Call for Nomination

High Performance Engineering

Ref. IO/16/CFT/70000243/CDP

Purpose

The purpose of this Framework Contract is to provide high performance engineering and physics development services for ITER Port Plugs and Diagnostics Division. Most of the systems are the scope of the Domestic Agencies (DAs). About 30% of the systems scope is however completely IO scope. A large variety of systems are covered by this Contract.

Background

Diagnostics are a critical part of the operation of ITER. They provide the means to observe, control and sustain the plasma performance over long timescales. ITER will operate with plasma current in the region of 15 MA and toroidal fields of 5 T. The pulse lengths will be in the region of 500 s typically and will extend up to several thousand seconds during more advanced operation. A key objective of this device is Q=10 operation. This means that a typical fusion power of 500 MW will be provided for 50 MW input. While this is exactly what the ITER device is designed to do, it is nevertheless a challenging design objective in terms of diagnostics. This power will need to be managed and the generated neutrons will need to be confined. The device will be the first magnetic fusion device to be licensed as a nuclear facility. The combination of the above puts the ITER device in a new category of fusion machines.

Access to diagnostic systems in the region of the tokamak area is generally quite difficult and in some cases almost impossible after initial assembly. This is a key driver in the design of the systems and gives rise to a requirement for redundancy and very high reliability or both. Typically to access light from the plasma while minimizing activation outside of the chamber, one has to use mirrors and a labyrinth. This puts some critical mirror surfaces in direct line of the plasma and as a result, material from the plasma can add a layer of unspecified material thus degrading the performance of the system. In some cases, a certain amount of this can be tolerated. As expected, the situation is worse for the shorter wavelengths. Methods of avoiding these issues are being designed and developed. These kinds of issues are evident in several other areas. An example of this is in the area of magnetic measurements. In current magnetic fusion machines, the use of conventional loop type magnetic sensors to provide a whole range of measurements is common place. The plan is also to deploy similar technologies in ITER. In this case, the long pulses and effect of neutrons combine to provide a range of issues. These include various drift phenomena. To counter these effects, various options are being addressed. These include using special wiring arrangements and types to

minimize neutron effects, and also the use of steady state sensors and conventional sensors placed outside the vacuum vessel where neutron effects will be less.

The integrity of the confinement boundaries is a critical issue in ITER. For diagnostics, these are typically defined by port plugs, feedthroughs and window assemblies. For port plugs, controlling neutron leakage and minimizing deflections due to large electromagnetic loads is a particular challenge while for windows, a strong boundary is required. Other areas that challenge the current knowledge include reflections from the beryllium first wall and their effect on the various measurements such as wall temperature, impurity species, ion temperature etc. Safety issues related to tritium and dust also need to be handled. From the physics interpretation side, there are many systems where new boundaries are explored.

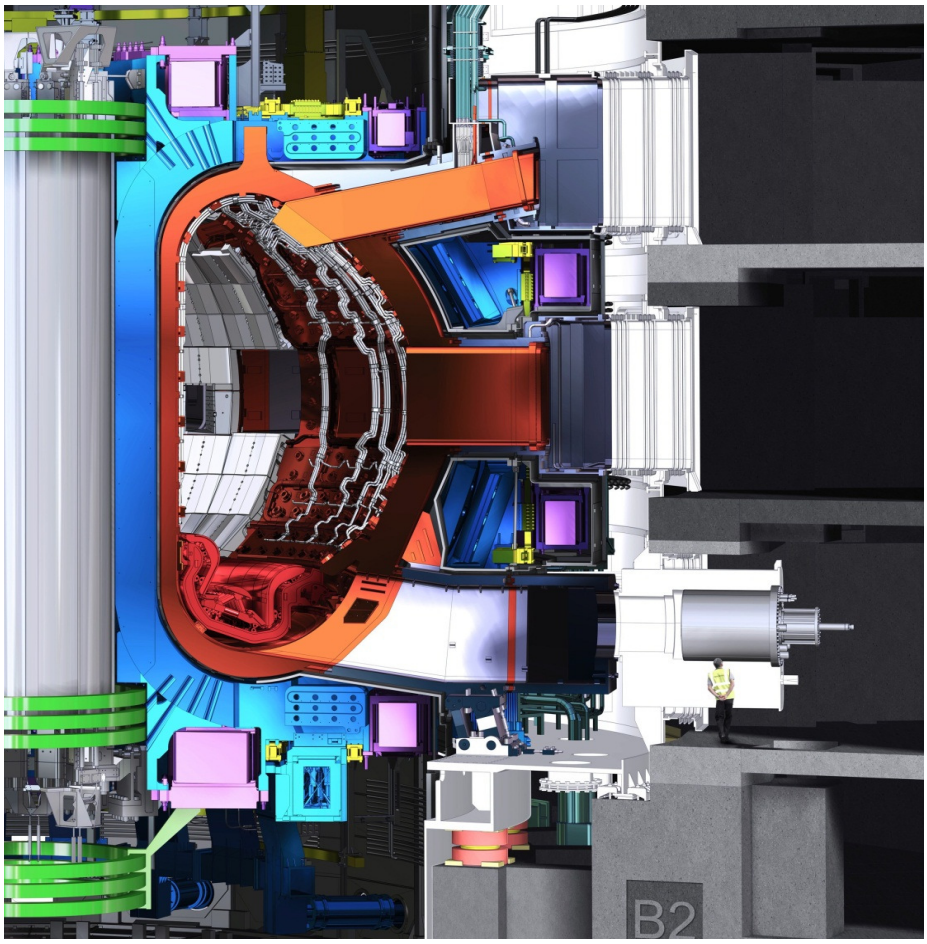

Figure 1: Overview of the ITER tokamak (Shows in a side view of half the machine the resource would work on all aspects of the diagnostic engineering– note regarding scale: the width of the horizontal inner vacuum vessel is approximately 4 m.

Scope of work:

The scope of the development services requested in this specification requires that the Contractor provides specialized expertise to contribute to, establish and reinforce the ITER Port Plugs and Diagnostics Teams.

As a general statement, the details of the services to be provided by the Contractor will be defined in the Task Order Technical Specification.

These Technical Specifications will be defined specifically for each Task Order depending on the actual requirement and will include a technical scope, the organization of the Task Order within IO and a description of the deliverables.

The volume of the work to be carried out under this Framework Contract corresponds on average to 8 FTE (Full Time Equivalent) of trained diagnostic engineers (diagnosticians) for the full Contract duration.

The ITER project Port Plugs and Diagnostic scope comprises of 100 diagnostics projects including diagnostics, structural engineering, Port Plug Test Facilities including conventional and Nuclear Protection Important Components. They require a variety of activities. As a consequence the workload for the activities to be performed will not match exactly the number of individual resources. The number could vary from zero to 20 resources.

Experience

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

- Mechanical-Electrical-Vacuum systems including Diagnostic Project Engineering
- Tritium system measurement including Diagnostic Project Engineering
- Nuclear Safety Important Non-Metal Windows including Diagnostic Project Engineering
- Nuclear Safety Important requirements development including implementation
- Electrical Engineering and Electronic Engineering and I&C Development including Diagnostic Project Engineering
- General Project Engineering.

Work description

Port Plugs and Diagnostic System Development requires skills to progress the technical development of diagnostics in-vessel, ex-vessel and port-based systems.
The scope of work covers predominantly the provision of **on-site** diagnostics engineering expertise supported by back-office engineering as necessary. The following activities are foreseen:

- Development of vacuum to electrical and mechanical systems,
    - Development of mechanical solutions for integration of above components
    - Evaluation of reports related with the above components
- Design and Development of windows Protection Important components
    - Development of interfaces for the above components
    - Evaluation and development of reports for above components
- Design and Development of Tritium/Erosion and Deposition Diagnostics
    - Development of interfaces for the above components

    - Evaluation and development of reports for above components
- Design and Development of Electrical Engineering Infrastructure for PPD systems
- Development of systems to support above work

Duration of services

The Contract will be carried out over an initial firm period of four (4) years and an optional period of two (2) years. The Contract is scheduled to come into force in December 2016.

Timetable

The tentative timetable is as follows:

Description	Date
Call for Nomination	23rd May 2016
Release of Pre-qualification	14th June 2016
Pre-qualification results	22nd June 2016
Release of Call for Tender	25th July 2016
Tender submission date	12th Sept. 2016
MAC Approval	Oct. 2016
Indicative Award date	End Oct. 2016
Indicative Contract signature	End Nov. 2016
Indicative Contract start date	1st Dec. 2016

Candidature

Participation is open to all legal persons participating either individually or in a grouping (consortium) which is 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 cannot be modified later without the approval of the ITER Organization.

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 form the tender procedure.

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