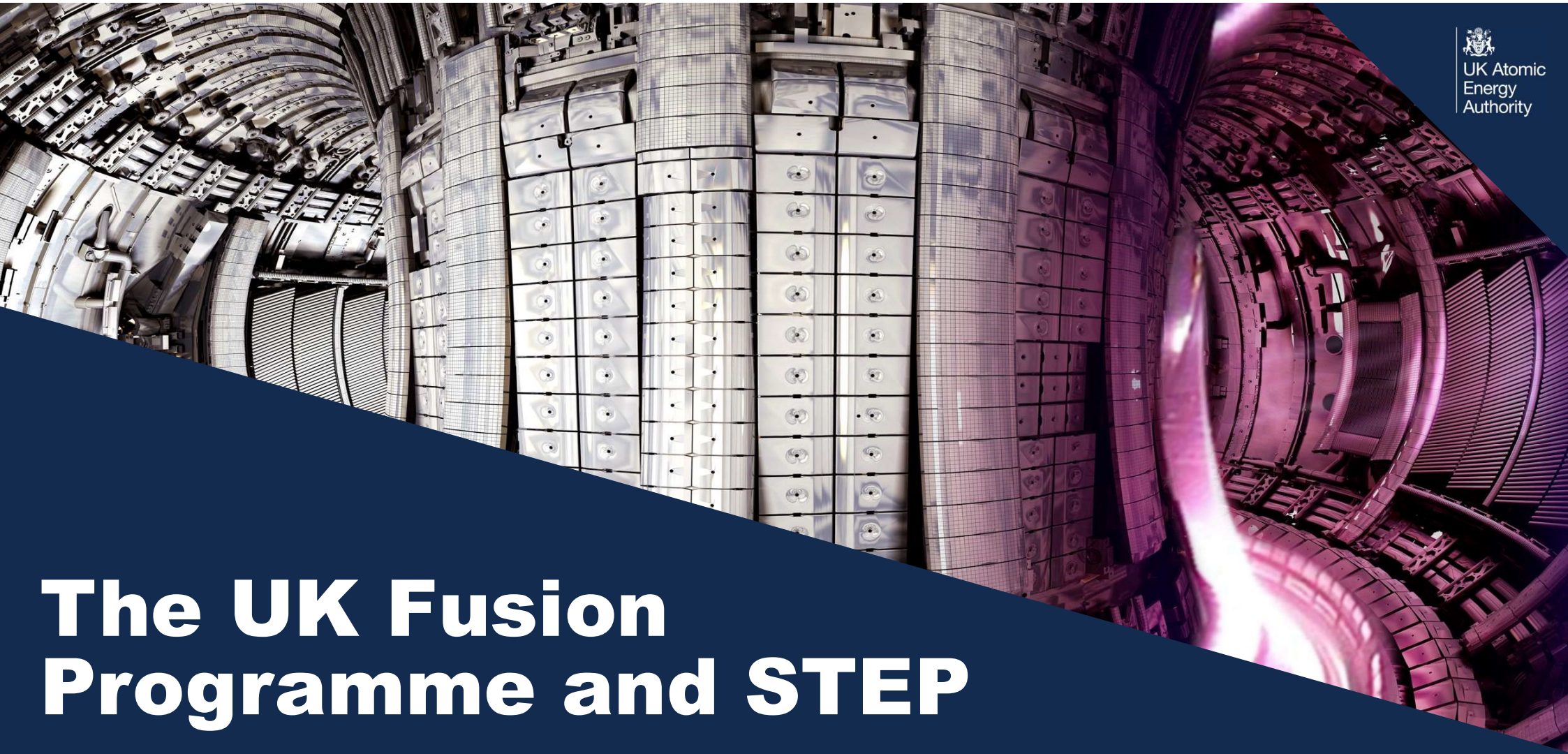


UK Atomic Energy Authority

The UK Fusion Programme and STEP

Ian Chapman

UK fusion strategy

“Overarching goals of the fusion strategy

1. For the UK to demonstrate the commercial viability of fusion by building a prototype fusion power plant in the UK that puts energy on the grid

2. For the UK to build a world-leading fusion industry which can export fusion technology around the world in subsequent decades”

Department for Business, Energy & Industrial Strategy

UK Atomic Energy Authority

Towards Fusion Energy

The UK Government’s Fusion Strategy

October 2021

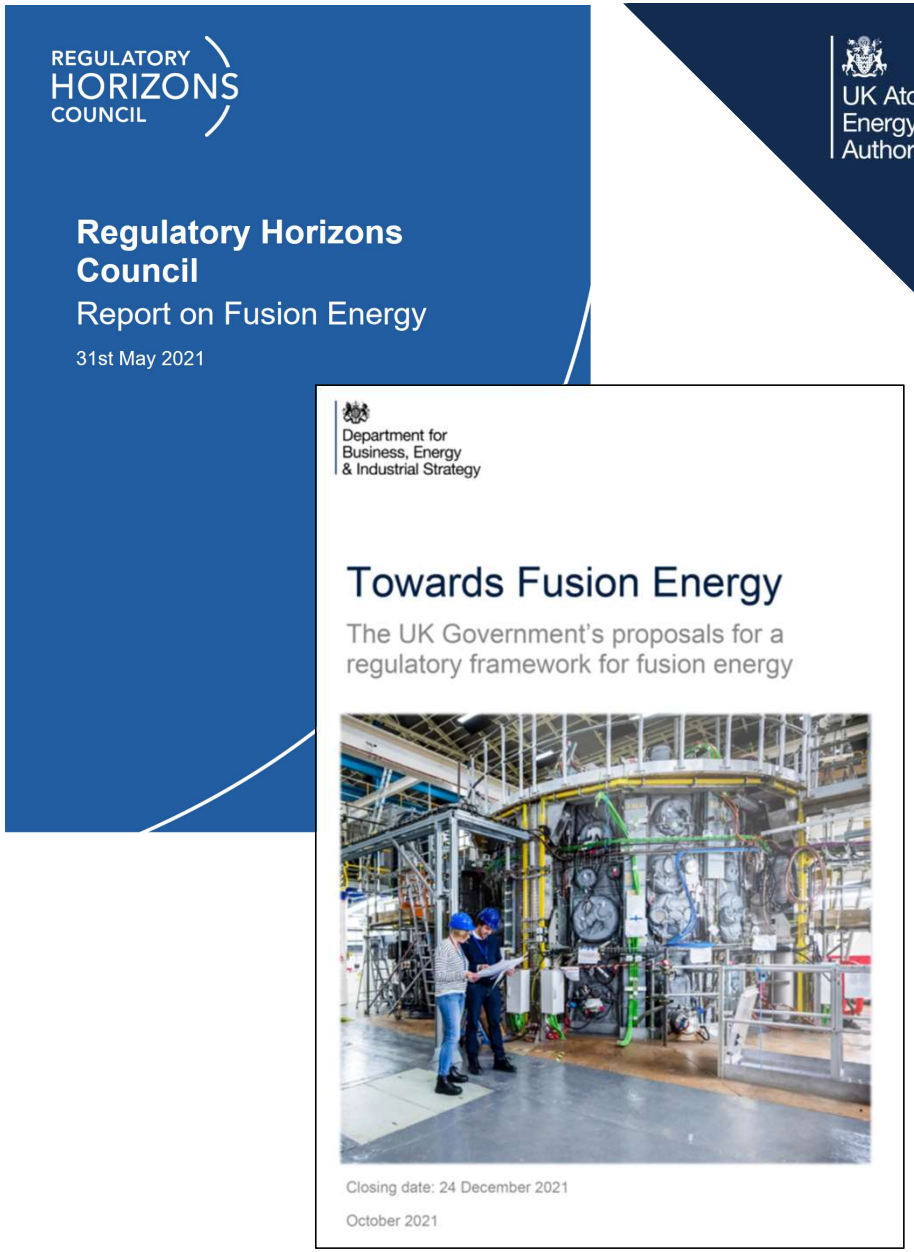
Fusion regulation

Green Paper:

"We want to **trailblaze a proportionate and pro-innovation approach** and collaborate internationally to maximise fusion's long-term global potential. With this plan, the UK hopes to lead the world on fusion regulation and enable the safe and rapid development of [fusion]"

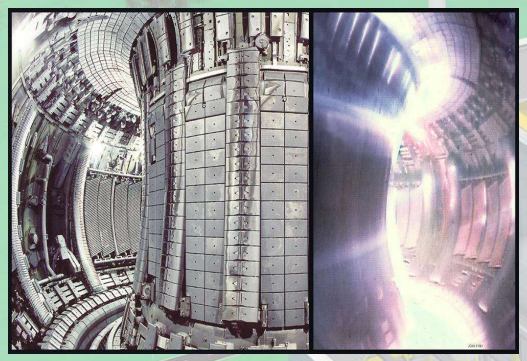
Recent Queen's Speech:

"The main elements of the Energy Security Bill include… Creating a new pro-innovation regulatory environment for fusion energy."

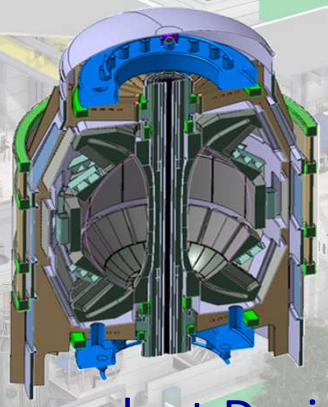


UK Programme integrated approach

UK Atomic Energy Authority

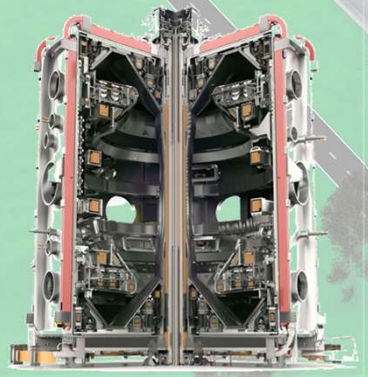


High performance plasmas in JET



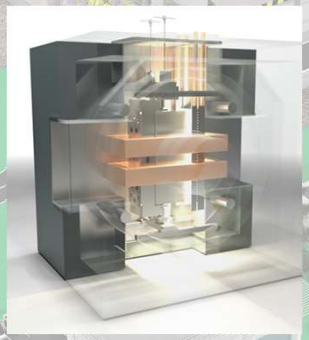
Powerplant Design STEP and DEMO

Advanced computing and digital design



Heat exhaust in MAST Upgrade

Develop materials in Materials Research Facility (MRF)

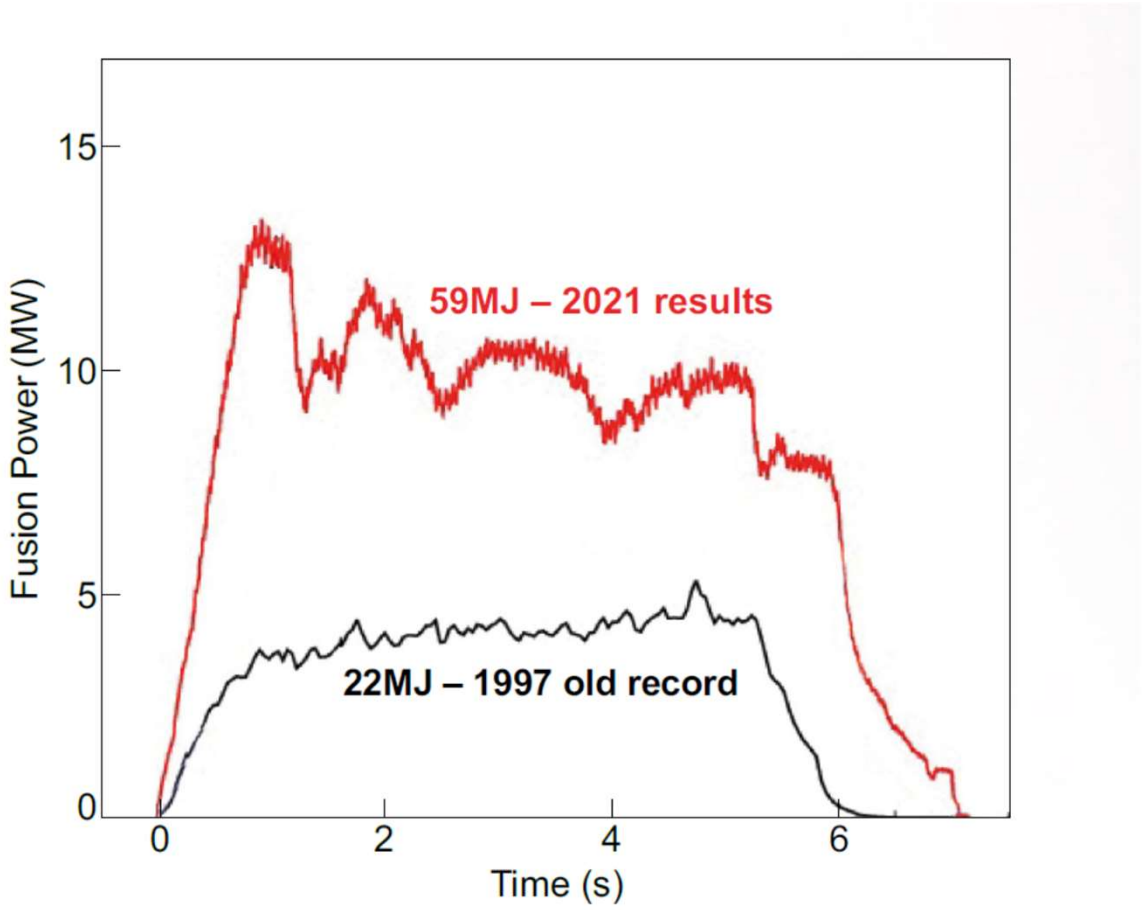


Test components in Fusion Technology Test Facilities (FTF)

Tritium handling in Hydrogen-3 Advanced Technology (H3AT)

Robotic handling in RACE

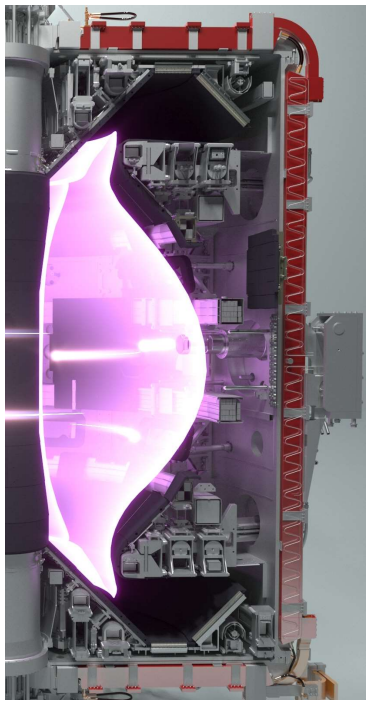
New world record in JET

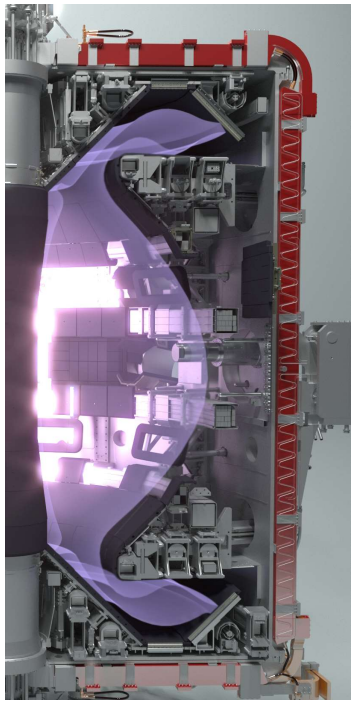


Winner of the RAEng Major Project Award for 2021

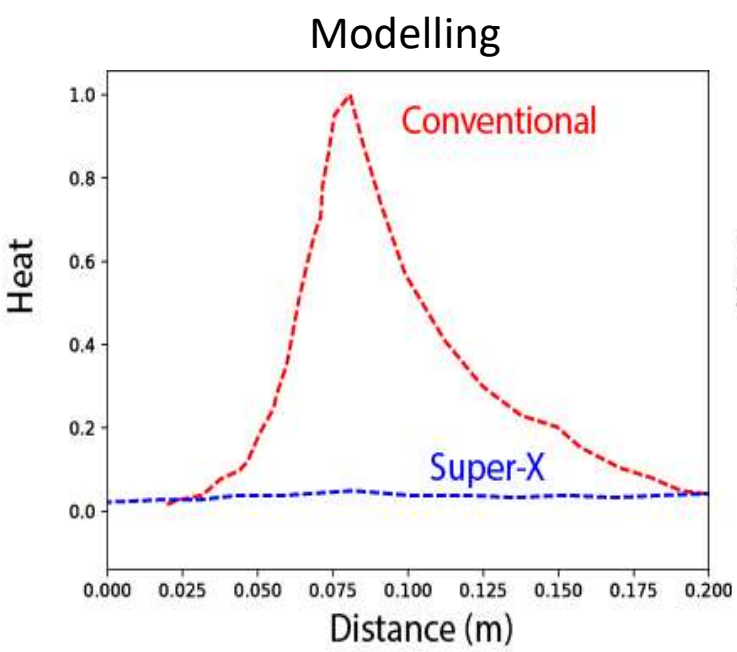
UK Atomic Energy Authority

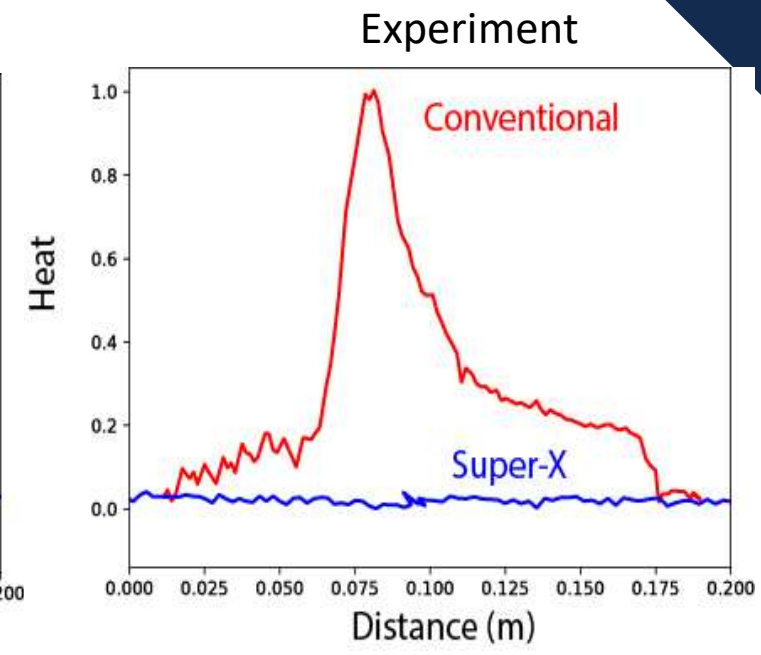
Reduced heat by more than 10 times





Conventional Super-X





Predicted more than 10 times reduction now shown in experiments

Magneto-thermal hydraulics test CHIMERA


H3AT
UK Atomic Energy Authority
FTE
STEP


H3AT

RACE

UK Atomic Energy Authority

Remote Applications in Challenging Environments


20t
Street

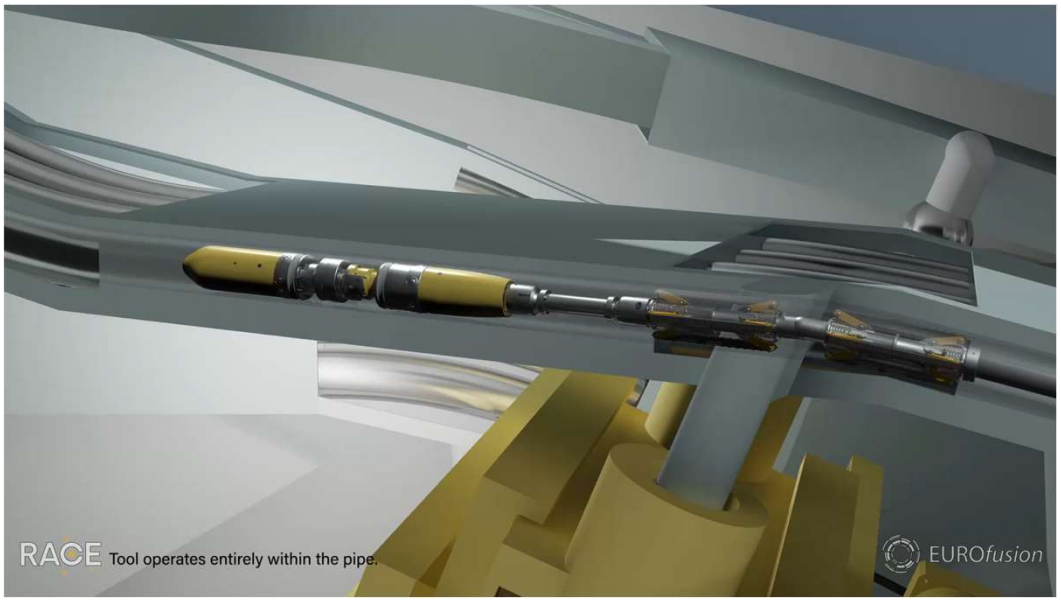

RACE

Robotics interface areas

UK Atomic Energy Authority

Develop enabling technologies

- Drive development where there is no overlap with industry
- In-bore laser pipe cutting, welding, NDT, and alignment → plant design
- In-vessel movers (blanket and divertor)
- Control system development
  - Adaptive position control, structural simulator, physical sensing, automation, AI



In-bore cutting tool deployment

Cutting tool and test rig

National fusion skills

UK Atomic Energy Authority

Bring together and lead national and international collaborations:

- UK academia – 30+ universities, 13 Centres for Doctoral Training, 150 PhDs

Develop next generation with essential skills

- UKAEA has multi-award-winning apprentice scheme which provides skilled people for >20 industrial partners
- Currently training 280 apprentices with funding secured to expand to 1000 by 2025

Spherical Tokamak for Energy Production – STEP

- Predictable net electricity production
- Lower capital cost than other fusion power plant designs
- £220M investment for concept design by 2024

- Already a national endeavour with 290 companies involved in delivery and 20+ universities

STEP high-level schedule

UK Atomic Energy Authority

Concept (till 3/24)

- Concept / Reference Plant Design
- Programme Development
- Site selection
- Transition to Target Operating Model

Detailed Design and Mobilisation

- Engineering Design
- Long lead procurement
- Early Manufacture
- Site development

Main Construction

- Full plant manufacture and assembly
- Full site development
- Equipment and system testing

Commissioning and Operations

- Non-active and active commissioning
- Prototype ops

STEP siting update

- Concluded 18-month siting exercise
- Made recommendation to our Secretary of State last week
- Announcement expected late 2022

STEP Future Target Operating Model

UK Atomic Energy Authority

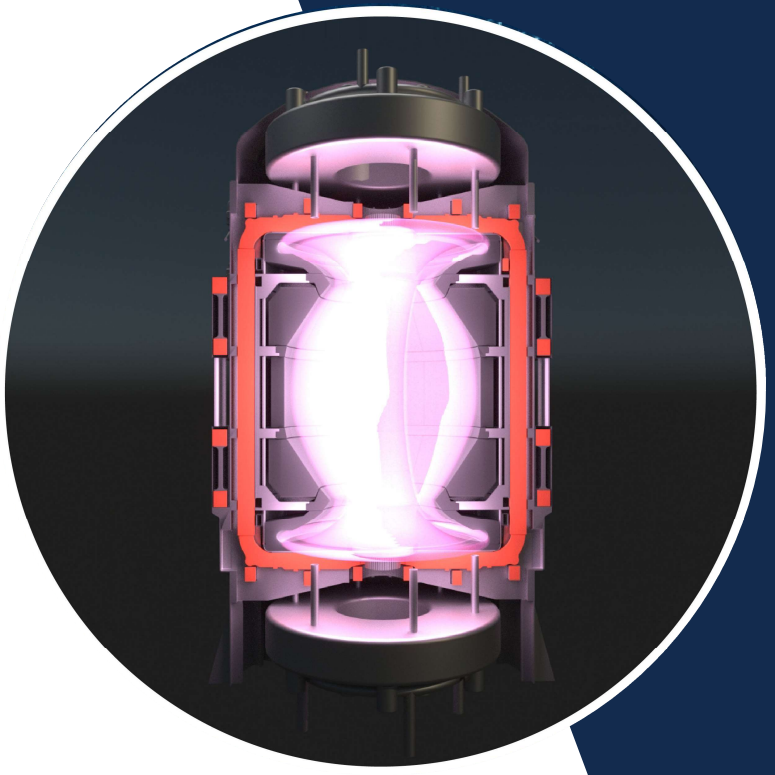
STEP Delivery Organisation
Subject to approval:
Special Purpose Vehicle, company limited by shares

Technology & Engineering Partner	Facility Construction Partner	Fusion Partner *UKAEA*

Industrial Base – Multiple SMEs delivering packages

UK fusion is moving at pace

UK Atomic Energy Authority



- Government published first ever fusion strategy including regulation consultation
- Major advances this year: JET D-T, MAST-U results; new facilities
- STEP progressing on track. Concept design by 2024
- Opportunities for closer relationship with the US in the future