

## Technical Specifications (In-Cash Procurement)

# Technical Specification for Framework Contract in Engineering Services for Maintainability Analyses

The document specifies the requirements for a Framework Contract regarding engineering services to perform maintainability analyses at ITER GBS levels to support the Maintainability activity.

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### 1 Preamble

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) [1] that constitutes a full part of the technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of [1].

### 2 Purpose

This technical specification document describes the scope of work to be performed under the Framework Contract service for the Maintainability activity.

### 3 Acronyms & Definitions

#### 3.1 Acronyms

The following acronyms are the main one relevant to this document.

Abbreviation	Description
CC	Critical Component
DIR	Design Integration Review
GBS	Geographical Breakdown Structure
ORE	Occupational Radiation Exposure
PBS	Plant Breakdown Structure
PPE	Personal Protective Equipment
SPV	Single Point of Vulnerability

For a complete list of ITER abbreviations see: [ITER Abbreviations \(ITER\\_D\\_2MU6W5\)](#)

#### 3.2 Definitions

**Accessibility:** Accessibility refers to the relative ease with which an assembly or component can be reached for repair, replacement, or servicing.

**Contractor:** shall mean an economic operator who have signed the Contract in which this document is referenced.

**Human Factors and Ergonomics:** ergonomics (or human factors) is the discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

**Maintenance:** the organized activity, both administrative and technical, of keeping structures, systems and components in good operating condition, including both preventive and corrective aspects. ITER Maintenance Plan is defined in [9].

**Maintainability:** ability of an item under given conditions of use, to be retained in, or restored to, a state in which it can perform a required function, when maintenance is performed under given conditions and using stated procedures and resources.

**Task:** The task consists of the set of prescribed objectives, goals, which are defined by work organization, and assigned to workers. Task is a required, recommended, or permissible action, intended to contribute to the achievement of one or more outcomes of a process.

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**Working situation:** The concept of working situation, in its ecological approach, covers the task, the physical environment where the task is performed (i.e. the premises, the equipment, the tools, the available information), the procedures, the objectives to be reached in terms of performance and safety, the work organization (including the means of worker's supervision). These characteristics are observable. Working situation is a situation where one or several tasks are performed by an individual or a group of individuals (working together [collaboration] or independently but sharing the same workspace / working simultaneously [coactivity]) in a given operation context (normal/routine, degraded, incidental-accidental).

**Workplace:** The physical area where a person performs tasks. It may include physical fixtures such as furniture, equipment, hallways, stairs, vehicles, and displays and is affected by environmental variables such as lighting, temperature, and noise.

**Workspace:** Volume allocated to one or more persons in the work system to complete the work task. Workspace is one of the dimensions taken into account in the design for Accessibility.

**Workstation:** A location where the operator may spend only a portion of the working shift. It is a subset of the workplace. An operator may travel and work at several different workstations in the workplace. Combination of work equipment for a particular person in a workspace.

## 4 Applicable Documents & Codes and standards

### 4.1 Applicable Documents

This is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the below list of reference documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, this is the responsibility of the contractor to seek clarification from IO.

Upon notification of any revision of the applicable document transmitted officially to the contractor, the contractor shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

Ref	Title	IDM Doc ID	Version
[1]	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
[2]	Maintainability Design Plan	BBNPZ2	1.1
[3]	Working Instruction for Scoping and Identification of Critical Components for Operations	39DWTY	2.0
[4]	Safe Access for Maintainability	RUGWUK	1.4
[5]	Human and Organizational Factors Lessons Learned and Standard Requirements for ITER Maintenance and Local Operations	YQSQ46	3.6
[6]	Ergonomic Guideline on physical constraints/limits applicable to upper limb	WLLRBU	2.1
[7]	Identification of space reservations related to accessibility, operability and maintainability	94DLFK	1.0

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Ref	Title	IDM Doc ID	Version
[8]	Protective Equipment and Hostile Environment Layout	RBYZ42	1.2
[9]	ITER Maintenance Plan	7E5YZY	2.1
[10]	Design Integration Review Procedure	3CNWMT	3.0
[11]	Working Instruction for Construction Readiness Review	QXW4KQ	3.2
[12]	Guideline for Systems Maintainability	BBNAYB	1.1
[13]	Standard Maintenance Templates Handbook	63P48A	1.0
[14]	Procedure for ITER CAD Data Exchanges	2NCULZ	4.2

## 4.2 Applicable Codes and Standards

This is the responsibility of the contractor to procure the relevant Codes and Standards applicable to that scope of work.

Ref	Title
CS1	EPRI 1015139: Guidelines for Inspectability for New Plant Components
CS2	EPRI NP-4350: Human Engineering Design Guidelines for Maintainability
CS3	ASD Technical Report 61-424: Guide to Integrated System Design for Maintainability (1961)
CS4	MIL-STD-1472F (23 August 1999) - DESIGN CRITERIA STANDARD - HUMAN ENGINEERING
CS5	MIL-STD-470 Maintainability Program Requirements (for Systems and Equipment)
CS6	MIL-STD-471A, Maintainability Verification/Demonstration/Evaluation
CS7	IEC 60300-3-10:2001 Dependability management - Part 3-10: Application guide - Maintainability
CS8	IEC 60706-2:2006 Maintainability of equipment - Part 2: Maintainability requirements and studies during the design and development phase
CS9	IEC 60706-3:2006 Maintainability of equipment – Part3: Verification and collection, analysis and presentation of data.

## 5 Scope of Work

This section defines the specific scope of work for the Framework Contract service, in addition to the contract execution requirements as defined in [1].

In agreement with ITER Project Requirements, ITER Systems, Structures and Components maintainability must be ensured:

- ITER systems must be maintained in the least time, at the least cost, with a minimum expenditure of support resources, without adversely affecting the item's performance or/and its safety characteristics.
- The maintainability of ITER systems must ensure the minimum time to recognize, isolate, and correct a malfunction, to understand and apply technical procedures, to gain access to faulty items, to repair or replace faulty items, and to test and verify accuracy and adequacy of the maintenance actions.

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The maintainability of ITER systems components needs to be assessed, in particular in complex and congested ITER buildings locations (refer to Appendix A), and will be implemented through the Maintainability activity [2]. The maintainability, in terms of workplace accessibility and workstation ergonomics, must be verified at the occasion of the integration reviews to ensure that issues are identified and resolution actions defined, and that opportunities for improvement are incorporated, within the ITER systems design iterations.

Accessibility to components located in the different ITER building areas, in particular those that are identified as Single Points of Vulnerability (SPV) and Critical Components (CC) [3] must be ensured to perform the required maintenance tasks (corrective and preventive), while at the same time, workstation ergonomics are respected, and temporary, or permanent, provisions are defined to support the maintenance tasks (e.g., platforms, lifting & handling equipment). In addition, the time and PPE requirements to perform the tasks will have an impact on the Occupational Radiation Exposure (ORE), in particular in building areas with a hostile environment, and need to be taken into consideration to support the verification of ORE limits for the ITER facility.

The maintainability analyses are expected to be performed by ITER Geographical Breakdown Structure (GBS), focusing on specific rooms of each ITER GBS or on the overall ITER GBS, to support Design Integration Reviews (DIR) [10] prior to Construction [11], using the building environment as defined in 3D ENOVIA models.

The scope of work consists of maintainability analyses of ITER systems in multiple ITER GBS.

### 5.1.1 Description

The maintainability analyses in each ITER GBS shall include the following activities focusing on the working situations for the maintenance of ITER systems components:

- Accessibility analyses at the level of the workplace using 3D models to assess the relative ease with which SPV and CC can be reached for repair, replacement, or servicing (including the use of tools/equipment supporting the maintenance tasks) in agreement with Human Factors Standard Requirements for ITER Maintenance and Local Operations [5], Ergonomic Limitations [6][12] and Safe Access for Maintainability [4]
- Ergonomic task analyses at the level of the workstation using 3D models to verify if the maintenance tasks (guidance for standard equipment provided in [13]) can be performed in compliance with Human Factors Standard Requirements for ITER Maintenance and Local Operations [5] and Ergonomic Limitations [6] [12]
- Based on the accessibility and ergonomic analyses support the definition of workspace volumes in 3D models and ensure their connection to the circulation paths and escape routes, to ensure a full, and safe, trajectory allowing the maintenance tasks [7]
- Based on the ergonomic task analyses identify, whenever required, additional tools/equipment to support the maintenance tasks. This could involve, for example, permanent or temporary means of access, as well as lifting and handling provisions for the removal and replacement of heavy equipment.
- Support the definition of laydown and storage area volumes within the workplace to support the maintenance tasks [7]
- Identification of maintainability issues, estimate of the maintainability indicators (as defined in [2]), and recommendations for improvement.

In particular, based on the accessibility analyses and ergonomic task analyses listed previously, the Contractor shall be able to identify and provide solutions for tools/equipment to perform each maintenance task. These tools/equipment includes, for example, means for

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inspection, permanent or temporary means of access, temporary lifting and handling provisions for the removal and replacement of heavy components, temporary provisions to transport heavy components, specific tooling for dismantling operations, temporary space for temporary storage of removed components. The solutions for tools/equipment to perform the maintenance task shall be visualized in 3D with proper attachment or fixation (whenever applicable), as means to demonstrate the feasibility of the tools/equipment implementation and of the maintenance task.

### 5.1.2 *Service Duration*

The maximum expected duration for the Framework Contract is 4 years.

## 6 Location for Scope of Work Execution

The services described in this Framework Contract shall be performed full time, on-site or offsite as best required to execute each activity with the required level of quality. Regular meetings (at minima weekly) shall be held in order to report to the Maintainability Officer the progress on the execution of this Framework Contract, and to discuss difficulties/issues encountered for decision-taking.

In case this Framework Contract is executed offsite, an additional general progress meeting shall be held on-site every month to address major issues and opportunities for improvement on the execution of the Framework Contract.

## 7 IO Documents

Under the defined scope of work, and for each maintainability analysis in an ITER GBS, IO will make available to the Contractor an input documentation package containing 3D detailed models to perform the analyses. It is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the reference documents or the list of input data to perform the studies. The Contractor shall trace the maturity of input data used for the studies and will follow/update the studies depending on the level of maturity of data. The present Technical Specification takes precedence over the referenced documents or input data. In case of conflicting information, it is the responsibility of the Contractor to seek clarification from IO.

## 8 List of deliverables and due dates

The deliverables will be defined in each specific task order. All formal deliverables shall be stored in the exchange area of the Framework Contract and follow the workflow agreed in at the Kick-off Meeting.

## 9 Quality Assurance requirements

Not applicable.

## 10 Safety requirements

Not applicable.

### 10.1 Nuclear class Safety

Not applicable.

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### 10.2 Seismic class

Not applicable.

## 11 Specific General Management requirements

GM3S section 6 [1] applies completed/amended with the below specific requirements.

### 11.1 Contract Gates

Not applicable

### 11.2 Work Monitoring

- Weekly progress meetings for global follow-up.
- Working meetings on demand for specific requests, whenever required
- General progress meeting on-site every month.

### 11.3 Meeting Schedule

Besides the kick-off meeting at the beginning of the contract, the meetings identified in Section 11.2 are applicable.

### 11.4 CAD design requirements

The exchange of CAD data to access the 3D detailed models (contextual data) of the concerned ITER GBS areas shall be made according to [14].

## 12 Responsibilities & Resources Profiles

### 12.1 IO Responsibilities

The IO will appoint a RO for the technical follow up of this contract, which is the Maintainability Officer. The Maintainability Officer will assess the performance and quality of the work and is responsible for checking the deliverables against requirements, schedule, and processes.

### 12.2 Specific Responsibilities of the Contractor

The Contractor shall be able to use the following tools as detailed below:

- **CATIA™ v5 / Enovia:** the contractor is able to consult (read only) the Enovia database, using CATIA v5.
- **Naviswork™/3dxml viewer:** the contractor is able to use these viewer tools.
- **Delmia™:** the contractor ability to use this tool, or another maintainability simulation tool, will be an advantage
- **Unity™/Interact** plug ins for virtual reality simulations of the maintenance tasks and ergonomic analyses: the contractor is able, or willing to learn how, to use these tools.



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### 12.3 Contractor Resources Profiles

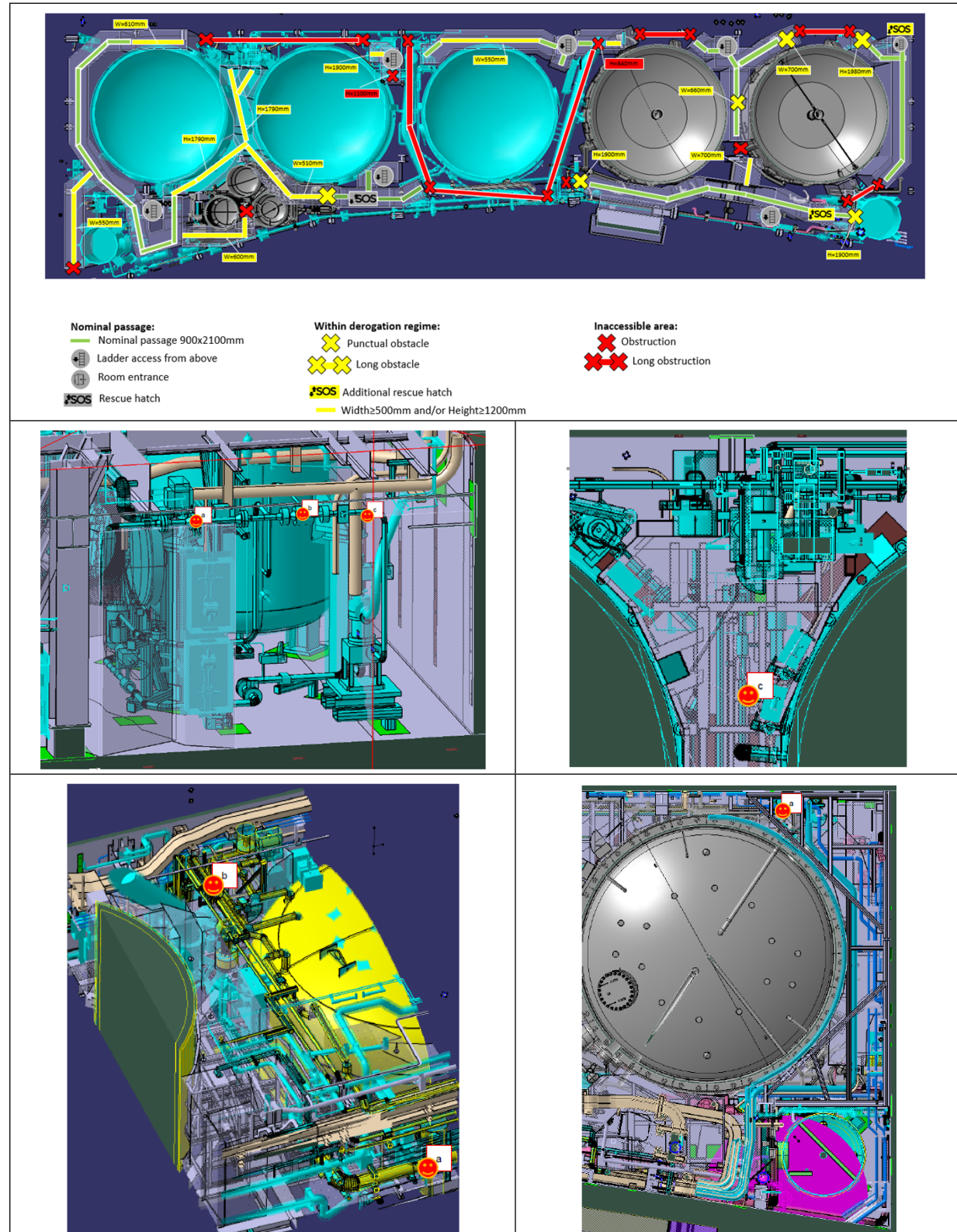
The Contractor shall provide resources with the following competencies for each yearly task order:

- **Expert** resource (1 FTE):
  - Authoritative knowledge and experience (minimum 10 years) in the development and maintenance of complex systems in nuclear facilities with a focus on Maintenance, Maintainability, Human Factors, and Ergonomics.
- **Proficient** resource (1 FTE):
  - Confirmed knowledge and experience (minimum 5 years) in the development and maintenance of complex systems with a focus on Maintenance and Maintainability
  - Experience in CAD design and 3D model implementation (CATIA™, Navisworks™) and on the use of specific maintainability simulation tools (e.g., Delmia™, Process Simulate, or similar). Knowledge of Virtual/Augmented Reality Simulation tools is desirable (e.g., Unity/Interact plug-ins, or similar).

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## Appendix A Overview of an ITER GBS Environment

Each ITER GBS contains usually multiple ITER Systems (with many critical components to be maintained) and are often extremely complex areas with a high occupancy rate, low accessibility, and with several maintainability issues. An overview of the environment of one of these areas (Drain Tank Room) is provided below.



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