TONY ST-ARC REACTOR RINGS DEATH KNELL FOR ENERGY CRISIS

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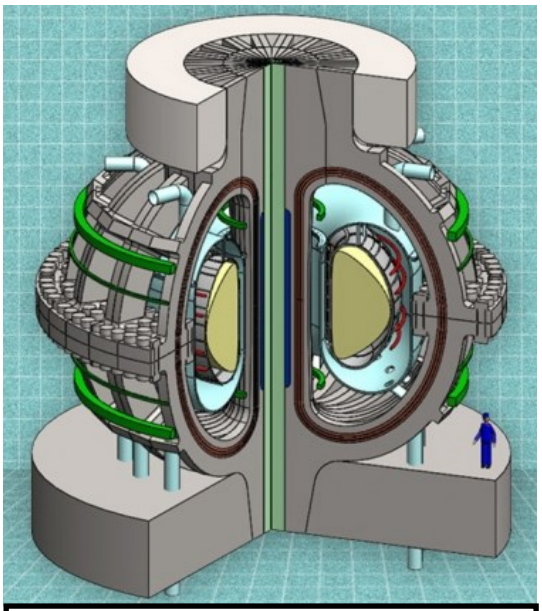
Researchers at MIT's Plasma Science and Fusion Center (PSFC) have unveiled a revolutionary new fusion reactor design which could become the new standard for energy production in the near future. The group have taken advantage of several newly available disruptive technologies and designed a device with the highest fusion power to volume ratio yet, published in the journal *Fusion Engineering and Design* in November 2015.

One ARC reactor would satisfy the power consumption for the entire city of York.



An inside look at the 3.2 m radius ARC reactor. (Source: PSFC website)

Fusion energy promises practically unlimited power for the entire globe, and has done for many years. The latest global collaboration, colossal radius 6.2 m tokamak ITER in southern France, has seen costs skyrocket and although it was planned decades ago, it still has not been built. ARC will be about 1/8 the volume of ITER and consequently far less expensive. ARC is estimated to cost around $4 billion while as of 2015 ITER will cost $14 billion, a figure that is expected to rise significantly before its completion.

For fusion power to become a reality, reactors must utilise the most cutting-edge technologies as possible. The key technology in ARC is high-temperature superconductors, which revolutionise many aspects of tokamak reactor design.

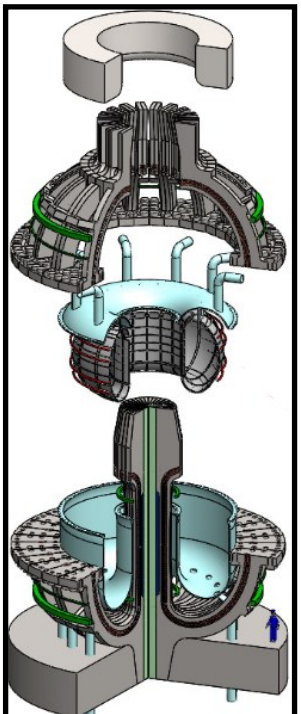
"ARC is JET on steroids." said Dennis Whyte, the head of the design team. JET in Oxfordshire holds the world record for tokamak fusion performance. While ARC and JET are the same size, ARC will produce 50 times the power output record of JET, 500 Megawatts of fusion power, sustained for a far longer time. JET was built in about 4 years and ARC is expected to take a similar amount of time.

With continual environmental damage caused by fossil fuels and their ever shrinking supply, a scientific answer has to be found to pre-emptively solve the coming energy crisis. Fusion energy harnesses star-power in compact form to produce huge potential amounts of energy from hydrogen plasma - superheated hydrogen gas - at temperatures ten times that of the Sun's core.

"The enabling technology to be able to shrink the fusion device size is this new superconducting technology," explains Brandon Sorbom, a PhD student in the PSFC group. Fusion power output depends strongly on the magnetic field strength in the device. The new superconductors enable a minimum two-fold increase in magnetic field strength over those previously used in tokamaks like ITER, enabling much smaller devices to produce sufficient power to make them economically feasible

PSFC's team's design brief was 'Smaller, sooner.', as for fusion to take off, reactors must be built within 10 years of their design in order to not get left behind by rapidly advancing technology. "[Problems experienced with] ITER are a valuable lesson" emphasised Whyte, going on to highlight the importance of ARC's modular design in keeping up with constant technological advances.

Modular design, in combination with 3D-printed components, allows for increased design efficiency. Minimal space is wasted and as soon as a new technology is developed, parts can be remade and replaced.



ARC deconstructed: ARC's modular design makes it faster to build, faster to repair and faster to improve. (Source: PSFC website)

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