

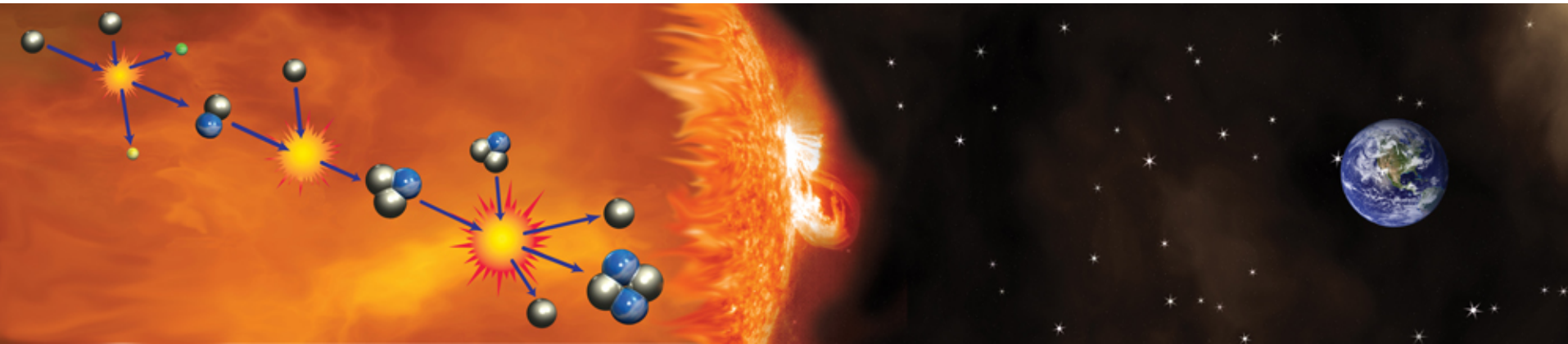


# The ITER project: A good example of a global project

Carlos Alejaldre  
ITER Nominee Deputy Director-General



# Fusion powers the sun and the stars



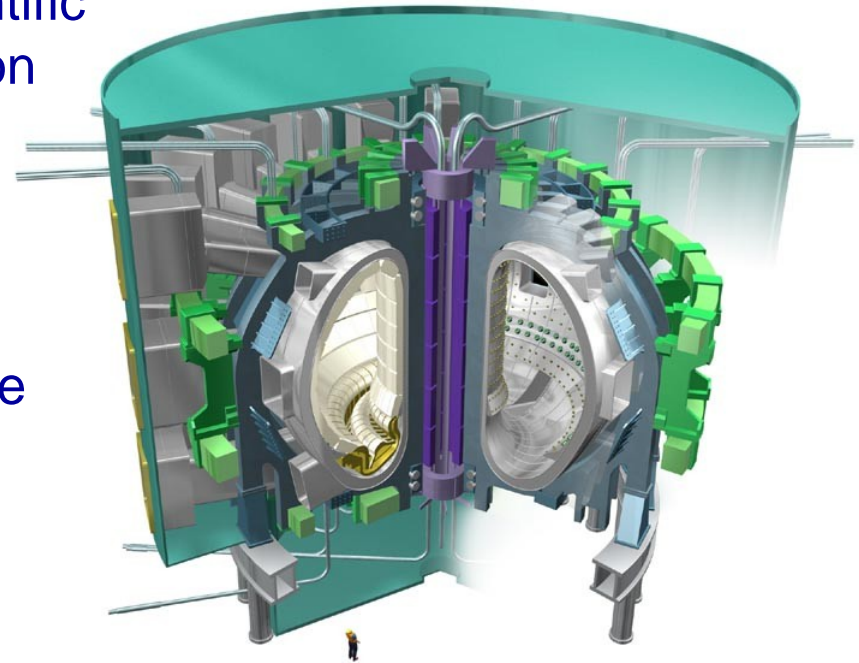
**On Earth,  
fusion could provide:**

- Essentially limitless fuel, available all over the world
- No greenhouse gases
- Intrinsic safety
- No long-lived radioactive waste
- Large-scale energy production



# ITER – Key facts

- Objective: to demonstrate the scientific and technological feasibility of fusion power
- Designed to produce 500 MW of fusion power (ten times the energy input) for an extended period of time
- 10 years construction, 20 years operation
- Cost: 5 billion Euros for construction, and 5 billion for operation and decommissioning





# Location: Cadarache, France



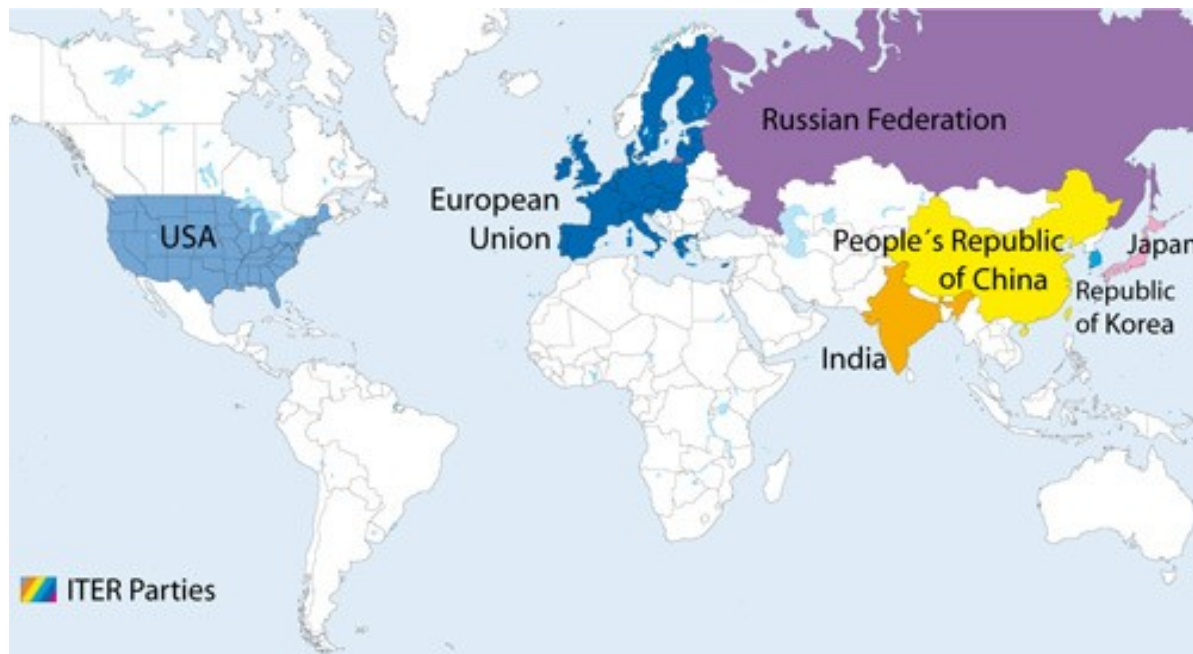
— = Itinerary ITER components





# ITER Collaboration

- Because of its size and cost and the involvement of virtually all the most developed countries, representing over half of today world's population, ITER may become a new reference point for global science projects.
- The ITER project is one of the world's biggest scientific collaborations.





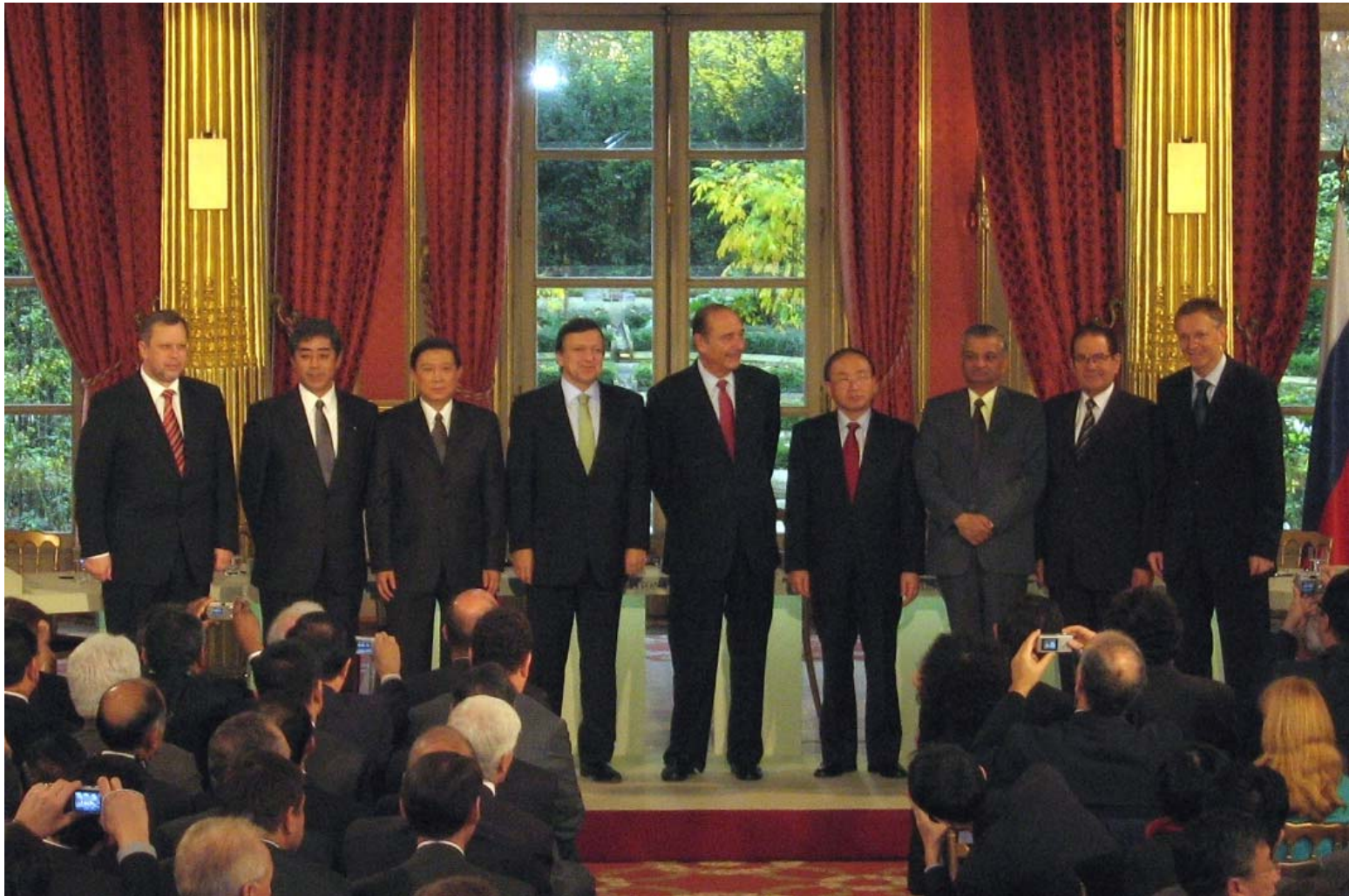
# ITER History



- **1988-1991 - (CDA) Conceptual Design Phase**
  - Start of common activities among EU, USSR, USA and JA.
  - Selection of machine parameters and objectives.
- **1992-1998 - (EDA) Engineering Design Phase**
  - Developed design capable of ignition - large and expensive.
  - The Parties (EU, JA, RF, US) endorsed design but could not afford to build it.
- **1999 – 2001 – (EDA continues)**
  - US withdraws from project.
  - Remaining Parties searched for less ambitious goal.
  - New design: moderate plasma power amplification at about half the cost.
- **2001 - now (CTA and ITA)**
  - End of EDA and start of negotiations on construction and operation.
  - 4 site offers.
  - 2003: US re-joins, China & South Korea are accepted as full partners.
  - Cadarache selected as ITER site in June 2005.
  - India joins in December 2005



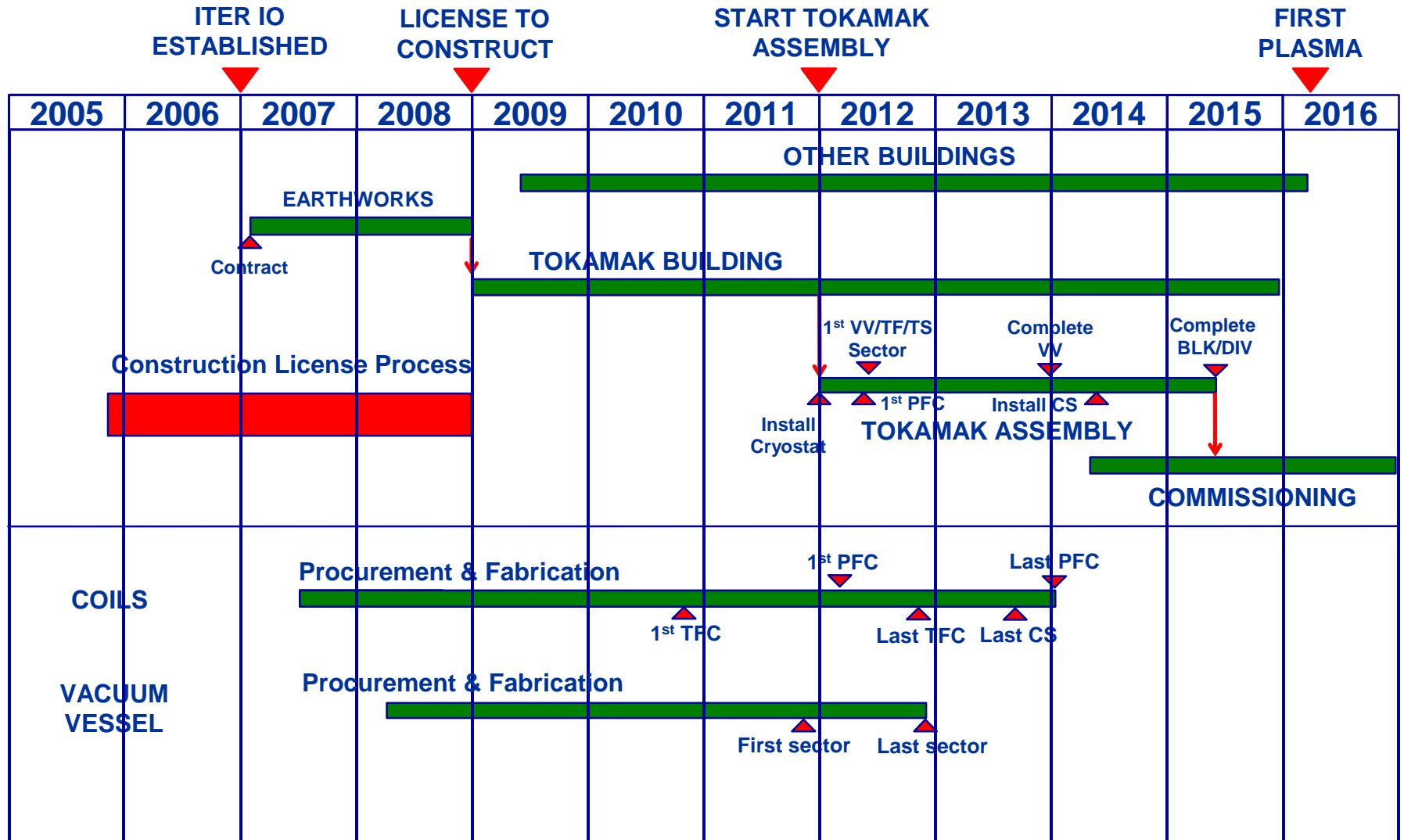
# Mutual trust is our greatest asset



Ceremony ITER Agreement Signature, Elysée Palace, 21 November 2006



# Project Schedule





# The Core of ITER

**Central Solenoid**  
Niobium-Tin, 6 units

**Cryostat**  
24 m high x 28 m diameter

**Toroidal Field Coil**  
Niobium-Tin, 18 units

**Vacuum Vessel**  
9 sectors

**Poloidal Field Coil**  
Niobium-Titanium  
6 units

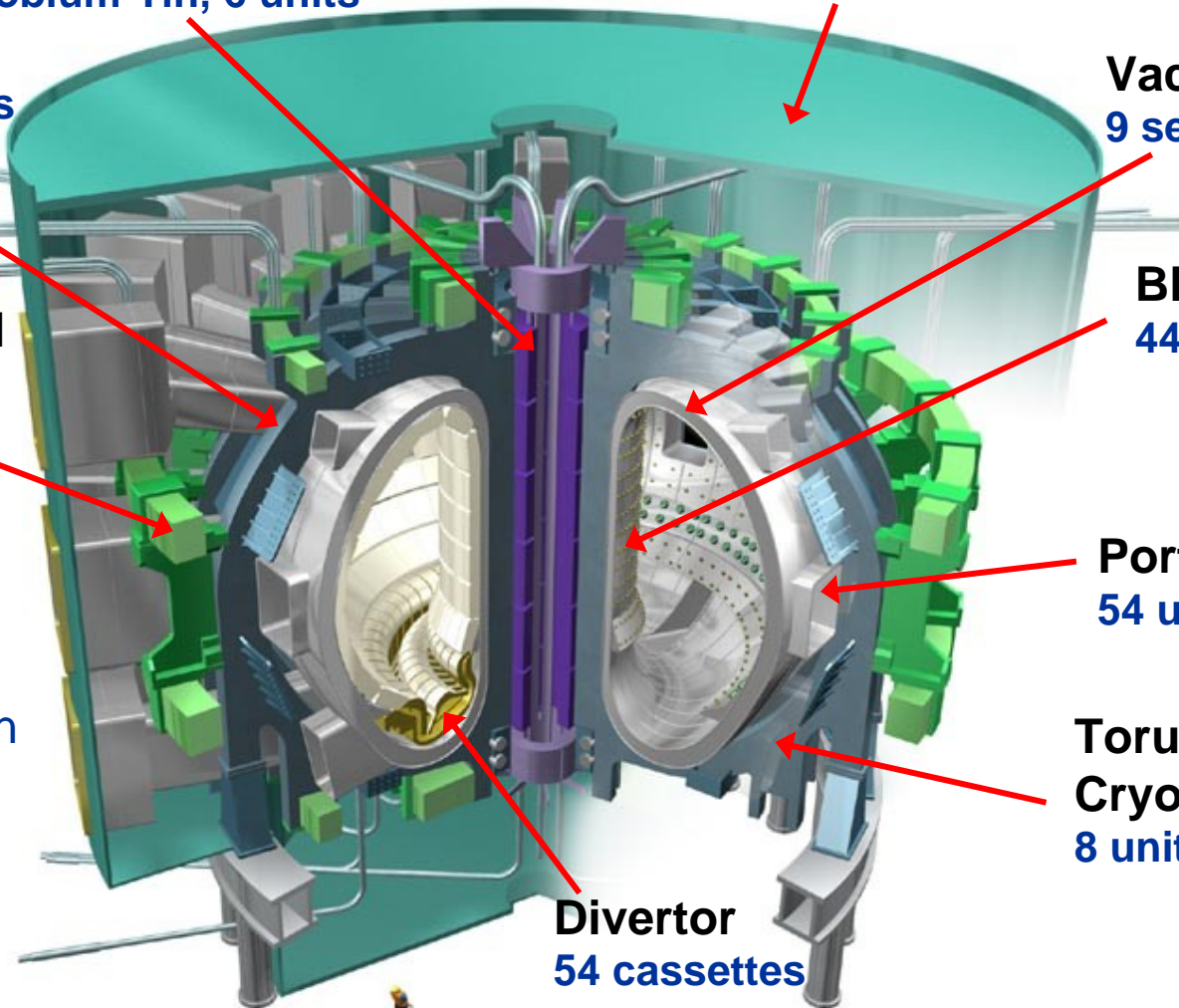
**Blanket**  
440 modules

**Port Plugs**  
54 units

Weight:  
Magnets: 10.150 ton  
Total: 23.350 ton

**Torus Cryopumps**  
8 units

**Divertor**  
54 cassettes

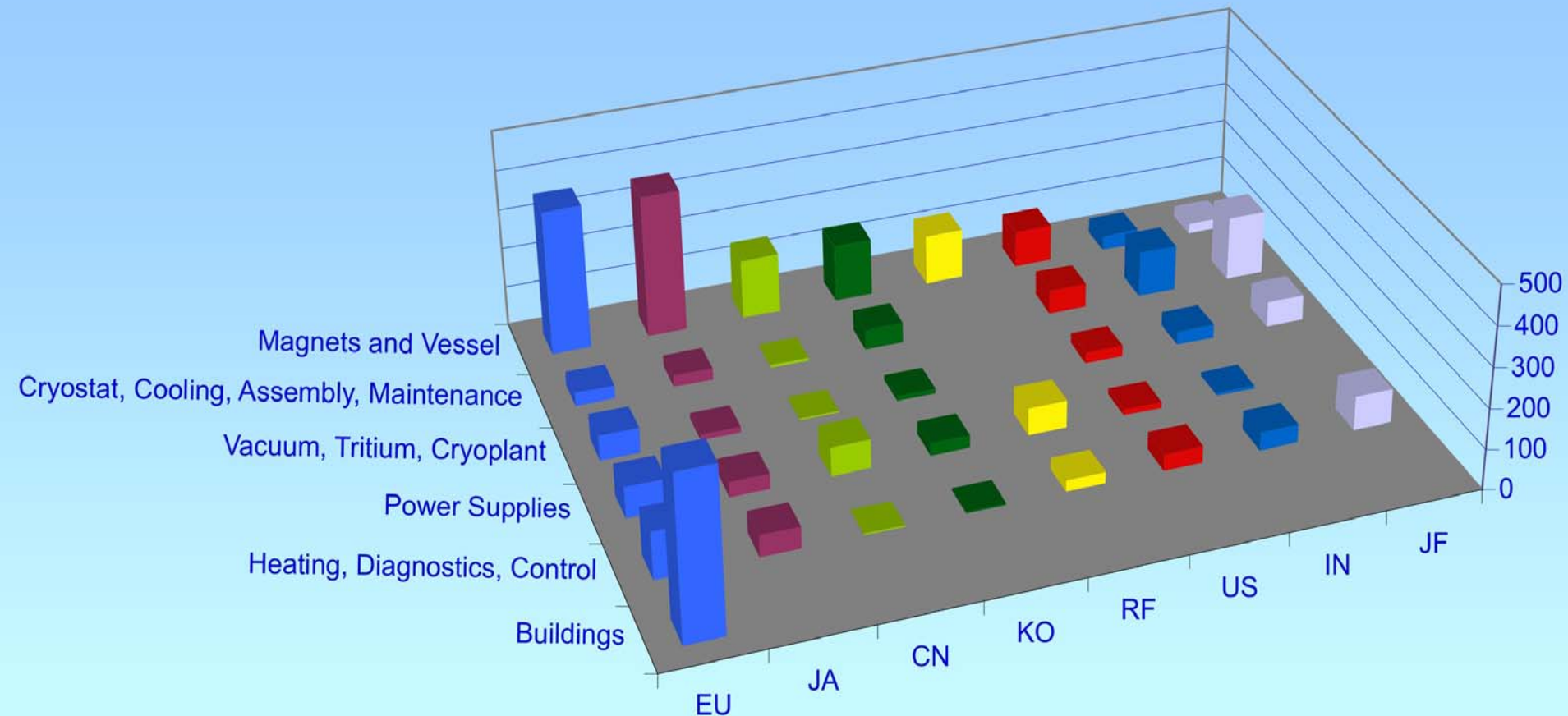


Plasma Volume: 840 m<sup>3</sup>, Fusion Power: 500 MW



# Contributions in kind

A unique feature of ITER is that almost all of the machine will be constructed through *in kind* contributions from the Parties





# Procurements sharing

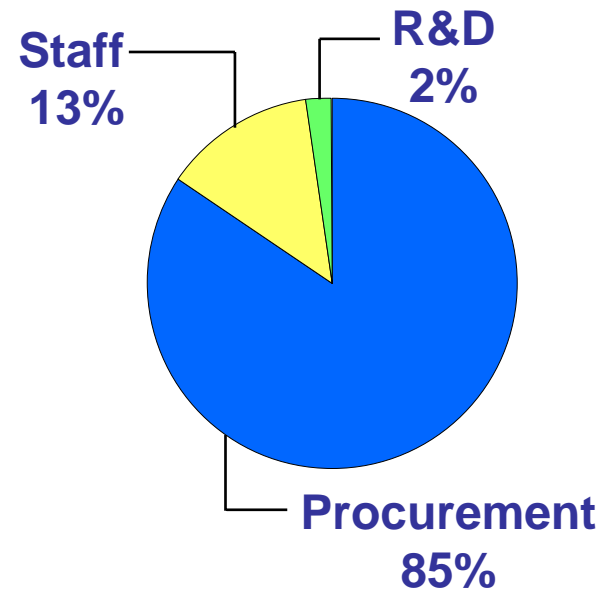
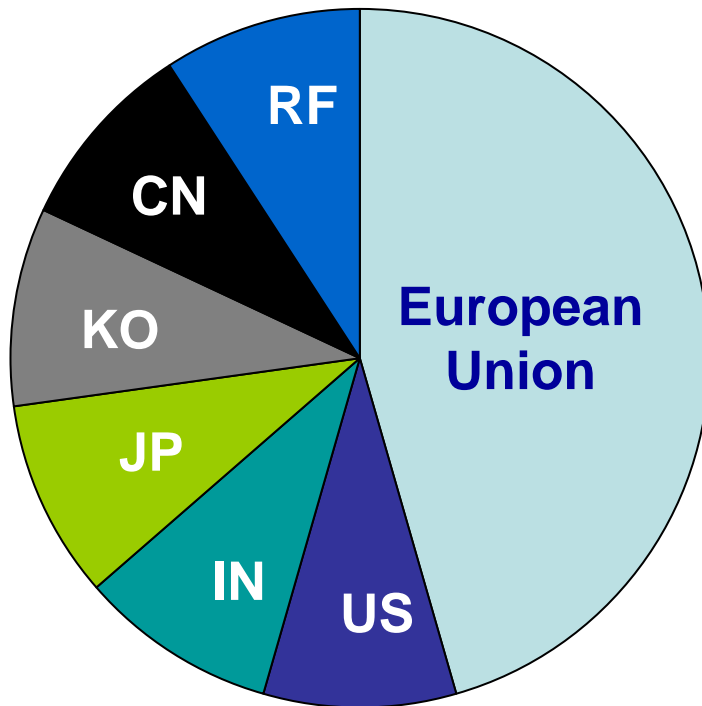
## Example for the Procurement Sharing Agreements

PACKAGE		kiUA	ALLOCATION	REMARKS	
1.1 Magnet	Toroidal Field Magnet Windings	1A	85.2	EU=100%	1A for 10 TF (including 1 prototype) and 1B for 9 TF (including 2.5 kiUA for fabrication verification)
		1B	82.3	JA=100%	
	Toroidal Field Magnet Structures	2A	51.4	EU=10%, JA=90%	Fabrication of whole structures by JA and Pre-compression ring (0.6 kiUA) by EU. Final assembly of 10 TF coil cases by EU (10%)
		2B	47.7	JA=100%	
	Magnet Supports	2C	22.85	CN=100%	
	Poloidal Field Magnet 1 & 6	3A	13.6	EU=50%, RF=50%	PF1 by RF and PF6 by EU
	Poloidal Field Magnet 2 to 5	3B	33.6	EU=100%	
	Correction Coils	3C	2.6	CN=100%	
	Central Solenoid Magnet	4A+4 B	39.6	US=100%	
	Feeders	5A	26.15	CN=100%	
	Feeders Sensors	5B	18.05	FUND=100%	
	Toroidal Field Magnet Conductors	6A	215	EU=20%, JA=25%, RF=20%, CN=7%, KO=20%, US=8%	
Central Solenoid Magnet Conductors	6B	90	JA=100%		



# Construction Sharing

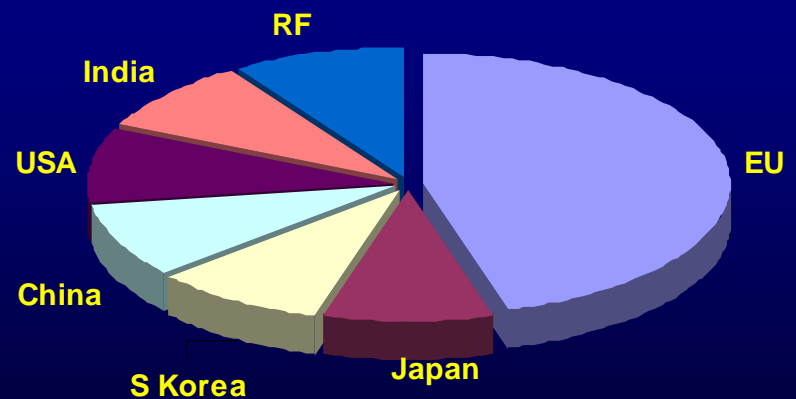
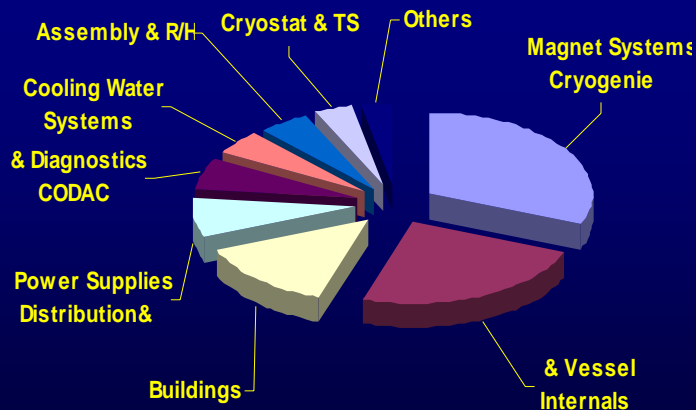
- Overall sharing: EU 5/11, other six parties 1/11 each.
- Overall contingency of 10% of total.
- Total amount: 5,079 million Euro (2007)





# Organisation Challenges

- In-Kind?
  - Involve all the Parties in key fusion technology areas.
  - Share the cost of the device by 'value' and not by currency.
  - Automatically ensure fair return
- Sharing: 5/11 EU (1/11 procured in Japan), 1/11 Others. (of which 10% centrally funded and 90% in-kind)

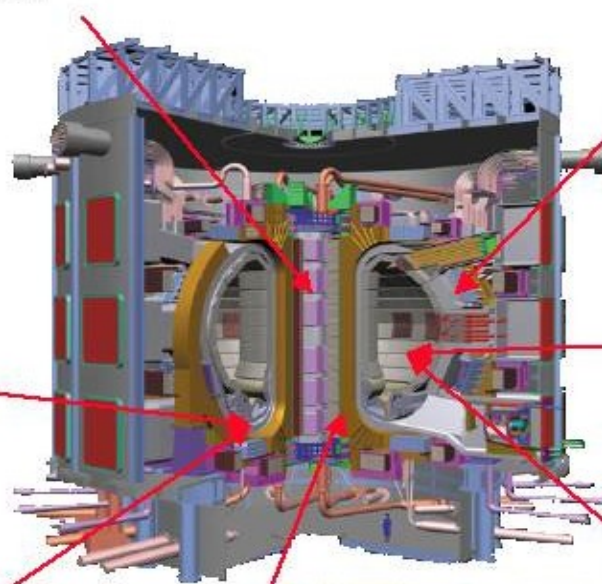


# Collaboration with industry



**CENTRAL SOLENOID MODEL COIL**

**VACUUM VESSEL SECTOR**



**BLANKET MODULE**



**REMOTE MAINTENANCE OF BLANKET**



**REMOTE MAINTENANCE OF DIVERTOR CASSETTE**



**DIVERTOR CASSETTE**



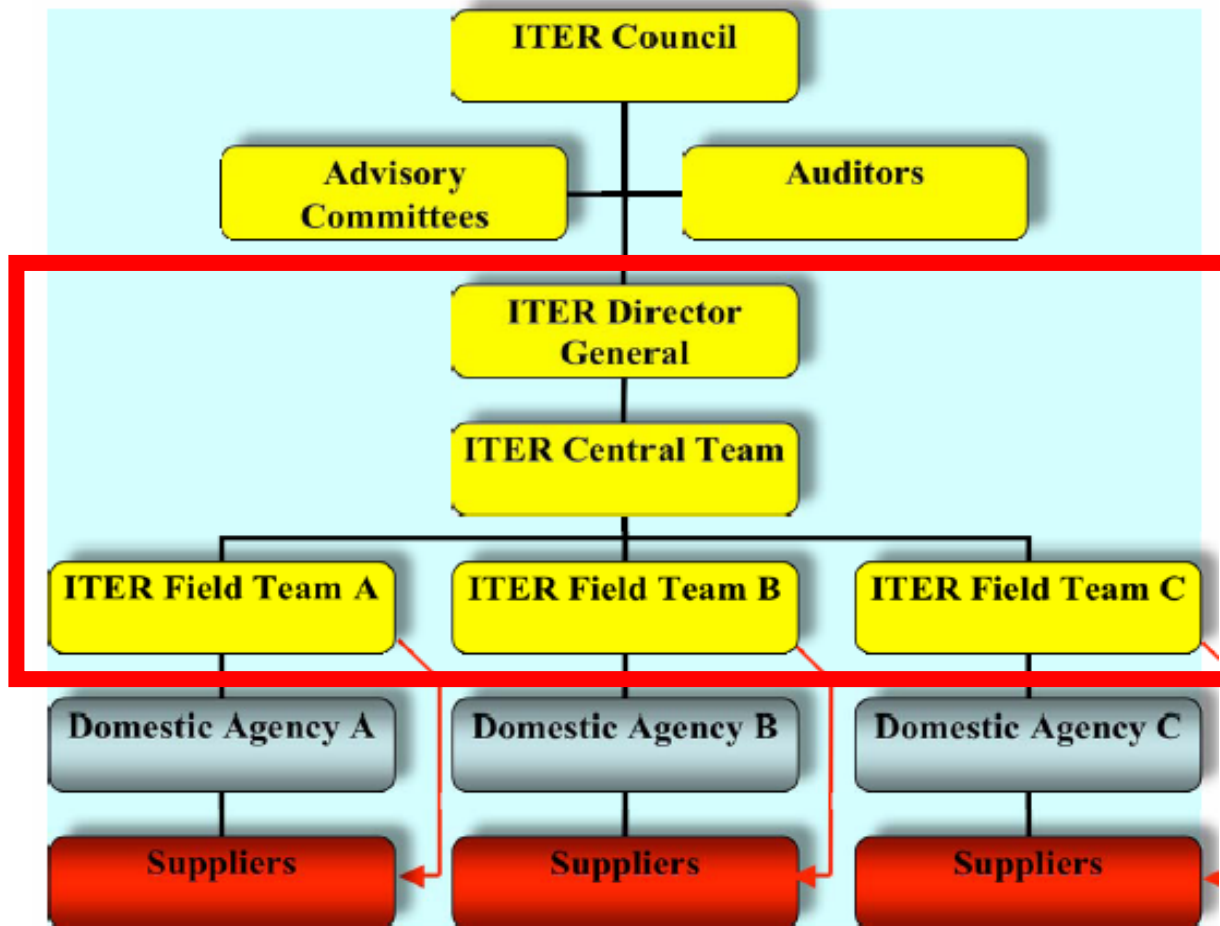
**TOROIDAL FIELD MODEL COIL**





# Organisation Challenges

- Forging one coherent project team across multiple cultures (and time zones) with industrial support.





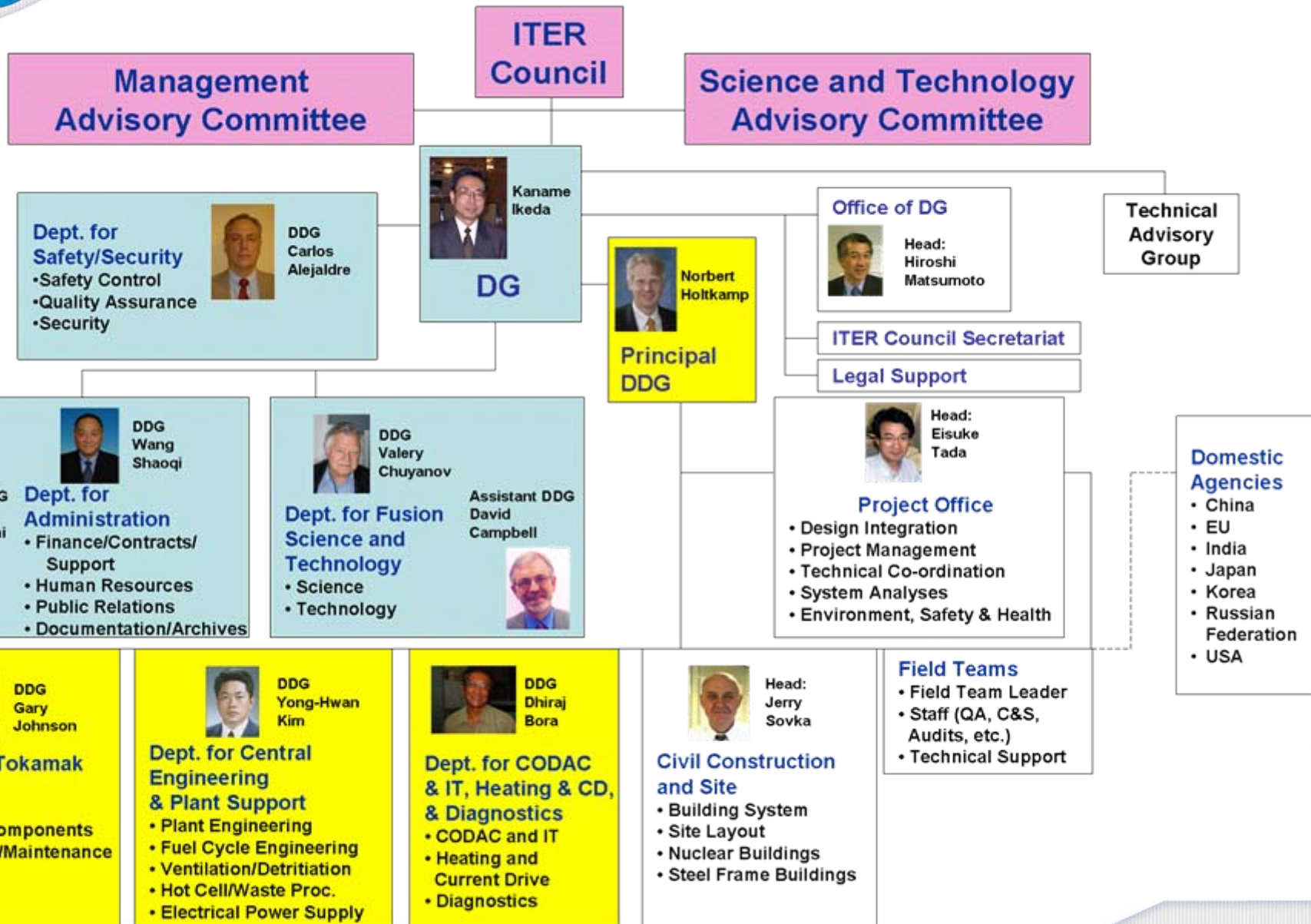
# Roles & Responsibilities for Construction

The ITER Organization, all the Parties, and the Fusion Community work together on ITER.

<b>ITER Organization</b>	<b>Seven Parties</b>
<ul style="list-style-type: none"><li>• Planning/Design</li><li>• Integration / QA / Safety / Licensing / Schedule</li><li>• Installation</li><li>• Testing + Commissioning</li><li>• Operation</li></ul>	<ul style="list-style-type: none"><li>• Detailing / Designing</li><li>• Procuring</li><li>• Delivering</li><li>• Support installation</li></ul>

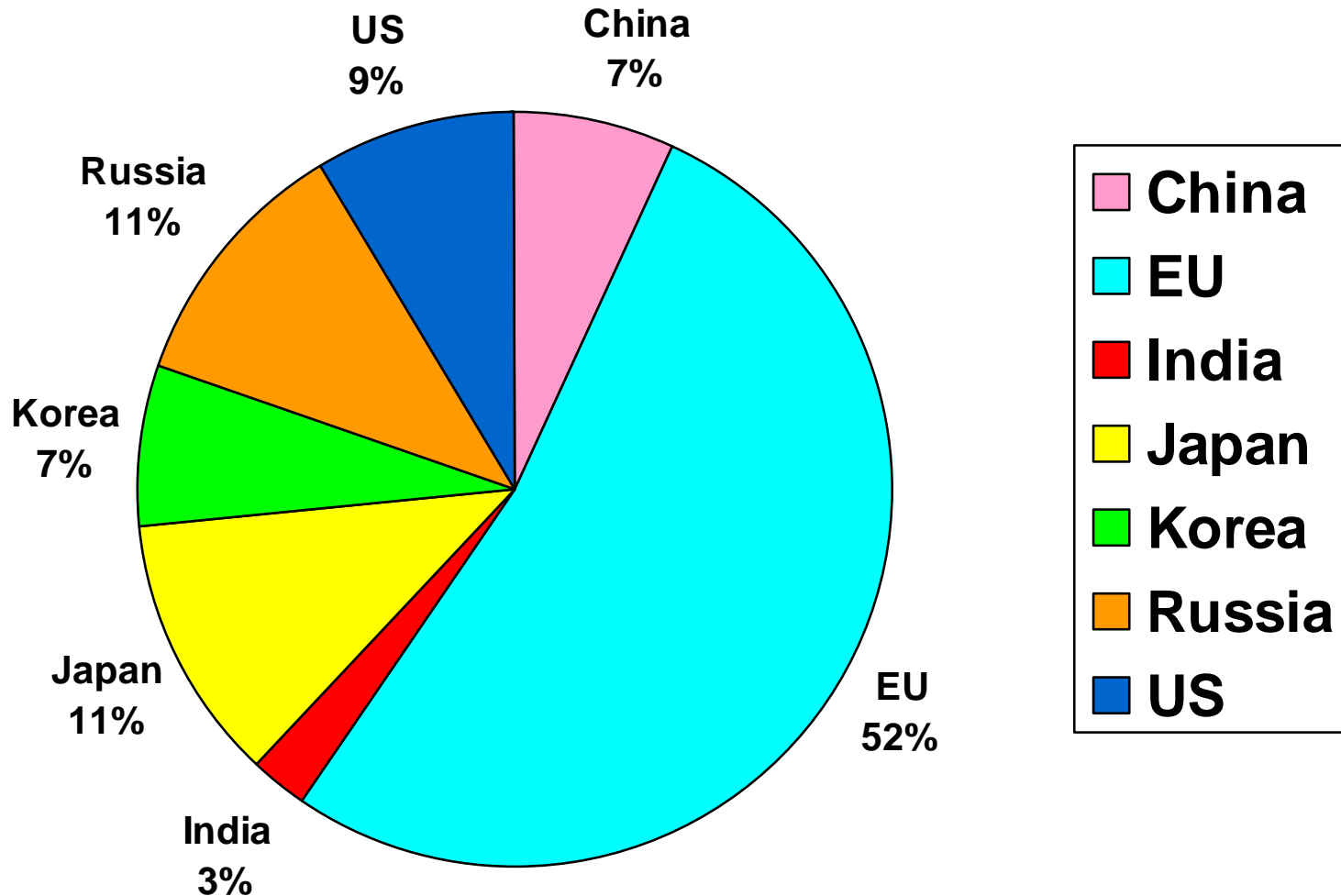


# ITER Organization





# Proportion of Professional Staff by Party



Breakdown by Party of 116 professional staff present as of 30 April 2007, not including 52 open positions and/or visiting researchers



## Summary

- ITER is one of the most challenging and innovative scientific projects in the world today.
- ITER was designed since its conception as a global project.
- Most of the ITER components will be constructed through *in kind* contributions, demanding a very high level of international cooperation.
- The International dimension of ITER is an opportunity and a challenge.