

Technical Specifications (In-Cash Procurement)

C4T 19159 Summary of Tech_Spec

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SUMMARY OF TECHNICAL SPECIFICATIONS

VACUUM-VESSEL IN-SERVICE INSPECTION (VV ISI) WORK PACKAGE WP4 DESIGN AND PROCUREMENT OF ACOUSTIC EMISSION SYSTEM FOR THE THREE UPPER PORTS

Call for Nomination Reference IO/20/19159/PMT

1 Purpose

The purpose of this project is to provide the designing and procurement of an integrated ex-vessel Acoustic Emission Monitoring System (AEMS) used during hydrostatic pressure tests of the ITER Vacuum Vessel after putting the ITER Tokamak into operation.

There are seven Work Packages (WPs), in total, which are intended to support the implementation of the IO strategy for In-Service Inspection of the Vacuum Vessel (VV ISI):

- WP1: VV ISI Equatorial Port 7 ISI access penetration;
- WP2: VV ISI Lower Ports ISI penetrations;
- WP3: VV ISI Shell inspection tools and RH equipment;
- WP4: VV ISI Acoustic Emission Monitoring System (AEMS);
- WP5: VV ISI Equipment for remote inspection of the lip seal welds;
- WP6: VV ISI Equipment for remote inspection of the VV Gravity Supports;
- WP7: VV ISI Corrosion Monitoring Chambers.

The CFTs for VV ISI WPs 1/2/3/5/6/7 are completed and the relevant Contracts signed. Currently all signed Contracts are under intensive execution.

The work to be carried out within this Call for Tender is for Work Package #4 (WP4), Design & Procurement Contract.

2 Background

ITER is a joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power. The partners in the project - the ITER Parties - are the European Union (represented by EURATOM), Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA. ITER is being constructed in Europe, at Cadarache in the South of France. General information on the scope and design of the ITER Machine is described in the www.iter.org website.

ITER is a Basic Nuclear Installation (INB-174) licenced by the French Nuclear Authority (ASN).

The ITER Vacuum Vessel is a Protection Important Component (PIC), Safety Class 1, as it provides the first confinement barrier of the Tokamak and Decay Heat Removal (DHR) function. VV is classified as a level N2 Cat IV Nuclear Pressure Equipment following the French Decree 12 December 2005 (ESPN). The VV design involves inherent access restrictions for In-Service Inspection and very specific design and load conditions.

On the ground of its nuclear classification, the ITER Vacuum Vessel requires In-Service Inspection. IO has developed a VV ISI strategy involving continuous load monitoring and load following and dedicated periodic inspection and requalification.

3 Scope of work

The services to be provided are as follows:

“Vacuum Vessel In-Service Inspection Work Package 4 (VV ISI WP4): Design & Procurement of Acoustic Emission Monitoring System (AEMS) for three VV Upper Ports”

The subject of the WP4 Design & Procurement Contract is to develop, qualify, and deliver an integrated Ex-Vessel system for Acoustic Emission (AE) monitoring of three Upper Ports during hydrostatic pressure tests of the ITER Vacuum Vessel that includes all necessary components, both, hardware and software.

The objective of that Acoustic Emission Monitoring System (AEMS) is to support the prevention of material degradation of the Vacuum Vessel Nuclear Pressure Equipment (VV NPE).

IO intends to use the data collected by the AEMS in support of the execution of periodic inspection and periodic requalification the ITER Vacuum Vessel Nuclear Pressure Equipment (VV NPE) required by the French ESPN Regulation.

Technical Specification

A Technical Specification will be issued for WP4, and all Candidates, once they have been prequalified by the IO, will be invited to provide proposals.

The award for WP4 will be based on the Candidate's ability to meet the requirements defined in the Technical Specification.

Areas of Expertise

Following Areas of Expertise (AoE) are prerequisite for successful execution of the work in the scope of WP4:

- 1) Design of Acoustic Emission Monitoring System (AEMS) to evidence adequate safety;
- 2) Prototyping and Qualification of designed VV ISI AEMS;
- 3) Manufacturing of designed VV ISI AEMS;
- 4) Assembly/Installation/Testing of manufactured AEMS;
- 5) Commissioning of manufactured AEMS.

The required AoE include, but are not limited to, the following topics:

- *Thermal analysis:* Both steady state and transient, including surface heat flux and volumetric heat loads, heat transfer by radiation and convection.

- *Mechanical analysis:* Both static and dynamic analysis (linear and non-linear), including a variety of loads, typically: seismic, EM, thermal.
- *Structural Integrity:* To assess the acceptance of the thermal and stress fields, generated by various loads combinations, against the applicable structural design criteria (including “Structural Design Criteria for ITER In-Vessel Components”, “RCC-MR 2007 Construction Rules for Mechanical Components of Nuclear Installations”, “ASME B31.3 Process Piping”, “ASME Boiler and Pressure Vessel Code”, EUROCODE & EN13-445 for pressure vessels, EN13001 for lifting systems and EN13480 for piping systems).
- *French Regulations:* To prepare analysis report to be submitted to the Agreed Notified Body (ANB), as required by ASN (Autorité de Sûreté Nucléaire). Familiarity with the “French Decree 99-1046 of 13 December 1999 on Pressure Equipment (ESP - Equipement Sous Pression)” and “French Order of 12 December 2005 on Nuclear Pressure Equipment (ESPN - Equipement Sous Pression Nucléaire)”.
- *System engineering analysis:* To analyse the propagation of requirements and to perform functional analysis. Global requirements from high level ITER documents like the Project Requirements have to be propagated to all systems and vice versa it has to be analysed whether the propagated requirements fulfil the global ones. Functional Analysis (FA) shall be used to derive the functional specifications for ITER Systems. The FA shall also be used as entry point to risk analysis and RAMI (Reliability, Availability, Maintainability, and Inspectability) analysis.
- *Manufacturing feasibility and optimization:* To provide feedback to the design from a manufacturer’s perspective, to identify areas of the design with feasibility issues, to propose improvement of the design with the aim to facilitate the fabrication and reduce the construction cost without impact to performance or quality of the components.
- *Cost studies:* To develop cost assessment of proposed design solutions and in support of Project Change Requests. Cost breakdown should typically include engineering and manufacturing activities, to a level sufficiently detailed to allow identification of cost drivers and including, e.g., the cost for manufacturing drawings, materials, manufacturing jig and fixtures, welding, non-destructive testing, tolerances, test and inspection, QA documentation.
- *Schedule evaluation:* To support the ITER Organization for manufacturing and assembly schedules evaluation to have realistic and reliable schedule based on the experiences from existing similar projects.
- *Manufacturing inspections:* To provide the ITER Organization on welding experiences of design, materials and process, as well as on non-destructive examination (X-ray, ultrasounds, helium leak test, dimensional tests, pressure tests, etc.). Familiarity with the corresponding EN standards and/or similar code and standard for nuclear facility is an advantage.
- *Instrumentation & Control:*
 - o *Qualification:* To contribute to the follow up of qualifications of instruments.
 - o *Procurement:* To assist in the follow up of the procurement of instrumentation with a particular emphasis on signal conditioning and data acquisition. This works includes in particular the development of procedures for factory acceptance and site acceptance with high quality assurance standards.
- *Assembly feasibility and optimization:* To identify areas of the design with assembly feasibility issues, to propose improvement of the design with the aim to facilitate the assembly on-site and reduce the construction cost without impact to performance or quality of the components. Assembly feasibility assessment shall include all aspects of assembly including rationalisation of assembly requirements (including testing), lifting, handling and alignment and the corresponding interfaces to the relevant tools, transport

from factory to assembly site, interfaces with other systems and their assembly activities.

4 Experience Requirements

The ITER Organization is looking for Contractors with demonstrated experience in each Area of Expertise. The companies or consortia of companies selected shall be recognised for their knowledge and expertise in the field of ISI engineering and supply within the realm of nuclear technology, e.g. international experience in implementation of large-scale nuclear projects and recent generation nuclear power reactors, and will have experience in:

- Developing inspection solutions and procedures for plants with a similar profile to ITER;
- Carrying out mock-up work-up (virtual and physical) to validate inspection equipment and procedures;
- Controlling operating costs through standardisation, simplification and optimisation of the design solutions;
- Developing documentation for the nuclear installation licensing basis, including design justifications for proper implementation of ALARA principle.

The companies or consortia of companies are expected to provide direct evidence of this work in their submissions. Previous experience and knowledge of the ITER project is not required, however, the companies need to be self-sufficient in seeking out detailed information in order to accomplish the contract successfully.

In addition, during the tendering process the Supplier will have to provide evidence of:

- *QA system:* The Tenderer shall have and maintain a valid ISO 9000 certification and shall have the duty to verify and document the equivalent quality level of all its subcontractors and consultants.
- *Professional Software:* The Tenderer shall provide a list of the professional software available and used, e.g. for structural (static, dynamic, seismic), thermal and thermo-mechanical analyses, electromagnetic analyses (such as ITER conventional multi-physic analysis software ANSYS), CAD software (such as ITER conventional CAD software CATIA V5 and/or V6, if it is applicable) etc.

5 Award of the Contract

One contract will be awarded for WP4 in order to provide the full range of services required. It is not expected that a single company will have the full capability required for all AoE, and as such, companies are encouraged to tailor their proposed support in areas relating to their specific skills and interests. Suitable teaming arrangements for multiple companies are also encouraged, where appropriate, to enhance the offering of the Tenderer.

The language used at ITER is English. A fluent professional level is required (spoken and written English).

6 Candidature – Expression of Interest

Participation is open to all companies participating either individually or in a grouping (consortium) which is established in an ITER Member State. A consortium may be a

permanent, legally-established grouping or a grouping, which has been constituted informally - but formalized with engagement letters -- 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 consortia shall be presented at the pre-qualification stage, where they will be assessed as a whole. Consortia cannot be modified later without the prior approval of the ITER Organization.

Withdrawal of the United Kingdom from the European Union (BREXIT)

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 continue 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.

The ITER Organization may decide to broaden the eligibility to other countries as deemed appropriate.

7 Timetable for the Tender Process

The tentative schedule for this tender process is as follows:

Call for Nomination	June 2020
Invitation for Pre-Qualification	August 2020
Invitation for Call for Tender	September / October 2020
Tender Submission	December / January 2020
Award of Contract	April / May 2021