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Call For Tender Documents

Integration and Commissioning of ITER Control System - Technical Summary

This is the technical summary document issued at Call for Nomination (IO/19/CFT/7-509/ERA)

Integration and Commissioning of ITER Control System

Call for Nomination

Ref. IO/19/CFT/7-509/ERA

1 Purpose

The purpose of this Contract is to provide the technical services required for the integration and commissioning of ITER integrated control systems comprising plant system instrumentation and control (I&C), provided "in-kind" by the ITER members, and the central control system, provided "in-fund" by IO-CT. Services focus on control system software including all layers from controllers interfacing actuators and sensors to operational Human Machine Interface (HMI) using selected ITER technologies as specified in the Plant Control Design Handbook (PCDH) and satellite documents.

This Contract is a framework contract, where each task order (TO) is a free standing engineering activity with its own budget.

2 Background

The ITER Instrumentation and Control (I&C) System is the term encompassing all hardware and software required to operate the ITER machine. The ITER I&C System has two levels of hierarchy; the Central I&C Systems and the Plant Systems I&C, and three segregated vertical tiers; conventional control (CODAC), machine protection (interlocks) and safety. The Central I&C Systems are "in-fund", i.e. procured by the ITER Organization (IO). The Plant Systems I&C are "in-kind", i.e. procured by the seven ITER Domestic Agencies (DAs). There are 171 Plant Systems I&C with associated sensors and actuators. The primary goal of the ITER I&C system is to provide the fully integrated control of the ITER machine. Standardization of Plant System I&C is a pre-requisite. Mandatory requirements and recommendations for the Plant System I&C development lifecycle and component selections are documented in the Plant Control Design Handbook (PCDH) and satellite documents (publicly available at https://www.iter.org/mach/codac/PlantControlHandbook). To complement and to enforce the standards, the IO has developed a software framework called the CODAC Core System. This framework is used to interface and support the development of every ITER plant system.

The selected technologies are Siemens S7 PLC slow controllers, Step7 and TIA portal, PCIe based fast controllers, RedHat Linux, C/C++, Java, Python, open source software (Experimental Physics and Industrial Control System – EPICS, Control System Studio, etc.)

Figure 1 illustrates the physical architecture of the integrated ITER I&C system. A plant system I&C is a unit, which interfaces to CODAC and which includes a set of tightly coupled controllers, with one and only one, Plant System Host (PSH) implementing a set of plant-specific and generic (common) functions. A control group, or subsystem, is an assembly of plant system I&Cs and central coordination. The 18 control groups are defined in Table 1.

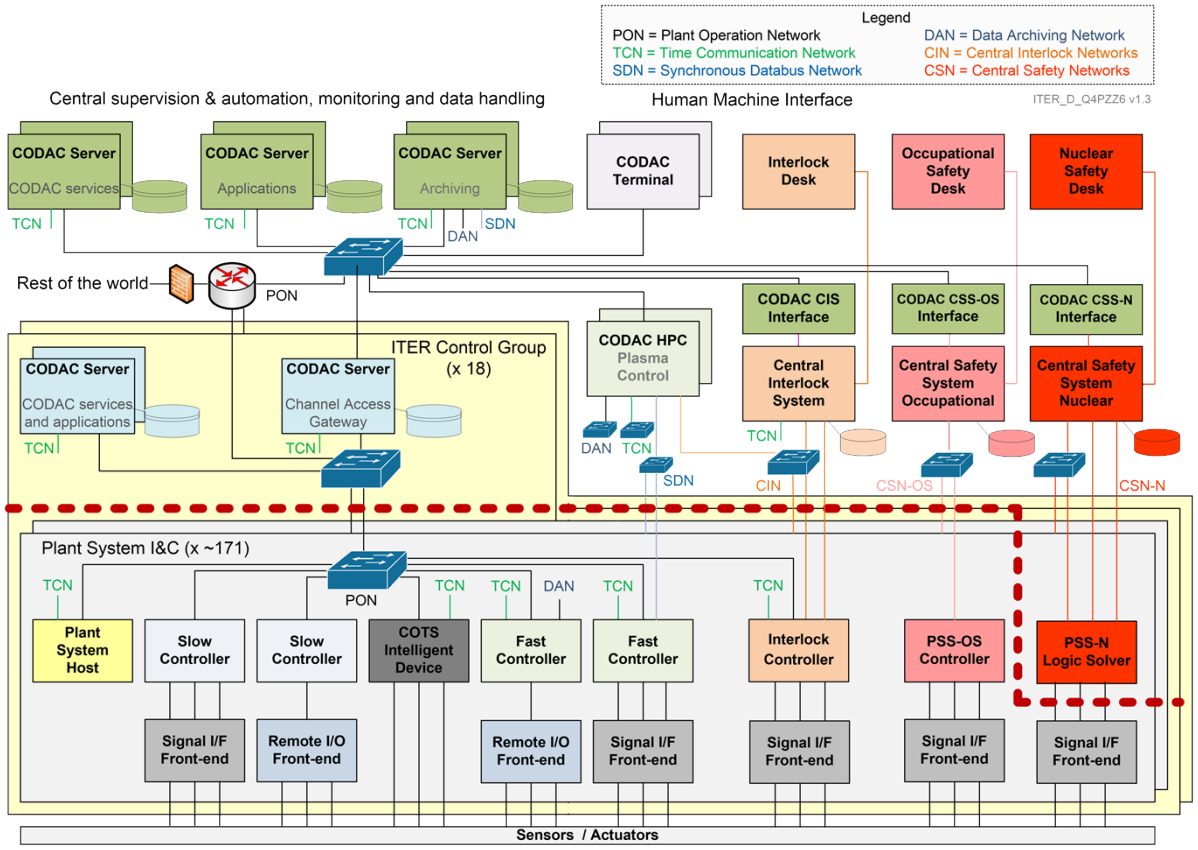

Figure 1: Physical architecture of ITER integrated control system

Name	Description	First Plasma
BUIL	Buildings	Yes
UTIL	Utilities (electrical, liquid & gas and RPC)	Yes
CWS	Cooling Water	Yes
CRYO	Cryogenics	Yes
VAC	Vacuum	Yes
VV	Vacuum Vessel	Yes
CRST	Cryostat and Thermal Shield	Yes
MAG	Magnets and Coil Power Supplies	Yes
FUEL	Fuelling and Wall Conditioning	Yes
EC	Electron Cyclotron Heating and Current Drive	Yes
PFCS	Plasma Facing Components	Yes
D1	Diagnostics 1 – Measurements	Yes
D2	Diagnostics 2 – Support	Yes
IC	Ion Cyclotron Heating and Current Drive	No
NB	Neutral Beam Heating and Current Drive	No
RAD	Radiological Waste and Monitoring	No
RH	Remote Handling	No
TRIT	Tritium	No

Table 1: Control Breakdown Structure with 18 control groups or subsystems

Plant system software delivered by third party contains signal input/output configuration, possible device drivers for COTS intelligent devices, controller applications (process control) executing on slow and/or fast controllers, interface configuration to central system, plant system specific HMI operator screens and configuration of central services such as archiving and alarm definitions. Software is grouped in units and are delivered and versioned in the software repository.

During site acceptance testing, integration and commissioning many problems are discovered and corrective actions are required. This is particular true for software. Figure 2 illustrates the established configuration control process for software versioning, deployment and testing. Off-line test facilities provide tools to debug issues without accessing the target system.

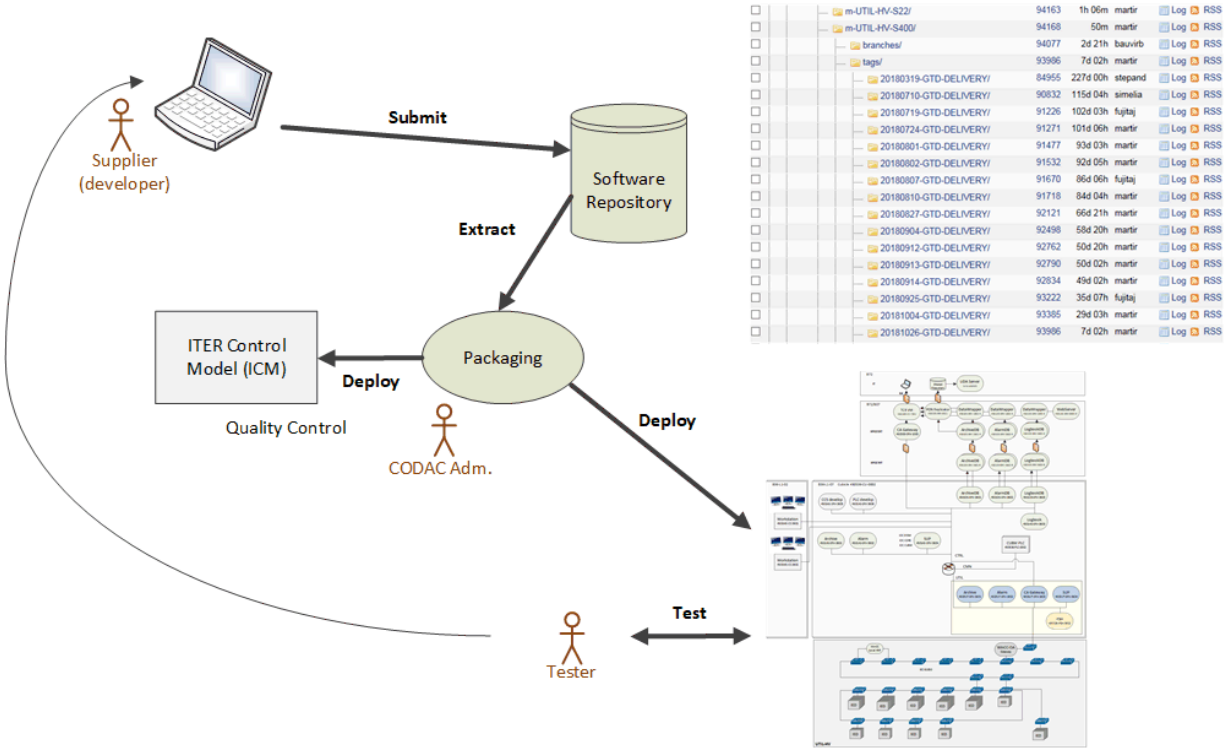

Figure 4: Software versioning, deployment and testing

To keep track of defects and enhancements ticketing systems are used (Bugzilla, Jira).

3 Scope of Work

This summary covers the technical services to be provided to IO along the site acceptance testing, integration, commissioning, operation and maintenance of plant systems. The service scope covers the conventional controls, interlock controls and occupational safety controls with focus on software.

These services cover the following topics:

1. **SAT and Integration:** Support the preparation of integration by reviewing deliverables (documentation and software) from plant system supplier. Perform off-line software testing using test facilities in the lab. Dry run the integration package on the ITER Control Model (ICM). Support the deployment on the target. Participate in site acceptance testing of the plant system. Identify and document control system issues. Propose and implement solutions. Use test facilities in the lab to verify solutions before deployment on the target.

   Services are expected to be provided on-site with potential back office support.

2. **Commissioning:** Participate in the commissioning of the plant system. Identify and document control system issues. Propose and implement solutions. Use test facilities in the lab to verify solutions before deployment on the target.

   Services are expected to be provided on-site.

3. **Operation and Maintenance:** Implement corrections and enhancements as requested by Operation. Use test facilities in the lab to verify solutions before deployment on the target.

   Services are expected to be provided on-site with possible off-site back office support.

4. **Technical Support:** Design and implement different solutions and/or new features as identified during any lifecycle phase. Such cases will be identified as stand-alone projects. Use test facilities in the lab to verify solutions before deployment on the target.

   Services are expected to be provided on-site with possible off-site back office support.

4 Duration of Services

The contract will be carried out over an initial firm period of four (4) years firm and an optional period of two (2) years. The contract is scheduled to come into force in October 2020.

5 Timetable

The tentative timetable is as follows:

Call for Nomination	November 2019
Prequalification	January 2020
Call for Tender	April 2020
Signature	October 2020

6 Experience

The Contractor shall have adequate experience for the work and activities as detailed below.

- Capability to develop, debug, maintain and improve plant system controller software using the IO selected technology
- Capability to develop, debug, maintain and improve interfaces to actuators and sensors using the IO selected technologies
- Capability to develop, debug, maintain and improve Human Machine Interfaces using the IO selected technologies
- Capability to develop, debug, maintain and improve integrated supervision and automation using the IO selected technologies
- Capability to develop, debug, maintain and improve communication and networking using the IO selected technologies

7 Candidature

Participation is open to all legal persons participating either individually or in a grouping (consortium). All legal persons including all consortium members should be established in an ITER Member State. A legal person cannot participate individually or as a consortium partner in more than one application or tender. A consortium may be a permanent, legally-established grouping or a grouping, which has been constituted informally for a specific tender procedure. All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.

The consortium groupings shall be presented at the pre-qualification stage. The tenderer's composition cannot be modified without the approval of the ITER Organization after the pre-qualification.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities. Candidates (individual or consortium) must comply with the selection criteria. The IO reserves the right to disregard duplicated reference projects and may exclude such legal entities from the pre-qualification procedure.

The UK is not a party to the ITER Agreement but to EURATOM Treaty. The draft Withdrawal Agreement between the EU and the UK provides that the provisions of the EURATOM treaty continues to apply to and in the UK for a transition period following its withdrawal from the EU and EURATOM. If the Withdrawal Agreement is not ratified (a no-deal Brexit) the EURATOM Treaty ceases to apply to and in the UK on the withdrawal date.

Until the Withdrawal Date, the UK remains a full member of the EU and EURATOM and until that date UK entities retain the right to participate in IO procurement procedures. In case

they are selected, a Brexit clause is included in the contract. Likewise during the Transition period UK entities may participate in IO procurement procedures.

After the end of the Transition Period, when the Euratom Treaty ceases to apply to and in the UK, any UK entities bidding as a prime contractor or consortium partner, will be rejected from the IO procurement procedures. UK entities will no longer be recognised as entities of an ITER Member and will no longer have the right to participate in IO procurement procedures, unless the UK has entered into an Agreement with Euratom. Where UK entities can demonstrate a unique and specific competence in a certain field the IO, with approval of the ITER Council, may also allow them to participate in a procurement procedure.

8 Reference

Further information on the ITER Organization procurement can be found at: http://www.iter.org/org/team/adm/proc/ Pages/Welcome.aspx