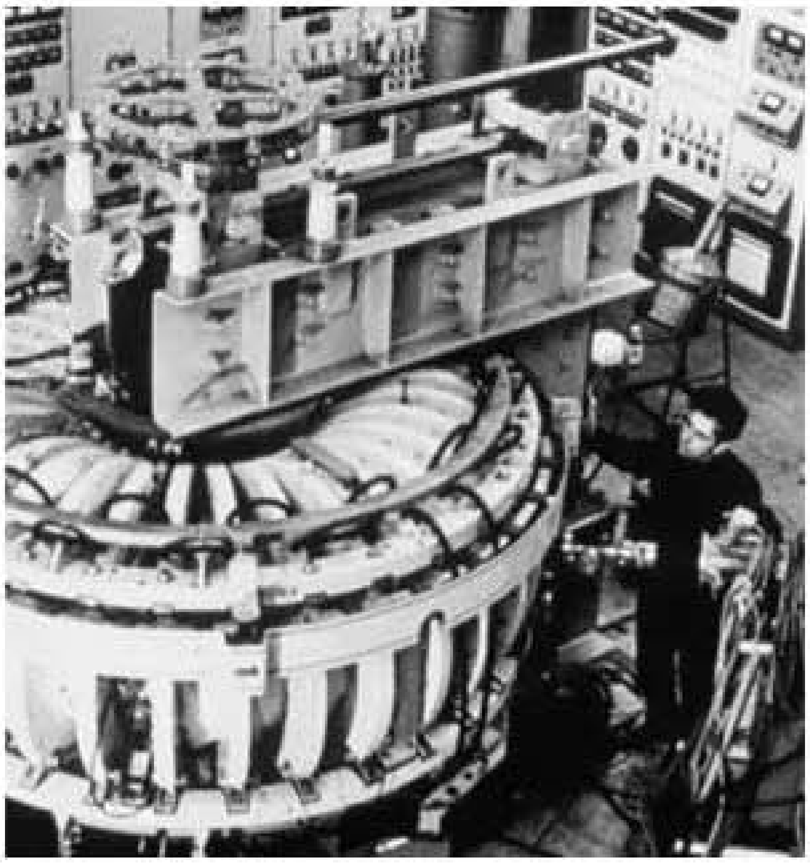
DAILY NEWS 9 October 2009

ITER: A brief history of fusion

By Roger Highfield, Valerie Jamieson, Neil Calder and Robert Arnoux



Some 70 years ago scientists obtained the first insights into the physics of sunshine: when the sun and other stars transmute matter, tirelessly transforming hydrogen into helium by the process of fusion, they release colossal amounts of energy.

By the mid-1950s "fusion machines" were operating in the Soviet Union, the United Kingdom, the United States, France, Germany and Japan. Yet harnessing the energy of the stars was to prove a formidable task.

After pioneering work in the Soviet Union in the late 1950s, a doughnut-shaped device called a tokamak was to become the dominant concept in fusion research. Since then, tokamaks have passed several milestones.

Experiments with actual fusion fuel – a mix of the hydrogen isotopes deuterium and tritium – began in the early 1990s in the Tokamak Fusion Test Reactor (TFTR) in Princeton, US, and the Joint European Torus (JET) in Culham, UK. JET marked a key step in international collaboration, and in 1991 achieved the world's first controlled release of fusion power.

While a significant amount of fusion power was produced by JET, and TFTR, exceptionally long-duration fusion was achieved in the Tore Supra tokamak, a EURATOM-CEA installation located at France's Cadarache nuclear research centre and later in the TRIAM-1M tokamak in Japan and other fusion machines.

In Japan, JT-60 has achieved the highest values of the three key parameters on which fusion depends – density, temperature and confinement time. Meanwhile, US fusion installations have reached temperatures of several hundred million °C.

In JET, TFTR and JT-60 scientists have approached the long-sought "break-even point", where a device releases as much energy as is required to produce fusion. ITER's objective is to go much further and release 10 times as much energy as it will use to initiate the fusion reaction. For 50 MW of input power, ITER will generate 500 MW of output power.

ITER will pave the way for the Demonstration power plant, or DEMO, in the 2030s. As research continues in other fusion installations worldwide, DEMO will put fusion power into the grid by the middle of this century. The last quarter of this century will see the dawn of the Age of Fusion.

Read more: *ITER: The way to a benign and limitless new energy source*