
DEMO Central Team (DCT) and Work Package DEMO Design (WPDES) Project Execution Plan (PEP)

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| IDM ref. | EFDA_D_2NLDR3 |
| Version | See also IDM |
| Date of Issue | 01/07/2021 |
| Status | See also IDM |

DOCUMENT APPROVAL RECORD

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CHANGE LOG

| Reason for and (short) description of changes(s) | Version | Date |
|--|---------|------------|
| First Issue | V1.0 | 06/08/2020 |
| Updated WBS and budget table | V2.0 | 01/07/2021 |
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ACRONYMS AND ABBREVIATIONS

Abbreviations used in the DCT and WPDES PEP.

| Acronym | Definition |
|---------|----------------------------------|
| BB | Breeding Blanket |
| BoP | Balance of Plant |
| CAD | Computer Aided Design |
| CD | Conceptual Design |
| DC | Diagnostics and Control |
| DCT | DEMO Central Team |
| DDA | DEMO Design Authority |
| DEMO | Demonstration Fusion Power Plant |
| DIV | Divertor |
| HCD | Heating and Current Drive |
| MAG | Magnets |
| MAT | Materials |
| OGS | Other goods and services |
| PES | Plant Electrical Systems |
| SAE | Safety and Environment |
| SE | Systems Engineering |
| WBS | Work Breakdown Structure |
| WP | Work Programme / Work Package |
| WPBB | Work Package Breeding Blanket |
| WPDES | DEMO Design Work Package |

Table 0.1 – Acronyms and Abbreviations

1 INTRODUCTION

1.1 Document Description

This document provides an overview of the objectives and the corresponding scope of work to be performed by the DEMO Central Team (DCT) and the Work Package DEMO Design (WPDES).

1.2 Intended Use of this Document

This document has been written to outline the activities that will be carried out by DCT and WPDES in the Conceptual Design (CD) phase. It is foreseen that this document will be reviewed and updated yearly throughout the duration of the CD phase.

2 WP DESCRIPTION

2.1 WP Objectives

- To assist the DEMO Project.

2.2 WP Description

The WPDES will support the DCT to advance the technical basis of DEMO in order to arrive to an integrated concept design so that detailed assessments of technical feasibility, reliability, safety, maintainability and costs can be progressively undertaken. WPDES consists of a set of activities, directed by the DCT, to be executed in the appropriate EUROfusion research units, universities and industry, the latter primarily through a dedicated Framework Services Contract¹. The DCT will work in close collaboration with all WPs and organise frequent technical coordination meetings to discuss the evolution of the baseline design configuration, to resolve technical issues and coordinate the interfaces, to rapidly converge to a plant layout, including the architecture of the critical systems.

At least until the completion of the concept selection phase, the DCT will centralise the effort to define the architecture of systems that are critical for the definition of the overall plant and have a strong impact on its performance. These include Plasma, Containment Structures, Breeding Blanket, Divertor, Heating and Current Drive Systems and Magnets Systems. This architecting work will be managed using an agile methodology. The technology R&D will remain in the Work Packages (WPs). For a number of systems, with limited impact on the overall DEMO plant architecture, or where the system design competence is primarily in the Beneficiaries, such as Tritium Fuelling and Vacuum Systems, Balance of Plant, Plant Electrical System and Diagnostics and Control Systems, the responsibility for the design will remain with the respective WPs. Nevertheless, for these systems, technical input and coordination from the DCT is foreseen.

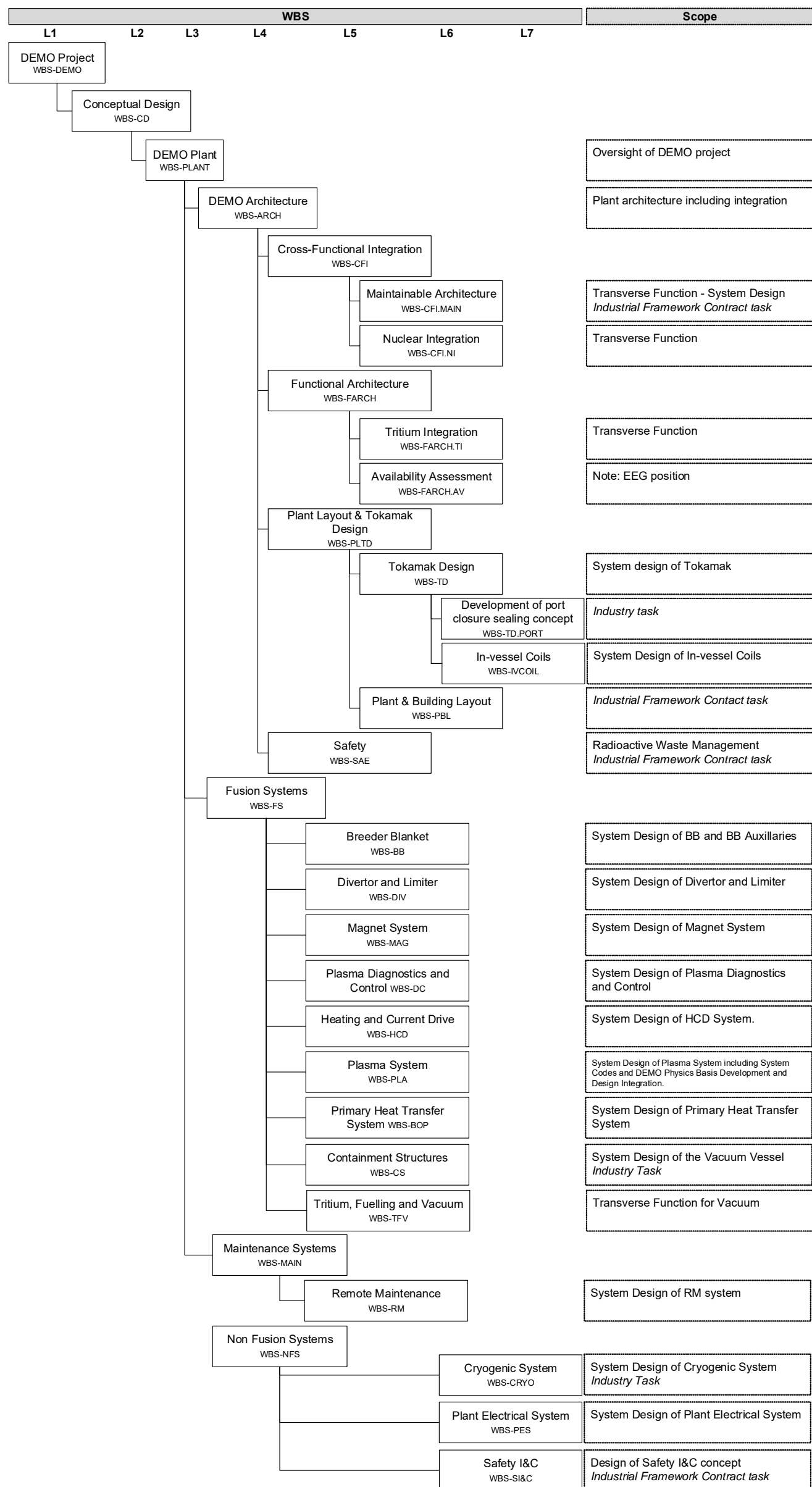
A proposal for the management of the activities is described in the DEMO Project Charter (1).

¹ The services of this Framework Contract will be provided in the form of individual work requests, based on technical specifications that will be the basis of individual task orders.

3 WORK BREAKDOWN STRUCTURE

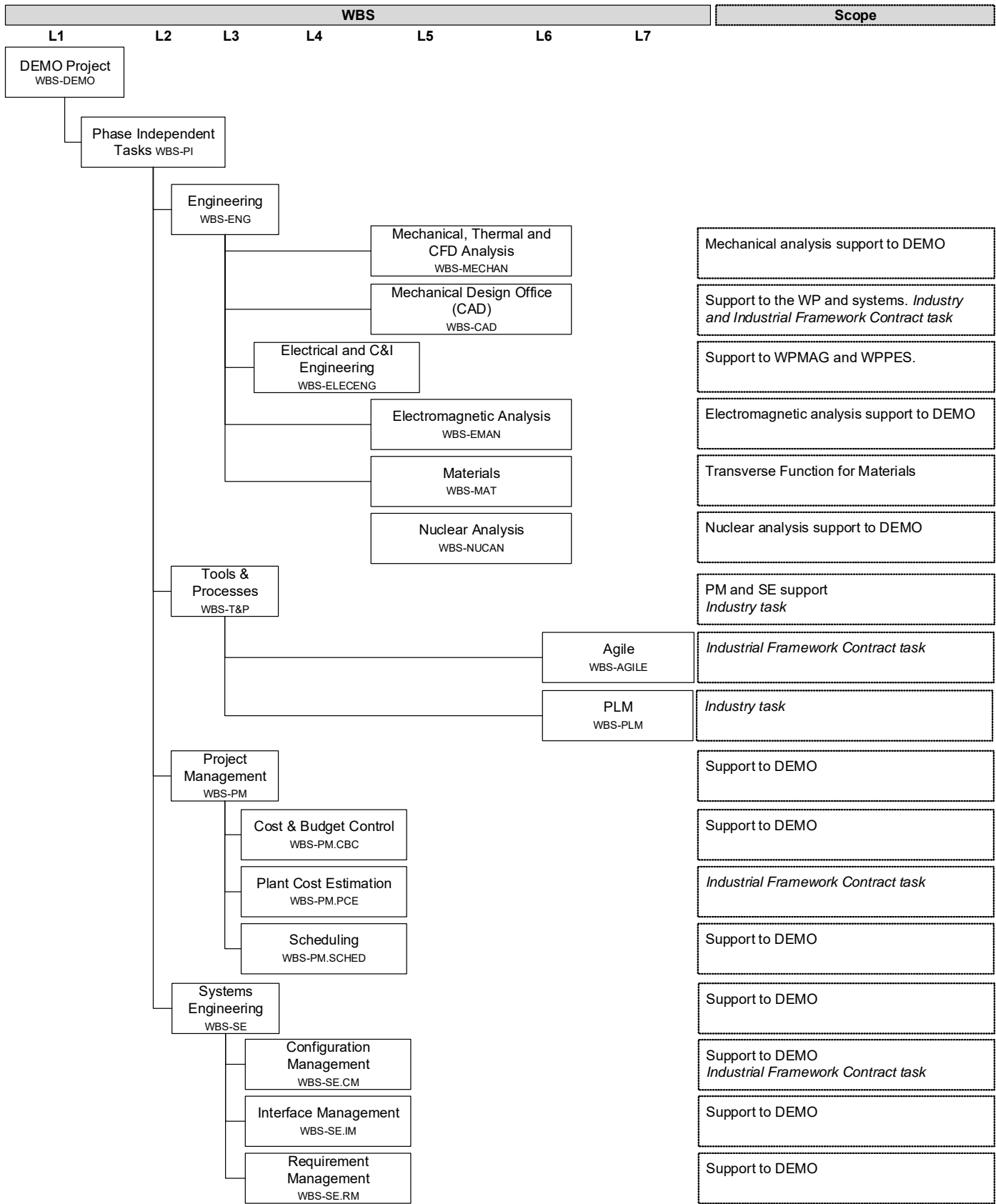
The Work Breakdown Structure (WBS) for DCT and WPDES is presented in Figure 3-1.² However, it should be noted that the activities of the WPDES should retain sufficient flexibility and be revised periodically to match the needs arising from the DEMO design evolution, as the CD progresses.

Figure 3-1 – WBS of DCT/WPDES activities



² Refer to DEMO WBS for the DCT and WPDES resourced WBS.

Figure 3-1 – WBS of DCT/WPDES activities (cont.)



4 SCHEDULE

4.1 Agile Methodology

Work shall be organised in an agile way to ensure efficient design iterations. It is foreseen to use in the feasibility phase (a) “sprints” and (b) internal reviews, supported by the DEMO Design Authority³ to ensure rapid and impartial assessments.

4.2 List of Milestones and Deliverables

Table 4.1 – DCT and WPDES Milestones

| Milestone ID | Title | Grant Milestone | Date |
|--------------|---------------------------------------|-----------------|-------------------|
| G2 | DEMO Gate G2 review meeting completed | DES.M01 | 2024 ⁴ |
| G3 | Gate G3 | Yes | 2027 |

Table 4.2 – DCT and WPDES Deliverables

| Deliverable ID | Title | WBS ID | Grant Deliverable | Date |
|----------------|---|--------------------------------------|-------------------|------|
| PM-D01 | DEMO PEP | WBS-PM | | 2021 |
| PM-D02 | WPDES PEP ⁵ | WBS-PM | DES.D01 | 2021 |
| SE.CM-D01 | Project Change Dossier ⁶ - 2021 record | WBS-SE.CM | | 2021 |
| SE.CM-D02 | Project Change Dossier - 2022 record | WBS-SE.CM | | 2022 |
| SE.CM-D03 | Project Change Dossier - 2023 record | WBS-SE.CM | | 2023 |
| SE.CM-D04 | Project Change Dossier - 2024 record | WBS-SE.CM | | 2024 |
| DEMO-D01 | Technical Baseline 2024 ⁷ | WBS-DEMO | | 2024 |
| DEMO-D02 | Summary report on Technical Baseline 2024 | WBS-DEMO | DES.D02 | 2024 |
| PM-D03 | Project Performance Baseline 2024 ⁸ | WBS-PM WBS-PM.PCE WBS-PM.SCHED | | 2024 |

³ Refer to DEMO Project Charter (1)

⁴ G2 is allocated in a timeframe between H2 2024 to H1 2025, which cannot be fixed at the time of document production.

⁵ This document will be subject to periodic revisions. This deliverable refers to the PEP approved in 2021.

⁶ Every decision of the DEMO Design Authority that requires a modification of the baseline (e.g. down-selection of a variant, selection of an architecture) will be recorded in the Project Change Dossier.

⁷ The technical baseline (T) gives the technical definition of the project and contains engineering documentation: requirements, drawings, schematics, bill of materials, data-sheets, etc.

⁸ The project performance baseline (PP) defines the “project management” part of the project, incl. PEP, ERICA register and additional documents like schedule and cost estimate, etc.

| | | | | |
|-----------|---|--------------------------------------|---------|------|
| PM-D04 | Summary report on Project Performance Baseline 2024 | WBS-PM WBS-PM.PCE WBS-PM.SCHED | DES.D03 | 2024 |
| T&P-D01 | Management Baseline 2024 ⁹ | WBS-T&P WBS-PM WBS-SE | | 2024 |
| T&P-D02 | Summary report on Management Baseline 2024 | WBS-T&P WBS-PM WBS-SE | DES.D04 | 2024 |
| DEMO-D03 | Knowledge Management Dossier | WBS-DEMO | DES.D05 | 2024 |
| DEMO-D04 | DEMO G2 Document Map report ¹⁰ | WBS-DEMO | DES.D06 | 2024 |
| SE.CM-D05 | Project Change Dossier - 2025 record | WBS-SE.CM | | 2025 |
| SE.CM-D06 | Project Change Dossier - 2026 record | WBS-SE.CM | | 2026 |
| SE.CM-D07 | Project Change Dossier - 2027 record | WBS-SE.CM | | 2027 |
| DEMO-D05 | Technical Baseline 2027 | WBS-DEMO | | 2027 |
| DEMO-D06 | Summary report on Technical Baseline 2027 | WBS-DEMO | Yes | 2027 |
| PM-D05 | Project Performance Baseline 2027 | WBS-PM WBS-PM.PCE WBS-PM.SCHED | | 2027 |
| PM-D06 | Summary Report on Project Performance Baseline 2027 | WBS-PM WBS-PM.PCE WBS-PM.SCHED | Yes | 2027 |
| T&P-D02 | Management Baseline 2027 | WBS-T&P WBS-PM WBS-SE | | 2027 |
| T&P-D03 | Summary report on Management Baseline 2027 | WBS-T&P WBS-PM WBS-SE | Yes | 2027 |
| PLM-D01 | Product Life Cycle Management (PLM) Platform | WBS-PLM | Yes | 2027 |

⁹ The management baseline (P) defines “how” things are organized and must be done in the project. At a high level, it defines the governance of the project, at a lower level, it contains in general procedures to follow by all actors of the projects.

¹⁰ This deliverable maps out the complete baseline reporting submitted at Gate G2.

5 FACILITIES, INDUSTRY AND INTERNATIONAL COLLABORATION

5.1 Facilities

Table 5.1 – Facilities used to carry out DCT & WPDES activities

| Facility Name/ Location | R&D Activities | Planned period(s) of use | Deliverable(s) |
|----------------------------|----------------|-----------------------------|----------------|
| n/a | n/a | n/a | n/a |

5.2 Industrial Involvement

Industrial partners shall participate in project activities as indicated in Table 5.2 and Table 5.3.

Table 5.2 – Work Package activities foreseen to be part of the Industrial Framework Contract

| WP Activities | Planned period(s) of engagement | WBS ID |
|--|------------------------------------|--------------|
| DEMO Complex Building Design | 2021 - 2024 | WBS-PBL |
| Safety Analysis | 2021 - 2024 | WBS-SAE.S |
| Tools for agile design methodologies | 2021 - 2024 | WBS-AGILE |
| Tokamak Building Design Pressure Choice | 2021-2024 | WBS-PBL |
| Plant systems & geometrical integration services | 2022 - 2024 | WBS-PBL |
| Design office services to support the central team | 2021 - 2024 | WBS-CAD |
| Cost estimation services | 2021 - 2024 | WBS-PM.PCE |
| Configuration management services | 2022 - 2024 | WBS-SE.CM |
| Safety & licensing support | 2022 - 2024 | WBS-SAE.S |
| System design (cooling water, safety & convent. systems) | 2022 - 2024 | WBS-BOP.S |
| Preliminary Design of Safety Mitigation System | 2022 - 2024 | WBS-SI&C |
| Maintenance strategy concept inside bioshield | 2022 - 2024 | WBS-CFI.MAIN |

Table 5.3 – Work Package Industrial Activities outside of the Framework Contract

| WP Activities | Planned period(s) of engagement | WBS ID |
|---|------------------------------------|-------------------------------------|
| Development of port closure plate sealing concept | 2021 - 2025 | WBS-TD.PORT Note: Subcontracting |
| Conceptual design of the Vacuum Vessel | 2022 - 2025 | WBS-VV.S Note: Subcontracting |

| | | |
|--|-------------|---|
| Cryogenic Plant and Cryo-distribution Systems | 2021 - 2025 | WBS-CRYO Note: Subcontracting |
| Execution of key project management and system engineering activities | 2021 - 2025 | WBS-T&P Note: Subcontracting |
| Set-up and configure a PLM system | 2022 - 2025 | WBS-PLM Note: Subcontracting |
| DEMO design activities with CAD in support to DCT | 2022 - 2025 | WBS-CAD Note: Other Goods and Services (OGS) |
| Dedicated R&D on fabrication techniques fabrication methods - manufacturing trials | 2024 - 2025 | Note: OGS |
| Stiction / bonding tests to validate (PoP) in-vessel component interfaces | 2022 | Note: OGS |

5.3 International Collaboration

Table 5.4 – Work Package International Collaboration

| Country | Description of Collaboration |
|---------|------------------------------|
| n/a | n/a |

6 BUDGET

Table 6.1 and **Error! Reference source not found.** summarises the planned budget of WPDES and DCT. The values shown here were agreed by the General Assembly on 6th/7th April 2021. It is important to note the following:

- i. The table includes the employment and secondment costs of the members of the DCT to Garching;
- ii. The EC Industry Framework budget (worth 10.5M€) will be deducted, because the EC decided to fund these activities outside the Eurofusion Grant Agreement.

Table 6.1 – DCT and WPDES Project Budget

| Year | PPY @ 70% | PPY @ 100% | Total PPY cost [k€] | Total Eq./OGS @ Cost [k€] | Total Missions Cost [k€] | Indirect Costs (k€) | Unit Costs [k€] | Subcontracting 100% (k€) | Total Resources (k€) |
|--------------|--------------|------------|---------------------|---------------------------|--------------------------|---------------------|-----------------|--------------------------|----------------------|
| 2021 | 38.3 | 17.4 | 4,253 | 350 | 23 | 1157 | 720 | 480 | 6,983 |
| 2022 | 46.1 | 28.8 | 5,570 | 650 | 47 | 1,566 | 900 | 480 | 9,213 |
| 2023 | 50.3 | 30.9 | 6,093 | 500 | 52 | 1,661 | 1,080 | 480 | 9,866 |
| 2024 | 55.1 | 30.9 | 6,476 | 575 | 57 | 1,777 | 1,200 | 480 | 10,565 |
| 2025 | 56.2 | 31 | 6,606 | 575 | 62 | 1,811 | 1,200 | 480 | 10,734 |
| TOTAL | 245.9 | 139 | 28,998 | 2,650 | 241 | 7,972 | 5,100 | 2,400 | 47,361 |

7 REFERENCES

1. DEMO Project Charter Proposal, EFDA_D_2P3ZEP.
2. DEMO Project Execution Plan, EFDA_D_2NV475.