

# The ITER Project

*Progress amid challenges*



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**2<sup>nd</sup> Fusion Forum Deutschland**  
**8 December 2022**

# Agenda

1. Project Progress
2. Addressing Challenges
3. Appointment of new DG
4. Follow up from 1<sup>st</sup> FFD
5. Q&A



# Project Progress



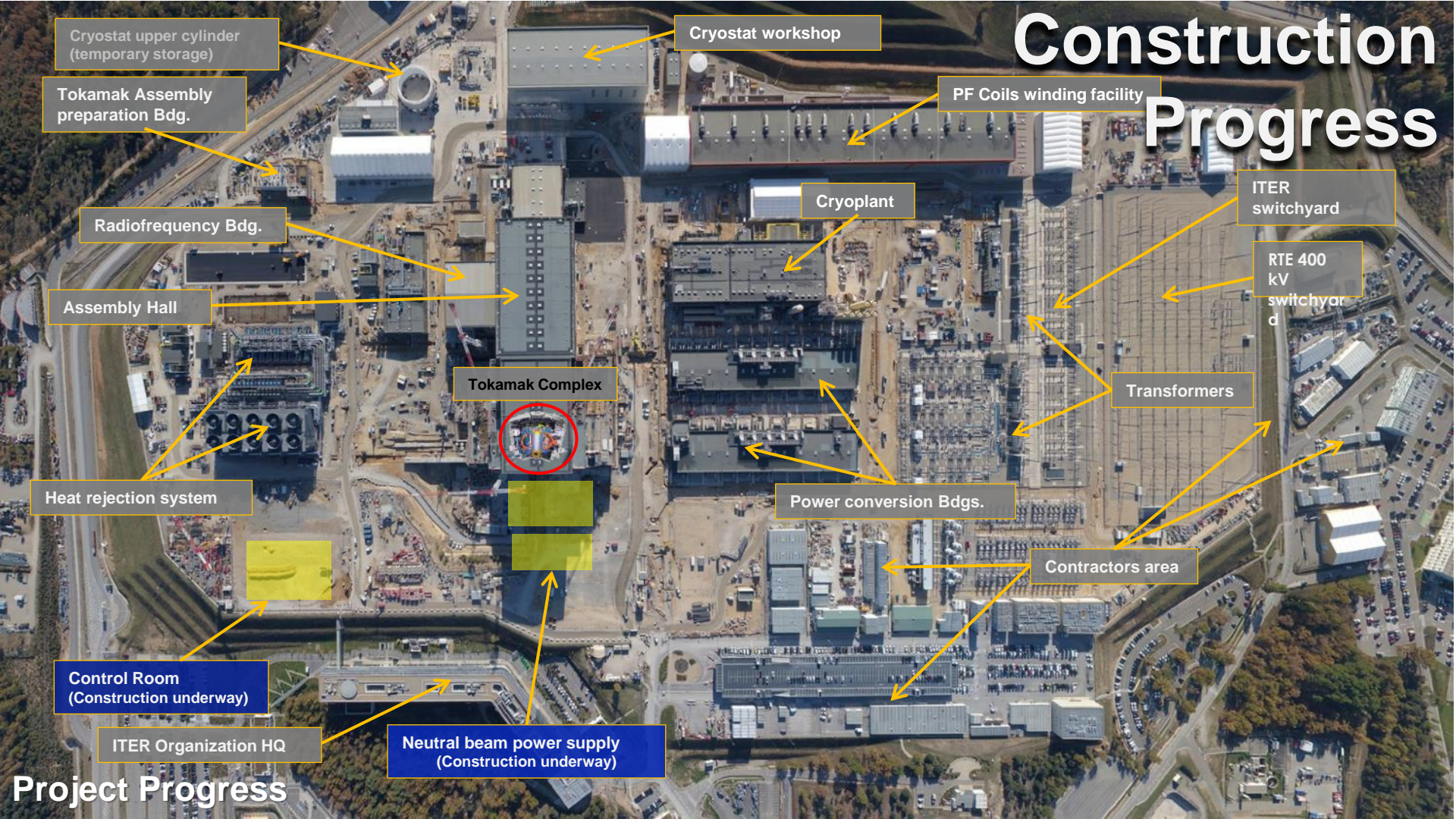
# Eight years of steady progress

2014–2022



**>80% of civil works complete**

# Construction Progress



Cryostat upper cylinder  
(temporary storage)

Tokamak Assembly  
preparation Bdg.

Radiofrequency Bdg.

Assembly Hall

Heat rejection system

Control Room  
(Construction underway)

ITER Organization HQ

Neutral beam power supply  
(Construction underway)

Cryostat workshop

Cryoplant

PF Coils winding facility

Tokamak Complex

Power conversion Bdgs.

ITER  
switchyard

RTE 400  
kV  
switchyard

Transformers

Contractors area

## Project Progress

# Two years of recent progress: Tokamak Complex



Tokamak Complex,  
Project Progress March 2020



First crane access from Assembly  
Hall to Tokamak Building,  
28 March 2020



# A crucial milestone

On May 26-27 2020, the 1,250-tonne base of the Cryostat (procured by India) was successfully inserted into the Tokamak Assembly Pit.

Project Progress

# A crucial milestone



The Cryostat Base, 30 metres in diameter, was positioned with a final tolerance under 3 mm at all metrology points



# Celebrating Start of Machine Assembly

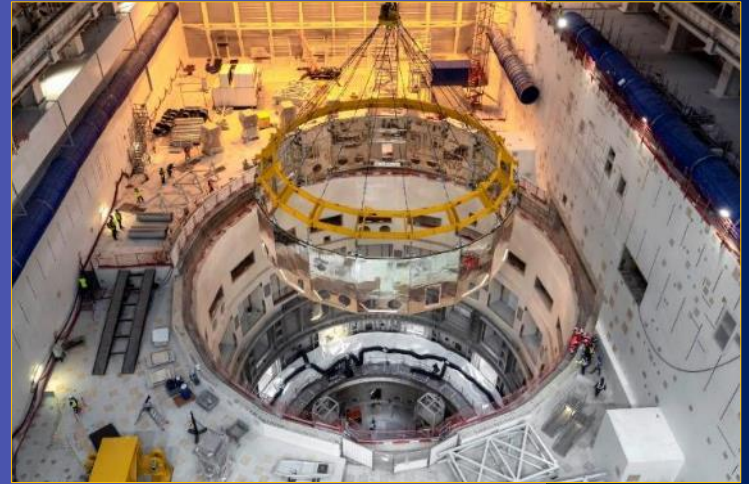


On 28 July 2020, ITER celebrated the Start of Machine Assembly with a virtual ceremony, hosted by French President Emmanuel Macron, with contributions from 7 ITER Heads of State and multiple ministers

# Two years of recent progress: Tokamak Complex

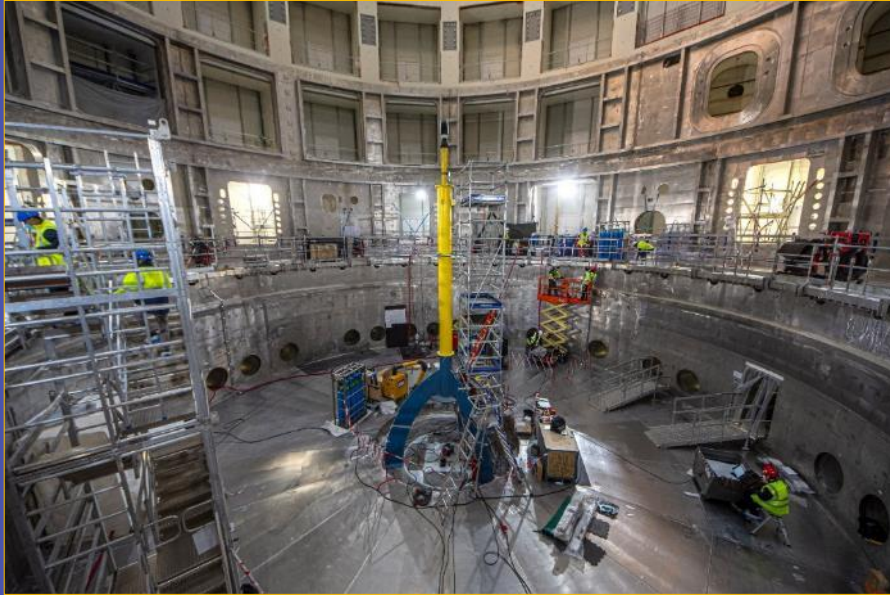


**Cryostat Lower Cylinder lift,  
31 August 2020**



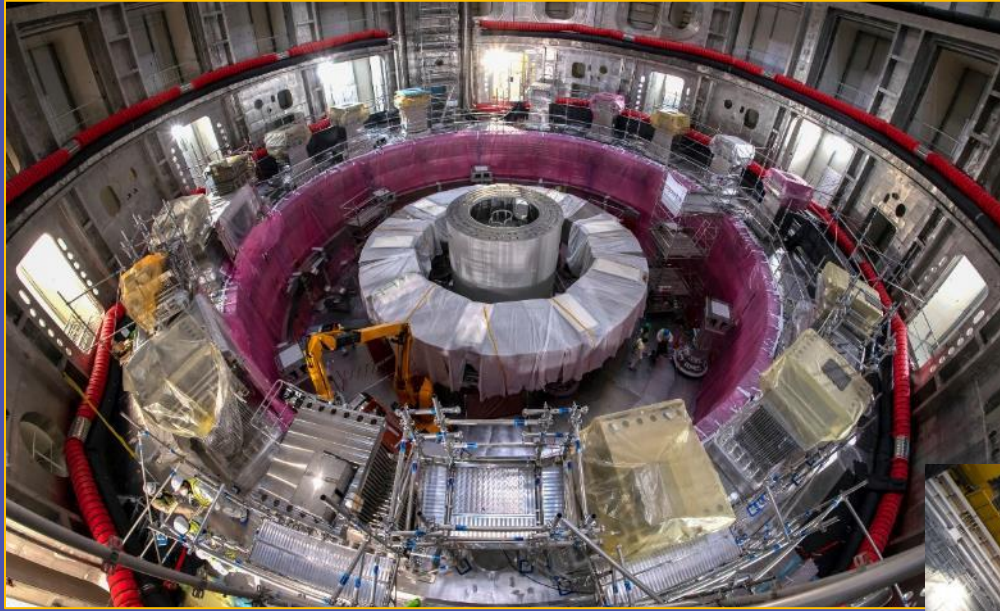
**Inserting the Cryostat  
Thermal Shield,  
14 January 2021**

# Two years of recent progress: Welding cylinder to base



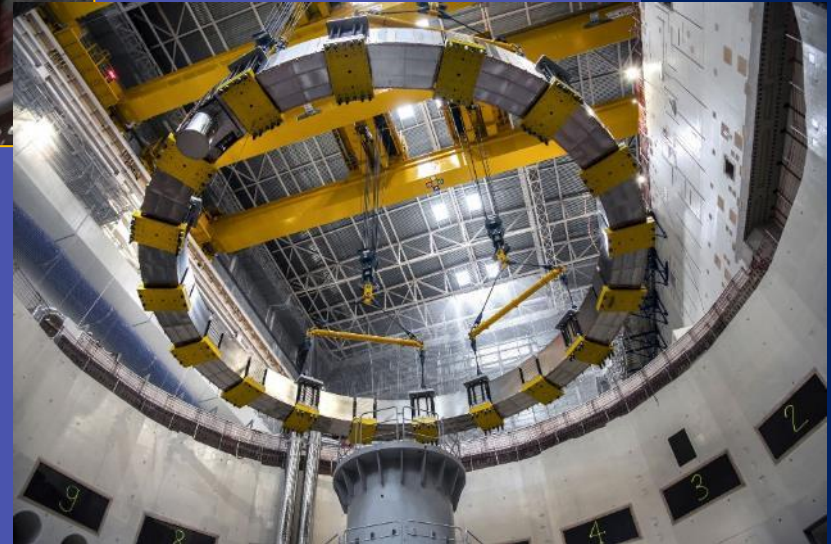
The Cryostat Base and Lower Cylinder are now welded together (combination of manual and robotic welding). Non-destructive leak tests are ongoing.

# First Magnets Installed



Poloidal Field Coil #6  
April 2021

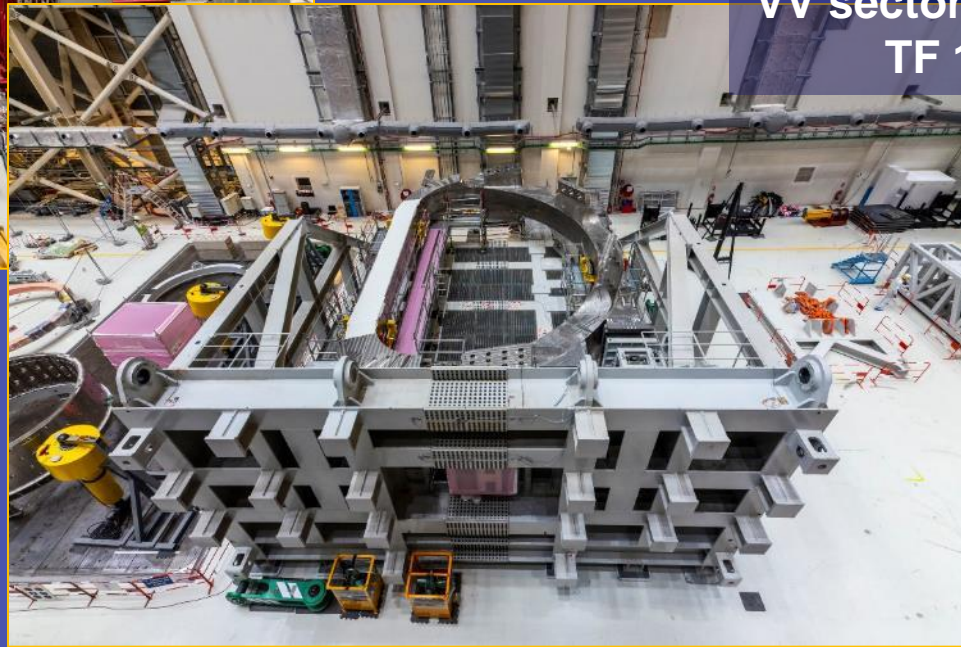
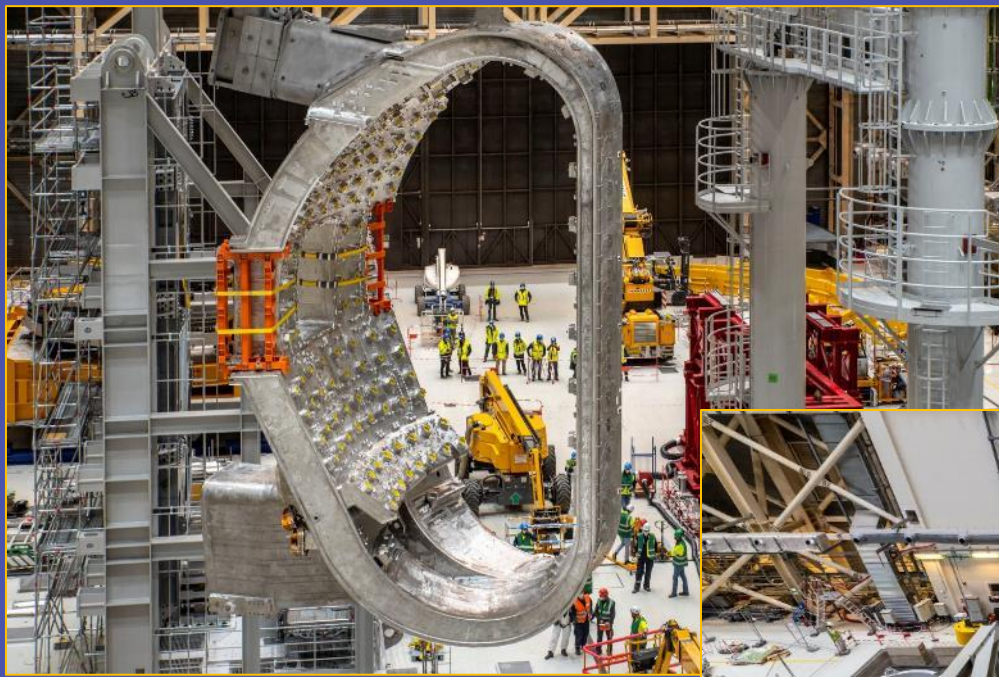
Poloidal Field Coil #5  
August 2021



# First Sector Subassembly

May-June 2021

VV sector 6 (Korea);  
TF 12 (Japan).



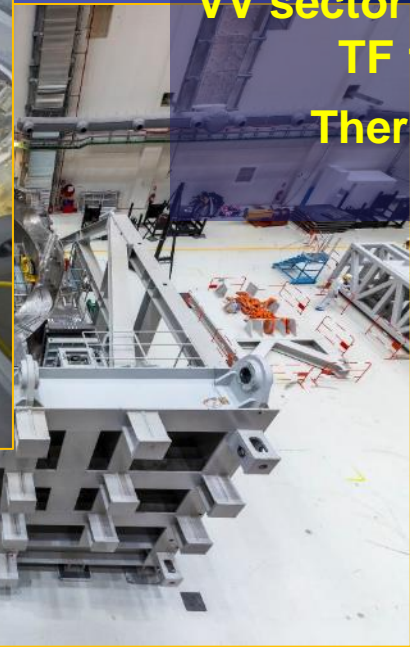
Project Progress

# First Sector Subassembly

May-June 2021

VV sector 6 (Korea);  
TF 12 (Japan)

Thermal shield  
(Korea).



Project Progress

# And the second ...

January 2022



December 2021

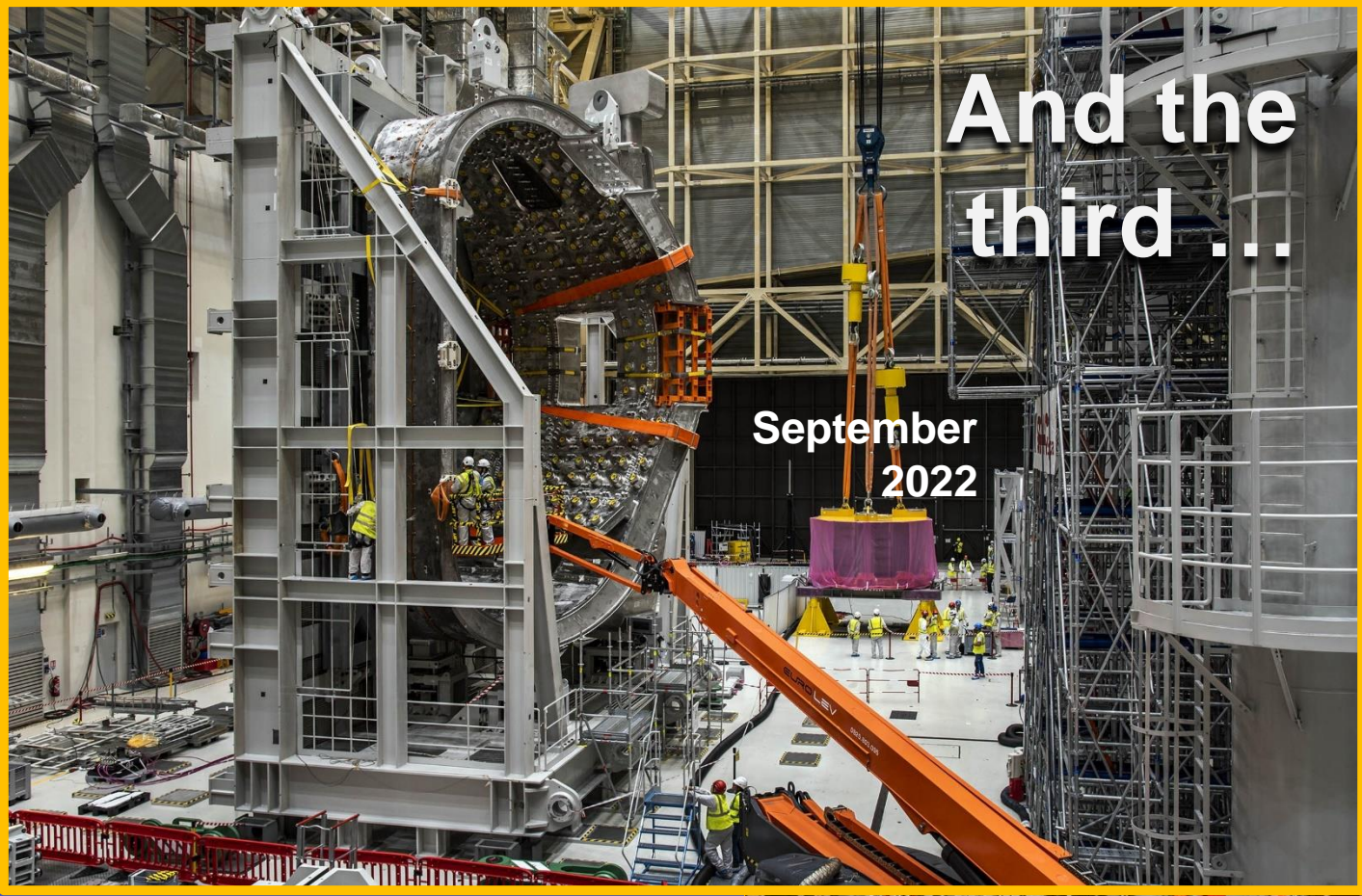


Project Progress

And the  
second ...

And the  
third ...

September  
2022



Project Progress





**Project Progress**

**Installation of Vacuum  
Vessel Sector Module 6  
(May 2022)**



**First Central Solenoid  
module in preparation,  
February 2022**

**Project Progress**



Second CS module  
September 2022

First Central Solenoid  
module in preparation,  
February 2022

Project Progress



**Project Progress**

**Control Building (B71)**



We have delivered

LAFORT

Area 30

Four of 13 steel frames in place for the Neutral Beam High Voltage Building

Project Progress



Project Progress

**Radiofrequency Building:  
One of the two sets of high-voltage power supplies for the electron  
cyclotron resonance heating (ECRH) system is installed (Nov 2022).**

# Cryogenics Plant and System

Cryoplant and  
cryoline  
installation



Project Progress

# Cryogenics Plant and System

Start of liquid helium plant commissioning, 30 November 2021

Project Progress





# Cryogenics Plant and System



**Cryoplant: installation complete, progressing to commissioning**  
**- Liquid Nitrogen Plant: filling tank to evaluate evaporation rate (May 2022)**

Project Progress

# Cryogenics Plant and System



Project Progress

~75% of cryolines have been installed  
(Oct 2022).

# Cryogenics Plant and System



Project Progress

~75% of cryolines have been installed  
(Oct 2022).

# Electrical Networks

January 2019:  
Connected to  
French grid

June 2021:  
Reactive power  
compensation  
nears finalization.



Project Progress

# Magnet Power Conversion

Components from China, India, Korea and Russia.



Project Progress

# Magnet Power Conversion

Underground infrastructure includes cooling water for electrical components



82% of the equipment has now been installed in the Magnet Conversion buildings (100% in Building 33), March 2022



# Heat Rejection System

ITER's cooling water systems will be capable of removing ~1.2 gigawatts of heat.



Project Progress

# Manufacturing and Deliveries



BRINGING THE POWER OF THE SUN TO EARTH  
ITER



Project Progress

PF Coil manufacturing essentially complete



# Manufacturing and Deliveries



First correction coils installed



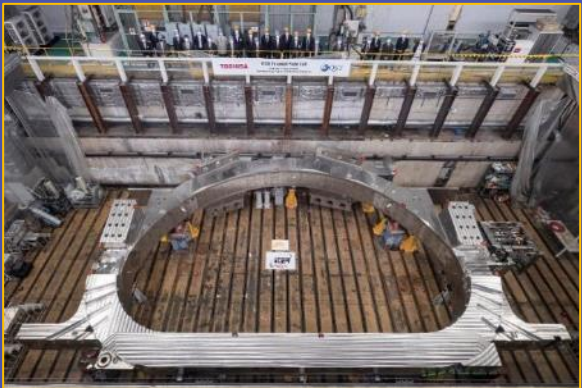
Cryostat completion celebrated in March 2022



Five vacuum vessel sectors in advanced fabrication



Multiple TF coils delivered, two installed



# Manufacturing and Deliveries



Three VV sectors delivered (most recent was 1 April 2022)



Poloidal field coil #1 ready for shipment



Two central solenoid modules delivered, five more in late stages of fabrication

# Manufacturing and Deliveries



Three VV sectors delivered (most recent was 1 April 2022)



Poloidal field coil #1 ready for shipment



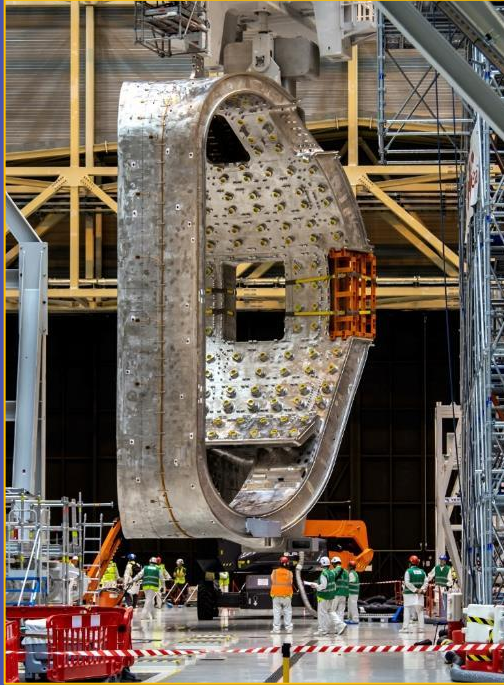
Modules delivered, of fabrication

Project Progress

# Addressing Challenges



# Vacuum Vessel Sectors' Dimensional Issues

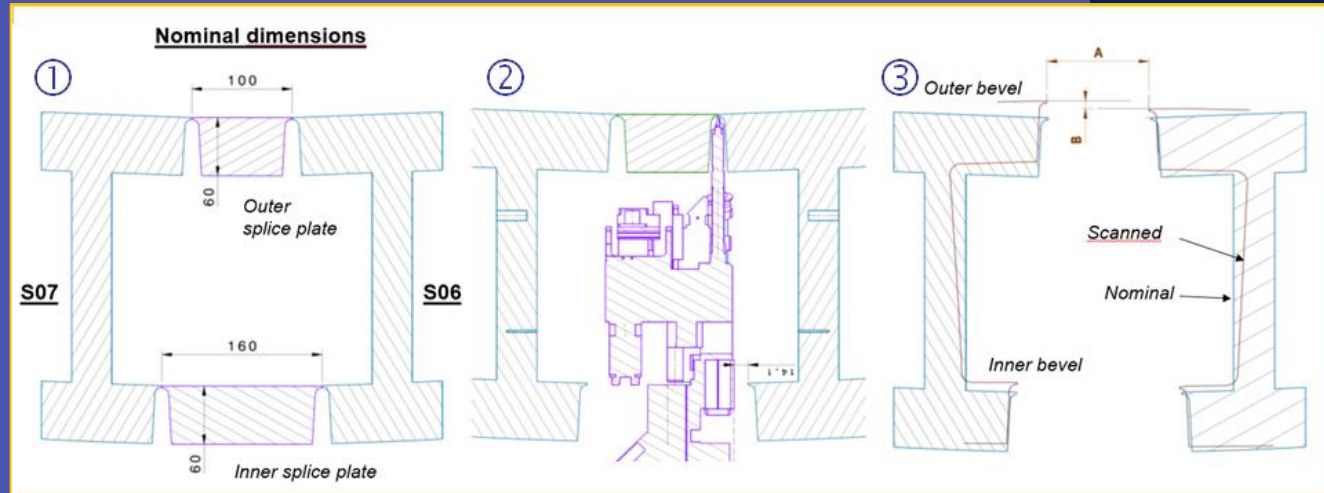


Vacuum Vessel:

Comprised of 9 x 40 vacuum vessel sectors.

The detected dimensional non-conformities affect the interface welding between sectors.

Issues have been investigated, and repair strategies initiated.



Addressing Challenges

# Global Stress Corrosion Cracking on Thermal Shields (TS)

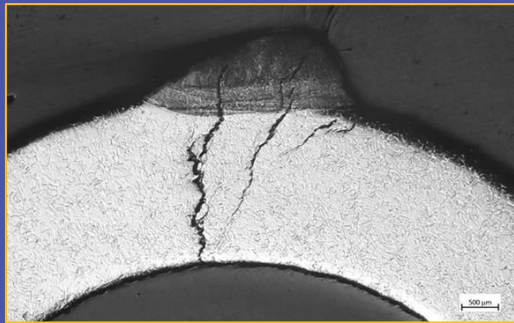


Thermal Shield: actively-cooled component between the VV sectors and TF coils.

**Cause:** Stress Corrosion Cracking (SCC) due to chlorine residues (design flaw (tbc))

**Decision:** SCC is a global issue and all TSs need to be repaired.

**Recovery Solutions:** complete removal of all cooling pipes on thermal shield components, except for some Lower Cryostat Thermal Shields already installed in the Tokamak Pit.



Addressing Challenges

# Appointment of new DG

# New Director-General: Pietro Barabaschi



- May 2022: ITER Council initiated new DG search
- 15 September: final interviews and selection
- 16 October: new DG took office
- 19-20 October: MAC-34
- 16-17 November: IC-31
- Improved accuracy and transparency in communication
- Implement Project structure with integration of IO and DAs
- Improved relationship with French regulator
- Reliable solutions to technical FOAK challenges
- Improved quality culture



# Follow up from 1st FFD



## 1<sup>st</sup> FFD, Karlsruhe, 17<sup>th</sup> May 2022:

### The IO is looking for procurements in the following areas:

- Very large works' contracts already awarded for Assembly Phase I, but **Mechanical Assembly sub-contract** might be an opportunity and small/medium size multi millions contracts still needed) → contact points at suppliers listed in the Backup.
- **Electrical supply and installation contracts.**
- Largest contracts already awarded but **Steel Structures and Piping Installation sub-contract** might be an opportunity.
- **Architect Engineering contract** including coordination across large installation works contracts (**Hot Cell Facility, Detritiation plant**).
- **Engineering Service Support contracts** (Stress analysis, isometric/drawing support, specialized engineering contracts).
- **Contracts for design, prototyping, manufacturing and supply of specialized components.**
- **Radiation Waste and Remote Handling Engineering and Installation contracts** (**Hot Cell Facility**)
- **Material Supply contracts** (MRO components, piping, valves) with optional short term delivery solutions.
- **Global Maintenance Services contracts** for electrical, mechanical and general services.
- **Scientific Collaboration Service** contracts.
- **IT Services** contracts.

It is expected, that these business opportunities are not affected by the ongoing repair works

**How can smaller companies which can offer highly attractive technologies, processes and know how (in particular for general nuclear, tritium, robotics and hot cell applications) make business with ITER, if the main contracts go to much larger companies?**

- ❑ Does the IO make known to the industrial communities those companies which have been pre-qualified to participate in a tender?
  - ❑ Yes, the IO provides the list of pre-qualified suppliers under <https://www.iter.org/proc/overview>.
  - ❑ The suppliers can then make contact with them to organize consortium or subcontracting arrangements.

**❑ Does the IO pro-actively bring these companies together with smaller companies for them to make up their mind with whom they wish to partner?**

❑ The IO is generally not taking any active part in this process as it needs to maintain independence and fairness.

❑ However, there is a possibility for the smaller company to get the support from the (German) ILO network

❑ French partners working for ITER have decided to make themselves more visible (with the support of the French ILO) to help foreign entities interested to partner with them.

<https://www.iter.org/proc/industrialsupport>.\*

(\*) The link provided in this page is pointing to (unfortunately) a French language site for the Comité Industriel ITER, where valuable tools and information are available to filter potential entities by type of activity.

## ❑ Which Get Together events are there?

- ❑ 'Information Days' that are organized before the pre-qualification
- ❑ Information sessions to the pre-qualified entities but indeed only with the pre-qualified companies, or
- ❑ ITER Business Forum (IBF)\*

(\*) Unfortunately, the 2023 IBF had to be cancelled

- ❑ **Can latecomers (e.g. the German companies) still be introduced to the pre-qualified companies?**
  - ❑ It is always possible for smaller entities coming late to connect with the pre-qualified entities to work as subcontractors for them.
  - ❑ However, forming a consortium or trying to integrate later into a consortium would be more difficult as the IO does not permit (some exceptions exists) changes of the consortium after the pre-qualification – as the qualification is at consortium level.

**Are there any insurance companies which offer insurances for smaller companies for the topic of product liability?**

- ❑ The IO refrains from proposing or mentioning insurance companies to avoid entering into any sort of liabilities**
- ❑ However, the ILO would be the right forum to address this point.**



*Thank you for your attention!*





**Questions?**