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## TECHNICAL SUMMARY

### Call For Nomination

IO/20/CFT/70000596/LLU

## Prototyping, Manufacturing and Delivery of Dust Monitor System

### 1 Scope

The work described below is for the ITER Dust Monitor design and analyses of the system, prototyping, testing and qualification of its subsystems for operation. The goal of this contract is to progress the ex-vessel design of Dust Monitor from its current state of approved conceptual design, through prototyping, to final design and manufacturing or manufacturing oversight for key components and their delivery to ITER. This will involve iteratively progressing the hardware and operational design by performing mechanical, nuclear, thermal and Electro-Magnetic analyses, including accident scenarios, detailing use cases for operation and maintenance, implementing solutions to issues found and producing a full set of documentation. By the preliminary design review, PDR, a prototype of ex-vessel subsystems will be produced and tested in air and vacuum, and afterwards any issues raised at PDR will be resolved. By the FDR, a full set of manufacturing drawings for a full system prototype will be produced and afterwards any issues raised at FDR will be resolved. All components developed within the framework shall be the property of IO. The final design of the system will be fully compatible for use in the nuclear phase of ITER.

### 2 Estimated Duration

The duration of the contract is estimated to be 4 years with potential to extend it for another 2 years. Contract duration will include PDR, FDR, MRR, delivery and commissioning at ITER.

#### 2.1 Tentative schedule of this Call for Tender

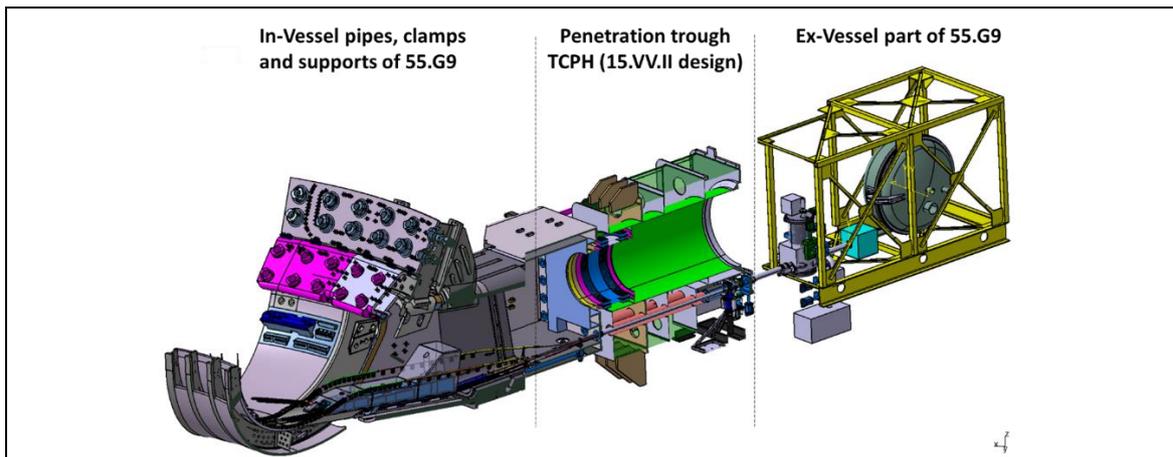
The indicative Call for Tender milestones are:

Call for Nomination	Beginning of August 2020
Issuing of Prequalification invitations	Beginning of September 2020
Issuing of Call for Tender	Middle of November 2020
Submission of Tenders	Middle of January 2021
Award of Contract	April 2021

### 3 Work Description

#### 3.1 Description of the system

ITER produces some amount of dust during operation due to interaction of in-vessel reactor surfaces with plasma which should be controlled and monitored. Monitoring is realized by endoscopes that will be inserted into the main chamber of ITER on demand between plasma pulses. This diagnostic tool is called the Dust Monitor and the related activity Dust Monitoring. The Dust Monitoring endoscopes will be located in bottom parts of ITER in two of 18 lower ports – Lower Port 6 and 12. One of these ports is shown in Figure 1.



**Figure 1.** Main parts and sub-systems of 55.G9 Dust Monitor Endoscope

Most of the time Dust Monitor endoscopes rest outside the vacuum vessel in a shielded endoscope enclosure on a movable trolley in the Port Cell, as shown on Figure 1. All components inside the endoscope enclosure units are compatible with vacuum. On demand, the endoscopes will be inserted through valves and slide along existing guide tubes for ~15 m, until the inspection region.

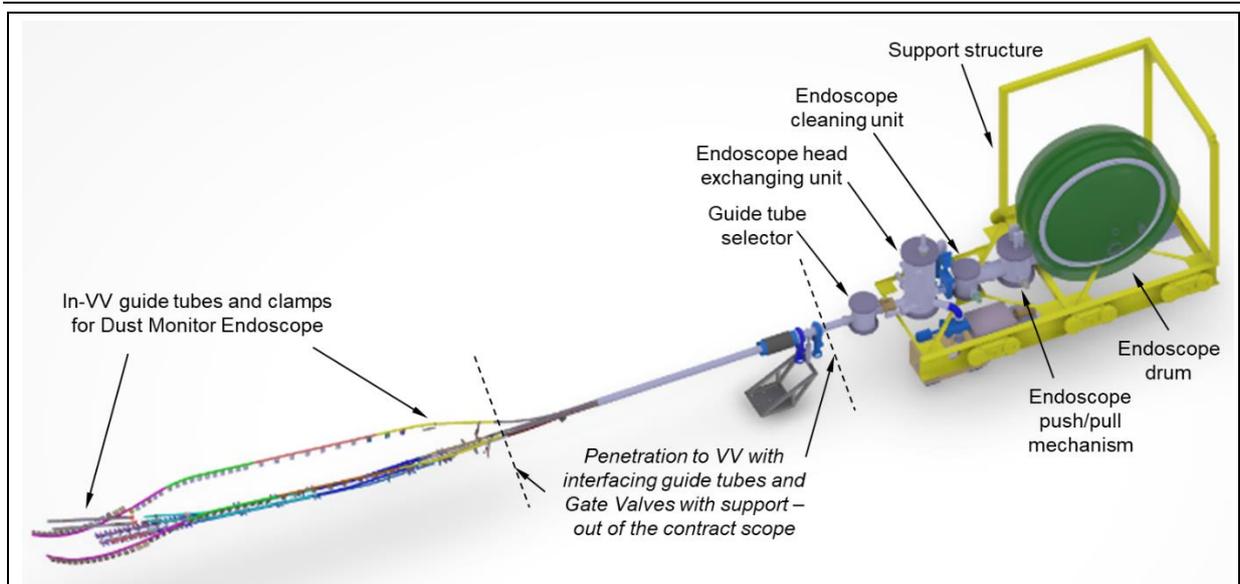
The two main functions of Dust Monitor endoscopes are to observe dust grains or aggregates in the range of 30-1000  $\mu\text{m}$  and collect highly activated dust grains in the range 0.1-300  $\mu\text{m}$  inside endoscope head. It is expected this dust will migrate. As a result all internal systems must be contained inside chambers providing safety-important confinement and, in some areas, shielding.

Dust Monitor sub-systems are shown on Figure 2:

- **Endoscope drum with push/pull and rescue mechanisms;**
- **Guide tube selector;**
- **Endoscope cleaning unit** with dust container;
- **Endoscope head exchanging unit** with head latching and unlatching mechanisms;
- **Shielded container** for dust transportation to Hot Cell Facility;
- **Support Structure** (will require adaptation of generic structure design for dust monitor).

The **dust collection head** of endoscope and **endoscope pipe** sub-systems are not shown on the Figure 2.

- The Dust collection head has a ~100 mm long and 25 mm diameter cylindrical shape. Development of dust collection head internal features is not in the scope of contract. However, development of endoscope head exchanging unit with latching/unlatching mechanisms for fixing of endoscope head on endoscope pipe is in the scope.
- The endoscope pipe is made of Titanium tubing of 8 mm diameter and 1 mm thick walls. It contains wiring and fibres for dust collection actuation, imaging and illumination



**Figure 2.** Isometric view of current arrangement of diagnostic modules.

It is required that that Dust Monitor is compatible with the following operational conditions and environment and satisfies the following requirements in deployment:

- Temperature of 100 °C;
- Pressure <10 Pa
- Magnetic field near inspection region up to 8T dropping to < 0.5T in Port Cell

At all times, key requirements also include:

- Ultra-High-Vacuum (UHV) compatible materials exposed to primary vacuum;
- Radiation tolerant materials and components. Exposure varies by region, but dust activates up to 500Gy/h contact dose rate and neutron fluxes in Port Cell are up to  $1e+9$  n/cm<sup>2</sup>/s with a total fluence up to  $1e+16$  n/cm<sup>2</sup> over the ITER life time.

### 3.2 Details of expected output

The purpose of this framework contract is to progress the mechanical design, of the full diagnostic system, from its current status to FDR and beyond by iteratively performing improvements until acceptable results of the load analyses (mechanical, structural, thermal, nuclear and EM) are achieved.

The Contractor shall consider maintenance scenarios in the port cell with support from the IO, including manned access requirements and development of appropriate tooling.

Once a high level of maturity of the design has been reached, in agreement with IO, the contractor is to provide full manufacturing drawings, components technical specifications, assembly specifications for the prototypes. The Contractor will be in charge of procurement and manufacturing of the system and sub-system components and the prototypes.

The prototypes developed within the framework should be intended and usable for the non-nuclear phase. At the same time, all tests and prototypes intended to prove any aspects related to the safety requirements for the Dust Monitor SSCs (Systems, Structures & Components) identified as PIC and PIA shall be subjected to the Order of 7th February 2012 applied to all the components important for the protection (PIC) and the activities important for

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the protection (PIA). These requirements will be flowed down through the system requirements. The prototypes developed within the framework shall be the property of the IO and may be used as final components depending on the items. The contactor and IO may agree to qualify key components directly for the nuclear phase.

The I&C development will be developed separately and will evolve simultaneously with design development of ex-vessel subsystems. Presently it is foreseen that I&C for this system will be procured under separate IO frameworks. In this context, the contractor shall manage the interface with I&C, providing appropriate specifications for the functions, actuators, sensors and devices to be controlled via the I&C interface. For ITER I&C, the ITER PCDH must be followed and this is freely consultable online.

## **4 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 from the tender procedure.

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.

### **4.1 Specific requirements and conditions**

The acceptance criteria for the selection of the tender cover a broad range as listed below.

- Experience in the following areas shall be demonstrated by the supplier:
  - Ability to perform mechanical design in CAD (Catia/ Enovia)
  - Ability to perform engineering justification of integrated SSCs through analysis (EM, thermal, structural, electromagnetic)
  - Ability to define and to justify maintenance, assembly and installation procedures
  - Ability to prepare technical specifications for manufacturing with industry
  - Ability to deliver on schedule
  - Ability to manage I&C interfaces
- Experience with design of mobile equipment or complex mechanical design for nuclear or space industry installations, experience with design, development and manufacturing

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of automated systems. The bidder shall provide customer reference world-wide, where he has executed similar tasks in the past. Customer references & Purchase orders shall be attached along with the bid.

- Management of the quality assurance
  - The contractor shall demonstrate the ability to implement a quality plan relevant with respect to the manufacture of nuclear equipment.
  
- As the working language of ITER Organization is English so all deliverables shall be provided in English language only. The bidders shall have English speaking persons who should involve in this task who can discuss/communicate in English in various periodic meetings.

The CV of the persons, who will be later involved in the execution of the task orders, may be requested with the tender.

## **5 Safety requirements**

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case, the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- The Order shall be flowed down to specific requirements to the system.

These requirements will be flowed down in the requirements document for this system.

## **6 References**

The ITER PCDH is open to consult online at:

<https://www.iter.org/fr/mach/codac/plantcontrolhandbook>.

Further information on the ITER Organization procurement can be found at:

<http://www.iter.org/org/team/adm/proc>