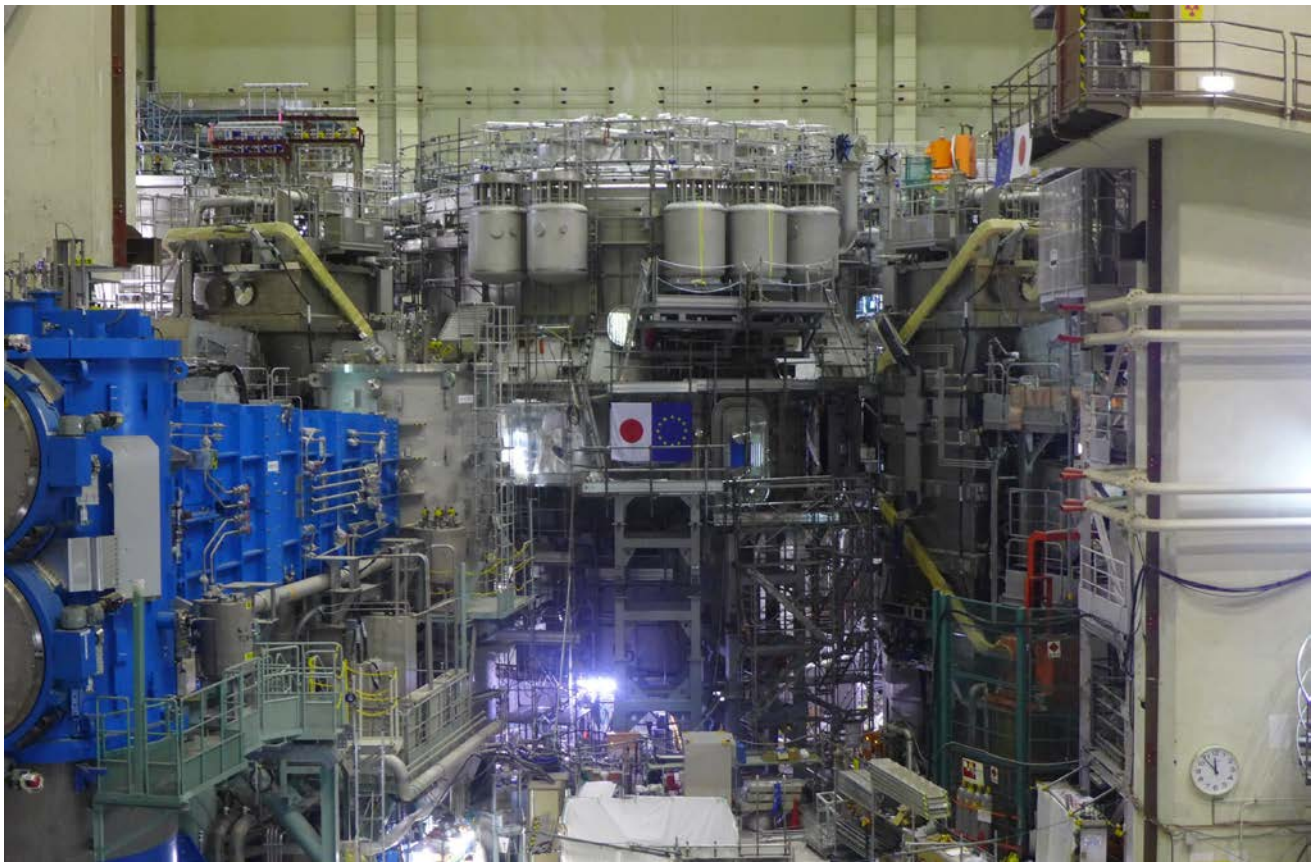
JT-60SA Newsletter
No. 113, April 2020

Headline

JT-60SA: World's largest superconducting tokamak completed!



JT-60SA experimental device completed

QST (the National Institutes for Quantum and Radiological Science and Technology) completed the assembly of the JT-60SA device in March 2020. This has been achieved under a joint programme between the Japanese National Centralised Tokamak Facility Programme and the Satellite Tokamak Programme conducted by Europe and Japan as one of the Broader Approach Activities in Naka, Ibaraki since 2007. JT-60SA is now the largest superconducting tokamak in the world

Integrated commissioning will now start checking in sequence the operation of each system, including evacuating the JT-60SA plasma chamber and cooling the superconducting coils, leading up to the first plasma operation expected in the autumn of 2020.

News

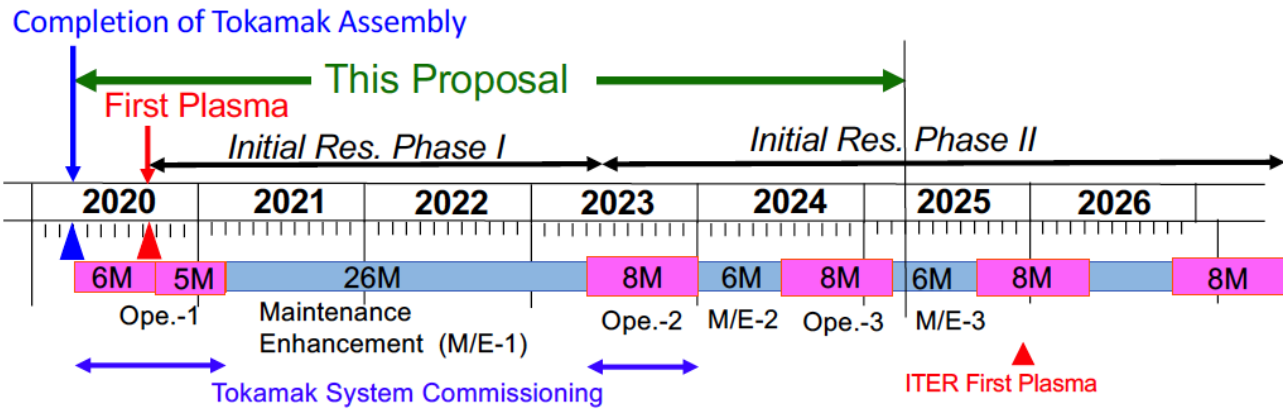
Joint Declaration on Broader Approach Activities signed

A joint declaration on Broader Approach Activities in the field of fusion energy was signed by representatives of the Government of Japan and Euratom on 2 March 2020.

The satellite tokamak programme activity will focus on the operation and exploitation of the recently assembled JT-60SA.

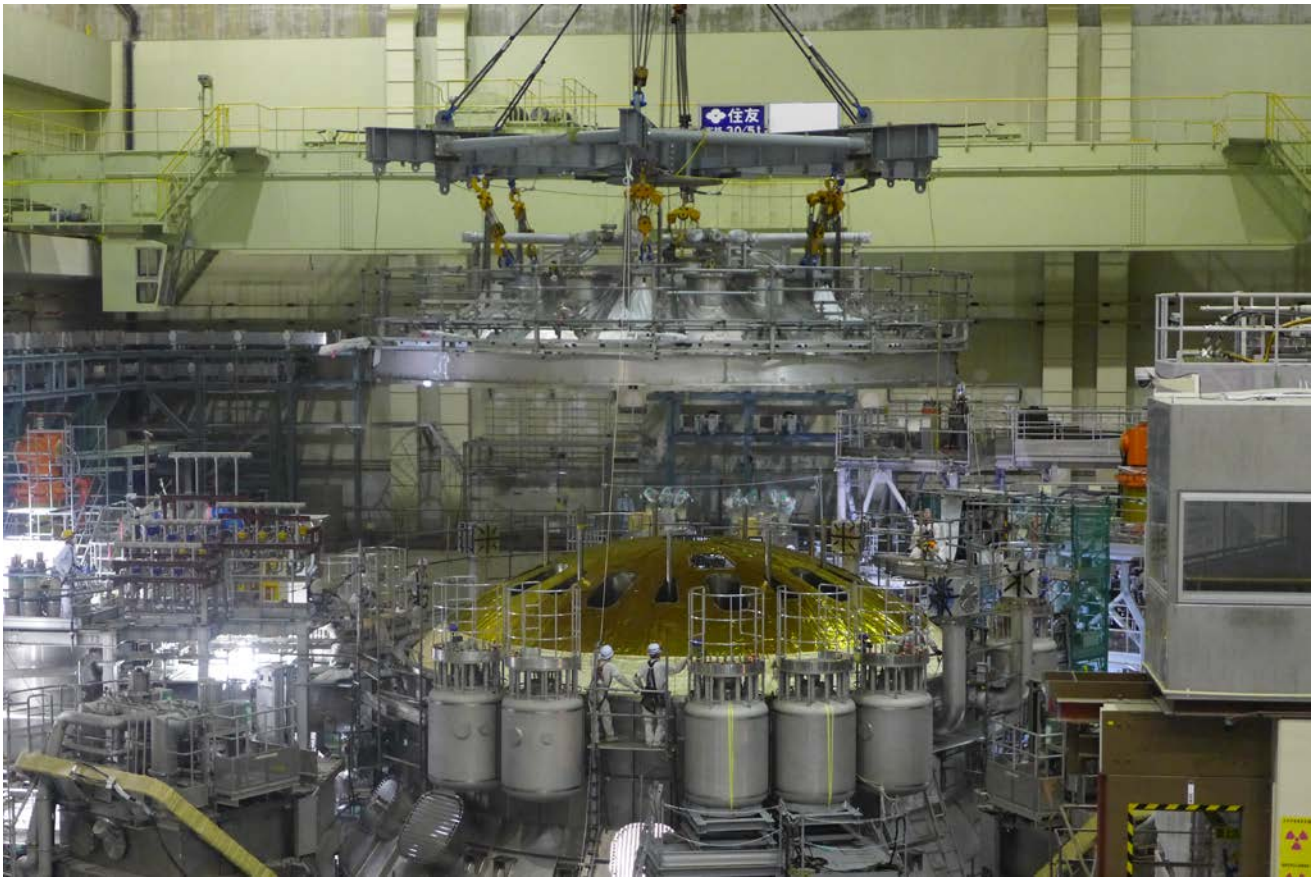
The new period 2020–2025 is the first operation phase of JT-60SA. In this phase JT-60SA will:

i) complete integrated commissioning including the first plasma, and evaluate the engineering achievements in constructing this large tokamak device,
ii) execute plasma experiments for ITER risk mitigation, ITER scenario development, and study steady-state high pressure plasma operation requirements for DEMO, and
iii) enhance the device capability to allow high-power heating experiments with deuterium.



News

Cryostat top lid installed



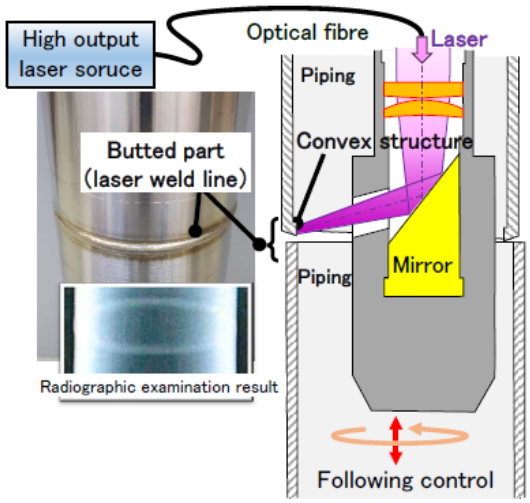
Cryostat top lid being installed

The cryostat top lid of JT-60SA, made from two 180° modules was integrated in the assembly hall in January 2020. For welding, grooves 6 mm deep were made on the front and the back of the 36 mm thick top lid. High quality welding has been assured by penetrant inspection of each weld layer.

After welding, the assembly of the ports, and welding of the window frames and stiffening rings, were completed. The top lid was installed on the tokamak on 30 March 2020. The cryostat top lid is 11.5 m in diameter and weighs 45 t, and an assembly accuracy of ≤ 2mm from the centre, well within tolerances, has been achieved. This activity completed the assembly of JT-60SA.

News

In-pipe laser welding technology developed



Pipe welded part (left) and welding tool developed (right)

Many cooling-water pipes in the JT-60SA device are arranged in a small space, where it is difficult to fix the pipe joints and weld the pipes from outside. Therefore, an in-pipe welding technology where the pipes are welded from inside, by high-power laser transmission through optical fibres, has been used to develop the ability to accurately weld even if the positional adjustment of the joint is not perfect.

As a result, by measuring the joint in advance, the technology has been developed to control the laser irradiation position using a weld following technique with a high accuracy of ≤ 0.1 mm, even if the position adjustment of the joint is incomplete.

In previous pipe welding experiments using a general automatic welding machine, a gap in a pipe joint could not be tolerated, but this achievement has established the technology to permit a gap close to 1 mm and to accurately weld under the complex conditions where imperfect alignment and inclination exist.

This result offers the prospect of the sophistication of connection of cooling-water pipes in the JT-60SA device and significantly advances the in-pipe welding technology developed for ITER.

Weld following has been successfully performed for a small and medium diameter pipe (about 50 mm in diameter) from inside with a position adjustment margin for the first time in the world. It is expected also that this result can be used for industrial purposes such as the difficult work of repairing and exchanging pipes closely packed in plant equipment.

News

Magnetic probe and junction box developed

Figure 1: External view of junction boxes (upper: new, lower: original)

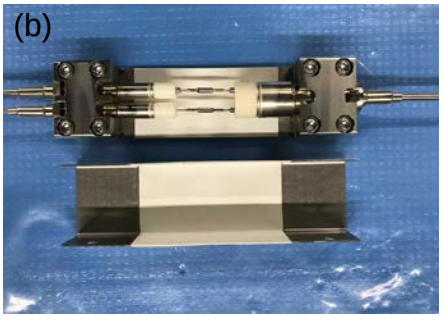


Figure 2: Internal of new junction box

In JT-60SA, magnetic probes are used to measure one turn voltage in the toroidal direction, stored energy in the plasma and instability strength. Junction boxes are used to connect the mineral insulated cables for the probes (Figure 1, 2).

The amount of equipment in the vacuum vessel will significantly increase due to the machine enhancement planned after the completion of the integrated commissioning. Therefore, there is a concern about interference of the equipment with the existing junction boxes, and the reduced size of the junction box has been developed in preparation for that phase.

For the development

(1) the method of fixation of the connecting part was improved
(2) the insulation performance by ceramic thermal spraying to the inner wall of the junction box was improved, and
(3) the inner structure such as the connecting part was reviewed

As a result, the volume has been successfully decreased to ≤ 40% of original (height x width x length 30 x 60 x 300 mm). The withstand voltage of this junction box has satisfied the requirement of ≤10 Pa and ≥ 1500 V, and the prospect is bright for the application to the actual machine.

News

Director-General of the ITER Organisation visits Naka site

Group photo with Dr. Bernard Bigot, Director-General of the ITER Organisation

Dr. Bernard Bigot, Director-General of the ITER Organisation visited Naka site on 31 January 2020 to inspect the progress of the JT-60SA construction.

The representatives of QST including Yasuhide Tajima (QST Executive Director) welcomed him. They saw the operation sequence in the central control room and construction work in the torus room.

Dr. Bigot admired the progress of the JT-60SA assembly work. He stressed that the future cooperative relationship between JT-60SA and ITER based on the research cooperation framework agreed at the end of 2019 by QST, Fusion for Energy and ITER will be advantageous to both sides and greatly contribute to ITER operation.

Meeting

26th STP Project Committee Meeting

Participants in the 26th STP Project Committee Meeting

The 26th Meeting of the Satellite Tokamak Programme Project Committee (STP-PC) was held on 17 March 2020. A total of 23 participants joined the meeting also by videoconference. There were 6 members from the Project Committee, the Project Leader (PL), 6 experts from the Project Team, and 10 experts from the European and Japanese Home Teams (HTs).

In this meeting, the PL and the European and Japanese Project Managers reported on the progress of the STP project, and made recommendations on the “Annual Report 2019”, “Project Plan for BA Phase I”, “Project Plan for BA Phase II” and “Update of Work Programme 2020 (BA Phase II)” to be submitted by the PL to the BA Steering Committee (BASC).

The STP-PC expressed satisfaction with the achievements and the progress in both European and Japanese procurements as well as the assembly, installation and commissioning activities since the last STP-PC Meeting. These include delivery of the 1st toroidal field (TF) spare coil, the spare TF coil winding pack, TF coil sensors and power supply (PS) spare parts to Naka site, progress of PS combination tests including superconducting magnet power supplies (SCMPSs), quench protection circuit (QPC) and booster PS, and the steady progress of the assembly work of central solenoid (CS), cryostat thermal shields, port thermal shields, cryostat vessel body and cryostat top lid.

The STP-PC appreciated the Procurement Arrangement (PA) completion of poloidal field (PF) coils manufacturing, thermal

shields and TF coil test facility, and the installation of TF coil displacement and stress sensors. The STP-PC commended the strenuous efforts of the Japanese HT for the above assembly with two shift work of 16 or 24 hours per day to meet the project schedule. The STP-PC also commended the effort of the Implementing Agencies to maintain project momentum by anticipating critical BA Phase II activities, and in particular the effort of EUROfusion as a European Voluntary Contributor for several machine enhancements.

The STP-PC recommended the “Annual Report 2019”, “Project Plan for BA Phase I”, “Project Plan for BA Phase II” and “Update of Work Programme 2020 (BA Phase II)” for approval by the BASC.

The STP-PC decided that the next STP-PC meeting (PC-27) would be held on 26 October 2020.

Calendar

2 July 2020
25th Meeting of the BA Steering Committee (SC-25)
Naka, Japan

October 2020
36th Technical Coordination Meeting (TCM-36)
Naka, Japan

26 October 2020
27th Meeting of the STP Project Committee (PC-27)
Naka, Japan

24–29 January 2021
24th International Conference on Plasma Surface Interactions in Controlled Fusion Devices (PSI-24)
Jeju, Korea.

21–25 June 2021
47th European Physical Society Conference on Plasma Physics (EPS2021)
Sitges, Spain

Contact Us

The JT-60 Newsletter is released by the JT-60SA Project Team.

Suggestions and comments are welcome and can be sent to newsletter@jt60sa.org.