1. (normative)  
   Design justification file (DJF) - DRD
   1. DRD identification
      1. Requirement identification and source document

This DRD is called from ECSS-E-ST-10, requirements 5.3.1d, 5.3.1g, 5.3.1h and 5.4.1.4b.

* + 1. Purpose and objective

The objective of the design justification file (DJF) is to present the rationale for the selection of the design solution, and to demonstrate that the design meets the baseline requirements.

The DJF is progressively prepared during the detailed design process and according to the system engineering plan (SEP) (as defined in ECSS-E-ST-10 Annex D), and serves the following purposes:

* it provides access to the necessary justification information,
* it presents a review of all acquired justifications,
* it constitutes a basic element for decision taking concerning the product definition qualification.

The DJF together with the Design Definition File (DDF) (as defined in Annex G) and the technical requirements specification (TS) (as defined in ECSS-E-ST-10-06 Annex A) are the basic documents used for the development of the product. These documents are used to monitor the evolution of the design.

The DJF is a collection of all documentation that traces the evolution of the design during the development and maintenance of the product. The DJF is updated according to the evolution of the DDF, in accordance with the above-mentioned objectives.

The DJF provides also access to coherent and substantiated information which can be used to support decision-making in the analysis of change requests for the management of non conformances.

The DJF contains results obtained during the evolution of the design as a consequence of the activities performed along the design process:

* Analysis and trade-off reports concerning the evaluation of alternative design solutions and the justification of the choice.
* All results obtained during the verification of the design as a consequence of the activities performed along the verification process.
* Test Reports on engineering model, structural and thermal model and qualification model (e.g. Protoflight Models).

1. The DJF is a logical file covering all technical disciplines required for the considered system. In general, the elements of the DJF are “rolled out” as separate documents.
   1. Expected response
      1. Scope and content

Introduction

The DJF shall contain a description of the purpose, objective, content and the reason prompting its preparation.

Applicable and reference documents

The DJF shall list the applicable and reference documents in support to its generation.

The applicable document list shall contain the reference to the relevant product specifications, and the relevant DDF and system engineering plan.

The reference document list shall contain the reference to:

Trade-Off-Reports, as defined Annex L.

Analysis Reports (e.g. requirements allocation analysis, functional analysis).

Requirements Traceability Matrix, as defined in Annex N (with link to analysis).

Verification Control Document

All verification documentation, such as:

Analysis Reports (e.g. reports w.r.t. qualification aspects)

Test Reports

ROD Reports

Inspection Reports

Verification Reports

Design description

The DJF shall contain a description of the expected product, its intended mission, architecture and design, and the functioning principles on which it is based.

The DJF shall define the requirement criteria levels for qualification and acceptance verification of the product.

Design Justification File Synthesis

The DJF shall present status of the design justification in response to requirements, with emphasis on the driving requirements that have a big impact on the system design, production and maintainability (see also K.2.1<8.2.4>a.)

The DJF shall present an overall system qualification status synthesis, including:

the list of requirements which have not been met (e.g. nonconformances), including proposed actions,

the list of all critical points, and how criticalities have been or are intended to be resolved,

the identification of requirements which have not been justified yet, and associated risks analysis, with emphasis on those that can have an impact at system level.

Justification of the Functional Architecture

The DJF shall contain the demonstration that all requirements of the preliminary technical requirements specification are allocated to functional blocks of the system functional architecture.

Where requirements assigned to functional blocks do not have their origin within any of the customer preliminary technical specifications, these requirements shall be justified.

Justification of the Physical Architecture

The DJF shall contain the demonstration that the system design conforms to the requirements of the technical specification, and identify products which are reused (e.g. COTS).

The DJF shall also provide the justification for the choice of architectural elements at the next lower level, or lower levels in case of system critical elements.

Where requirements do not have their origin within any of the upper level technical specifications, these shall be justified.

Development activities and synthesis of development results

The DJF shall present the development activities (e.g. assessments, analyses, tests, and trade-offs) and the design drivers, which lead to and justify the design as defined in the DDF, in line with the development approach identified in the SEP.

The justification shall concern all the engineering disciplines contributing to design and development of the product (including its operational modes and scenarios).

The DJF shall include the status of DJF of lower level products.

1. Activities related to verification are dealt with in section K.2.1<8>.

For the system and each discipline, following information shall be produced:

Activity inputs, such as requirements, operational modes, assumptions, analysis cases, boundary conditions, model descriptions and limitations.

Activity results, such as

raw results,

evaluation of results,

evaluation of margins with respect to the technical requirements contained in the TS,

identification of any marginal areas.

Activity synthesis, such as

evidence of compliance to the technical requirements contained in the TS,

list of technical requirements which have not been met, including proposed actions,

list of all critical points, and how criticalities have been or are intended to be resolved,

identification of aspects of the design, which are not yet justified, and assessment of inherent risks.

The DJF shall reference the requirements traceability matrix, e.g. w.r.t. building up the justification of a considered system top level requirements in terms of the various elements contributing to it, including where relevant contribution from other disciplines (e.g. pointing as a function of thermal, structures, and AOCS).

Verification activities and synthesis of results

Verification plan

The DJF shall integrate or refer to the document that conforms to the verification plan DRD defined in ECSS-E-ST-10-02 Annex A.

1. The verification activities are detailed in the Verification Plan (VP), which also contains the justification of the verification strategy (as defined in ECSS-E-ST-10-02).

Qualification verification and synthesis of results

<8.2.1> Qualification evidence

The DJF shall present the evidence of the qualification of the design in conformance to the applicable technical requirements and proper qualification margins.

1. This is done in line with the qualification approach identified in the VP.

The DJF shall cover the system and all disciplines relevant to the product in all its operational modes and scenarios, addressing all applicable technical requirements and proper qualification margins.

* 1. 1 This is done in line with the system verification matrix.
  2. 2 The formal compliance with the qualification requirements is recorded in the VCD, together with references to the close-out documents.

<8.2.2> Implementation of the qualification plan

The DJF shall present the implementation of the qualification plan and the status thereof, addressing the detailed definition of qualification activities (e.g. analysis, test, ROD, and inspection), including the detailed definition of the tests, the prediction of expected test results, test success criteria, test specifications, and model validations.

1. Details on test specifications are provided in ECSS-E-ST-10-03 Annex B.

<8.2.3> Validation of models

The DJF shall contain all evidence (e.g. analyses, test results, and model descriptions and correlations) regarding the suitability and validation of all models used for the analysis of the system.

<8.2.4> Requirements status log

The DJF shall include a requirement status log addressing each requirement in turn, and including the

reference to relevant elements of the verification plan,

synthesis of the justifications acquired, calling up references to the supporting activities and evidence (e.g. Technical Notes listed in section K.2.1<4>),

list of justifications to be acquired and related activities,

conclusion / action flag.

<8.2.5> Manufacturing process status log

The DJF shall include a requirement status log, addressing design relevant aspects of manufacturing processes, and recording their characteristics in regard to qualification.

Acceptance verification

The DJF shall present the implementation of the acceptance verification and the status thereof, addressing the detailed definition of acceptance activities (e.g. inspection, test, analysis), including the detailed definition of the tests, the prediction of expected test results, test success criteria, and test specifications.

1. Details on test specifications are provided in ECSS-E-ST-10-03 Annex B.

The DJF shall cover the system and all disciplines relevant to the product, addressing all acceptance verification activities in line with the system verification Plan (VP).

Justification of System Technical Budgets and Margins

The DJF shall present a synthesis of all technical budgets and margins for specific parameters according to the functional and physical architectures.

1. For technical budgets and margins, see ECSS-E-ST-10 Annex I.

Justification of Constraints imposed by the System Design

Design constraints on the production

The DJF shall present the justification of constraints induced by the system or product design definition on the production activities e.g. operational allowable envelopes, restrictions on assembling sequences, procedures and testing modes, exclusion zones, manufacturing environmental conditions, and conditions for procurement.

System design constraints for operation

The DJF shall present the justification of constraints induced by the system or product design definition on the implementation of the operations e.g. operational allowable envelopes, restrictions on operating modes, and exclusion zones.

System design constraints for transportation and storage

The DJF shall present the justification of constraints induced by the system or product design definition on the transportation activities and during the periods of storage of the product e.g. allowable envelopes, restrictions on transportation and storage, exclusion zones, packaging, shock levels, temperature environments, humidity, cleanliness, regulations, and dangerous materials.

System design constraints for maintainability

The DJF shall present the justification of constraints induced by the system or product design definition on the maintenance activities and procedures e.g. operational allowable envelopes, accessibility, tooling, support materials, parts availability, and deliveries.

Constituent documents

The DJF shall integrate or refer to the documents that conform to the:

ECSS-E-ST-10 Annex L, Trade-Off-Report - DRD

ECSS-E-ST-10 Annex Q, Analysis Report - DRD

ECSS-E-ST-10 Annex O, Requirement Justification File - DRD

ECSS-E-ST-10 Annex N, Requirements Traceability Matrix - DRD

ECSS-E-ST-10-02 Annex B, Verification Control Document - DRD

ECSS-E-ST-10-02 Annex C, Test Report - DRD

ECSS-E-ST-10-02 Annex D, Review Of Design Report - DRD

ECSS-E-ST-10-02 Annex E, Inspection Report - DRD

ECSS-E-ST-10-02 Annex F, Verification Report - DRD

The DJF shall include or refer to the DJF of lower level elements of the product.

* + 1. Special remarks

None.