

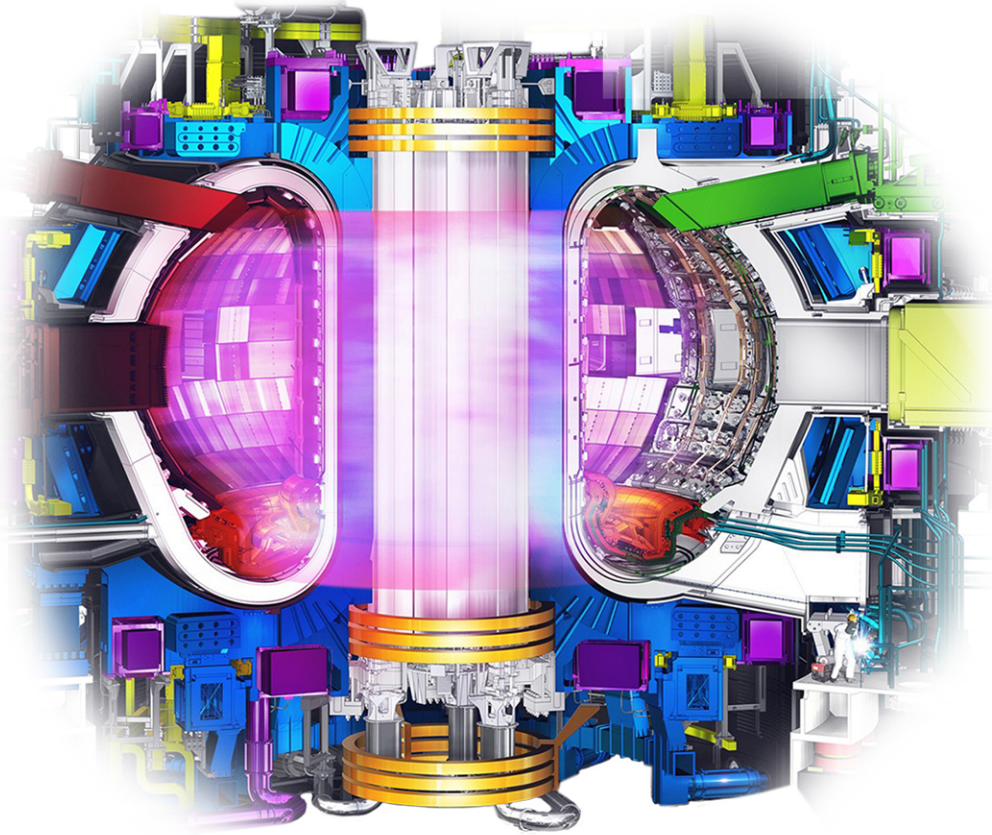
ITER:

An International Venture

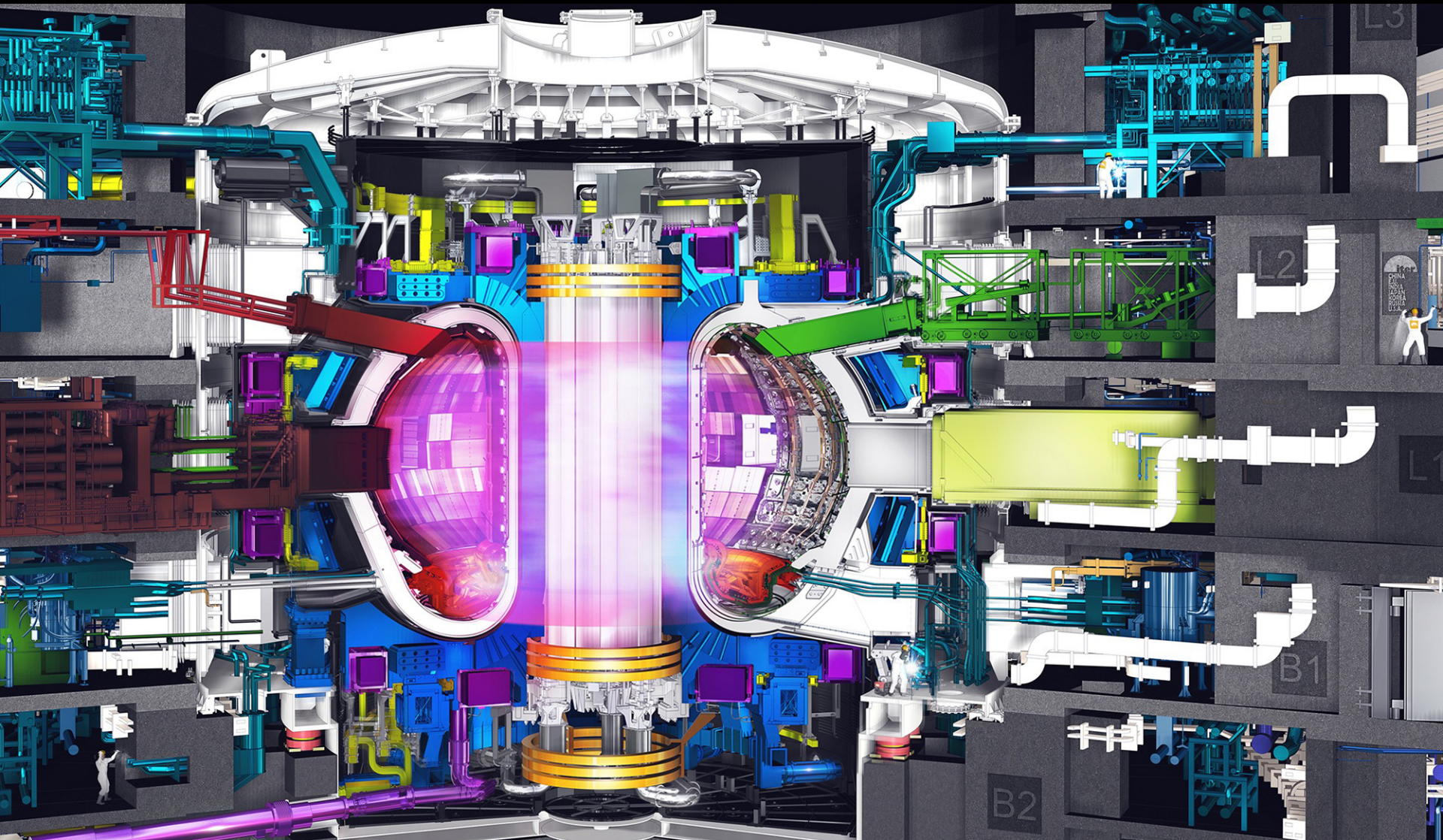
**Ned R. Sauthoff, US ITER Project Manager
and Bernard Bigot, ITER Director-General**

***Fusion Power Associates
December 13, 2016***

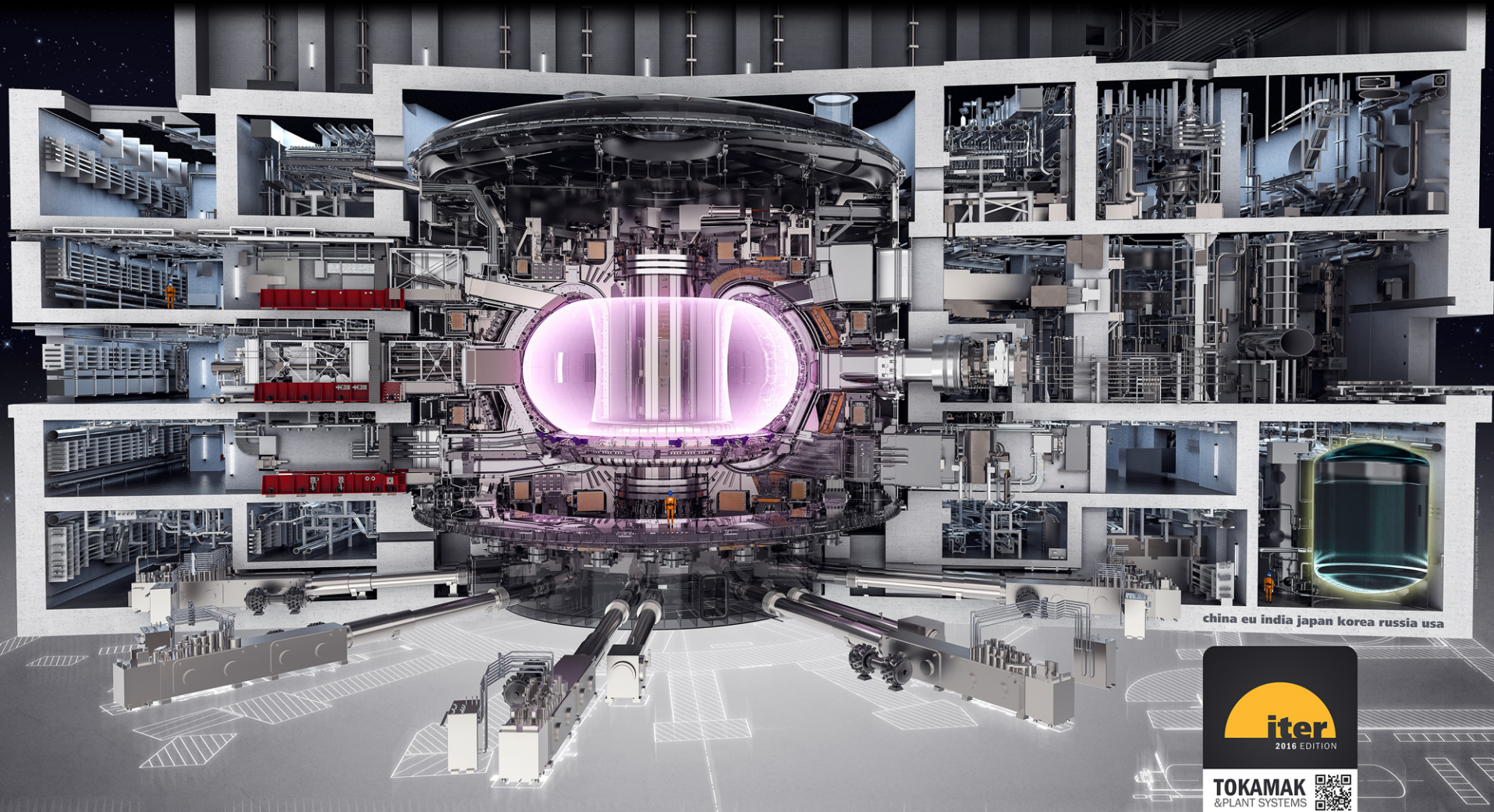
ITER Tokamak Core



ITER Tokamak and Directly-Interfacing Systems



Tokamak Complex



ITER Site

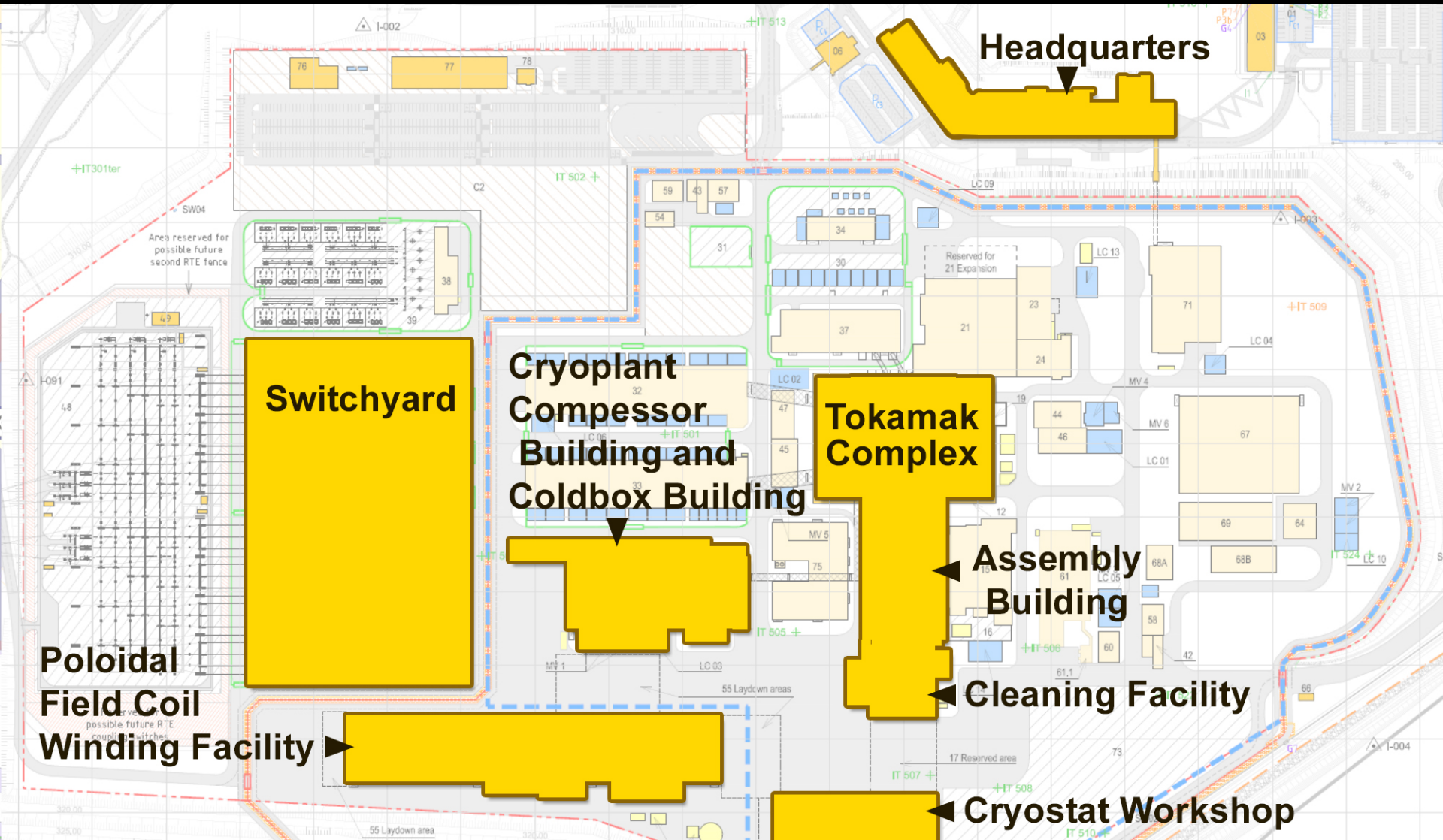


china eu india japan korea russia usa

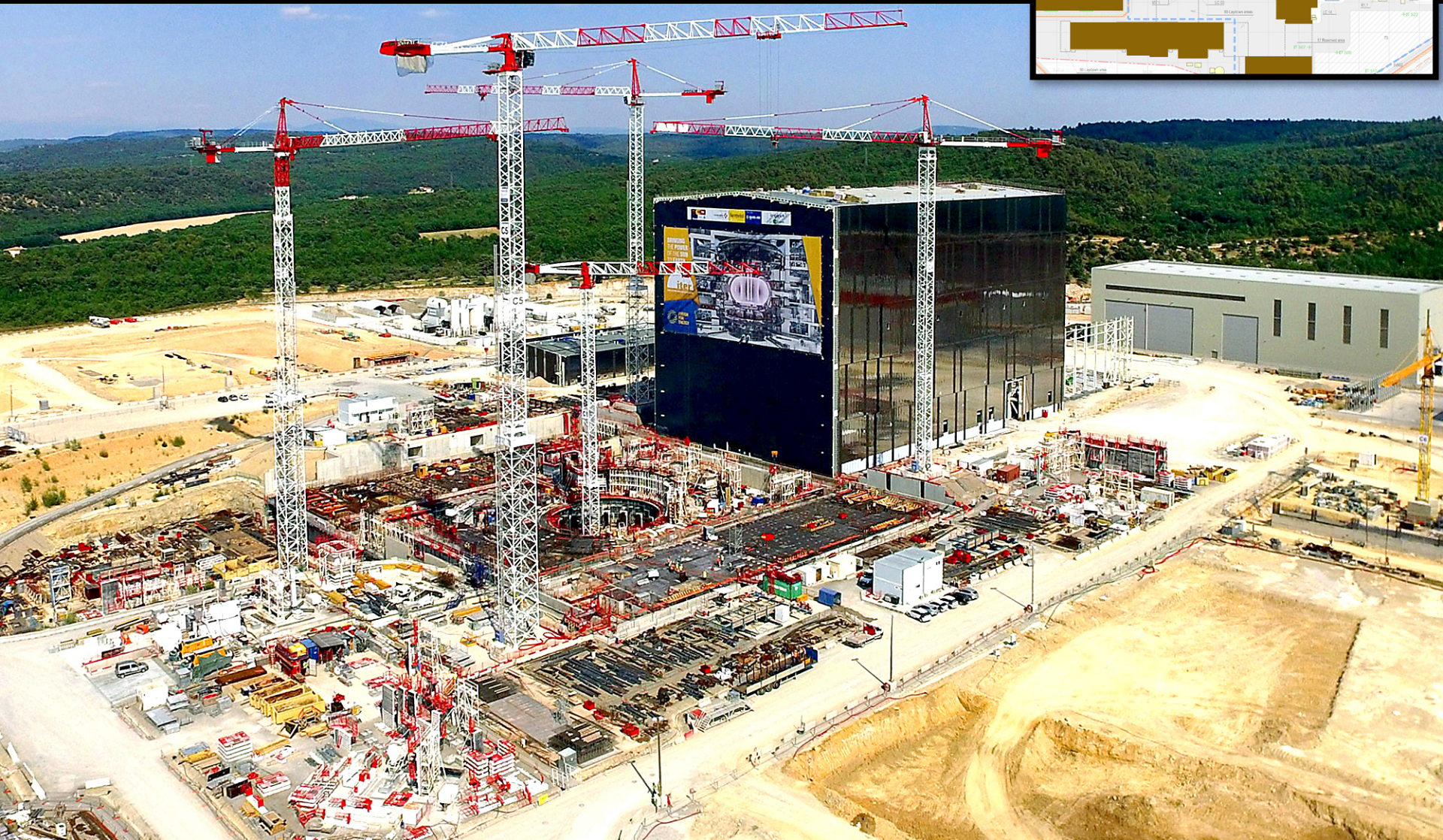
ITER Site



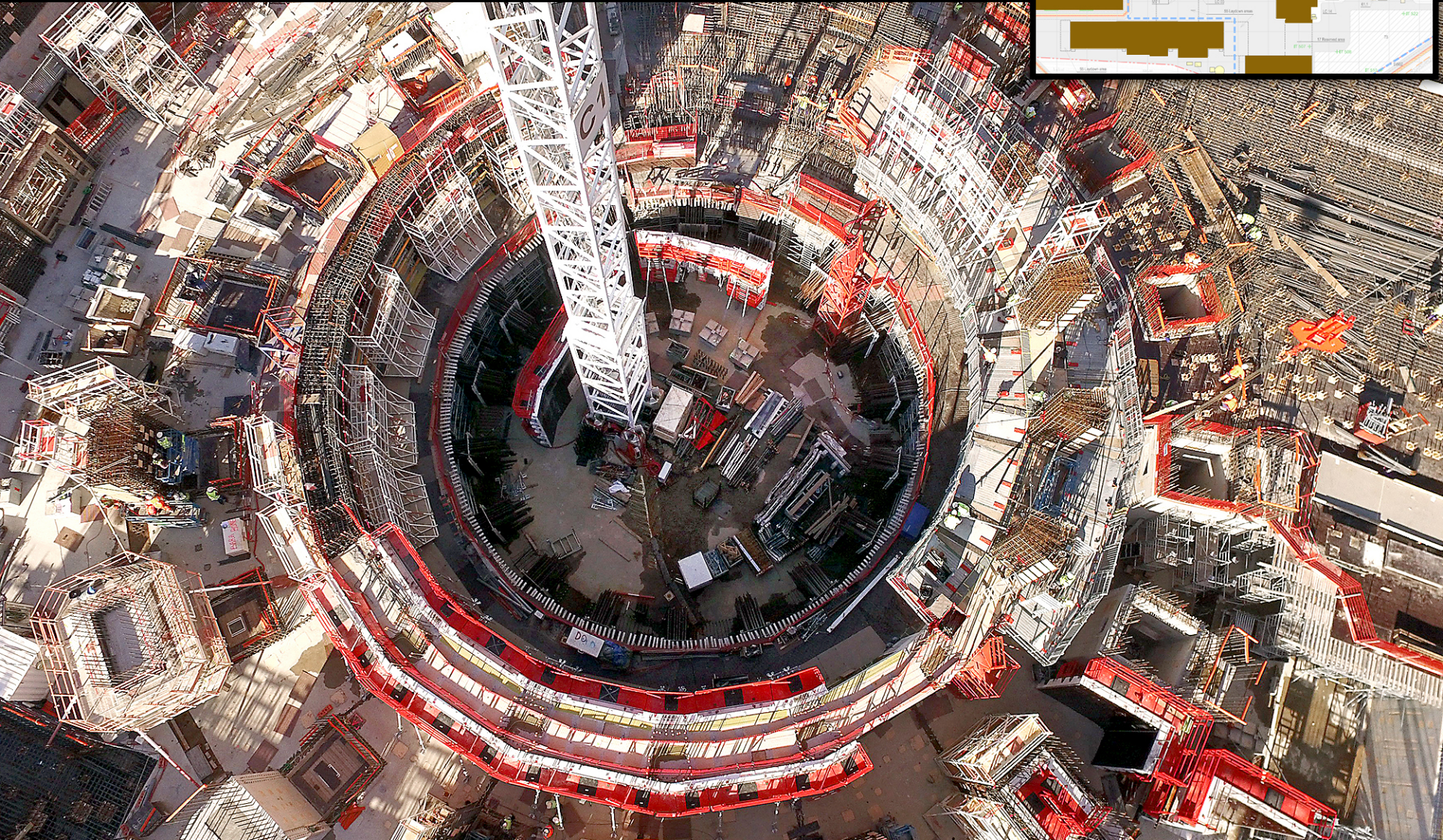
Overview of the ITER Site



Tokamak Complex



Tokamak Pit

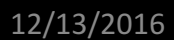


View from Tokamak Pit

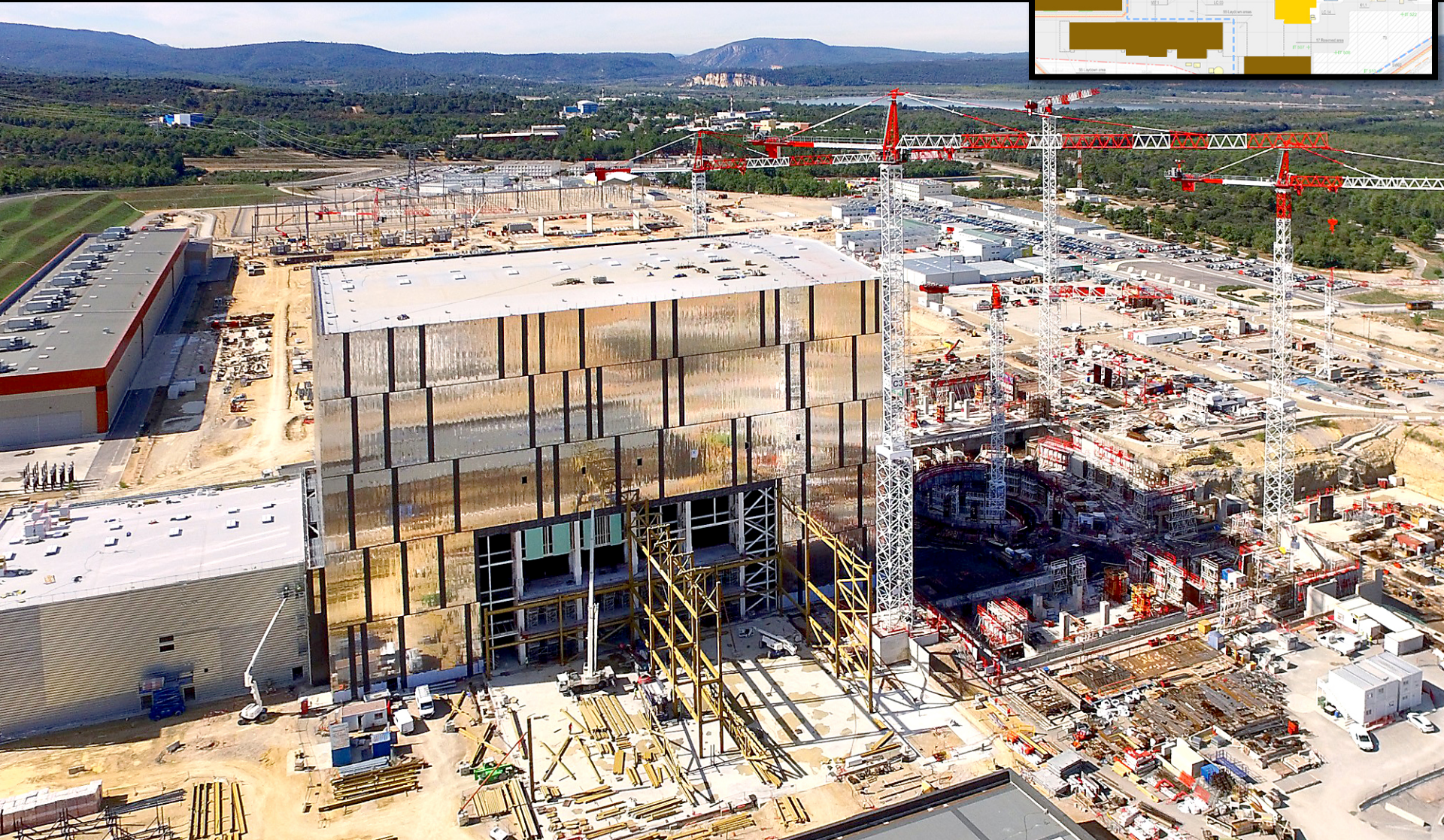


Tokamak Complex Sub-basement





Assembly Building and Cleaning Facility



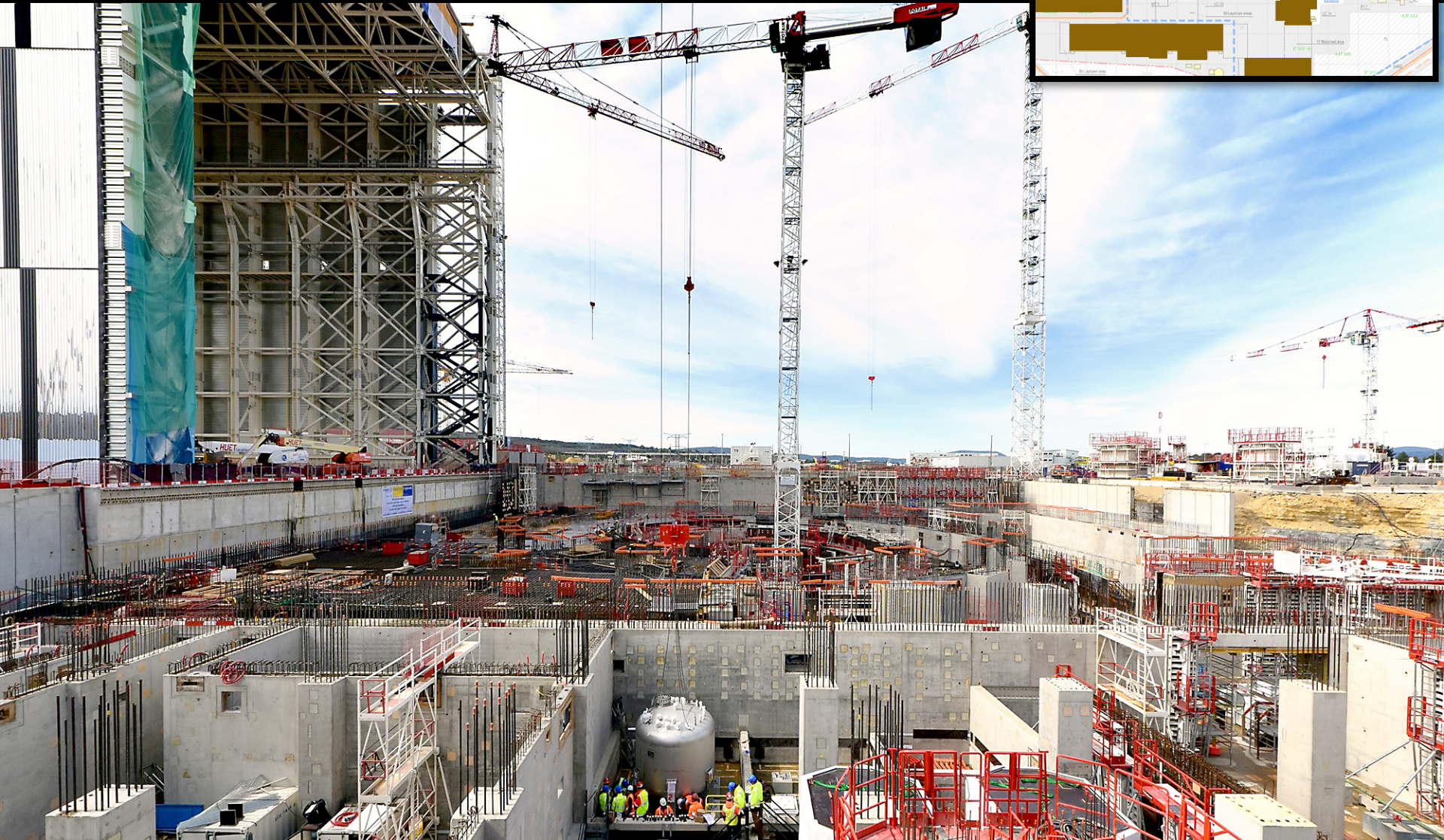
Assembly Building



Tritium Building Construction



First Plant Components Installed



Cryoplant Compressor Building and Coldbox Building

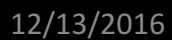


400 kV Switchyard



HV Transformers Installed





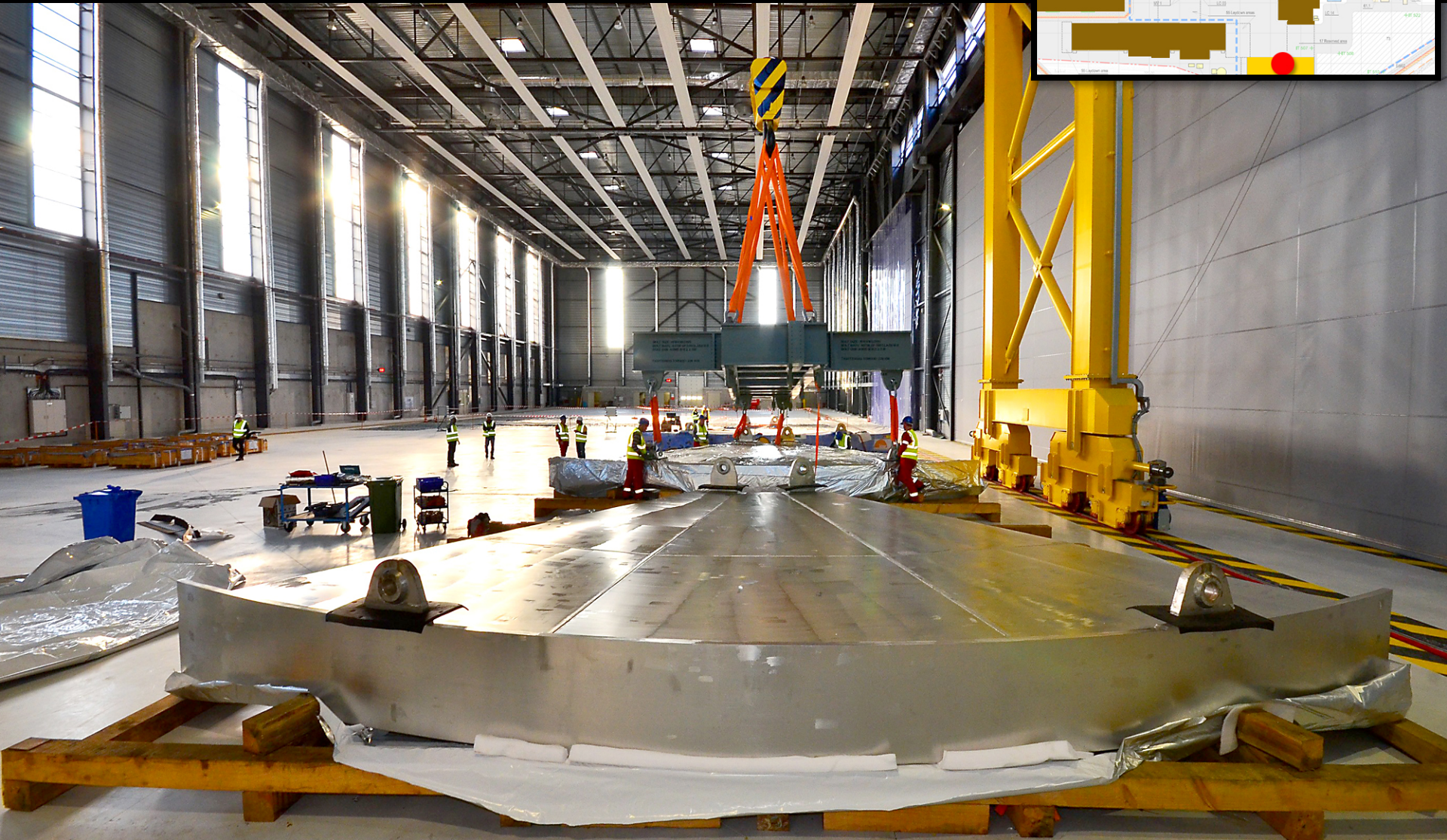
Poloidal Field Coils Tooling Stations



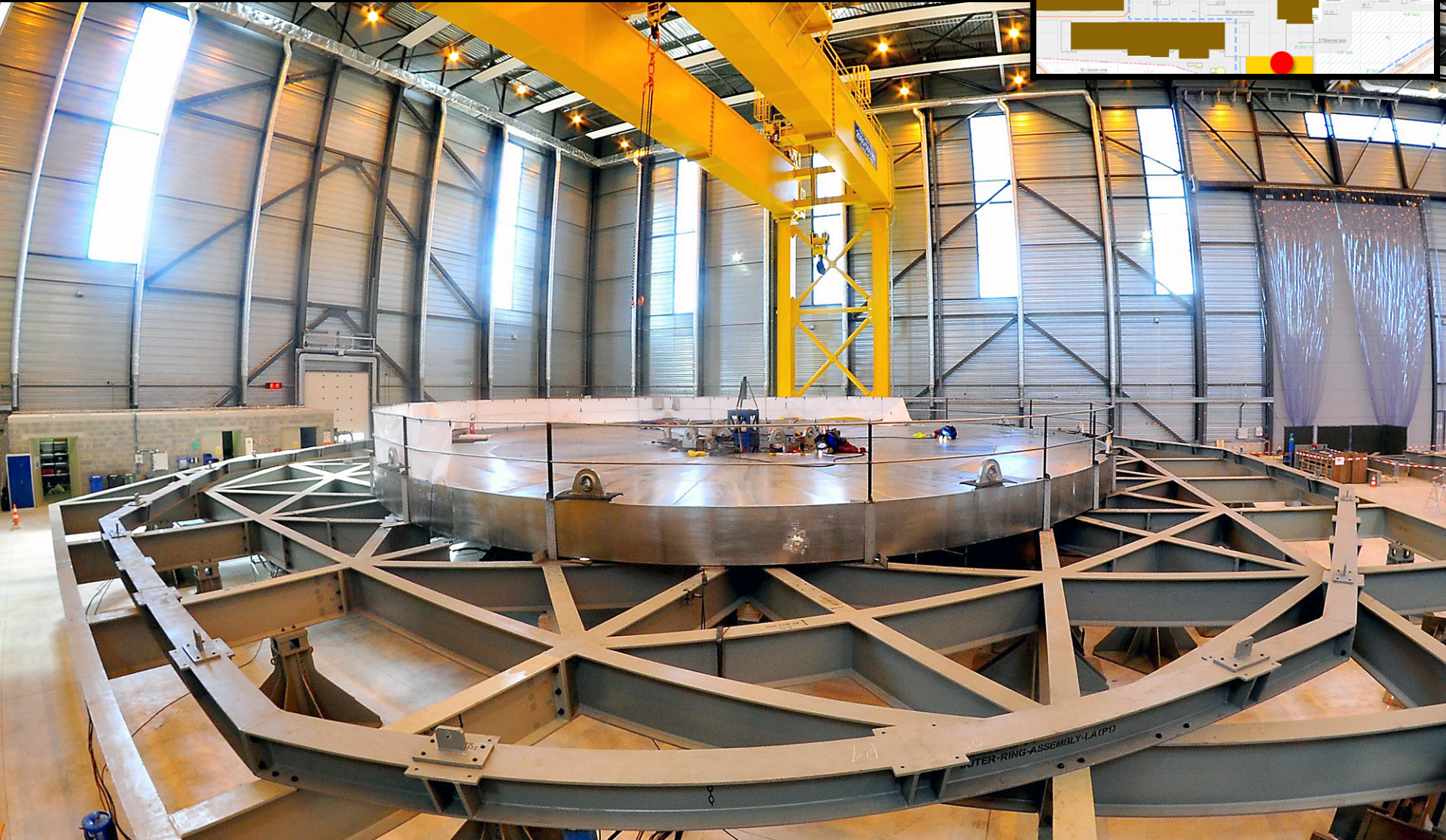
Poloidal Field Coils Winding Station



Inside the Cryostat Workshop



Cryostat Base Welding Underway



Construction-Management-as-Agent Contract Signed



On 27 June, ITER Organization signed a 10-year Construction Management-as-Agent (CMA) contract with the MOMENTUM joint venture, to manage and coordinate the assembly and installation of the Tokamak and associated plant systems.

MOMENTUM

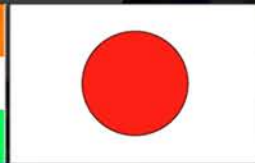


an
assystem



ITER Partner Manufacturing Progress

China • European Union • India • Japan • South Korea • Russia • United States





Manufacturing Progress



Tooling for Poloidal Field coil #6 (the second-smallest ring-shaped ITER magnet, at 350 tons, 10 m in diameter), is complete and is being commissioned at ASIPP in Hefei, China.

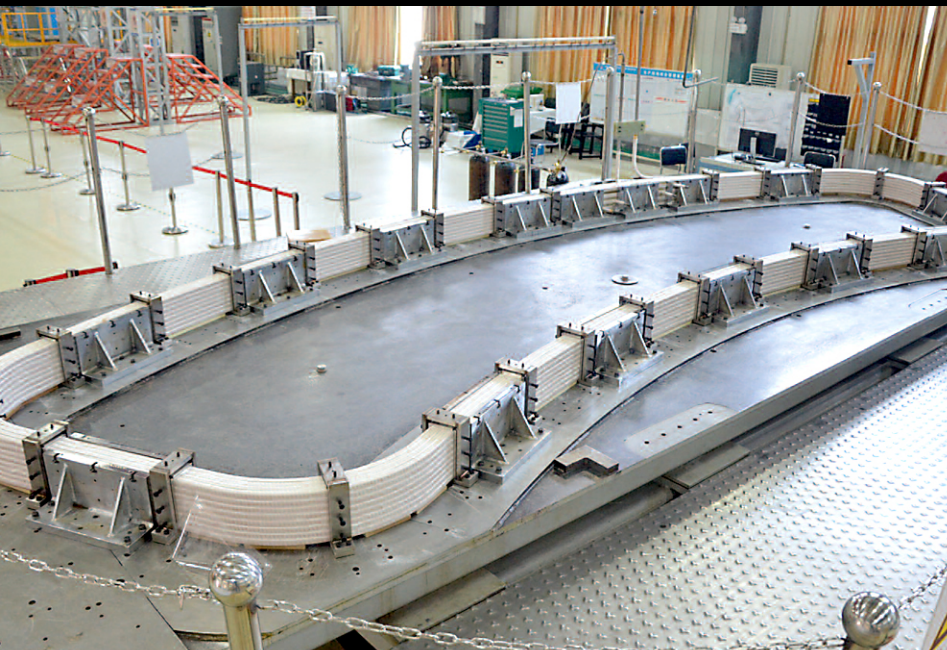


The first pulsed power electrical network transformer has been installed at the ITER site.

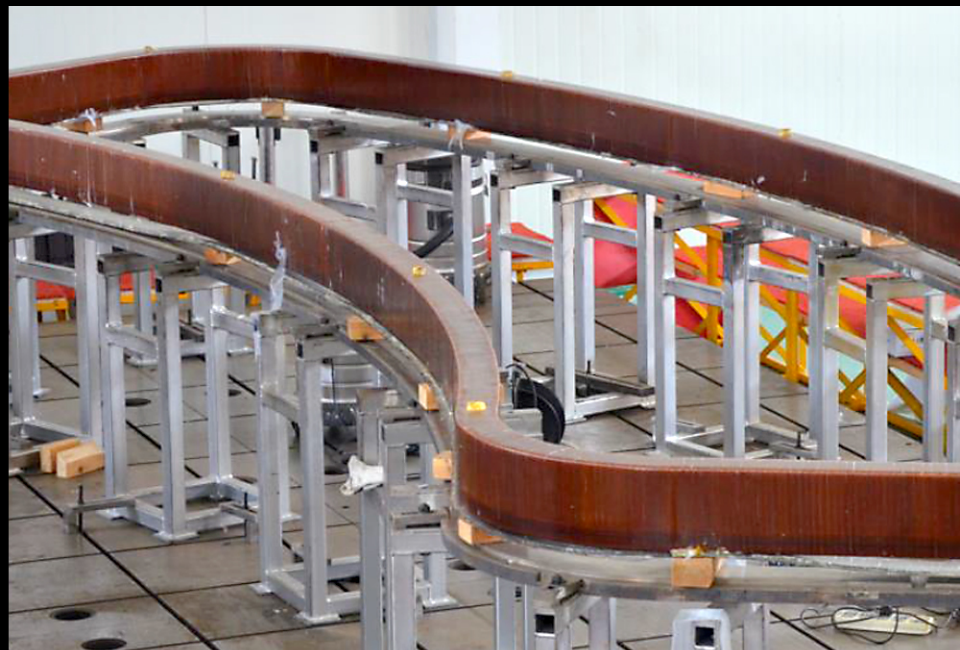
Magnet Systems, Power Systems, Blanket, Fuel Cycle, Diagnostics



Manufacturing Progress



At the Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP), the first-of-series, multiple-pancake bottom correction coil winding is prepped for the wrapping of ground insulation.



Correction coil vacuum pressure impregnation of a dummy double pancake at ASIPP.

Magnet Systems, Power Systems, Blanket, Fuel Cycle, Diagnostics



Manufacturing Progress



The first resin impregnated toroidal field coil winding pack was completed at ASG in La Spezia, Italy.

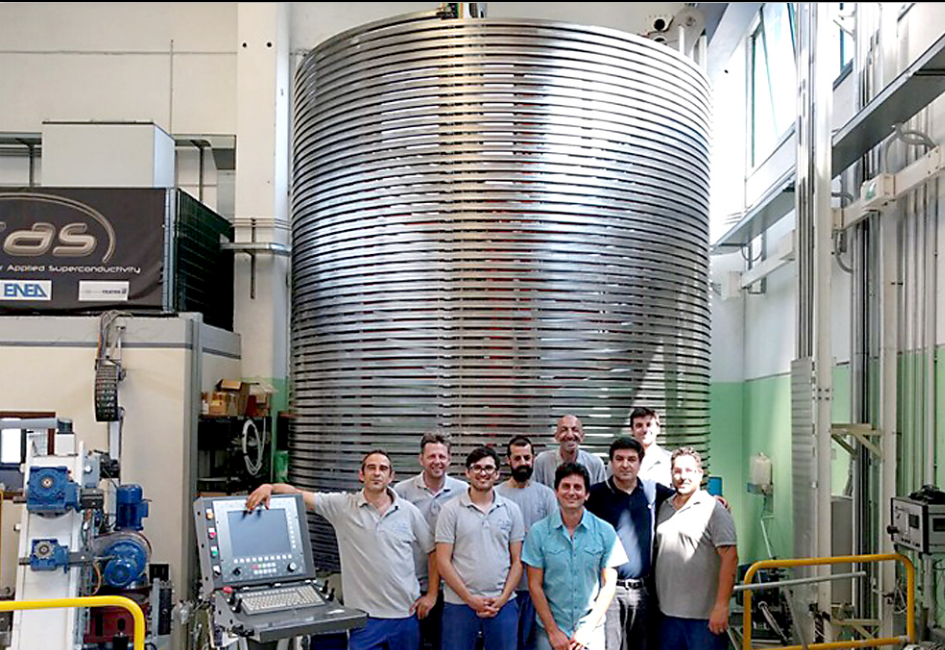


Quench tanks for the ITER cryoplat have been delivered to the site.

Building, Magnet Systems, Heating & Current Drive Systems, Vacuum Vessel, Divertor, Blanket, Power Systems, Fuel Cycle, Tritium Plant, Cryoplat, Diagnostics, Radioactive Materials



Manufacturing Progress



Production was completed for European poloidal field coils conductor.

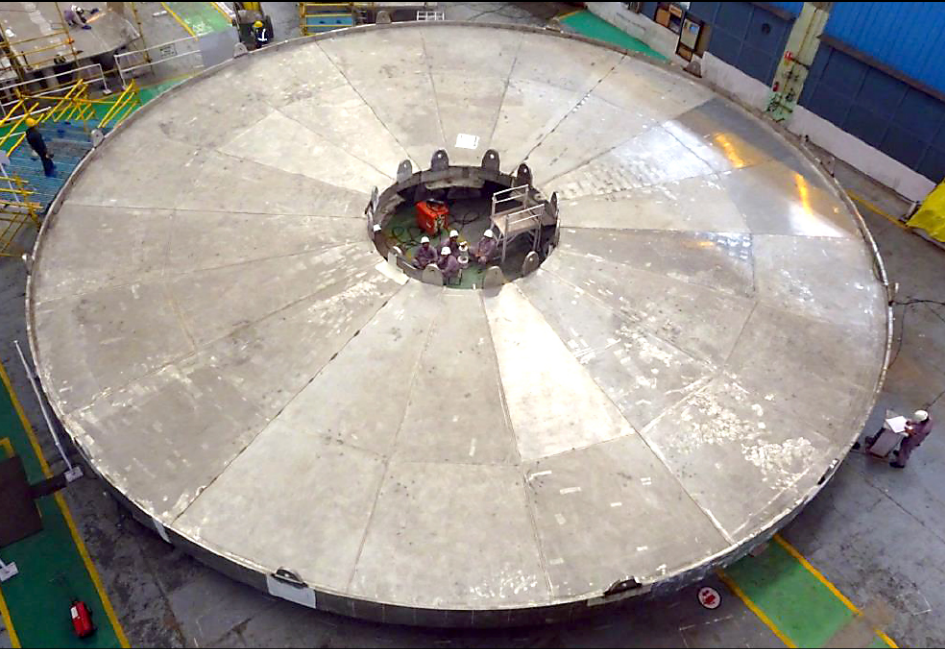


Part of the 35 m long transmission line which is connected to the SPIDER vessel at the Neutral Beam Testing Facility (NBTF) site in Padua, Italy.

Building, Magnet Systems, Heating & Current Drive Systems, Vacuum Vessel, Divertor, Blanket, Power Systems, Fuel Cycle, Tritium Plant, Cryoplant, Diagnostics, Radioactive Materials



Manufacturing Progress



India is responsible for fabrication and assembly of the 30 x 30 m ITER cryostat. The base plates were delivered to ITER in December 2015.



In the cryostat manufacturing facility, a segment of the pedestal ring (part of tier 2 of the base) is inspected before delivery to ITER.

**Cryostat, Cryogenic Systems, Heating and Current Drive Systems,
Cooling Water System, Vacuum Vessel, Diagnostics**



Manufacturing Progress



Thousands of in-wall shielding components have been manufactured, passed factory acceptance testing, and are being prepared for shipment.

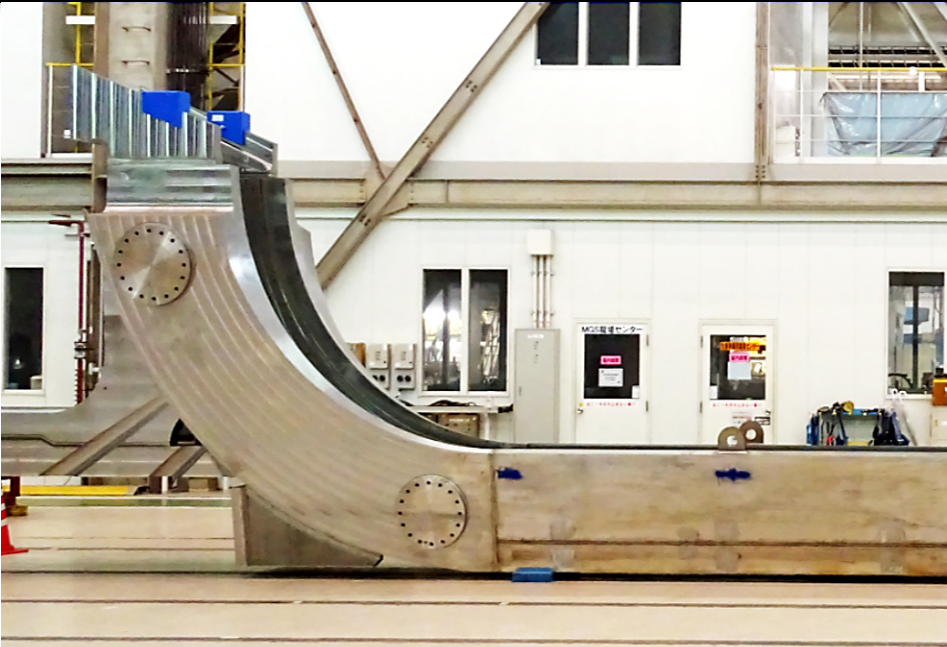


A 3 MW radio frequency high voltage power supply was successfully operated at ITER parameters.

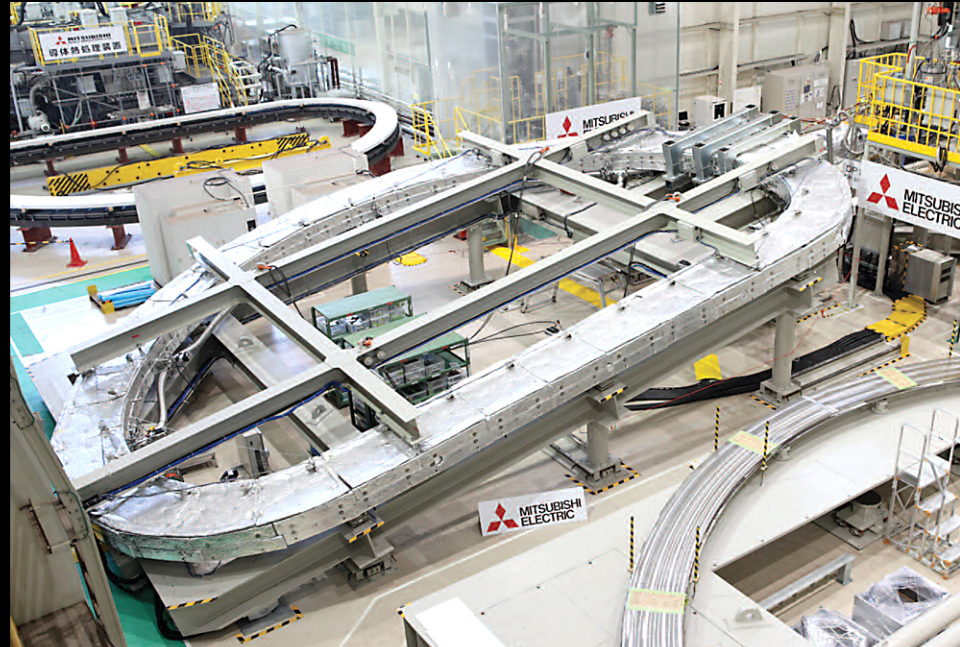
**Cryostat, Cryogenic Systems, Heating and Current Drive Systems,
Cooling Water System, Vacuum Vessel, Diagnostics**



Manufacturing Progress



Connection of segments for the first inboard toroidal field coil structure.



Toroidal field pancake series production at Mitsubishi Heavy Industries' Futami factory.

Magnet Systems, Heating & Current Drive Systems, Remote Handling, Divertor, Tritium Plant, Diagnostics



Manufacturing Progress



Series production of central solenoid conductor continues. 28 of 49 conductors have already been shipped to the US.



Assembly tests on the 1 MV bushing at Hitachi for the full-scale ITER neutral beam injector.

Magnet Systems, Heating & Current Drive Systems, Remote Handling, Divertor, Tritium Plant, Diagnostics



Manufacturing Progress



Port stub assembly for Sector 6 of the vacuum vessel.



Vacuum vessel Sector 6 inner shell assembly, showing poloidal "t-ribs."

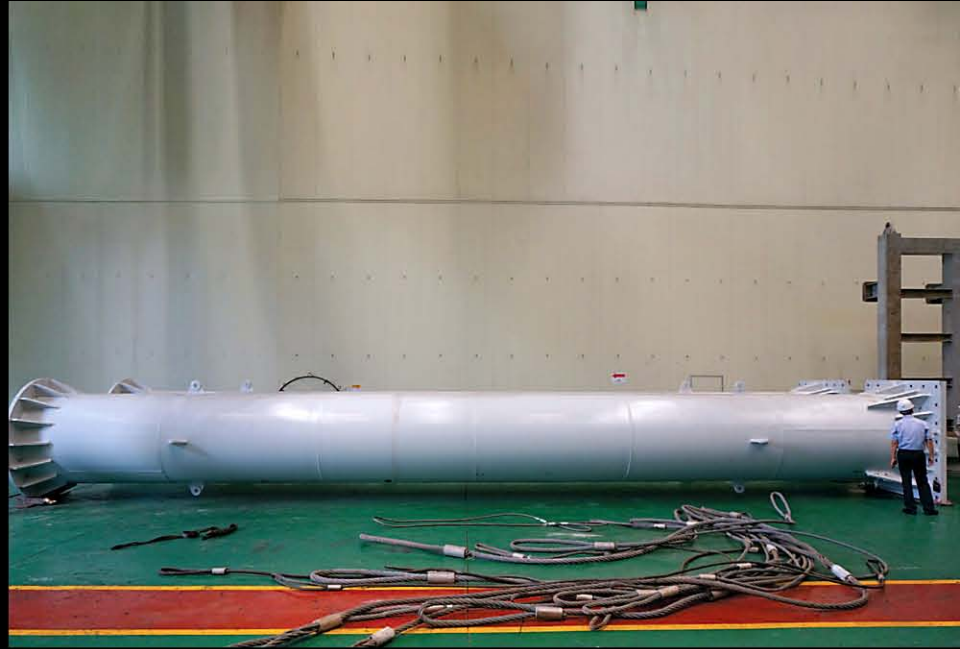
**Vacuum Vessel, Blanket, Power Systems, Magnet Systems,
Thermal Shield, Assembly Tooling, Tritium Plant, Diagnostics**



Manufacturing Progress



At Sam Hong Machinery in Changwon, fabrication is progressing on all nine 40° thermal shield sectors, including outboard welding (above).



Staff inspects the outboard columns of the giant sector sub-assembly tool at Taekyung Heavy Industries in Changwon.

**Vacuum Vessel, Blanket, Power Systems, Magnet Systems,
Thermal Shield, Assembly Tooling, Tritium Plant, Diagnostics**



Manufacturing Progress



Russia completed its share of toroidal field conductor in June 2015, marking the end of a 5-year campaign to manufacture 28 production lengths (more than 120 tons of material).



Welding of double-wall parts of the Upper Port Stub Extensions #12 and 02 for the vacuum vessel are complete.

Power Systems, Magnet Systems, Blanket, Divertor, Vacuum Vessel, Diagnostics, Heating & Current Drive Systems



Manufacturing Progress



Winding of a double pancake for poloidal field coil 1.

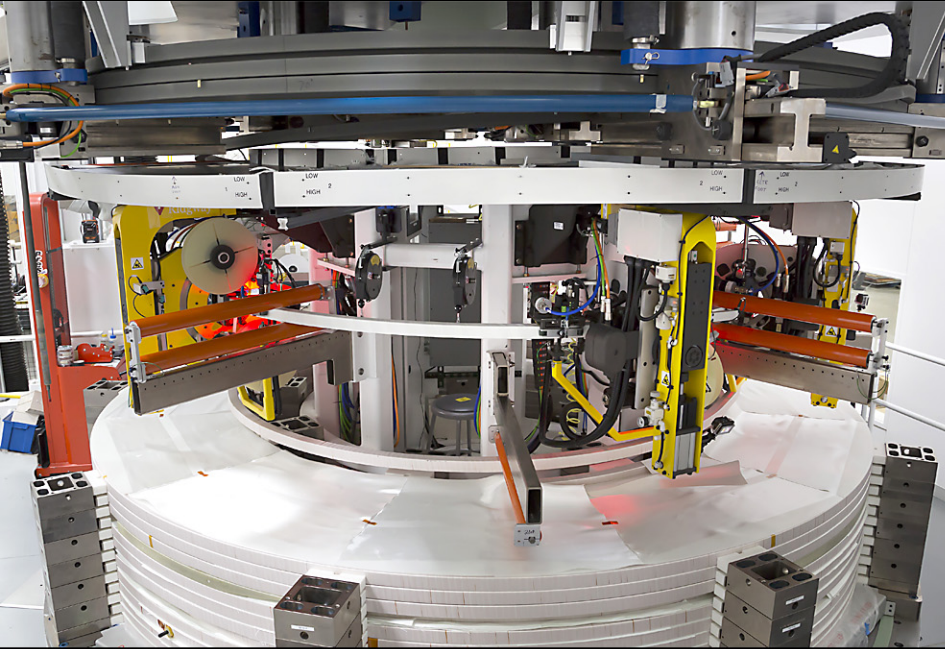


Vacuum pressure impregnation of a dummy poloidal field coil.

**Power Systems, Magnet Systems, Blanket, Divertor, Vacuum Vessel,
Diagnostics, Heating & Current Drive Systems**



Manufacturing Progress



Turn insulation of the central solenoid mock-up coil has been completed.



Tie plates for the central solenoid structure are being machined.

**Cooling Water System, Magnet Systems, Diagnostics,
Heating & Current Drive Systems, Fuel Cycle, Tritium Plant, Power Systems**



Manufacturing Progress



The US has delivered an array of components for the steady state electrical network and will complete deliveries in 2017.

Integrated conductor at Criotec in Chivasso, Italy. The US will complete toroidal field coil conductor fabrication in 2017.

**Cooling Water System, Magnet Systems, Diagnostics,
Heating & Current Drive Systems, Fuel Cycle, Tritium Plant, Power Systems**

ITER Council Update



china eu india japan korea russia usa

“ITER Council endorsed an updated schedule for the ITER Project through First Plasma and to Deuterium-Tritium Operation.”

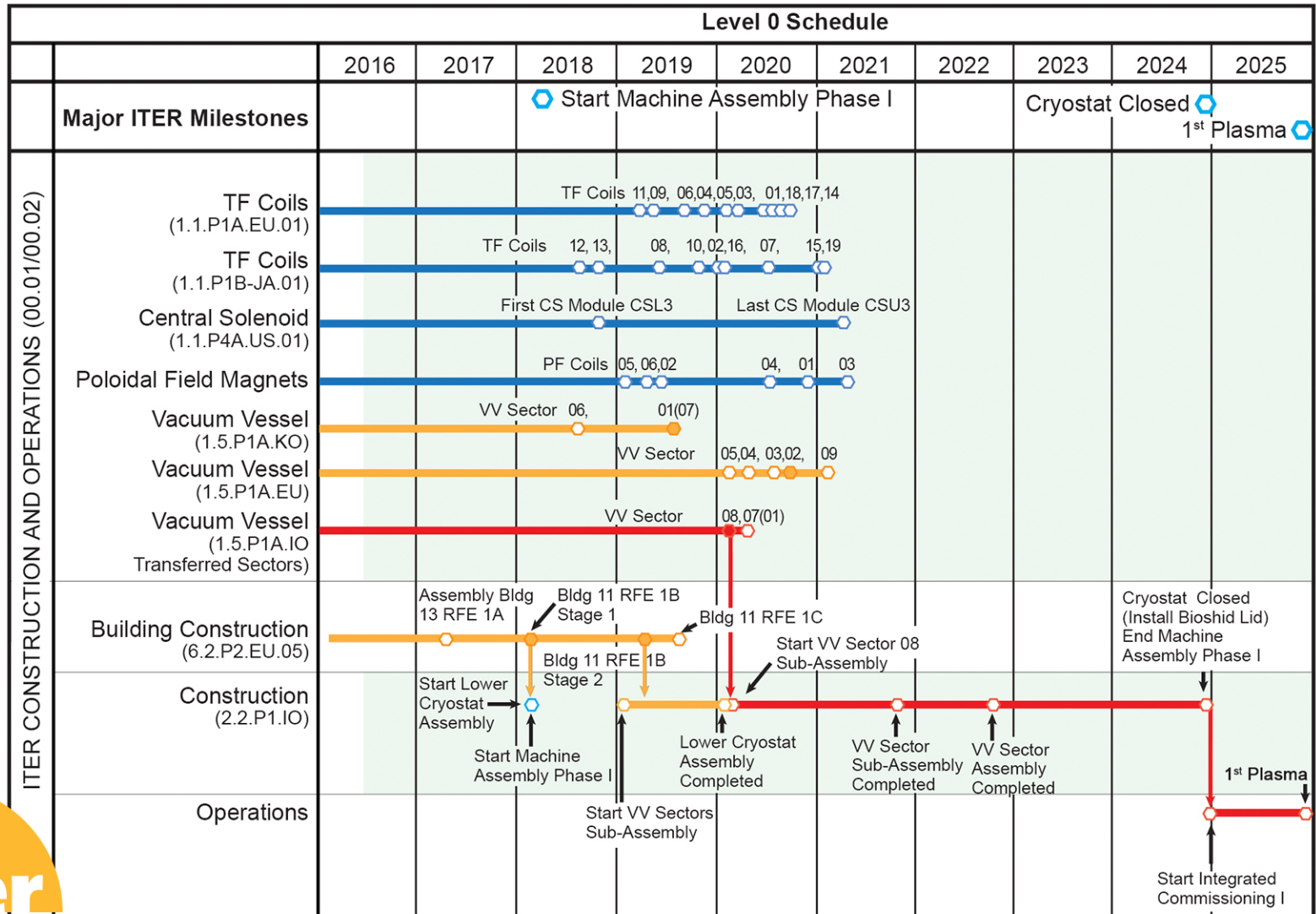


“The Council concluded that:

- Project construction and manufacturing have sustained a rapid pace for the past 18 months...**
- The staged approach as selected in the updated schedule after First Plasma increases confidence and minimizes risk by focusing on completing ITER in stages...**
- The continued evidence of effective decision-making, deep understanding and prompt mitigation of risks, and rigorous adherence to standards of quality, safety and schedule commitments provide a strong basis for confidence that the project will maintain its current positive momentum.”**

Source: Press Release, ITER Organization, 17 November 2016

Major Assembly Milestones

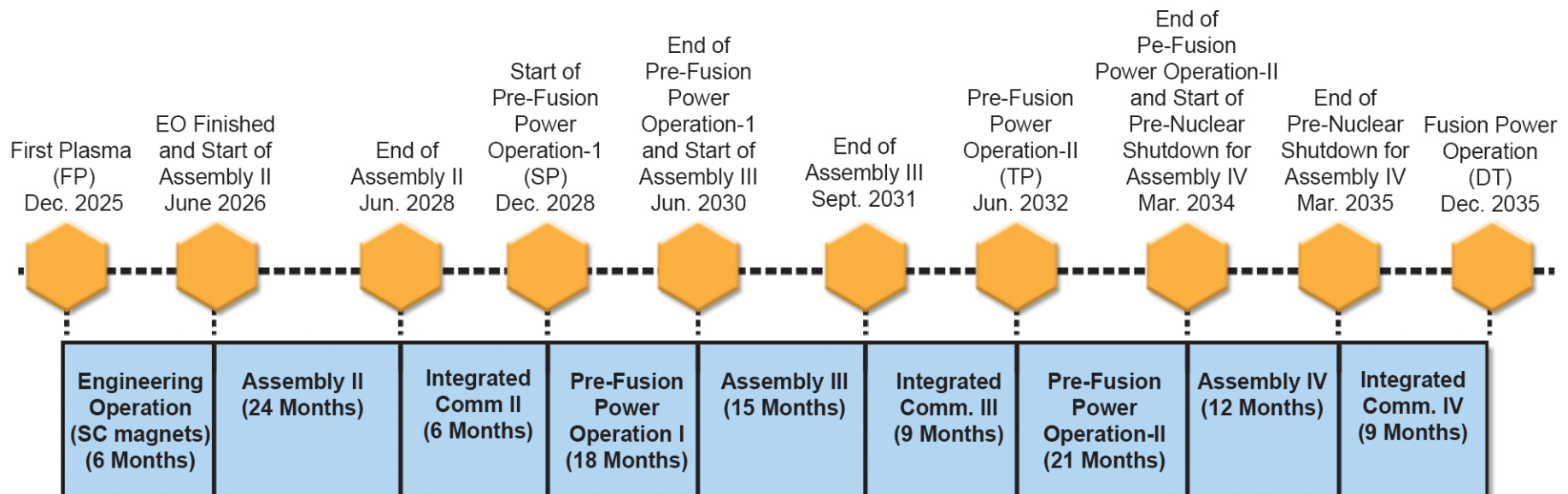


A Staged Approach to DT Plasma



Extensive interactions among IO and Das to finalize revised baseline schedule proposal

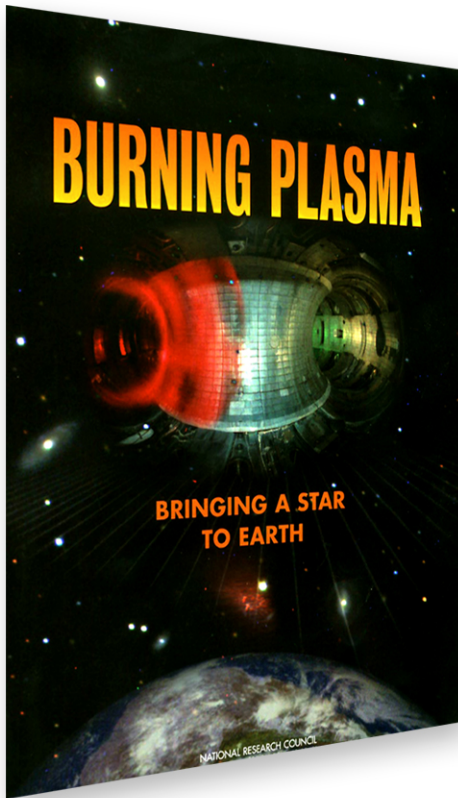
- ✓ Schedule and resource estimates through First Plasma (2025) consistent with Members' budget constraints
- ✓ Proposed use of 4-stage approach through Deuterium-Tritium (2035) consistent with Members' financial and technical constraints



US Update



ITER's Role in the US Fusion Program

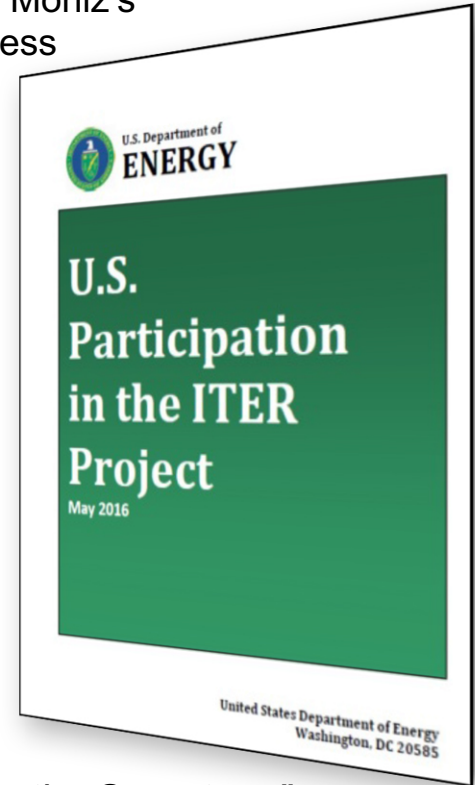


National Research Council (2004)

From the “Executive Summary”:

“...A burning plasma...is an essential step to reach the goal of fusion power generation....The committee concluded that there is high confidence in the readiness to proceed with the burning plasma step. The International Thermonuclear Experimental Reactor (ITER), with the United States as a significant partner, was the best choice. Once a commitment to ITER is made, fulfilling it should become the highest priority of the U.S. fusion research program.”

DOE Secretary Moniz's report to Congress (May, 2016)

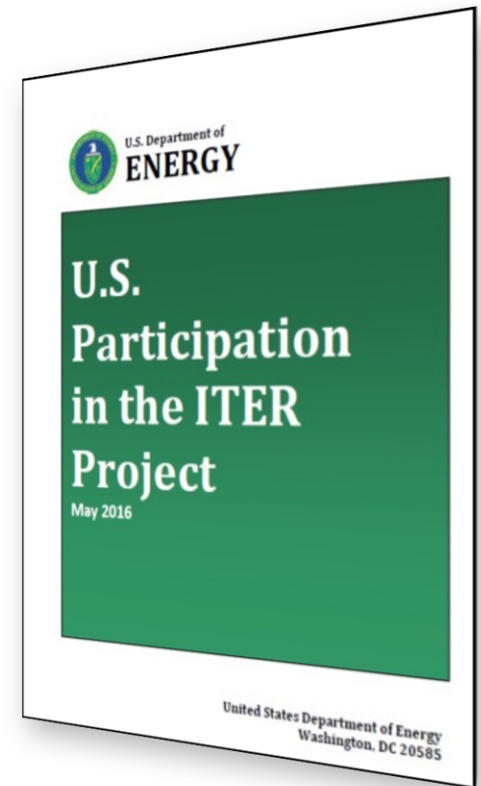


From the “Message from the Secretary”:

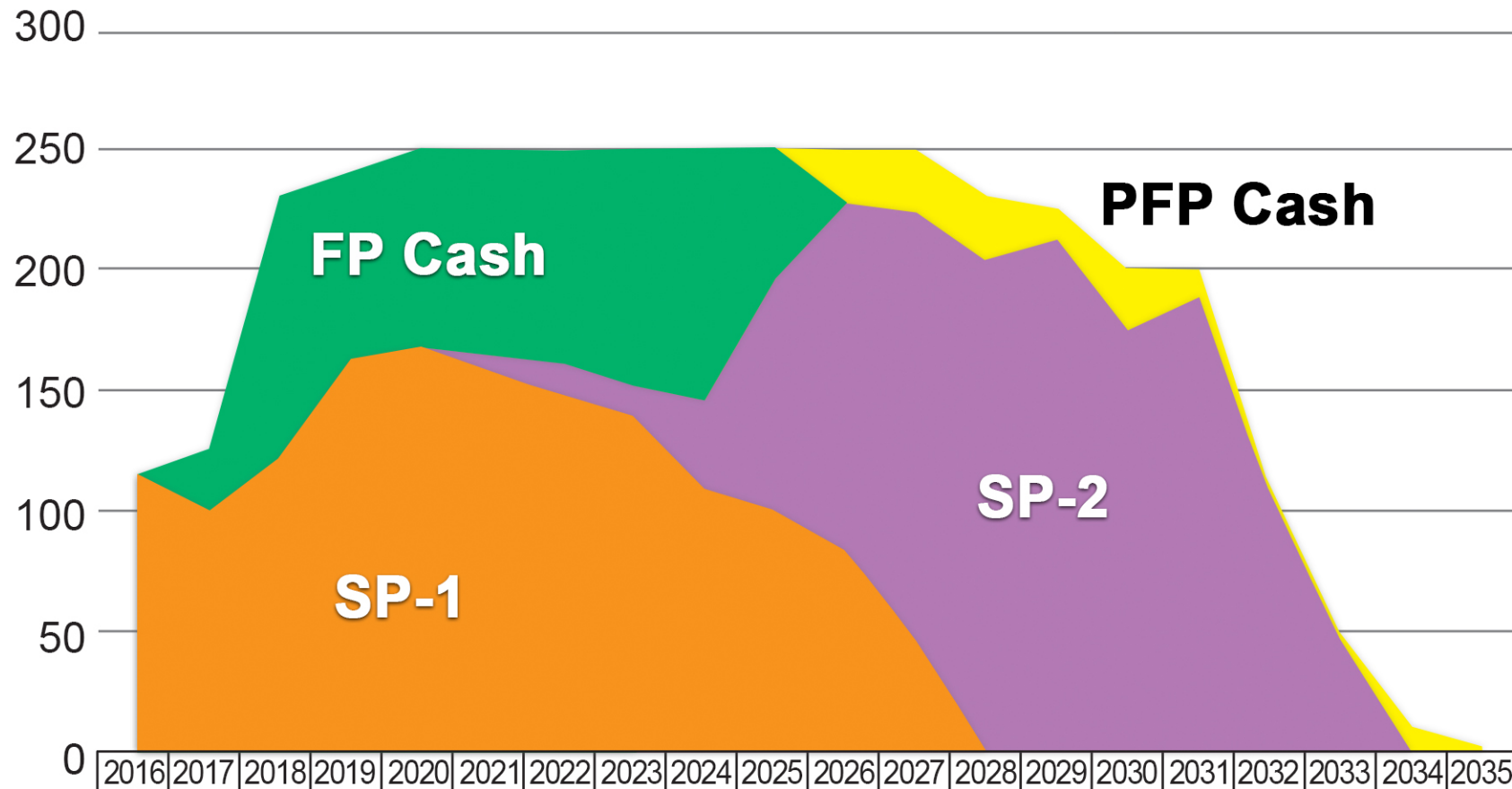
“ITER remains the best candidate today to demonstrate sustained burning plasma, which is a necessary precursor to demonstrating fusion energy power.”

Secretary's Report to Congress: Highlights

- “The project appears to be technically achievable, although significant technical and management risks remain.”
- “The U.S. ITER in-kind contributions have been designed, constructed and delivered consistent with the key milestones. Four of the twelve U.S. hardware systems are currently in final fabrication.”
- “DOE recommends continuing the reforms already underway, implementing additional measures as described in this report, and revisiting this recommendation as part of the FY 2019 budget process (end of 2017 to early 2018).”



S-1's Report's "2028" Budget Profile



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
■ PFP Cash	0	0	0	0	0	0	0	0	0	0	23	26	25	13	25	11	3	3	10	2
■ FP Cash	0	25	108	77	82	85	88	98	105	54	0	0	0	0	0	0	0	0	0	0
■ PFP Hardware	0	0	0	0	0	8	13	13	36	96	144	178	205	212	175	189	107	45	0	0
■ FP Hardware	115	100	122	163	168	157	148	139	109	100	83	45	0	0	0	0	0	0	0	0

US ITER CD-2/3 Review (November 14-17, 2016)



**DOE/SC OPA Assessment of US ITER Project
USIPO, Oak Ridge, Tennessee
November 14 - 17, 2016**

