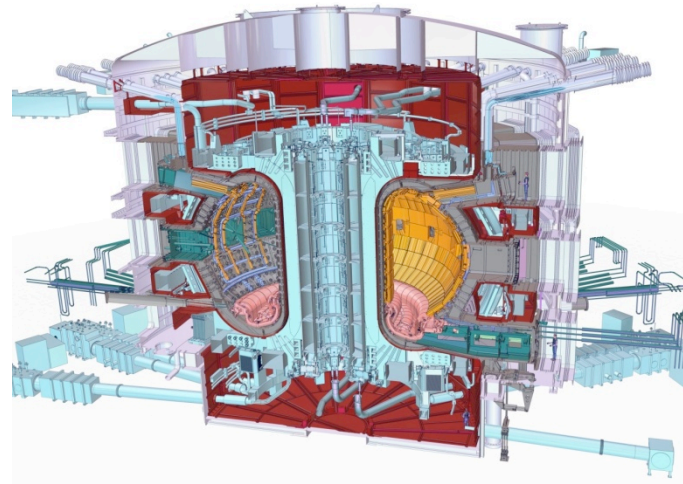


---

# ITER PROJECT



J. FARINEAU ITER ORGANIZATION

June 27th, 2011

SOFE Chicago

1

---

# Contents

- **ITER Context and Background**
- **ITER Technical Systems**
- **ITER: Organization & Contractual Rules**
- **New ITER Project Baseline**
- **ITER Key Technologies and next CFT's**
- **ITER Progress and PA'S Status**

---

# ITER CONTEXT AND BACKGROUND

June 27th, 2011

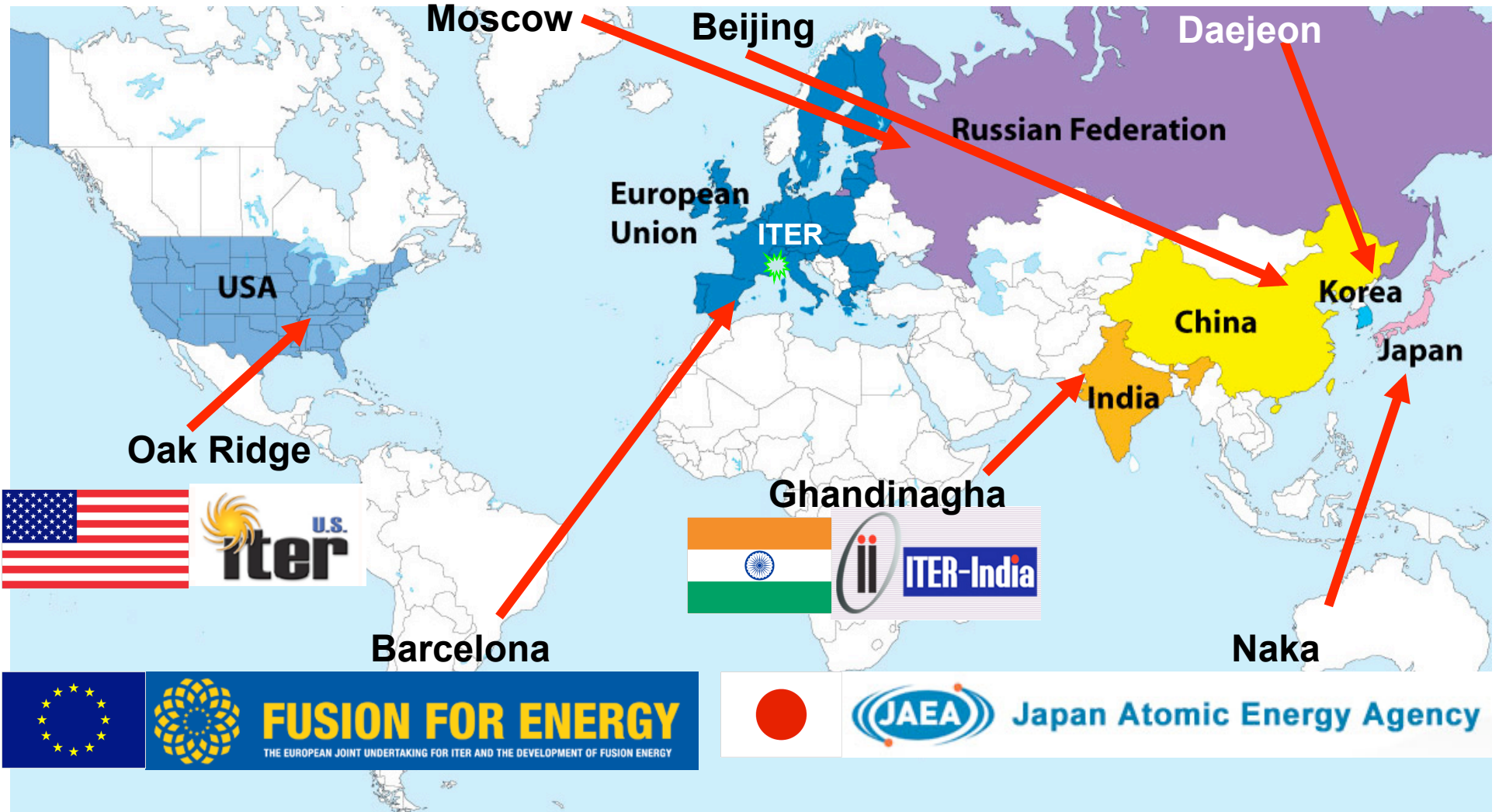
SOFE Chicago

3

---

# Why Fusion ?

- **Fuel: abundant, world-wide distributed:**
  - sufficient *deuterium* in seawater for millions of years
  - *tritium* is produced from *lithium*
    - conservative lithium ore recovery estimates indicate sufficient supplies for thousands of years
    - sufficient lithium in seawater for millions of years
- **Safety: no risk of major accidents:**
  - reactor contains fuel for only a few seconds burn
- **Waste: no long-term burden:**
  - low radio-toxicity after < 100 years



June 27th, 2011

SOFE Chicago

5

---

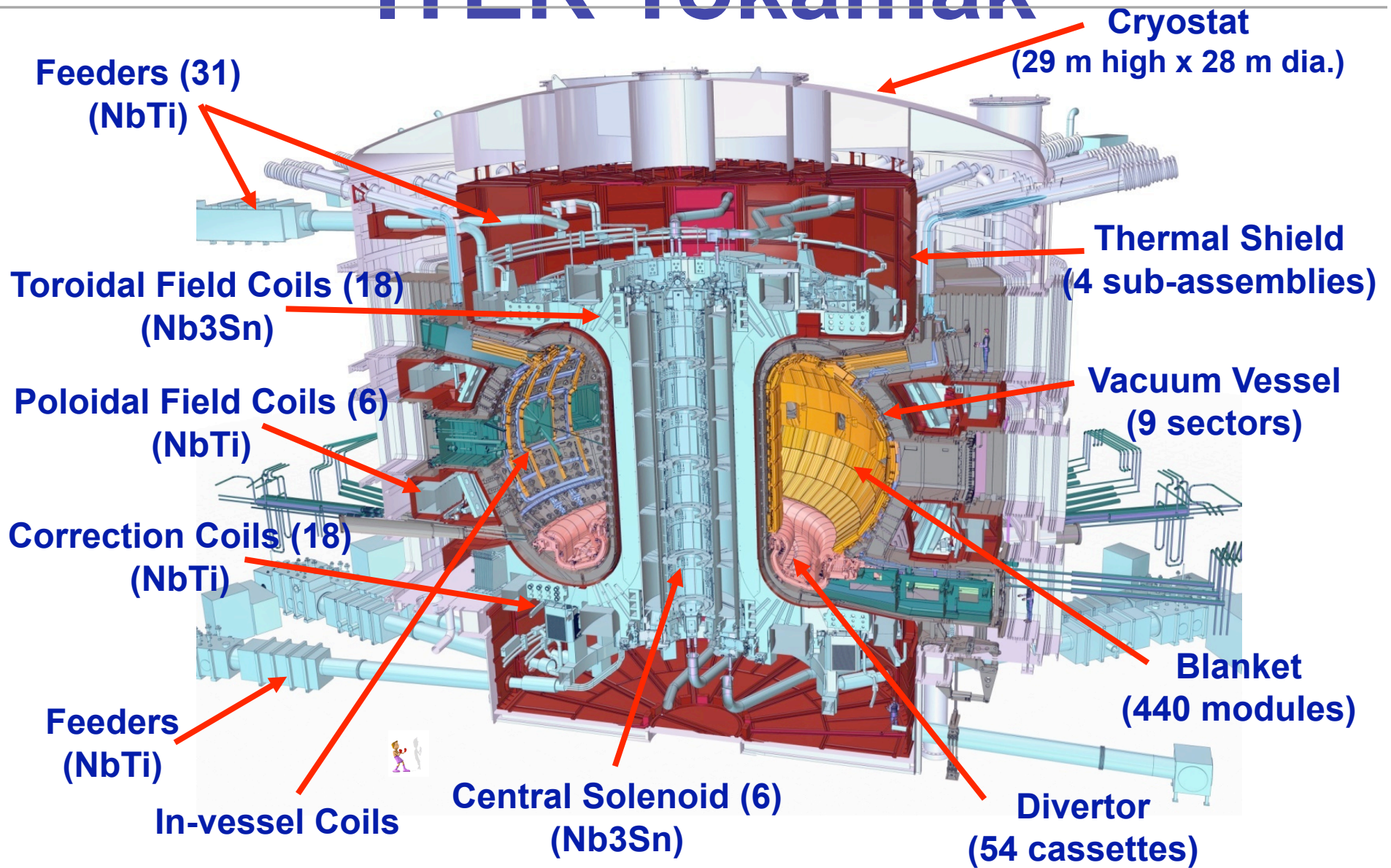
# ITER TECHNICAL SYSTEMS

June 27th, 2011

SOFE Chicago

6

# ITER Tokamak

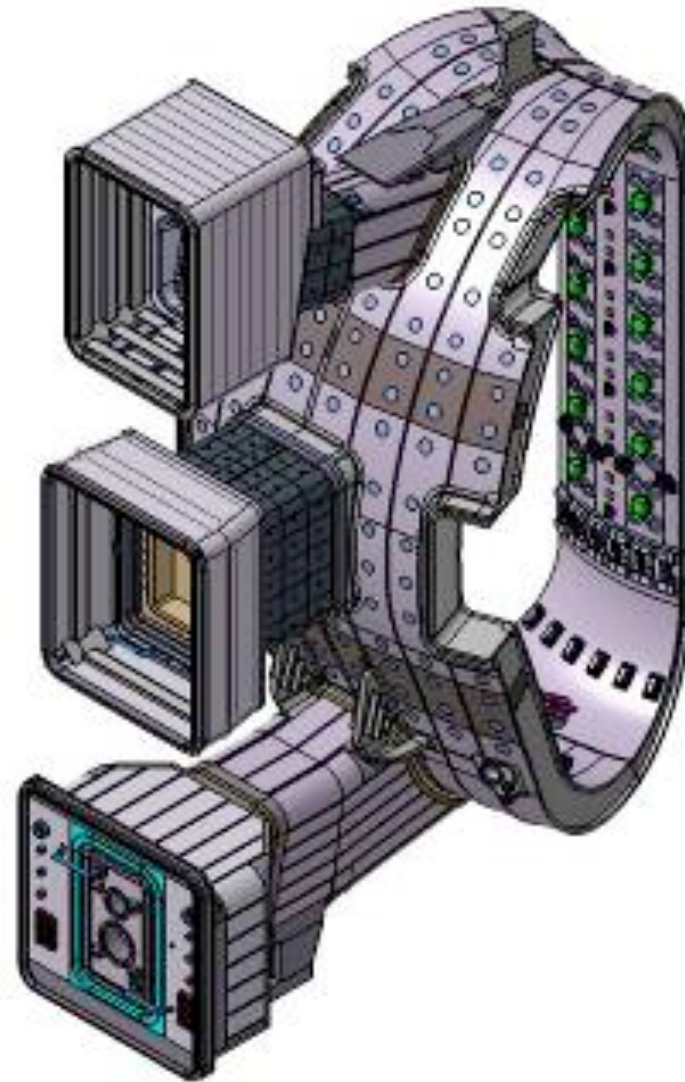
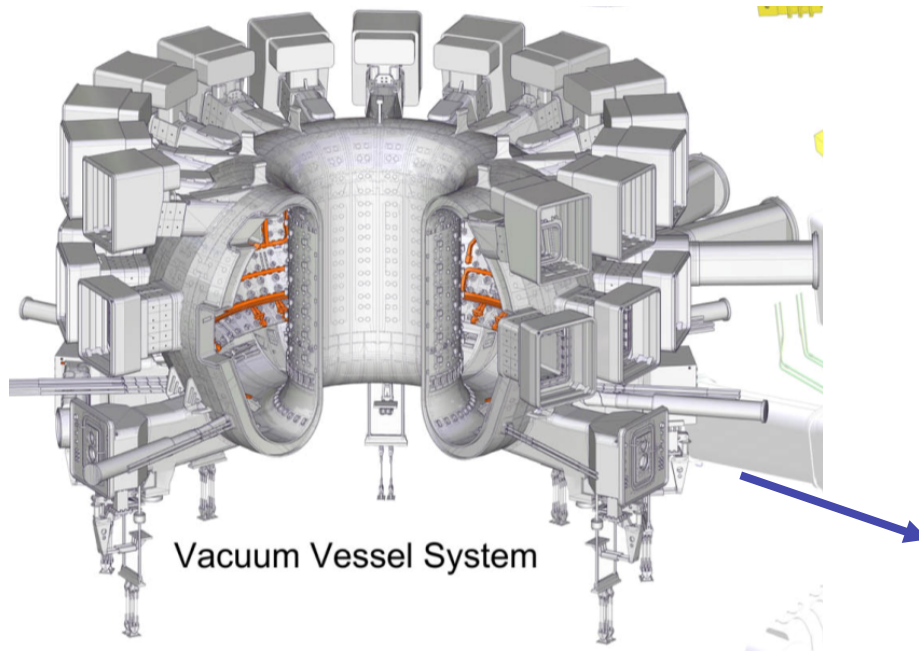


June 27th, 2011

SOFE Chicago

7

# Vacuum Vessel



## Facts

- First safety barrier for ITER
- SS 316 LN-IG
- ~5300 tons (VV, ports, shielding only)
- 19.4 m (63 ft) torus outer diameter
- 11.3 m (37 ft) torus height
- 9 Sectors assembled in triplets

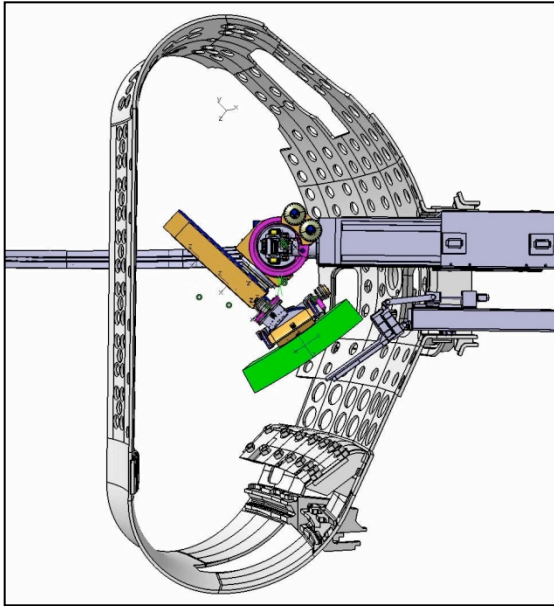
June 27th, 2011

SOFE Chicago

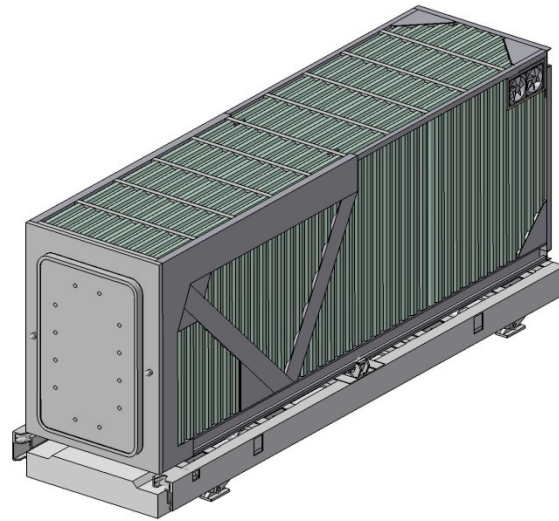
8



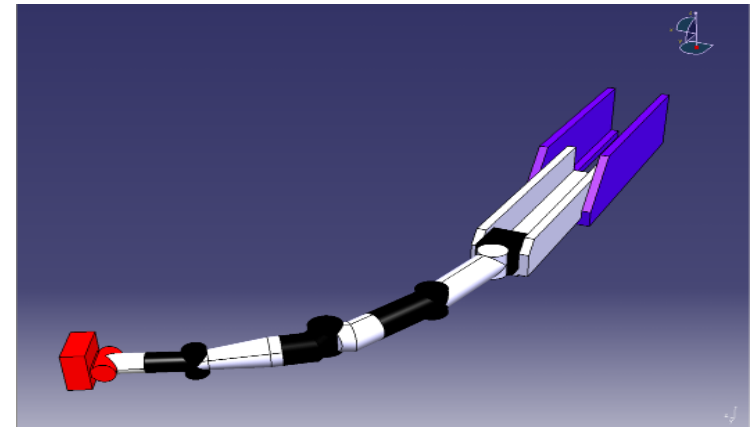
# Remote Handling Systems



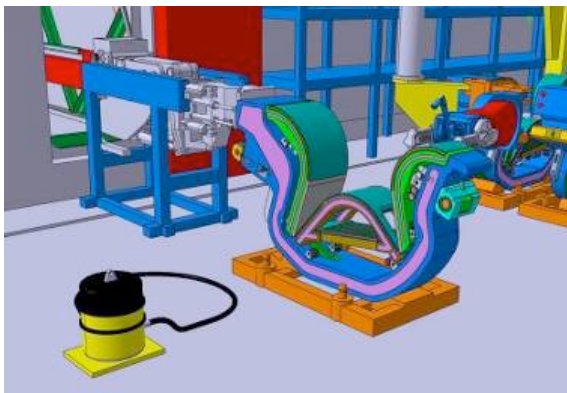
**Blanket RH System (JA)**



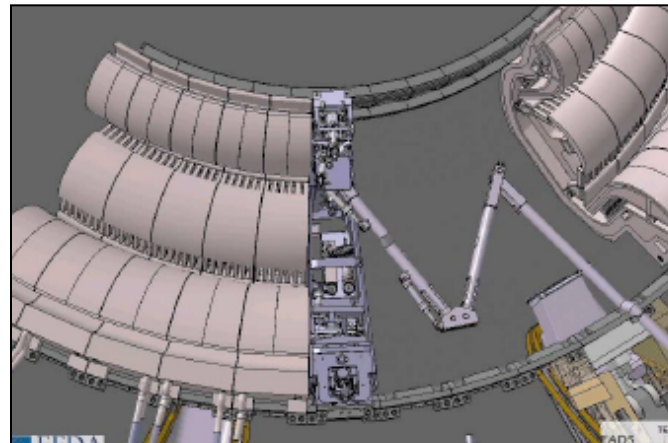
**Transfer Cask Systems (EU+CN)**



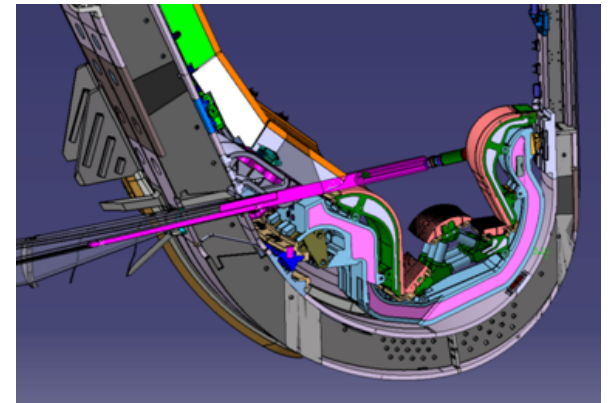
**Multi Purpose Deployer**



**Hot Cell RH Equipment**  
June 27th, 2011

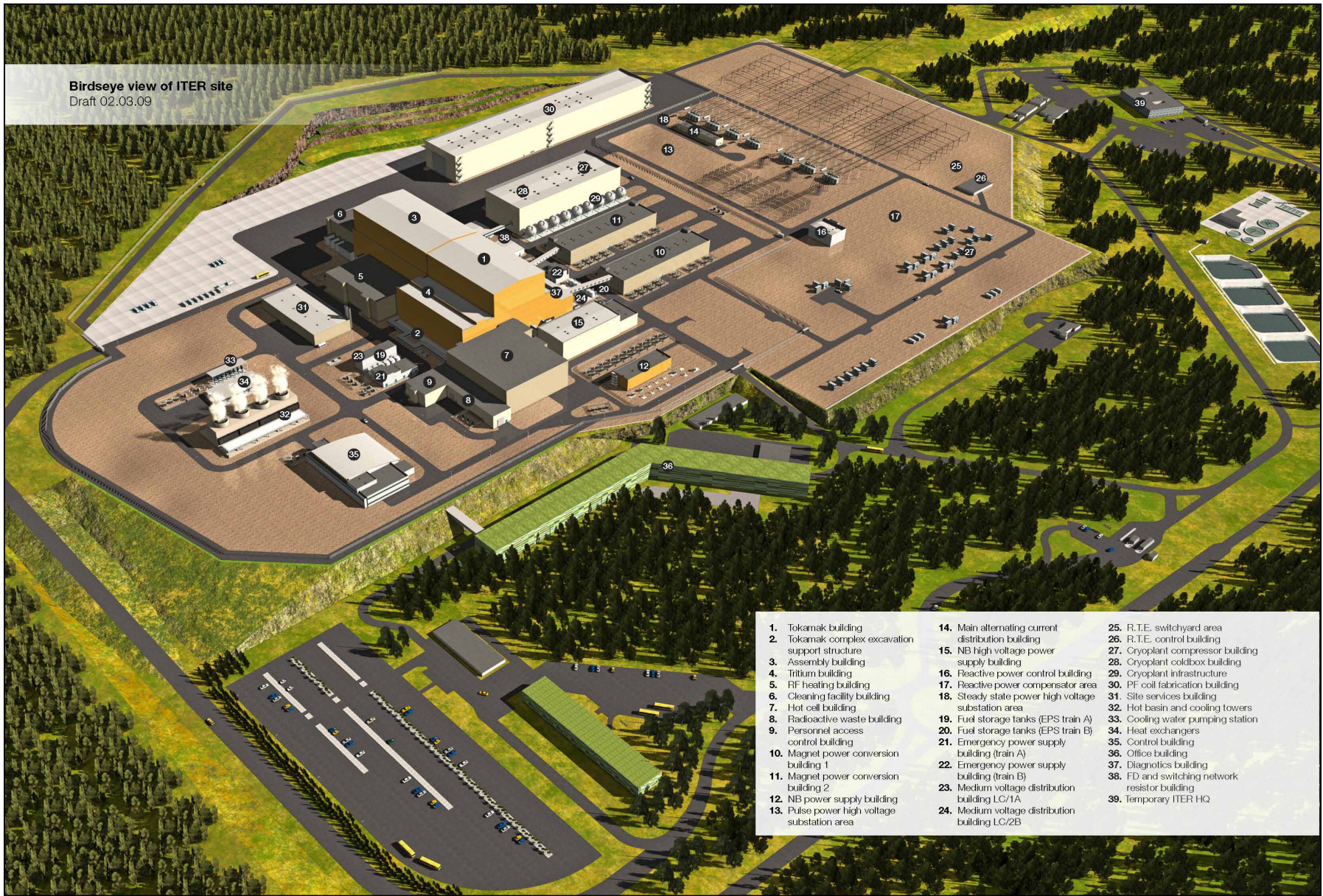


**Cassette Toroidal Mover**  
SOFE Chicago

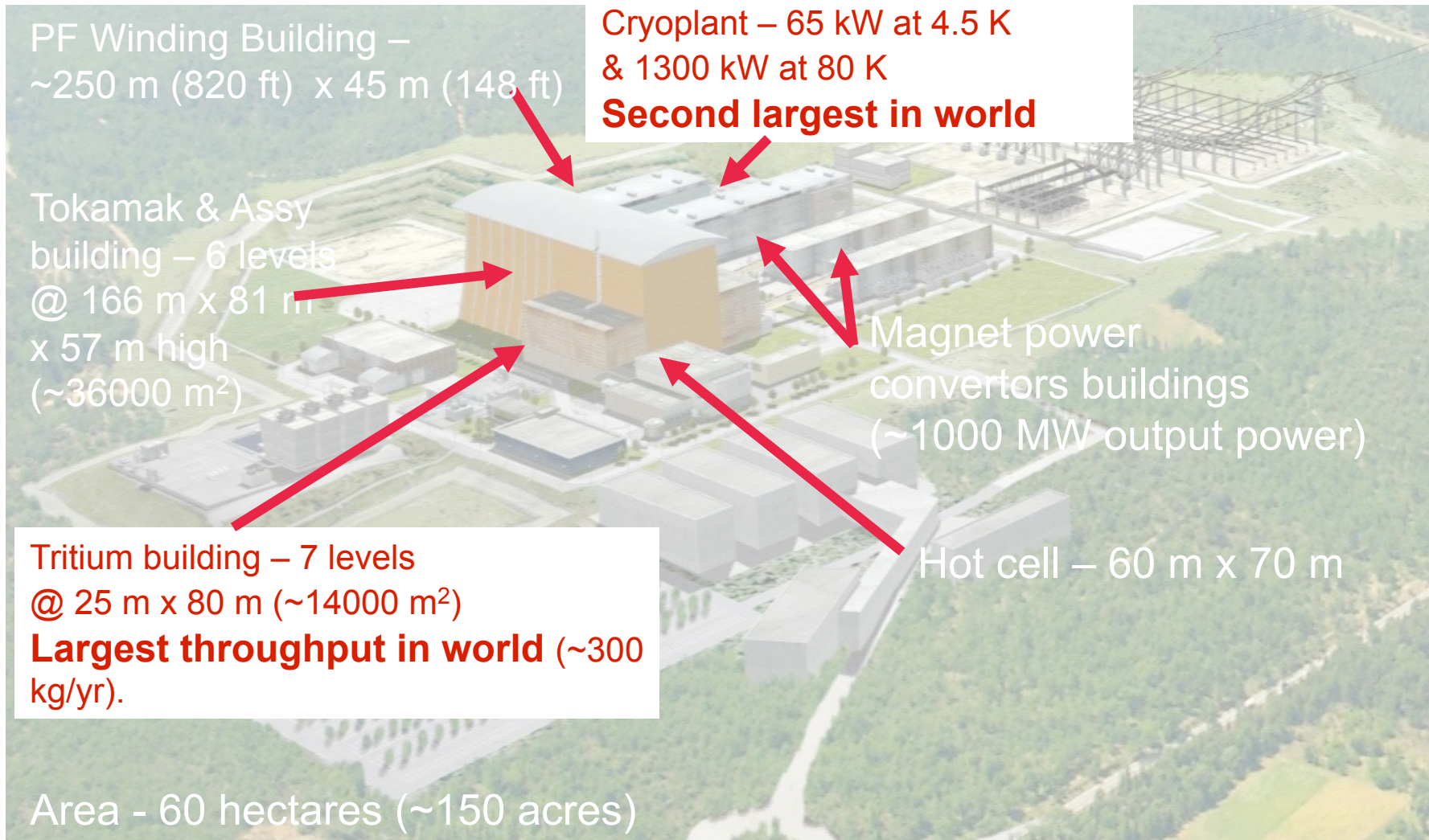


**In-Vessel Viewing System**

# ITER Project Site Layout: 3-D graphics view



# ITER Buildings and Facilities



June 27th, 2011

SOFE Chicago

11

---

# ITER Organization & Contractual Rules

June 27th, 2011

SOFE Chicago

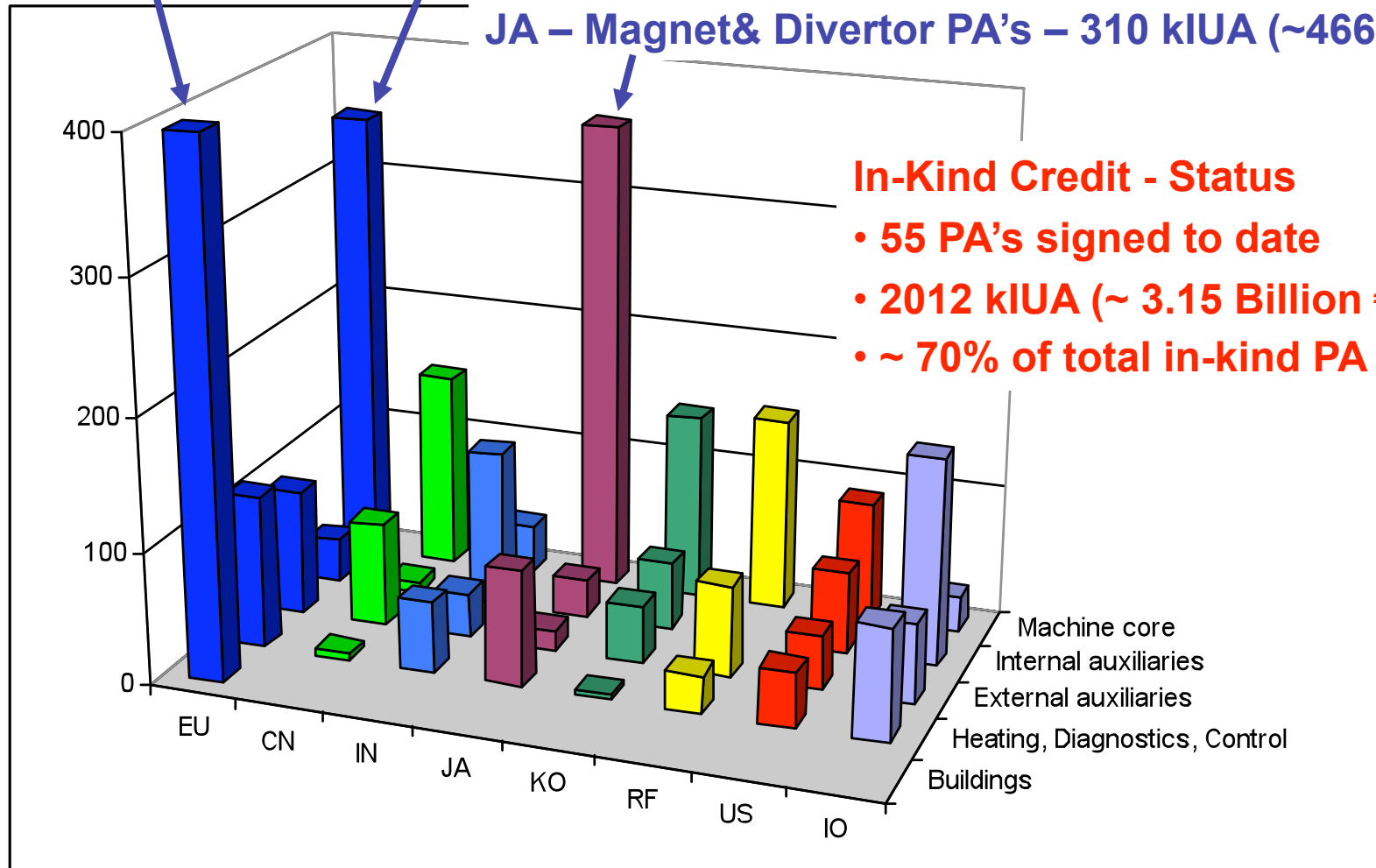
12

# In-Kind Contributions (Credit Values)

EU – Buildings & Excavation PA's – 377 kIUA (~580 Million €)

EU – VV & Magnet & Divertor PA's – 297 kIUA (~460 Million €)

JA – Magnet & Divertor PA's – 310 kIUA (~466 Million €)



- In-Kind Credit - Status**
- 55 PA's signed to date
  - 2012 kIUA (~ 3.15 Billion €)
  - ~ 70% of total in-kind PA value

June 27th, 2011

SOFE Chicago

13

# Integration between IO and DAs

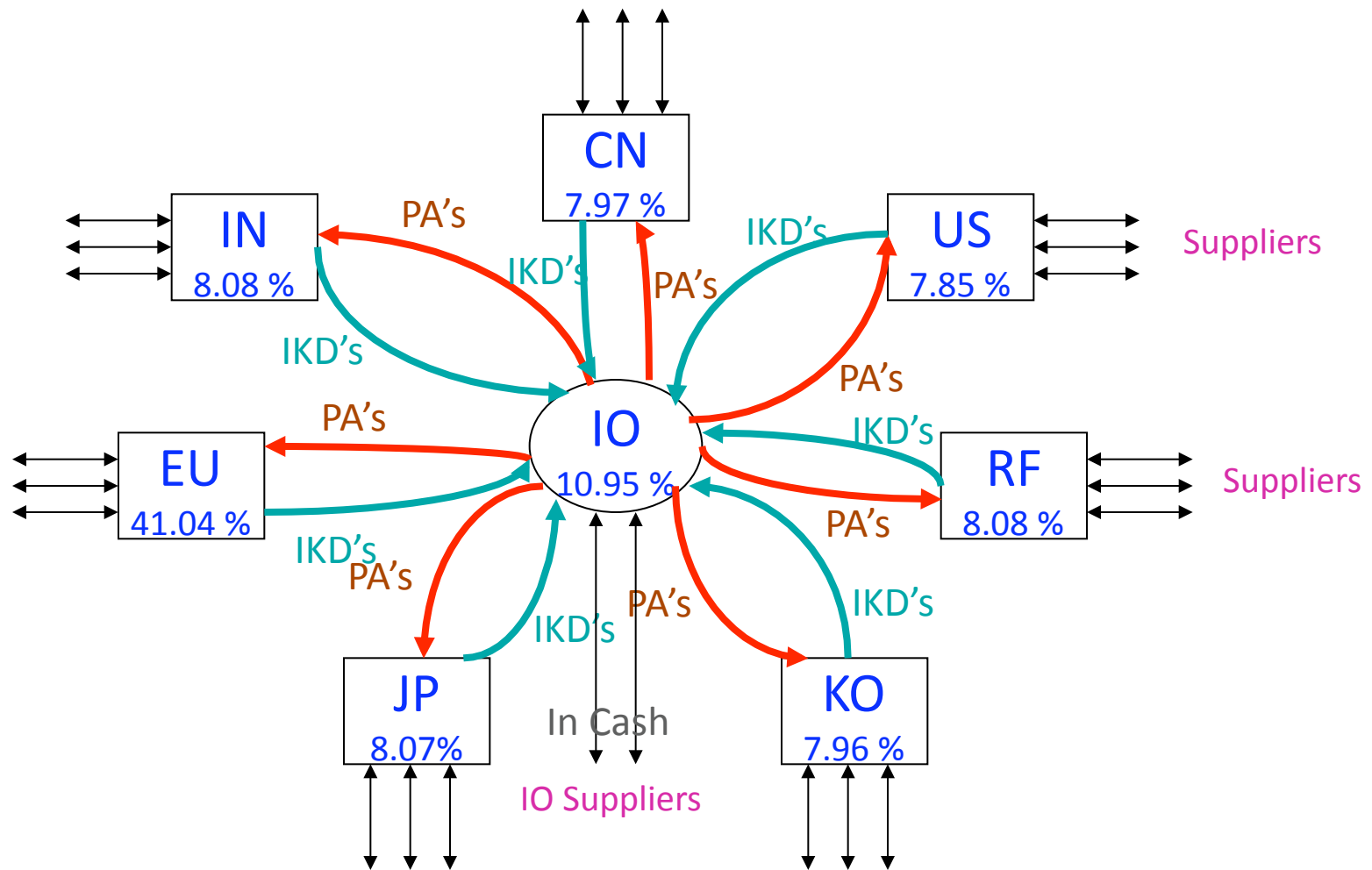
## - Basic Roles and Responsibilities -

<b>ITER Organization</b>	<b>Seven Members (Domestic Agencies, DA)</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 / Manufacturing</li> <li>- Delivering</li> <li>- Supporting installation</li> <li>- Conformance</li> </ul>

\* Depending on type of specification

- Functional: Functional requirements by IO and design by DAs
- Detail Design: Conceptual design by IO and detailed design by DAs
- Build-to-print: Detailed design by IO and fabrication/shop design by DAs

# Relationship IO-DA's-Suppliers (1)



PA: Procurement Arrangements  
IKD: In Kind Deliveries

June 27th, 2011

SOFE Chicago

15

# Relationship IO-DA's-Suppliers (2)

---

- ITER strictly sticking to Public Market Rules
- Possibility to work for ITER only through Call For Tender
- Bigger part of Business for European suppliers in F4E
- Different kinds of Contracts:
  - Support Engineering, services
  - R & D
  - Parts Procurements
- For European Industry, could make sense to build partnership with other companies
- For IO contracts with a competition worldwide, ITER could be the opportunity to build international partnership
- Collaboration can be extended beyond ITER scope



---

# NEW ITER PROJECT BASELINE

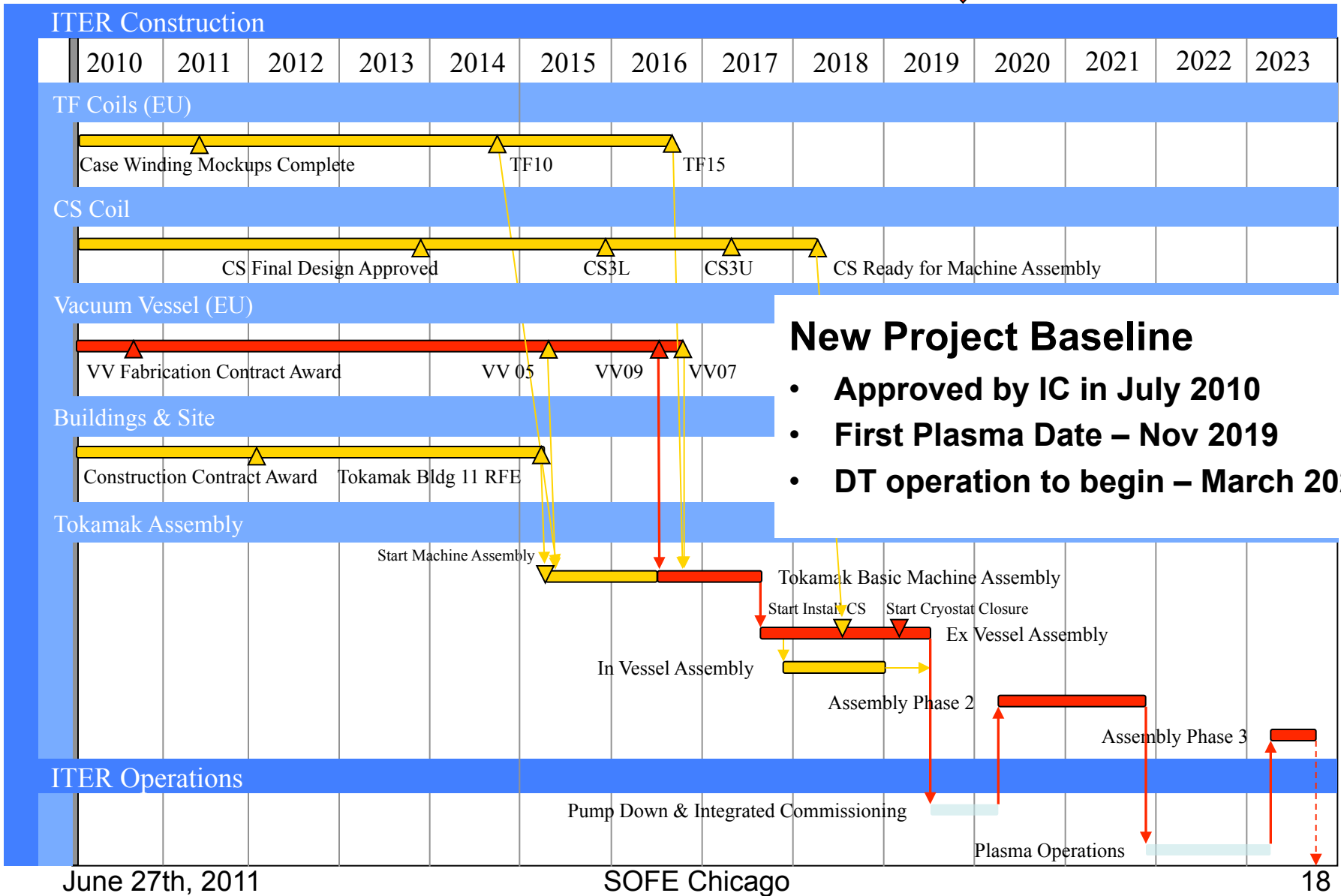
June 27th, 2011

SOFE Chicago

17

# New Baseline Schedule for 2019 First Plasma

First Plasma



---

# ITER Key Technologies and next CFT's

June 27th, 2011

SOFE Chicago

19

# Key Technologies

---

**Superconductive Coils ( $\text{Nb}_3\text{Sn}$  and NbTi)**

**Welded steel structures (TIG, NG-TIG, MIG, EB, Laser,...)**

**High-Vacuum technologies**

**High heat flux technologies**

**Insulating coatings**

**Neutral Beam Power Supplies and High Voltage Components ( of the order of 1 MV)**

**High Power, High Frequency Transmission Lines and Sources (in the ranges 5-8 GHz and 120-180 GHz)**

**Electrical Power Supplies**

# Key Technologies

---

**Remote Handling Tools**

**Vacuum Cryopumps**

**Mechanical Pumps and Cooling Water Systems**

**Tritium Handling and Atmosphere Detritiation and**

**Tritium Compatible Valves**

**Materials for tritium breeding blankets including ceramic breeder and beryllium pebbles and permeation barriers**

**Buildings and Infrastructure**

# Next Call For Tender's up to end 2011 (1)

- Development Equipments and Design activities for CODACS
- HCD – IC & EC: R&D and Design activities
- Many types of activities for Diagnostics Systems
- IT activities: Maintenance, SAP Assistance, general support and consultancy
- Tokamak: Materials & Welding qualification testings
- Tokamak: Heat Flux testing
- Component mechanical testing
- Welding performance under irradiation
- Mechanical test – Magnet support
- In Vessel Coils interface trial
- Thermo-Mechanical tests on Blanket
- Quench Detection Instrumentation Studies
- Blanket & Divertor R. H. activities
- Hot Cell remote Handling Technology

# Next Call For Tender's up to end 2011 (2)

---

- Remote Handling R&D
- Remote Handling Procedures Validation
- Framework Contract on Access Control, Security Design and Procurement Support
- Framework Contract on Human factors
- Software System for Support of Assembly & Installation work Package Engineering & Planning
- Cryogenic Plant (Liquid Helium, 65 kW)
- Final Design of Detritiation System
- Cable Engineering
- Tritium Plant (elements of)
- Support to the owner for Electrical Engineer
- Leak localization: Water or Helium leaks in Cryostat or in Torus
- HTWP Design
- Proof of Design for DS Scrubber columns to replace molecular sieves

---

# ITER Progress and PA's Status

June 27th, 2011

SOFE Chicago

24



# Jacketing Lines Status

- CN, JA and RF have set up their jacketing lines; EU and Us are starting; KO is negotiating with JA.



CN Jacketing Line

at ASIPP

June 27th, 2011

JA Jacketing Line

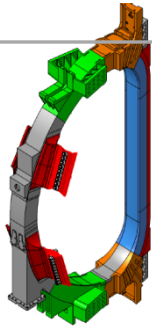
at NSE

SOFE Chicago

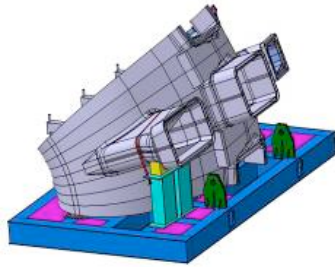
RF Jacketing Line

at UNK

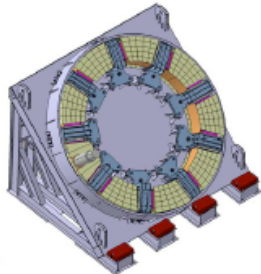
25



**TF Coil ~360 t**  
**16 m Tall x 9 m Wide**



**VV Sector ~400 t**  
**12 m Tall x 9 m Wide**



**PF1 Coil ~200 t**  
**9.4 m Dia**

June 27th, 2011

## Roads Upgrades Complete

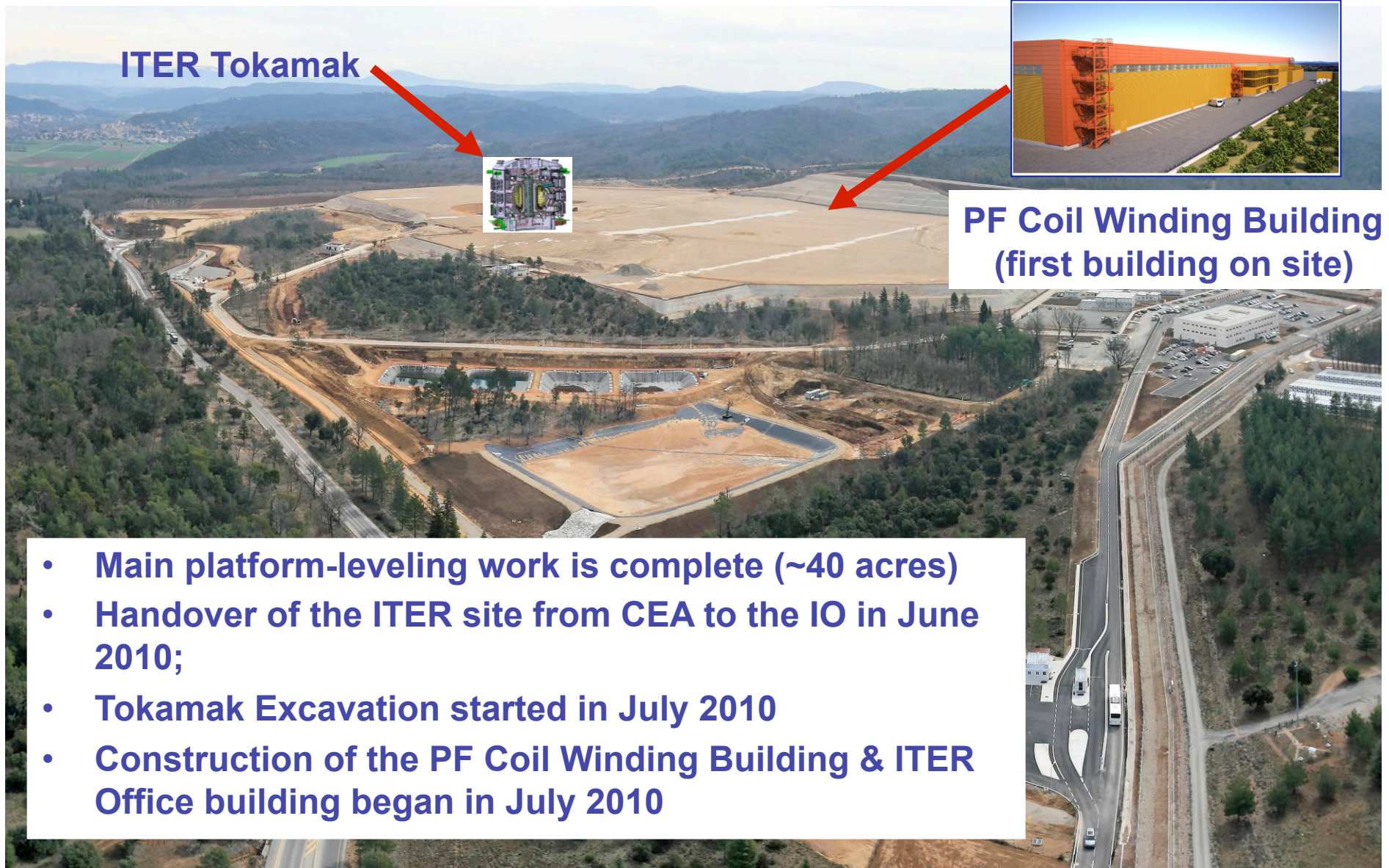


## Heavy Component on Road (TF Coils, VV Sectors, & PF1 Coil)

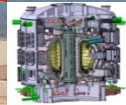
SOFE Chicago

26

# ITER Construction Site



ITER Tokamak



PF Coil Winding Building  
(first building on site)

- Main platform-leveling work is complete (~40 acres)
- Handover of the ITER site from CEA to the IO in June 2010;
- Tokamak Excavation started in July 2010
- Construction of the PF Coil Winding Building & ITER Office building began in July 2010

June 27th, 2011

SOFE Chicago

27

Photo By:-Iter Organization-

View Of:i72+B04 - HQ Bldg./Bridge/Tunnel



June 27th, 2011

SOFE Chicago

28

Photo By: -Iter Organization-

View 01:55 - PF Coil Fabrication Bldg.



Site: -refer GPS-

11 MAY 2011 14:39

SSW mag

E: 005° 46' 39.01"

N: 043° 42' 22.75"

June 27th, 2011

SOFE Chicago

29

# PA's to be signed by end of 2011

	PA REFERENCE	PROJECTION DATE
1	5.3.P6.JA.01 NB H&CD Power Supply for Heating Neutral Beam	May 2011 (float under review)
2	2.4.P1A.IN.01 Cryostat	May 2011 (float under review)
3	3.4.P1.EU.01 Cryoplant	May 2011 (float under review)
4	3.4.P2.IN.02 Cryolines Late Delivery	May 2011 (float under review)
5	2.3.P1.JA.01 In-Vessel remote Handling Blanket	June 2011 (362 days)

	PA REFERENCE	PROJECTION DATE
6	5.5.P1.US.01 Diagnostics	May 2011 (float under review)
7	5.5.P1.CN.01 Diagnostics	May 2011 (float under review)
8	5.5.P1.RF.01 Diagnostics	May 2011 (float under review)
9	5.5.P1.KO.01 Diagnostics	May 2011 (float under review)
10	5.5.P1.IN.01 Diagnostics	May 2011 (float under review)

# PA's to be signed by end of 2011

	PA REFERENCE	PROJECTION DATE
11	3.2.P5.EU.01 Water Detritiation Systems Tanks	May 2011 (float under review)
12	5.3.P2.JA.01 HV Bushing for NBTF	May 2011 (float under review)
13	4.1.P8C.US.01 SSEN Components	Dec 2011 (float under review)
14	5.5.P1.JA.01 Diagnostics	June 2011 (float under review)
15	2.3.P2.EU.01 In-vessel remote Handling Divertor	July 2011 (187 days)

	PA REFERENCE	PROJECTION DATE
16	2.4.P1B.IN.01 Vacuum Vessel Pressure Suppression System	July 2011 (318 days)
17	4.1.P1B.CN.01 Pulsed Power Electrical Network (PPEN)	Dec 2011 (float under review)
18	1.1.P4A-B.US.01 Additional Central Solenoid conductor and materials (AMENDMENT)	July 2011 (float under review)
19	2.3.P3.EU.01 Ex-Vessel Remote Handling Transfer Cask System	July 2011 (float under review)
20	5.5.P1.EU.01 Diagnostics	Aug 2011 (float under review)

June 27th, 2011

SOFE Chicago

31

# PA's to be signed by end of 2011

	PA REFERENCE	PROJECTION DATE
21	5.2.P3.RF EC Gyrotrons	Sept 2011 (float under review)
22	5.5.P1.US.02 Diagnostics <b>2<sup>nd</sup> PA</b>	Sept 2011 (float under review)
23	5.5.P1.CN.02 Diagnostics <b>1<sup>st</sup> Amendment</b>	Oct 2011 (float under review)
24	5.5.P1.KO.02 Diagnostics <b>1<sup>st</sup> Amendment</b>	Oct 2011 (float under review)
25	5.5.P1.IN.02 Diagnostics <b>1<sup>st</sup> Amendment</b>	Oct 2011 (float under review)

	PA REFERENCE	PROJECTION DATE
26	5.2.P3.IN.01 EC RF Gyrotrons	Oct 2011 (float under review)
27	5.2.P3.EU.01 EC RF Gyrotrons	Oct 2011 (float under review)
28	4.1.P8C.EU.01 SSEN Components	Dec 2011 (float under review)
29	5.8.P1.RF.01 Port Plug Test Facility	Oct 2011 (float under review)
30	5.2.P4.IN.01 EC HV Power Supply	Oct 2011 (float under review)
31	3.1.P6.CN.01 Gas Injection System & GDC (Glow Discharge Cleaning System)	Nov 2011 (float under review)

June 27th, 2011

SOFE Chicago

32



# PA's to be signed by end of 2011

	PA REFERENCE	PROJECTION DATE
32	5.2.P4.EU.01 EC HV Power Supply	Dec 2011 (float under review)
33	2.3.P4.EU.01 In-Vessel Remote Handling Viewing & Metrology System	Dec 2011 (160 days)
34	3.4.P3.IN.01 Cryodistribution Components	Dec 2011 (float under review)
35	1.7.P1.EU.01 Cassette Body and Assembly	Dec 2011 (float under review)

---

**THANK YOU FOR YOUR ATTENTION**

June 27th, 2011

SOFE Chicago

34

---

# BACK-UP SLIDES

June 27th, 2011

SOFE Chicago

35

## As of today, 55 Procurement Arrangements have been signed.

	REFERENCE	Signature date
1	1.1.P6A.JA.01 TF Conductors	28 November 2007
2	1.1.P6A.EU.01 TF Conductors	18 December 2007
3	1.1.P6A.RF.01 TF Conductors	12 February 2008
4	1.1.P6A.KO.01 TF Conductors	07 May 2008
5	1.1.P6A.CN.01 TF Conductors	16 June 2008
6	1.1.P1A.EU.01 TF Magnet Windings	20 June 2008
7	1.1.P6C.CN.01 PF Conductors	10 October 2008
8	1.1.P1B.JA.01 TF Magnet Windings	19 November 2008
9	1.1.P2B.JA.01 TF Magnet Structures	19 November 2008
10	6.2.P2.EU.01 PF Coil Winding Facility	19 November 2008
11	1.5.P1A.KO.01 Main Vessel	19 November 2008
12	1.5.P2A.KO.01 Equatorial and Lower Ports	19 November 2008

June 27th, 2011

SOFE Chicago

36

## As of today, 55 Procurement Arrangements have been signed.

	REFERENCE	Signature date
13	6.2.P2.EU.02 Architect Engineering Services	4 May 2009
14	6.2.P2.EU.03 Tokamak Pit Excavation and Drainage	4 May 2009
15	6.2.P2.EU.04 Seismic Isolation Pads	4 May 2009
16	5.3.P7A.IN.01 Diagnostic neutral Beam Power Supply	19 April 2009
17	1.1.P6C.EU.01 PF Conductors	4 May 2009
18	1.7.P2C.RF.01 Divertor Dome	9 June 2009
19	1.5.P2B.RF.01 Upper Ports	9 June 2009
20	1.7.P2A. JA.01 Divertor Outer Vertical Target	17 June 2009
21	1.1.P6A.US.01 TF Conductors	18 June 2009
22	2.6.P1A-1B.US.01 Tokamak Cooling Water System	18 June 2009
23	1.1.P3A-B.EU.01 PF Magnets 2,3,4,5,6 (EU)	19 June 2009
24	5.3.P6.EU.01 Power Supply for Heating Neutral Beam ( Low Voltage)	13 July 2009

June 27th, 2011

SOFE Chicago

37

## As of today, 55 Procurement Arrangements have been signed.

	REFERENCE	Signature date
25	2.2.P2A.KO.01 Machine Assembly Tooling	3 August 2009
26	1.5.P1B.IN.01.0 VV In-Wall Shielding Block Assemblies	24 September 2009
27	1.1.P6C.RF.01 PF Conductors	2 October 2009
28	4.1.P1A-P8B.EU.01 SSEPN and PPEN Detailed System Engineering Design	26 October 2009
29	1.5.P1A.EU.01.0 VV Main Vessel 7 sectors	19 November 2009
30	1.1.P6B.JA.01 Central Solenoid Conductor	8 December 2009
31	5.1.P3.IN.01.0 IC H&CD RF Power Sources	5 February 2010
32	1.7.P2D.RF.01 PFC HHF Tests	23 February 2010
33	1.1.P4A-B.US.01 Central Solenoid Magnet	12 March 2010
34	1.7.P2B.EU.01.0 Divertor Inner Vertical Targets	12 March 2010
35	5.3.P7B.IN.01 Diagnostic Neutral Beam Line	22 March 2010

June 27th, 2011

SOFE Chicago

38

## As of today, 55 Procurement Arrangements have been signed.

	REFERENCE	Signature date
36	2.6.P2A.IN.01 Component Cooling Water System (CCWS) Chilled Water System (CHWS) and Heat Rejection System (HRS)	22 March 2010
37	5.1.P2.US.01 IC Transmission Lines	30 April 2010
38	1.1.P3C.CN.01 Corrections Coils	11 May 2010
39	1.1.P2C.CN.01 Magnet Supports	11 May 2010
40	1.1.P6C.CN.02 Conductors for CC and Feeders	11 May 2010
41	5.2.P2.US.01 Electron Cyclotron Main Transmission Lines	12 May 2010
42	1.1.P2A.EU.01 Pre compression rings	12 May 2010
43	6.2.P2.EU.05 Buildings Construction	14 May 2010
44	2.7.P1.KO.01.0 Thermal Shield	17 May 2010
45	3.4.P2.IN.01 Lower Pipe Chase Cryolines	10 June 2010
46	5.3.P9.EU.01.0 Neutral Beam Test Facility Components	27 October 2010

June 27th, 2011

SOFE Chicago

39

# As of today, 55 Procurement Arrangements have been signed.

	REFERENCE
47	5.3.P9.IN.01 Neutral Beam Test Facility Components (Spider and Calorimeter)
48	1.1.P5A.CN.01 Magnet Feeders
49	1.1.P3.RF.01 Poloidal Field Magnet 1
50	4.1.P3.RF.01 Switching Network, Fast Discharge Units, DC Busbar & Instrumentation
51	4.1.P2.KO.01 AC/DC Converters
52	5.1.P4.IN.01 IC H&CD Radio Frequency Power Supply
53	3.1.P4.US.01 Vacuum Auxiliary Systems Early Delivery
54	4.1.P2.CN.01 AC/DC Converters
55	4.1.P2.CN.02 RPC-HF