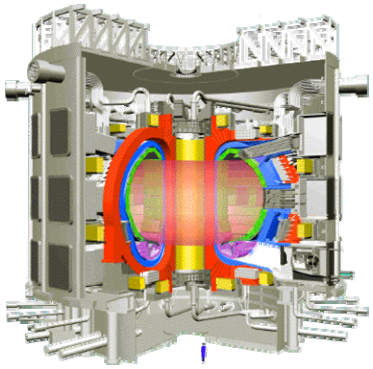
Experience of ITER Project and Site Selection

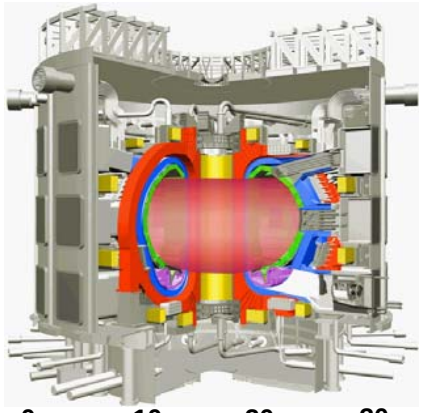


Toshihide Tsunematsu

Director General
Fusion Research and Development Directorate
Japan Atomic Energy Agency

Outline of the ITER Project

Participants: EU, JA, RF, US, CN, KO, IN



Major Specifications

Fusion Power	: 500 MW
Q Value	: >10
Major Radius	: 6.2 m
Minor Radius	: 2.0 m
Plasma Current	: 15 MA
Magnetic Field	
Maximum	: 11.8 T
Plasma Center	: 5.3 T

US-USSR Summit in 1985

Objective

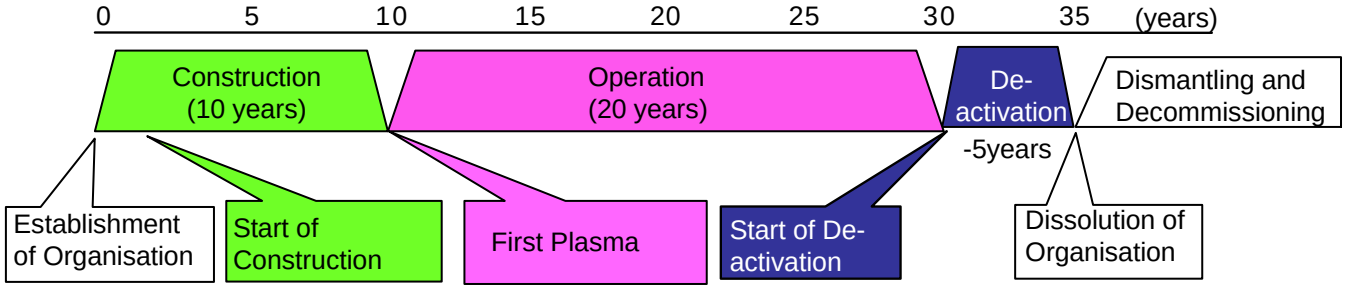
Demonstration of the Scientific and Technological Feasibility of Fusion Energy for Peaceful Purposes:

1. Controlled Ignition and Extended Burn
2. Demonstration and Testing of Integrated Technologies

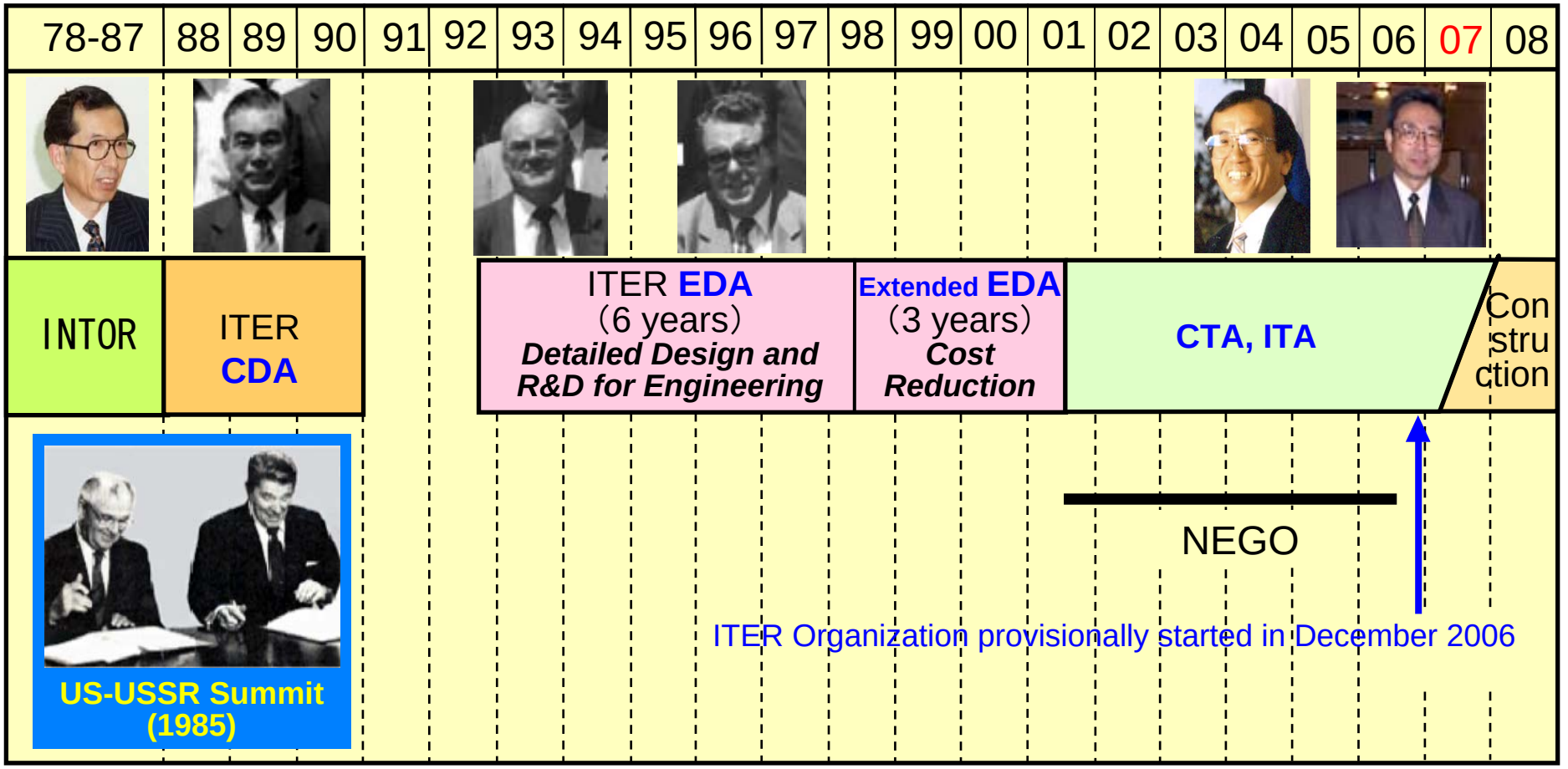
Progress

1985	US-USSR Summit Meeting
1988-1990	Conceptual Design Activities (CDA)
1992-1998	Engineering Design Activities (EDA)
1998-2001	Extended EDA
2001-	Negotiations for the Joint Implementation Agreement
2003-	Ministerial-level Meetings for the ITER Site Decision

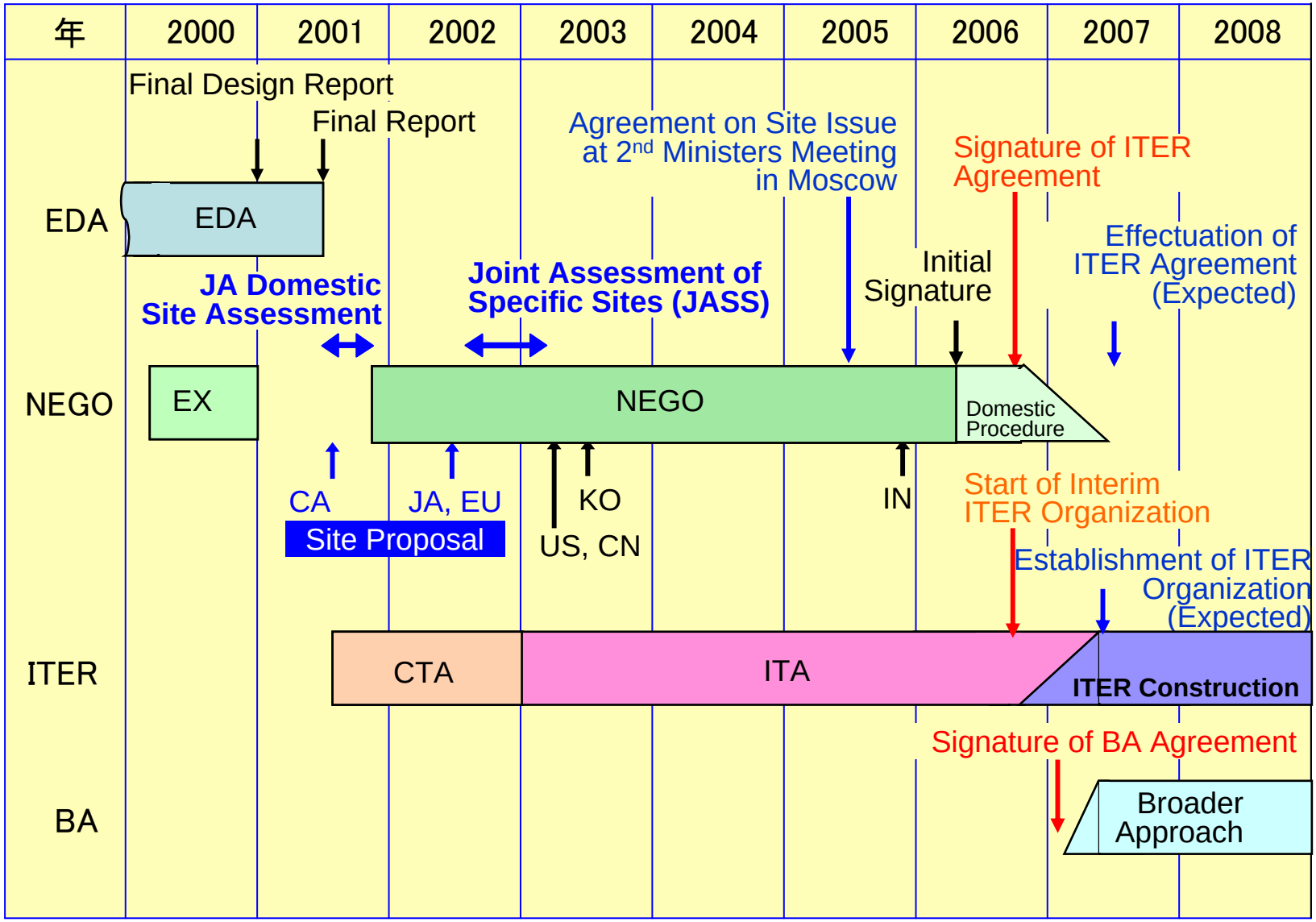
Schedule



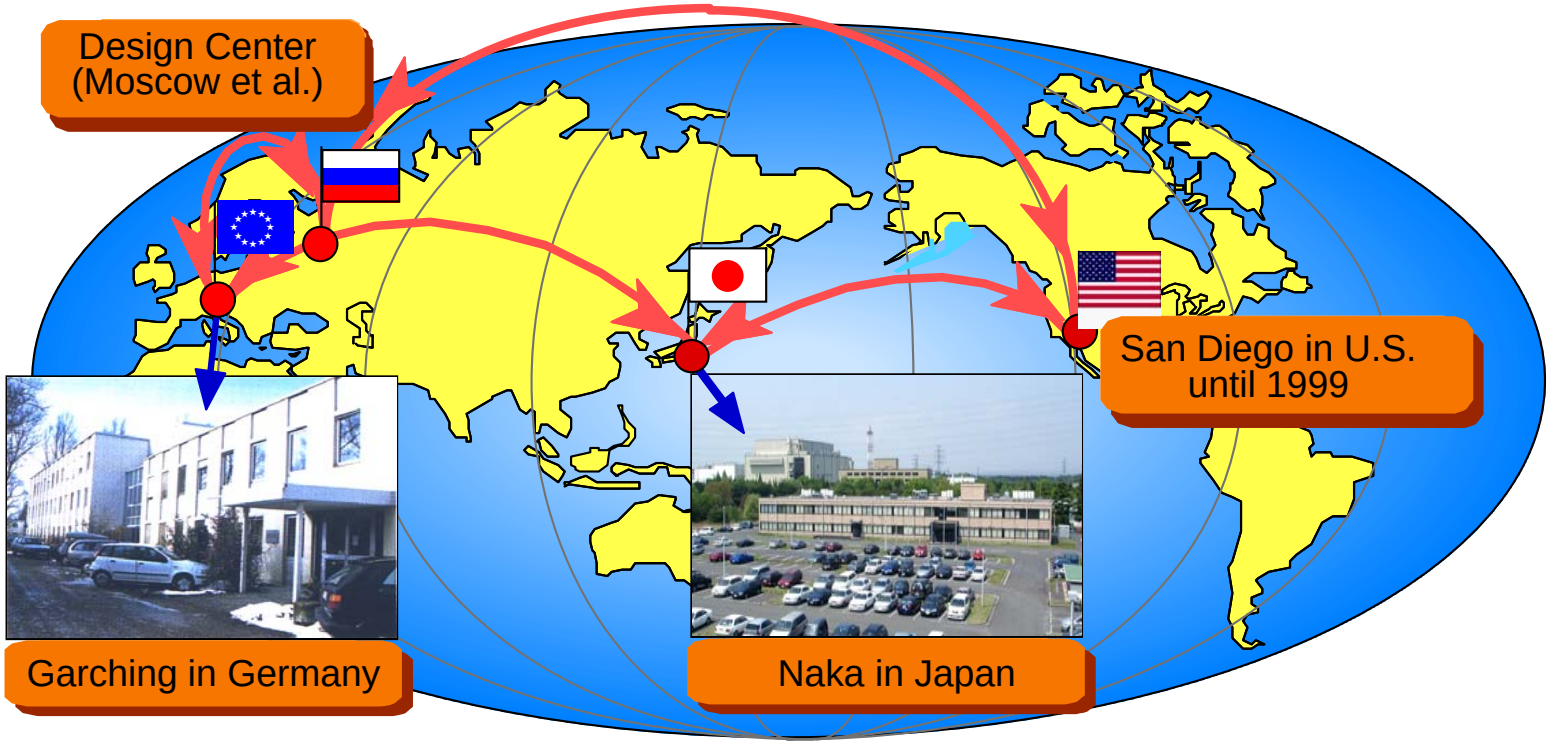
Long Term History of ITER Project



Recent Progress of ITER and Broader Approach

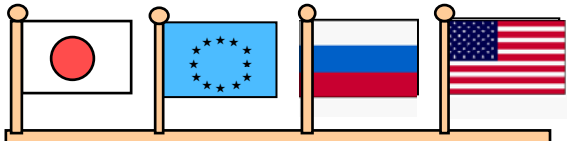


ITER Design Work Implemented Globally



- **Activity Bases for ITER Joint Central Team (1992-2001)**
- **About 80 Members in all for International Design Team**
- **Design Study for ITER Construction**

ORGANIZATION OF ITER EDA



ITER COUNCIL

PHYSICS R&D

VOLUNTARY PHYSICS ACTIVITIES

MANAGEMENT ADVISORY COMMITTEE

TECHNICAL ADVISORY COMMITTEE

DIRECTOR

(TASK AGREEMENTS)

ENGINEERING R&D

DESIGN TASK

DESIGN

JOINT CENTRAL TEAM

INTEGRATION (SAN DIEGO)

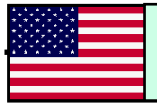
OUT - VESSEL (NAKA)

IN - VESSEL (GARCHING)

JA HOME TEAM

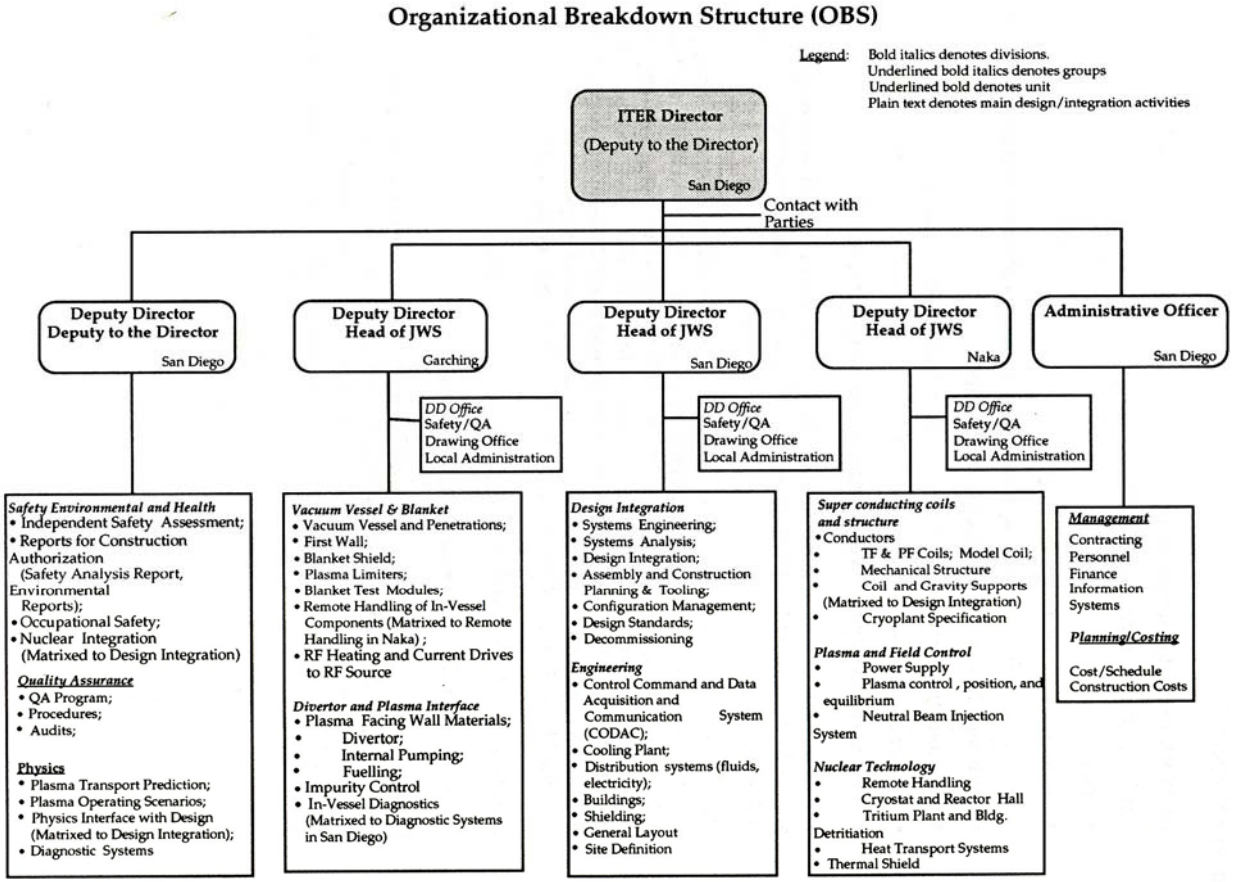
EU HOME TEAM

RF HOME TEAM



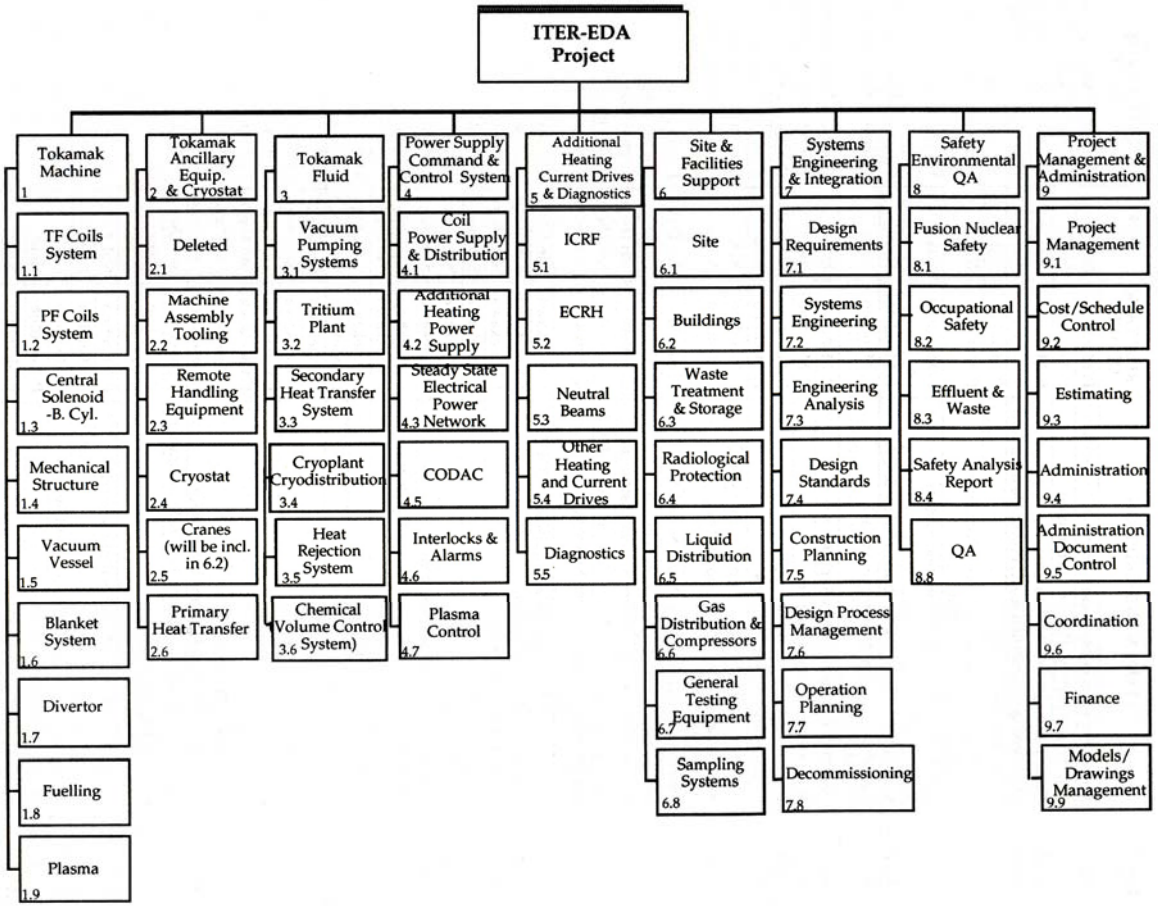
US HOME TEAM

Organization Breakdown Structure (OBS)



Work Breakdown Structure (WBS)

a tree-like structure with unique identification numbers consisting of levels used to plan and organize the work of the project



ITER EDA: Manpower & Resource

	Original EDA 1992～1998 (Six Years)	Extended EDA 1998～2001 (Three Years)
Joint Work Sites for JCT	Garching (Germany), Naka (Japan), San Diego (U.S.)	Garching (Germany), Naka (Japan)
Manpower for Design Work (PPY)	Whole Manpower 1420 PPY ・Joint Central Team 730 PPY (30～40 PPY from Each Party) ・Home Teams 690 PPY	Whole Manpower 570 PPY ・Joint Central Team 310 PPY (30～40 PPY from Each Party) ・Home Teams 260 PPY
Resource for Engineering R&D (IUA)	544 kIUA	113 kIUA

PPY (Professional-Person-Year)

Amount of work which takes one year by one professional design engineer with a support staff

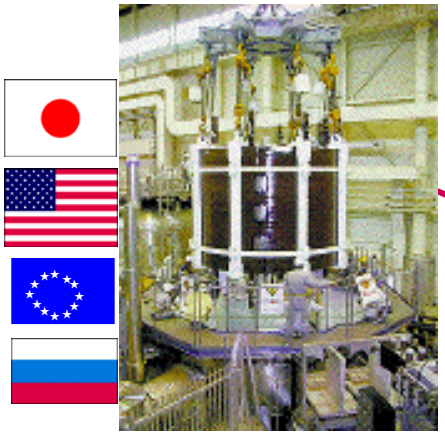
IUA (ITER Units of Account)

one IUA is equivalent to 1000 US$ at January 1989 values

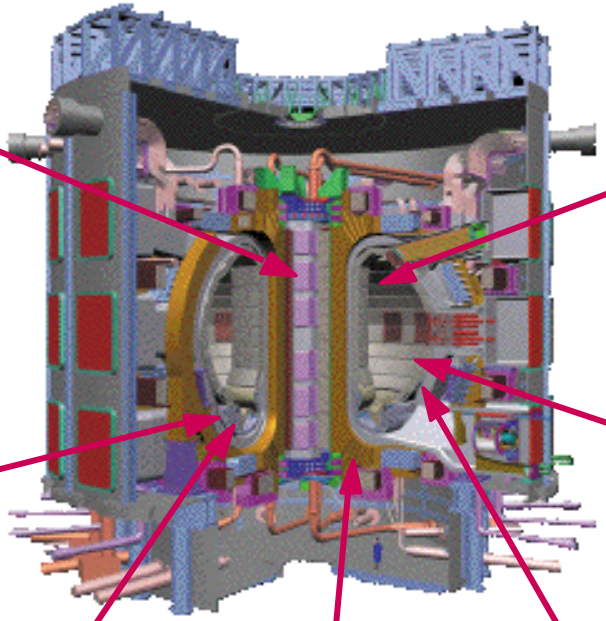
Purpose of Enginerring R&D

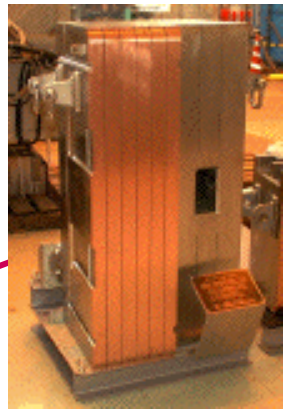
1. Acquisition of Developed Technology and Related Data which prove the Basis of Design and Safety Analysis
2. Confirmation of manufacturing Tokamak Components, Manufacture and Test of Actual Scale Model for Proof of Performance
3. Manufacture of Actual Scale Model for Preparation of Actual Production by Multilateral Cooperation
4. Confirmation of Quality Control System for Actual Production
5. Acquirement of Data for Cost Estimation of Actual Production
6. Development of Element Technology for Peripheral Equipments (for key elements)

ITER Technology Development

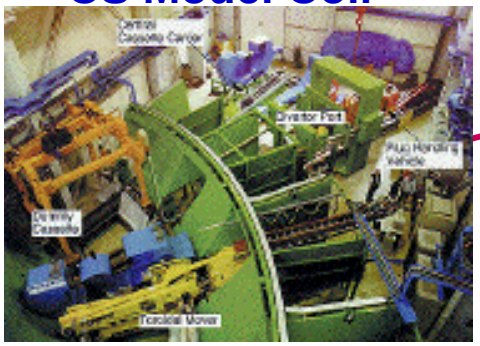


CS Model Coil



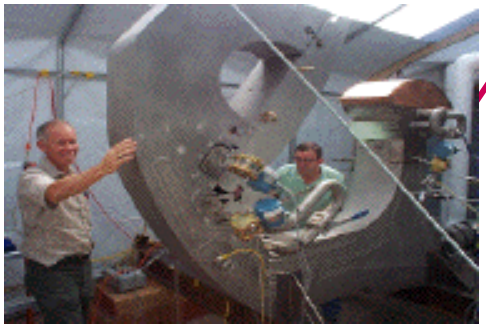


Blanket Module



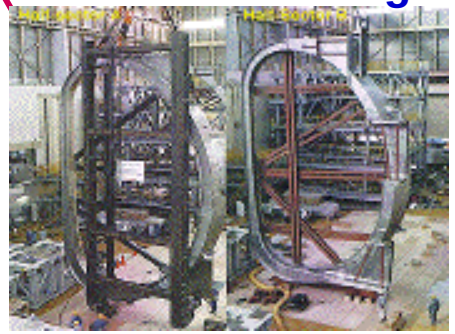
Divertor Cassette
Remote Handling

Blanket Module
Remote Handling



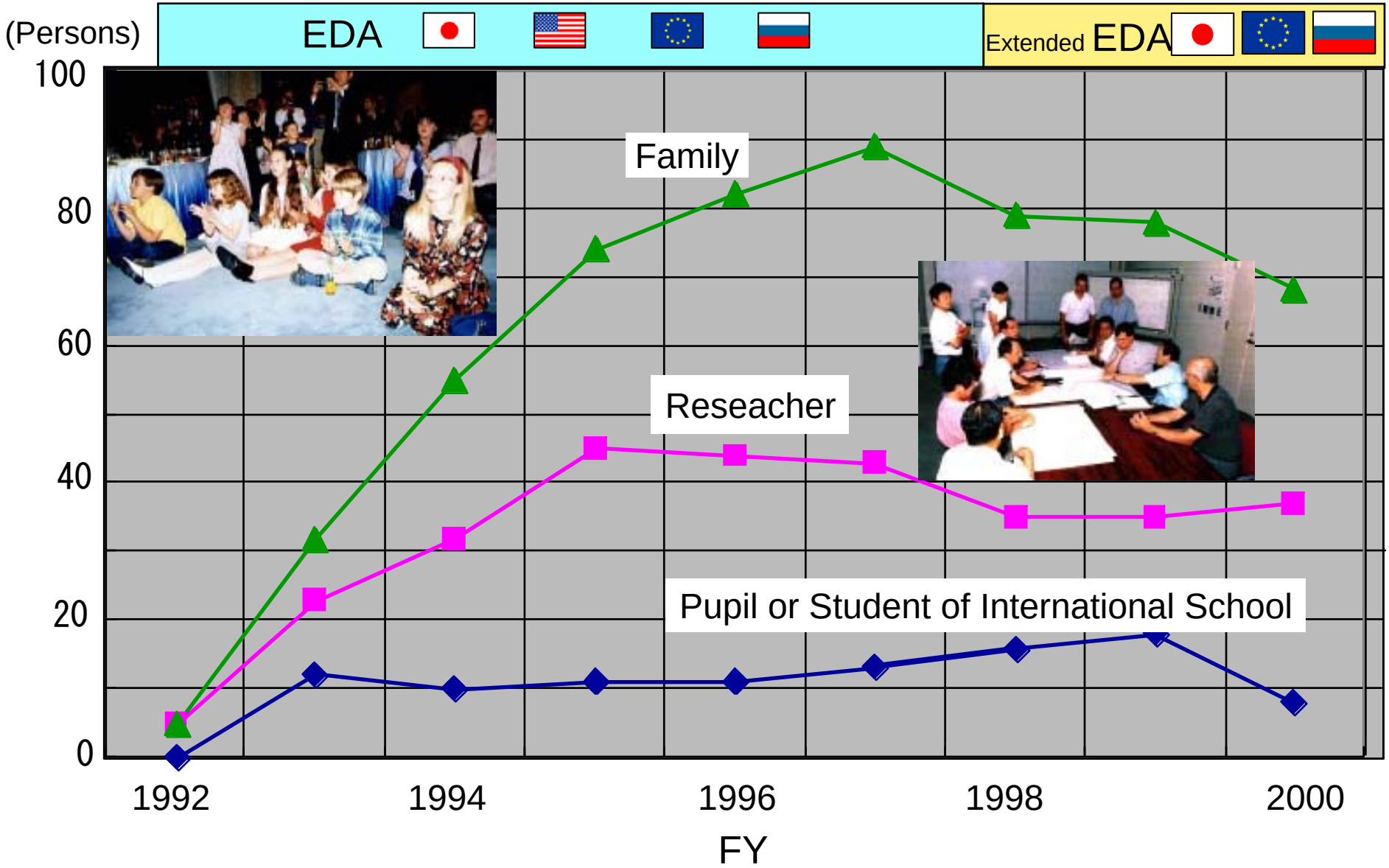
Divertor Cassette

TF Model Coil



VV Sector

Foreigner's Reception at Naka Joint Work Site



Conclusion on ITER Project at Council for Science and Technology Policy (CSTP)

CSTP decided to start consultation on ITER in June 2001.
→ Study of ITER site in Japan started at MEXT in July 2001.

CSTP Conclusion on ITER in May 2002

- ITER Project should be promoted by the Government as a whole.
- Proper domestic site must be selected aiming at the hosting of ITER in Japan at the Negotiations.
- Sharing of the cost should reflect the economical scale of each participating Party with maintaining a contribution of a certain level.
- Framework of fair return should be formed that ensures the balance between contribution and benefit.

- with attention to

- ITER should not affect other important policies on science and technology. It should be financially secured within nuclear energy R&D budget through prioritization and efficiency improvement.
- Liaison structure with ITER project should systematically established in domestic fusion research together with prioritization and efficiency improvement.
- Education and training of the next generation researchers and engineers for supporting fusion R&D, development of other confinement system, and development of low activation materials must be taken care of.

Assessment on Possible ITER Sites in Japan

Specialist Committee on Site Assessment for ITER

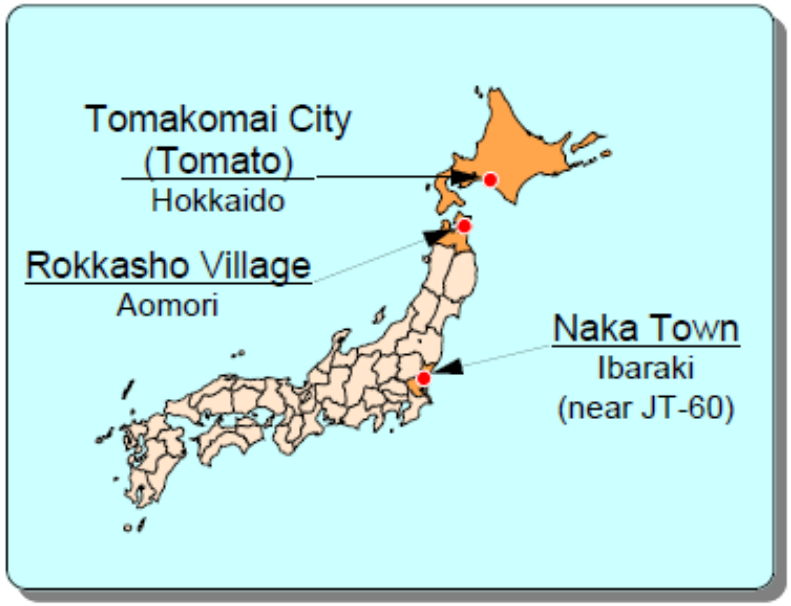
of the Ministry of Education, Culture, Sports, Science and Technology (MEXT)

- Decision of Inspection Condition
- Offer for Public Subscription

early July 2001

Prefectural and Local Governments Proposed Possible Sites for ITER

late July 2001



- Hearing from Three Municipalities
- On-Site Inspection
- Evaluation of the Aptitude of the Site

Report Submitted on October 18, 2001

- "The three sites are satisfied with site requirement such as land, area, and geotechnical characteristics."
- Considering the aptitude such as social and reserch environment, finaly Naka Town and Rokkasho Village were judged as the suitable site for ITER.
- However, this report does not decide the candidate site of Japan, but only evaluate the aptitude as the site.

Agreement by the Cabinet

- **The Cabinet agreed in May 2002 to offer a site for hosting ITER in Japan based on the conclusion of CSTP.**
- **Rokkasho was selected as the Japanese candidate site in May 2002.**
- **The site offer from Japan was made at the Negotiations meeting in June 2002.**

Negotiation (NEGO)

Members: Participant Parties of EDA, Party proposing a Site (JA、EU、RF、CA)

- 8-9 Nov. 2001 — 1st NEGO
- 18-19 Feb. 2003 — 8th NEGO: US to Return and CN to Join
- June 2003 — KO to Join

Main Issues at NEGO:

- Joint Implemetation of ITER Project (ITER Agreement)
  - Organization： Council and Director-General
  - Principal of Contribution
  - Mechanism of Decision Making (Unanimity and Weighted Voting System)
  - Condition of Accession of any State or International Organization
- Site Assessment: Joint Assessment of Specific Site (JASS)
- Consideration of Procurement Allocation

Check Items at JASS

1. Technical Aspects

1.1 Site Requirements

A. Land
B. Heat Sink
C. Energy and Electrical Power
D. Transport and Shipping
G. Regulations and Decommissioning

1.2 Site Design Assumptions

A. Land
B. Heat Sink
C. Energy and Electrical Power
E. External Hazards
F. Economical Infrastructure
- Industrial
  - Existence of high tech industry which can support construction and operation of ITER.
- Research Infrastructure
  - already existing research facilities in the field of fusion, nuclear, and science.
  - advanced computational facility, academically informative environment.
  - broad community support for the fusion research
- Workforce
  - Pool of highly trained engineers and scientific workers who could support construction and operation of ITER.

2. Socio-Cultural Aspect

- Access and Transport
- Social infrastructure and living conditions
  - educational facilities,
  - housing
  - cultural facilities
  - availability of medical service in English
  - stable community support
  - access to international airports and large cities
  - job opportunities for spouses

3. Licensing Aspects

3.1 Roadmap toward a License
- design impact
- cost impact
- schedule impact

4. Host/ILE Relation

4.1 Site Support

5. Financial Aspects

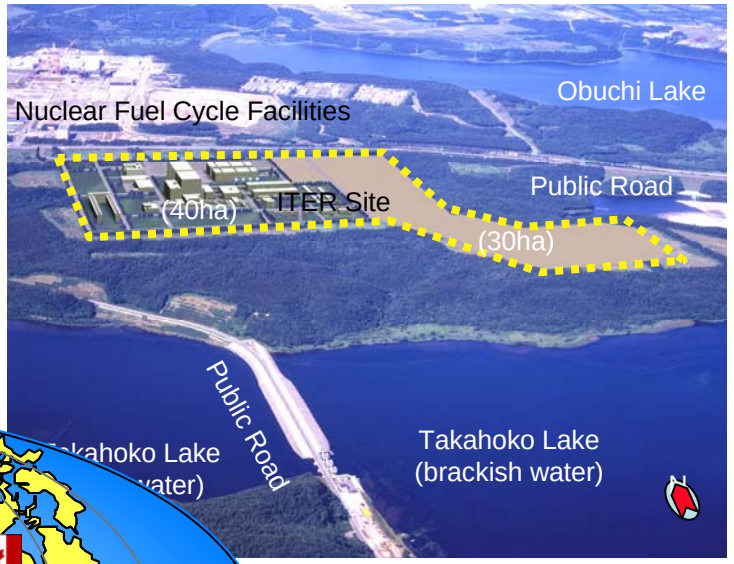
5.1 Operational Costs

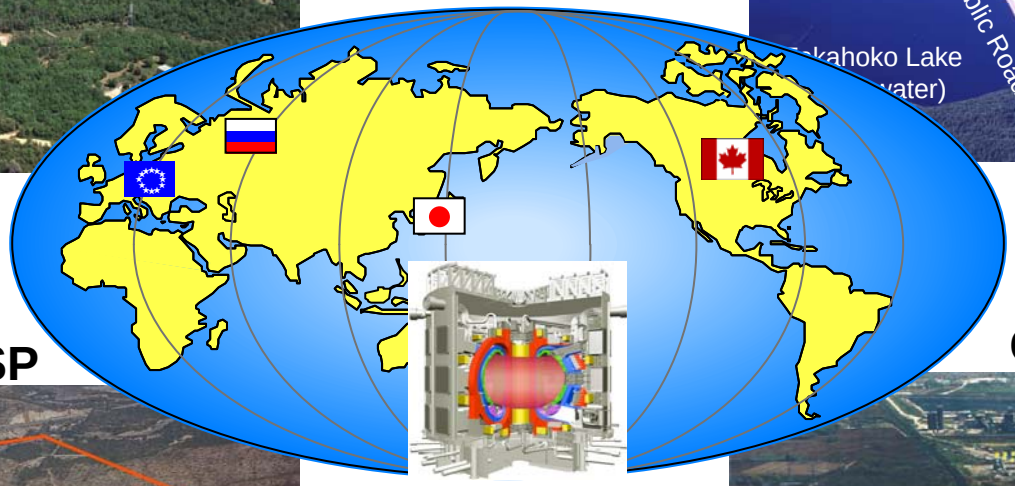
5.2 Decommissioning Costs

FOUR ITER SITES

CADARACHE-FR

ROKKASHO-JA





VANDELLOS-SP

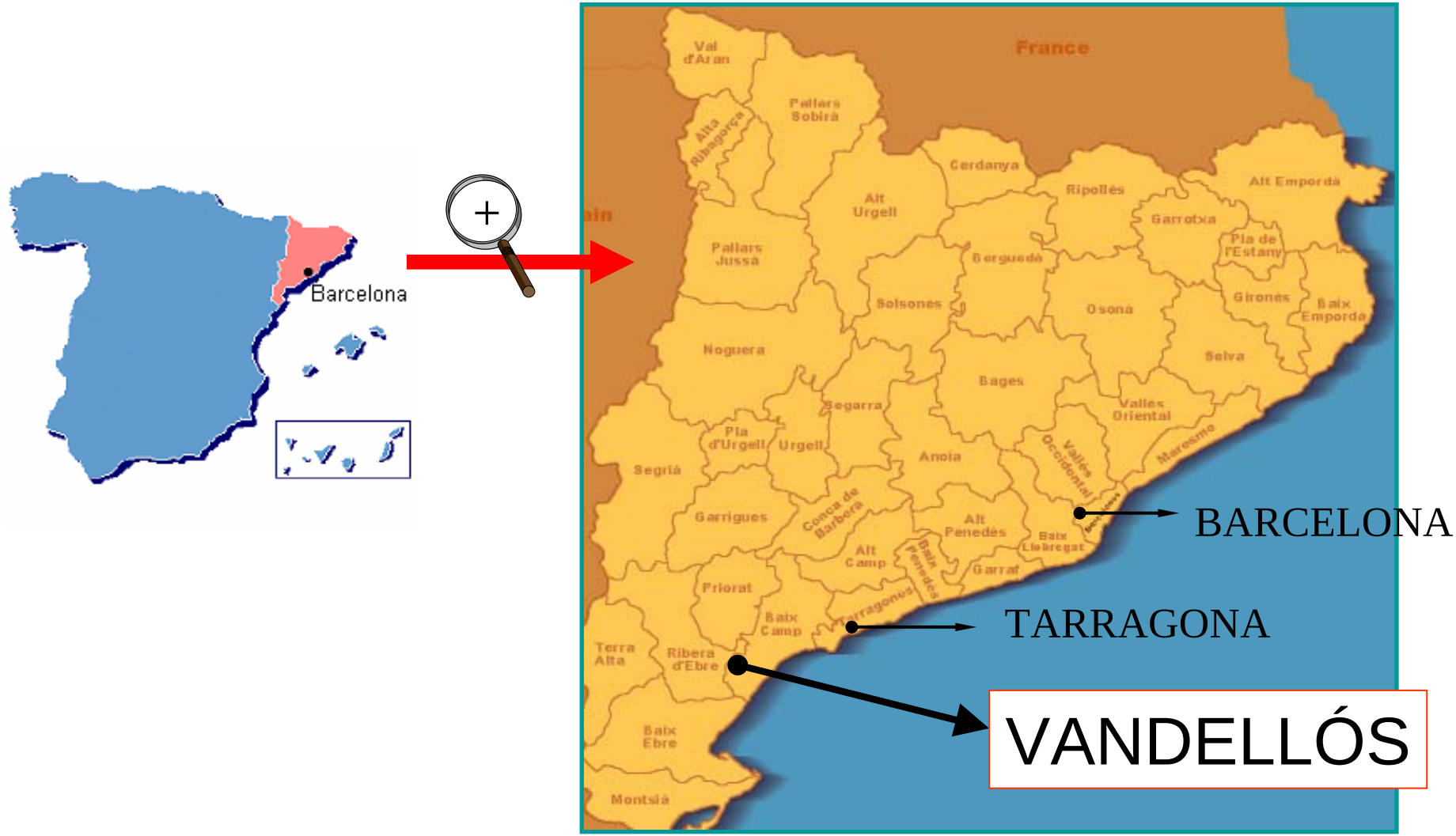
CLARINGTON-CA

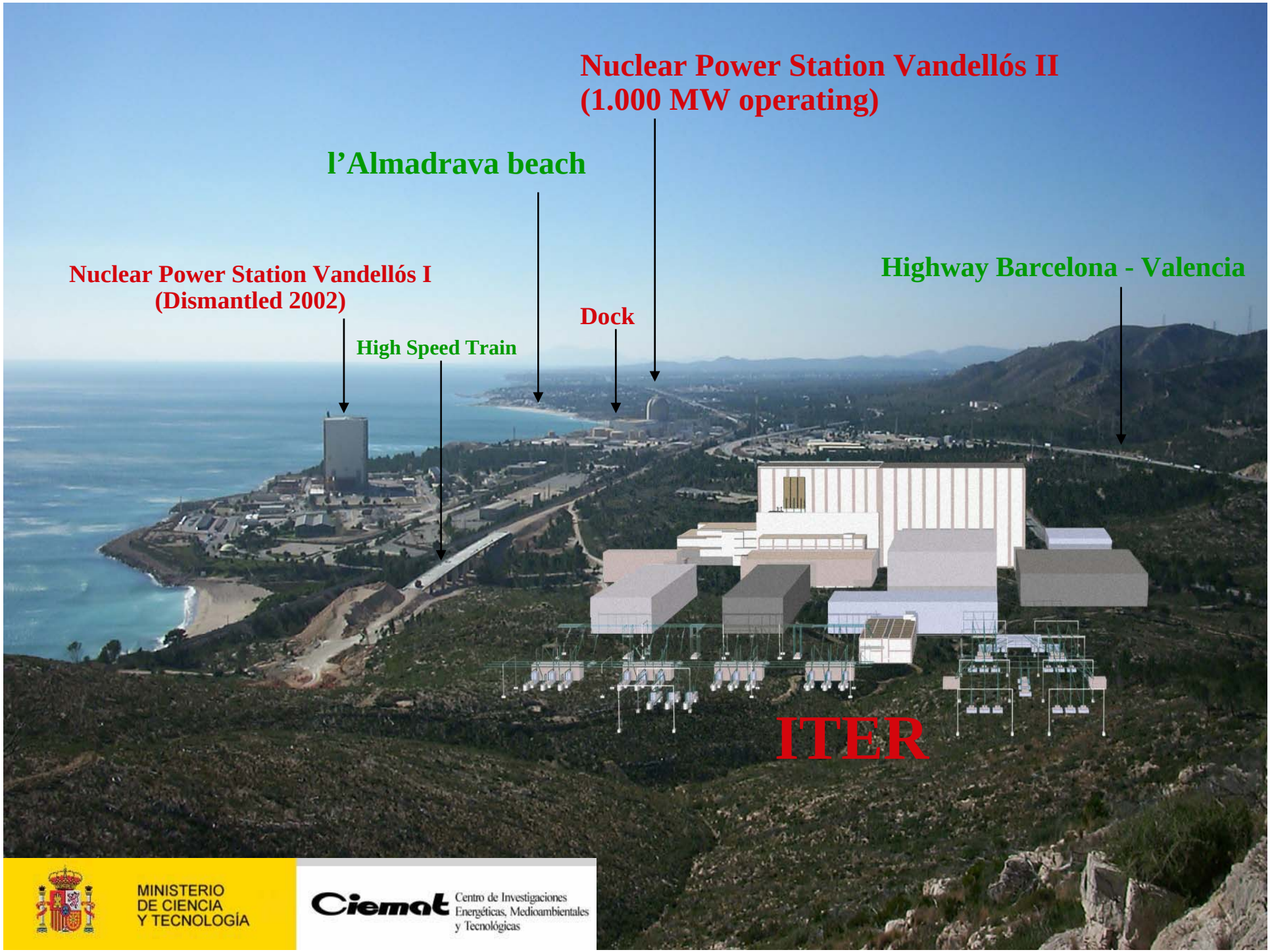
Cadarache Site in France

= Itinerary ITER components


ITER
(project)
Tore Supra
(existing)

VANDELLÓS Site in Spain

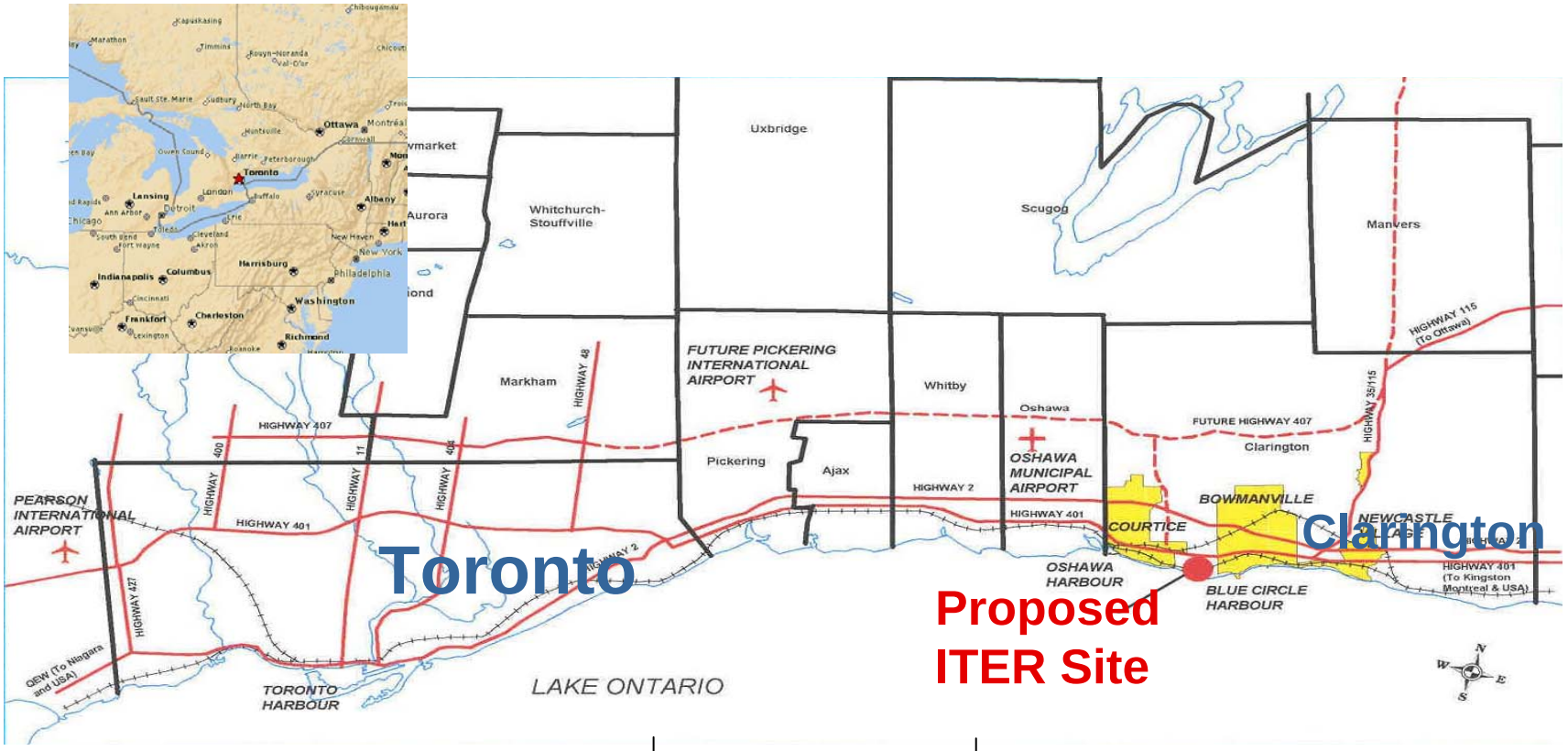




MINISTERIO
DE CIENCIA
Y TECNOLOGÍA

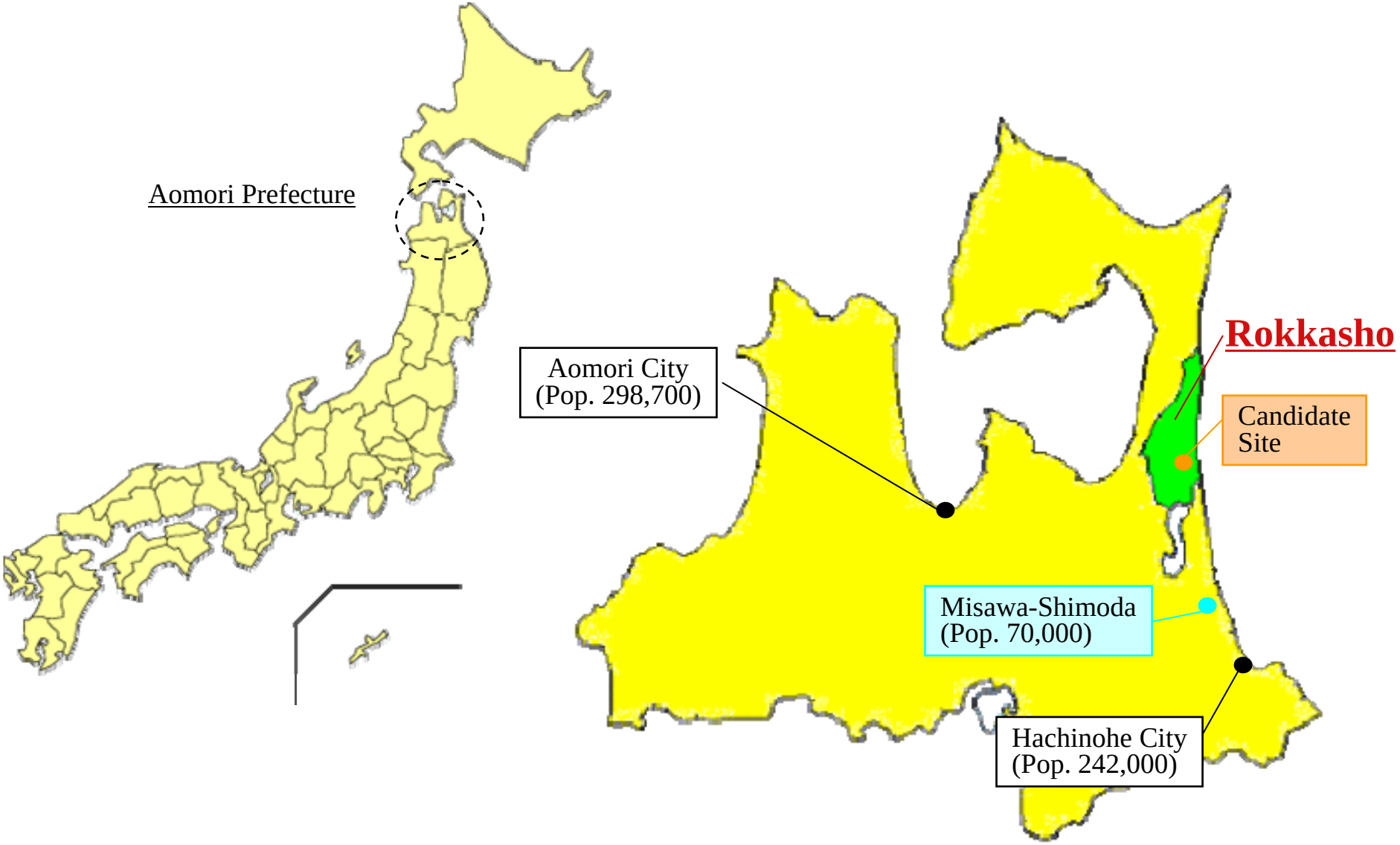
Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

Clarington Site in Canada



Iter Construction Site at Clarington

Rokkasho Site in Japan



Aerial View from the Pacific Ocean

JASS Final Report

<Summary>

- All four Sites are sound and fully capable to respond to all ITER Site Requirements and Design Assumptions.
- ITER may be successfully implemented at any of the candidate Sites.
- Some differences amongst Sites do however exist. The assessment of some issues led to the identification of appropriate mitigation measures to be put in place by the respective Hosts.

<Specific Notes for Each Site>

Clarington

・Tritium can be favourably transported to the ITER Site without crossing any public access property.
・Site preparation cost, which is normally borne by the Host, might eventually be borne by the ITER Parties in the current Canadian offer.

Rokkasho

・A large dock already exists and is connected to the Site via an existing public road. Excellent topography and geo-technical characteristics are among the strengths of the Site.
・Electricity unit cost is relatively higher. Its impact on the operational costs will be further assessed.

Cadarache

・The support of Cadarache Centre will be available right from the beginning of the construction phase.
・Cadarache is located far from a dock. The road modifications and upgrades are required for transportation, and the on-site construction of the largest PF coils will be mandatory.

Vandellos

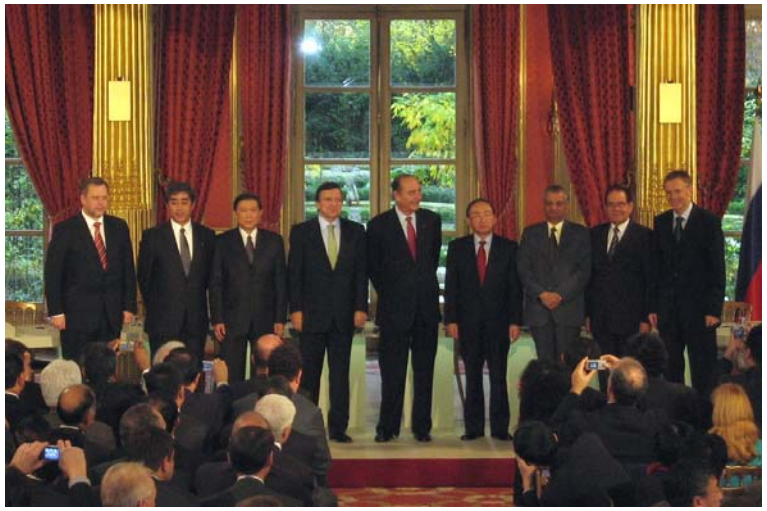
・The proposed Site is suitable for the generic lay-out and fulfils all geo-technical requirements. The railway line divides and somewhat constrains the Site into two plots.
・The cost of living is below the European average but increasing at a faster rate.

Recent Progress and Near Future Schedule for ITER Project

Jun. 28, 2005	The 2nd Ministerial Meeting for ITER It was officially announced that ITER will be built at the Cadarache site.
Nov. 7, 2005	The 5th Preparatory Meeting for ITER (IAEA Vienna) The negotiators unanimously agreed on the proposal of Japan to designate Mr Kaname IKEDA as Director General Nominee for the prospective ITER Organisation.
Nov. 21, 2006	Signature and Provisional Application of ITER Agreement (Paris)
Feb. 5, 2007	Signature of Broader Approach (BA) Agreement (Tokyo)
Jun. 1, 2007	Effectuation of BA Agreement
Jun. 21, 2007	The 1st Meeting of BA Steering Committee (Tokyo)
Nov. 2007	The 1st Meeting of ITER Council (Cadarache, planned)
Nov. 2007	The 2nd Meeting of BA Steering Committee (Barcelona)

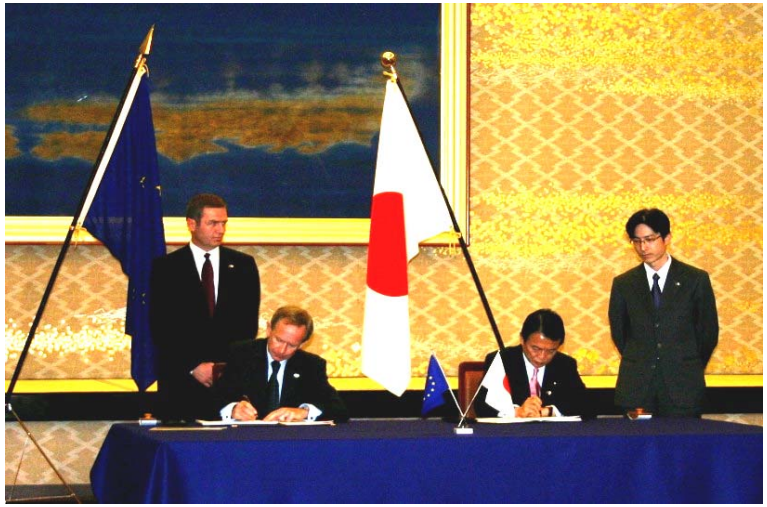
Signature of ITER Agreement and BA Agreement

ITER Agreement signed in Nov. 2006



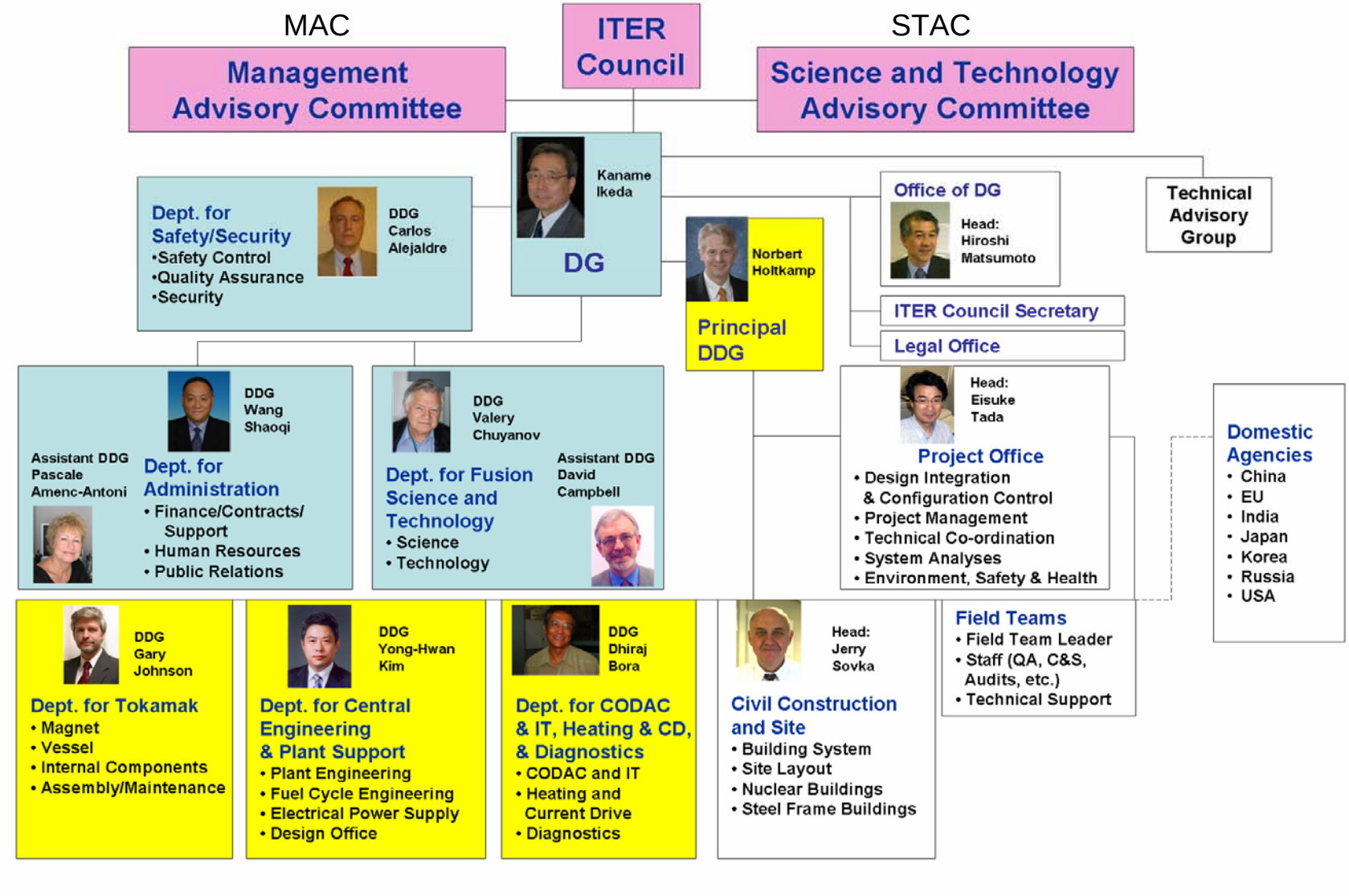
Ceremony ITER Agreement Signature,
Elysee Palace, 21 November 2006

BA Agreement signed in Feb. 2007

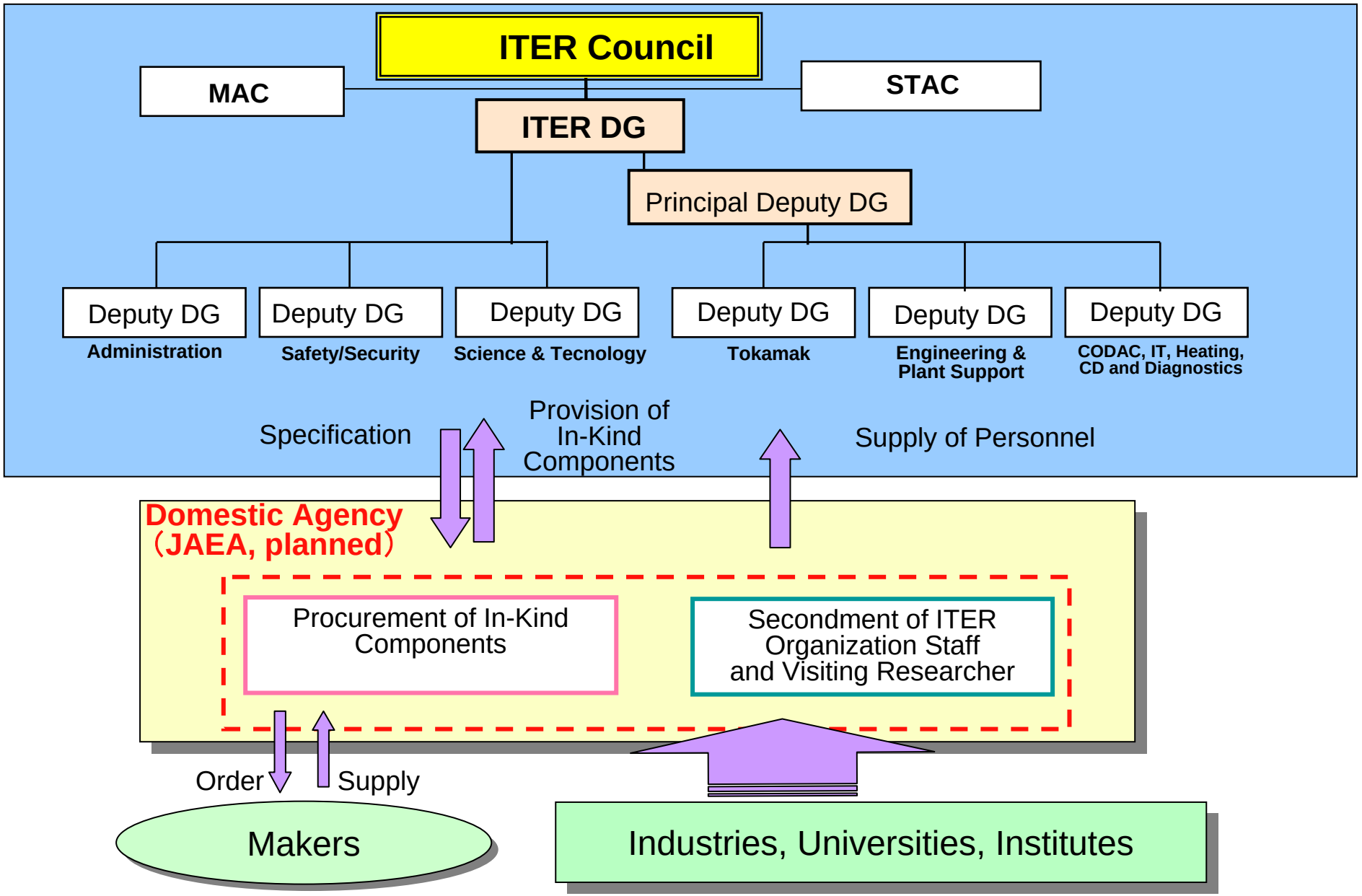


Ceremony BA Agreement Signature,
MOFA Iikura House, 5 February 2007

Management Structure of ITER



Implementing Structure at ITER Construction Stage



Implementing and Collaborating Structure for ITER & BA in Japan