

Technical Specifications (In-Cash Procurement)**Technical Summary for CODAC Core System Software
Maintenance Framework Contract Tender**

This Technical Summary covers the supply of software maintenance services for the CODAC Core System software distribution.

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1 Background and Objective

The Controls Division (CD) of the ITER Organization (IO) provides and manages CODAC Core System (CCS), the software platform used for CODAC (Controls, Data Acquisition and Communication) of the ITER machine. The current framework contracts for CODAC Core System Engineering Services were established in 2016 and will terminate in March 2021.

The objective of this Call for Tender is to select qualified companies / consortia with extensive experience in the required fields of work, proven track records in the implementation, exploitation and maintenance of CODAC Core System, and to award the Framework Contract that will supply the software maintenance needs through the construction and commissioning phases of the ITER project for the period of 2021-2026.

The Framework Contract shall be implemented by the means of awarded Task Orders in order to execute the specific services.

2 Required Experience

The candidates shall have demonstrated capabilities and experience through various projects in the fields of software development, maintenance and testing, covering high-level applications, communication software and low level drivers for different hardware architectures.

Given the very broad scope of experience needed, the IO would like to encourage interested parties to form consortia to achieve a solid coverage of the complete spectrum.

The specific experience and qualities sought by IO include:

- Linux operating system usage, including tools for diagnosing and resolving abnormal behaviour in user code as well as in the system processes and in system configuration;
- Software development in a Linux environment using C, C++ (including recent standards C++11 and C++17), Java and Python (Python 3) programming languages;
- Development and maintenance of complex Java software using the Eclipse RCP and Spring frameworks and the Maven build system;
- Usage of XML technologies in software development;
- Software quality control: development and maintenance of scripted/automated test procedures, execution of test procedures, review and production of technical documentation for software products, code reviews;
- Development and maintenance of Linux device driver (kernel module and user space library) software on RHEL MRG-R and multi-core CPUs;
- Development and maintenance of communication software in the context of high throughput and low-latency applications;
- Development and maintenance of software and applications in an EPICS environment;
- Development and maintenance of driver level software in the Nominal Device Support version 3 (NDSv3) software framework;
- Development and maintenance of driver software for I/O cards in the PXI/PXIe and uTCA architectures;
- Development and maintenance of FPGA applications using LabVIEW FPGA.

The working language of ITER is English, and a fluent professional level is required (spoken and written) by all staff working under the Framework Contract and Task Orders.

3 CODAC Core System

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 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 using Step7 and TIA Portal software, PCIe based fast controllers with PXI/PXIe and uTCA I/O crates, RedHat Linux, C/C++, Java, Python, open source software (Experimental Physics and Industrial Control System – EPICS, Control System Studio, etc.).

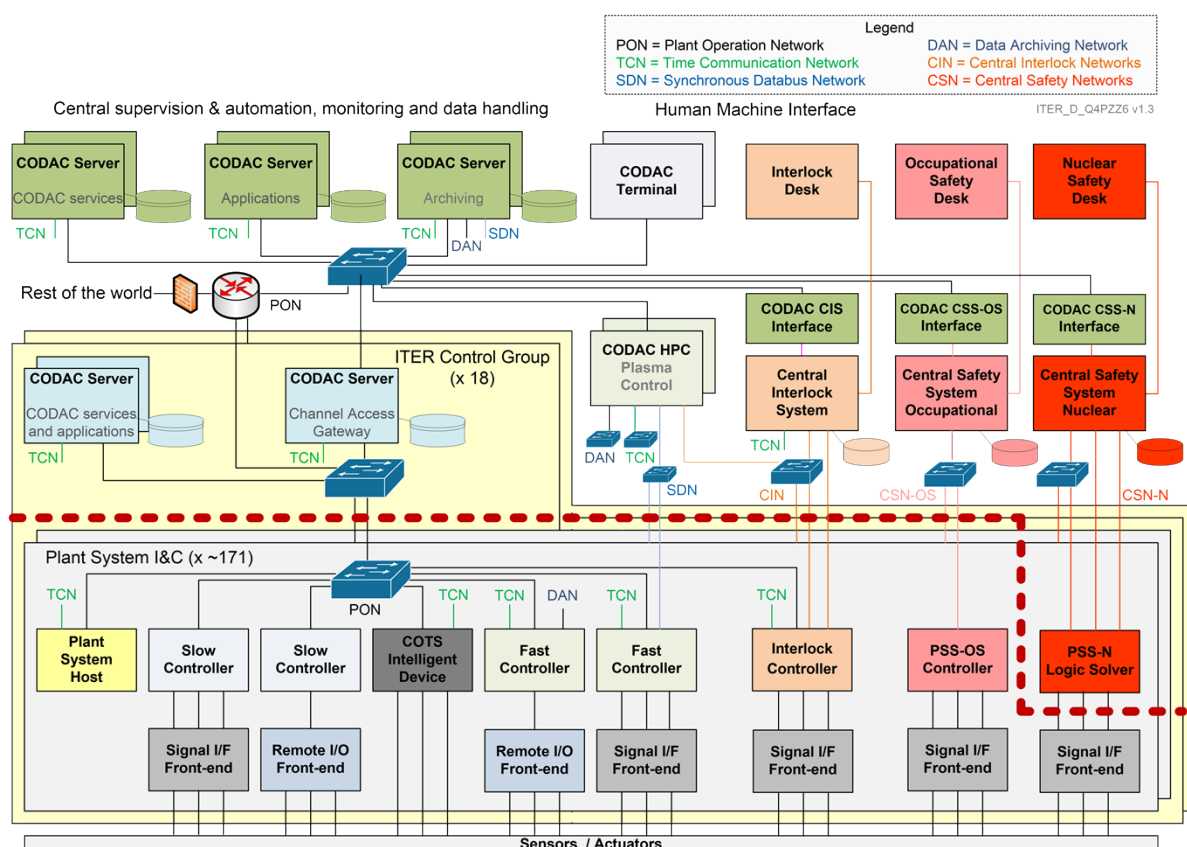


Figure 1 Physical Architecture of the ITER Integrated Control System

Figure 1 illustrates the physical architecture of the integrated ITER control system. A plant system I&C is a unit that interfaces to CODAC and includes a set of tightly coupled controllers, with one dedicated 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.

Plant system software delivered by third parties (users) 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.

The SDD and Maven components are the main CCS tools used to create plant system software. Powerful high-level Java applications, based on the Eclipse RCP and Spring frameworks, allow almost every aspect of a plant system I&C to be interactively configured. The project's data is kept and validated in a complex RDB design, and a Maven controlled build process creates and packages the executable software for deployment on the plant system controllers.

4 Scope of Work

The scope of the services requested covers the software maintenance of the CODAC Core System distribution. This includes:

- **Preventive maintenance**
Identify unknown defects and fix those selected.
- **Corrective maintenance**
Diagnose an issue, resolve it and verify the resolution.
- **Perfective maintenance**
Specify, implement and test/verify improvements.
- **Adaptive maintenance**
Adapt code to changes in dependency software, e.g. operating system and drivers.

QA and the improvement of testability will be an important aspect across all parts of this work, focusing on the improvement of scripted/automated software testing (unit tests as well as integrated testing).

The software modules to be maintained under this contract include:

- **SDD and Maven components**
Complex user-level Java applications using the Eclipse RCP and Spring software frameworks.
- **Linux drivers for I/O hardware**
Linux kernel modules supporting I/O hardware supported by CODAC Core System. This includes I/O, Data Acquisition and Timing/Trigger cards based on the PXI/PXIe and uTCA architectures.
- **EPICS Support modules for I/O hardware**
EPICS Device Support modules for the supported I/O hardware and other devices, field buses and protocols.
- **NDSv3 core and device driver modules**
Core and Device Driver modules for the Nominal Device Support v3 driver framework.
- **High Performance Network libraries**
C and C++ user level libraries supporting the ITER High Performance Networks for time synchronization and low latency synchronous communication.
- **IRIO libraries for advanced FPGA data acquisition systems**
Software framework for the development of advanced data acquisition systems (DAQs) using National Instruments RIO FPGA-based devices, EPICS and LabVIEW FPGA.

5 Quality Assurance Requirements

As a Nuclear Operator, IO requires that for the entire duration of the Framework Contract, Contractors shall hold, and maintain, as a mandatory requirement, a valid ISO 9001 (or an equivalent QA program approved by the IO). Failure to do this may lead to a potential termination of such contract.

The missions and tasks executed under this Framework Contract shall be carried out in compliance with the applicable IO Quality Requirements.

6 Contract Basis and Execution

The CODAC Core System User Support will be procured via a Framework Contract.

Following contract award, Task Orders will be issued for the implementation of the services. All Task Orders to be executed under this contract are on a deliverable basis.

In the Technical Specification at tendering stage, a catalogue of services will be defined for the Framework Contract. The services specified in Task Orders will refer to those in the service catalogue with respect to scope and cost, and with clarifications on specific schedule and deliverables in the Task Order.

The ITER Organization will award the Framework Contract for a total period of 5 years. The initial award shall be for a firm period of 4 years, and an optional period of one year.

It is envisaged that the first Task Order will commence in March/April 2021.

The release of the option is correlated to performance requirements that will be indicated in the Technical Specification at tendering stage. The option may or may not be released at the IO's sole discretion.

7 Tender Timetable

The tentative timetable for setting up the contract is as follows:

- Call for nomination sent: March 2020
- Pre-Qualification launch: May 2020
- Call for Tender launch: September 2020
- Award of the Contract: December 2020
- First Task Order: March 2021

8 Candidature

Participation is open to all legal entities established in an ITER Member State, which is:

- European Union including Switzerland (EURATOM Members),
- Republic of India,
- Japan,
- People's Republic of China,
- Republic of Korea,
- Russian Federation, or
- United States of America.

On 31 January 2020, the UK left the EU and EURATOM with a transition period from 1st February to 31 December 2020 to be used to determine the conditions of their future

relationship. EURATOM is the ITER Member and the withdrawal of the UK from EURATOM leads to the fact that UK is not anymore party to the ITER project.

Until the 31 December 2020, current end date of the transition period, UK entities retain the right to 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.

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 that 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 cannot be modified later without the approval of the ITER Organization.

In the event of a consortium, a draft of the Consortium Agreement, or letter of intent and Power of Attorney signed by all the consortium members shall be submitted together with the tender.

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

9 Reference

Further information on the ITER Organization procurement can be found at:
<http://www.iter.org/org/team/adm/proc/overview>.