

Technical Specifications (In-Cash Procurement)

**C4N - Design Analysis for the ITER Tokamak
Engineering Department**

SUMMARY OF TECHNICAL SPECIFICATIONS

The purpose of this Framework Contract is to provide analysis support for the design, procurement, acceptance, installation and commissioning of ITER Tokamak components.

DESIGN ANALYSIS FOR THE ITER TOKAMAK ENGINEERING DEPARTMENT

Call for Nomination (C4N) Summary of Technical Specifications

1. Purpose

The purpose of this Framework Contract is to provide analysis support for the design, procurement, acceptance, installation and commissioning of ITER Tokamak components.

2. Background

ITER (“The way” in Latin) is a next generation fusion tokamak designed “to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes”. With a long lifespan over than 30 years, it is intended that ITER will be a single step between the current set of fusion experiment and DEMO, a fusion power plant designed to demonstrate safe and reliable, commercial electricity production.

The ITER Organization consists of 7 Parties, acting through the Domestic Agencies (CN, EU, IN, JA, KO, RF, US) each of them will have a role in supplying most of the systems. The ITER Organization has the overall responsibility for the design and operation of the machine.

The Tokamak is the part of the ITER machine closest to the thermonuclear plasma and includes:

- The Vacuum Vessel and Vacuum Vessel Ports
- The Blanket System
- The Divertor
- The Test Blanket Systems
- The Port Plugs
- The Diagnostics
- The In-vessel Viewing system
- Ion cyclotron heating
- Electron cyclotron heating
- Heating and diagnostic neutral beams

3. Scope of Work

The engineering services to be provided are related to the analysis support for the design, procurement, acceptance, installation and commissioning of ITER Tokamak components.

The estimated overall effort of the Framework Contract will be tentatively of about 40-50 professional person year.

It includes the supporting analysis as required by the design and construction of the tokamak components. It includes the following Areas of Expertise:

- *Electromagnetic analysis.* Off-normal plasma conditions (i.e. plasma disruptions and Vertical Displacement Events) generate eddy and halo currents in the tokamak components, including pipes and pipe bundles. These currents interact with the toroidal and poloidal magnetic field thus generating large electro-magnetic (EM) forces. Eddy and halo currents in the structures shall be calculated on the basis of inputs provided by the DINA code. After that the EM loads shall be evaluated and properly interpolated on very detailed thermo-structural models.
- *Neutronic analysis:* to calculate the neutronic heat deposition, the material activation and radiation map/dose, the material damage (dpa) and the helium production.
- *Computational fluid dynamic analysis:* to calculate pressure drop, flow rate, heat transfer coefficient, draining and drying, using 1D and 3D CFD codes.
- *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: pressure, 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 Regulation:* to prepare analysis report to be submitted to the Agreed Notified Body (ANB), as required by ASN (Autorité de Sureté Nucléaire). Familiarity with the “French Decree 99-1046 of 13 December 1999 on Pressure Equipment (ESP - Equipement Sous Pression)” and “French Order 2005 December 12th for nuclear pressurised equipment (ESPN - Equipement Sous Pression Nucleaire)”.
- *Independent Peer Review:* to perform the reviewing and technical checking of the analysis reports prepared by the ITER Organization or by any other Performer on behalf of the ITER Organization. The scope of the reviewing and technical checking is to check the analyses or calculation package for technical adequacy and conformance with the project requirements. The Reviewer has to verify the accuracy of the analysis procedure (model, assumptions, acceptance or design criteria, loads and boundary conditions, etc.) and the Checker has to verify that the developed model reflects the effective design and that all input conditions are properly referenced and implemented. The conclusions from the independent reviewer should be explicit enough, quantitative and qualitative to enable the IO Technical Responsible Officer to decide on whether to accept the analysis deliverables, request for a revision or to reject it.

4. Experience Requirements

The ITER Organization is looking for Contractors with demonstrated experience in each Area of Expertise.

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, neutronic analysis, CAD software, etc.

5. Award of Framework Contract

It is not expected that a single company will have the full capability required for all Areas of Expertise, 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. General information on the scope and design of the ITER machine is described in the www.iter.org website.

It is contemplated that the ITER Organization will award the Framework Contract for an initial period of three years, and may extend contract options for two additional years as required to complete the necessary engineering work.

The framework contract will be implemented by means of Task Orders, intended as a self-standing engineering activity. Each Task Order shall be signed by the Contactor and the ITER Organization.

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

6. Candidature – Expression of Interest

Candidature 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.

7. Timetable for the Tender Process

The tentative schedule for this tender process is as follows:

Call for Nomination (C4N)	<i>May 2019</i>
Pre-qualification of Companies	<i>June - July 2019</i>
Invitation for Call for Tender	<i>August - September 2019</i>
Tender Submission	<i>October - November 2019</i>
Contract placement	<i>December 2019 – January 2020</i>
First Task Order signature	<i>December 2019 – January 2020</i>