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EXTERNAL REFERENCE

Technical Specifications (In-Cash Procurement)

Tokamak I&C Expert Support

This specification defines the tasks to be carried out by a Tokamak I&C Expert to complement the general I&C support

Approval Process			
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1 INTRODUCTION

1.1 Purpose and Scope of the Document

This document specifies the services related to provision of expertize in Tokamak Instrumentation and Control (I&C). The aim is to mitigate the risk of design errors and integration problems of the ITER control system.

1.2 Background

The ITER Control System is divided in three vertical tiers; conventional control, machine protection and safety and two horizontal layers; central control and local plant control. The central control implements integrated operation and is under IO responsibility. The local plant control is designed and supplied by industries contracted by ITER Domestic Agencies and has to interface to the central control. There are a total of 207 local plant control systems.

The ITER project is entering a critical phase where most plant systems are having final design and manufacturing reviews over the next two years and the first plant system arriving on site for integration at the end of 2015. The quality of reviews and communication with the suppliers over the next couple of years will determine the effort (cost) required to achieve integrated operation.

1.3 Glossary

N/A

1.4 Acronyms

CODAC	Control, Data Access and Communication
CIS	Central Interlock System
CSS	Central Safety System
I&C	Instrumentation and Control
IDM	ITER Document Management
IO	ITER Organization
N/A	Not Applicable
PSEG	Plant System Engineering Group
QA	Quality Assurance

2 SCOPE OF WORK

The requested services involve expert analysis and reviews of plant systems functionality and design as well as integrated operation from a Tokamak operation background.

2.1 Subtask 1: Plant System design and manufacturing reviews

The number of formal design and manufacturing reviews of plant systems will increase considerable over the next years (Table 2-1). These reviews are the formal means to correct plant system design to allow later integration.

The Expert shall participate in a subset of design and manufacturing reviews, either as support to the PSEG leader or as substitute. This work involves study of all documentation in advance, participation in the review meeting, and generation of comments in form of Chits and follow-up of those.

2.2 Subtask 2: Tokamak compliant functionality

Internal and external technical meetings to resolve issues take place on a daily or weekly basis. One aspect, which is under staffed at the moment, is relevant experience from Tokamak operation. This experience is fundamental in taking correct decisions on a day to day basis.

The Expert shall participate in some of these meetings to give advice in aspects related to Tokamak operation. Dedicated short term Task Forces to address particular problems will be formed and the Expert shall take the lead of some of those.

2.3 Subtask 3: Functional analysis of integrated operation

Detailed scenarios for required functionality to operate ITER needs to be developed. A first draft for conventional control is available in CODAC Functional Analysis *(ITER_D_MN9HZ4 v1.1)*. It shall be expanded and similar documents developed for interlock and safety. In particular the interplay between the segregated tiers (CODAC, CIS and CSS) shall be analyzed.

The Expert shall develop scenarios, particular on Tokamak specific inter plant automation such as pump down, cool down, warm up, coil excitation, etc. The scenarios shall be verified by analyzing the design of concerned plant system and documented in technical notes.

2.4 Subtask 4: Detailed interface definition

Interfaces between plant systems and the central control system are defined in the plant system profile database. The level of detail must go down to variable level (commands, status, topics) to verify functionality and integration.

The Expert shall review detailed interface definitions for some plant systems and raise issues if defects are discovered.

2.5 Subtask 5: Definition of integration activities and schedule

Integration of plant systems on-site will start in 2016 and last for many years. The detailed activities and schedule for plant system integration is being developed now.

The Expert shall participate in detailed definition of activities and schedule for some of the plant systems.

Table 2-1 Near term Final Design Reviews extracted from project schedule

PBS	PA No.	Title	PS I&C	FDR
11	1.1.P5B.IO	Feeder Sensors	MAG-MATF MAG-MSPC	Dec-15
24	2.4.P1A.IN.01	Cryostat	CRST-CYSI	Oct-14
24	2.4.P1B.IN.01	Vacuum Vessel Pressure Suppression System	VV-VPSI	Nov-14
26	2.6.P1A-B.US.01	Tokamak Cooling Water System: Material & Transportation	CWS-TCWS	Sep-16
26	2.6.P2A.IN.01	Heat Rejection System (HRS) & Comp Cooling Water (CCWS), Chilled Water System (CHWS)	CWS-SCSU	Jan-15
27	2.7.P1.KO.01	Thermal Shield	CRST-TSMD	Oct-14
31	3.1.P1.EU.02	Front End Cryo-Distribution: Front End Cryopump Distribution	VAC-CR,VAC-RS, VAC-TN	Mar-16
31	3.1.P2.US.01	Roughing Pumps and Roughing Pumps (VS-RP)	VAC-CR,VAC-SV, VAC-TN, VAC-VENT	Jun-17
31	3.1.P3.EU.01	Leak Detection	VAC-LD	Dec-16
31	3.1.P4.US.02	Vacuum Auxiliary Systems (Main Delivery Items)	VAC-CR,VAC-GV, VAC-SV,VAC-TN, VAC-VENT	Jan-15
31	3.1.P4.US.03	Vacuum Auxiliary Systems Third Delivery Items	VAC-CR,VAC-GV, VAC-SV,VAC-TN VAC-VENT	Dec-17
18	3.1.P6.CN.01	Gas Injection System (GIS)	FUEL-FIG	Mar-17
18	3.1.P6.CN.02	Gas Discharge Cleaning Cond System (GDC)	FUEL-GDC	Feb-17
34	3.4.P1.EU.01	Cryoplant (LN2 and Auxiliary Systems) and Cryoplant	CRYO-CA,CRYO-CD,CRYO-CH	Jun-15
34	3.4.P1.IO	Cryoplant	CRYO-CD,CRYO-CH,CRYO-MC	Sep-14
34	3.4.P3.IN.01	Cryodistribution Components	CRYO-CD, CRYO-CH	Mar-17
41	4.1.P2.CN.01	AC/DC Converters	MAG-PFCS	Dec-14
41	4.1.P2.CN.02	Reactive Power Compensation-HF	MAG-PFCS UTIL-RPC	Aug-14 Oct-14
41	4.1.P2.KO.01	AC/DC Converters	MAG-CCPS MAG-PFCS MAG-TFPS	May-14
41	4.1.P3.RF.01	Switching Network, Fast Discharge Units, DC Busbar & Instrumentation	MAG-CCPS MAG-PFCS MAG-TFPS	Aug-14 Jun-16
52	5.2.P1A.JA.01	EC Equatorial Launcher	EC-TS	Oct-17
52	5.2.P1B.EU.02	EC Upper Launcher PTB Window, EC Upper Launcher PTB Main Plug, and EC Upper Launcher	EC-TS	Sep-15
52	5.2.P2.US.01	EC Transmission Line	EC-TS	May-18
52	5.2.P3.JA.01	EC RF Gyrotrons	EC-GN	Mar-15
52	5.2.P3.RF.01	EC RF Gyrotrons	EC-GN	Jul-15
52	5.2.P4.EU.01	EC HV Power Supply	EC-GN	Nov-14
52	5.2.P4.IN.01	EC HV Power Supply	EC-GN	Mar-15
52	5.2.P4.IO	EC System	EC-MC	Sep-19
55	5.5.P1.CN.03	QC Equatorial Port Plug	D2-QC	Sep-16
55	5.5.P1.EU.02	C7 Collective Thomson Scattering		Apr-15
55	5.5.P1.EU.18	G1 Vis/IR Camera	D1-N1	Mar-17
55	5.5.P1.IN.00	Diagnostics	D1-LJ	Jan-16
55	5.5.P1.IN.02	ED XRCS Survey System	D1-LE	Jun-17
55	5.5.P1.KO.02	55.E3 – VUV Core Survey Spectrometer & 55.EG – Divertor VUV Spectrometer	D1-L3 D1-LH	Jan-16
55	5.5.P1.RF.05	E2 H-Alpha and Visible Spectroscopy	D1-L2	Feb-18
55	5.5.P1.RF.06	QB Equatorial Port Plug 11	D2-QB	Nov-16
58	5.8.P1.RF.01	Port Plug Test Facility (PPTF)	RH-PPT1,RH-PPT2,RH-PPT3	Nov-14
64	6.4.P1.EU.01	Radiological Protection for design	RAD-REMS	Jul-17

3 ESTIMATED DURATION

Two years from contract signature, expected in January 2015, until December 2016.

4 LIST OF DELIVERABLES AND DUE DATE

The Expert shall issue monthly progress reports in IDM detailing work performed and deliverables produced as well as defining the scope and deliverables for next month.

Deliverables shall include design review chits, meeting minutes, technical notes and contributions to documents.

5 ACCEPTANCE CRITERIA

Monthly progress reports approved by IO in IDM.

6 PAYMENT SCHEDULE

Payments will be based on daily rates.

The Expert shall issue monthly invoices.

7 SPECIFIC REQUIREMENTS AND CONDITIONS

The Expert proposed by the bidder to carry out the work described in Section 2 must satisfy the following criteria:

- At least five years of experience in Tokamak plant system I&C design and active participation in formal design reviews;
- At least five years of experience in formal interface definition and management for Tokamak plant system I&C;
- At least five years of experience in functional analysis of Tokamak systems (plant system I&C and integrated control system);
- At least five years of experience in integrating plant system I&C and central supervisory control system;
- At least five years of experience in integrating, commissioning and operating a large scale Tokamak;
- Some familiarity with ITER I&C standards (Plant Control System Handbook) would be considered an advantage;
- Capability to work in English language, both verbally and written;

8 QUALITY ASSURANCE (QA) REQUIREMENT

The organization which supplies the engineering services shall have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in ITER document ITER Procurement Quality Requirements (22MFG4).

Prior to commencement of the scope of work a Quality Plan shall be prepared in accordance with Quality Plan (22MFMW) and shall be submitted for IO

Deviations and Non-conformities will follow the procedure detailed in IO document MQP Deviations and Non Conformities (22F53X) .