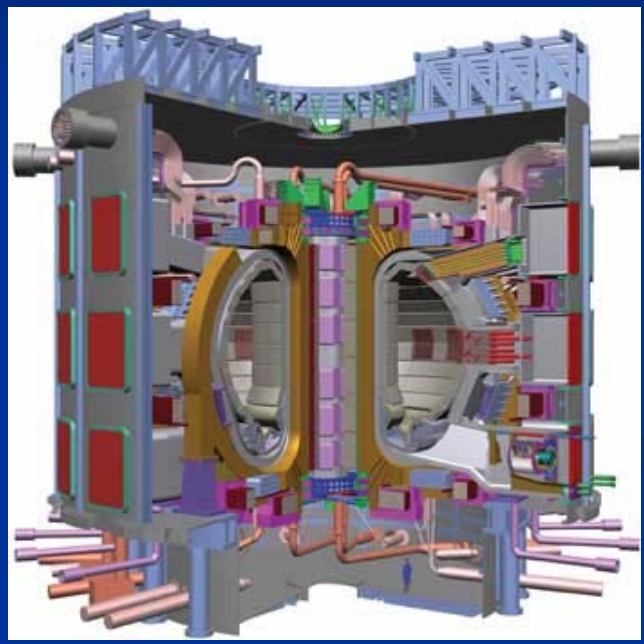
ITER



Courtesy of ITER.

Kathreen Thome and An Vu

Professor Molvig

05/18/06

- What is ITER?
- History
- Where are we now?
- Visions for the future

What is ITER?

- International Thermonuclear Experimental Reactor
- "The Way"
- An international tokomak experiment intended to be the bridge between current studies of plasma physics and future power plants.

Purpose

- "To demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes"
- At least 10X Power Amplification
- Greater than 5X Steady-State
- 500s fusion pulse
- Ignition
- Integrate and test technologies for future reactors

Participating Teams

Courtesy of ITER.

Cost Distribution

- Total estimated cost: €10 billion ($12.1 billion)
- Europe will provide 45.45% of costs
- China, Japan, Korea, Russian Federation, USA, India will each provide 9.09%

Before ITER

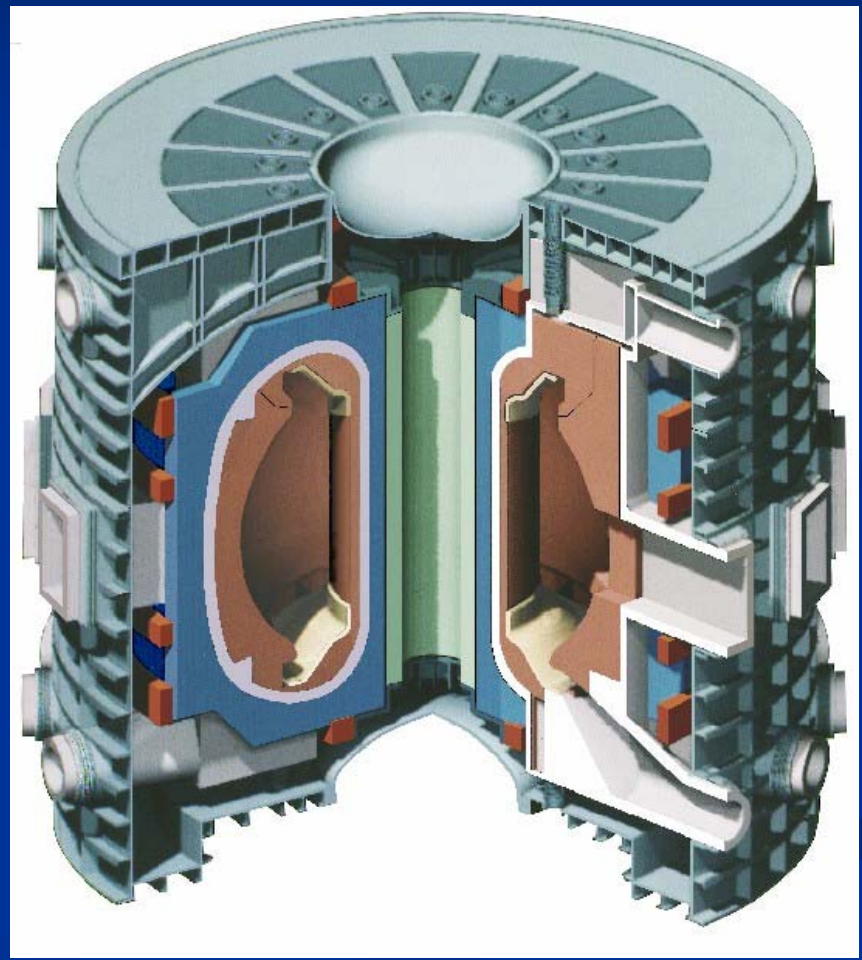
- Late 1970s, EURATOM, Japan, Soviet Union, and USA were building large tokamaks
- IFRC of IAEA propose participants work together to build INTOR
- Geneva Superpower Summit, November 1985

Conceptual Design Activities (CDA)

- April 1988-December 1990
- Garching, Germany: hosted by the Max Planck Insitut für Plasmaphsik (IPP)
- Two Work Phases
  - Definition
  - Design

ITER CDA Tokomak Design

Plasma major radius (m)	6.0
Plasma half width at mid-plane (m)	2.1
Plasma elongation (95% flux surface)	1.98
Toroidal magnetic field on axis (T)	4.85
Nominal maximum plasma current (MA)	22
Nominal fusion power (MW)	1000
Nominal inductive pulse length (s)	>200



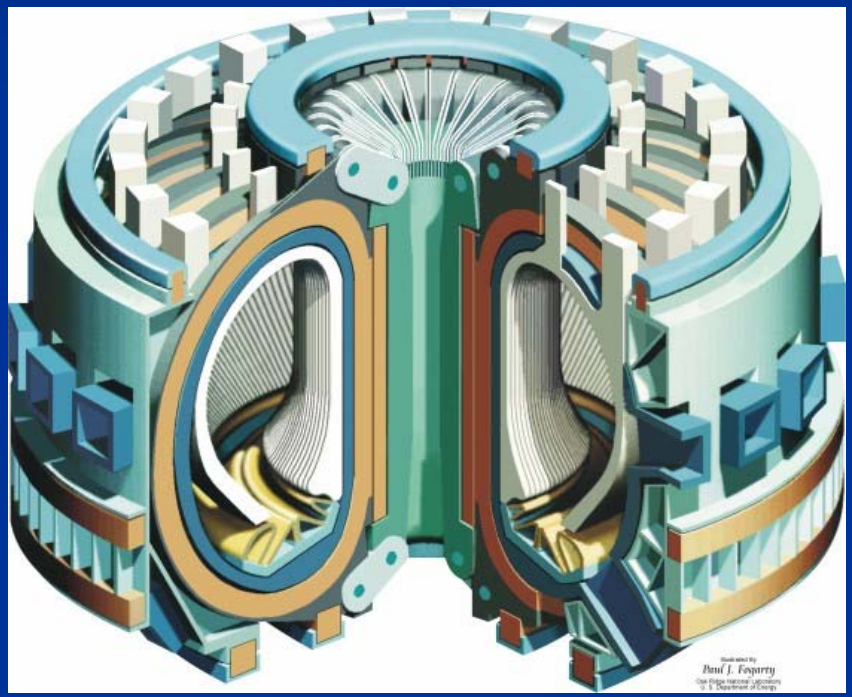
Courtesy of ITER.

Engineering Design Activities (EDA)

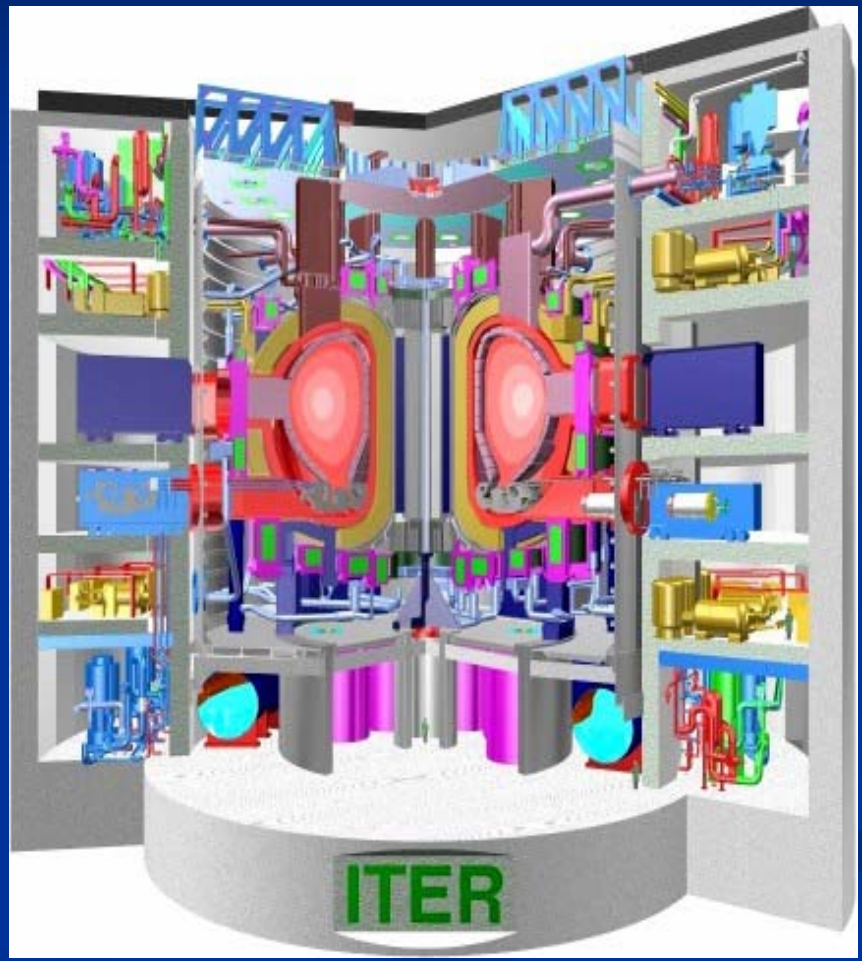
- Needed:
  - Agreement between participating countries
  - Site of design work
    - 3 sites offered: Germany, Japan, USA
- Finally signed on July 21st, 1992

Photo removed for copyright reasons.
Signature of the ITER EDA Agreement in 1992.

A Few Changes In Design



Courtesy of ITER.



Courtesy of ITER.

Evolution of ITER design

	CDA	ODR	98	Final
Plasma Major Radius (m)	6.0	7.7	8.1	6.2
Plasma Half-Width at mid-plane (m)	2.1	3.0	2.8	2.0
Plasma Elongation (95% flux surface)	1.98	1.6	1.6	1.7
Toroidal magnetic field on axis (T)	4.85	6.0	5.6	5.3
Nominal maximum plasma current (MA)	22	24	21	15
Nominal fusion power (MW)	1000	1500	1500	500
Nominal inductive pulse length (s)	>200	1000	>1000	>400
Average neutron wall load (MW/m^2)	~1.0	0.91	~1.0	0.57

Coordinated Technical Activities (CTA)

- Designed to maintain integrity of project
- Project Board coordinated Participant Teams plus International Team
- Prepared for start of construction
- Ended December 2002

ITER Transitional Arrangements (ITA)

- Came into effect January 1st 2003 and will end upon entry to ITER Joint Implementation Agreement (JIA)
- Organizational and joint technical preparations
- Structure
  - ITER Preparatory Committee
  - Nominee Director General
  - Participant Teams

Negotiations

- Began in June 2001 for Joint Implementation of ITER
  - with Canada, Euratom, Japan, and the Russian Federation
  - In 2003, US, China, and the Republic of Korea joined
- Tasks
  - Drafting the JIA
  - Select ITER construction site
  - Agree who will provide what and how costs will be shared
  - Identify Director General for ILE

Where to?

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Photo of Rokkasho-Mura, Japan.

Figure removed for copyright reasons.
Photo of Vandellos, Spain.

Figure removed for copyright reasons.
Photo of Cadarache site in France.

Figure removed for copyright reasons.
Map image depicting Clarington, ON, Canada.

June 18th, 2005 – ITER Finds A Home

Courtesy of Wikipedia.

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Photo of Cadarache site in France.

Next Step

- Finalizing JIA
- Choose Director-General
- Only then will ITER Organization and construction phase begin

The Near Future

- JIA signed and ITER organization established
- 7 years construction phase
- 21 years operation phase
- Decommissioning

Bibliography

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