectives.

The Chief Executive has direct charge of UKAEA on a day-to-day basis and is accountable to the Board for the financial and operational performance of UKAEA and its subsidiaries. The Chief Executive is also UKAEA's Accounting Officer and is responsible to Parliament through the Committee of Public Accounts and other Select Committees for the stewardship of resources. His responsibilities are set out in a letter from the BEIS Permanent Secretary and the accompanying Accounting Officer Memorandum. The Accounting Officer has a personal responsibility for the propriety and regularity of the public finances for which he is answerable; for the keeping of proper accounts; for prudent and economical administration; for the avoidance of waste and extravagance; and for the efficient and effective use of all available resources. He is also responsible for taking formal action by issuing an Accounting Officer Direction, if the UKAEA Board is contemplating a course that would infringe these requirements. No Directions were issued during the year.

### Directors and Directors' independence

For the year to 31st January 2018, the Board comprised the Chair, one Executive Director and five independent Non-Executive Directors. In February 2018, two Non-Executive Directors retired and replacements have been appointed, effective 1st April 2018. The Chief Financial Officer and Director of Corporate Affairs was in attendance as Authority Secretary. The composition of the UKAEA Board is in line with other bodies that report to BEIS. A list of Board members and their biographical details is included in the Directors' Report.

The Non-Executive Directors constructively challenge and help develop proposals on strategy, and bring strong and independent judgement, knowledge and experience to the Board's deliberations. The independent Directors are of sufficient calibre and number that their views carry significant weight in the Board's decision making.

The Board considers all its Non-Executive Directors to be independent in character and judgement.

No Non-Executive Director:

- has been an employee of UKAEA within the last five years;
- has, or has had within the last three years, a material business relationship with UKAEA or its former or current subsidiaries;
- receives remuneration from the Authority other than a Director's fee;
- has close family ties with any of UKAEA's advisers, Directors or senior employees;
- holds cross-directorships or has significant links with other Directors through involvement in other companies or bodies; or
- has served on the Board for more than nine years.

## Board Committees

### Attendance

The number of full Board meetings and committee meetings attended by each Director during the year was as follows:

	Board	Remuneration Committee	Audit Committee	Board Assurance Committee
Roger Cashmore	5 (5)	3 (3)	4 (4)	
Keith Burnett (retired 31 Jan 18)	2 (4)	0 (2)	0 (3)	
Ian Chapman	5 (5)	–	–	
Norman Harrison	5 (5)	3 (3)	4 (4)	
Jim Hutchins	5 (5)	3 (3)	4 (4)	
Peter Jones (retired 31 Jan 18)	4 (4)	2 (2)	3 (3)	
Chris Theobald	5 (5)	3 (3)	4 (4)	2 (2)

Figures in brackets indicate the maximum number of meetings in the period in which the individual was a Board member.

### Remuneration Committee

The Remuneration Committee met three times during the year. All its members are independent Non-Executive Directors. Where necessary, non-committee members are invited to attend.

The Committee's principal responsibility is to make recommendations to BEIS on the level of Directors' remuneration. In addition, the Committee regularly reviews UKAEA's executive remuneration policy in relation to its competitors and industry norms and contract periods. The Committee also advises on any Human Resources policy issue or any proposed change to remuneration arrangements or terms and conditions of UKAEA staff generally which would require the agreement of Government.

As the members of the UKAEA Board are appointed by BEIS, UKAEA does not maintain a nominations committee.

### Audit Committee

The Audit Committee met four times during the year. All its members are independent Non-Executive Directors.

For the year to 31st January 2018, the Committee had at least one member possessing what the Smith Report and HMT's Audit Committee Handbook describe as recent and relevant financial experience, Peter Jones FCCA, (Non- Executive Director - retired January 2018). Whilst we awaited the appointment of our new Directors, the Audit Committee remained quorate and financial expert support for the remaining members was provided by Peter Jones, who participated in the Q4 Board reviews and the review of the Annual Financial Statements in an expert consultant capacity. Shrinivas Honap was appointed as Non-Executive Director and chair of the Audit Committee from 1 April 2018.

It will be seen from the Directors' biographical details included in the Directors' Report that the other members of the Committee brought to it a wide range of experience from positions at the highest level in the UK scientific and business community.

Under its terms of reference, the Committee is responsible for: monitoring the effectiveness of the external audit process and overseeing the terms of engagement and remuneration of the external auditor; endorsing UKAEA's policy on the provision of non-audit services by the external auditor; monitoring and reviewing the effectiveness of the internal audit programme and the implementation of recommendations arising from it; reviewing the actions and judgements of management in relation to annual and other financial statements before submission to the UKAEA Board; reviewing annually the system of internal control and the processes for monitoring and evaluating the risks facing UKAEA; and reviewing UKAEA's procedures for detecting and preventing fraud and its whistleblowing policy.

Key areas considered by the Audit Committee during the year were:

- The workplan of and key areas of focus for Internal Audit;
- Progress with completion of internal audit actions;
- The fraud landscape and UKAEA counter-fraud action plan;
- The accounts and management of UKAEA's pension schemes; and
- UKAEA's statutory accounts, including assumptions for the site restoration provision.

### Other Committees reporting to the Board

The Culham Programme Advisory Committee (CPAC), which has an external chair and membership, all of whom have backgrounds in fusion and industry, provides expert external scrutiny of UKAEA programmes and strategy, and reports directly to the Board. The key role of the committee is to review the UKAEA corporate strategies and scientific programme and provide guidance and advice to the Executive on the implementation and planning for these, as well as independent assurance to the Board that the whole UKAEA programme is soundly-based and achievable. Reviews of UKAEA's MAST Upgrade project are carried out by a sub-committee under the same chairman and are reported to CPAC.

The Board Assurance Committee, chaired by one of the non-executive directors, is intended to strengthen Board oversight of assurance matters and met twice during the year. The Committee includes expert external members, in addition to the non-executive chair, to bring independent views on relevant issues.

### Corporate Governance Review Processes

UKAEA's corporate governance arrangements are kept under constant review to ensure that they are compliant with best practice as applicable to the public sector, and with any additional Treasury requirements. It made a formal assessment during the year of its compliance against the code of good practice for government and concluded that UKAEA met the requirements of the code. In addition, the Board keeps its own performance under review and conducted a self-assessment of its own performance based on a template developed by the NAO and Non-Executive Directors' Group. The results indicated predominantly good performance with a couple of areas for improvement. The first is to ensure sufficient early warning of problems with project delivery and as a result, major project dashboards are presented at each Board meeting. A Programme and Major Projects Committee was established in 2018 to improve the level of governance and quality of reporting and the highlights from this committee are reported to the Board by the Chief Operating



Officer. The second area for improvement related to cash flow and is an area which the Board will be able to monitor going forward with the improvements in reporting that are now in place.

In addition, The Board reviews the performance of its sub-committees on an annual basis, using a self-assessment process. The review of the Audit Committee indicated good performance in all areas of the committee's remit. The review of the Remuneration Committee indicated good performance in all areas except for senior succession planning. This was recognised as an area for improvement in last year's review and although work has been undertaken, with UKAEA's expanding business and some difficulties in recruitment, this is an area for further development.

During the year the Board held a strategy meeting with UKAEA senior managers and business leaders to discuss UKAEA's future plans. Board members have also attended an all-staff talk.

UKAEA's subsidiary, AEA Insurance Ltd, has appropriate governance arrangements in place. These are formally reviewed and updated as necessary by its Board of Directors, which includes UKAEA's Chief Financial Officer and Director of Corporate Affairs. A compliance and company secretarial summary is tabled for review at each Board meeting. A risk register and provisions for an annual internal audit of controls and risks are also in place.

The UKAEA Group has a 50% interest in a joint venture, Harwell Science and Innovation Campus Public Sector Limited Partnership (HSIC PubSP), the public-sector partner in Harwell Science and Innovation Campus Ltd Partnership (HSIC), which is responsible for the development of the Harwell Campus. Both HSIC PubSP and HSIC have appropriate and fully documented governance arrangements in place, covering such matters as membership of and decisions made by their Boards of Directors, appointment and removal of Directors, funding and confidentiality. The Chief Financial Officer and Director of Corporate Affairs is on the Boards of both HSIC PubSP and HSIC. In addition, BEIS as sponsor is kept regularly informed of developments on the Campus.

Internal Review of corporate governance framework

A current project, led by the Head of Assurance, is reviewing UKAEA's corporate governance framework in relation to its Integrated Business Management System. Work has begun to develop a number of new corporate policies to complement those already in place.

#### **Internal Review of corporate governance framework**

A current project, led by the Head of Assurance, is reviewing UKAEA's corporate governance framework in relation to its Integrated Business Management System. Work has begun to develop a number of new corporate policies to complement those already in place, the first of which is an Ethics Policy. Annual reviews of compliance with the corporate policies are being set up where necessary, and responsibilities for delivery of these reviews are being formally allocated.

#### **The Risk and Internal Control Framework**

On behalf of the Chief Executive, the Head of Assurance has been appointed to co-ordinate deployment of the risk management arrangements, ensure consistency of approach and periodically report risk to the Executive Committee and Board. Ownership of divisional or functional risk registers is assigned to relevant senior managers, and individual risks are owned by the most appropriate manager. The Corporate Risk Review Group, which meets quarterly, provides oversight of corporate and major project risks. It reviews the status of the risk register and the progress of mitigations identified by the risk owners.

The UKAEA Chief Financial Officer and Director of Corporate Affairs is nominated as the Senior Information Risk Owner (SIRO), with special responsibilities for information risks.

The Board formally reviews key risks biannually in conjunction with UKAEA's risk appetite statement. The risk landscape is used to inform the business strategy and aid the management of the delivery of business objectives.

Performance of major projects includes current status, risk and financial metrics, and is reviewed on a monthly basis by the Executive and also at each Board Meeting.



### Information Assurance

Information risks are overseen by an Information Assurance Steering Committee (chaired by the SIRO), which feeds significant risks into the Corporate Risk Review Group. During the year Responsible for Information e-learning was undertaken by all relevant employees, further information assurance training was rolled out to staff, and the internal communications campaign continued, with key themes of cyber security, information security and preparation for GDPR. UKAEA achieved Cyber Essentials certification, a Government-backed cyber security certification scheme, and is progressing the 10 Steps to Cyber Security Framework. Funding was received from BEIS to invest in IT infrastructure and IT/information business continuity; this work will continue over the next few years.

There have been no reportable data breaches or data loss incidents during the year.

### Key Risks

Key risks can be grouped into the following areas:

- The UK's plan to exit the EU and Euratom agreements has created considerable uncertainty and this is impacting across the UKAEA risk landscape. Although external risks are beyond its direct control UKAEA seeks to influence them through all available channels
- funding (including the impact of changes in the Euro: Sterling exchange rate) and the development of existing and future programmes and business development activities that enable future growth;
- recruitment and retention of employees with key skills and capabilities required for the success of the organisation;
- implementation of and follow up actions relating to major projects including completion of MAST upgrade, new capabilities such as RACE, MRF and DT operation and extension of the JET operation; and
- Maintenance of UKAEA's reputation as a world leader in fusion research.

### Going Concern

The financial statements have been prepared on a going concern basis. UKAEA currently relies on funding from the European Commission to finance the operation of the JET programme and this represents approximately 45% of UKAEA's total revenue. The current contract between UKAEA and the Commission for the operation of JET covers a five-year period to 31 December 2018. Although the UK's withdrawal from the European Union and the European Atomic Energy Community (Euratom) increases the uncertainty relating to the future funding of JET, on 8th December 2017 a joint report from the negotiators of the EU and UK government stated that "following withdrawal from the Union, the UK will continue to participate in the Union programmes financed by the Multiannual Financial Framework (MFF) 2014-2020 until their closure. Entities located in the UK will be entitled to participate in such programmes. Participation in Union programmes will require the UK and UK beneficiaries to respect all relevant Union legal provisions including co-financing. Accordingly, the eligibility to apply to participate in Union programmes and Union funding for UK participants and projects will be unaffected by the UK's withdrawal from the Union for the entire lifetime of such projects." As the MFF sets the ceiling for Euratom Research i.e. the budget for JET operation, EUROfusion and ITER, the statement that the UK will continue to participate in the MFF until the end of 2020 permits the funding of JET to December 2020.

Looking beyond 2020, the Prime Minister gave a speech on science and modern Industrial Strategy on 21 May, in which she said the following: "The United Kingdom would like the option to fully associate ourselves with the excellence-based European science and innovation programmes – including the successor to Horizon 2020 and Euratom Research & Training. It is in the mutual interest of the UK and the EU that we should do so. Of course such an association would involve an appropriate UK financial contribution, which we would willingly make." In addition, a Policy Paper entitled 'Framework for the UK-EU Partnership Science, Research and Innovation' was issued by BEIS on the 23 May 2018, where it was stated that: "The UK would like to explore a close association to Euratom Research and Training based on the Swiss precedent." This demonstrates the clear UK government position that it wishes to continue a close cooperation with Euratom into the next framework programme which would enable JET to continue operation in support of ITER.

In addition, EUROfusion, who manage the European fusion programme, have approved their contribution to a series of additional upgrades to the MAST facility which will take place from 2018 to 2022. Our sponsor department, BEIS, have also demonstrated their support for the fusion programme by their £86m investment in the new Hydrogen-3 Advanced Technology (H3AT) and the Fusion Technology Facilities (FTF) which is taking place between 2017 and 2021.

The Board, Executive and I therefore believe that the commitment of Europe and the UK Government to fusion research is sufficient to support continuing operations for the foreseeable future.



UKAEA's Statement of Financial Position includes liabilities of over £364m for site restoration and restructuring costs. Matching reimbursement receivables are recognised for the majority of these liabilities on the basis of assurances from BEIS that it continues to accept responsibility in principle for these costs and provides for them in the BEIS departmental resource accounts. These assurances are re-confirmed annually and there is therefore no effect on UKAEA's ability to operate as a going concern.

## Other Matters

### Pension arrangements

The closure of the present UKAEA pension final salary scheme and the move of affected staff to the Civil Service career average 'alpha' scheme is paused on instruction from HM Treasury. We believe that it is unlikely that the anticipated move will take place before April 2020, subject to HM Treasury approval.

### General Data Protection Regulation

The General Data Protection Regulation (GDPR) comes into force on 25 May 2018 and will replace the UK's Data Protection Act, 1998. A project was initiated during 2017/18 to prepare UKAEA for this new legislation. The state of preparedness has been audited as part of the Information Assurance Audit and has been given a rating of "substantial assurance".

### Alexander Tax Review

I confirm that the UKAEA is compliant with the requirements of the Alexander Review (2012). We have one Senior Staff member on secondment and have confirmed that they are paid via the payroll of their seconding organisation. All other Senior Staff and Non-Executive Members are paid via UKAEA payroll. In all cases, this results in appropriate tax contributions being deducted at source. During the year under review, UKAEA reviewed the tax arrangements of its off-payroll appointments. All contractors within scope of this exercise have been required to provide evidence of tax compliance. All off-payroll appointments were tax compliant as at 31st March 2018.

### MacPherson Review of Quality Assurance

UKAEA conducted a review of analytical modelling as advocated by the Macpherson review (2013) can confirm that it conducts no analytical modelling within the scope of the review.

## New developments during the year

### Industrial Strategy Funding

On 6 March 2018 the new Hydrogen-3 Advanced Technology (H3AT) and the Fusion Technology Facilities (FTF) projects' governance structure was approved by the Programme Sponsoring Group. This group reports to the UKAEA Board and is chaired by the UKAEA Chief Executive Officer. Its membership includes senior members of the UKAEA management team, representatives of the Delivery Partners, BEIS and the Department for International Trade.

Both projects have their own project management plans and project boards, reporting into an overarching programme board, which in turn reports into the Sponsoring Group. Programme health checks will be carried out by an independent third-party, drawing on programme management best practice such as the Managing Successful Programmes framework and the NAO Framework, at key points during the programme's delivery and after the initiation stage which is currently underway. This will provide assurance to the Sponsoring Group that the programme has been set up effectively and is being managed appropriately.

A Programme Management Plan has been approved which includes the programme vision, scope, goals and objectives, schedule and milestones and how the programme will be monitored and controlled. Particular emphasis has been placed on establishing formal Benefits Realisation Management.

### Continued growth in breadth of activities

UKAEA continues to expand its MRF and RACE activities and develop its property provision in order to accommodate this growth. UKAEA follows appropriate governance and control arrangements for internal approval and monitoring of these projects.

### Completion of Internal Audit recommendations and actions

The following table summarises progress during the year on completing recommendations and actions arising from Internal Audit reviews:

Carried forward from previous years	4
2017/18 Internal Audit recommendations raised	57
Completed on time	36
Completed late	4
Overdue at 31st March 2018	10
Total actions outstanding but not overdue at 31st March 2018	11





A UKAEA performance metric on Internal Audit recommendations was reintroduced for 2017/18 to re-focus attention on timely completion and the weighting attached to the performance metric in computing the corporate bonus will be increased for 2018/19.

**New transaction processing system and payroll system**

Following the introduction of UKAEA's new finance, procurement and HR transactional system in September 2016, a post-implementation project has successfully completed many outstanding actions including considerable improvements as the year progressed in management reporting and reconciliations, both of which were the subject of internal audit recommendations, as well as the training of staff. Moreover, additional staff have been recruited to supplement the team. Following the current period of stabilisation, an upgrade software release will be implemented during 2018/19.

An audit of our new payroll system during the year identified several control weaknesses however the majority of these were closed by the end of the year. In order to improve control going forward, an interface between UKAEA's transaction processing system and the payroll provider's system is being explored so that reliance on manual controls will no longer be required. Minor discrepancies in overtime reconciliations have been investigated and addressed with additional training and working instructions.

**Plant and equipment maintenance**

Although there are areas of appropriate diligence by UKAEA staff in caring for, nurturing and supporting complex research plant through its lifecycle, this is not sufficiently comprehensive across the whole business. The Chief Engineer's Unit have agreed to undertake a lead role in addressing recent audit findings in order to ensure the necessary rigour and robustness concerning plant and equipment maintenance within the Authority going forward.

**Agency Supplied Trade and Craft workers**

UKAEA identified a lack of key governance controls over resourcing and expenditure in this specific area of its workforce. To address this, an action plan has been developed and a project manager assigned to deliver the necessary improvements. Oversight of this important deliverable is provided by the Chief Operating Officer

**Review of effectiveness of risk management and internal controls**

As Accounting Officer, I have responsibility for reviewing the effectiveness of the systems of risk management and internal control. My review of the effectiveness of these systems is informed by the work of the internal auditors and the senior managers within UKAEA who have responsibility for the development and maintenance of the internal control framework, the SIRO's report on how risks to information are being managed and controlled, and comments made by the external auditors in their management letter and other reports.

UKAEA has an internal audit function which operates in accordance with Public Sector Internal Audit Standards and an Audit Charter approved by the Audit Committee. The work of Internal Audit is determined by analysis of the risks to which UKAEA is exposed. The annual internal audit programme is based on this analysis and additionally includes a 3-year rolling programme to test key financial controls. It includes reviews which test and challenge the effectiveness of the management of risks and information.

The Head of Internal Audit provides me, as Accounting Officer, with regular reports on internal audit activity in UKAEA. These reports include an independent opinion on the adequacy and effectiveness of UKAEA's system of risk management and internal control. Internal audits undertaken during the year took into account an assessment of where the greatest control risks were, and this approach resulted in the following classifications:

Classification	Substantial Assurance	Moderate Assurance	Limited Assurance
Number of reports	1	5	4

The Head of Internal Audit has concluded that, based on the audit work undertaken and taking into account all available evidence, the system of internal control, governance and risk management within the Authority was operating effectively throughout the year with the exception of some key controls within financial reporting and payroll, which were largely addressed by the end of the financial year.

Issues relating to Agency Supplied Trade and Craft Workers and maintenance of plant and equipment existed at the year end date, but plans are in place to address these in a timely manner, with management recognising the importance of both.

I have reviewed all evidence provided to support the annual Governance Statement. My conclusion is that UKAEA's overall governance and internal control structures are generally sound and fit for purpose.

**Professor Ian Chapman**  
**Chief Executive and Accounting Officer**  
**11 July 2018**



# Accountability Report

## Remuneration and Staff Report

### Remuneration Policy

The remuneration of Directors is set by the Secretary of State for BEIS with the approval of HM Treasury in accordance with the Atomic Energy Authority Act 1954. The UKAEA Remuneration Committee makes recommendations to BEIS on the overall remuneration package for Executive Directors. The Non-Executive Directors who form the Committee are not involved in decisions relating to their own remuneration.

In reaching its recommendations, the Committee has regard to the following considerations:

- the need to recruit, retain and motivate suitably able and qualified people to exercise their different responsibilities; and
- the funding available to UKAEA.

The Committee takes account of the evidence it receives about wider economic considerations and the affordability of its recommendations.

### Service contracts

Executive Directors are appointed by the Secretary of State for BEIS. This is normally for a three year term that may be renewed upon expiry in accordance with the guidelines issued by the Commissioner for Public Appointments.

### Remuneration and pension entitlements

The individual components of the remuneration packages are:

#### Salary and fees

The CEO as Executive Director receives a basic salary which is reviewed annually by UKAEA's Remuneration Committee. The Chair and Non-Executive Directors receive fees for their services. Members of the Executive Team also receive a basic salary which is reviewed annually by the Remuneration Committee. The Remuneration Committee makes recommendations to BEIS as appropriate.

#### Benefits

Members of the Executive Team receive a car allowance.

Executive Directors, and members of the Executive Team, are also reimbursed for reasonable expenses incurred in line with the policy for UKAEA's employees. These reimbursements are not included in the table below.

#### Performance related bonuses

The performance bonuses for Executive Directors are calculated in accordance with performance against agreed objectives, confirmed by BEIS on the basis of recommendations from the Remuneration Committee. The total bonus is made up of two components: the performance of UKAEA against specific quantified targets, and the performance of the individual against specific targets. Members of the Executive Team receive bonuses based on formulae that are agreed each year by the Remuneration Committee, and which are subject to approval by BEIS where applicable. The performance-related bonuses for 2017/18 shown in the table below are subject to approval by BEIS.

## Accountability Report Remuneration and Staff Report

Individual Directors' remuneration for the year is shown in the table below, with salaries disclosed on an accruals basis. This part of the report is subject to audit.

<b>2017/18</b>	<b>Salary/ Fees £k</b>	<b>Benefits<sup>(b)</sup> To nearest £100</b>	<b>Annual Bonus £k</b>	<b>Pension benefit<sup>(c)</sup> £k</b>	<b>2017/18 Total £k</b>
<b>Chair</b>					
Roger Cashmore	20-25	–	–	–	20-25
<b>Non-Executive Directors</b>					
Keith Burnett (a)	10-15	–	–	–	10-15
Norman Harrison	10-15	–	–	–	10-15
Jim Hutchins	10-15	600	–	–	15-20
Peter Jones (a)	10-15	1,000	–	–	10-15
Chris Theobald	10-15	2,200	–	–	15-20
<b>Executive Directors</b>					
Ian Chapman	160-65	–	20-25	111	295-300
<b>Members of the Executive Committee</b>					
Martin Cox	110-115	5,000	5-10	(13)	110-115
David Martin	125-130	6,100	5-10	(9)	130-135
Catherine Pridham	120-125	6,100	10-15	24	160-165

<b>2016/17</b>	<b>Salary/ Fees £k</b>	<b>Benefits<sup>(b)</sup> To nearest £100</b>	<b>Annual Bonus £k</b>	<b>Pension benefit<sup>(c)</sup> £k</b>	<b>2016/17 Total £k</b>
<b>Chair</b>					
Roger Cashmore	20-25	–	–	–	20-25
<b>Non-Executive Directors</b>					
Keith Burnett	10-15	–	–	–	10-15
Norman Harrison	10-15	200	–	–	15-20
Jim Hutchins	10-15	400	–	–	15-20
Peter Jones	10-15	2,300	–	–	15-20
Chris Theobald	10-15	2,700	–	–	15-20
<b>Executive Directors</b>					
Steve Cowley (to 30 September 2016) <sup>(a)</sup>	100-105	1,400	10-15	14	130-135
Ian Chapman (from 1 October 2016)	80-85	–	10-15	147	240-245
<b>Members of the Executive Committee</b>					
Martin Cox	110-115	5,000	5-10	12	140-145
David Martin	120-125	6,100	10-15	8	150-155
Catherine Pridham	115-120	6,100	10-15	31	170-175

Notes:

- The full year fees for Peter Jones and Keith Burnett were £15k. Steve Cowley's annual salary was £205k.
- Expenses disclosed for the Chair and Non-Executive Directors in 2018 and in the comparatives for 2017 relate to travel for Board and other meetings at Culham and include the tax liability on these expenses which was met by UKAEA.
- The value of pensions benefits accrued during the year is calculated as (the real increase in pension multiplied by 20) plus (the real increase in any lump sum) less (the contributions made by the individual). The real increases exclude increases due to inflation or any increase or decrease due to a transfer of pension rights. In some cases the pensions benefit is negative in real terms where pay increases and additional service have not offset the effect of inflation.

## Remuneration ratios

These figures are subject to audit.

	2017/18 £	2016/17 £
Highest Paid Director's Total Remuneration	187,381	176,147
Median Total Remuneration	42,300	43,632
Ratio	4.43	4.0

Reporting bodies are required to disclose the relationship between the remuneration of the highest paid director in their organisation and the median remuneration of the organisation's workforce.

The remuneration of the highest paid director in UKAEA in the year 2017/18 was £187,381 (2016/17: £176,147). This was 4.43 times (2016/17: 4 times) the median remuneration of the workforce, which was £42,300 (2016/17: £43,632). The change between years was largely due to an increase in the remuneration of the highest paid director.

No employee received remuneration in excess of the highest-paid Director in either 2017/18 or 2016/17.

Total remuneration includes salary, performance-related pay and benefits in kind. It does not include pensions benefit, employer pension contributions and the cash equivalent transfer value of pensions.

The range of staff remuneration included in the calculation above was £11,665 to £187,381 (2016/17: £11,624 to £176,147).

## Pension entitlements

Executive Directors and members of the Executive Committee are members of the United Kingdom Atomic Energy Authority Combined Pension Scheme that pays an annual pension based on pensionable final earnings together with a lump sum at normal retirement age. Benefits are also payable in the event of death or ill health retirement. UKAEA also operates an unfunded pension arrangement for three former Chief Executives to take account of pensionable pay above the earnings cap introduced by the Finance Act 1989.

Further details of the pension schemes and unfunded pensions can be found later in the Remuneration and Staff Report.

The pension entitlements shown in the table below (which is subject to audit) are those that would be paid annually on retirement based on service to 31 March 2018 and include the value of added years paid for by Directors.

	Accrued pension as at 31/3/17 £k	Lump sum As at 31/3/17 £k	Real increase in accrued pension <sup>(a)</sup> £k	Real increase in lump sum <sup>(a)</sup> £k
<b>Executive Directors</b>				
Ian Chapman <sup>(b)</sup>	20-25	70-75	5-7.5	15-17.5
<b>Members of the Executive Committee</b>				
Martin Cox	50-55	160-165	(0-2.5)	(0-2.5)
David Martin	55-60	175-180	0-2.5	0-2.5
Catherine Pridham	10-15	35-40	0-2.5	5-7.5

Notes:

(a) The real increase has been calculated after subtracting inflation.

## Accountability Report Remuneration and Staff Report

The following table (which is subject to audit) sets out the Cash Equivalent Transfer Value (CETV) of the Executive Directors' and Executive Team members' accrued pension entitlements which have been calculated by the Scheme managers in accordance with the Occupational Pension Schemes (Transfer Values) Regulations 1996 as amended, having taken actuarial advice. The transfer values do not represent sums paid or payable to the Directors or Executive Committee members but represent a potential liability of the pension scheme or UKAEA.

	<b>CETV at 31 March 2017 £k</b>	<b>Real increase in CETV £k</b>	<b>CETV at 31 March 2018 £k</b>
<b>Executive Directors:</b>			
Ian Chapman <sup>(a)</sup>	218	52.5-55	298
<b>Members of the Executive Committee</b>			
Martin Cox	1,247	(12.5-15)	1,257
David Martin	1,270	(7.5-10)	1,346
Catherine Pridham	198	12.5-15	244

Notes:

(a) The real increase has been calculated after subtracting inflation

Members of the pension scheme have the option to pay Additional Voluntary Contributions; neither the contributions nor the resulting benefits are included in the above tables.

# Staff Report

This section is subject to audit.

## Staff costs

Staff costs comprise:

	2018 £k	2017 £k
<b>Permanently employed staff:</b>		
Salaries, bonuses and allowances	36,479	33,153
Social security costs	4,227	3,758
Pension costs	5,946	4,425
	46,652	41,336
Other staff	18,378	19,081
	<b>65,030</b>	<b>60,417</b>

## Staff numbers

The average number of full time equivalent staff during the year was as follows:

	2018	2017
Directly employed	787	694
Other staff	343	352
	<b>1,130</b>	<b>1,046</b>

Directly employed staff included 10 senior staff.

Directly employed staff included 11 senior staff.

Other staff are hired staff. The majority of these are used to carry out specialist work in UKAEA's scientific facilities.

## Staff composition

At 31 March 2018, all five of UKAEA's Board members were male. A female trainee non-executive director attended board meetings as part of the government's Women Onboard scheme during the year.

Three of the Executive Team were male and one female. Five of the fourteen members of the wider Executive Committee were female.

UKAEA has a total of 11 senior grade staff, of whom 9 were male and 2 female. At 31 March 2018, 681 (77.9%) of employees were male and 193 (22.1%) were female, compared with 574 (77.5%) male employees and 167 (22.5%) female employees at 31 March 2017.

## Sickness absence

The average sickness absence per employee for UKAEA during the 2017/18 year was 6.7 days per person, compared with 6 days in 2016/17. This is considerably lower than the public sector average of 8.5 days per employee for all public services workers as disclosed in the latest Chartered Institute of Personnel and Development Health and Wellbeing at work report.

## UKAEA Pension Schemes

(a) Defined benefit schemes

UKAEA has three defined benefit schemes: the Combined Pension Scheme (CPS), the Principal Non-Industrial Superannuation Scheme (PNISS) and the Protected Persons Superannuation Scheme (PPSS). These schemes have members from other employers as well as UKAEA. No information in these financial statements relates to other employers participating in the CPS, PNISS or PPSS, although the Group has overall responsibility for the management of the schemes. No contingent liability is expected to arise from this responsibility.

In common with other public sector schemes, the CPS, the PNISS and the PPSS do not have many of the attributes of normal pension

schemes. All contributions are paid to and benefits paid by HM Government via the Consolidated Fund. Any surplus of contributions made in excess of benefits paid out in any year is surrendered to the Consolidated Fund and any liabilities are met from the Consolidated Fund via the annual Parliamentary vote. The Government does not maintain a separate fund and actuarial valuations are based on a theoretical calculation as to how a typical UK pension scheme would have invested the historical surplus of contributions over payments.

In accordance with the FReM, the schemes are accounted for as defined contribution schemes.

Employer contributions are calculated in accordance with HM Treasury methodology “Superannuation Contributions Adjusted for Past Experience” and are based on the expected cost of members’ benefits as they accrue. The total contributions paid by the Group during the year were £5,924 k (2017 : £4,406k).

(b) Defined contribution schemes

UKAEA manages two defined contribution schemes, the Additional Voluntary Contribution (AVC) scheme and the Shift Pay Pension Savings Plan (SPPP) scheme, both of which are fully insured schemes administered by Prudential Assurance Company Ltd to whom contributions are paid.

The AVC scheme includes members from UKAEA and from other employers who are members of CPS or PPSS and who have opted to pay additional voluntary contributions. No employer contributions are made to this scheme.

The members of the SPPP scheme include shift working employees of UKAEA and other employers who are members of CPS or PPSS. The costs of the SPPP scheme, which are directly linked to shift pay earnings, are charged to the statement of comprehensive income at the time the shift pay is paid. The total contributions paid by UKAEA during the year were £20k.

(c) Unfunded retirement benefits

Three former UKAEA chief executives have unfunded retirement benefits which are not included in the UKAEA pension schemes.

The movement in the liability for these benefits is shown below:

	<b>Group and Authority</b>	
	<b>2018</b>	<b>2017</b>
	<b>£k</b>	<b>£k</b>
At 1 April	2,323	1,986
Change in discount rate	47	362
Interest on liability	64	70
Benefits payable	(79)	(78)
Actuarial (gain) loss	(104)	(17)
	<b>2,251</b>	<b>2,323</b>

The interest on liability is included in the statement of comprehensive income and the actuarial loss is included in taxpayers’ equity. The closing liability, discounted at the appropriate pensions liability discount rate, is included in other provisions for liabilities and charges in the statement of financial position (Further details of provisions are given in Note 20).

**Staff Policy**

UKAEA has an equal opportunities policy which requires that all job applicants enjoy equal opportunity for employment on the basis of ability, qualifications, experience and suitability for the work. We deliver in-house training on diversity and equality, unconscious bias and specific recruitment training. Both courses cover diversity and equality, ensuring that line managers are aware of their responsibilities towards, and the benefits of, these topics.

UKAEA’s equal opportunities policy provides a framework for ensuring that equality is considered throughout the employment of staff. For those who become disabled during their employment, we provide occupational health facilities which provide direct support to the employee and also advise line managers on modifications and restrictions which are required. In addition to the training mentioned above, HR Business Partners provide coaching on flexible working and unconscious bias to ensure that disabled persons are given equal opportunity in training, career development and promotion.

## Expenditure on consultancy

There was no expenditure on consultancy in either the current or the previous year.

## Off-payroll appointments

(a) Off-payroll engagements as of 31 March 2018, for more than £245 per day that last for longer than six months

Number of existing engagements as of 31 March 2018 38

Of which:

Number that have existed for less than one year at time of reporting 9

Number that have existed for between one and two years at time of reporting 10

Number that have existed for between two and three years at time of reporting 1

Number that have existed for between three and four years at time of reporting 3

Number that have existed for more than four years at time of reporting 15

(b) New off-payroll appointments, or those that reached six months in duration, between 1 April 2017 and 31 March 2018, for more than £245 per day and that last for longer than six months

Number of new engagements, or those that reached six months in duration, between 1 April 2017 and 31 March 2018 15

Of which:

Number assessed as caught by IR35 14

Number assessed as not caught by IR35 1

Of which:

Number engaged directly (via Personal Service company) and on UKAEA payroll -

Number of engagements reassessed for consistency/assurance purposes during the year 1

Number of engagements that saw a change to IR35 status following the consistency review -

(c) Off-payroll engagements of board members, and/or senior officials with significant financial responsibility, between 1 April 2017 and 31 March 2018

Number of off-payroll engagements of board members, and/or senior officials with significant financial responsibility, during the financial year 1

Total number of individuals on payroll and off-payroll that have been deemed "board members, and/or senior officials with significant financial responsibility" during the financial year 12

The off-payroll engagement above related to the short term engagement of Peter Jones, former Non-Executive Director up to January 2018, to provide expert advice to UKAEA pending the appointment of a replacement Non-Executive Director.



## Trade Union Facility Time

Table 1 – Relevant Union Officials

Number of employees who were relevant union officials during the relevant period	Full-time equivalent employee number
14	14

Table 2: Percentage of time spent on facility time

Percentage of working time spent on facility time by employees who were relevant union officials	Number of employees
0%	–
1-50%	14
51-99%	–
100%	–

Table 3: Percentage of pay bill spent on facility time

	Figures £
Total cost of facility time	8,109
Total pay bill	46,652,218
Percentage of the total pay bill spent on facility time, calculated as: (total cost of facility time ÷ total pay bill) x 100	0.017%

Table 4: Paid trade union activities

Time spent on paid trade union activities as a percentage of total paid facility time hours calculated as: (total hours spent on paid trade union activities by relevant union officials during the relevant period ÷ total paid facility time hours) x 100	5.79%
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### Exit packages paid to employees

There were no exit packages paid to employees in 2017/18 or the previous year, and therefore no resource cost.

On behalf of the Board

**Norman Harrison**  
Chair of Remuneration Committee  
11 July 2018

**Professor Ian Chapman**  
Chief Executive and Accounting Officer  
11 July 2018



# Accountability Report Parliamentary Accountability and Audit Report

## The Certificate and Report of the Comptroller and Auditor General to the Houses of Parliament

### Opinion on financial statements

I certify that I have audited the financial statements of the United Kingdom Atomic Energy Authority for the year ended 31 March 2018 under the Atomic Energy Authority Act 1954. The financial statements comprise: the Group and Authority Statements of Comprehensive Net Expenditure, Financial Position, Cash Flows, Changes in Taxpayers' Equity; and the related notes, including the significant accounting policies. These financial statements have been prepared under the accounting policies set out within them. I have also audited the information in the Remuneration and Staff Report that is described in that report as having been audited.

In my opinion:

- the financial statements give a true and fair view of the state of the Group's and of the United Kingdom Atomic Energy Authority's affairs as at 31 March 2018 and of the Group's and the Authority's net income for the year then ended; and
- the financial statements have been properly prepared in accordance with the Atomic Energy Authority Act 1954 and Secretary of State directions issued thereunder.

### Opinion on regularity

In my opinion, in all material respects the income and expenditure recorded in the financial statements have been applied to the purposes intended by Parliament and the financial transactions recorded in the financial statements conform to the authorities which govern them.

### Basis of opinions

I conducted my audit in accordance with International Standards on Auditing (ISAs) (UK) and Practice Note 10 'Audit of Financial Statements of Public Sector Entities in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of my certificate. Those standards require me and my staff to comply with the Financial Reporting Council's Revised Ethical Standard 2016. I am independent of the United Kingdom Atomic Energy Authority in accordance with the ethical requirements that are relevant to my audit and the financial statements in the UK. My staff and I have fulfilled our other ethical responsibilities in accordance with these requirements. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

### Responsibilities of the Board and Accounting Officer for the financial statements

As explained more fully in the Statement of Accounting Officer's Responsibilities, the Board and the Accounting Officer are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view.

### Auditor's responsibilities for the audit of the financial statements

My responsibility is to audit, certify and report on the financial statements in accordance with the Atomic Energy Authority Act 1954.

An audit involves obtaining evidence about the amounts and disclosures in the financial statements sufficient to give reasonable assurance that the financial statements are free from material misstatement, whether caused by fraud or error. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with ISAs (UK), I exercise professional judgment and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Group's and the United Kingdom Atomic Energy Authority's internal control.
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.



- conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's and the United Kingdom Atomic Energy Authority's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the entity to cease to continue as a going concern.
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the consolidated financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Group to express an opinion on the consolidated financial statements. I am responsible for the direction, supervision and performance of the group audit. I remain solely responsible for my audit opinion.

I communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

In addition, I am required to obtain evidence sufficient to give reasonable assurance that the income and expenditure reported in the financial statements have been applied to the purposes intended by Parliament and the financial transactions conform to the authorities which govern them.

#### Other Information

The Board and the Accounting Officer are responsible for the other information. The other information comprises information included in the annual report, other than the parts of the Remuneration and Staff Report described in that report as having been audited, the financial statements and my auditor's report thereon. My opinion on the financial statements does not cover the other information and I do not express any form of assurance conclusion thereon. In connection with my audit of the financial statements, my responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or my knowledge obtained in the audit or otherwise appears to be materially misstated. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact. I have nothing to report in this regard.

#### Opinion on other matters

In my opinion:

- the parts of the Remuneration and Staff Report to be audited have been properly prepared in accordance with Secretary of State directions made under the Atomic Energy Authority Act 1954;
- in the light of the knowledge and understanding of the Group and the Authority and its environment obtained in the course of the audit, I have not identified any material misstatements in the Performance Report or the Accountability Report; and
- the information given in Performance Report and Accountability Report for the financial year for which the financial statements are prepared is consistent with the financial statements.

#### Matters on which I report by exception

I have nothing to report in respect of the following matters which I report to you if, in my opinion:

- adequate accounting records have not been kept or returns adequate for my audit have not been received from branches not visited by my staff; or
- the financial statements and the parts of the Remuneration and Staff Report to be audited are not in agreement with the accounting records and returns; or
- I have not received all of the information and explanations I require for my audit; or
- the Governance Statement does not reflect compliance with HM Treasury's guidance.

#### Report

I have no observations to make on these financial statements.

**Sir Amyas C E Morse**  
**Comptroller and Auditor General**  
**National Audit Office**  
**157-197 Buckingham Palace Road**  
**Victoria, London, SW1W 9SP**  
**16 July 2018**



# Consolidated Statement of Comprehensive Income

## for the year ended 31 March 2018

	Note	Group		Authority	
		2018 £k	2017 £k	2018 £k	2017 £k
<b>Income</b>					
Revenue	5	101,627	98,632	100,503	97,912
Other Income		3,240	1,657	4,246	3,074
Share of revenue of joint venture		(1,041)	(660)	–	–
		<b>103,826</b>	<b>99,629</b>	<b>104,749</b>	<b>100,986</b>
<b>Expenditure</b>					
Raw materials and consumables		21,994	21,726	21,994	21,726
Other external expenses		22,813	23,648	22,813	23,648
Staff costs	6	64,115	60,417	64,115	60,417
Depreciation, amortisation and impairment		1,712	1,245	1,712	1,245
Other expense		1,444	(97)	2,030	1,306
Costs charged to provisions		(1,108)	(2,987)	(1,108)	(2,987)
		110,970	103,952	111,556	105,355
Revaluation adjustment		868	973	868	973
Costs capitalised		(6,695)	(3,829)	(6,695)	(3,829)
		<b>105,143</b>	<b>101,096</b>	<b>105,729</b>	<b>102,499</b>
		<b>(1,317)</b>	<b>(1,467)</b>	<b>(980)</b>	<b>(1,513)</b>
<b>Operating (loss)/profit</b>					
Finance income	8	123	221	74	151
Finance expense	8	(29)	(98)	(29)	(98)
Loss on disposal of assets		(3)	(4)	(3)	(4)
Share of profit/(loss) of joint venture after tax	13	12,168	1,980	–	–
		<b>10,942</b>	<b>632</b>	<b>(938)</b>	<b>(1,464)</b>
<b>Profit/(loss) before tax</b>					
Current tax credit – RDEC	10	3,865	3,575	3,865	3,575
Deferred tax (debit)/credit	10	(1,147)	918	(1,147)	918
		<b>13,660</b>	<b>5,125</b>	<b>1,780</b>	<b>3,029</b>
<b>Profit for the year</b>					
<b>Other comprehensive income</b>					
Net gain/(loss) on revaluations		6,207	1,358	2,742	834
Actuarial gains/(losses) on defined benefit pension plans		57	(345)	57	(345)
Income tax (debit)/credit relating to components of other comprehensive income		(339)	(1,672)	(339)	(1,672)
Other comprehensive income for the year		5,925	(659)	2,460	(1,183)
		<b>19,585</b>	<b>4,466</b>	<b>4,240</b>	<b>1,846</b>
<b>Total comprehensive income for the year</b>					

The notes on pages 60 to 82 are an integral part of these financial statements.

# Consolidated Statement of Financial Position

## as at 31 March 2018

		Group		Authority	
	Note	2018 £k	2017 £k	2018 £k	2017 £k
<b>Non-current assets</b>					
Property, plant and equipment	11	45,502	37,662	45,502	37,662
Investment property	12	60,030	60,840	60,030	60,840
Financial assets	13	32,986	14,152	16,723	13,523
Other receivables	15	355,366	349,585	355,366	349,585
<b>Total non-current assets</b>		<b>493,884</b>	<b>462,239</b>	<b>477,621</b>	<b>461,610</b>
<b>Current assets</b>					
Inventories		11	11	11	11
Trade and other receivables	15	31,772	26,632	32,623	27,230
Financial assets	13	6,769	7,196	–	–
Cash and cash equivalents	16	37,116	57,168	35,194	54,872
<b>Total current assets</b>		<b>75,668</b>	<b>91,007</b>	<b>67,828</b>	<b>82,113</b>
<b>Total assets</b>		<b>569,552</b>	<b>553,246</b>	<b>545,449</b>	<b>543,723</b>
<b>Current Liabilities</b>					
Trade and other payables	17	37,512	54,771	37,505	54,763
Provisions for liabilities and charges	20	7,024	6,493	6,004	5,402
<b>Total current liabilities</b>		<b>44,536</b>	<b>61,264</b>	<b>43,509</b>	<b>60,165</b>
<b>Total assets minus current liabilities</b>		<b>525,016</b>	<b>491,982</b>	<b>501,940</b>	<b>483,558</b>
<b>Non-current liabilities</b>					
Other payables	17	278	1,620	278	1,620
Deferred income	18	5,544	5,767	5,544	5,767
Deferred income tax liabilities	19	10,322	8,837	10,322	8,837
Provisions for liabilities and charges	20	367,372	361,797	366,155	359,887
<b>Total non-current liabilities</b>		<b>383,516</b>	<b>378,021</b>	<b>382,299</b>	<b>376,111</b>
<b>Assets less liabilities</b>		<b>141,500</b>	<b>113,961</b>	<b>119,641</b>	<b>107,447</b>
<b>Taxpayers' equity</b>					
General reserve		13,658	13,658	13,658	13,658
Revaluation reserve		13,671	11,606	13,671	11,606
Retained earnings		114,171	88,697	92,312	82,183
<b>Total taxpayers' equity</b>		<b>141,500</b>	<b>113,961</b>	<b>119,641</b>	<b>107,447</b>

The notes on pages 60 to 82 are an integral part of these financial statements.

The Financial Statements on pages 56 to 82 were approved by the Board on 11 July 2018 and were signed on its behalf by:

**Professor Ian Chapman**  
Chief Executive and Accounting Officer  
11 July 2018

# Consolidated Statement of Cash Flows

## for the year ended 31 March 2018

		Group		Authority	
	Note	2018 £k	2017 £k	2018 £k	2017 £k
<b>Cash flows from operating activities</b>					
Profit for the year		13,660	5,125	1,780	3,029
Adjustments for non-cash transactions:					
– Depreciation, amortisation and impairment		1,712	1,245	1,712	1,245
– Deferred income released	18	(277)	(275)	(277)	(275)
– Change in fair value of investment property	12	868	974	868	974
– Loss on disposal of property, plant and equipment		3	4	3	4
– Net finance income recognised		(94)	(123)	(45)	(53)
– Income tax debit/(credit)	10	(2,718)	(4,493)	(2,718)	(4,493)
– Share of loss/(profit) of joint venture		(12,168)	(1,980)	–	–
Changes in working capital:					
– (Increase)/decrease in trade and other receivables		(1,057)	(4,316)	(1,310)	(4,262)
– (Increase)/decrease in inventories		–	(1)	–	(1)
– (Increase)/decrease in current financial assets		427	549	–	–
– Increase/(decrease) in trade and other payables		(18,548)	14,743	(18,548)	14,748
– Use of provisions		134	(3,885)	900	(2,910)
<b>Net cash inflow/(outflow) from operating activities</b>		<b>(18,058)</b>	<b>7,567</b>	<b>(17,635)</b>	<b>8,006</b>
<b>Cash flows from investing activities</b>					
Purchase of property, plant and equipment	11	(6,871)	(4,521)	(6,871)	(4,521)
Investment in joint venture	13	(3,200)	–	(3,200)	–
<b>Net cash inflow/(outflow) from investing activities</b>		<b>(10,071)</b>	<b>(4,521)</b>	<b>(10,071)</b>	<b>(4,521)</b>
<b>Cash flows from financing activities</b>					
Grant from sponsoring department		7,954	3,076	7,954	3,076
Interest received		123	221	74	151
<b>Net cash inflow/(outflow) from financing activities</b>		<b>8,077</b>	<b>3,297</b>	<b>8,028</b>	<b>3,227</b>
<b>Net increase/(decrease) in cash and cash equivalents in the period</b>		<b>(20,052)</b>	<b>6,343</b>	<b>(19,678)</b>	<b>6,712</b>
Cash and cash equivalents at the beginning of the period		57,168	50,825	54,872	48,160
<b>Cash and cash equivalents at the end of the period</b>		<b>37,116</b>	<b>57,168</b>	<b>35,194</b>	<b>54,872</b>

The notes on pages 60 to 82 are an integral part of these financial statements.

# Consolidated Statement of Changes in Taxpayers' Equity

## for the year ended 31 March 2018

Group	General reserve £k	Revaluation reserve £k	Retained earnings £k	Total £k
Balance at 1 April 2016	13,658	12,766	79,995	106,419
<b>Changes in Taxpayers' Equity 2016/17</b>				
Capital Grant from sponsoring department	-	-	3,076	3,076
Total comprehensive income for the year	-	(838)	5,304	4,466
Depreciation transfer	-	(322)	322	-
<b>Balance at 31 March 2017</b>	<b>13,658</b>	<b>11,606</b>	<b>88,697</b>	<b>113,961</b>
<b>Changes in Taxpayers' Equity 2017/18</b>				
Capital Grant from sponsoring department	-	-	7,954	7,954
Total comprehensive income for the year	-	2,403	17,182	19,585
Depreciation transfer	-	(338)	338	-
<b>Balance at 31 March 2018</b>	<b>13,658</b>	<b>13,671</b>	<b>114,171</b>	<b>141,500</b>

Authority	General reserve £k	Revaluation reserve £k	Retained earnings £k	Total £k
Balance at 1 April 2016	13,658	12,766	76,101	102,525
<b>Changes in Taxpayers' Equity 2016/17</b>				
Capital Grant from sponsoring department	-	-	3,076	3,076
Total comprehensive income for the year	-	(838)	2,684	1,846
Depreciation transfer	-	(322)	322	-
<b>Balance at 31 March 2017</b>	<b>13,658</b>	<b>11,606</b>	<b>82,183</b>	<b>107,447</b>
<b>Changes in Taxpayers' Equity 2017/18</b>				
Capital Grant from sponsoring department	-	-	7,954	7,954
Total comprehensive income for the year	-	2,403	1,837	4,240
Depreciation transfer	-	(338)	338	-
<b>Balance at 31 March 2018</b>	<b>13,658</b>	<b>13,671</b>	<b>92,312</b>	<b>119,641</b>

The notes on pages 60 to 82 are an integral part of these financial statements.



# Notes to the Financial Statements

## 1 General information

UKAEA is an NDPB and was established by the Atomic Energy Authority Act 1954. The address of UKAEA's registered office is Culham Science Centre, Abingdon, Oxfordshire, OX14 3DB. Its sponsoring government department is the Department for Business, Energy and Industrial Strategy. UKAEA and its subsidiaries are referred to as "the Group".

## 2 Basis of preparation

The financial statements comply with the provisions of the Atomic Energy Authority Act 1954 and the Accounts Direction issued by HM Treasury. The latter requires the financial statements to be prepared in accordance with the Government Financial Reporting Manual (FRoM) issued by HM Treasury as updated annually. The accounting policies contained in the FRoM apply International Financial Reporting Standards (IFRS) as adapted or interpreted for the public sector. Where the FRoM permits a choice of accounting policy, the accounting policy which is judged to be most appropriate to the particular circumstances of the Group for the purpose of giving a true and fair view has been selected.

The financial statements have been prepared on a going concern basis. UKAEA currently relies on funding from the European Commission to finance the operation of the JET programme and this represents approximately 45% of UKAEA's total revenue. The Governance Statement within the Accountability Report (pages 39 to 45) gives details of arrangements for UK participation in EU programmes up to 2020, UK Government statements on continued collaboration post 2020, and additional investment on the Culham site.

The Board, Executive team and Accounting Officer therefore believe that the commitment of Europe and the UK Government to fusion research, combined with the acceptance by BEIS of responsibility for costs associated with UKAEA site restoration and restructuring liabilities, is sufficient to support continuing operations for the foreseeable future.

The financial statements are presented in pounds sterling, which is UKAEA's functional currency, and have been prepared under the historical cost convention, except for land and buildings, investment properties, assets held-for-sale and derivative financial instruments which are stated at fair value.

The preparation of financial statements in conformity with IFRS requires judgements, estimates and assumptions to be made that affect the application of accounting policies and the reported amounts of income, expenses, assets and liabilities. Estimates and underlying assumptions are reviewed on an ongoing basis. Revisions to accounting estimates are recognised in the period in which the estimates are revised and in any future periods affected. Information about significant areas of estimation uncertainty and critical judgements in applying accounting policies that have the most significant effect on the amounts recognised in the consolidated financial statements is included in the notes to the financial statements.

## 3 Significant accounting policies

The principal accounting policies applied by UKAEA in the preparation of these financial statements are set out below. These policies have been applied consistently in dealing with all items that are considered material to the financial statements.

### 3.1 Provisions

Provisions are recognised when: the Group has a present legal or constructive obligation as a result of past events; it is probable that an outflow of resources will be required to settle the obligation; and the amount has been reliably estimated.

UKAEA's site restoration provision is the most significant area of estimation uncertainty in the financial statements. Full details are in Note 20.

Where there are a number of similar obligations, the likelihood that an outflow will be required in settlement is determined by considering the class of obligations as a whole. A provision is recognised even if the likelihood of an outflow with respect to any one item included in the same class of obligations may be small.

Provisions are measured at the present value of the expenditures expected to be required to settle the obligation using real rates of interest. The change in the provision due to passage of time and changes in discount rate is recognised as finance expense or finance income as appropriate.



Where assurances have been received from another party that they will reimburse some or all of the expenditure required to settle a provision, and the requirements for recognition of IAS 37.53 are met (i.e. it is virtually certain that reimbursement will be received if the obligation is settled) a reimbursement asset will be recognised to the extent of the amount expected to be reimbursed. The reimbursement asset is shown separately from the related provision in the statement of financial position.

### 3.2 Consolidation

#### (a) Subsidiaries

Subsidiaries are entities controlled by the Group. Control exists when the Group has the power to govern the financial and operating policies of an entity so as to obtain benefits from activities and actually exercises this power. In assessing control, potential voting rights that are currently exercisable are taken into account. The financial statements of subsidiaries are included in the consolidated financial statements from the date that control commences until the date that control ceases. The accounting policies of subsidiaries are changed when necessary to align them with the policies adopted by the Group.

#### (b) Joint ventures

Joint ventures are those entities over which the Group exercises joint control through a contractual arrangement. The results, assets and liabilities of joint ventures are incorporated in the consolidated financial statements using the equity method of accounting. Investments in joint ventures are initially carried in the statement of financial position at cost and subsequently adjusted by post-acquisition changes in the Group's share of the net assets of the joint venture, less any impairment in the value of individual investments. Losses of joint ventures in excess of the Group's interest in those joint ventures are not recognised, except where the Group has made a commitment to make good those losses.

#### (c) Transactions eliminated on consolidation

Intra-group transactions, balances and unrealised gains and losses on transactions between Group companies are eliminated on consolidation.

### 3.3 Revenue recognition

Revenue is recognised when the amount can be reliably measured, it is probable that future economic benefits will be received and when specific criteria have been met as described below. The amount of revenue is not considered to be reliably measurable until all contingencies relating to the sale have been resolved. Revenue is shown net of value added tax, returns, rebates and discounts. See Note 3.17 below on the adoption of IFRS 15 from 1 April 2018.

#### (a) Service contracts

Revenue from cost recovery contracts for managing the UK's fusion research programme and the European Union's JET facility is recognised to the extent of costs incurred in the period that are expected to be recoverable from customers.

Revenue from other service contracts is recognised under the percentage-of-completion method. Revenue is generally recognised based on the services performed to date as a percentage of the total services to be performed. If circumstances arise that may change the original estimates of revenues, costs or extent of progress toward completion, estimates are revised. These revisions may result in increases or decreases in estimated revenues or costs and are reflected in income in the period in which the circumstances that give rise to the revision become known.



#### **(b) Rental income**

Rental income from investment properties is recognised in the statement of comprehensive income on a straight-line basis over the term of the lease. Lease incentives granted are recognised as an integral part of the total rental income over the term of the lease.

#### **(c) Grant-in-aid**

Grant-in-aid relating to revenue expenditure is recognised in the statement of comprehensive income in the same period as the related expenditure that it is intended to fund.

This departure from the specified treatment in the FReM has been agreed with HM Treasury.

Capital grants from UKAEA's sponsoring department are recognised as financing and credited to reserves in line with the FReM.

### **3.4 Research expenditure**

Expenditure on research activities, undertaken with the prospect of gaining new scientific or technical knowledge and understanding, is recognised in the statement of comprehensive income when incurred.

### **3.5 Employee benefits**

#### **(a) Short-term employee benefits**

Short-term employee benefits are recognised in the year in which the related service is provided. A liability is recognised for the amount expected to be paid under short-term bonus arrangements if the Group has a present legal or constructive obligation to pay this amount as a result of past service provided by employees and the obligation can be estimated reliably.

#### **(b) Termination benefits**

Termination benefits are payable when employment is terminated by the Group before the normal retirement date, or whenever an employee accepts voluntary redundancy in exchange for these benefits. The Group recognises termination benefits when it is demonstrably committed to either: terminating the employment of current employees according to a detailed formal plan without possibility of withdrawal; or providing termination benefits as a result of an offer made to encourage voluntary redundancy. Benefits falling due more than 12 months after the reporting date are discounted to their present value.

#### **(c) Retirement benefits**

Obligations for contributions to defined contribution schemes are recognised as an expense when they are due. The Group has no further payment obligations once the contributions have been paid.

The Group operates three defined benefit schemes for the benefit of its employees. Two of these are closed to new members. The schemes are unfunded multi-employer defined benefit schemes. In accordance with the FReM, these schemes are accounted for as defined contribution schemes in these financial statements and the obligations recognised are limited to the contributions due.

The Group also has a separate liability in respect of unfunded retirement benefits relating to three individuals. The liability recognised in the statement of financial position is the present value of the defined benefit obligation at the reporting date, together with adjustments for unrecognised past-service costs. The defined benefit obligation is calculated annually by independent actuaries using the projected unit credit method. The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using a real rate of interest set by HM Treasury. Actuarial gains and losses arising from experience adjustments and changes in actuarial assumptions are charged or credited to equity in the period in which they arise.

### **3.6 Segment reporting**

Operating segments are reported in a manner consistent with the internal reporting provided to the chief operating decision-maker. The chief operating decision-maker, who is responsible for allocating resources and assessing performance of the operating segments, has been identified as the UKAEA Board.

### **3.7 Foreign currency translation**

Transactions in foreign currencies are translated to the functional currency of the Group using the exchange rates at the dates of the



transactions. Monetary assets and liabilities denominated in foreign currencies at the reporting date are retranslated to the functional currency using the exchange rates at that date. Foreign exchange gains and losses resulting from the settlement of transactions and from the translation of monetary assets and liabilities are recognised in the statement of comprehensive income except when deferred in taxpayers' equity as qualifying cash flow hedges.

### 3.8 Property, plant and equipment

Land and buildings are occupied by the Group and are shown at fair value, based on periodic, but at least quinquennial, valuations by external independent valuers, less subsequent depreciation for buildings. In the intervening years, these valuations may be updated by the Group with the assistance of independent advice as required. A valuation of all the properties was carried out in February 2018.

Fair value is based on market values for existing use as there are no alternative uses for the land and buildings. Where this basis is not applicable because of the specialised nature of the asset, valuations are carried out on a depreciated replacement cost basis.

Increases in the carrying amount arising on revaluation of land and buildings are credited to the revaluation reserve. Decreases that offset previous increases of the same asset are charged against the revaluation reserve; all other decreases are charged to the statement of comprehensive income. Each year the difference between depreciation based on the revalued carrying amount of the asset charged to the income statement and depreciation based on the asset's original cost is transferred from the revaluation reserve to retained earnings.

In accordance with the FReM, other classes of property, plant and equipment with short useful lives or low book values are stated at historical cost less depreciation as a proxy for current valuations. Subsequent costs are included in the asset's carrying amount or recognised as a separate asset, as appropriate, only when it is probable that future economic benefits associated with the item will flow to the Group and the cost of the item can be measured reliably. All other repairs and maintenance are charged to the statement of comprehensive income during the financial period in which they are incurred.

Land is not depreciated. Assets under construction are not depreciated until they are in use. Depreciation on other assets is calculated using the straight-line method to allocate their cost or revalued amounts to their residual values over their estimated useful lives, as follows:

- Buildings up to 40 years
- Plant, machinery and equipment up to 10 years

The assets' residual values and useful lives are reviewed, and adjusted if appropriate, at each reporting date.

Property, plant and equipment may have component parts with different useful lives. In accordance with the provisions of IAS 16 – Property, Plant and Equipment, each part of any newly recognised item of property, plant and equipment with a cost that is significant in relation to the total cost of the item is depreciated separately.

An asset's carrying amount is written down immediately to its recoverable amount if the asset's carrying amount is greater than its estimated recoverable amount (Note 3.11).

Gains and losses on disposals are determined by comparing the proceeds with the carrying amount and any amounts to be released from deferred income on disposal and are recognised in the statement of comprehensive income. When revalued assets are sold, any amounts included in the revaluation reserve are transferred to retained earnings.

### 3.9 Investment property

Investment property, comprising freehold land and buildings, is held either for rental yields or capital appreciation and is not occupied by the Group. Investment property is carried at fair value, representing open market value determined annually by external independent valuers.



Fair value is based on active market prices, adjusted, if necessary, for any difference in the nature, location or condition of the specific asset. In the absence of current prices in an active market, the valuations are prepared by considering the aggregate of the estimated cash flows expected to be received from renting out the property. Valuations reflect the allocation of maintenance and insurance responsibilities between the Group and the lessee and the remaining economic life of the property.

Changes in fair values are recognised in the statement of comprehensive income.

### **3.10 Intangible assets**

Intangible assets comprise acquired computer software licences and are stated at cost, net of amortisation and any provision for impairment. The cost of intangible assets, less estimated residual value, is amortised on a straight line basis over their estimated useful lives of up to five years.

### **3.11 Impairment of non-financial assets**

Assets that are subject to depreciation or amortisation are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognised for the amount by which the asset's carrying amount exceeds its recoverable amount. The recoverable amount is the higher of an asset's fair value less costs to sell and value in use. For the purposes of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash flows. Non-financial assets that suffered impairment are reviewed for possible reversal of the impairment at each reporting date.

### **3.12 Inventories**

Inventories are stated at the lower of cost and net realisable value. Cost is determined using the first-in, first-out method. The cost of work in progress comprises raw materials, direct labour, other direct costs and related production overheads. Net realisable value is the estimated selling price in the ordinary course of business, less applicable selling expenses.

### **3.13 Cash and cash equivalents**

Cash and cash equivalents includes cash in hand, deposits held at call with banks and other short-term highly liquid investments with original maturities of three months or less.

### **3.14 Current and deferred income tax**

The tax charge or credit for the period comprises current and deferred tax. Tax is recognised in the income statement, except to the extent that it relates to items recognised directly in equity. In this case, the tax is also recognised in equity.

Current tax is the expected tax payable or receivable on the taxable income for the year, using tax rates enacted or substantially enacted at the reporting date, and any adjustment to tax payable in respect of previous years.

RDEC credits payable by HM Revenue and Customs are treated as tax credits in line with the provisions of IAS12, and disclosed separately in the income statement.

Deferred tax is recognised, using the liability method, on temporary differences arising between the tax bases of assets and liabilities and their carrying amounts in the consolidated financial statements. Deferred tax is determined using tax rates (and laws) that have been enacted or substantially enacted by the reporting date and are expected to apply when the related deferred tax asset is realised or the deferred tax liability is settled.

Deferred tax assets are recognised only to the extent that it is probable that future taxable profit will be available against which the temporary differences can be utilised.

### **3.15 Financial instruments**

Non-derivative financial instruments comprise trade and other receivables, investments, cash and cash equivalents and trade and other payables and are recognised initially at fair value. Subsequent to initial recognition, non-derivative financial instruments are measured as described below.



Loans and receivables are non-derivative financial assets with fixed or determinable payments that are not quoted in an active market. They are included in current assets, except for maturities greater than 12 months after the reporting date which are classified as non-current assets. The carrying values, less impairment provision, of loans and receivables are assumed to approximate their fair values.

Other financial liabilities are non-derivative financial instruments with fixed or determinable payments that are not quoted in an active market. They are included in current liabilities, except for maturities greater than 12 months after the reporting date which are classified as non-current liabilities. The carrying values of other financial liabilities are assumed to approximate their fair values.

### 3.16 Operating leases

Payments made under operating leases are recognised in the statement of comprehensive income on a straight-line basis over the term of the lease. Lease incentives are recognised as an integral part of the total lease expense over the term of the lease.

### 3.17 New and amended accounting standards

Certain new standards, amendments and interpretations to existing standards have been published but are not effective on UKAEA's accounting period.

The following new standards, amendments and interpretations to existing standards are not yet effective or are not yet effective in HMT's 2017/18 FReM and have not been early adopted by the Authority:

IFRS 9 – Financial Instruments (IAS 39 replacement – Financial Instruments: Recognition and Measurement) – effective date 1 January 2018

IFRS 15 – Revenue from Contracts with Customers (IAS 18 replacement – Revenue) – effective date 1 January 2018

IFRS 16 – Leases (IAS 17 replacement – Leases) – effective date 1 January 2019

IFRS 17 – Insurance Contracts (IFRS 4 replacement – Insurance Contracts) – effective date 1 January 2021

The Board anticipate that the adoption of these standards and interpretations in future periods will have no material impact on the financial statements of the Authority.

## 4 Financial risk management

Due to the nature of its activities, the Group is not exposed to the same degree of financial risk faced by other business entities. Financial instruments play a much more limited role in creating or changing risk and generally financial assets and liabilities are generated from day-to-day operational activities and not held to change the risks facing the Group in undertaking its activities. While the Group has significant financial liabilities relating to decommissioning and restructuring, most of the risks attached to these liabilities do not rest with the Group as they are broadly matched by reimbursement assets.

### (a) Foreign exchange risk

Foreign exchange risk arises when future commercial transactions or recognised assets or liabilities are denominated in a currency that is not the Group's functional currency. The Group operates internationally and is exposed to foreign exchange risk arising from various currency exposures, primarily with respect to the Euro.

### (b) Interest rate risk

As the Group has no borrowings or significant interest-bearing assets, the Group's income and operating cash flows are substantially independent of changes in market interest rates. Cash balances on deposit are held in highly rated fixed term deposits and the exposure to interest rate risk is minimal and appropriately managed.

### (c) Credit risk

The Group's income is received primarily from public sector bodies in the UK and Europe and the exposure to credit risk is therefore considered to be low.

### (d) Liquidity risk

The Group is primarily financed by income from other public sector bodies, in the UK and in Europe. Uncertainties about the timing and amount of some of this income, particularly income from Europe, expose the Group to liquidity risk. The Group has a facility to request temporary working capital funding from the Department for Business, Energy and Industrial Strategy should the need arise.

## 5 Segment information

As the majority of the Group's activities do not represent the provision of public services, segment information in accordance with IFRS 8 is included in these financial statements. The fees and charges analysis required by the FReM does not apply to UKAEA.

### 5.1 Reportable segments

The Group has two reportable segments, as described below, which are the Group's main business areas reported to the Authority Board. The business areas offer different services and are managed separately because they require different strategies and have different funding streams.

The following summary describes the operations in each of the Group's reportable segments:

- (a) Fusion research – research into using fusion to create a new source of energy that is safe and environmentally benign
- (b) Property management – management and development of the Culham and Harwell campuses for future scientific use

Other segments include grant-in-aid funding and insurance. None of these segments meets any of the criteria for determining reportable segments in 2018 or 2017. The results of these segments are included in the "other" column in the segmental analyses below.

The segment information for the reportable segments for the years ended 31 March 2018 and 31 March 2017 is as follows:

	Fusion research £k	Property management £k	Other £k	Total £k
<b>Year ended 31 March 2018</b>				
External segment revenue	91,866	4,708	5,053	101,627
Less: Share of revenue of joint venture	–	(1,041)	–	(1,041)
Other income	3,023	4	213	3,240
Expenditure	(93,879)	(3,701)	(6,695)	(104,275)
Investment property revaluation	–	(868)	–	(868)
Operating profit/(loss)	1,010	(898)	(1,429)	(1,317)
Finance income	74	–	49	123
Finance expense	–	–	(29)	(29)
Loss on disposal of fixed assets	–	–	(3)	(3)
Share of profit/(loss) of joint venture	–	12,168	–	12,168
Profit/(loss) before income tax	<b>1,084</b>	<b>11,270</b>	<b>(1,412)</b>	<b>10,942</b>

### Year ended 31 March 2017

External segment revenue	87,655	4,251	6,726	98,632
Less: Share of revenue of joint venture	–	(660)	–	(660)
Other income	1,101	3	553	1,657
Expenditure	(88,631)	(3,594)	(7,898)	(100,123)
Investment property revaluation	–	(973)	–	(973)
Operating profit/(loss)	125	(973)	(619)	(1,467)
Finance income	151	–	70	221
Finance expense	–	–	(98)	(98)
Loss on disposal of fixed assets	–	–	(4)	(4)
Share of profit/(loss) of joint venture	–	1,980	–	1,980
Profit/(loss) before income tax	<b>276</b>	<b>1,007</b>	<b>(651)</b>	<b>632</b>

Revenue from external parties is measured in a manner consistent with that in the statement of comprehensive income.

## Reconciliation between Reportable Segments and Statement of Comprehensive Income

	2018 £k	2017 £k
<b>Revenues</b>		
Total revenue for reportable segments	96,574	91,906
Other revenue	5,053	6,726
Consolidated revenue per Statement of Comprehensive Income	<b>101,627</b>	<b>98,632</b>
<b>Profit or loss</b>		
Total profit or loss for reportable segments	12,354	1,283
Other profit or loss	(1,412)	(651)
Consolidated profit before income tax per Statement of Comprehensive Income	<b>10,942</b>	<b>632</b>

## Geographical segments

In presenting information on the basis of geographical segments, segment revenue is based on the geographical location of customers.

	2018 £k	2017 £k
<b>Group Revenue</b>		
United Kingdom	45,063	35,985
Europe	55,762	62,546
Rest of the World	802	101
	<b>101,627</b>	<b>98,632</b>

## Revenue from major customers

	2018 £k	2017 £k
European Commission	45,521	55,929

Revenue from the European Commission is attributable to the fusion research segment.

## 6 Staff costs and operating profit

### 6.1 Staff costs

Staff costs comprise:

	2018 £k	2017 £k
Permanently employed staff:		
Salaries, bonuses and allowances	36,479	33,153
Social security costs	4,227	3,758
Pension costs – defined contribution plans (see below)	5,946	4,425
	46,652	41,336
Other staff	17,463	19,081
	<b>64,115</b>	<b>60,417</b>

Full details of UKAEA's pension schemes are given in the Remuneration Report. The total contributions paid by the Group to the CPS during the year were £5,924k (2017: £4,406k). The total contributions paid by UKAEA during the year to the SPPP were £20k (2017: £17k).

### 6.2 Operating profit

Operating profit has been arrived at after charging/(crediting):

	2018 £k	2017 £k
Change in fair value of investment property	868	973
Net foreign exchange losses/(gains)	(39)	(147)
Operating lease rentals – plant, machinery and vehicles	255	211
Non-cash items:		
– Depreciation, amortisation and impairment	1,712	1,245

## 7 Auditor's remuneration

The total remuneration of the Group's auditor, the National Audit Office, for services provided to the Group was:

	2018 £k	2017 £k
<b>Audit fees</b>		
UKAEA	60	58

### Audit of subsidiary and joint venture

The audit fee paid to the auditors of AEAIL was £8k (2017: £8k). The audit fee paid to the auditors of HSIC PubSP, in which UKAEA has a share of one half, was £28k (2017: £12k). The audit fee paid to the auditors of HSIC LP, in which UKAEA has a share of one quarter via HSIC PubSP, was £51k (2017: £25k).



**8 Finance income and expense**

	Group		Authority	
	2018 £k	2017 £k	2018 £k	2017 £k
<b>Income</b>				
Interest on term bank deposits	123	221	74	151
<b>Expense</b>				
Revalorisation of provisions:				
– Roll forward of discount rate schedule and unwinding of discount (see below)	(1,034)	(1,256)	(1,034)	(1,256)
– Adjustments to reimbursement receivables	999	1,284	999	1,284
Interest on unfunded retirement benefits	64	70	64	70
	<b>29</b>	<b>98</b>	<b>29</b>	<b>98</b>

A £999k credit to the income statement in 2017/18 (2017: credit of £1,284k) relates to the provision for the decommissioning of JET, and is matched by adjustments to the reimbursement receivable. It is the net of £4,814k discount charge and a credit of £5,813k unwinding of discount (2017: net of £1,604k discount charge and a credit of £2,888k unwinding of discount). Full details are provided in Note 20.

**9 Analysis of net income**

	Group	
	2018 Total £k	2017 Total £k
<b>Income</b>		
Income from activities	101,627	98,632
Other income	3,240	1,657
Interest receivable	123	221
Share of revenue of joint venture	(1,041)	(660)
Share of profit/(loss) of joint venture	12,168	1,980
	116,117	101,830
<b>Expenditure</b>		
Raw materials and consumables	21,994	21,726
Other external expense net of costs capitalised	16,118	19,819
Staff costs	64,115	60,417
Other expense <sup>(a)</sup>	1,444	(97)
Cost charged to provisions	(1,108)	(2,987)
Revaluation adjustment	868	973
Non-cash items:		
– Depreciation and impairment	1,712	1,245
– Finance expense	29	98
– Loss on fixed asset disposal	3	4
	105,175	101,198
<b>Net income after interest and before tax</b>	<b>10,942</b>	<b>632</b>

(a) The £97k credit against other expense in 2016/17 relates to Group consolidation adjustments

## 10 Income tax (expense)/credit

	Group and Authority	
	2018 £k	2017 £k
<b>Current tax</b>		
Current tax credit (RDEC)	3,545	3,575
Adjustments relating to previous years	320	–
	<b>3,865</b>	<b>3,575</b>
<b>Deferred tax</b>		
Origination and reversal of temporary differences	121	594
Recognition of deferred tax asset (Note 19)	(1,268)	324
	<b>(1,147)</b>	<b>918</b>
<b>Total income tax (expense)/credit</b>	<b>2,718</b>	<b>4,493</b>

The current tax on the Group's profit before tax differs from the theoretical amount that would arise using the weighted average tax rate applicable to profits of the consolidated entities as follows:

	2018 £k	2017 £k
Profit/(loss) for the year	13,660	5,125
Income tax expense/(credit)	(2,718)	(4,493)
Profit/(loss) excluding income tax	10,942	632
Tax calculated at the standard UK corporation tax rate of 19% (2017: 20%)	2,079	126
Tax effects of:		
– Reversal of timing differences	(324)	213
– Expenses not deductible	(119)	297
– R&D expenditure credit under s104A CTA 2009	831	894
– Brought forward losses set against trading profits	(2,203)	(1,307)
– Non-trading profits offset by RDEC credit	(319)	(200)
– Net RDEC claim 2017/18	(3,545)	–
– Net RDEC claim 2016/17	–	(3,575)
– Tax losses for which no deferred income tax asset was recognised	55	(23)
– Adjustments for previous periods	(320)	–
<b>Current tax expense/(credit) for the year</b>	<b>(3,865)</b>	<b>(3,575)</b>

The income tax charged/(credited) to equity during the year is as follows:

	2018 £k	2017 £k
Fair value gains on property, plant and equipment	339	1,673

**11 Property, plant and equipment**

Group and Authority	Land £k	Buildings £k	Plant and equipment £k	Assets under construction £k	Total £k
<b>Cost or valuation</b>					
At 1 April 2016	11,217	19,527	6,102	3,360	40,206
Additions	–	–	704	3,817	4,521
Disposals	–	(153)	(205)	–	(358)
Revaluation	637	197	–	–	834
Transfers	–	30	143	(173)	–
<b>At 31 March 2017</b>	<b>11,854</b>	<b>19,601</b>	<b>6,744</b>	<b>7,004</b>	<b>45,203</b>
Additions	–	–	211	6,660	6,871
Disposals	–	–	(12)	–	(12)
Revaluation	197	2,656	–	–	2,853
Transfers within property, plant and equipment	–	222	2,070	(2,292)	–
Transfer to investment property	–	(193)	–	–	(193)
<b>At 31 March 2018</b>	<b>12,051</b>	<b>22,286</b>	<b>9,013</b>	<b>11,372</b>	<b>54,722</b>
<b>Depreciation and impairment</b>					
At 1 April 2016	–	3,494	3,034	–	6,528
Depreciation charge	–	723	522	–	1,245
Disposals	–	(153)	(201)	–	(354)
Transfers	–	122	–	–	122
<b>At 31 March 2017</b>	<b>–</b>	<b>4,186</b>	<b>3,355</b>	<b>–</b>	<b>7,541</b>
Depreciation charge	–	854	828	–	1,682
Disposals	–	–	(9)	–	(9)
Transfer to investment property	–	(42)	–	–	(42)
Impairment depreciation	–	48	–	–	48
<b>At 31 March 2018</b>	<b>–</b>	<b>5,046</b>	<b>4,174</b>	<b>–</b>	<b>9,220</b>
<b>Net book value</b>					
<b>At 31 March 2017</b>	<b>11,854</b>	<b>15,415</b>	<b>3,389</b>	<b>7,004</b>	<b>37,662</b>
<b>At 31 March 2018</b>	<b>12,051</b>	<b>17,240</b>	<b>4,839</b>	<b>11,372</b>	<b>45,502</b>

All property, plant and equipment is owned by the Group.

There was £1,493k capital expenditure contracted for at the reporting date but not recognised in the financial statements (2017: £342k). This related mainly to assets in course of construction.

## 12 Investment property

	Group and Authority	
	2018 £k	2017 £k
At 1 April	60,840	61,692
Change in fair value	(868)	(974)
Net transfer from property, plant and equipment	76	–
Impairment	(18)	–
Correction of legacy depreciation balance	–	122
<b>At 31 March</b>	<b>60,030</b>	<b>60,840</b>

Investment properties were valued at fair value at 28 February 2018 by independent valuers. The valuations were undertaken by Carter Jonas in accordance with the Valuation Standards of the Royal Institute of Chartered Surveyors, IFRS and guidelines in HM Treasury's FReM. The Group has adopted this valuation at the reporting date on the grounds that there were no material changes between the valuation date and the reporting date.

Investment properties are held for their investment potential. Rental income from tenants outside the Group is negotiated at arm's length. The following amounts have been recognised in the income statement:

	Group and Authority	
	2018 £k	2017 £k
Rental income	2,000	1,985
Direct operating expenses:		
– Investment properties that generated rental income	1,427	1,677
– Investment properties that did not generate rental income	304	235

## 13 Financial assets

	Group		Authority	
	2018 £k	2017 £k	2018 £k	2017 £k
<b>Non-current</b>				
At 1 April	14,152	11,648	13,523	13,523
Investment in joint venture	3,200	–	3,200	–
Revaluation	15,634	2,504	–	–
<b>At 31 March</b>	<b>32,986</b>	<b>14,152</b>	<b>16,723</b>	<b>13,523</b>
Investment in subsidiary undertakings	–	–	3,000	3,000
Investment in joint venture	32,986	14,152	13,723	10,523
	<b>32,986</b>	<b>14,152</b>	<b>16,723</b>	<b>13,523</b>
<b>Current</b>				
Term bank deposits	6,769	7,196	–	–
<b>At 31 March</b>	<b>6,769</b>	<b>7,196</b>	<b>–</b>	<b>–</b>

## a) Investment in subsidiary undertakings

Name	Country of incorporation	Ownership interest %	
		2018	2017
AEA Insurance Limited	Isle of Man	100	100

All subsidiary undertakings are included in the consolidation. The proportion of voting rights in the subsidiary undertakings held directly by the Group does not differ from the proportion of shares held.

## (b) Investment in joint venture

The Group has a 50% interest in a joint venture, Harwell Science and Innovation Campus Public Sector Limited Partnership (HSIC PubSP), the public sector partner in Harwell Oxford, which is responsible for the development of the Harwell Oxford Campus. The interest in the joint venture is accounted for using the equity method in the Group financial statements.

	Group	
	2018 £k	2017 £k
At 1 April	14,152	11,648
Share of profit/(loss) net of tax	12,168	1,980
Additions	6,666	524
<b>At 31 March</b>	<b>32,986</b>	<b>14,152</b>
Analysed as follows:		
Cost or valuation	19,761	13,095
Share of retained profits/(losses)	13,225	1,057
	<b>32,986</b>	<b>14,152</b>

The £12,168k share of profit of the joint venture (2017: profit of £1,980k) represents UKAEA's share of the operating profit of Harwell Oxford via HSIC PubSP, and was largely due to revaluation adjustments. The increase in investment compared with the previous year was mainly due to a higher share of non-current assets in the joint venture, and related to Harwell Oxford investment properties and assets under construction.

The following amounts represent the Group's share of the income, results, assets and liabilities of the joint venture. They are included in the Statement of Comprehensive Net Income and Statement of Financial Position:

	2018 £k	2017 £k
<b>Profit/(loss) net of tax</b>		
Income	12,557	2,122
Expenses	(389)	(142)
	<b>12,168</b>	<b>1,980</b>
<b>Assets</b>		
Current assets	11,316	7,218
Non-current assets	35,448	12,138
	<b>46,764</b>	<b>19,356</b>
<b>Liabilities</b>		
Current liabilities	2,420	714
Non-current liabilities	11,358	4,490
	<b>13,778</b>	<b>5,204</b>
<b>Net assets</b>	<b>32,986</b>	<b>14,152</b>

There are no contingent liabilities relating to the Group's interest in the joint venture, and no significant contingent liabilities of the venture itself.

#### (c) Term bank deposits

Term bank deposits are held with major UK banks. The average interest rate on the deposits held at 31 March 2018 was 0.56% (2017: 0.63%). The credit risk associated with these investments is considered to be low because of the size and status of the banks involved.

#### 14 Financial instruments by category

Term deposits (Note 13(c)) are categorised as held to maturity investments. With the exception of UKAEA's interest in its subsidiary and joint venture (Notes 13(a) and 13(b)), which are exempted from the application of IAS 39, all other financial assets of the Group and the Authority were categorised as loans and receivables at both 31 March 2018 and 31 March 2017. All financial liabilities of the Group and the Authority were categorised as other financial liabilities at both 31 March 2018 and 31 March 2017.

The majority of financial instruments relate to contracts to buy non-financial items in line with the Authority's expected purchase and usage requirements and the Authority is therefore exposed to little credit, liquidity or market risk.

**15 Trade and other receivables**

	Group		Authority	
	2018 £k	2017 £k	2018 £k	2017 £k
<b>Amounts falling due after more than one year</b>				
Reimbursement receivables (Note 20):				
– Site restoration	313,054	304,937	313,054	304,937
– Restructuring	42,312	44,648	42,312	44,648
	<b>355,366</b>	<b>349,585</b>	<b>355,366</b>	<b>349,585</b>
<b>Amounts falling due within one year</b>				
Trade receivables	3,143	2,032	3,143	2,032
Reimbursement receivables (Note 20):				
– Site restoration	226	170	226	170
– Restructuring	3,437	3,275	3,437	3,275
Prepayments and accrued income	15,770	12,132	15,756	12,115
VAT	2,097	1,940	2,097	1,940
Corporation Tax	7,120	6,948	7,120	6,948
Other receivables	(21)	135	844	750
	<b>31,772</b>	<b>26,632</b>	<b>32,623</b>	<b>27,230</b>

There are no impaired assets in any of the classes of trade and other receivables.

The reimbursement receivables have been discounted at the rates applicable to the provisions to which they relate. Further details of these rates are disclosed in Note 20.

**16 Cash and cash equivalents**

	Group		Authority	
	2018 £k	2017 £k	2018 £k	2017 £k
At 1 April	57,168	50,825	54,872	48,160
Net change in cash and cash equivalent balances	(20,052)	6,343	(19,678)	6,712
<b>At 31 March</b>	<b>37,116</b>	<b>57,168</b>	<b>35,194</b>	<b>54,872</b>
The following balances were held at 31 March:				
Commercial banks and cash in hand	37,116	57,168	35,194	54,872
	<b>37,116</b>	<b>57,168</b>	<b>35,194</b>	<b>54,872</b>

## 17 Trade and other payables

	Group		Authority	
	2018 £k	2017 £k	2018 £k	2017 £k
<b>Amounts falling due within one year</b>				
Trade payables	2,385	830	2,385	830
Accrued costs	9,440	10,863	9,433	10,855
Payments received on account	23,841	41,339	23,841	41,339
Social security and other taxes	1,088	1,170	1,088	1,170
Corporation tax	-	166	-	166
Other payables	758	403	758	403
	<b>37,512</b>	<b>54,771</b>	<b>37,505</b>	<b>54,763</b>
<b>Amounts falling due after more than one year</b>				
Payments received on account	278	1,620	278	1,620

## 18 Deferred income

The majority of UKAEA's deferred income relates to capital grants for the construction of the RACE building and for the purchase of equipment for the Materials Research Facility. Both these buildings are on the Culham site.

	Group and Authority	
	2018 £k	2017 £k
At 1 April	5,767	6,042
Deferred income received	54	-
Released to income statement	(277)	(275)
<b>At 31 March</b>	<b>5,544</b>	<b>5,767</b>



**19 Deferred income tax**

Group and Authority	Investment property £k	Land and buildings £k	Total £k
<b>Deferred tax liability</b>			
At 1 April 2016	8,120	2,716	10,836
Income statement debit/(credit)	(594)	–	(594)
Charged directly to equity	–	1,673	1,673
<b>At 31 March 2017</b>	<b>7,526</b>	<b>4,389</b>	<b>11,915</b>
Movements during 2017/18:			
Income statement debit/(credit):			
- Revaluation	(122)	–	(122)
Charged directly to equity:			
- Revaluation	–	339	339
<b>At 31 March 2018</b>	<b>7,404</b>	<b>4,728</b>	<b>12,132</b>
<b>Deferred tax asset</b>			
At 31 March 2017			3,078
Increase/(decrease) in deferred tax asset			(1,268)
<b>At 31 March 2018</b>			<b>1,810</b>
<b>Net deferred tax liability</b>			
<b>At 31 March 2017</b>			<b>8,837</b>
<b>At 31 March 2018</b>			<b>10,322</b>

**Deferred tax liability**

A change to the UK corporation tax rate from 20% to 19% was substantively enacted on 26 October 2015, with effect from 1 April 2017, and a further reduction to 18% was enacted on the same date with effect from 1 April 2020. An additional reduction to 17% for periods from 1 April 2020 was enacted on 6 September 2016. The closing deferred tax liability has therefore been calculated at 17% as the liability is not expected to unwind before 1 April 2020.

Movements in the deferred tax provision relating to investment property are charged or credited to the income statement. Movements in the provision relating to land and buildings are charged or credited to the revaluation reserve.

**Deferred tax asset**

Deferred income tax losses are recognised for tax depreciation and tax loss carry-forwards to the extent that the realisation of the related tax benefit through future taxable profits is probable. The adoption of the RDEC means that previous trading losses are brought into the annual corporation tax computation. UKAEA now therefore expects to utilise its remaining carried forward losses in 2018/19. A deferred income tax asset of £175k has therefore been recognised in the Accounts, calculated at the tax rate expected to be in force in 2018/19.

In addition, UKAEA has recognised a deferred income tax asset of £1,636k in respect of RDEC set-off amounts that can be carried forward against future taxable income. Under the RDEC rules, these can only be utilised after existing trading losses have been exhausted. However, it is now expected that UKAEA will utilise these in 2018/19.

The total deferred tax asset of £1,810k has been netted off UKAEA's deferred tax liability in the Accounts as it fulfils the conditions for offsetting in IAS12.

## 20 Provisions for liabilities and charges

Group	Site restoration £k	Restructuring £k	Other £k	Total £k
<b>At 1 April 2016</b>	281,805	52,425	13,604	347,834
Changes in price levels	6,790	537	89	7,416
Unwinding of discount	(2,888)	718	(47)	(2,217)
Discount charge	16,370	–	–	16,370
Provided in the year	3,090	4,625	681	8,396
Provisions not required written back	–	(1,099)	(1,391)	(2,490)
Provisions utilised in the year	(61)	(3,813)	(3,145)	(7,019)
<b>At 31 March 2017</b>	<b>305,106</b>	<b>53,393</b>	<b>9,791</b>	<b>368,290</b>
Changes in price levels	8,355	1,497	127	9,979
Unwinding of discount	(5,813)	128	(49)	(5,734)
Discount charge <sup>(1)</sup>	5,735	–	–	5,735
Provided in the year	–	–	2,355	2,355
Provisions not required written back	–	(308)	(791)	(1,099)
Provisions utilised in the year	(102)	(3,684)	(1,344)	(5,130)
<b>At 31 March 2018</b>	<b>313,281</b>	<b>51,026</b>	<b>10,089</b>	<b>374,396</b>

Note:

- The discount charge represents the net impact of increases in the discount rates applying to the years 2018/19 to 2027/28 and reductions in the discount rate applying to years from 2028/29 onwards in line with HM Treasury guidance. Further details are disclosed in the text below.

### At 31 March 2017

Non-current	304,937	49,670	7,190	361,797
Current	169	3,723	2,601	6,493
	<b>305,106</b>	<b>53,393</b>	<b>9,791</b>	<b>368,290</b>

### At 31 March 2018

Non-current	313,055	47,362	6,955	367,372
Current	226	3,664	3,134	7,024
	<b>313,281</b>	<b>51,026</b>	<b>10,089</b>	<b>374,396</b>

**(a) Site restoration**

The decommissioning provision represents the estimated costs of decommissioning the JET facility at UKAEA's Culham site, including the storage, processing and eventual disposal of radioactive wastes.

Calculation of the liabilities is based on the technical assessments of the processes and methods likely to be used in the future to carry out the work. Estimates are derived from the latest technical knowledge and commercial information available, taking into account current legislation, regulations and Government policy. Summary figures are built up by aggregating detailed estimates for individual liabilities. Allowance is also made for infrastructure costs, which are an appropriate share of site running costs and other overhead costs attributable to plant and buildings. The calculation is reassessed annually.

The last detailed Life Time Plan (LTP) for decommissioning, funded by the Nuclear Decommissioning Authority (NDA), was drawn up in 2007/08. Since then UKAEA has each year carried out a high level assessment of changes to the assumptions made in the previous LTP. For example, the provision includes estimates for the decommissioning of facilities built since 2007/08, and an assessment of the effect of changes to some key assumptions such as the date of JET closure.

The NDA have agreed to carry out a full update to the Lifetime Plan during 2018/19. Until this full update is completed the "top-down" approach, with a review and agreement of key assumptions by the NDA is the basis for this provision.

The approach taken, until a further LTP is prepared, and the fact that much of the work required to deal with the liabilities will not be undertaken until well into the future, means that there is at present a significant uncertainty as to the amount of the provision and the associated receivable due from BEIS which is described later in this Note. This significant uncertainty does not impact on either net assets or the net profit reported in the financial statements.

The best estimate of the cost of dealing with the liabilities at 31 March 2018 is discounted to the reporting date at real discount rates advised by HM Treasury. The rates now applied are set out below, together with the rates applying at 31 March 2017:

	<b>2018</b>	<b>2017</b>
	<b>Rate %</b>	<b>Rate %</b>
<b>Short term – 0 to 5 years from the date of the Statement of Financial Position (SFP)</b>		
2018/19	-2.42	-2.70
2019/20	-2.42	-2.70
2020/21	-2.42	-2.70
2021/22	-2.42	-2.70
2022/23	-2.42	-2.70
<b>Medium term – 5 to 10 years from the SFP</b>		
2023/24	-1.85	-1.95
2024/25	-1.85	-1.95
2025/26	-1.85	-1.95
2026/27	-1.85	-1.95
2027/28	-1.85	-1.95
<b>Long term – greater than 10 years from the SFP</b>		
2028/29 and subsequent financial years	-1.56	-0.80

The unwinding of discount in the year to March 2018 represents the difference between the cash flows for the years from 2018/19 onwards discounted to 31 March 2018 at the 2017 rates and those cash flows discounted back to 31 March 2017 using the same discount rates for each financial year. The discount charge for the year to 31 March 2018 represents the effect of changes in the discount rates applying to each financial year as advised by HM Treasury. The charge has been calculated as the difference between the net present value of the liabilities at the SFP and the sum of (i) the net present value of the same liabilities discounted to 31 March 2017 at the 2017 rates and (ii) the unwinding of discount calculated as described above. The most significant factor affecting the discount charge is the increase in the negative discount rates applying to years 2028/29 onwards in accordance with the new HM Treasury discount rate schedule.

The provision is expressed in 2017/18 money values using an inflation rate of 2.74% to uplift it from 2016/17 values. The analysis of expected timing of discounted cash flows is as follows:

	<b>Group and Authority</b>	
	<b>2018</b>	<b>2017</b>
	<b>£k</b>	<b>£k</b>
Not later than one year	226	169
Later than one year and not later than five years	86,202	52,029
Later than five years and not later than ten years	149,235	143,930
Later than ten years and not later than twenty years	58,258	92,809
Later than twenty years and not later than fifty years	19,360	16,169
	<b>313,281</b>	<b>305,106</b>

The best estimate of the undiscounted cost of dealing with the liabilities is £273,499k (2017: £266,374k).

A letter issued by the then Secretary of State for Energy in 1986 stated that the Government was prepared to continue to accept responsibility in principle for those costs which the Authority incurs in treating and disposing of nuclear wastes and in decommissioning plant arising from:

- (i) programmes carried out by the Authority and its predecessors prior to 1 April 1986; and
- (ii) programme agreement work undertaken for BEIS and its predecessors after 1 April 1986.

These assurances were reconfirmed by BEIS in May 2018. On the basis of these assurances a matching receivable is included in the statement of financial position.

UKAEA has assessed the impact of the date of JET closure, which is a key variable, on the best estimate recognised in the 2017/18 Annual Accounts. This gives a range of undiscounted and discounted costs (including the best estimate) as follows:

Undiscounted costs	£273,302k to £273,926k (2017: £266,183k to £266,621k)
Discounted costs	£304,882k to £333,072k (2017: £301,223k to £305,178k)

**(b) Restructuring**

The restructuring provisions represent termination benefits payable under early retirement arrangements to employees who had retired early, or had accepted early retirement, before 31 March 2018. These benefits continue at least until the date at which the employee would have reached normal retirement age, and in many cases part of the benefit is payable for life. The restructuring provisions are discounted to the reporting date at the discount rate for pension liabilities advised by HMT, which is 0.10% in 2017/18 (2017: 0.24%). The undiscounted cost of the group provisions is £51,442k (2017: £54,477k) and the benefits are estimated to be payable over a period up to 35 years.

The analysis of the expected timing of discounted cash flows is as follows:

	Group and Authority	
	2018 £k	2017 £k
Not later than one year	3,664	3,723
Later than one year and not later than five years	13,990	14,094
Later than five years	33,372	35,576
	<b>51,026</b>	<b>53,393</b>

Part of the expenditure required to settle the restructuring liabilities will be reimbursed by other parties as follows:

- (i) Lump sums paid to employees on early retirement are refundable to the Group from the appropriate pension scheme at or after the date on which the individual concerned would have reached normal retirement age.
- (ii) Assurances covering restructuring provisions made before 1 April 2004 have been received from BEIS, and reconfirmed in May 2018, and expenditure related to these provisions is reimbursed by BEIS.

On the basis of these reimbursement arrangements, receivables have been included in the statement of financial position.

**(c) Other provisions**

The largest single provision is for £3,498k and relates to the disposal of operational waste arising from UKAEA's previous contract to operate JET, which ended in December 2014. The provision was discounted at the Treasury rates for general provisions referred to in note 20(a) above. The undiscounted cost of the provision is £3,453k. In addition, UKAEA has made provision of £550k for the eventual decommissioning of the MRF at its Culham site. The remaining provisions mainly comprise unfunded retirement benefit obligations and claims relating to industrial-related injuries.

**21 Operating leases****(a) The Group as lessee**

Non-cancellable operating lease rentals are payable as follows:

	2018 £k	2017 £k
Not later than one year	102	204
Later than one year and not later than five years	94	17
Later than five years	–	–
	<b>196</b>	<b>221</b>

The Group leases vehicles and office equipment under operating leases.

### (b) The Group as lessor

The Group leases its investment property with lease terms of between 0.5 and 25 years. The leases contain market review clauses in the event that the lessee exercises the option to renew. The lessee does not have an option to purchase the property at the expiry of the lease period.

The future minimum lease payments under non-cancellable leases are as follows:

	<b>2018</b>	<b>2017</b>
	<b>£k</b>	<b>£k</b>
Not later than one year	1,696	967
Later than one year and not later than five years	1,720	2,065
Later than five years	190	55
	<b>3,606</b>	<b>3,087</b>

Rental income received during the year is disclosed in Note 12.

## 22 Related party transactions

UKAEA is an NDPB sponsored by BEIS which is regarded as a related party.

During the year, UKAEA had various material transactions with BEIS and with other entities for which BEIS is regarded as the responsible department, in particular EPSRC. STFC is UKAEA's partner in the Harwell Science and Innovation Campus Public Sector Limited Partnership (Note 13). Other material transactions took place with the Civil Nuclear Constabulary and the NDA, organisations within the BEIS Group.

No Board member, key manager or other related party has undertaken any material transactions with the Group during the year, except for remuneration as disclosed on pages 46 to 49.

## 23 Statutory borrowing limit

During 2017/18, the statutory borrowing limit set by Section 3 of the Atomic Energy Authority Act 1986 as amended by The United Kingdom Atomic Energy Authority (Limit on Borrowing) Order 1991 remained at £200m. There were no borrowings by UKAEA during the current or previous year.

## 24 Events after the reporting period date

In accordance with the requirements of IAS10 – Events After the Reporting Period, post Statement of Financial Position events are considered up to the date on which the Accounts are authorised for issue. This is interpreted as the same date as the date of the Certificate Report of the Comptroller and Auditor General.

There were no reportable events after the reporting period date.

# Glossary

<b>AVC</b>	Additional Voluntary Contribution	<b>IFRS</b>	International Financial Reporting Standards
<b>AEAIL</b>	AEA Insurance Ltd	<b>ITER</b>	Next generation international experimental fusion reactor
<b>AI</b>	Artificial Intelligence	<b>JET</b>	Joint European Torus
<b>BEIS</b>	Department for Business, Energy and Industrial Strategy	<b>LTP</b>	Life Time Plan
<b>CRC</b>	Carbon Reduction Commitment Energy Efficiency Scheme	<b>MRF</b>	Materials Research Facility
<b>CETV</b>	Cash Equivalent Transfer Value	<b>MAST-U</b>	Mega Amp Spherical Tokamak Upgrade device
<b>CEO</b>	Chief Executive Officer	<b>NAO</b>	National Audit Office
<b>CERN</b>	European Laboratory for Particle Physics	<b>NNUF</b>	National Nuclear Users Facility
<b>CDT</b>	Centre for Doctoral Training	<b>NDPB</b>	Non-Departmental Public Body
<b>CPS</b>	Combined Pension Scheme	<b>NDA</b>	Nuclear Decommissioning Authority
<b>CCFE</b>	Culham Centre for Fusion Energy	<b>OAS</b>	Oxfordshire Advanced Skills
<b>CPAC</b>	Culham Programme Advisory Committee	<b>OSR</b>	Radioactive and Out of Scope of Regulations
<b>DEMO</b>	Demonstration fusion power station	<b>PPSS</b>	Protected Persons Superannuation Scheme
<b>DT</b>	Deuterium-tritium campaigns	<b>PNISS</b>	Principal Non-Industrial Superannuation Scheme
<b>EDS</b>	Exhaust Detritiation System	<b>RACE</b>	Remote Applications in Challenging Environments facility
<b>EPSRC</b>	Engineering and Physical Sciences Research Council	<b>R&amp;D</b>	Research & Development
<b>FRem</b>	Government Financial Reporting Manual	<b>RDEC</b>	R&D Expenditure Credit
<b>FTE</b>	Full Time Equivalent	<b>RoSPA</b>	Royal Society for the Prevention of Accidents
<b>FTF</b>	Fusion Technology Facilities	<b>STFC</b>	Science & Technology Facilities Council
<b>H3AT</b>	Hydrogen-3 Advance Technology – tritium facility	<b>SIRO</b>	Senior Information Risk Officer
<b>HMT</b>	Her Majesty's Treasury	<b>SPPP</b>	Shift Pay Pension Savings Plan
<b>HSIC PubSP/LP</b>	Public/private sector partnership for the Harwell joint venture	<b>SFP</b>	Statement of Financial Position
<b>IAS</b>	International Accounting Standards	<b>UKAEA</b>	UK Atomic Energy Authority
<b>IET</b>	Institution of Engineering and Technology		
<b>IoP</b>	Institute of Physics		





