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EXTERNAL REFERENCE

Call for Expert Documents

Provision for Services in Support of Heat Loads Specifications and Assessment of Internal Components

The scope of this Call for Expertise includes the supply of a specialised engineer/physicist to update the Heat Load Specifications of the Blanket and Divertor systems, to evaluate the 3D heat load distributions on the Plasma Facing Component envelope, then to perform thermal analysis with the objective to assess the design performance.

Approval Process			
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Read Access	**LG: General view access to Divertor docs, LG: People with add access, GG: IO DDGs (and Senior Advisors), AD: Section - Tungsten Divertor, AD: Department - Administration, AD: Department - Administration - EXT, AD: Auditors, project administrator, RO**		

Provision for Services in Support of

Heat Loads Specifications and Assessment of Internal Components

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1 Background and Objectives

The Blanket and Divertor systems are among the most technically challenging components of the ITER machine, having to accommodate high heat fluxes from the plasma, large electromagnetic loads during off-normal events and demanding interfaces with many key systems and the plasma itself.
The Final Design Review (FDR) for the Blanket System (Shield Block, First Wall panels and Attachments) was successfully held in April 2013 and the Blanket System is now in its Procurement Arrangement (PA) preparation phase. The effort on the Blanket System for the next few years would require minor variants designs to be developed and verified, in particular regards to the local First Wall panels shaping.
The FDR for the Full Tungsten (W) Divertor was successfully held in June 2013. Some design changes compared to the CFC/W Divertor design were implemented to provide protection of the target leading edges, since with the introduction of W in the target regions, no misalignment is tolerable. For this purpose a shaping strategy of the Plasma Facing Components (PFC) was developed. Some questions were raised during the FDR on the shaping that require additional verification of the proposed design.

The objectives of this Task Order are to provide the ITER Organization (IO) with update of the PFC heat loads specifications and to proceed to the systematic evaluation of heat loads distribution for the defined reference scenarios and design of internal components. Finite element calculations shall also be provided to verify the thermal performance of the design.

2 Scope of Work

The scope of this Call for Expertise includes the supply of a specialised engineer/physicist contracted to ITER to perform the following tasks:

- To refine or prepare relevant Heat Load Specifications (HLS) in collaboration with Divertor and Blanket physicists and engineers. This means in turns:
    - To get acquainted with the current HLS and close-out reports of the FDRs;
    - To organize, chair and minutes meetings with relevant engineers and physicists;
    - To update the corresponding HLS.

- To evaluate the 3D heat load distributions on the PFC envelope. This means in turns:
    - To select the CATIA model from the IO database for the meshing of the “shadowed” and “shadowing” components;
    - To perform the 3D field line tracing with dedicated code, interfacing with magnetic equilibrium reconstructions from scenario development codes used at the IO (CORSICA, DINA);
    - To post-process the data;
    - To provide the proper analysis report including all the compiled results.

- To perform 3D Finite Element thermal calculations on the PFC. This means in turns:
    - To select the CATIA model from the IO database for the meshing of the components;

- To perform the 3D Finite Element heat calculations with ANSYS;
- To post-process the data;
- To provide the proper analysis report including all the compiled results.

3 Estimated Duration

The duration of the engineering support services will be for one year.

The IO may exercise the option to extend these services for a maximum of two additional period of one year. Such option shall be exercised by written notice to the Contractor no later than 90 days before the expiration of the initial term of the contract or of the additional period.

The expected starting date of the contract is 20th **January 2013** or the signature date of the Task Order, whichever is later.

4 Work Description

The work description of the engineering support to be provided by the Contractor is, but not limited to, the following:

Subtask 1:
- Refine the Divertor heat load specifications and reference plasma scenarii used as basis for the shaping analysis, following to the questions raised by the panel expert during the full-W Divertor FDR.
- Evaluate the 3D thermal load distributions at the target region and baffle region for the Dome, Inner and Outer Vertical Targets (IVT & OVT).
- Perform 3D Finite Element thermal calculations on target region and baffle region for the IVT & OVT and confirm/infirm that the shaping is acceptable.

Subtask 2:
- Prepare the Divertor heat load specifications for the particular case of the strike-point excursions along the divertor targets.
- Evaluate the 3D thermal load distributions on the target/baffle transition region of the Outer Vertical target.
- Perform 3D Finite Element thermal calculations on the target/baffle transition region of the Outer Vertical target with the objective to define the range of the strike-point excursions.

Subtask 3:
- Refine the Blanket heat load specifications, following the effort of clarification done in the frame of the full-W Divertor design development.
- Evaluate the thermal load distribution on the First Wall panel minor variants generated by diagnostic intrusion and confirm/infirm that the shaping is acceptable.
- Evaluate the thermal load distribution on the First Wall panel edges, perform the 3D Finite Element thermal calculations and confirm/infirm that the margin to critical heat flux is acceptable.

Note that in all the subtasks above, the thermal load distribution is expected to be calculated first at the “global” scale of the PFC, second at the “local” scale of the monoblock (with the

exception of Dome where the load distribution is expected to be calculated at "global" scale only).

5 Responsibilities

5.1 Contractor's Obligations

The Contracted engineer will be fully dedicated to performing the Services.

The contracted engineer is expected to be on assignment at the ITER Site of Cadarache, France, to perform the work for the entire duration of this Expert Contract.

The contract does not allow reassignment of the contracted engineer for the duration of the task without the prior approval of the ITER Organization (IO).

The contracted engineer will be bound by the rules and regulations governing IO safety and security.

In case of a non-EU citizen, it is required for the Contracted engineer to obtain his/her French working visa prior their arrival in France.

5.2 Obligations of IO

IO shall make available to Contractor's Personnel dedicated and located on IO site at Cadarache:

- Procedures, information and data and any other information for the Contractor to perform its functions under this Scope of Work;

- User facilities on equipment (including communication lines and computers) with adequate capacity necessary for a proper execution of the Services by the Contractor; Computers, software and all data produced during the contract shall remain property of the ITER Organisation.

- A safe work area which meets the requirements which are generally made for such an area for the satisfactory execution of the Services.

6 Deliverables and Due Dates

The reports on the above deliverables will be done at contract signature + 3 months and then after each quarter.. The priority order of the Sub-tasks will be defined by the IO Responsible Officer.

7 Specific Requirements and Conditions

The Contracted engineer assigned to perform the services described under these Specifications agrees to abide by the following nondisclosure conditions:

- Not to disclose, deliver, or use for the benefit of any person other than the IO, or its authorized agents, any restricted or confidential information or material he or she receives from the IO, other than material or information previously in the records of the Contractor or obtainable prior to such disclosure, delivery, or use, from third parties or from the public domain, or required to be disclosed by law or court order;

- To adhere to any reasonable policies or instructions provided by the IO as to the classification, use or disposition of any restricted or confidential information or materials;

- To not use any restricted or confidential information or material for personal gain.

The Contractor further agrees to take such reasonable steps as may be needed to ensure that the terms of the nondisclosure statements are observed during and after the termination of the Services.

8 Acceptance Criteria (including rules and criteria)

Monthly reports shall contain a description of the work carried out during the month.
All communications between the Contractor and the IO shall be in English language and all measures shall be given in the metric system SI. This includes all reports, documentation, correspondence and labelling.
Text and tables of the Final Report in MS-Word shall also be delivered electronically to the IO.

9 Technical Requirements

The contractor shall propose an engineer/physicist with the following competences:

- Master or PhD in Physics or in Engineering
- Advanced knowledge on Plasma Wall Interactions: at least 5 years of practical experience on heat loads specifications development;
- Advanced knowledge on PFC shaping activities: at least 5 years of practical experience as field line tracing code user;
- Knowledge on thermal analysis activities: at least 3 years of experience as Finite Element code user.
- Programming and modelling skills:
    - CATIA CAD software (awareness and understanding)
    - Field line tracing code (proficiency level required)
    - Interfacing and maths language like matlab (proficiency level required)
    - Finite Element code (proficiency level required)
- Ability to work effectively in a multi-cultural environment in English language
- Ability to work in a multidisciplinary team, with engineers and physicists
- Ability to organize and monitor activities
- Good planning and organisational skills

10 Travel Expenses

The ITER Organization may request Contractor's staff to travel and work at places other than ITER site. Travel mission expenses are claimed by the Contractor according to the following:

a) Only economy class flights are reimbursed by ITER Organization.
b) Subsistence expenses reimbursement rate for Contractor's employee shall not exceed the respective per diem rates.
c) Travel by train (first class) when agreed by ITER Organization
d) Travel by car reimbursement rate is 0.50 € / km when flight or train are not available

All claims for mission travel will be reimbursed only when supported by original invoices and flight tickets.

The maximum amount to be invoiced to ITER Organization shall be 3 000 Euro per year of duration of this Task Order.

11 Payment schedule / Cost and delivery time breakdown

Invoices will be paid monthly, based on working days worked and according to the resources allocated to the Contract in the month, supported by accepted deliverables.

Time for acceptance of the deliverables and written reports by the IO Responsible Officer shall be 15 calendar days.