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# Status of ITER

**Fusion Power Associates Annual Meeting and  
Symposium**

**Livermore, California, 3 - 4 December 2008**

**Kaname Ikeda**

**Director-General of the ITER Organization**

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# Main Outline

- History of ITER Project
- Construction Scheme
- Design Review and establishment of Baseline
- Organizational build up
- Progress in Construction Site and Licensing
- Schedule
- Procurement Arrangements
- Operation Plan
- Test Blanket Module Program
- External Relations
- International School

# The Way to Fusion Power – The ITER

***“For the benefit of mankind”***



The idea for ITER originated from the Geneva Superpower Summit in 1985 where Presidents Gorbachev and Reagan proposed international effort to develop fusion energy...

*...“as an inexhaustible source of energy for the benefit of mankind”.*

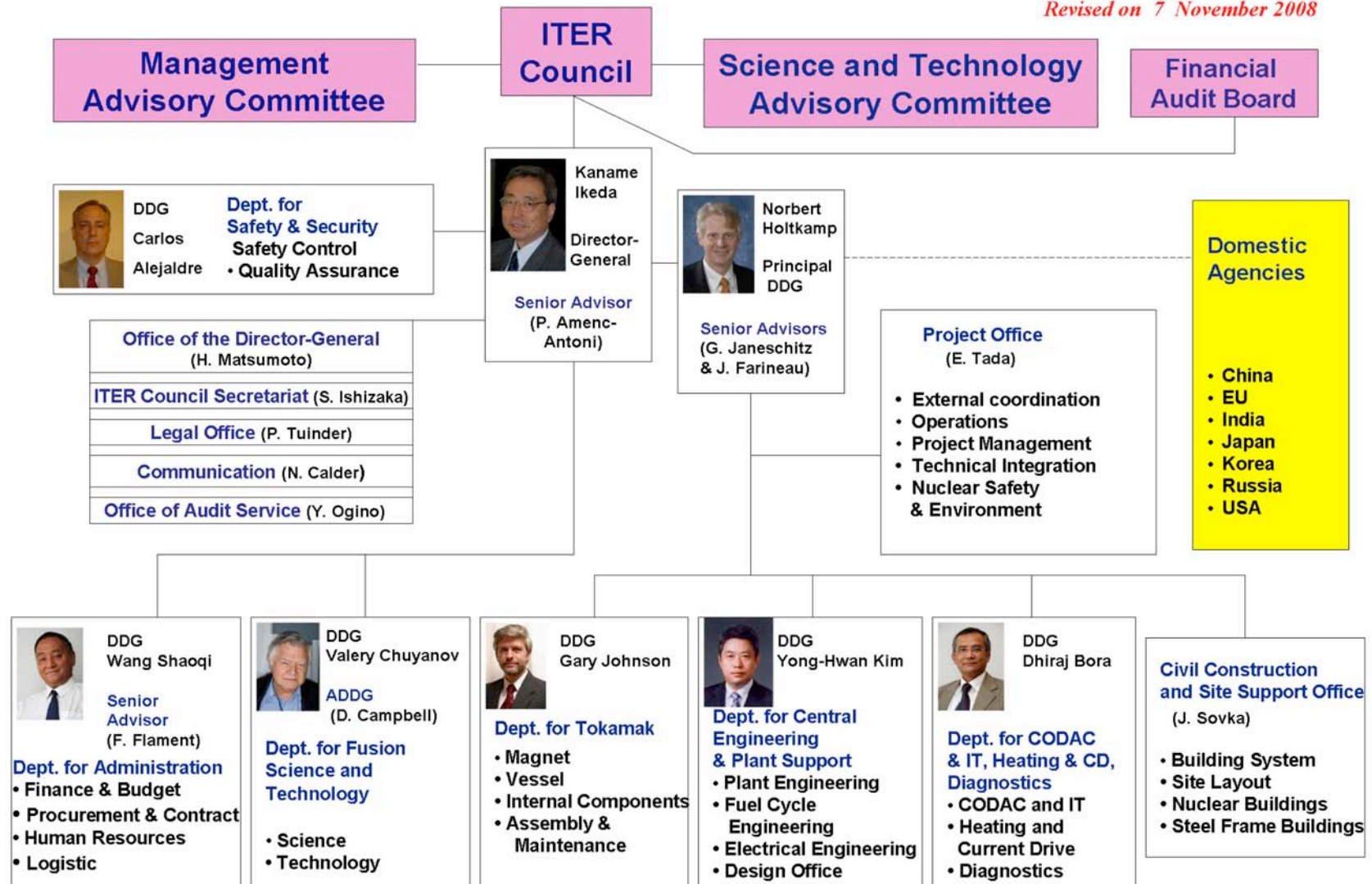


November 21,  
2006 in Paris :

China, Europe,  
India, Japan,  
Korea, Russian  
Federation and the  
United States of  
America sign the  
ITER Agreement.

# ITER Organization Structure

Revised on 7 November 2008

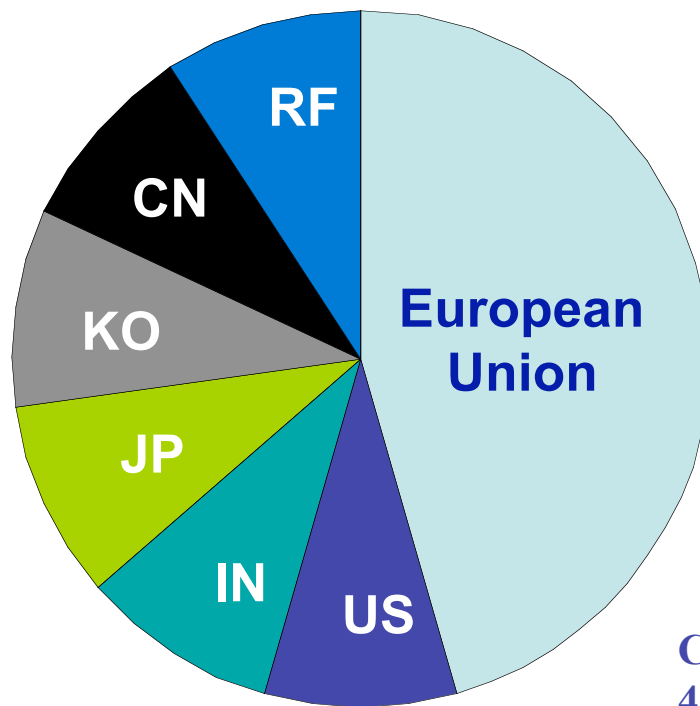


# Construction Sharing

Overall sharing:

EU 5/11, other six parties 1/11 each. Overall contingency of 10% of total. Total amount:

3578 kIUA (about 5,079 million Euro in 2007)



Total procurement value : 3021

Staff: 477

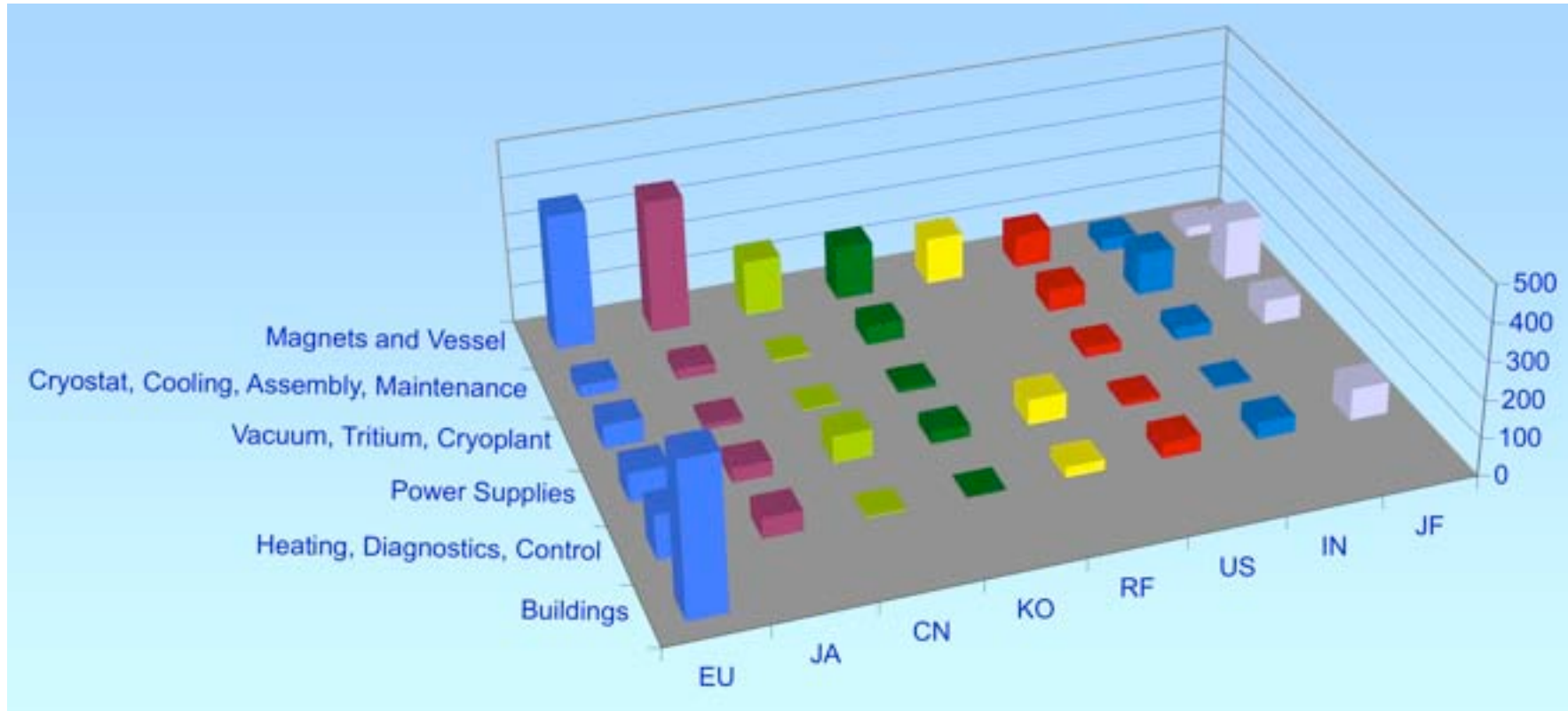
R&D: 80

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Total kIUA: 3578

Contribution of PACA's Local communities:  
467M€

# Sharing the Cost and the Technology



- Construction sharing across the 7 Members



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# Design Review

- Launched: November 2006;
- Goal: to arrive at new baseline design involving all fusion community:
  - After 2001 Baseline Design (FDR) technical work continued
  - Changes resulting from 2001 -2006 activities were integrated without detailed value study;
  - All of the changes had to be either formally integrated or rejected to develop a new Baseline Design.
- Design Review successfully finished in December 2007;
- Upon recommendations from STAC / IC, solutions for high-risk areas were further integrated into the baseline;
- In June 2008, Project Specification, highest hierarchical technical documentation was approved at IC.

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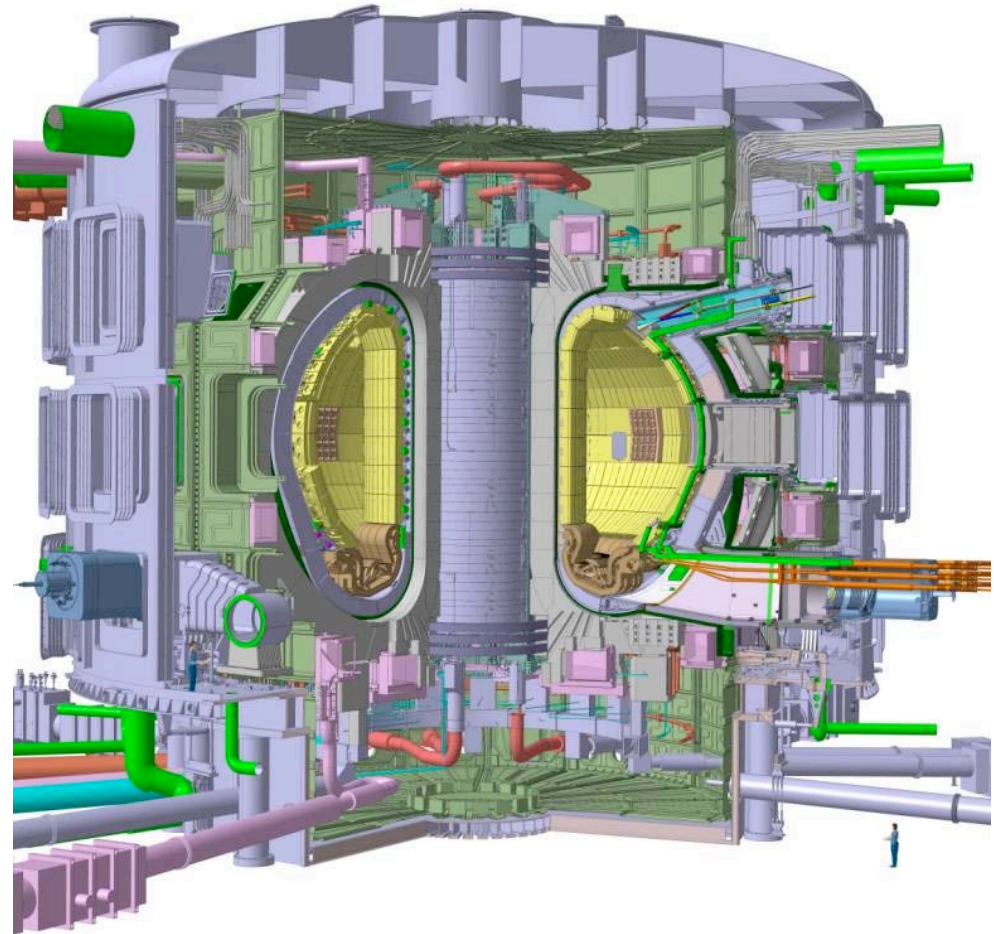
# The New Baseline

- The 2007 Baseline (until December)
  - Integrated the Design Changes from 2001 ~2006
- Additional solutions for high risk areas to be integrated into the baseline (“STAC issue list”) :
  1. For all major issues: ELM control, Vertical Stability, Plasma shaping + forces on the vessel a technical remedy is proposed but has a large impact;
  2. Some recommendations are easy to include (17 MA operation license) without cost or schedule impact;
  3. Some of the improvements are useful and accelerate the scientific program but do not have to be part of the baseline (optional).



# Finishing the Design Review

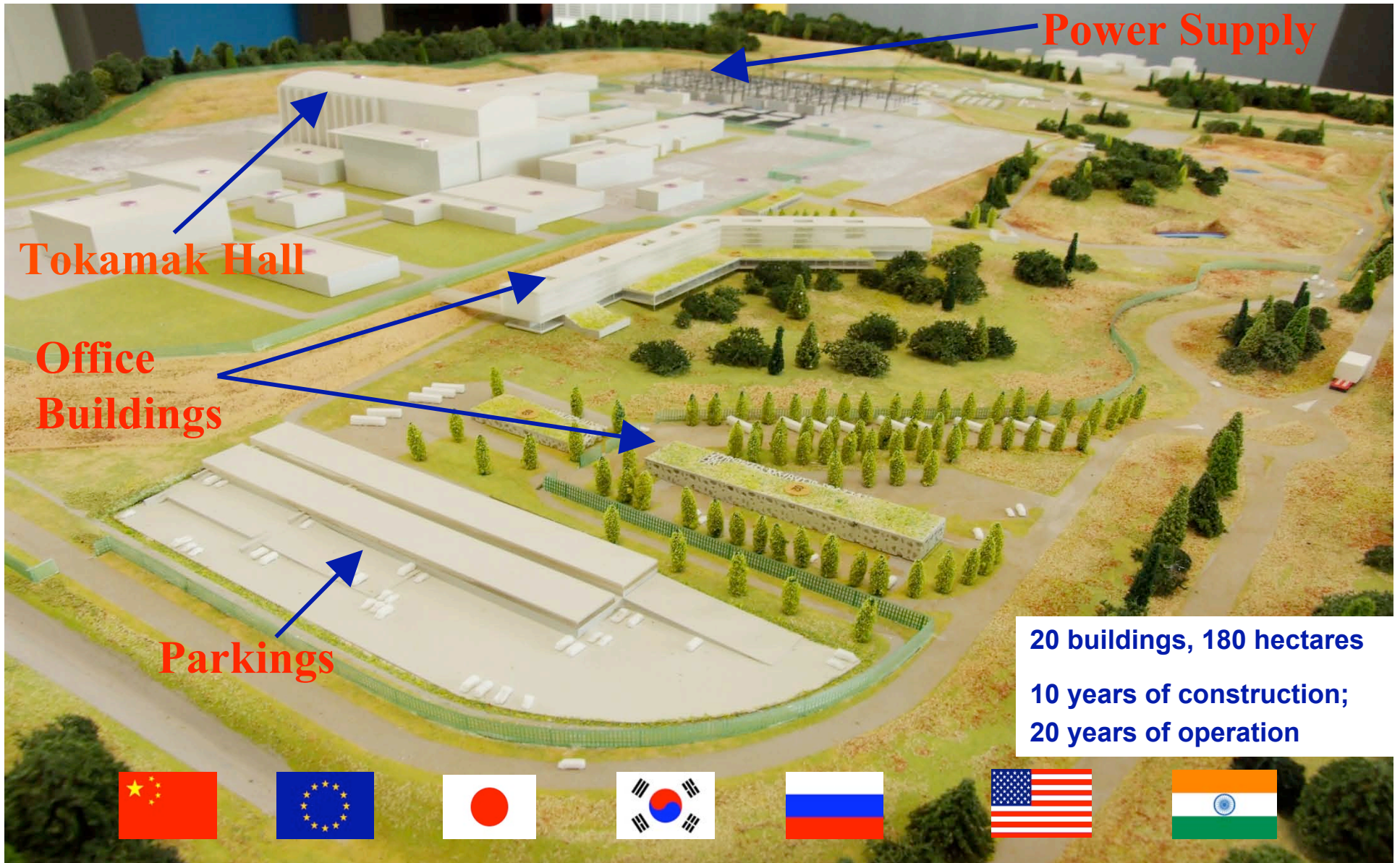
Total fusion power	500 MW
Additional heating power	50 MW
Q - fusion power/ additional heating power	$\geq 10$
Average 14MeV neutron wall loading	$\geq 0.5\text{MW/m}^2$
Plasma inductive burn time	300-500 s
Plasma major radius (R)	6.2 m
Plasma minor radius (a)	2.0 m
Plasma current ( $I_p$ )	15 MA
Toroidal field at 6.2 m radius ( $B_T$ )	5.3 T



**Machine mass: 23350 t (cryostat + VV + magnets)**

- shielding, divertor and manifolds: 7945 t + 1060 port plugs
- magnet systems: 10150 t; cryostat: 820 t

# ITER Site after Construction





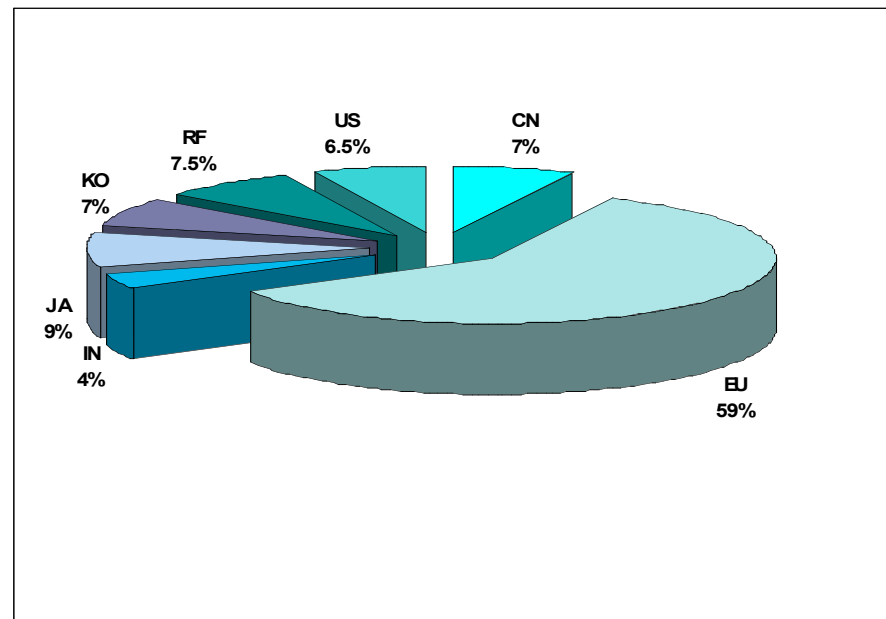
# Staffing Status

by the end of October 2008

- As of 31 October 2008, IO has a total of 293 staff, including 217 professional and 76 technical support staff;
- Early 2009, the total will be 340 with scheduled arrivals of new staff;
- 112 posts, including the 80 new positions, are in the recruitment process.

## Professional staff by Members on 31 October, 2008: Total 217

CN: 15  
EU: 129  
IN: 8  
JA: 19  
KO: 15  
RF: 17  
US: 14



## ITER Staff Group Picture on 17 November 2008



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## Progress of Infrastructure and Site Preparation

- In November 2008, part of the ITER staff has moved into the temporary Building on the ITER site, which will house 300 staff and will be the first building on the ITER site. It will serve as the ITER Headquarters until the completion of the permanent office building in 2011;
- Agence ITER France advances ITER site preparations steadily-site platform leveling 90% already complete;
- Substantial progress has been made on completing the many kilometres of access roads, drainage pipes, retention basins and other infrastructure required to support the construction of the ITER facility;
- The Architectural Drawings are complete and the call for tenders for the construction of the Annex building is planned to be launched early in 2009 with the construction expected to commence in the second half of the year.



# ITER Construction Site / AIF



# Licensing Process

- Construction Permit was awarded in July 2008;
- On 31 January 2008, the files for “*Demande d’Autorisation de Creation*”, including the Preliminary Safety Report, were sent to the French Nuclear Authorities;
- In July, the French Authorities asked questions and requested additional documentation from IO;
- IO will provide further information and documentation by February 2009;
- Public Enquiry is expected by summer 2009;
- An ITER CLI (*Commission Locale d’information*), including international experts, is being set up and will hold its 1<sup>st</sup> meeting before the end of this year.



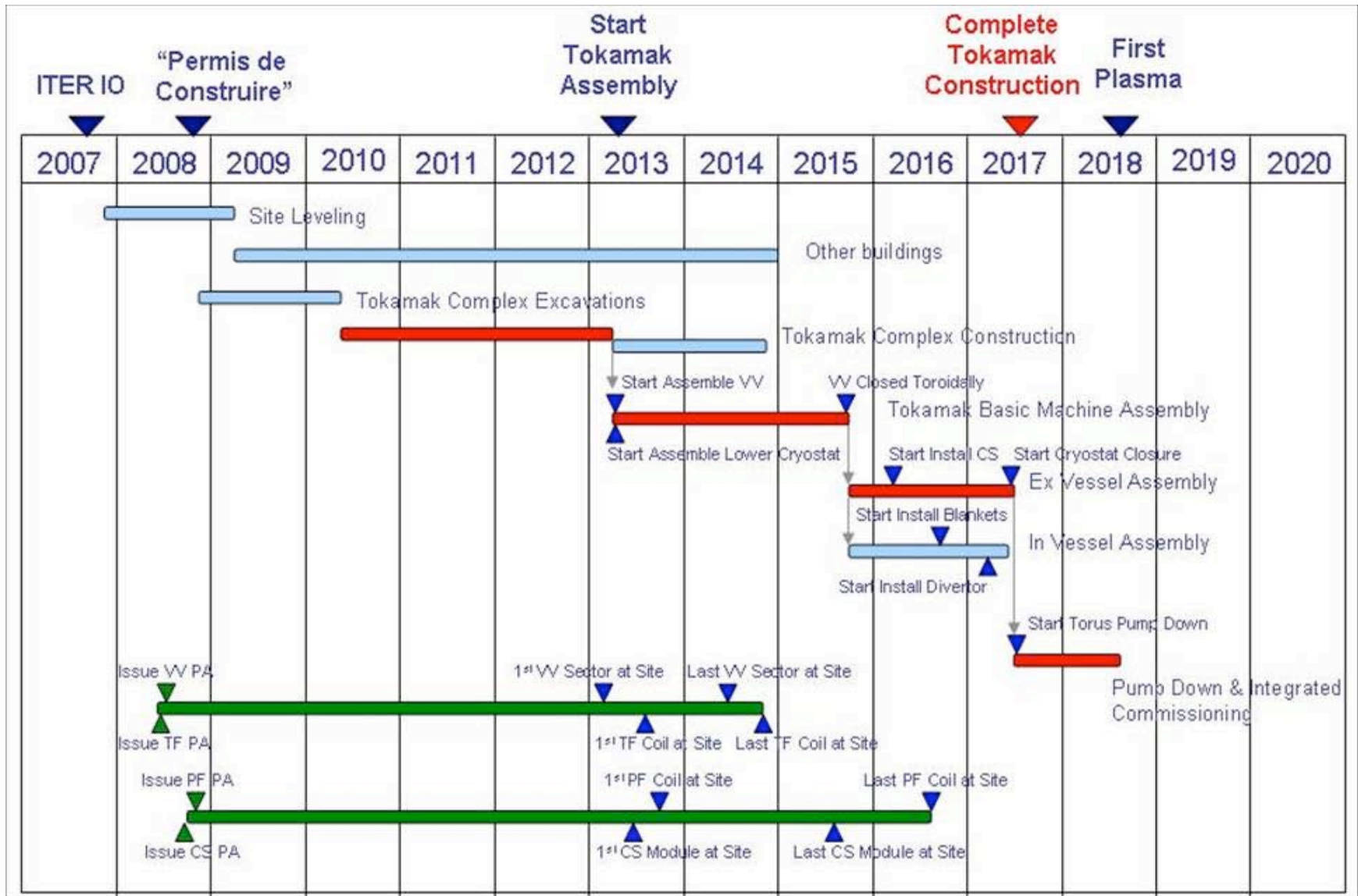


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## Integrated Project Schedule (IPS)

- Top down IPS was developed and reconciled with the bottom-up schedules with a reasonably aggressive, acceptable risk schedule that can realistically deliver ITER on the planned completion date;
- IPS is based upon the following assumptions:
  - Technical baseline from Dec 2007, not including STAC issues;
  - Increased IO & DA resources will be made available;
  - Procurement Arrangements will be completed as needed.
- Critical paths have been identified and risk management measures have been taken.

# Current Reference IPS



# Status of Procurement Arrangements

- 12 Procurement Arrangements (PAs) have been signed

PA	DA	kIUA	Signature date
TF Conductors	JA	53.73	28 November 2007
TF Conductors	EU	43.39	18 December 2007
TF Conductors	RF	41.54	12 February 2008
TF Conductors	KO	43.39	07 May 2008
TF Conductors	CN	16.15	16 June 2008
TF Magnet Winding	EU	89.74	20 June 2008
PF Conductors	CN	49.75	10 October 2008
Vacuum Vessel	KO	24.8	19 November 2008
V V Equatorial and Lower Ports	KO	57.7	19 November 2008
TF Magnet Winding	JA	74.6	19 November 2008
TF Magnet Structures	JA	47.7	19 November 2008
PF Coil Winding Building	EU	12.8	19 November 2008

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# Operation Plan

- ITER's programmatic objective will be pursued by the IO through a common international research program developed and executed with participation of the best research personnel from all the Parties;
- Each party should be able to have broad scientific and technical participation in the common ITER Program:
  - Visiting scientists and engineers from each Party will play an important role in the exploitation of ITER
  - Each Party will have remote access to ITER data, and remote participation in experiments will be facilitated.
- ITER Operation Plan has been developed based on existing ITER Baseline Design.

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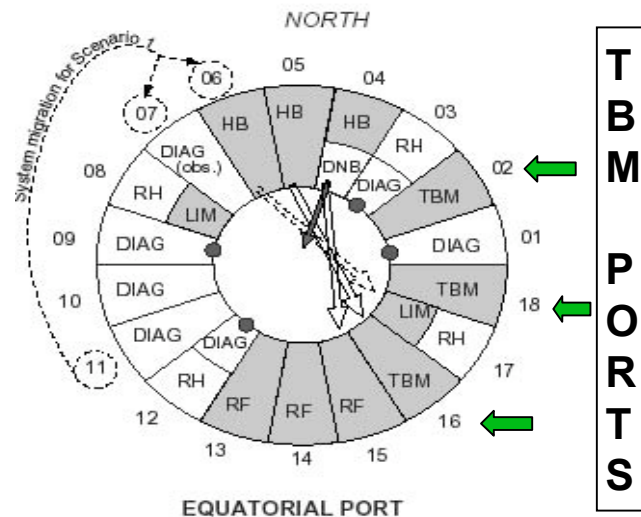
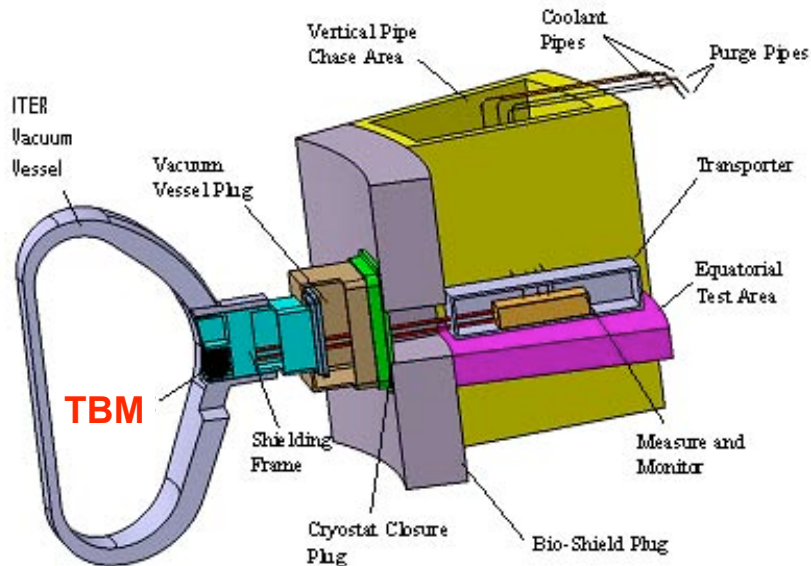
## Test Blanket Module (TBM)

- TBM Program and the Program Committee was formally established at IC-3, November 2008;
- TBM Program is to be executed under the ITER Agreement;
- The required infrastructure is part of the ITER baseline;
- IO is to prepare a proposal specifying the sharing of additional expenses as a result of the TBM Program.

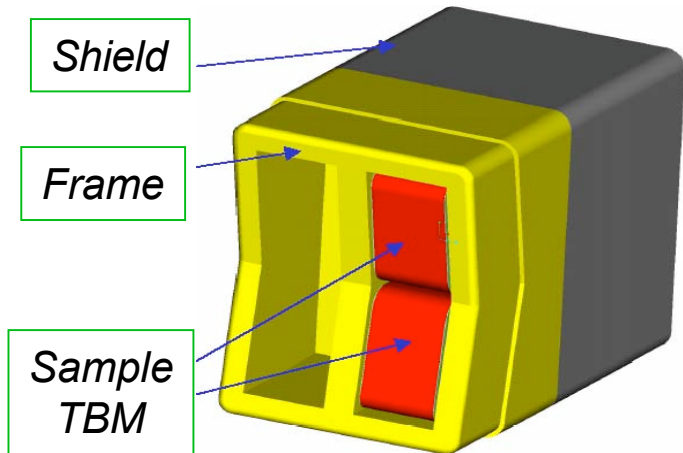
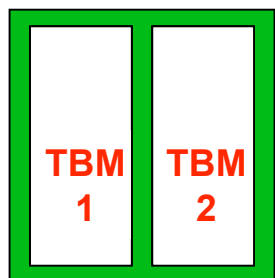
# TBM Systems in ITER

- ◆ 3 ITER equatorial ports (opening of 1.75 x 2.2 m<sup>2</sup>) devoted to TBM testing
- ◆ 6 TBMs (each half-port size) installed in 3 ports

View of TBMs Systems Locations

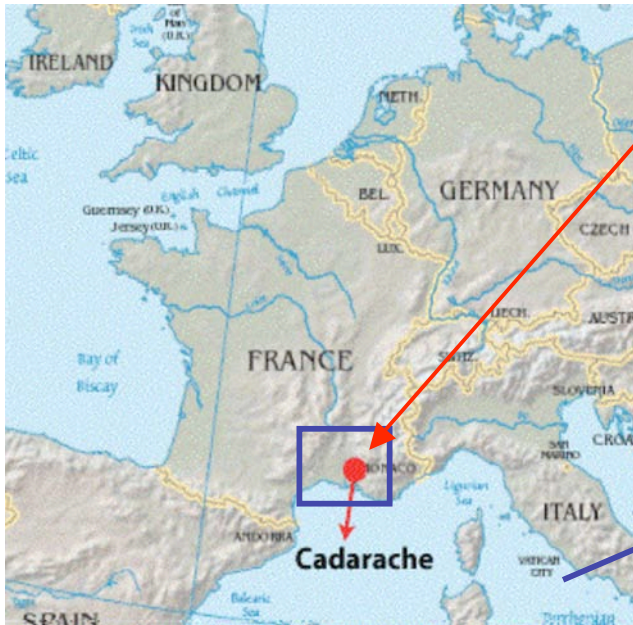


The TBMs first wall is recessed of 50 mm and protected with a Be layer





# Itinerary of ITER Components



ITER Site

— = Itinerary of ITER Components





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# External Relations

- The IC-2 approved the start of formal interactions with Kazakhstan. Immediately after IC-2, IO sent letters to the President and the relevant Ministries of Kazakhstan informing them of the decisions of the IC-2. In late October, Kazakhstan replied that the Kazakh Government would like to send a technical delegation to visit the IO at the end of November 2008. On 13 November, DG Ikeda visited Kazakhstan, starting the formal interactions between the two sides;
- Since the approval of the Co-operation Agreement with CERN by the first ITER Council, a strengthened collaboration has been developed;
- On 13 October 2008, the Cooperation Agreement with IAEA was signed by DG Ikeda and DDG Yury Sokolov on behalf of IAEA;
- The Principality of Monaco / ITER Postdoctoral Fellowship was established as a result of the Partnership Arrangement between the Principality of Monaco and the ITER Organization. The recruitment procedure of 5 fellows in 2008 was concluded by end of October 2008. They are expected to take up their posts by January 2009.

# The International School



- The International School was opened in September 2007 in Lycée des Iscles in Manosque;
- By the end of September 2008, 206 children ( 110 ITER children) were attending the school. They are being taught in 5 languages by 40 teachers;
- Currently 5 language sections are open: Japanese, German, English, Chinese and Italian. Supplementary support in Russian, Korean and Hindi is also available;

- The first phase of the new school building is planned to be finished in September 2009; the second phase is planned to be finished by September 2010;
- The 3rd meeting of the International Advisory Council for the International School was held in Cadarache on 25 November 2008.



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## Summary

- Design Review completed by the end of 2007 and good technical basis was established with solutions to high risk areas;
- IO has established IPS targeting the First Plasma July 2018;
- IO has already signed 12 Procurement Arrangements with the DAs;
- ITER site preparations are advancing steadily. Major construction in the Tokamak Complex is expected to start early next year.