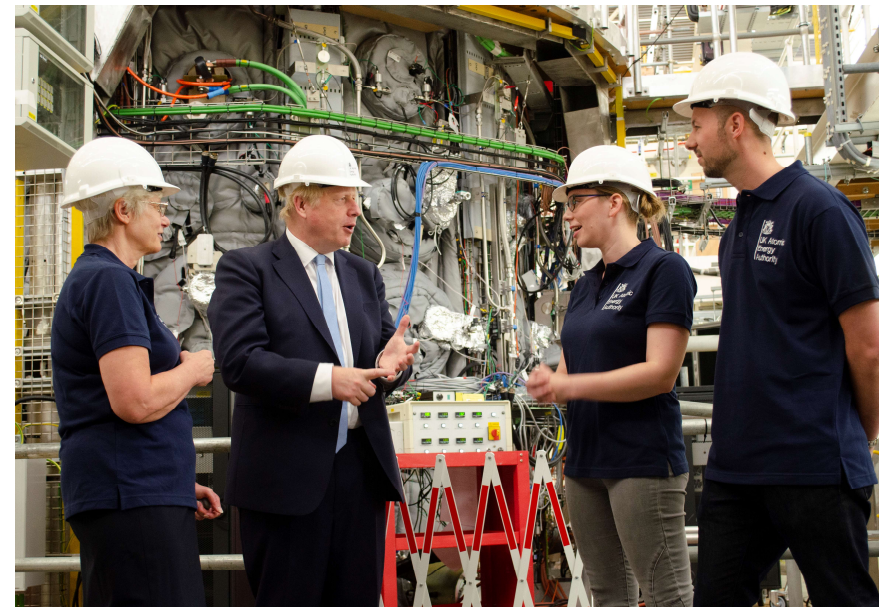


UKAEA Update

FPA, 16 December 2020 – Ian Chapman

Headline: Some big steps forward

- Lots of effort preparing for our future relationship with Euratom – expecting this to conclude imminently...
- Set a new record for fusion performance with deuterium in JET
- Completed preparations for high-performance tritium operation for the first time in two decades in 2021
- Commenced building H3AT and FTF at Culham
- Achieved first plasma in MAST Upgrade
- Opened UKAEA in Yorkshire
- Secured a new £12M robotics programme
- Funding to expand apprentices scheme to 1000
- Completed exec team & now nearly 2000 people
- Launched STEP siting process





HM Government

The Ten Point Plan for a Green Industrial Revolution

Building back better, supporting green jobs, and accelerating
our path to net zero



November 2020

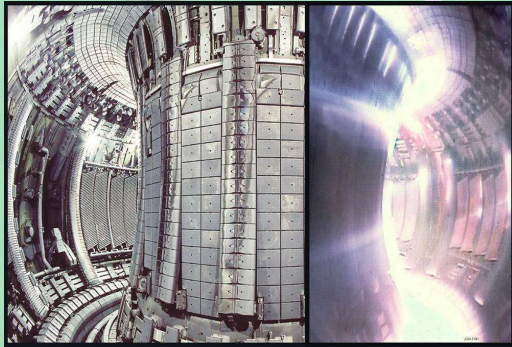
Ten point plan

“We are doubling down on our ambition to be the first country in the world to commercialise fusion energy technology, enabling low carbon and continuous power generation. We are already providing **£222 million for the visionary STEP programme** (Spherical Tokamak for Energy Production), which aims to build the world’s first commercially viable fusion power plant in the UK by 2040, and **£184 million for new fusion facilities, infrastructure and apprenticeships** to lay the foundations of a global hub for fusion innovation in the UK”



UK Atomic
Energy
Authority

Fusion needs integrated solutions



High performance
plasmas in JET

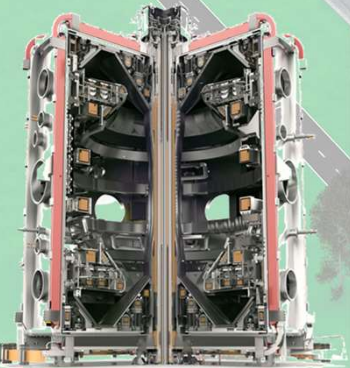
Minimise
financial
exposure

Reactor Design
STEP and DEMO

Minimise
technical
risk



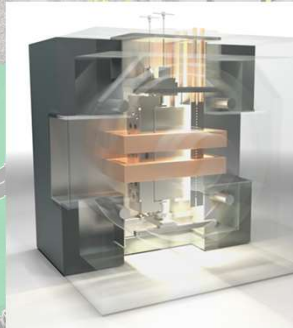
Advanced
computing and
digital design



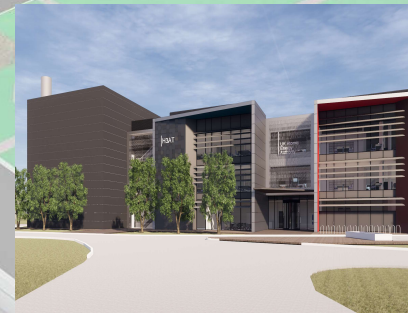
Heat exhaust in
MAST Upgrade



Develop materials in
Materials Research
Facility (MRF)



Test components in
Fusion Technology
Test Facilities (FTF)



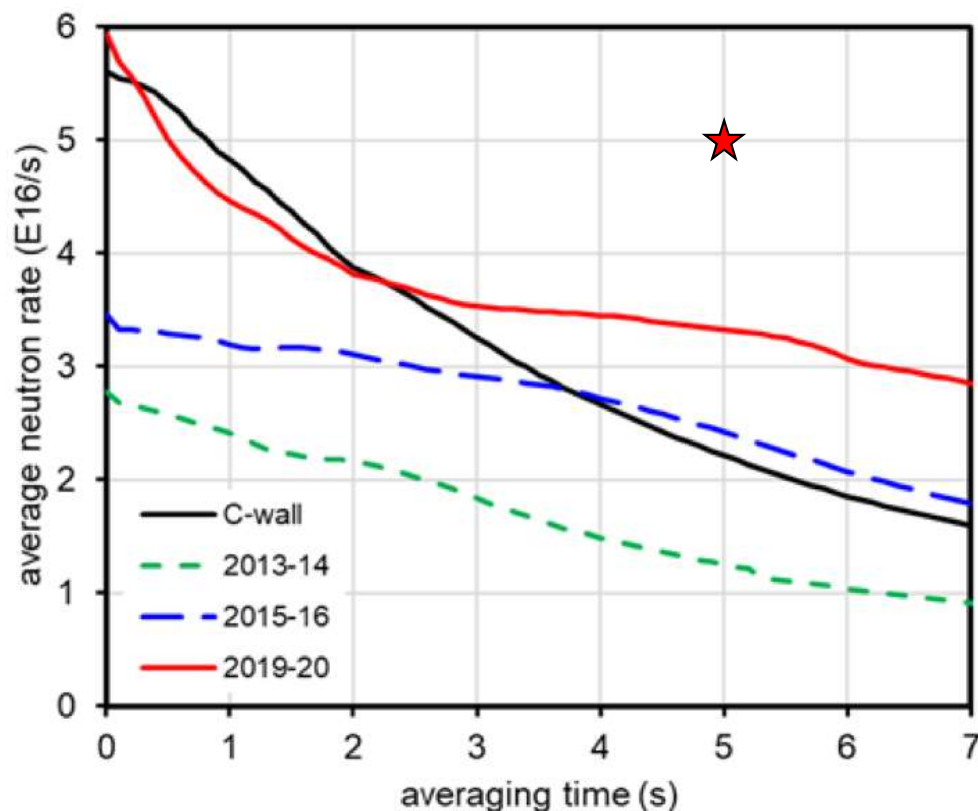
Tritium handling in
Hydrogen-3 Advanced
Technology (H3AT)



Robotic handling
in RACE

JET Update

- **DT rehearsal complete**
 - Many useful lessons in preparation for tritium campaigns
- **EUROfusion are satisfied we have made sufficient progress** to proceed with remaining campaigns



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5

16 December 2020

Shutdown	Restart	H/He ops	D ops	DT/T ops
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JET contract

We signed an amendment to the JET operating contract on 28th September, which means the contract now goes until end of October 2021 after D-T campaign

We remain in discussion with EUROfusion about extended operation in the next EU Framework Programme

AMENDMENT No. 5

to

CONTRACT FOR THE OPERATION OF THE JET FACILITIES

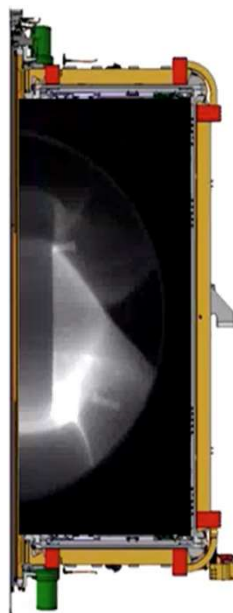
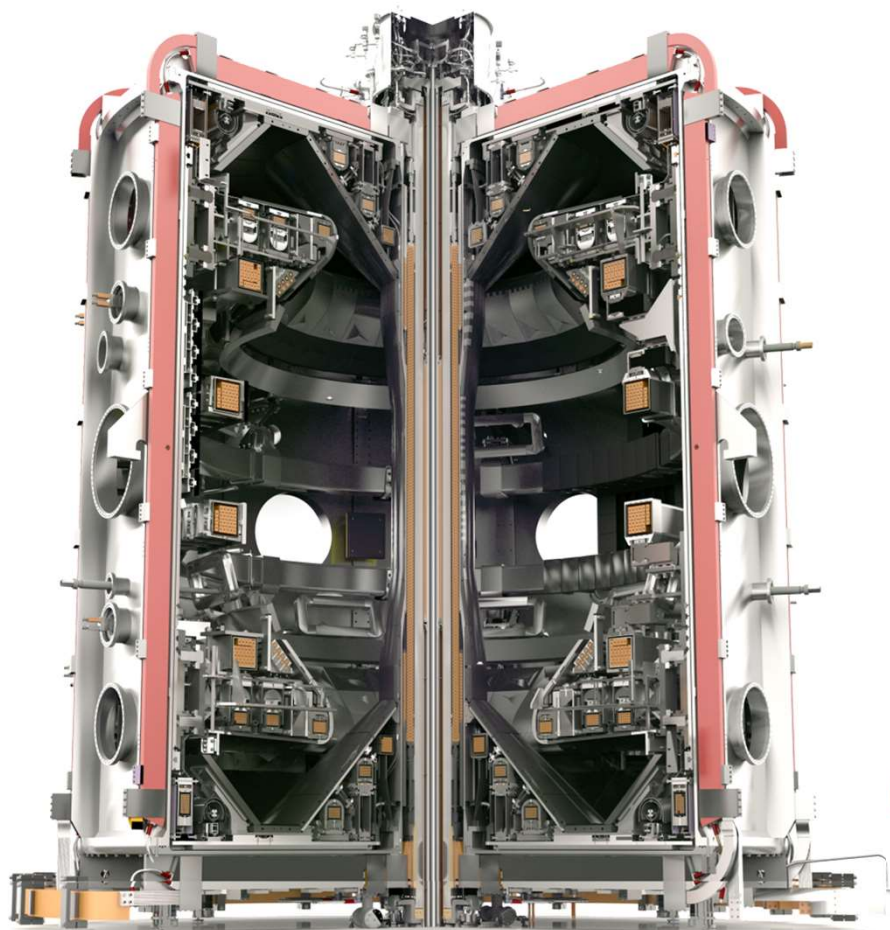
- 2.1 This Contract shall enter into force on the date of signature by the Parties. It shall apply from 1 January 2014 (start date of this Contract).
- 2.2 Amendment No. 5 to this Contract shall apply from 04 September 2020.
- 2.3 This Contract shall expire on 31 October 2021. It may be extended by the Parties.

ARTICLE 25 – JET24 REFURBISHMENTS AND ENHANCEMENTS

Costs for JET24 Refurbishments and Enhancements required to prepare JET for possible post-NJOC Operation shall be eligible under this Contract subject to the financial conditions set out in Annex III.



MAST Upgrade achieved first plasma

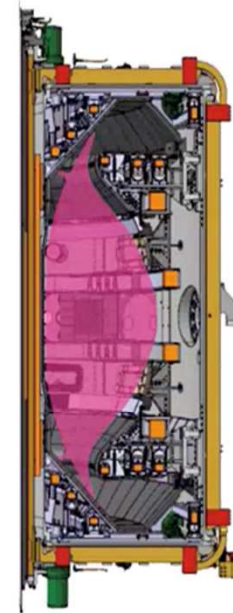


Breakdown

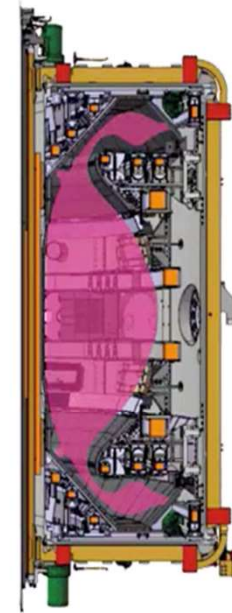


Ramp up

Limiter



Conventional



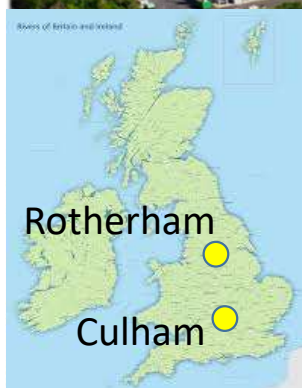
Super-X

Flattop

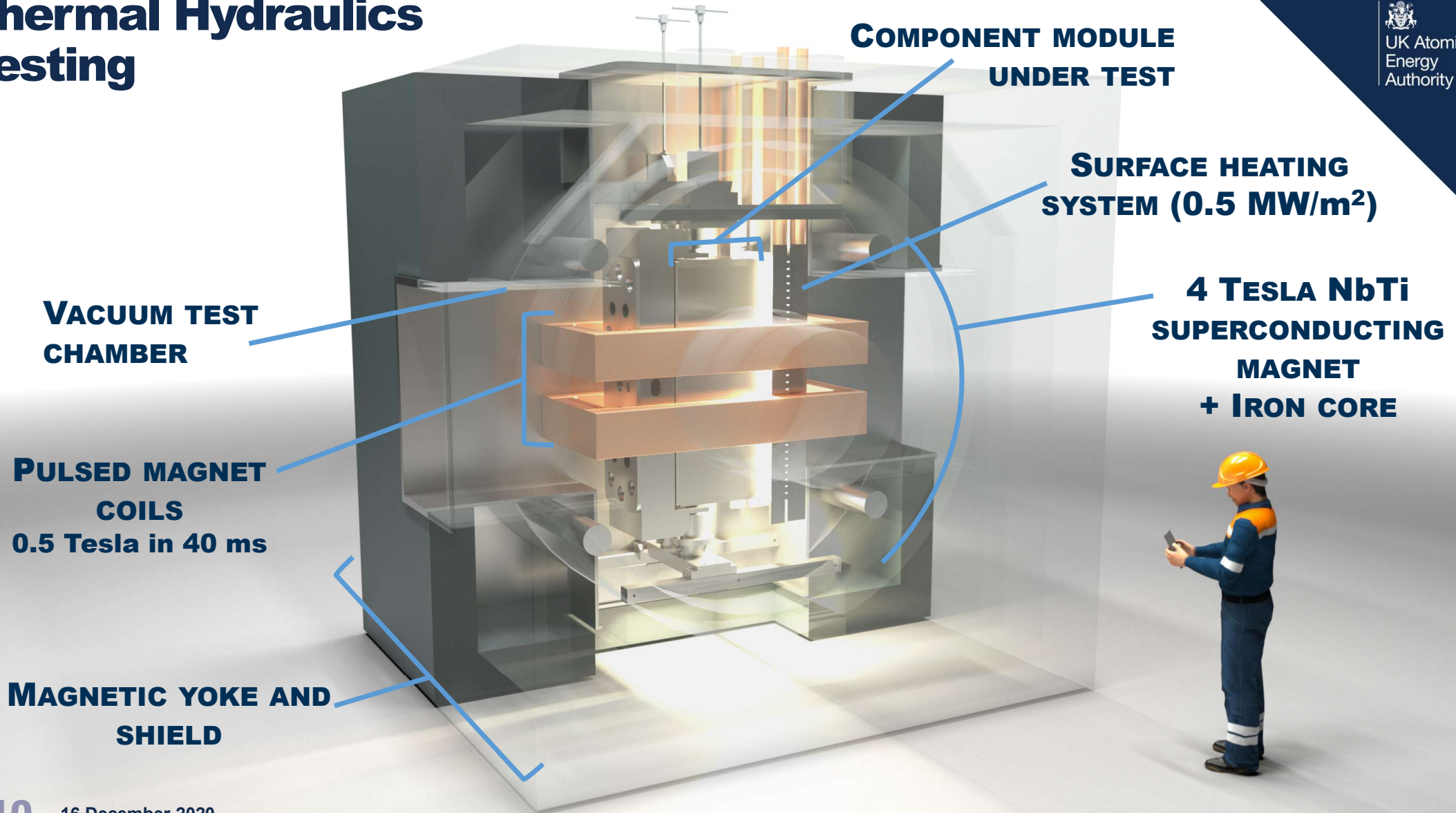
H3AT and FTF to open in 2022



UKAEA is now in Yorkshire too



Thermal Hydraulics Testing



MRF Update

Plans for additional equipment (pending funding decision in January)

1. Expanded mechanical testing including new hot cells
2. Equipment for measuring properties of materials at high temperatures having had high radiation doses
3. Plasma Focused Ion Beam
4. Analytic Electron Microscope

UKAEA made two other bids

5. Expansion of our ADRIANA radiometric lab
6. Thermohydraulics facility at UKAEA Yorkshire



RACE extension



LongOps [LONG Term OPerationS - LONG Reach Manipulators] UK – JAPAN Nuclear Robotics Research Collaboration

Sellafield – decommissioning
shielded process cells



TEPCO – Fukushima Dai-ichi
Unit 3 Large Scale Fuel Debris
Retrieval



UKAEA – fusion power
plant design for remote
operations



Reaching through a bio-shield to do work on the inside
Key themes: Task analysis; Digital Mock-Ups; Haptics

Apprentices Expansion

2019 150 learners in school

2020 Apprentice intake to rise to 280 with a target of 40% female

Phase 3 covers

- Power engineering

- Robotics and Artificial intelligence

- Space

- Nuclear Design

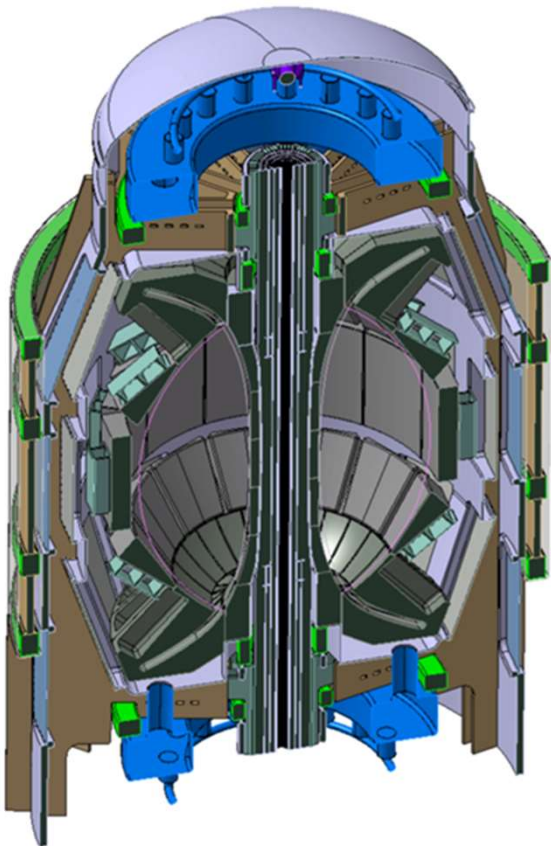
In five years, we will be training >1000 apprentices

New facilities at Culham (Sept 2023), the STEP site and elsewhere



STEP Prototype – the scale

- Precise parameters not decided:
 - Fusion power at the GW scale
 - Radial build comparable to JET
 - Characterized by targeting lower cost



STEP site

Two weeks ago we launched a call for communities across the UK to nominate sites which could host STEP. Nomination window will remain open until at least March 2021, with staged process due to conclude by the end of 2022

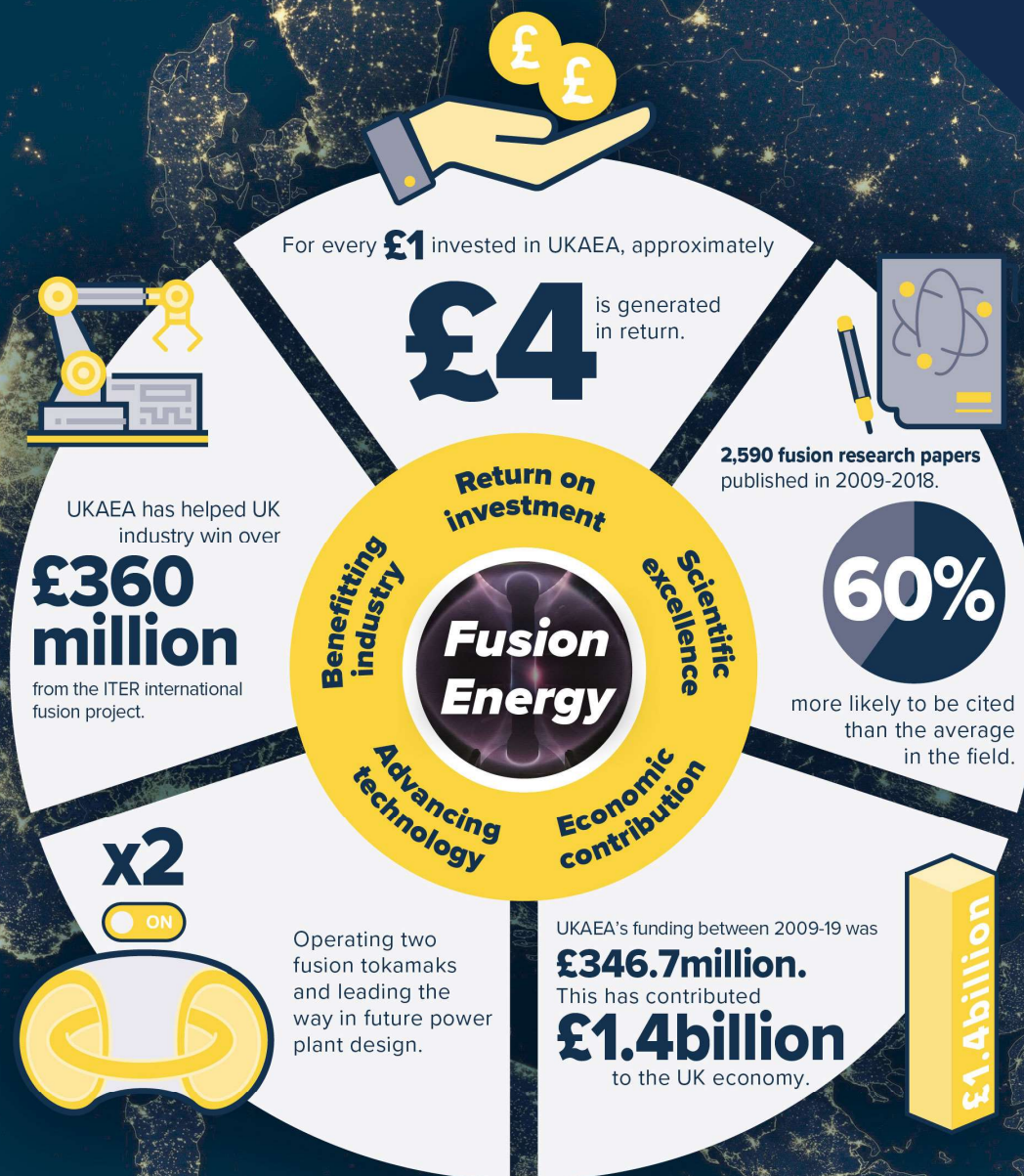
Only prescriptive constraint is size $>100\text{Ha}$, but naturally access to cooling water, grid connection etc will score favourably

It won't be Culham!



Impact of fusion investment

Assessment
carried out by
London
Economics
commissioned
by government



The STEP to delivering fusion



- Strong international partnerships for JET, ITER and EUROfusion
- An ambitious domestic plan with major technology facilities supporting STEP
- A vibrant private sector supported by UKAEA; opportunity to grow the campus and training schemes
- Team now largely in place, near-term funding secured... now to deliver...