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MQP Level 2

MQP L2 Procedure for the CAD management plan

The aim of this procedure is to recall the principles of CAD Data Management as industrial best practice, and to describe the strategy and plan for the management of CAD activities on the ITER project, this strategy responding to the ITER project requirements & organizational specificities such as the delocalized design implementation; the complex geometrical interfacing systems, etc...

Approval Process			
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Change Log			
MQP L2 Procedure for the CAD management plan (2DWU2M)			
Version	***Latest Status***	***Issue Date***	***Description of Change***
v1.0	In Work	07 Jun 2008	Draft version of the procedure for internal review only.
v1.1	In Work	09 Jun 2008	Draft version of the procedure for internal review only.
v1.2	In Work	10 Jun 2008	Draft version of the procedure for internal review only.
v1.3	Signed	13 Jun 2008	Renamed to remove 'Draft'. Reviewers names added to cover page. No other changes.
v1.4	Signed	13 Jun 2008	Renamed to remove 'Draft'. Reviewers names added to cover page. No other changes.
v1.5	Signed	19 Jun 2008	Renamed to remove 'Draft'. Reviewers names added to cover page. No other changes.
v1.6	Signed	25 Jun 2008	
v1.7	Approved	10 Jul 2008	
v2.0	Approved	25 Sep 2017	This new version is updated to support the new structure of the DO MQP documentation, as introduced by the the ITER Quality Assurance Program (QAP) (22K4QX), in the scope of the Software Control and Model Development process (Chapter 3.10.3 - CAD Models and Drawing Development). As in the previous version, it recalls the principles of CAD Data Management and describes the strategy and plan for the management of CAD activities on the ITER project. But, unlike previous version which was developping the subactivities into a single document, it flows down this genmeral approach and strategy for CAD Data management into the following processes and corresponding procedures: - Procedure for CAD Work Planning, Specification and Control (U34884). - CAD Execution Procedure (U348G8) - Procedure for Verification and Publication of CAD Data (U348ND) This segmentation is made to bring an easier reading, the sub procedures focusing then on specific types of activities related to CAD Management.. This procedure is also updated for a better alignment with the Design control procedures.
v2.1	In Work	04 Feb 2020	As per approved MQP doc request https://user.iter.org/?uid=2DBA8R the chages are: This update is performed to reflect the IO organizational changes applicable from the from 1st of January 2020. Without any change of content (besides the identification of the stakeholders in IO), the latest MQP template has been applied.
v2.2	Approved	17 Feb 2020	Still under same MQP doc request (see v. 2.1) some minor corrections (DCIN, ENGN).
v2.3	Approved	20 May 2025	This version includes the following changes: - Application of the MQP Document Template (438T76 v5.0) - Application of 2023 reorganization (siglums, services hierarchy naming, …) - Graphical simplification/synthetization of the Fig1 – CAD process – Synthetic view - Flowchart section, which was used to show the CAD process MQP

			document hierarchical view, is now removed. The added value text which was at the bottom of the graph is now used in the section 8 Interface with other processes. - Addition of a RACI matrix in the responsibilities area --> we'll kindly welcome comments on this new item in the document, to be reviewed. - Some rewording, rephrasing or minor typo corrections Changes of references: - Procedure for the Promotion of CAD Data (64F2QY) is replaced by Procedure for the Promotion of CAD Data (28LVHH) that will updated this year, - In section 5,1,3: Design Maturities in CAD Data - Content and acceptance criteria (V35CJH), which is not released, is replaced by Procedure for Verification and Publication of CAD Data (U348ND), the higher level document. Please note: - Text below the references table from previous version has been moved/adapted to section 8 Interaction with other processes in this new version.

Table of Contents

1 Purpose

The aim of this procedure is to recall the principles of CAD Data Management as industrial best practice, and to describe the strategy and plan for the management of CAD activities on the ITER project, this strategy responding to the ITER project requirements & organizational specificities such as the delocalized design implementation, the complex geometrical interfacing systems, the multiple CAD tooling, the CAD working/referential data implementation, etc...

This document defines the general approach, concepts and paradigms used for CAD Data handling and CAD activities management on the ITER project. This approach is propagated to the following processes, and further detailed in the corresponding procedures:

- CAD Work Planning, Specification and Control (U34884) [1],
- CAD Execution Procedure (U348G8) [2],
- Procedure for Verification and Publication of CAD Data (U348ND) [3].

The principles and requirements given in this procedure are extended into a collaborative design dimension through collaboration schemes described in the Protocol of Design Collaboration (24P2F6) [4].

2 Scope

As introduced by the ITER Quality Assurance Program (QAP) (22K4QX) [5] (section 3.10.3), in the scope of CAD process, this procedure for CAD Management Plan holds the foundation of all IO DO procedures as shown in the following figure:

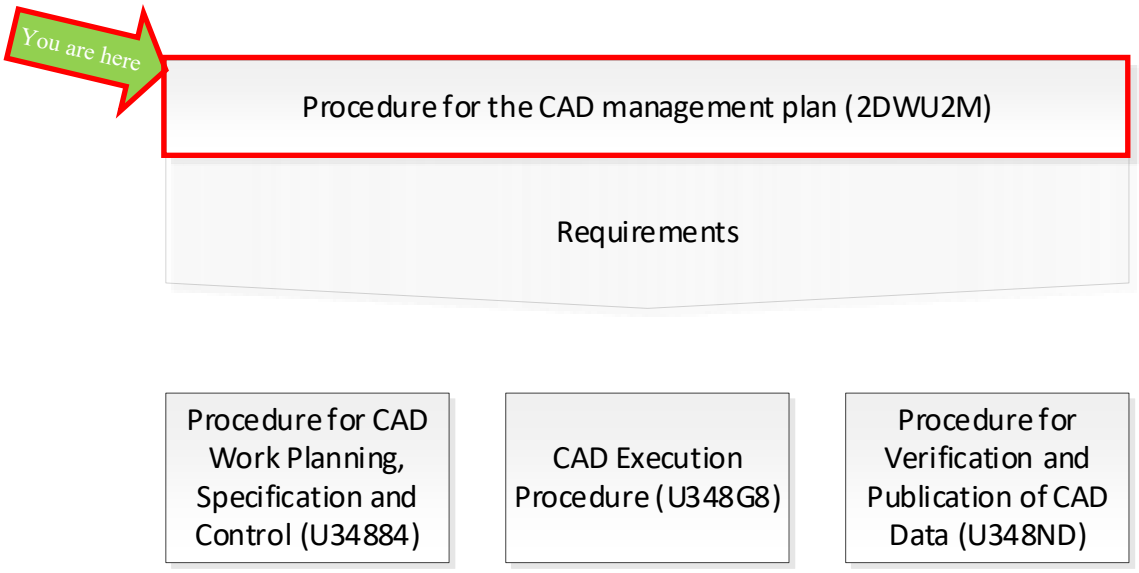

Fig1 – CAD process – Synthetic view

This procedure applies to:

- All ITER project phases: engineering, procurement, handover to construction, commissioning, operations, maintenance, etc.
- All activities involving CAD data production, usage and handling, not limited to the CAD Design itself, but also including:
    - All activities necessary to produce CAD data in a qualitative, controlled and integrated manner:
        - Definition of suitable CAD tools and approaches for the project,

- Administration of CAD systems and CAD data management systems,
- Construction of CAD infrastructure including collaborative capabilities,
- Management and outsourcing of CAD tasks and associated CAD resources management,
- Development of methods, rules and industrial practices in CAD matters,
- Verification, promotion, protection, publication and exchanges of CAD data.

o All activities related to the downstream usage of CAD data:

- Project and design integration,
- Configuration management,
- Collection of CAD data from ITER for manufacturing,
- Provide input for Analysis in accordance with the Procedure for Analyses and Calculations (22MAL7) [6].

As such, the present procedure shall be used by all ITER internal staff and external contributors producing, handling or otherwise using ITER CAD data.

3 Definitions and acronyms

Term	Acronym	Definition
CAD Activity Requester	CAAR	Any individual within IO in charge of product development or construction and requester of CAD activity or services. CAAR originates from departments/offices: MAP, PIP, CPO, CIC, ESD, SID.
Computer Aided Design	CAD	
CAD Data – General Definition		Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design.[1] CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing.[2] CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. (Source Wikipedia, https://en.wikipedia.org/wiki/Computer-aided_design - Edition 21/06/2017)
CAD Data – ITER IO DO refined definition		"CAD Data" is understood herein, and in all MQP documentation issued by IO DO, as the data satisfying the following characteristics: - Data providing the physical and engineering representation or contributing to the functional representation of a system or component, produced through Computer Aided Design software and forming Diagrams, 3D Models and Drawings used in the definition of the ITER plant and

		products, in their native format or through a conversion to neutral format, - undergoing the principles, lifecycle and sub-procedures set in the present procedure - Receiving a unique identifier delivered by the ITER CAD databases, allowing its unambiguous identification, control and traceability along the ITER supply chain. For the ITER project, CAD Data can be CATIA models and drawings, AVEVA models, schematics and isometrics, SSD Diagrams, any other drawing or diagram controlled in SMDD, etc… all of them satisfying the 3 criteria above. Data differing from the CAD Data as defined above, including data formats dedicated to visualization (for example 3Dpdf, 3dxml, smg, etc.) must be used for communication purposes only, and so shall not be used as input for CAD work or any contractual work. This type of data is outside the scope of this procedure. Data derived from the CAD data as defined above, used with Analysis software, after a data format conversion, undergo the Procedure for Analyses and Calculations (22MAL7) [6].
CAD Core Team	CCT	
Control and Integrated Commissioning Program	CIC	Part of the ITER Construction Project (CP)
Central Integration Division	CID	Part of the Science & Integration Department (SID).
ITER Construction Project	CP	
Domestic Agency	DA	
Domestic Agency Design Office	DA DO	DA DO vs IO DO are the acronym used to identify both types of DOs.
Design Control Group	DCG	
Design Coordinator	DECO	
Data Export Request	DER	
Data Export Task	DET	
Design Integration Section	DIS	Part of the Central Integration Division (CID).
Design Office	DO	
Engineering Services Department	ESD	
Geographical Breakdown Structure	GBS	
ITER Organization Central Team	IO-CT	
ITER Organization Design Office	IO DO	IO DO vs DA DO are the acronym used to identify both types of DOs.

		The IO DO is part of the Engineering Services Department (ESD).
Information Technology	IT	
Management & Quality Program	MQP	
Product Breakdown Structure	PBS	
Product Data Management	PDM	
Performer		An all-inclusive term used to cover DAs, contractors and subcontractors. (refer to [18]). Also called “IO Performer”.
Plant Installation Program	PIP	Part of the ITER Construction Project (CP).
Quality Assurance Program	QAP	
Responsible Engineer	RE	
Responsible Officer	RO	
Science & Integration Department	SID	Composed of the Science Division (SCD) and the Central Integration Division (CID).
Section Leader	SL	
System for the management of Diagrams and Drawings	SMDD	
System, Structure and Component	SSC	
See System Design	SSD	

4 References

[1]	CAD Work Planning, Specification and Control (U34884)
[2]	CAD Execution Procedure (U348G8)
[3]	Procedure for Verification and Publication of CAD Data (U348ND)
[4]	Protocol of Design Collaboration (24P2F6)
[5]	ITER Quality Assurance Program (QAP) (22K4QX)
[6]	Procedure for Analyses and Calculations (22MAL7)
[7]	Design Input Control Procedure (U34CSG)
[8]	Procedure for Identification and Controls of Items (U344WG)
[9]	Design Development Procedure (U34DDZ)
[10]	Procedure for the Promotion of CAD Data (28LVHH)
[11]	ITER System Design Process (SDP) Working Instruction (4CK4MT)
[12]	Design Review Procedure (2832CF)
[13]	Design Planning Procedure (U34ACR)
[14]	CAD Manual 01 - Instruction for Use and Introduction (AHFDDK)
[15]	Certification and Assignment of CAD roles in the ITER CAD tools (4EQUNW)
[16]	Procedure for the Design Collaboration Implementation Form (2E2MKW)
[17]	PA Annex B (2FRJMT)

[18]	Quality Requirements for IO Performers (22MFG4)

5 General principles

5.1 CAD Data Management principles

The CAD Management implemented for the ITER project, inherited from the state of the industrial best practice, obeys the following principles:

5.1.1 Principle: CAD data is a fundamental element of design to control the product definition and downstream activities:

This means:

- The generation of a product design, its geometrical and functional definition, relies on the CAD definition of designed objects involving Diagrams, 3D data (models) and CAD drawings.
- Design evolution in context: A new design or design evolution can be considered as consistent with the current project definition, if the Diagrams, CAD models and CAD Drawings defining the new design are successfully checked against the diagrams, models and drawings defining the up-to-date project reference data, assuming that the system requirements not subject to CAD representation are also fulfilled.
  This principle of design evolution in context is an implementation of the Design Input Control Procedure (U34CSG) [7] through the CAD representation.
- The Internal consistency of the CAD Data is ensured by the associativity of the CAD objects between themselves: The 3D Models are linked to Systems Diagrams; the 2D drawings are linked to the 3D models. These “document to document” links should be ensured by using of the same CAD system (or automatic bridges from one CAD system to another, such as SSD-Catia3D, or Aveva3D-Catia 3D) for generating and modifying all these objects. Should the use of a single CAD system be impossible for any reason (e.g. after conversion of a CAD model from a CAD software to another one, the Associativity of the 3D/2D is lost), a specific work instruction shall be put in place to bring the relevant confidence for this consistency.

5.1.2 Principle: CAD data, support to the Project identification of systems design and product elements:

- Uniqueness: A unique identifier is assigned to each CAD object. This unique identifier becomes the numbered reference which shall be used for any identification purpose in all the related processes.
- Versioning: Each significant change or set of changes is identified and recorded through a new version of the CAD Data object. The object can be uniquely identified through the combination of the CAD object identifier and version.
- Any CAD object identified as described above, shall carry the unambiguous identification of the system/component/part it represents through the usage of the numbering convention(s) defined for the project (On the ITER Project, this system/component/part identification is governed by the Procedure for Identification and Controls of Items (U344WG) [8]).

5.1.3 Principle: CAD data, design representation to control and trace the design developments:

The CAD Data is integrated into a lifecycle allowing the follow-up of its development through time, and so to monitor the project developments. As such, CAD data production and its control participate to the process of design development. (See Design Development Procedure (U34DDZ) [9])

The ITER CAD Data lifecycle is defined to allow:

- A fast design evolution and release (after cursory check), enabling an efficient concurrent design while the early design stage of neighboring objects implies short design cycles and frequent verification of integration aspects, so allowing a quick convergence on interfaces.
- An accurate and extensive check of the design is performed for the CAD Data to pass the gate reviews between the design phases defined by the project. Depending on the design stage, this extensive check assesses the system performances, compliance with design requirements, alignment with controlled interfaces and other integration aspects beyond the geometrical aspects, design justification through appropriate calculations, manufacturability, ability to install the system on plant, operability, etc…

The ITER CAD Data lifecycle uses the following values:

- CAD Data Status: The status of a diagram/model/drawing version is an attribute of the CAD Data representing the level of validation/checking through which the Diagram/model/drawing version has gone through. The action to push one CAD object to its next higher status is called 'Promotion'. The CAD Data statuses defined in the ITER CAD systems are introduced here after, further details about being given in the Procedure for the Promotion of CAD Data (28LVHH) [10]:
    - In-Work: means that no validation has been performed on this model version, this model version is currently in evolution.

      Note: This status says that the object version is not frozen yet, this is why this version, not enabling the proper traceability level, is not suitable for exchanges and usage by other entities than the object author.
    - Draft: Means that the model version has successfully gone through a succinct check meeting by IO and its content is frozen. This status has been established in ITER to enable a high frequency of publication of the design updates while offering rather good reliability of the drafted models for what concerns the occupied volume and the interfaces of the model. So, the model at status "Draft" can be considered as the "Best so far" design by interfacing systems, even if not verified through an exhaustive check. The checks for drafting are focused on the geometrical aspects and can be quickly performed so that the drafted models can be used as contextual data by the neighboring systems. Within one maturity (See below for definition of Maturity), there can be as many iterative drafted versions as required to reach the end of the design phase.
    - Approved: Means that this model version has successfully gone through an extensive assessment ensuring that all the acceptance criteria declared in the definition of the design phase/maturity are met. Because of this definition there should be only one approved version of one model within one Maturity. The model's compliance versus the maturity acceptance criteria is assessed through a dedicated CAD Data approval process described in the Procedure for the Promotion of CAD Data (28LVHH) [10].
    - Accepted: Similar to the 'Approved' status for what concerns the engineering value of the model, this status acknowledges the fact that part of the design definition was performed by a body external to IO-CT, through a PA, TA or contract, and the ITER Organization has limited its responsibility to the verification of requirements enounced in the contract

or PAs. For instance, this status can be used by ITER for Manufacturing design, where ITER members have verified the compliance of the design with the interfaces previously defined, while the responsibility of manufacturability lies with the manufacturer who produced and approved the drawings according to its Quality management plan.

Note: Depending on the type of CAD object or CAD system used to manage these objects, some statuses can be removed from - or other statuses can be added to - the canvas given above, while respecting the scheme of the engineering values given to each of the statuses explained above.

Relation between status and types of objects: The approval of a 3D Model data can be subsequent to the approval of the Diagrams defining the same system but cannot precede the approval of Diagrams. The approval of a 2D drawing is subsequent to the approval of the 3D models the drawing is based on but cannot precede the approval of the 3D models.

- CAD Data Maturity: The maturity of a CAD dataset refers to the project phase it is developed for. This maturity is an intrinsic property of each increment produced during evolution of the dataset. Consequently, each CAD data version (design increment) belongs to a single phase.
    - The design phases are sequenced as successive sets of design/engineering activities logically grouped together, targeting an identifiable design achievement within a general plan for system development. For a finer definition of these phases, Please refer to the ITER System Design Process (SDP) Working Instruction (4CK4MT) [11]
    - The design maturity is defined by the criteria to be fulfilled by the design and associated technical documents at the gate review that marks the end of a design phase. Successful verification of the design is realized through approval of the CAD data and its authorization at the gate review.
    - The Maturities set on the ITER project, as defined by the phases identified in the ITER System Design Process, are:
        - CD: Conceptual Design
        - PD: Preliminary Design
        - FD: Final Design
        - MD: Manufacturing Design
        - AB: As-Built
    - For further details of the Design Maturities and the associated acceptance criteria for CAD Data per maturity, please refer to Procedure for Verification and Publication of CAD Data (U348ND) [3], which defines the verification requirements for passing a gate and refers to the working instructions.
- Definition of Applicability, Distinction with Maturity: The applicability given to CAD Data (Diagram, 3D Model, Drawing) is the authorization to consider this CAD Data for a certain usage within a given scope: The applicability is the combination of the Applicability usage and the Applicability Scope. E.g. For Call for Tender in PBS XX.YY
    - One applicability is given to a CAD Data object (as for any other project document) in the frame of a Design Review as driven by the Design Review Procedure (2832CF) [12], assuming that all inputs of this Design Review have been previously approved. Consequently:
        - The applicability is not a unique and intrinsic value of the CAD object, it is associated to a particular release of this CAD Data at a given time: The applicability of a set of models is equivalent to the stamp “Released For …” printed on a hard copy of a drawings before it is sent to an entity having the need to use this drawing as input for engineering, design, manufacturing or construction purpose within an identified

contract or study. A single version of a CAD dataset can be given many applicabilities because it can be used in its present stage of design in different applications.

- The applicability is a value managed out of the strict perimeter of the CAD Data Management as defined earlier in this section, and its appearance on CAD Data might be limited to the data management systems related to the publication of the CAD data (SMDD mostly for what concerns DO), or to data management systems oriented towards construction and later phases (Hand-Over tool, Smartplant, ICP) The applicability values and their assignment are governed by the procedures for configuration management:

- In the strict scope of CAD Design, there are implicit applicabilities, as understood for years on the ITER project. They are defined by a combination of Maturity and Status.:
  - The CAD dataset(s) to be used as the starting point of a design phase must be the fully validated, 'Approved' status models which passed the gate review of the previous phase: For example, when initiating a new version of a model at the beginning of the 'Preliminary Design' phase, the reference shall be the latest model version approved in the maturity 'Conceptual Design'.
  - Models shall not be used as contextual data by an interfacing system or exported to perform calculations until they are validated to at least 'Draft' status

5.1.4 Principle: CAD data, the reference towards a Digital Mockup and the mean for Collaborative design:

The CAD reference data is managed taking into account the following requirements:

- All design actors use a common source of CAD data, any data duplication has to be prevented. To fulfil this requirement, the project is equipped with relational DBs enabling the efficient management of the CAD data, the so-called PDM (Product Data Management) system.

  Note: On ITER, because of the wide range of CAD Data types to be managed with several proprietary formats, the PDM system has not been implemented through a single Database but as a federated platform of interrelated Databases: Enovia, SSD, EDB, Smartplant, etc…

- Considering the Collaborative dimension of the ITER project,
  - The adequacy of the CAD Tools for seamless collaboration is a prime factor for the selection of the CAD tools used in the ITER CAD design by the DA, main partners and contributors.
  - The approach defined in the CAD Data Management section is made applicable and supported by the DA through the Protocol of Design Collaboration (24P2F6) [4]
  - CAD management tools shall ensure controlled access to CAD data by enabling role-based access control, managing modification rights, and governing the promotion and availability of data for other users.

- To ensure the traceability and the relevance of the exchanged data throughout the project:
  - Only CAD data exported from the PDM system shall be exported to partners/suppliers.
  - Data exported for partners or suppliers must first undergo a process of checking and validation, aligned with its intended use. Consequently, in-work data is excluded from potential exports.
  - The adequacy of the CAD data exported to partners/suppliers to the purpose of the pre-export validation process shall include checks by DIS. The interfacing systems ROs are informed about the exchanges and can comment on the validity of the data.

5.2 CAD Data and CAD activities Management requirements for ITER:

With respect to the section 3.10.3 CAD Models and Drawing Development of the ITER Quality Assurance Program (QAP) (22K4QX) [5], and aiming at an efficient implementation of the CAD Data Management Principles here above, 4 main requirements are formulated for the CAD Data and CAD activities Management in ITER:

- The CAD Strategy shall respond to the ITER project requirements & organizational specificities such as the delocalized design implementation defined in the Protocol of CAD Collaboration; complex geometrical interfacing systems requiring common design data management, tools & methods CAD Models & Drawings representing the components & systems used in the ITER Project shall be unambiguously identified, controlled and verified for validity prior to their publication and use for downstream activities;
  This requirement is enforced by the present procedure.
- The CAD activities shall be managed based on a CAD work-plan, compliant with the prioritization of the project needs, checks of the detailed specification of the tasks and deliverables, measurement based on Key Performance Indicators and Earned Value Management. The previous principles shall allow the assignment of the most adequate CAD resources (in-house and/or outsourced) in a flexible manner;
  This requirement is fulfilled by the application of the Procedure for CAD Work Planning, Specification and Control (U34884) [1].
- The CAD activities shall be implemented based on trained & certified users, a validated CAD infrastructure meeting project requirements, project standards & processes implementing technical, integration & CAD manual requirements;
  This requirement is fulfilled by the application of the CAD Execution Procedure (U348G8) [2]
- The CAD data deliverables shall be verified to comply with the project standards & processes implementing integration & CAD manual requirements. The technical performance of the deliverables is not validated by DO but by the PBS RO in charge if the associated CAD activity. Only after the previous verification by DO, the CAD data deliverables can be used for CAD exchange process and/or other downstream processes like Publications, Design Reviews & Manufacturing Readiness Reviews;
  This requirement fulfilled by the application of the Procedure for Verification and Publication of CAD Data (U348ND) [3].

As the CAD data is a fundamental element of design to control the product definition, the CAD Data and CAD Activities management requirements for ITER, as expressed in the bullets above, support the principles and requirements given by the Design control procedures:

- Design Planning Procedure (U34ACR) [13]
- Design Input Control Procedure (U34CSG) [7]
- Design Development Procedure (U34DDZ) [9]
- Design Review Procedure (2832CF) [12]

6 Workflow

6.1 Flowchart

This section is not applicable to the present document.

6.2 Responsibilities

6.2.1 RACI Table

Action	IO DO	CAAR	INT	IT	CMS	DA / Ext. Cont.
Selection of CAD Tools	R/A	C	I	C	I	I
Integrate CAD Systems - Maintain CAD tools map - Ensure & secure data transfer between CAD tools and CAD repositories Guarantee design data overall consistency	R/A	I	I	I	I	C
Supporting entire ITER plant configuration management	R/A	I	I	I	I	C
Specify CAD tools deployment and maintenance	R/A	I	I	C	I	I
Monitor CAD tools deployment and maintenance	R/A	I	I	C	I	I
Administrate CAD tools applications o Nominate and manage administration resources o Deploy and monitor CAD support contracts Manage CAD tools licenses contracts and editors' contracts	R/A	C	I	C	I	I
Develop collaborative and extended CAD software capabilities	R/A	C	C	C	I	I
Specify collaborative CAD tasks requirements for (including CAD software choice): - In-house tasks - Procurement Arrangements - Tasks Agreements Contracted Tasks	R/A	I	I	I	I	C
Coordination & Monitoring of CAD Production Activities - Edit global yearly CAD Workplan Manage CAD production ressources	R/A	C	I	I	I	I
Develop standardized CAD Methods and practices (develop and maintain CAD Manual)	R/A	C	I	I	I	I
Monitor CAD users' knowledge management: - Define training programs - Train CAD Users - Organize CAD users' certifications Provide write access to CAD tools and repositories	R/A	C	I	I	I	I

Verify CAD data (incl. IO-CT, DA or contract issued data): - Implement Quality Control of CAD data Promote CAD data	R/A	C	R			C
Ensure and secure publication of CAD Data (incl. IO-CT, DA or contract issued data)	R/A	I	C		I	R
Implement CAD Data Exchanges - Define CAD data exchange process Coordinate CAD data exchanges	R/A	I		I		C
Request CAD capability (software)	A	R	C	I	I	C
Request CAD resource (CAWP edition)	A	R	I			C
Identify and provide systems applicable standards to CAD data production (parts, symbols, …)	C	R/A		I		C
Provide technical specifications for CAD Production	C	R/A				C
Support to In-House CAD Production Provide engineering and CAD inputs	C	R/A	I		I	C
Check of CAD data functional aspects	C	R/A	I			C
Check of CAD data functional aspects	C	C	R/A			C
Control and maintain reference CAD data	C	I	R/A			I
Support of physical & functional integration Tasks (covers all RO tasks above when treats integration)	C	C	R/A			C
Support to CAD infrastructure deployment, maintenance, and externalization	A	I	I	R	I	I
Develop CAD Tools	C	I	I	R/A		I
Procure hardware for CAD infrastructure	C	I	I	R/A		I
Provide Configuration Management requirements	C	I	I	I	R/A	I
Define versioning, status, maturity, and applicability rules	C	I	I	I	R/A	I
Adhere to CAD collaboration protocols	A					R

6.2.2 IO DO Responsibilities

To respond efficiently to the requirements described above, the ITER project has designated the IO DO as the single Unit in the ITER organization responsible for:

- The selection of the most adequate CAD tools fulfilling the needs of the multiple disciplines of CAD design and multiple design phases and required for the entire ITER lifecycle. The new CAD capabilities requested by the CAAR departments shall be submitted to IO DO.
- The integration of the ITER CAD systems into a coherent tools map guaranteeing:
    - The required seamless transfer of data and information between the CAD systems and CAD repositories,
    - The overall consistency of the design data and information, and supporting the configuration management of the entire ITER plant

- The specification and the monitoring of the deployment & maintenance of the CAD tools in the ITER environment (including the DA and the contractors when opportune), in close interface with the IT division,
- The administration of the CAD applications and the associated resources, promoting a common and consistent implementation of engineering requirements throughout all CAD software. The engineering standards, collected from Departments are centralized and rationalized by the administrators, so their use is independent from the CAD systems. This administration is controlled by an authorized team of qualified administrators. The resources controlled by the DO to achieve this goal include the CAD support contracts, the management of the CAD software licenses, and any other contract with CAD software editors.
- The development of the collaborative capabilities of the CAD software to respond to the requirements of delocalized design and engineering, and respecting the contractual scheme of the collaborative tasks. These collaboration enablers support a homogeneous collaboration approach, and, independently from the tools, support the same configuration management processes.
- The specification of the CAD requirements associated to any of the CAD tasks held in a collaborative and contractual environment. This applies to the Procurement Arrangements and the Task Agreements signed with the DA, and to the contracts signed directly with industry. The choice of the CAD software amongst the existing ITER CAD tools to be used on a particular task is made by DO to respond the most adequately and efficiently to the type of engineering and design, and to the requirements to integrate the resulting design and data in a global configuration management approach.
- The coordination & monitoring of the CAD production activities including the resources and associated CAD Work-Plan, involving specifications, development of an estimation of CAD efforts/budgets, schedule/prioritization and reporting.

The development and the normalization of the methods and best industrial practices for the usage of CAD software, notified in a CAD manual applicable to all CAD tasks, held in ITER premises or externalized (refer to CAD Manual 01 - Instruction for Use and Introduction (AHFDDK) [14]):

- The education of the CAD users about the methods and best practices as defined earlier. The DO organizes the monitoring of the CAD users competences, and define the trainings programs suiting the CAD design needs. The DO organizes the certification of the CAD users having a write access to the ITER CAD repositories, as detailed in the Certification and Assignment of CAD roles in the ITER CAD tools (4EQUNW) [15],
- The organization and the implementation of the Quality Control of all CAD data produced in IO-CT or issued from tasks held in collaboration with DA (PA and TA) or as received as deliverable from contractors and any type of outsourcing of CAD activities, and the subsequent promotion operations,
- The organization of the controlled publication of the CAD Data used, reference and working environments by those producing CAD data for ITER design definition. This organization encompasses the definition of the processes to maintain this contextual data jointly with DIS, and the operations on CAD Data in the frame of these processes,
- The organization of the controlled exchanges of CAD data across the ITER contributors. This organization encompasses the definition of the CAD Data exchanges processes, and the operations required in the frame of these processes, as well as the coordination of the activities related to CAD data exchanges jointly with the DA and external contributors.

6.2.3 Engineering Departments and Offices, Responsible Officers

The IO-CT Engineering Departments are overall responsible for the design requirements, performances, sizing, functional & geometrical interfaces and associated quality as well as budget & schedule. This overall responsibility flows down in the frame of this procedure into the following missions:

- To contribute to the identification of upcoming CAD work needs allowing the prioritization of the developments required in the CAD systems and the construction of a resources loaded CAD Work plan (See Procedure for CAD Work Planning, Specification and Control (U34884) [1]).
- To identify at an early project stage, the standards applicable to the systems they oversee the design, and to provide the IO DO with the associated engineering data, allowing their implementation in the CAD tools by the IO DO. E.g. Standard and commercial parts allowing the construction of the ITER CAD catalogues, symbols for diagrams and schematics, etc.…
- To provide technical specifications required for the CAD production stage (as further detailed in the Procedure for CAD Work Planning, Specification and Control (U34884) [1]) , to integrate the CAD requirements in the specifications of outsourced activities involving CAD works, possibly including the definition of a Design Collaboration Implementation Form (refer to Procedure for the Design Collaboration Implementation Form (2E2MKW) [16]).
- In case of in-house CAD design production, to support the CAD activities by the relevant and timely provision of engineering and CAD inputs, technically supervising the IO-CT CAD Designers to produce the adequate CAD representation of the design under their responsibility.
- To check the functional aspects of the system design as represented through CAD, allowing the promotion and further publication of the validated CAD Data for downstream usages, as further specified in the Procedure for Verification and Publication of CAD Data (U348ND) [3].

6.2.4 DIS responsibilities

Design Integration Division (DIS) is, within the scope of this procedure, responsible:

- To control and check the integration aspects of the systems design as represented through CAD, allowing the promotion and further publication of the validated CAD Data for downstream usages, as further specified in the Procedure for Verification and Publication of CAD Data (U348ND) [3].
- To control the construction and the maintenance of the CAD data set used as the reference and working environment by those producing CAD data for ITER design definition, as further specified in the same procedure.
- Also, DIS RO endorses the RO responsibilities identified in section above when a CAD task is launched for the support of physical and functional integration activities: Same rules and responsibilities defined in this procedure apply.

6.2.5 ITPT Section Responsibilities

The IT Project Tools Section (ITPT), within the scope of this procedure, is responsible:

- To support CAD infrastructure deployment, maintenance, and externalization of the CAD infrastructure, as further detailed through the CAD Execution Procedure (U348G8) [2],
- To provide developments (code, customization, core DB management, etc …) of CAD tools, following the specification by IO DO,
- To procure the hardware necessary for the CAD infrastructure construction in IO-CT premises, following the identification, previsions, and monitoring of the needs by IO DO.

6.2.6 CMS Responsibilities

- The requirements for configuration management are given by the Configuration Management Section as inputs to IO DO, for them to flow-down these requirements into CAD infrastructure and rules.
- Definition/validation of versioning, status, maturity, applicability, and their application to Digital Mock-Up allowing the identification and traceability of the ITER product configuration (GBS, PBS, Values related to configuration stages - First plasma and others) …

6.2.7 IO Performers (DAs, Contractors & Subcontractors)

The present document is applicable to IO Performers, through:

- DAs Procurement Arrangements (refer to PA Annex B (2FRJMT) [17]) and Tasks Agreements,
- Contractors (including their subcontractors) contracts.

7 Records

This procedure is the foundation of all other procedures and working instructions issued by IO-CT DO; a recollection in here of the ensemble of records generated through all CAD activities would mostly lead to the risk of inconsistencies.

Please refer to separate procedures to identify relevant records.

8 Interactions with other processes

8.1 Internal Interactions

- The Protocol of Design Collaboration (24P2F6) [4], completed by the Procedure for the Design Collaboration Implementation Form (2E2MKW) [16], presents the adaptation of this CAD Management plan and associated strategy, rules and practices into the collaborative dimension of ITER.
- The Procedure for the Promotion of CAD Data (28LVHH) [10] implements the principles listed in this procedure, and mostly CAD data status identified in section 5.1.3.
- The CAD Work Plan, output of the CAD Work Planning, Specification and Control (U34884) [1], is built, and items are fixed following the guidelines, the requirements and the strategy defined in the present procedure.

  Key Interactions of this CAD process branch are with MAP, PIP, CPO, ESD, SID, CIC (CAAR depts.) and FPD.
- The CAD Execution Procedure (U348G8) [2] (infrastructure, rules and production) follows the guidelines and strategy defined in the present CAD management Plan Procedure.

  Key Interactions of this CAD process branch are with CAD Designers, CAD Support and CAAR Dept. RO.
- Procedure for Verification and Publication of CAD Data (U348ND) [3]. The CAD data validation, publication and exchanges are done in compliance with the principles of CAD requirements and project standards defined in the present CAD Management Plan Procedure.

  Key Interactions of this CAD process branch are with DIS, CAAR Dept. RO, DAs and Ext Contributors.
- The ITER CAD Manual (refer to CAD Manual 01 - Instruction for Use and Introduction (AHFDDK) [14]) describes the rules, standards and best practices to enable the management of the CAD Data, to guarantee the efficiency of the CAD Design and its reusability. This document,

made applicable through the CAD Execution Procedure (U348G8) [2], is fulfilling several of the IO DO responsibilities identified in section 6.2.

8.2 Interactions with Design Control process

- The present procedure is input for the Design Input Control Procedure (U34CSG) [7]. Procedure for Verification and Publication of CAD Data (U348ND) [3] describes the activities to control the input data for the design development process and part of these inputs will drive the CAD design evolution in its context (See section 5.1.1).
- The Design Development Procedure (U34DDZ) [9] defines the activities to generate an acceptable design output. The production and control of CAD data as described in this procedure are part of these design development activities, and the application of the principles of the present procedure contributes to the acceptability of the design output.
- The ITER System Design Process (SDP) Working Instruction (4CK4MT) [11]sets the defined phases defining the maturities applicable to the CAD Data. Referenced in the current procedure in section 5.1.3.
- The Design Review Procedure (2832CF) [12] sets the requirement to provide Approved data as input to the Design Reviews, and it is through the Design Reviews that an applicability is given to the set of reviewed data, including the CAD Data. See section 5.1.3.
- The Design Planning Procedure (U34ACR) [13] describes the generation of a design plan for ITER SSC in the design phase. The present CAD Management Plan Procedure sets the major requirements for a CAD work planning activity, further detailed in the CAD Work Planning, Specification and Control (U34884) [1], directly relation to the design plans.

8.3 Interactions with Identification & Controls of Item process

- The Procedure for Identification and Controls of Items (U344WG) [8] is input for the present procedure. It provides inputs to the identification of items in the CAD data, principle expressed in section 5.1.2.

8.4 Interactions with Analyses and Calculations process

- The present procedure provides inputs to Procedure for Analyses and Calculations (22MAL7) [6], which identifies requirements and procedures to be respected by all the ITER Project participants for Analyses and Calculations to ensure an existing, modified, or proposed design of structure, system, or component (SSC) will meet the ITER Technical Requirements.

Annex: Existing requirements to the Domestic Agencies or other parties

Req. ID	Requirement	Document's UID
N/A	Refer to section 6.2.7	2DWU2M