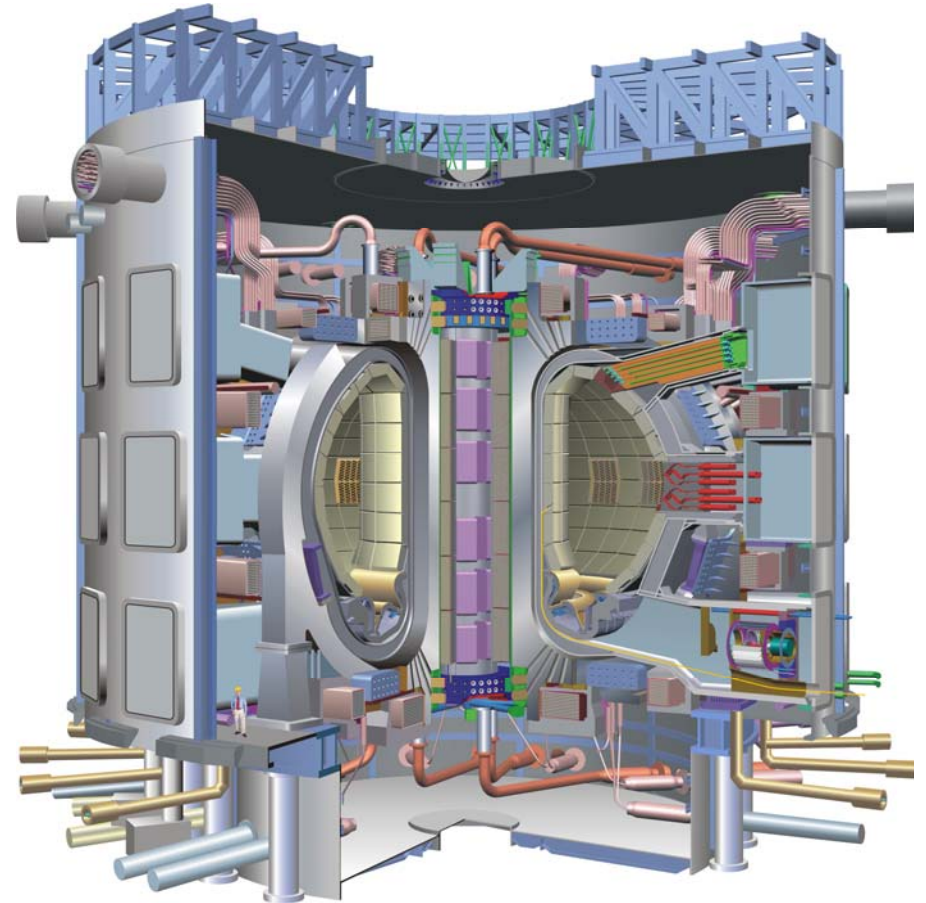


ITER Project Status

Tom Vanek
Acting Associate Director
for Fusion Energy Sciences

Ned Sauthoff
Director, U.S. ITER Project Office

FESAC
Gaithersburg, MD
March 1, 2007



Outline

- **Governmental Activities (Vanek)**
 - Agreement Signing and First Interim Council meeting
 - Other Points
- **Project Activities (Sauthoff)**
 - Organization
 - Management Systems and Procedures
 - Scope and Schedule
 - Fusion community roles that are key to ITER success

Signing Ceremony – November 21, 2006 Paris, France



- After fulfilling the requirements of the Energy Policy Act of 2005, including the 120-day review period by Congress of the ITER Agreement, the U.S. was pleased to sign the ITER Joint Implementation Agreement on November 21st.
- The Arrangement of Provisional Application, also signed on November 21st, affords the ITER Organization to pursue cooperation as provided in the ITER Agreement and to abide by the terms of the Agreement until it enters into force.

Accomplishments of the First Interim ITER Council Meeting

- **Held on November 21st with the Ministerial-level representatives leading their delegations. Chaired by Commissioner Janez Potočnik.**
- **The Council:**
 - empowered the Kaname Ikeda to exercise, on a provisional basis, the roles and functions defined for the Director-General of the ITER Organization and charged him with undertaking all measures necessary to bring the provisional ITER Organization into operation.
 - adopted, on a provisional basis, a) the Draft Rules of Procedure of the ITER Council, b) the Staff Regulations and c) the Project Resource Management Regulations.
 - noted the designation by the Host Party of the CEA as the entity to act on its behalf in making available the site support for ITER.
 - agreed on the establishment of Management Advisory Committee and the Science and Technology Advisory Committee as subsidiary bodies of the Interim ITER Council
 - details of chairmanship, membership and terms of reference to be addressed at March IIC meeting.
 - approved project plan, resource estimates, and annual budget.

Requirements of Ratification and Entry into Force

- **Department of State is developing the Executive Order necessary for the U.S. to complete its instrument of deposit of the ITER Agreement with the IAEA.**
- **In parallel, a necessary step for the U.S. is to ensure designation of the ITER Organization as an international organization under the International Organizations Immunities Act.**
 - This will enable the U.S. to afford privileges and immunities to the ITER Organization and its staff in the United States.
- **Status of other Parties' readiness for ratification:**
 - EU has submitted its instrument to the IAEA.
 - KO plans to submit on March 6.
 - JA plans to submit at the end of April.
 - CN suggested sometime ago that they could submit by April.
- **Entry into force will occur 30 days after all Parties have deposited their instruments of ratification/acceptance with the IAEA -- planned for mid-2007.**

Other Points of Interest related to ITER

- **The Broader Approach Agreement has been signed by the EU and JA delegations. The U.S. has requested the status and plans for integration with the ITER Project.**
- **Near-term US ITER Project Budgets include \$60 million in FY 2007 and a request for \$160 million in FY 2008.**
- **March 2007 Interim ITER Council Meeting planned. Key topics include:**
 - 2007 Staffing Plan
 - 2007 Budget and Resource Requirements
 - Procedures for the Conclusion of Procurement Arrangements and Guidelines for the Management of In-Kind Equipment
 - Update on Design Review
 - Broader Approach
 - Scientific Program including Test Blanket Modules

Outline Master

- **Governmental Activities (Vanek)**
 - Agreement Signing and First Interim Council meeting
 - Other Points
- • **Project Activities (Sauthoff)**
 - Organization
 - Management Systems and Procedures
 - Scope and Schedule
 - Fusion community roles that are key to ITER success

Director General Nominee and Principal Deputy Director General Nominee

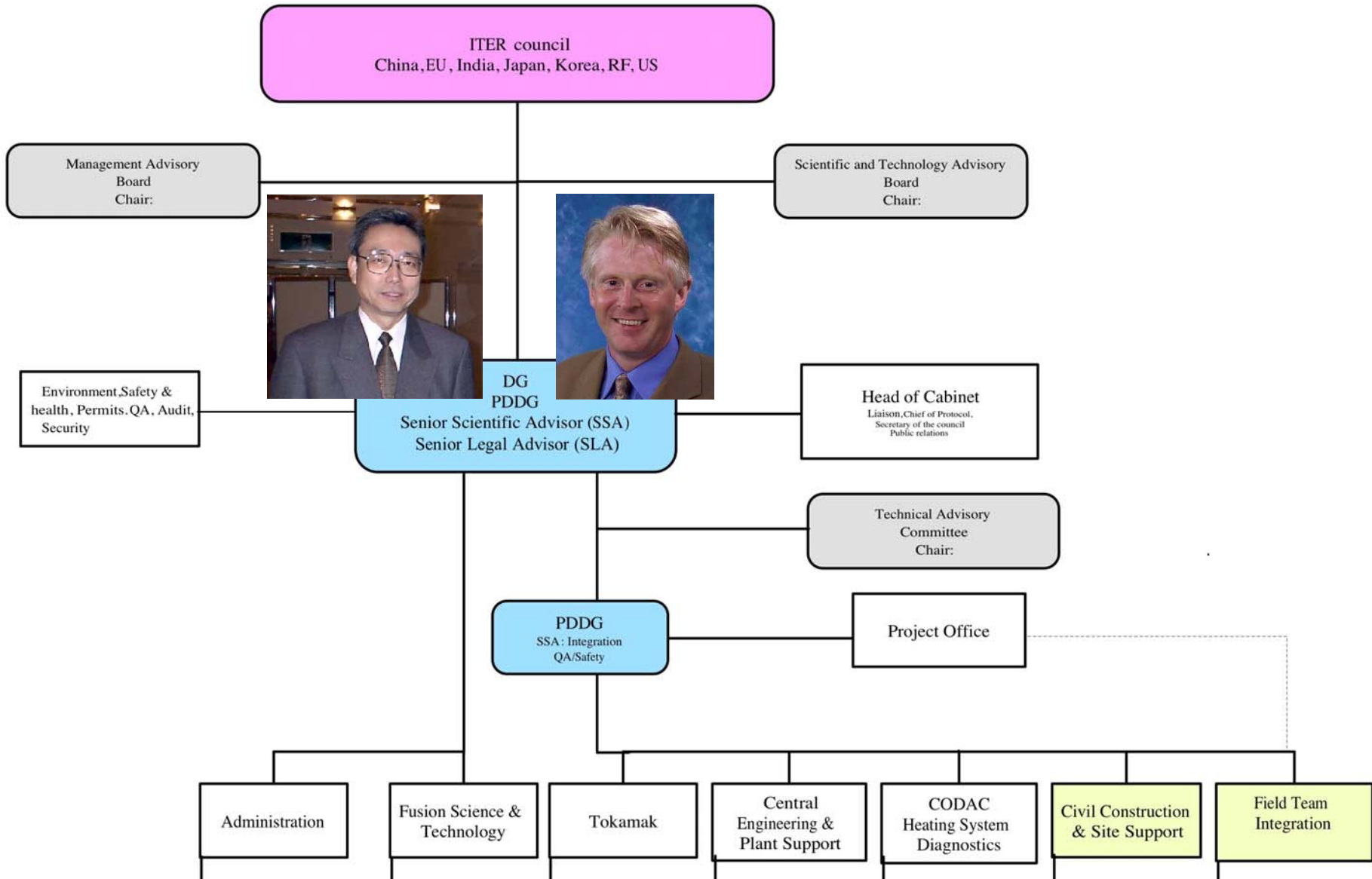
- Ambassador Kaname Ikeda



- Dr. Norbert Holtkamp

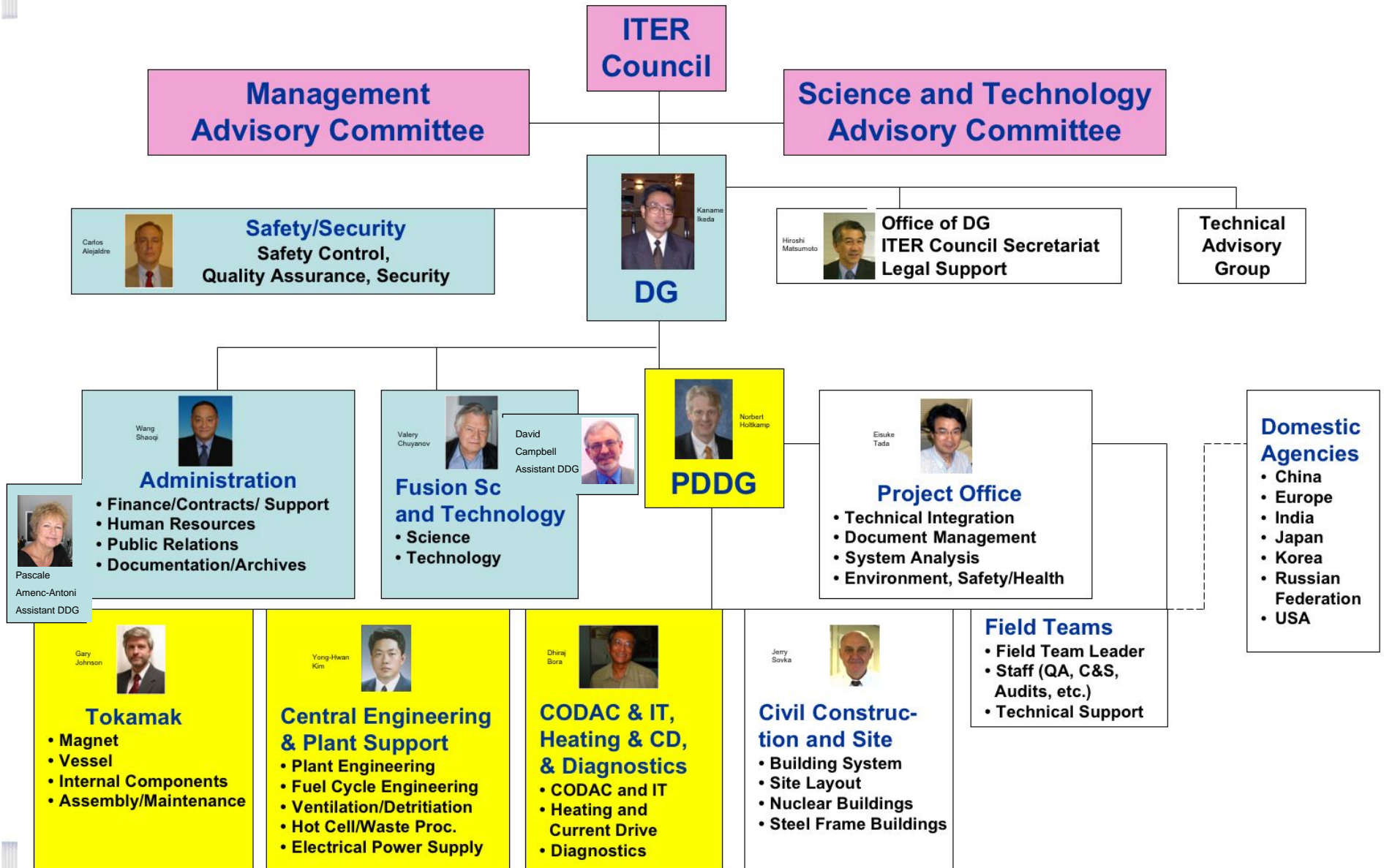


ITER Organization Structure at time of FESAC 6/2006





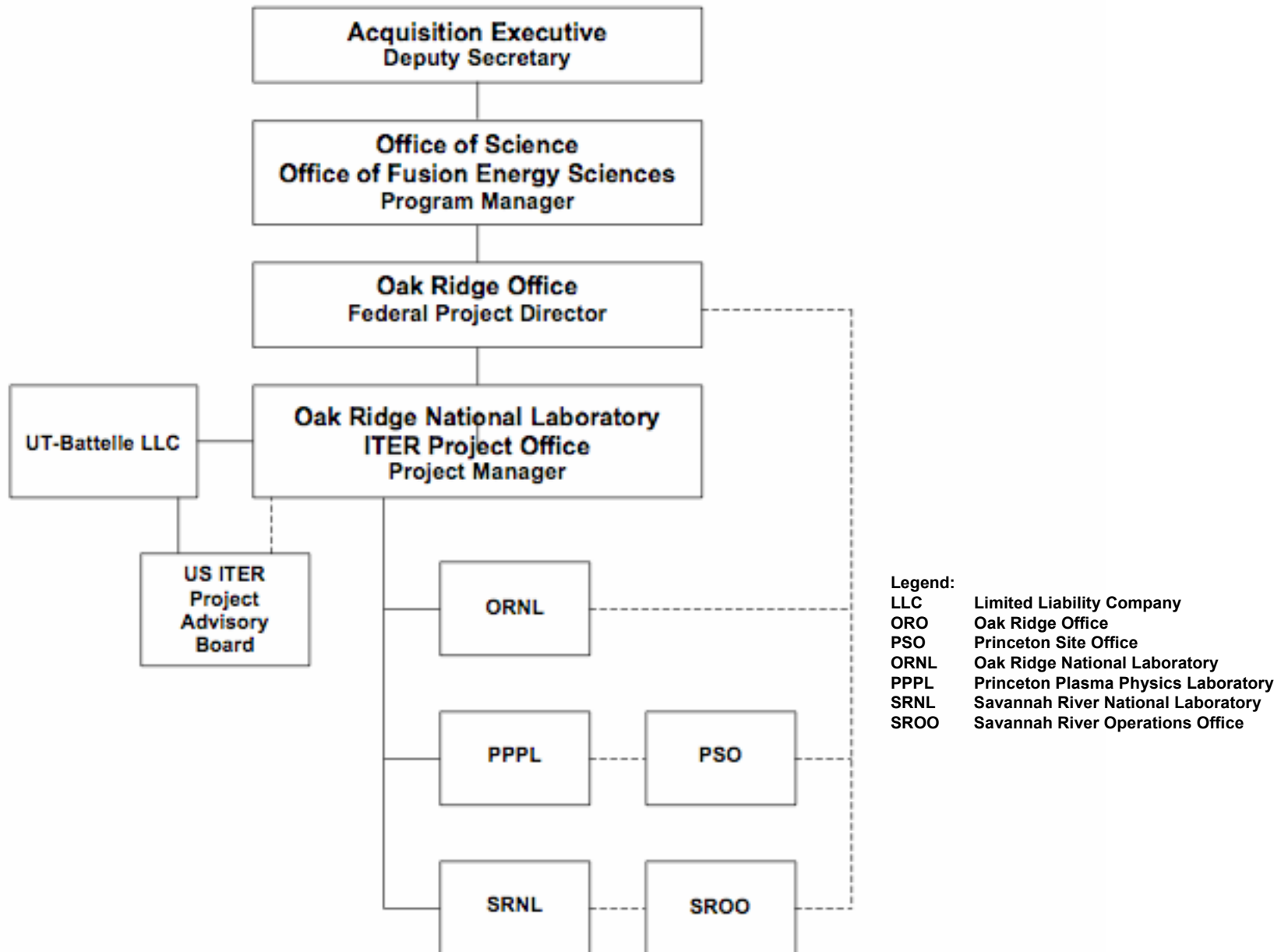
The ITER Organisation (IO) 2006 / 2007



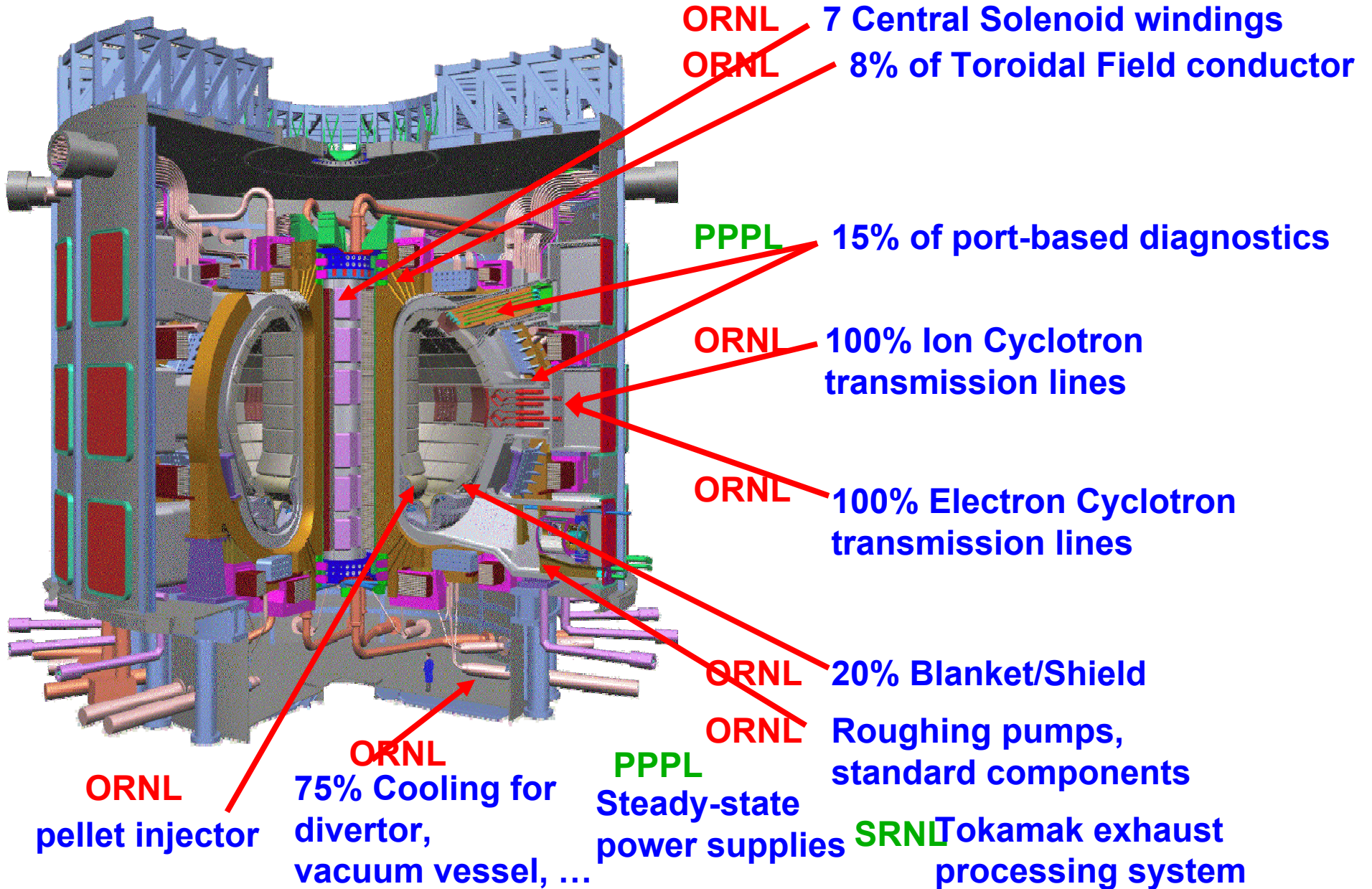
Our U.S. Secondees



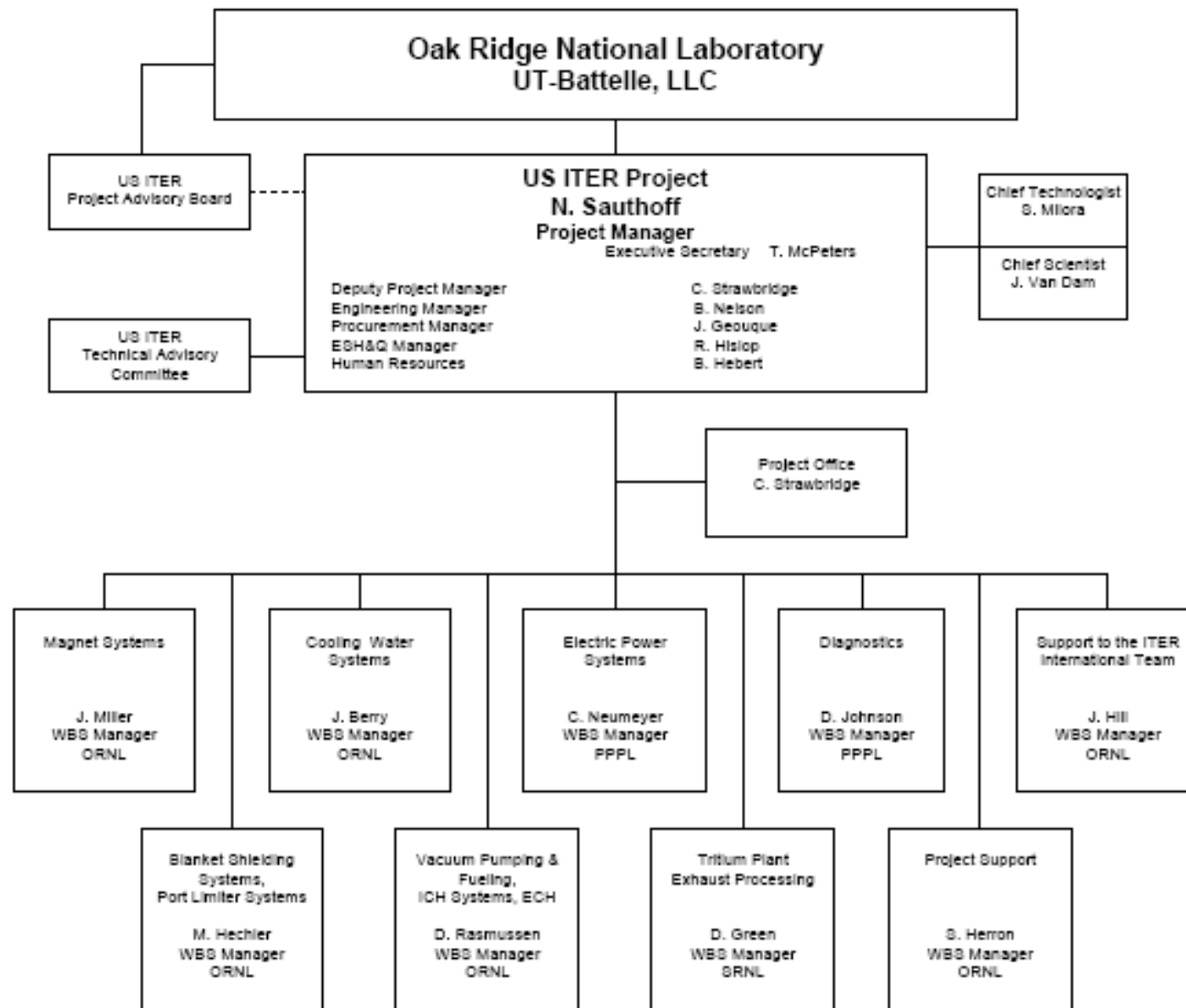
The U.S. ITER Integrated Project Team Structure



U.S. ITER In-kind Hardware Contributions



The U.S. IPO Management Team



Management Systems and Procedures

- The IO is developing systems and procedures
 - Scheduling
 - CAD
 - Configuration Control
 - Document Management
 - ...
- The U.S. is helping to jump-start the IO's project management and business systems infrastructure in Cadarache
 - Project Execution Plan
 - Scheduling for key subsystems
 - Leadership in Cooling Water...

ITER Project Working Groups

Working Groups, Including Hyperlinks to Web, IDM and Email (Last Update 09 Nov 2006)

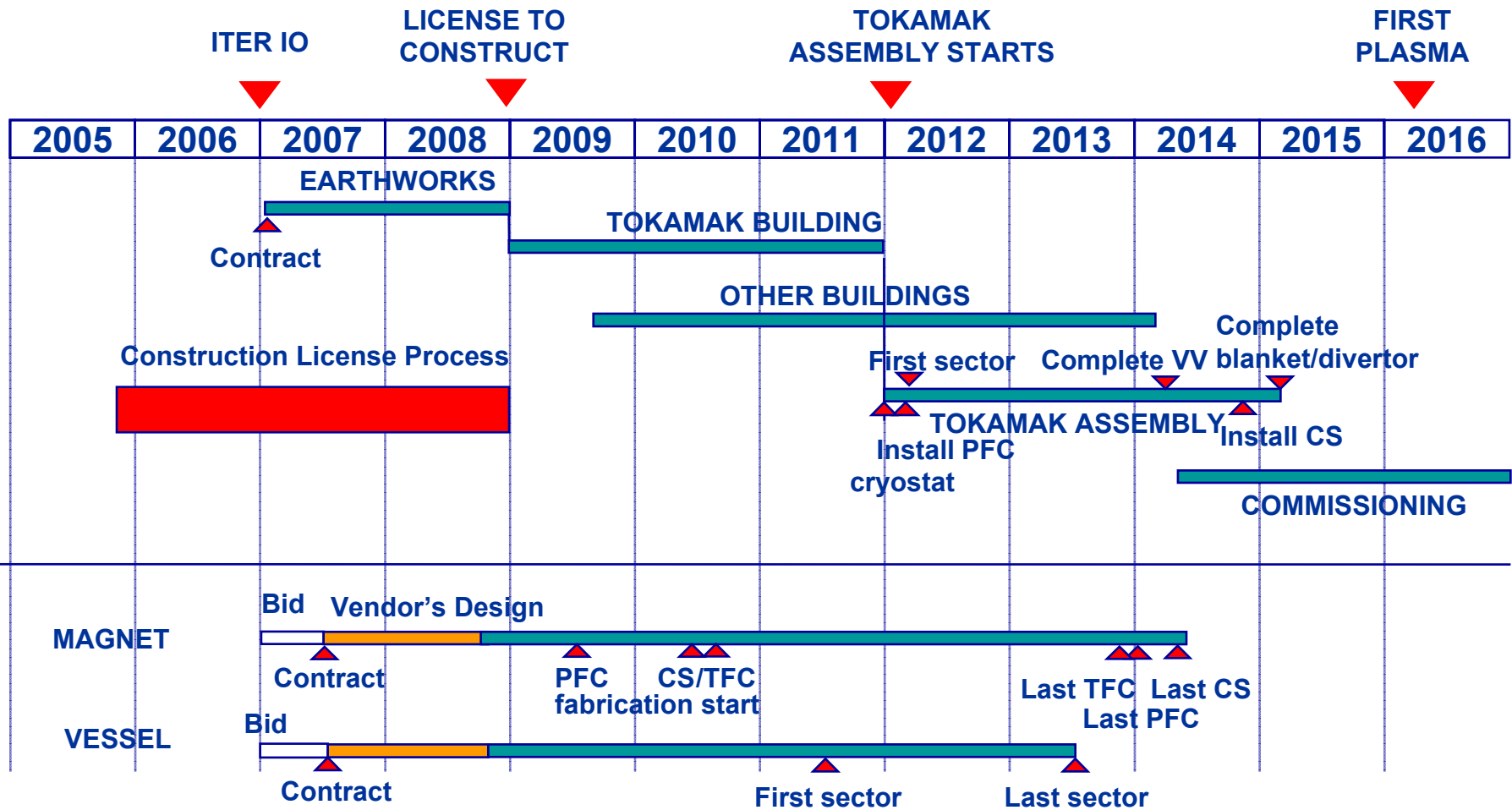
Secretary John How	Quality Assurance	Computer Aided Design	Codes and Standards	Information Technology	Planning and Scheduling	Procurement
Web Link	QA Web		Syst. Eng. Web Letter to PTs	IT-WG Web	P&S WG Web	Proc-WG web
IDM Link	QA IDM	CAD WG	C&S TF	IT-Working Group		
ITER Coordinator	K.Sowder	E.Martin	J-P Girard	H-W Bartels	Larry Lew	N.Holtkamp (Sec: A.Maas)
China	Caipin Zhou	Yuntao Song	Damao Yao	Weishan Kang	Songtao Wu & Caipin Zhou	Prof. Xie jikang (changed 9/11/06)
India	B. Doshi	R. Prakash	B. Doshi	I. Bandyopadhyay	R. Prakash	S K Mattoo
Korea (plus deputy)	H. J. Kim (J.H.Han)	N. I. Her (B. C. Kim)	S. I. Lee (H. J. Kim)	I. S. Choi	H. U. Ko (B. C. Kim)	B. S. Lim (H. J. Kim)
Japan (plus deputy)	M.Higuchi (Y. Neyatani)	K.Koizumi	M.Higuchi	K.Koizumi	K.Koizumi	M.Mori (Y. Neyatani)
Russia	V.Muratov	V.Muratov	G.Kalinin	I.Semenov	L. Makarova	V.Belyakov
USA	M.Skonicki	B. Nelson	B. Nelson	Dan Ciarlette	S. Herron	J. Geougue
Europe	M.Peyrot	F. Casci	M. Ferrari	K.Thomsen	M. Ferrari	E.Di Pietro
Additional Experts			G.Sannazzaro (ITER)	J.Lister (ITER) B.Wilhelm (EFDA) Yuntao Song (CN) H. U. Ko (KO)		

Scope and Schedule

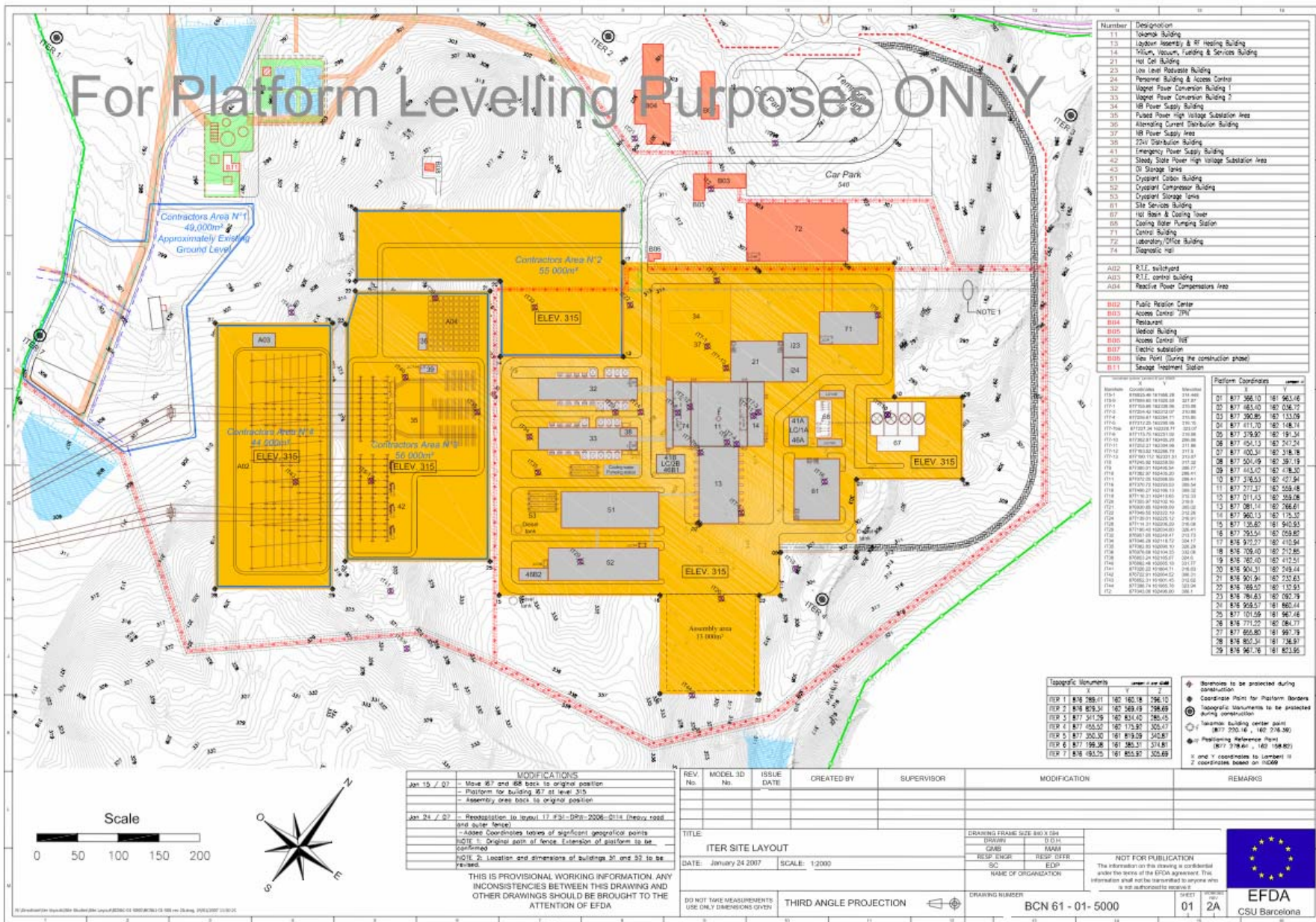
- The IO and U.S. are working toward finalization of procurement arrangements
- The IO is developing the integrated project schedule
 - Targeting first plasma in 2016
 - FY2008 will see the start of civil construction on site as well as long-lead procurements in the U.S.
- The IO is leading a Design Review
 - to update the 2001 ITER FDR, to resolve priority issues, to establish the project baseline and develop a preliminary experimental operations plan



The Schedule



Site Preparation





Design Review

Summary of activities

- the Design Review is being carried out by 8 Working Groups
- 7 Working Groups have already had direct meetings and teleconference meetings
- prioritization of the issues has been performed
- work plans have been generated asking for resources to solve the issues in time for the schedule
- documents from the different groups have different formats and substantial editing is still needed
- prioritization and the required resources will be distributed to parties next week and reviewed at WG Chairpersons' meeting 14-16 Feb.



Working Group 1: Design Requirements & Physics Objectives

Chairman:	Paul Thomas	EU
ITER Coordinator:	David Campbell	ITER
ITER Expert:	Michiya Shimada	ITER
	Valery Chuyanov	ITER
Members:	Alan Kaye	EU
	Karl Lackner	EU
	Ronald Stambaugh	US
	Richard Hawryluk	US
	Sergey Konovalof	RU
	Nikolay Ivanov	RU
	Gyung-Su Lee	KR
	Yutaka Kamada	JP
	Abhijit Sen	IN
	Pietro Barabaschi	EU
	Gabriella Saibene	EU
	Yong Liu	CN
	Jiangang Li	CN



Working Group 2: Safety & Licensing

Chairman:	Jean-Pierre Perves	EU
ITER Coordinator:	Jean-Philippe Girard	ITER
P-expert:	John Poole	EU
	Alistair Bell	EU
Members:	Werner Gulden	EU
	David Petti	US
	Boris Kolbasov	RU
	Jong Kap Kim	KR
	Takeshi Maruo	JP
	Denis Acker	EU
	Jose I. Villadoniga	EU
	Yican Wu	CN

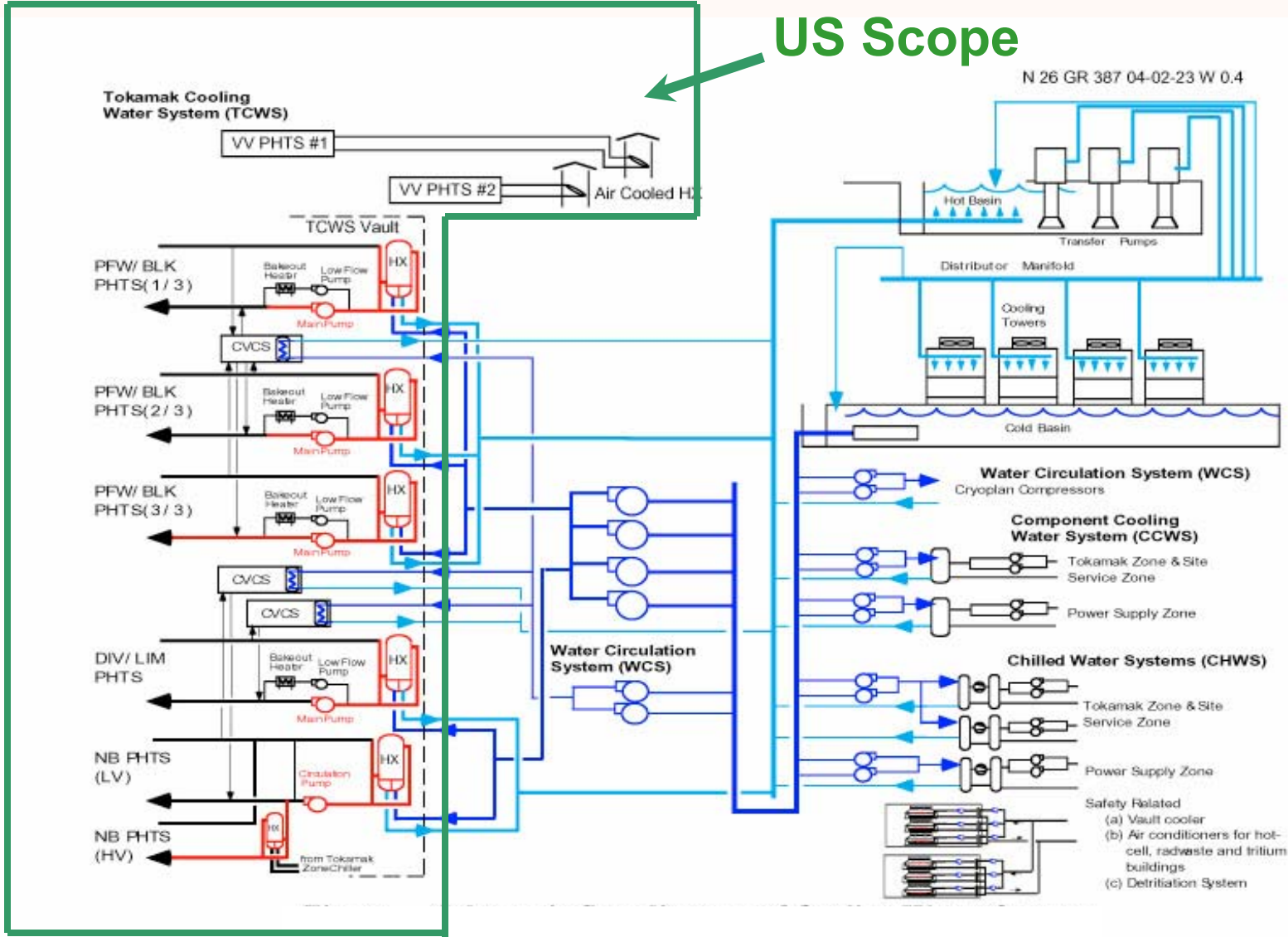


Working Group 3: Buildings

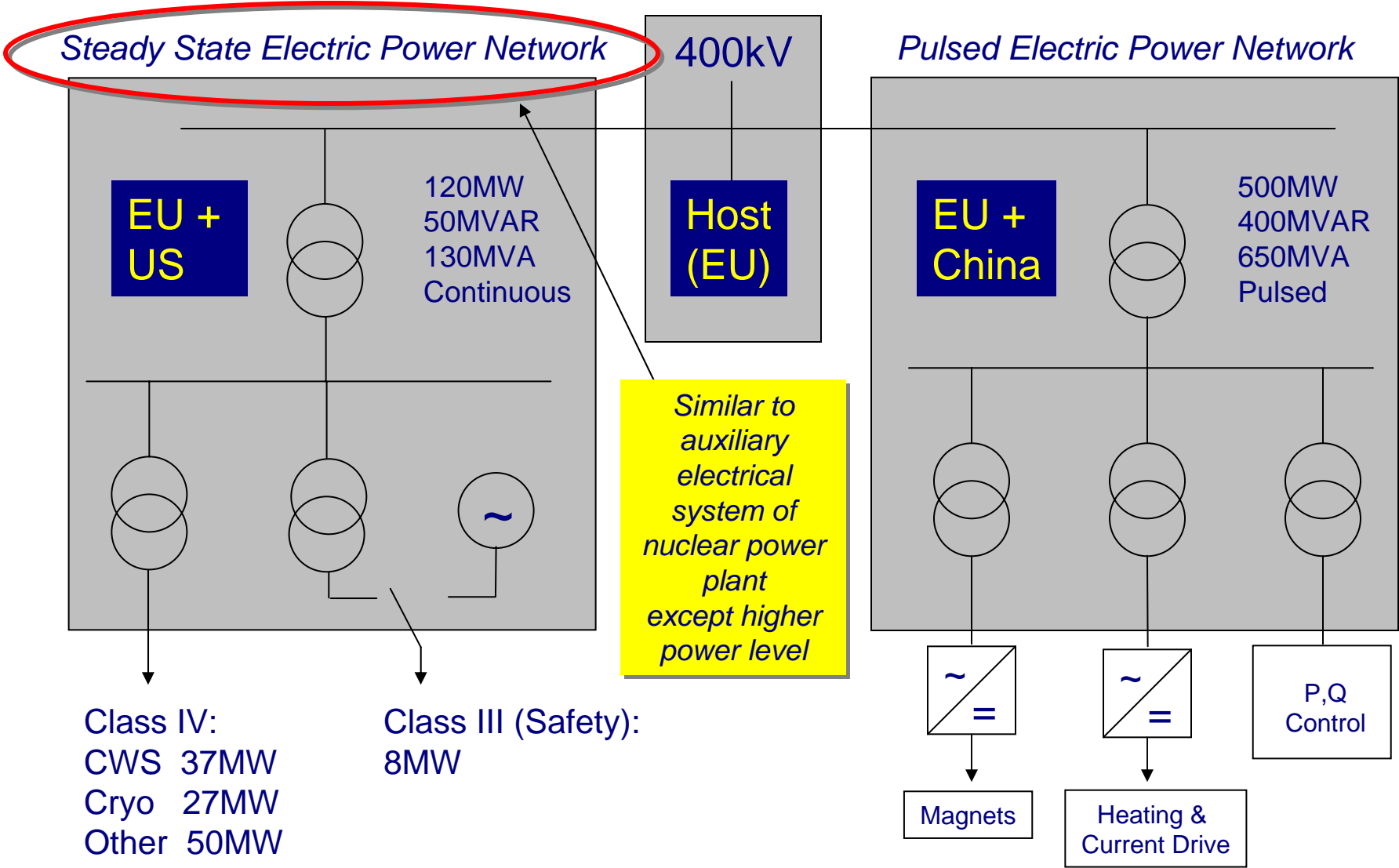
Chairman:	Carl Strawbridge	US
ITER Coordinator:	Jerry Sovka	ITER
P-expert:	Alexander Popov	RU
	Vadim Baulo	RU
Members:	Bong Sik Choi	KR
	G. Goverdhan	IN
	Kenichi Moriyama	JP
	Yuzuru Neyatani	JP
	Jan Berry	US
	Charles Neumeyer	US
	Enrico DiPietro	EU

Tokamak Cooling Water System

US Scope



Steady State Electric Power





Working Group 4: Magnets

Chairman:	Michel Huget	EU
ITER Coordinator:	Neil Mitchell	ITER
ITER Expert:	Paul Libeyre	ITER
	Carlo Sborchia	ITER
	Denis Bessette	ITER
P-expert:	Akira Yamamoto	JP
	D. Ivanov	RU
	Tom Taylor	EU
	Bruce Montgomery	US
Members:	Peide Weng	CN
	John Miller	US
	Igor Rodin	RU
	Keeman Kim	KR
	Kiyoshi Okuno	JP
	S. Pradhan	IN
	Ettore Salpietro	EU

Magnet Systems

TF Conductor and Central Solenoid



Cable Configuration

- Superconducting Strand Cr Coating $2 \mu\text{m} +0, -1 \mu\text{m}$
- Wrap - 0.05 mm, 50% Coverage
- 0.08 x 2 = 0.16 mm Total Wrap thickness, 50% Overlap
- 1 Cu + 2 Sc x 3 x 5
- x 5 + Core
- 0.08 x 2 = 0.16 mm
- 0.08 x 2 = 0.16 mm
- 0.08 x 2 = 0.16 mm

Cable Cross-Section

- Copper Strand Cr Coating $2 \mu\text{m} +0, -1 \mu\text{m}$
- 3Cu x 4 (Core)
- Central Spiral (30% Surface Void)
- Sub-strand Wrap
- Cable Wrap
- Central Cooling Channel
- Sc Strand
- Cu Strand

Six of the seven participant teams will provide TF conductor. The US team will fabricate nearly 8 km of TF conductor, including active, dummy, and test samples for qualification.

The U.S. Team will use CS conductor provided by the Japanese Team



Working Group 5: Vacuum Vessel

Chairman:	Songtao Wu	CN
ITER Coordinator:	Kimihiro Ioki	ITER
Members:	Gianfranco Federici	EU
	Bradley Nelson	US
	Eugeniy Kuzmin	RU
	Byung Chul Kim	KR
	Masataka Nakahira	JP
	Hideyuki Takatsu	JP
	Bharat Doshi	IN
	H.A. Pathak	IN
	Alan Peacock	EU
	Antonio Cardella	EU



Working Group 6: Heating

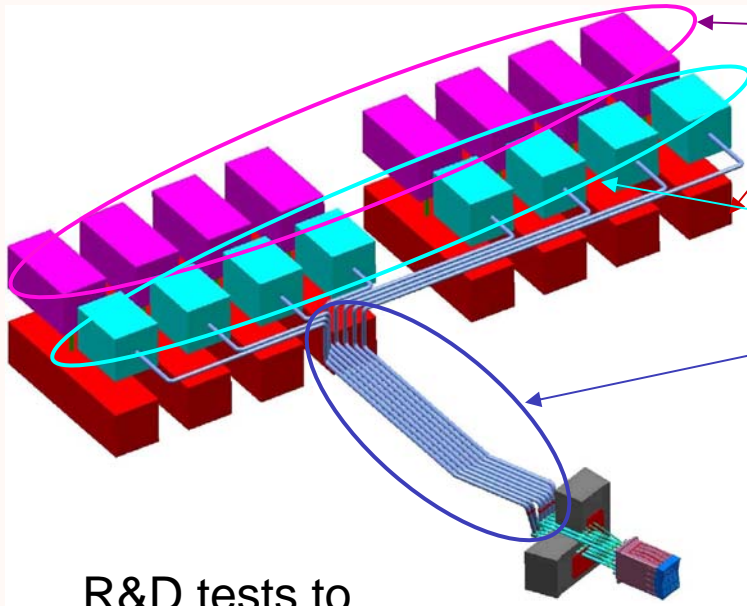
Chairman:	Jean Jacquinot	EU
ITER Coordinator:	Beatrix Schunke	ITER
	Arturo Tanga	ITER



Working Group 6: ICRF

ITER WG Assistant:	Bertrand Beaumont	ITER
P-expert:	Roberta Sartori	EU
	Raymond Koch	EU
	Jean-Marie Noterdaeme	EU
	Joel Hosea	US
	Claude Gormezano	EU
	Timothy Bigelow	US
Member:	David Rasmussen	US
	Aparajita Mukherjee	IN

Ion Cyclotron Transmission Lines

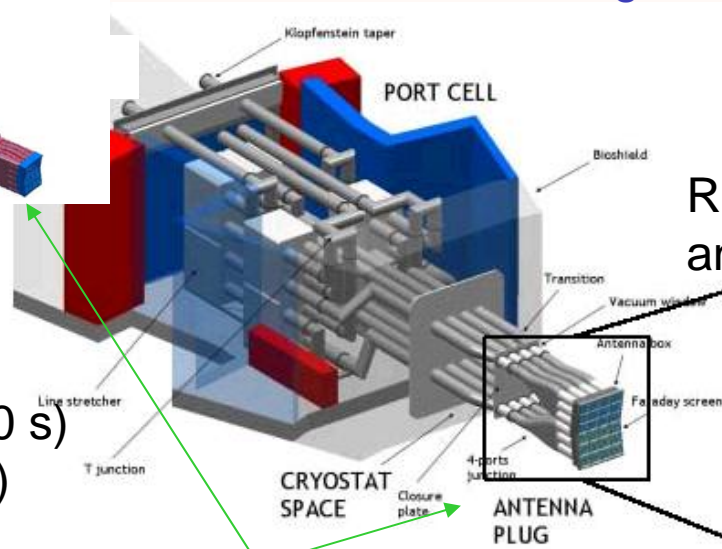


DC supplies and RF Sources (India)

Transmission line and tuning (US)

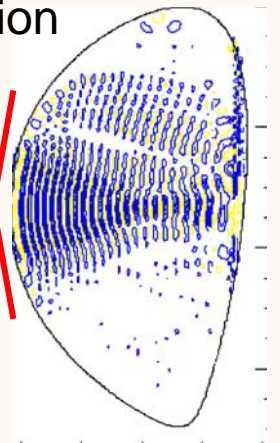
- Tuning/Matching components
- 8 water cooled coax lines @2.5 MW ea.
- 1000 m total length

R&D tests to address risk drivers:
 High power
 Low reflected power
 Long pulse cooling (3000 s)
 Scope increase (12 vs 8)



RF wave propagation and absorption

20 MW



Antenna and port plug (EU)

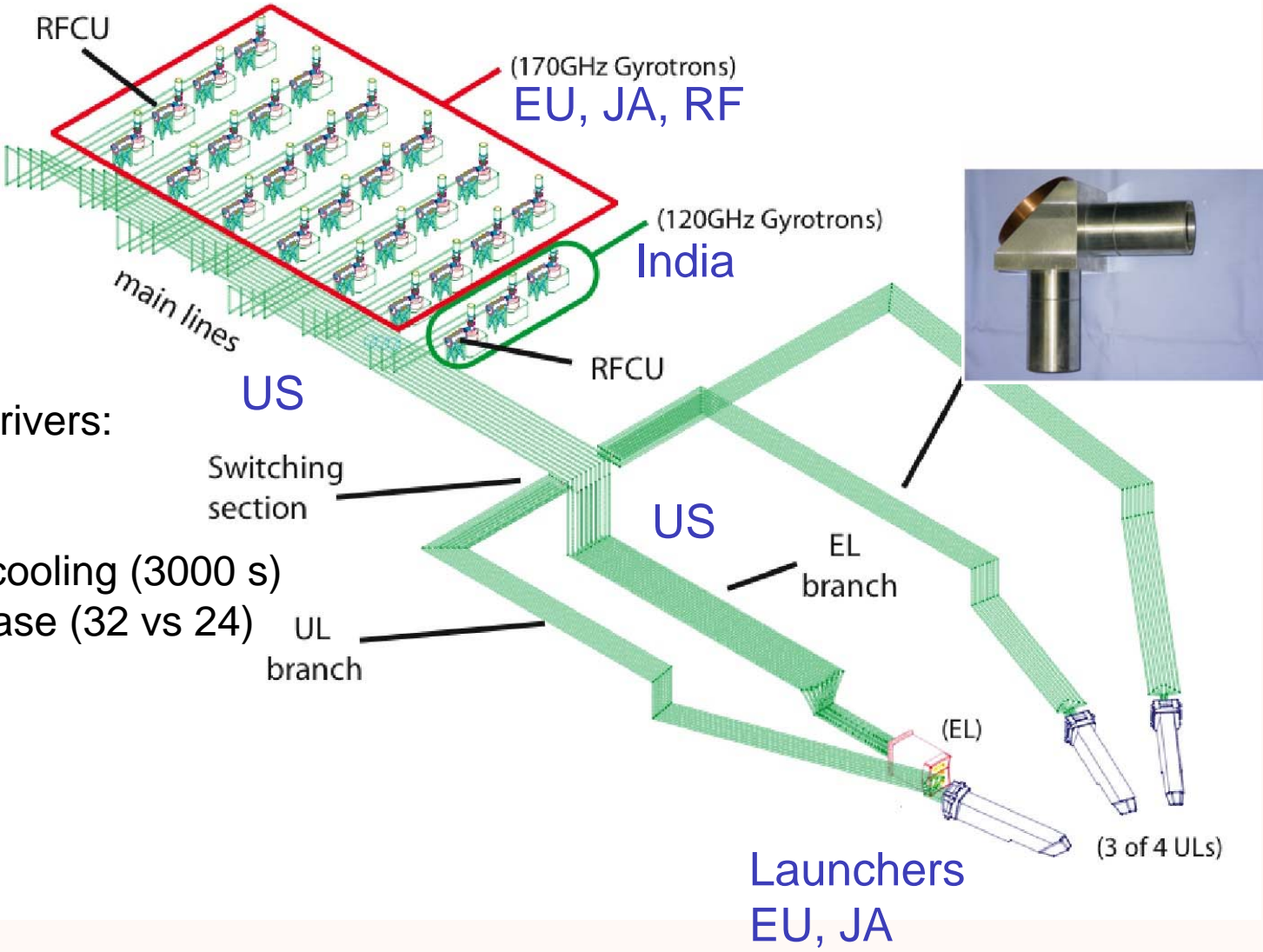
- One antenna with multiple independent current straps



Working Group 6: ECH

ITER WG Assistant:	Noriyuki Kobayashi	ITER
P-expert:	Manfred Thumm	EU
	Joe Tooker	US
	Mark Henderson	EU
	Roland Magne	EU
	Gabriella Saibene	EU
Member:	Shambhu Laxmikanth Rao	IN
	Nick Lopez-Cardozo	EU
	Keishi Sakamoto	JP
	Grigory Denisov	RU

ECH Transmission Lines



R&D tests to address risk drivers:

- High power
- Low loss
- Long pulse cooling (3000 s)
- Scope increase (32 vs 24)



Working Group 6: LHCD

ITER WG Assistant:	Bertrand Beaumont	ITER
P-expert:	Ronald Parker	US
	Stan Milora	US
	Jean-Marie Noterdaeme	EU
	Alain Becoulet	EU
Member:	P.K. Sharma	IN
	J.G. Kwak	KR
	Yuan Xi Wan	CN
	Francesco DeMarco	EU



Working Group 6: Neutral Beam

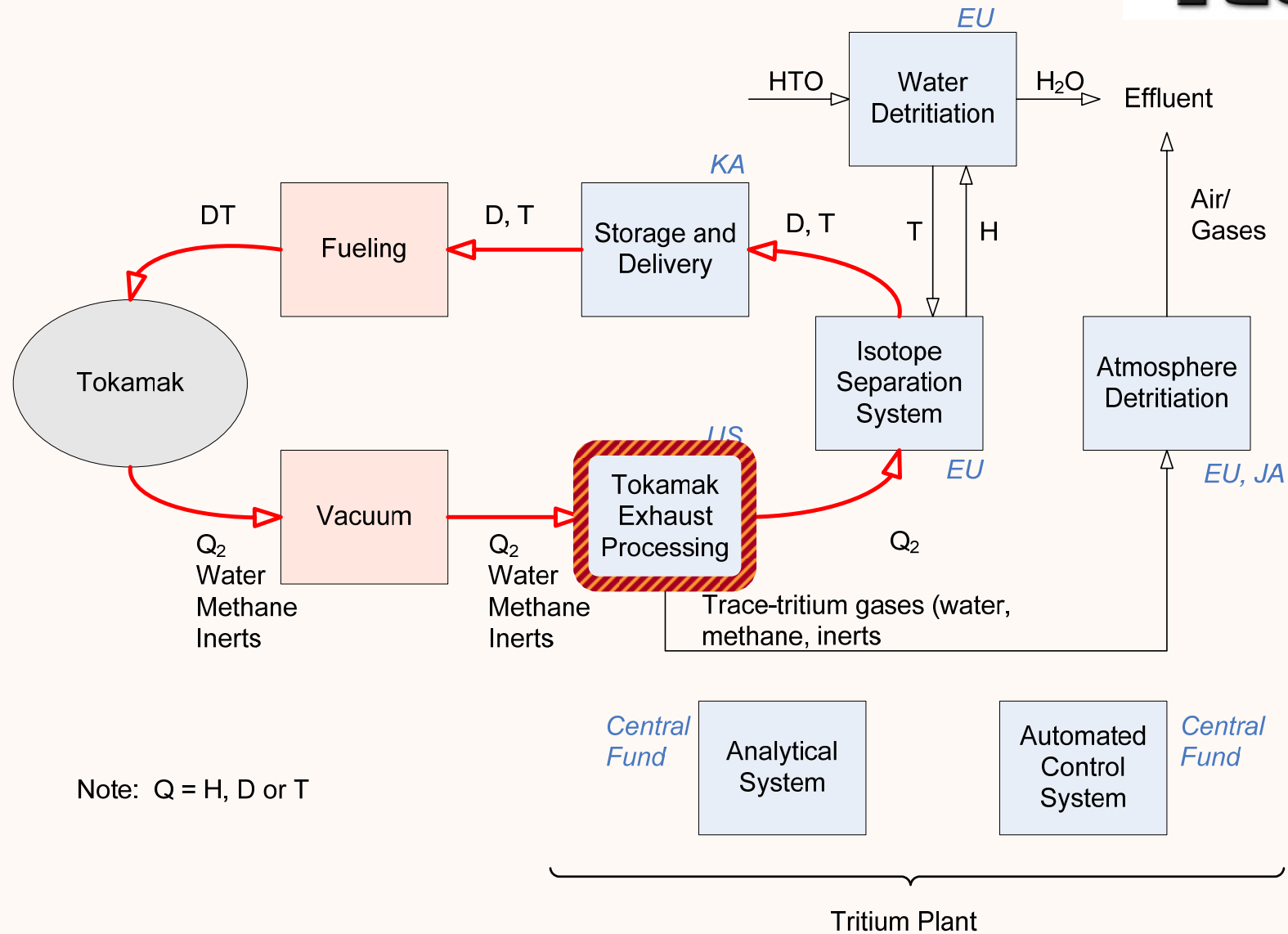
ITER WG Assistant:	Arturo Tanga	ITER
P-expert:	Alexander Krylov	RU
	Larry Grisham	US
	Arun Chakraborty	IN
	Osamu Kaneko	JP
	Timothy Jones	EU
	Vanni Antoni	EU
Member:	S.K. Mattoo	IN
	Tullio Bonicelli	EU



Working Group 7: Tritium

Chairman:	David Murdoch	EU
ITER Coordinator:	Manfred Glugla	ITER
ITER Expert:	Alexander Perevesentzev	ITER
P-expert:	Philippe Boucquey	EU
Member:	Kevin Sessions	US
	Hong Sunk Chung	KR
	Takumi Hayashi	JP
	Sergei Beloglazov	EU

Tokamak Exhaust Processing

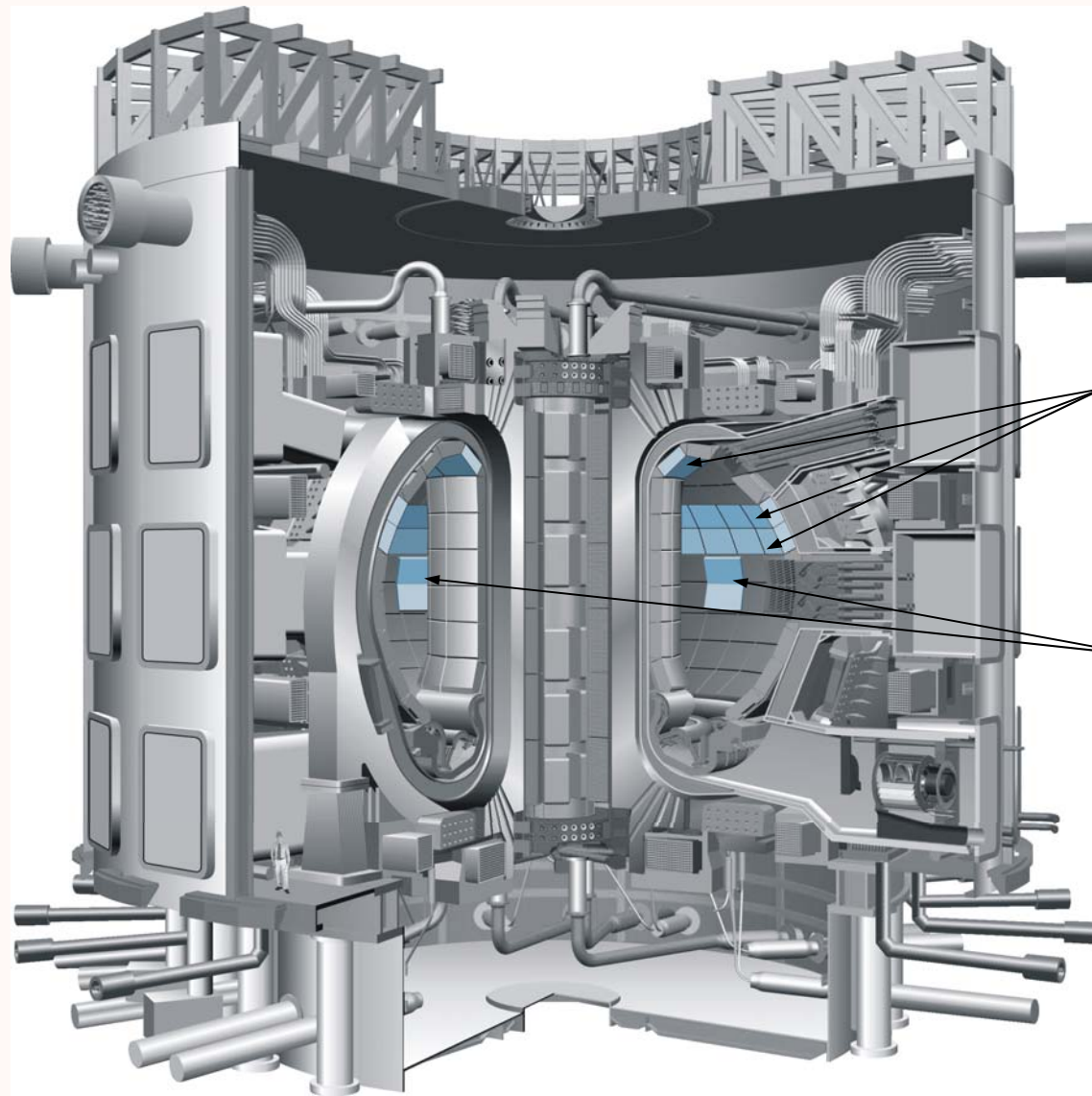




Working Group 8: In-vessel Components

Chairman:	Igor Mazul	RU	
ITER Coordinator:	Chris Lowry	ITER	
	Michael Pick	ITER	
Member:			
René Raffray	US	BongGuen Hong	KR
Horst Pacher	CA	Seungyon Cho	KR
Frédéric Escoubiac	EU	Ginming Chen	CN
André Grosman	EU	Damao Yao	CN
Massimo Roccella	EU	Jim Palmer	EU
Mike Hechler	US	Alberto Loarte	EU
David Johnson	US	Richard Tivey	ITER
Gulio Celentano	EU	Samir S. Khirwadkar	IN
Kensuke Mohri	JP	Satoshi Suzuki	JP
Peter Stangeby	US	Harald Bolt	EU
Charles Skinner	US	Kiyoshi Shibamura	JP
A. Alekseev	RU		

Blanket and Port Limiter Systems



**U.S. ITER
Blanket Module
Allocation
90 (20%)**

**U.S. ITER
Port Limiter
Allocation
2 (100%)**

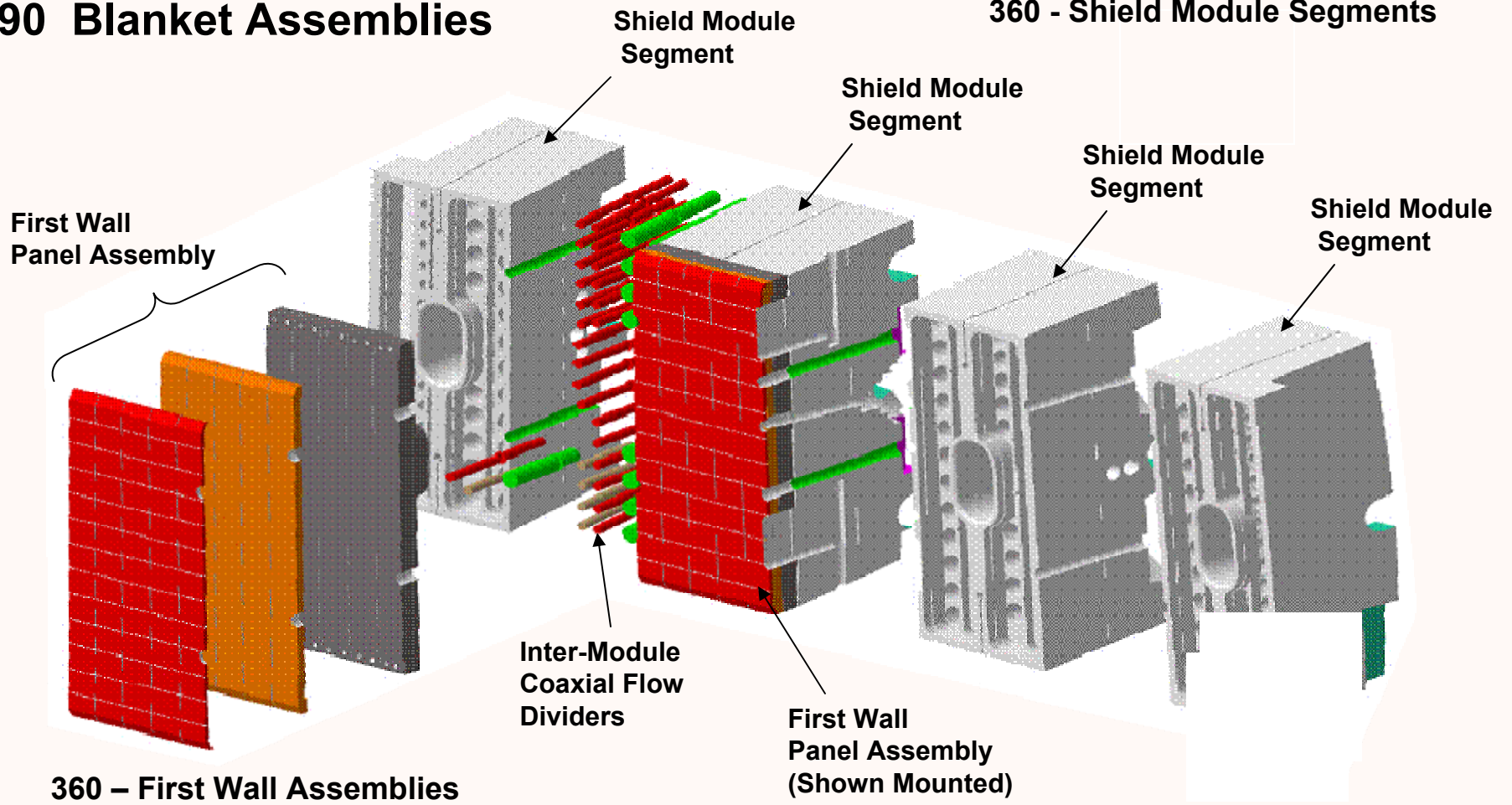
Blanket System



Blanket Module Elements

90 Blanket Assemblies

360 - Shield Module Segments

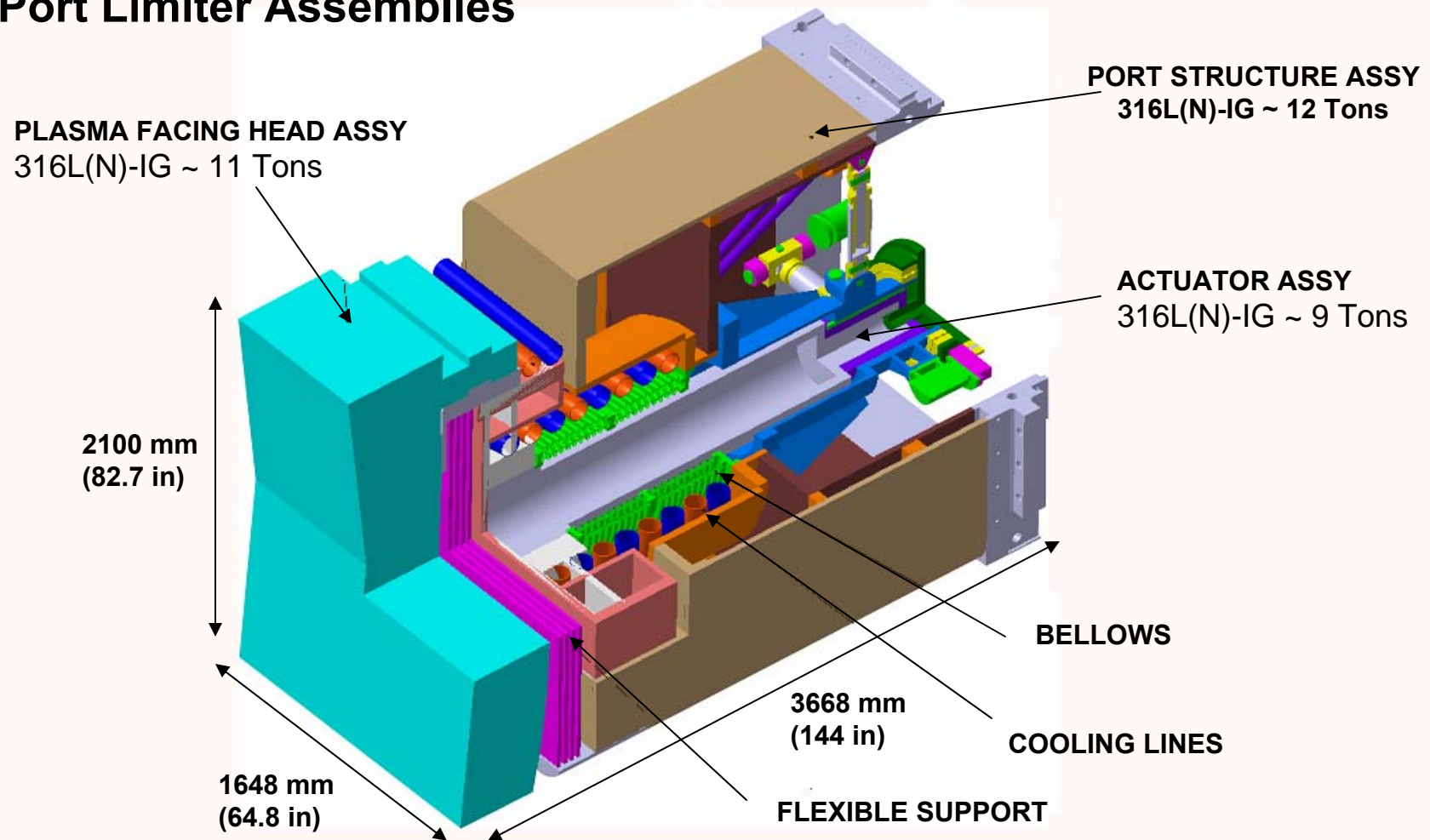


360 - First Wall Assemblies

Port Limiter System

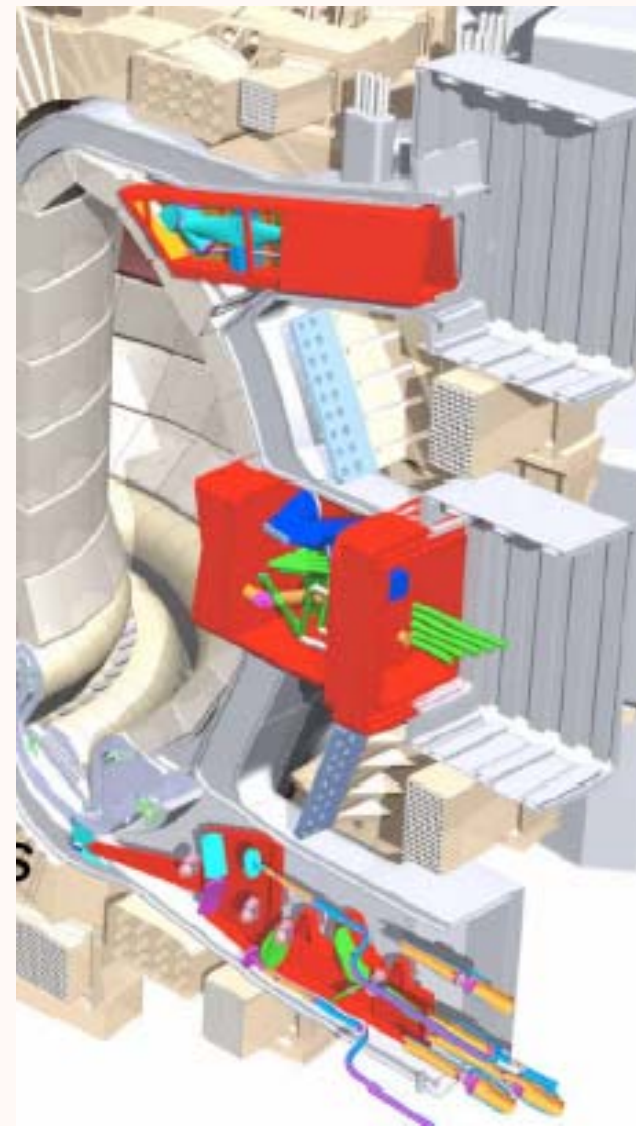


2 Port Limiter Assemblies

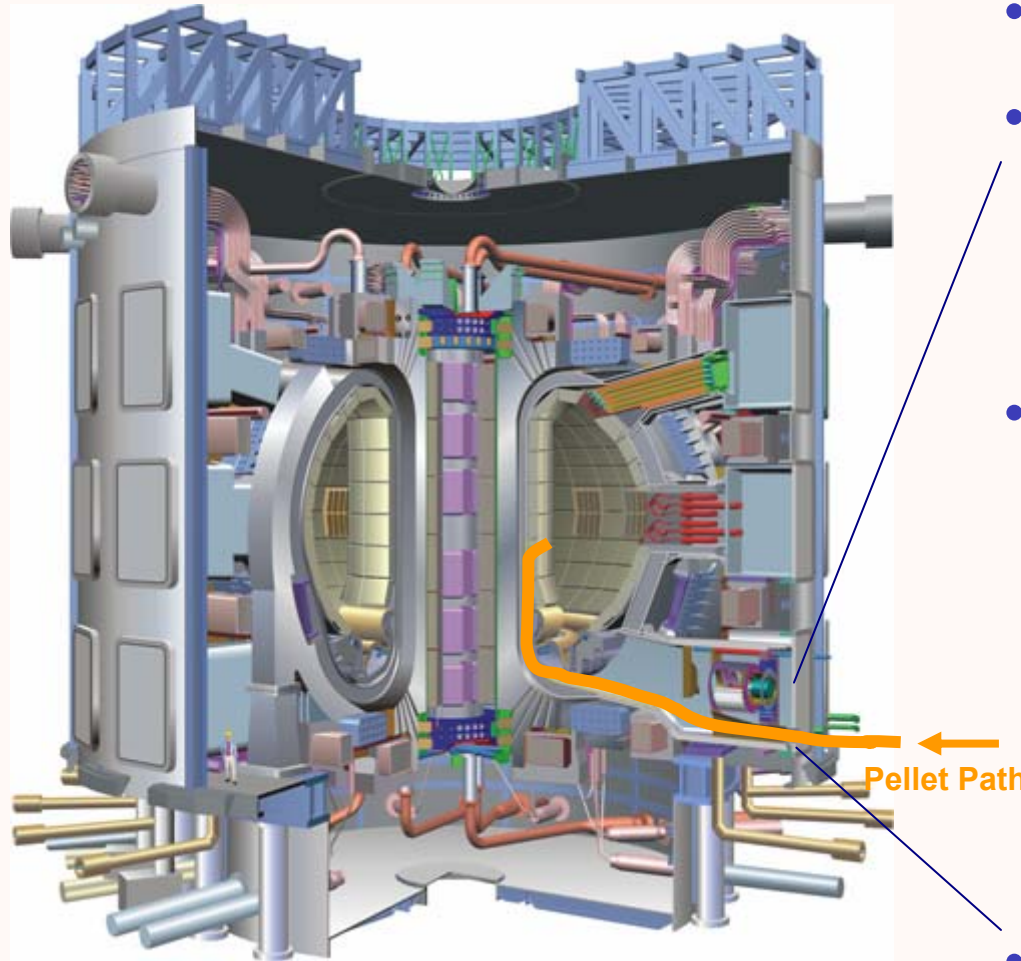


Diagnostic Instrumentation

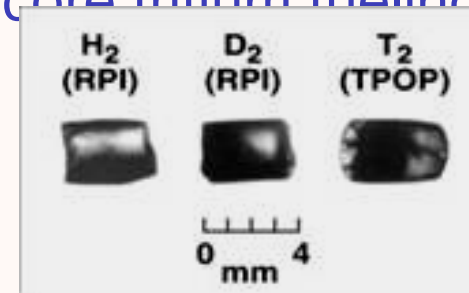
- Diagnostics are the means by which we observe the ITER plasma behavior, measuring some ~ 45 parameters.
- The U.S. has been allocated 16% of the ITER diagnostics.
- Implementing diagnostic front-end components, deeply embedded in massive port plug shield, and functioning in the harsh ITER environment, will be new and technically challenging.



Pumping and Fueling of ITER



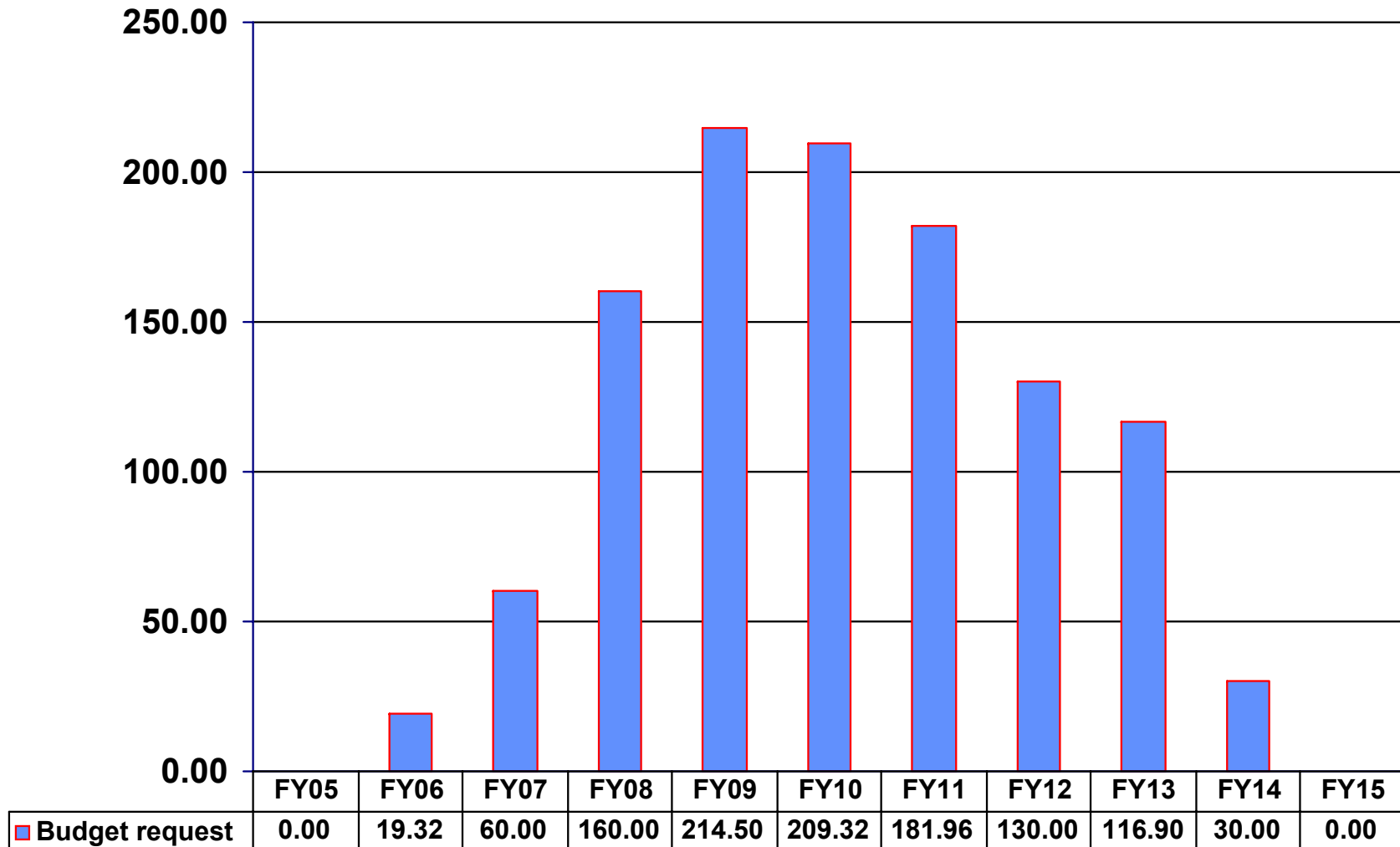
- 1000 m³ vacuum volume
- 8 Cryopumps (EU) backed by large tritium compatible roughing pump systems (U.S.)
- Pellet injection to achieve efficient core tritium fueling



Hydrogen, Deuterium and Tritium Pellets @ 14° Kelvin

- Guide tubes bring the pellets through the divertor ports to the inner wall.

The budget outlook for ITER



Fusion community roles that are key to ITER success

- **Design review participation**
 - Identification and assessment of issues
 - Suggestions of design solutions
 - Note: OFES is issuing guidance on community participation
- **Burning plasma studies**
 - Refinement of research objectives and experimental planning
 - Sensitivity studies
 - Design of plasma scenarios for start-up, research and performance
 - Choice of plasma-facing materials
 - Clarification of plasma-induced requirements and interfaces (disruptions, ripple, gas loads, ...)
 - Requirements for tritium-breeding concept tests
 - RWM and ELM control coils
 - ...

Main Messages

- **The ITER Agreement has been signed and the construction phase has now finally begun!**
- **The international ITER Organization is staffing up and the schedule is becoming better known**
- **The U.S. is helping to jumpstart the IO's project management and business systems infrastructure and to fill several vacancies temporarily**
- **An ITER Design Review is underway to prepare the 2007 Design Baseline, resolve priority issues, and develop a preliminary experimental operations plan**
- **Fusion community support and involvement are key to ITER success**