

Powering the Future?

Nia John

UKAEA's Mission





To lead the delivery of sustainable fusion energy and maximise scientific and economic benefit



Why fusion?



Fusion has little or no environmental impact

Fusion does not produce any 'long-lived' radioactive waste

There is no risk of critical safety events e.g. 'meltdown'

The fuels are abundant

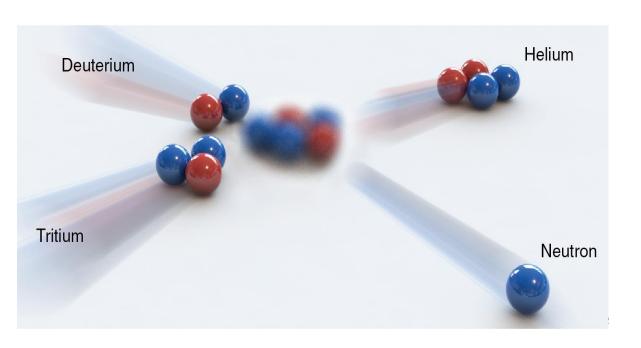
Deuterium is freely available in



Fusion ...



...occurs when two light nuclei are forced together, producing a larger nucleus and a neutron.



The combined mass of the two small nuclei is greater than the mass of the nucleus they produce

The extra mass is changed into energy:

$$E = mc^2$$

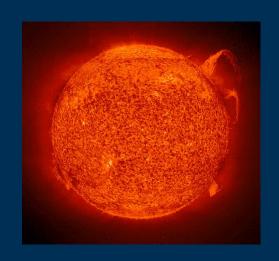
But fusion is really hard



Like charges repel

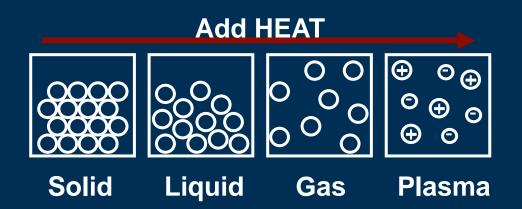
We need a balance of:

- Density
- Temperature
- Confinement



Centre of the sun = 15 million °C

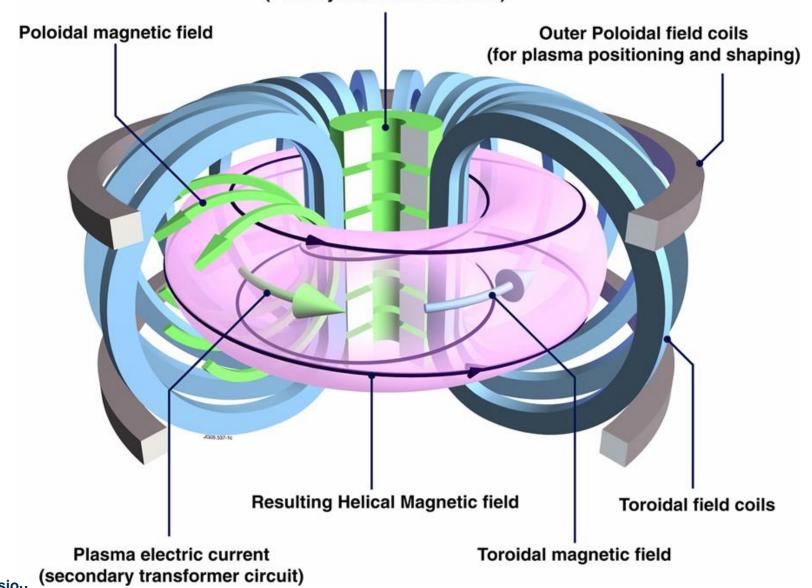
We need in excess of 150 million °C



The tokamak

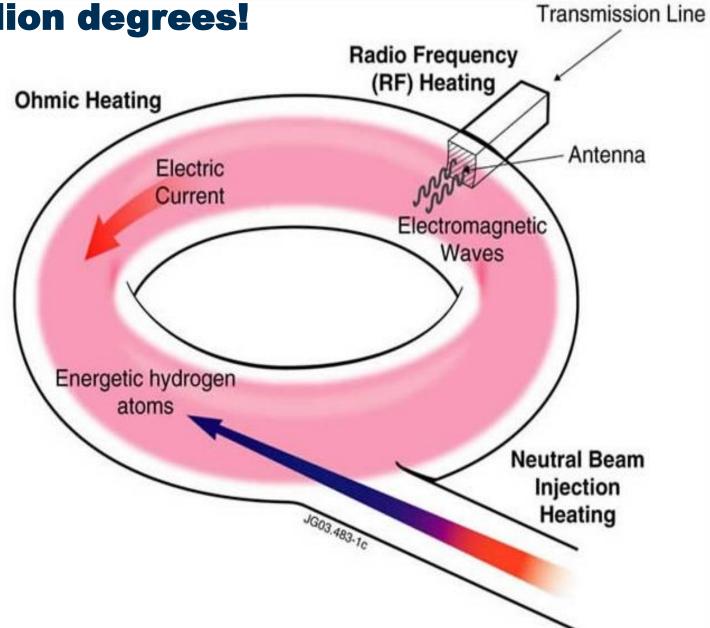


Inner Poloidal field coils (Primary transformer circuit)



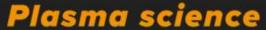
Heating the Tokamak up to 150 million degrees!





Research Challenges





Confining fusion fuel in a plasma at temperatures ten times hotter than the Sun's core.

Plasma exhaust

Designing an exhaust system to deal with the intense heat from the plasma.

Materials science

Developing materials that can withstand the demanding conditions inside a fusion reactor.

Fuel handling

The six

challenges

of fusion

Breeding and handling tritium fuel to power commercial fusion reactors.

Robotic maintenance

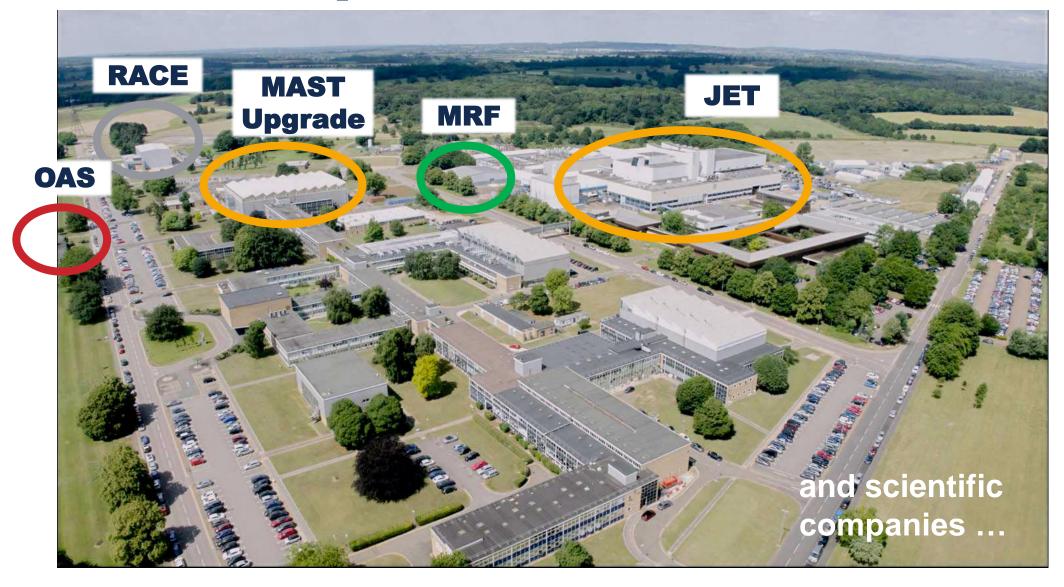
Maintaining the reactor entirely with robotics and remote maintenance techniques.

Innovative engineering

Taking advantage of new engineering and manufacturing techniques to advance fusion development.

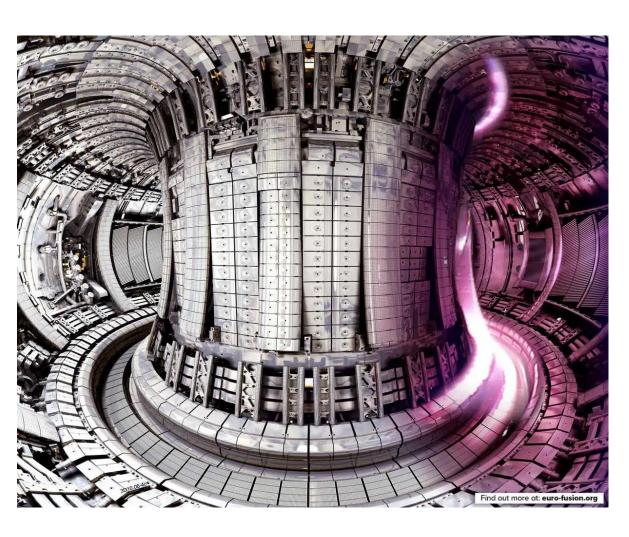
Culham Campus

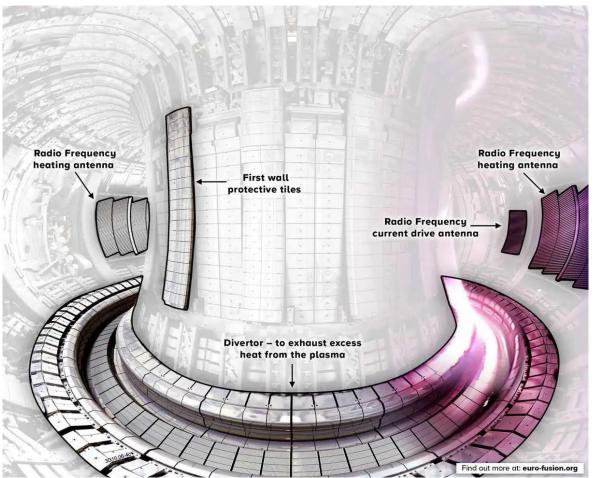




JET – Joint European Torus



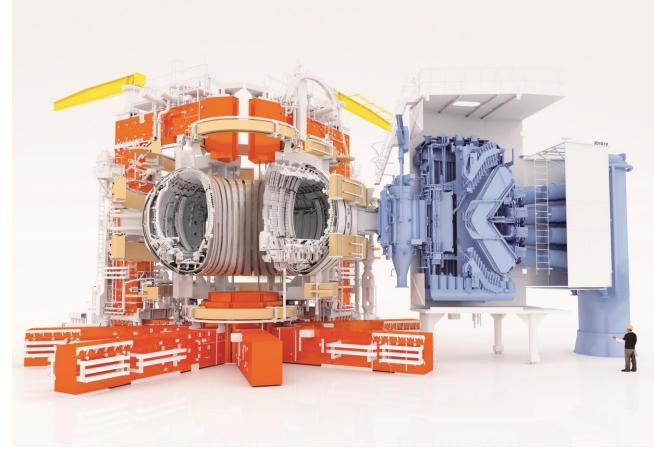




JET – Joint European Torus

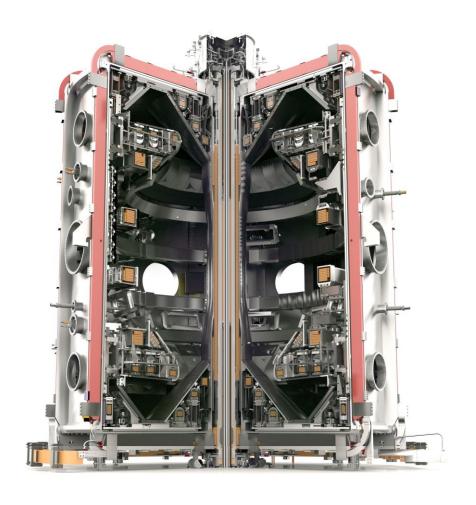






MAST Upgrade





Mega Amp Spherical Tokamak

Investigating tokamak physics at a more compact scale.

Present upgrade will improve understanding of exhaust physics in this configuration.

RACE

RACE - Remote Applications in Challenging Environments is now fully operational.

It is offering robotics expertise and facilities to fusion projects and to wider industrial partners (e.g. deep sea exploration, space, fission etc.) – tapping into a world wide remote applications market worth billions.







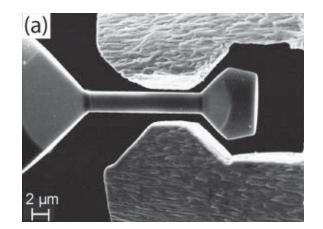
MRF







Universities UKAEA Sellafield



Processing and analysis of radioactive material and undertaking micromechanical testing of fusion and fission material samples – with UK universities and other labs.

FTF and H3AT



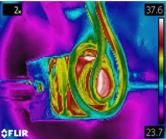
The Fusion Technology Facilities and the Hydrogen-3 Advanced Technology centre will be unique in the world, and will support UK industry to target £1Bn fusion income by 2025.



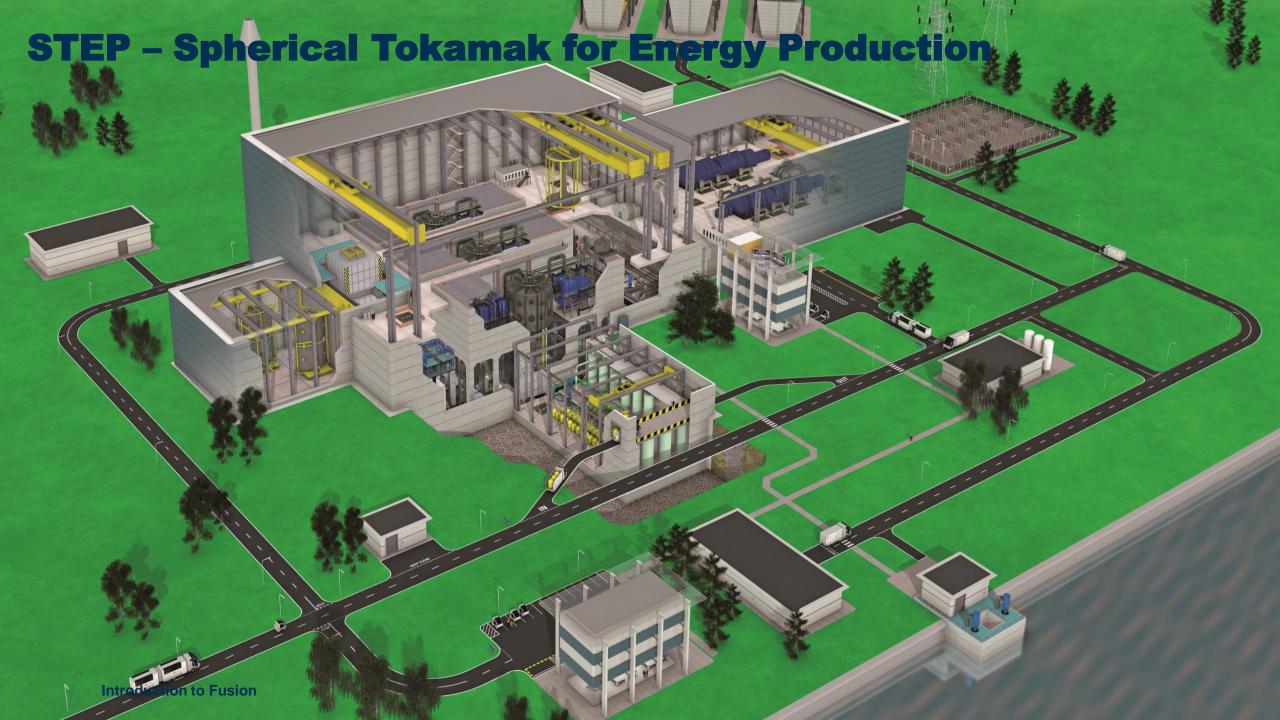






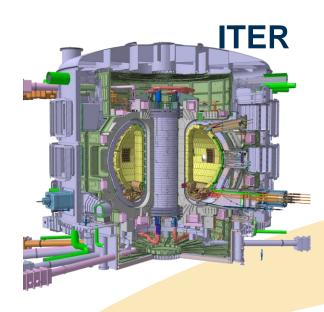




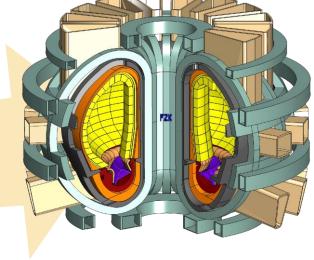


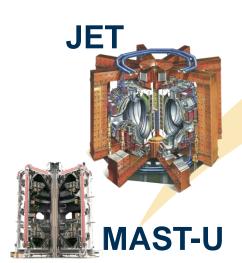
STEP













How to find out more...

On the web:

www.ccfe.ukaea.uk
www.euro-fusion.org

By email: Communications@ukaea.uk



Any Questions?