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EUROPEAN COOPERATION
ECSS
FOR SPACE STANDARDIZATION

Space engineering

Functional analysis

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Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance in space projects and applications. ECSS is a cooperative effort of the European Space Agency, National Space Agencies and European industry associations for the purpose of developing and maintaining common standards.

Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

The formulation of this Standard takes into account the existing ISO 9000 family of documents.

This Standard has been prepared by the ECSS Working Group E-10-05, reviewed by the ECSS Technical Panel and approved by the ECSS Steering Board.

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Scope

This Standard defines the requirements to perform functional analysis and the information outputs of that analysis. It applies to all types and combinations of space systems, projects and products. It also applies to project phases 0, A, B and C and at all levels.

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Normative references

This ECSS Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these apply to this ECSS Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ECSS-P-001	Glossary of terms
ECSS-E-00	Space engineering - Policy and principles
ECSS-E-10-02	Space engineering - Verification
ECSS-E-10	Space engineering - System engineering
ECSS-M-10	Space project management - Project breakdown structures
ECSS-M-20	Space project management - Project organization
ECSS-M-30	Space project management - Project phasing and planning
ECSS-Q-30-02	Space product assurance - Failure Modes Effects and Criticality Analysis (FMECA) (to be published)
EN-1325-1:1996	Value Management, Value Analysis, Functional Analysis vocabulary - Part 1: Value Analysis and Functional Analysis

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Terms, definitions and abbreviated terms

3.1 Terms and definitions

The following terms and definitions are specific to this standard in the sense that they are complementary or additional with respect to those contained in ECSS-P-001.

3.1.1 Constraint

A characteristic, result or design feature which is made compulsory or has been prohibited for any reason (EN 1325-1).

NOTE 1 Constraints are generally restrictions on the choice of solutions in a system.

NOTE 2 Two kinds of constraints are considered, those which concern solutions, and those which concern the use of the system.

NOTE 3 For example constraints can come from environmental and operational conditions, law, standards, market demand, investments and means availability, organization's policy.

3.1.2 Function

Intended effect of a system, subsystem, product or part (EN 1325-1).

NOTE Functions should have a single definite purpose. Function names should have a declarative structure (e.g. "Validate Telecommands"), and say "what" is to be done rather than "how". Good naming allows design components with strong cohesion to be easily derived.

3.1.3 Functional analysis

The technique of identifying and describing all functions of a system (EN 1325-1).

3.1.4 Operational mode

The manner or way of operating. The mode is realized by a group of related functions or tasks required to accomplish a specific operation.

3.1.5 Operational scenario

A summary of sequences of events and the environment for a specific operation.

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3.2 Abbreviated terms

The following abbreviations are defined and used within this standard.

Abbreviation	Meaning
FMECA	Failure Modes Effects and Criticality Analysis
ROD	Review of Design
RAMS	Reliability Availability Maintainability and Safety

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4

Principles and methods of functional analysis

4.1 Principles

In order to design, develop and prove any space engineering system, the mission and consequent functions, that the system shall perform, shall be clearly established. This functionality shall be distributed throughout the different design levels (e.g. systems, subsystems, units). This allocation of the system functions in a systematic way is an important step in establishing a design which meets all the design objectives.

4.2 Methods

Functional analysis is the technique of identifying and describing all the functions of a system. The purpose of the analysis is to identify and partition all the functions of any system required to perform the intended mission.

The analysis shall be performed to establish the system functions and to control the distribution and maintenance of these functions in a systematic and useful manner. Three techniques, function tree, functional matrix and functional block diagram shall be described, although it is recognized that other representations can also prove suitable.

At the top system level, the required functions shall be derived from the mission statement and are the basis of the system functional specifications. All these functions may be considered ”external” functions.

The solution to meet these functions may require new lower level functions to be identified which are a result of the chosen solution. These new functions may either be serviced at the system level where they were derived, in which case the function is satisfied, or may be passed to a lower level. A function, which is passed to a lower level, is a higher level function for the recipient level.

As the detail of the design progresses, each tier of the design shall add additional functions necessary to support the higher level functions. Both types of functions may be either solved internally within the system or refined into requirements and functions to be met at some lower level engineering unit. Thus, some functions have different levels of importance associated with them depending on how and where they originated. Some functions are readily achievable, while others are complex and expensive to meet. Often at the lower levels, solutions are available which readily meet most of the functions or during development it shall be established that a particular function is only met under specific conditions. To establish

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the consequences and impact of not meeting a requirement or to allow a function to be renegotiated, it shall be possible to establish the origins of any function.

Changes to requirements can arise at top system level, in which case the ”sub”-derived functions, which are affected at the lower tier level, shall be readily identifiable. A realistic example of top system level changes occurs when the launch vehicle is changed and as a consequence, the vibration spectrum or human factors can alter.

Functional analysis shall include different activities. The complexity of the analyses shall develop considering the design maturity, the evolution of the design and the complexity of the mission. Of course the ultimate aim shall be to achieve the simplest final design which meets all the system requirements and offers the best value. This requires that all the functions are met and also partitioned in a logic manner.

Functional analysis shall be approached in a systematic manner. Functions should not be passed from one system to another system of the same level, but should be received from a higher level system and either serviced or further distributed (and divided if necessary) to lower level systems.

Functional analysis shall exclude the assessment of the criticality of the functions in terms of reliability and safety, but shall serve as the basis of the functional failure analysis. FMECA requirements are described in ECSS Q-30-02.

Functional analysis shall also excludes any consideration of the engineering solution required to service an identified function, until ”internal” functions are identified as part of the required solution. By considering a system in terms of functions (being the problem to solve) and not in terms of technology (a possible solution), alternative technologies shall not be excluded, duplication can be avoided and components standardization can be improved.

4.3 Objectives

The objectives of functional analysis shall be to:

a. identify or update the functional requirements;

b. ensure the functions are partitioned in an appropriate manner;

c. allow the traceability of the functions;

d. identify the interfaces between functions.

This allows a complex engineering system to be understood and realized.

4.4 Logic and implementation overview

4.4.1 Performance

Functional analysis shall be performed as part of the overall design development process.

4.4.2 Implementation

The following functional analysis steps shall be implemented:

a. define the system and boundaries of the system under analysis by using the relevant requirements documents;

b. define the level of detail (depth of analysis);

c. identify the system functions/operational modes/operational scenarios;

d. represent the system by preparing the function tree(s), or functional matrix(ces), or functional block diagram(s).

The sequence of steps outlined above shall be valid for all uses, but the steps which are applied shall be determined on a case by case basis. The most common repre-

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sentation of the system is the function tree. The whole process is illustrated in Figure 1.

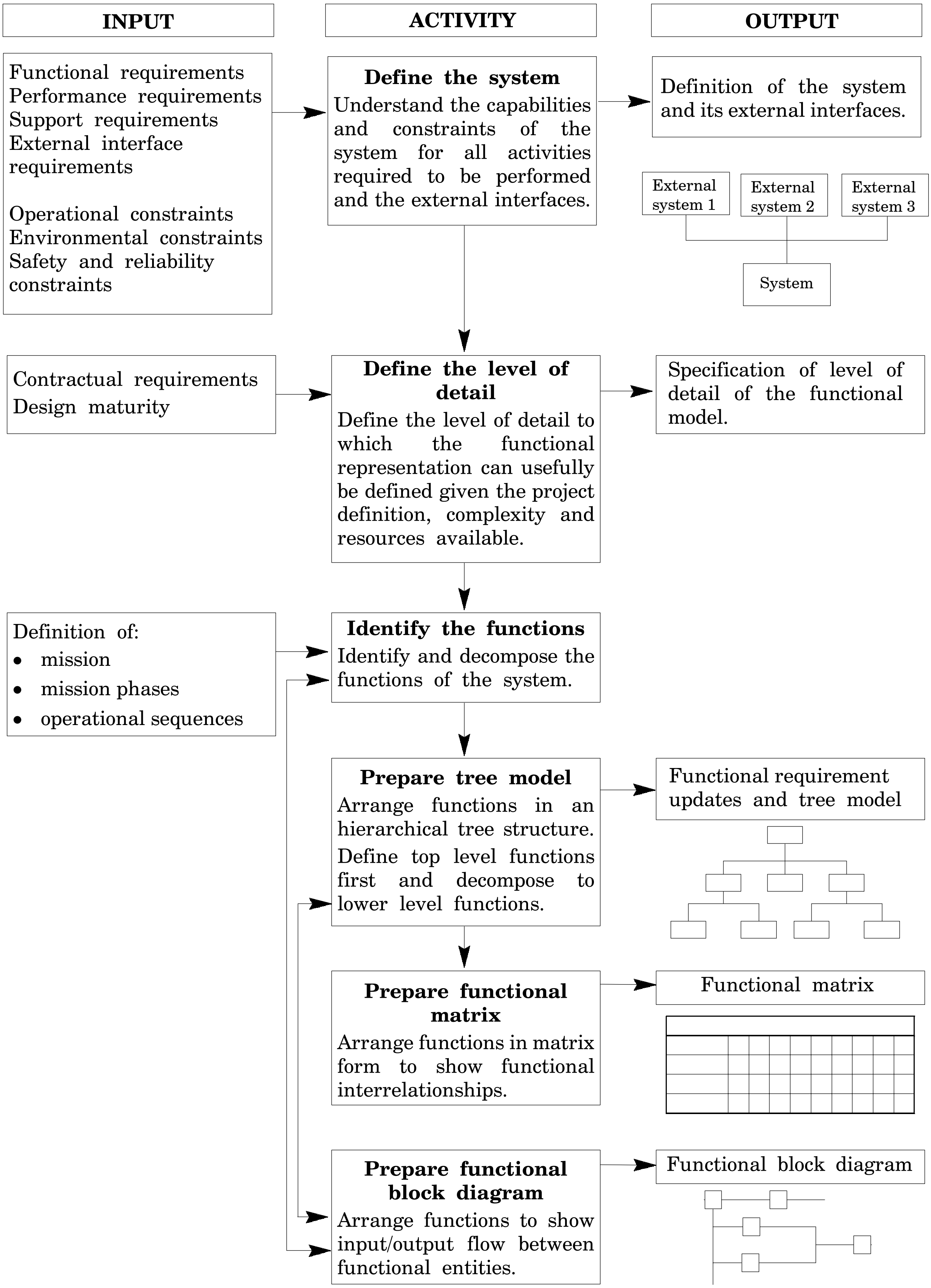

Figure 1: Functional analysis implementation overview

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4.4.3 Functional status

Functional analysis shall reflect the functional status of the system design. Each iteration of functional analysis shall provide more detail at lower levels of the functional system hierarchy.

4.5 Process

4.5.1 System definition

A system shall be designed to meet a given objective, i.e. satisfy the requirement of the users by performing a specified set of functions. It can be affected by the environment, acted upon by external systems or act itself upon the environment or external system. The users and the environment are outside the system.

a. The boundaries of a system or a product shall be defined by its relationship with the different external elements.

   External elements shall be users, the environment and the external systems. The system engineering process shall begin with the identification of the requirement, which is linked to a given user in a given situation and is conditioned by place, time and environment (e.g. humidity, ice). The given situation, the place, the environment and interfaces with external systems generate constraints.

b. The requirements and the constraints shall be described in terms of functions, not in terms of solutions.

   During its life cycle a system or a product may be placed in different situations and environments, which in turn generate constraints. Situations and environments may be characterized as nominal, worst case or contingency as relevant.

c. The different constraints generated by the different encountered conditions of a system shall be taken into account.

d. The functions and the constraints shall be completed by performance criteria.

4.5.2 Definition of the level of detail

The level of detail in performing functional analysis shall be determined by design maturity and it normally increases during the project life cycle.

Therefore, to avoid a non-productive level of detail, the analyst shall have a clear understanding of the analysis objectives applicable to the specific project phase for which the design is considered current.

a. The level of detail of functional analysis shall be described and documented.

b. The level of detail shall be in accordance with the contractual requirements and with the design maturity.

4.5.3 Identification of functions

A function may be decomposed into lower level functions. This division of the functions of a system, which shall start from the functional specification, is an essential part of functional analysis, and results in a hierarchical structure of functions.

Functional analysis shall:

a. provide the identification of the functions of the system;

b. identify the functions required to be performed in the different operational scenarios of the analysed mission;

c. identify the functions required by the different operational modes of the system.

   Operational modes shall include contingency modes induced by failures, faults or operator errors);

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d. provide a hierarchical decomposition of the functions of the system.

A hierarchical structure of the functions of a system shall provide clear visibility of the large number of functional elements making up the system. A hierarchical structure shall enable errors, omissions, inconsistencies and duplications to be detected.

A hierarchical structure starting at the higher level requirements and working down in detail, allows verification that the lower level functions are consistent with the top-level functions.

e. The hierarchical functional decomposition of the system shall ensure traceability between functional requirements throughout all the levels. Care should be taken not to decompose functions into too many subfunctions, from one level to the next. Each function should not be decomposed at the next lower level into more than seven subfunctions.

f. Functions shall be appropriate to the level at which they appear. To assess if the functions are appropriate at the level at which they appear, the following questions shall be asked:

- "How is the function realized?"
- "Why is the function required?"

g. Different hierarchical structures, or substructures, shall be produced when alternative functional solutions are considered.

Alternative functional solutions can meet the same functional requirements. The different functional hierarchical structures may be used to provide a better assessment of the different options.

h. Alternatives functional solutions shall be analysed and compared in a dedicated section of the functional analysis document.

i. Functional analysis shall identify the interrelationships between the functions.

4.6 Representation of the system

4.6.1 General

The following functional analysis methods to define and represent a system, i.e. the function tree, the functional matrix and the functional block diagram, overlap to some extent. This systematic sorting of the functions shall aid the definition of the design, verification and traceability of the requirements and also the performance of the FMECAs, safety and reliability analyses. If not specified by the customer, the most suitable method(s) shall be chosen for the specific analysis to be performed. The choice of methods and the areas of application shall be justified.

4.6.2 Function tree

Tree structures shall provide clear visibility of the large number of functional elements making up a system. A tree structure shall enable errors, omissions, inconsistencies and duplications to be detected through the branches. A hierarchical structure starting at system level working down in detail shall allow verification that the lower level functions are consistent with the top-level functions. A graphical hierarchical structure may be especially useful during the initial decomposition and structuring of functional requirements. The tree shall allow the functions to be regrouped and the relationship between functions to be established.

A lower level function can be required by a number of main functions and therefore it may appear several times in the function tree. Interfaces, information in and out, may be identified separately in a textual form and cross referenced to the functions in the tree representation. Function trees may be represented in many ways. Two suitable representations of the same example are given in Figure 2 and Figure 3.

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a. A function tree shall be based on the system requirements, functional requirements, and already defined functions.

b. A function tree shall specify the level in the functional hierarchy used for its preparation.

c. Each functional requirement in the reference set of requirements shall be arranged in a hierarchical manner.

d. Functions shall be decomposed into lower level functions. At the top level, the tree shall be a graphical representation of the system requirements, with parallel hierarchies for each of the different major functions. Each level of the tree shall represent the system functions at that specific level of abstraction. It shall provide similar levels of detail for each of the functions represented at that level. Functions at level “n” shall be decomposed into functions of level “n+1”.

e. Functions different from those traceable to the reference set of requirements shall not be introduced.

f. All functions shall be numbered in a manner allowing the higher level functions to be readily identified.

g. All functions shall be numbered in a manner allowing any existing lower level functions to be readily identified.

h. Functional levels shall not be omitted.

i. No functions shall be inserted between levels of the function tree.

j. Alternative functional solutions to insure the required functions shall be investigated and represented by different function trees.

k. All apparent inconsistencies in the nomenclature, functionality and structure of the function tree shall be identified and documented. Identified inconsistencies should be removed or rational for retention should be provided.

l. Functions required to satisfy a customer’s requirement shall be distinguished from those required to satisfy a requirement generated by the selected functional solutions.

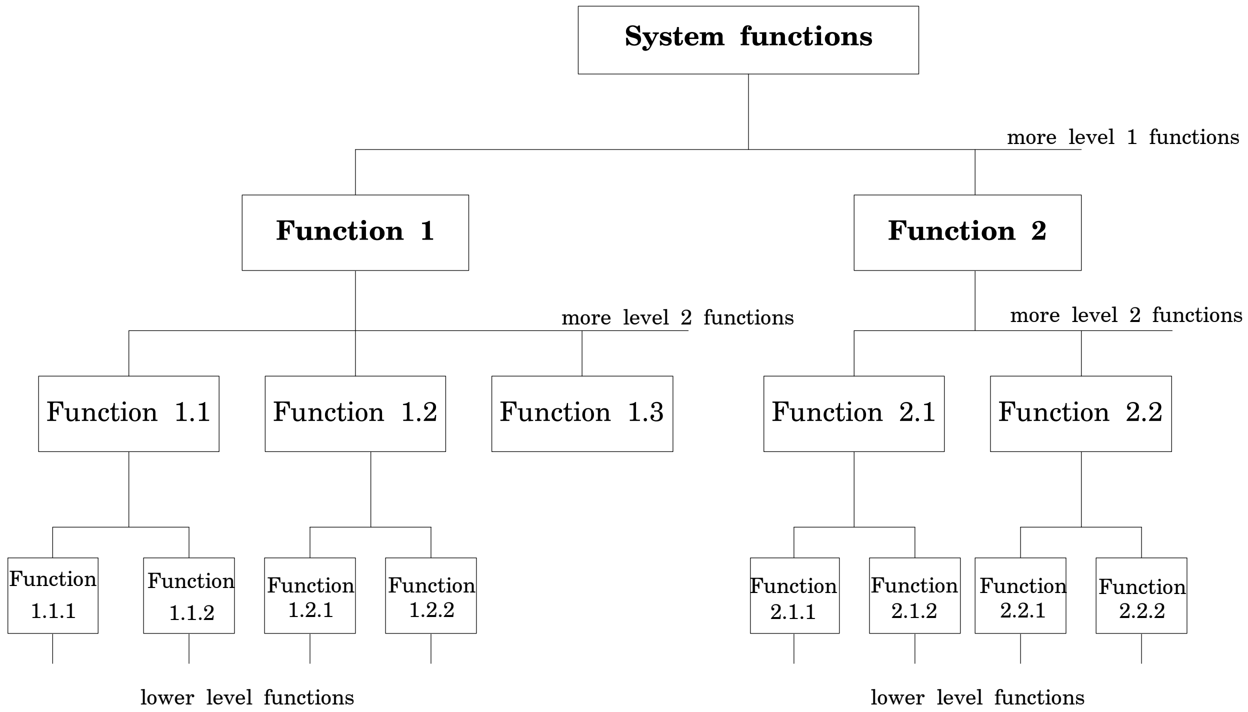

Figure 2: Function tree

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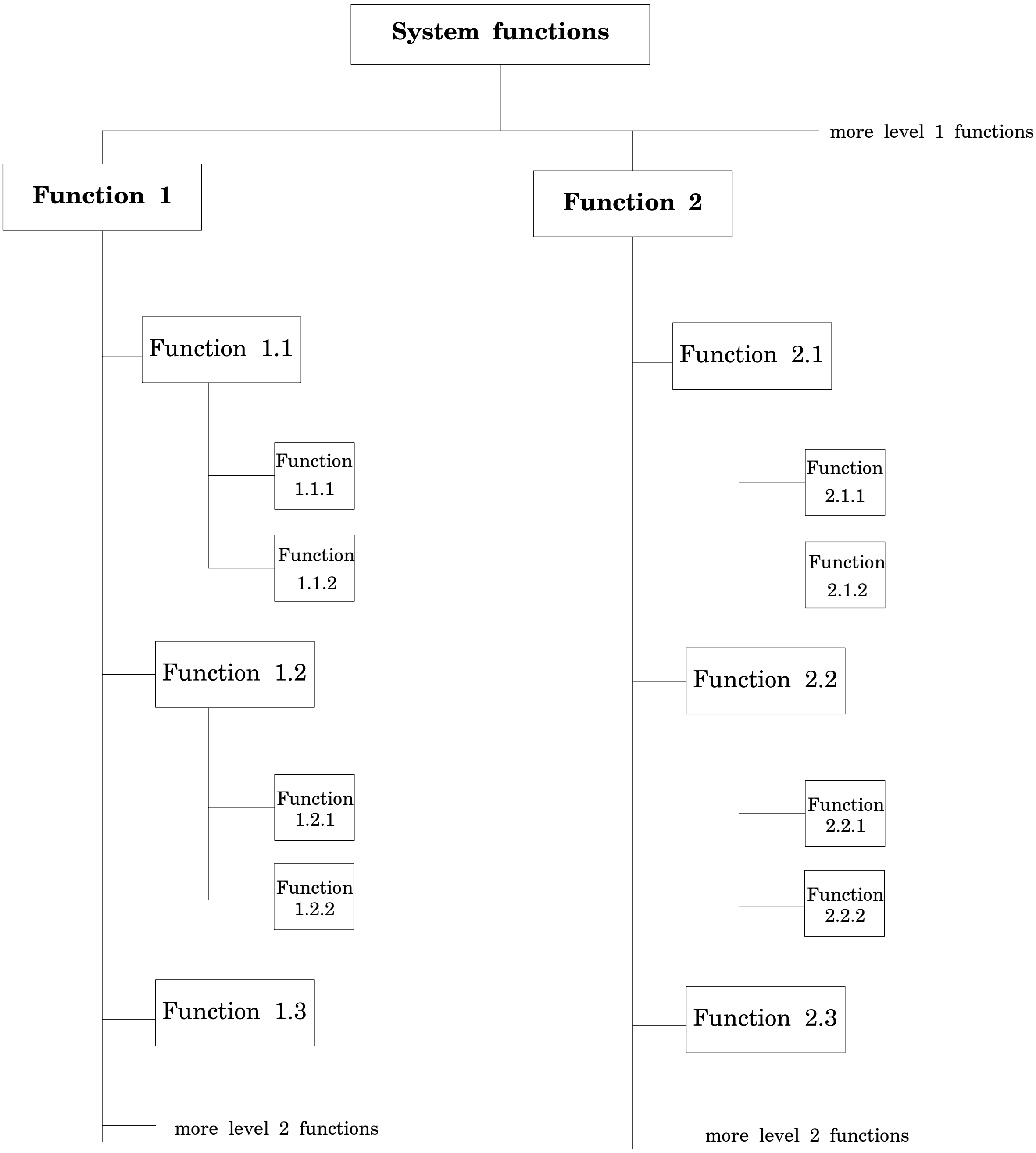

Figure 3: Function tree

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4.6.3 Functional matrix

Functional matrices should be used to complement the function tree, to represent the relationship between lower and higher functions, and between functions and operational modes/operational scenarios. They may cover the complete system or some specific areas. A number of matrices at different levels may be used.

a. A functional matrix shall be based on system requirements, functional requirements, already defined functions and system functional hierarchy.

b. A functional matrix shall specify the level in the functional hierarchy used for its preparation.

c. Different functional matrices shall be prepared to investigate and represent selected alternative functional (design) solutions.

d. The scope of each functional matrix, i.e. the set of functions to be considered and the type of relationship to be represented, shall be determined.

e. Each function of the functional matrix shall be identified by consistent and logical function number.

Functional matrices, may be used to represent relationships between, for example:

- functions at different levels
- functions and operational modes
- functions and operational scenarios
- functions generated from the user requirements
- functions generated from the selected functional solutions/technological principles

An example of a functional matrix is shown in Figure 4.

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Functional Matrix level 1 to level 2

Level 1 functions	Level 2 functions						
	Function 1.1	Function 1.2	Function 1.3	...	Function 2.1	Function 2.2	...
Function 1	×	×	×				
Function 2					×	×	
...							

Functional Matrix level 2 to level 3

Level 2 functions	Level 3 functions								
	Function 1.1.1	Function 1.1.2	Function 1.2.1	Function 1.2.2	Function 2.1.1	Function 2.1.2	Function 2.2.1	Function 2.2.2	...
Function 1.1	×	×							
Function 1.2			×	×					
Function 1.3									
...									
Function 2.1					×	×			×
Function 2.2							×		
...									

Figure 4: Functional matrix

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4.6.4 Functional block diagram

A functional block diagram shall be a system representation which emphasizes interfaces and interrelationships between functional entities (input/output flows).

The diagram shall make use of a limited set of symbols (boxes, lines, arrows and textual information) which analysts and designers use to represent a system of any required size. Each block forms a part of the whole and represents a function. Blocks shall be connected together by lines and arrows which give order and direction to the diagram. The lines shall not represent physical connections associated to the blocks but their functional dependencies. (See Figure 5: Functional block diagram).

A functional block diagram representation may also be organized in a series of diagrams, each with concise supporting text. In this case a high level overview diagram shall be used to represent the whole subject. Each lower level diagram shall be used to show a limited amount of detail about a well defined topic.

a. A functional block diagram shall be based on system requirements, functional requirements, already defined functions and system functional hierarchy.

b. A functional block diagram shall specify the level in the functional hierarchy used for its preparation.

c. If a hierarchy of diagrams is used, each diagram shall be consistent with the diagrams prepared for adjacent levels.

d. Different functional block diagrams shall be prepared for the various mission phases and operational modes to display possible different impacts on the overall mission.

e. Different functional block diagrams shall be prepared to investigate and represent selected alternative functional (design) solutions.

f. The functional block diagram shall be prepared for single levels of the function tree.

g. The functional block diagram shall describe the redundancy configuration.

h. Each block shall be identified by the consistent and logical function numbers. The function number shall be consistent with any other functional representation.

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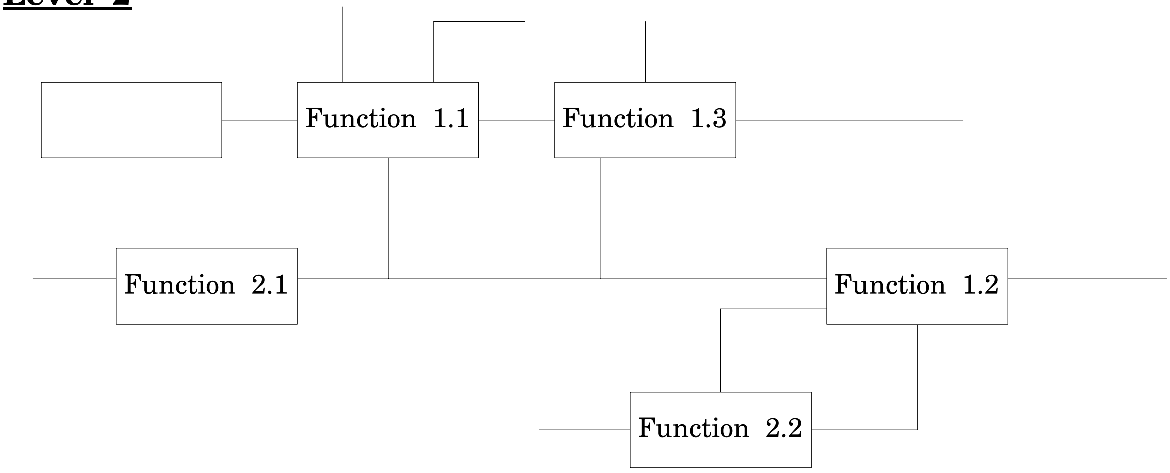
Level 2



Level 3

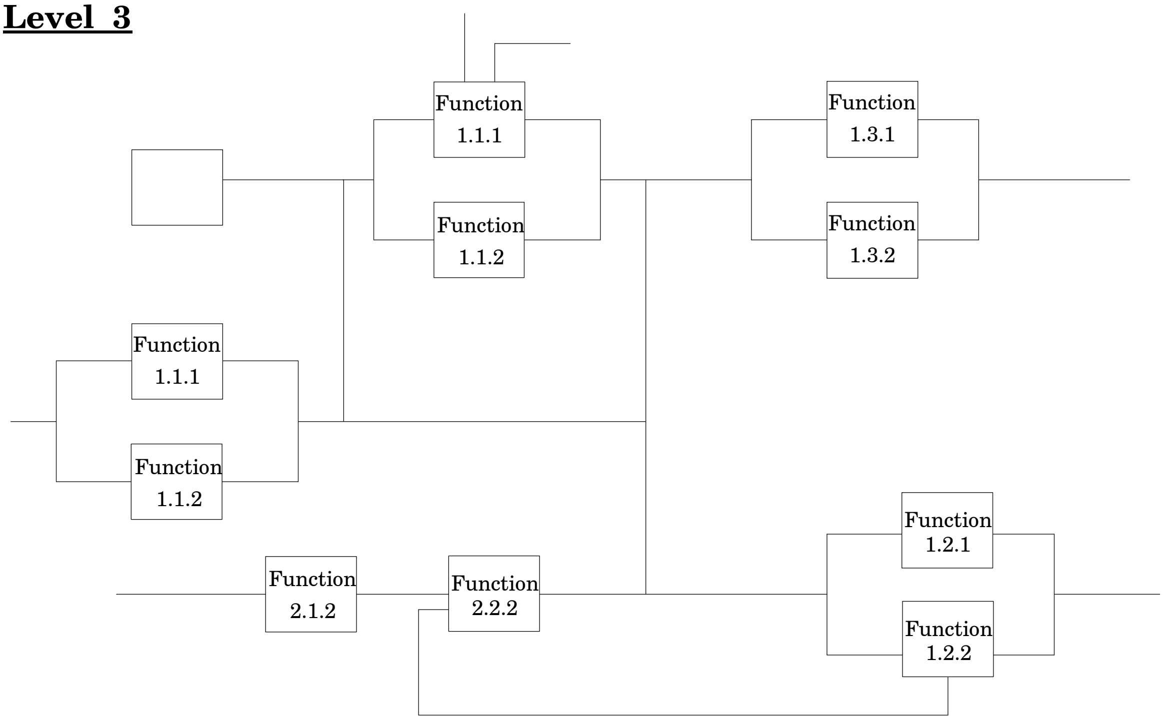


Figure 5: Functional block diagram

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4.7 Functional analysis and engineering disciplines

The scope of this subclause describes the relationship between functional analysis techniques and main aspects performed by engineering disciplines. It is an informative subclause but few requirements may be proposed when they are required.

4.7.1 Functional analysis and requirements

A comprehensible and unambiguous functional specification shall be the basis to properly manage a project, because:

- the cost of the future product or system depends on its functions and constraints;
- the functional specification is the reference in terms of quality of the future product;
- the responsibilities between customer and supplier shall be clearly defined.

For these reasons, the requirements of the functional specification shall be expressed in terms of functions with their performance criteria and level of performance criteria and constraints, whatever method is used for identifying them.

To attain this objective, functional analysis may be used to identify the functions that the future product should perform and its constraints.

The most frequently used methods to capture the requirements are:

- the natural or intuitive search (more easily applied when there is an existing product);
- the method of interaction with the external environment.

Functional analysis shall then be used to represent the identified system requirements in a structured way to help establish the system functional specification.

4.7.2 Functional specification

The preliminary functional system specification shall be one of the major outputs of the phase 0/phase A mission analysis activity by which user requirements are turned into preliminary functional requirements. The functional analysis approach should be used to identify requirements in terms of functions and constraints. Requirements for lower level contractors shall be formally imposed by the specifications. Functional analysis shall then be used to support the requirement allocation process.

4.7.3 Off-the-shelf item assessment

An "off-the-shelf" item shall be introduced as soon as possible in the design process since it may significantly modify the function tree, functional matrix or block diagram. It may represent an alternative functional solution to the system.

If recurrent items from previous space projects are used, the functional analysis shall take into account the use of "off-the-shelf items" in the following way:

a. The functions, that the item "off-the-shelf" can perform, shall be clearly identified by the functional analysis of the item, or through its technical description.

b. These functions shall be compared to the required functions that the item has to fulfil in the new system in order to ensure that all required functions are performed by the item.

c. If the item performs additional functions compared to the required ones, the functional analysis shall determine if those functions are not contradictory with the overall functions of the system.

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4.7.4 Software

Software design and development shall be part of the "system engineering" function to define the overall requirements to be built. These derived functions shall be expressed in a system technical specification. From this document, a decomposition of the system into subsystems and a partitioning of the system/subsystem into hardware and software shall be performed.

Thus the system requirements shall be established and the software requirements may be separated from the hardware requirements. The optimum partition shall be performed using a series of trade-off studies. Part of this comparative trade-off shall be a functional analysis which allows the complexity of the system to be considered. Any of the conventional analysis methods described may be used to partition the hardware and software.

a. The functional analysis shall be updated after the hardware and software partitioning performed during the physical "architecture" design.

b. The functional analysis shall be used to identify the control and data flow between functions.

As the software is detailed, the functional model shall be transformed into the "architectural" design by allocating the identified functions to software components and defining the control and data flow between them. This process shall be aided by the use of functional analysis trees.

However, where a function tree defines the data flow and control, care shall be taken to keep the software conventions of good programming which relate to the relative levels of the requirements being specified, the allowed "fan out" of the tree and the data flow. Where the arrows between functional boxes are being used to design the data flow and control data handling and the functional boxes represent subroutines, the function tree shall be adapted for software design ensuring that the variables enter and leave the subroutine via a common interface. Thus the arrows represent the pathway of the data both into and out of a subroutine. Returning to a main program directly via another subroutine shall not be permitted.

4.7.5 Operations

Functional analysis shall consider the operational constraints and may determine operational requirements at spacecraft and ground segment level.

a. Functional analysis of operations shall be performed before the system design is frozen and shall take place early in the design process because it could modify the function tree of the system by establishing new constraints.

Functional analysis shall influence the operational considerations in two directions :

b. Functional analysis shall consider as performance criteria the impact of the design on the future operations of the system.

c. The operations shall be subject to a detailed functional analysis.

4.7.6 Traceability

The traceability of functions shall be an essential feature of a design. It shall allow the design to be verified as complete and enables the significance of design non-compliances to be identified.

a. All functions shall be traceable.

b. All functions shall be backwards traceable. Backwards traceability shall allow the source of each requirement to be traced back to the function from which it was derived and shall allow subfunctions to be traced back to their higher level "mother" functions.

c. All functions shall be forward traceable. Forward traceability shall establish that each high level function has been implemented at the appropriate phase

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of the design and that all functions have been implemented (the design is complete).

NOTE If the traceability requirements have been implemented in a rigorous and proper manner, any backward untraceable functions are unnecessary. Any functions which are not forward traceable have been either omitted by the design or are implemented at their current level.

4.7.7 Verification

Verification is the confirmation by examination and provision of objective evidence that the specified requirements have been fulfilled (ISO 8402:1994, adopted by the ECSS-P-001).

It shall be the act of reviewing, inspecting, testing, checking, auditing or otherwise establishing whether items, processes, services or documents conform to the specified functions.

Verification may be separated into two classes of product, new designs and recurrent builds.

- New designs shall be qualified demonstrating appropriate margins to prove the design is robust and meets all the design functions.
- Recurrent builds may require a lower level of acceptance verification to determine the build and workmanship is as intended and the unit functions correctly.

a. All functions identified by the functional analysis shall be verified. There are four practices by which the functions may be verified:

   1. Testing
   2. Analysis
   3. Review of Design (ROD)
   4. Similarity.

   The applicable practice shall depend on the level of the review. Verification by testing should be the preferred option but is not always possible.

b. All functions shall be identified in the design and verification plan and verification matrix.

c. A verification method for each function shall be identified.

d. Completeness of functional analysis shall be verified by analysis and ROD (The verification requirements are detailed in ECSS-10-02).

4.8 Functional analysis and other disciplines

4.8.1 Dependability and Safety

a. Dependability and safety engineering should be an essential contribution to functional analysis development to:

   1. provide support in trade-off assessment between possible functional design solutions;
   2. provide inputs about the failure tolerance implementation approach at functional level;
   3. identify those additional functions required to respond to failure detection isolation and recovery requirements.

b. Functional analysis results should enable dependability and safety engineers to:

   1. acquire the knowledge of the system baseline and options in terms of operational modes and functional design configuration ;

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2. support the RAMS requirements allocation at lower contractual levels;
3. support the criticality assessment of functions in terms of response to fault tolerance and other RAMS requirements;
4. support the FMECA and safety analysis development at different levels;
5. build-up the reliability/availability modelling for a probability assessment.

4.8.2 Functional analysis and management

Functional analysis should be a supporting tool (method/technique) for some activities of the management process in order to contribute to the success of a project.

Management activities supported by functional analysis should be:

- identification of requirements;
- definition of mission scenario;
- definition of the baseline functional requirements for the system specification;
- definition of system functional architecture (system functions translated into functional architecture), elaboration of function tree (basis for construction of product tree necessary for the creation of the project breakdown structures);
- comparison between alternative solutions;
- handling of potential critical functions/conditions for the mission;
- make or buy decision process.

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Functional analysis and project phases

5.1 Objectives

Functional analysis objectives shall differ with respect to the project phase. The depth and detail of the analysis shall be determined in view of the actual design maturity reached.

Functional analysis shall mainly be conducted at top system level during phases 0 and A, while it may be carried-out to different levels during B and C.

To be in line with the objectives established by ECSS-M-30 for each design phase, functional analysis requirements are addressed by the following subclauses.

5.2 Project phases

5.2.1 Phase 0

During this phase functional analysis shall support the identification of requirements and the definition of the overall mission scenario. Therefore the effort shall be spent to provide:

a. representation of the identified potential user requirements and expectations in terms of functions. It shall also include those functions identified by other possible product applications within the market or due to commonality with similar projects;

b. definition of the reference mission scenario, acceptable degraded modes and identification of potential operational options to be further investigated;

c. assessment of all external constraints, in particular those imposed by the encountered combination of operational environments;

d. assessment of the constraints related to each specific requirement or imposed by the interfaces with other products to be used in conjunction with.

5.2.2 Phase A

a. During the feasibility phase functional analysis shall be performed to provide:

   1. support to the feasibility assessment on the basis of the requirements expressed or identified in the previous phase;

   2. definition of a system operational concept able to meet the perceived product application and user expectations;

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3. assessment of the various possible functional concepts by comparing these concepts against the requirements.

b. The outputs of this phase of functional analysis shall support negotiation and definition of the baseline functional requirements to be included in a preliminary system specification. Therefore all system functions shall be specified, including interfaces and constraints, for each operational mode of the product.

5.2.3 Phase B

a. Functional analysis carried out in this phase shall support the system functional architecture definition. It shall mainly be carried out at system level, but the lower level contractors shall also contribute to reflect all necessary details.

b. All primary system functions shall be translated into a functional architecture, but detail design shall not be finalized.

c. A detailed function tree shall be established to define hierarchical dependencies between functions at different levels, and to allow traceability from beginning to end conditions.

d. Trade studies shall also be conducted within this phase to allocate requirements to lower level functions, and to identify and resolve conflicts among functional requirements.

e. The system functional architectural model shall be evaluated:

1. to verify links between functions, lower level functions and operational modes of the mission scenario during each mission phase;
2. to allow selection of an optimized solution between alternative functional architectures;
3. to support the identification of potential critical functions as part of FMECA (see ECSS-Q-30-02)

f. At the end of this phase functional analysis shall be able:

1. to establish and validate a definitive system architecture and freeze the functional system specification;
2. to establish a set of lower level functional requirements to support lower level specifications definition;
3. to provide support for make-or-buy decisions.

5.2.4 Phase C

a. Functional analysis carried out in this phase shall support definition of the system detailed design.

b. In this phase functional analysis shall be carried out by:

1. lower level contractors, to implement the applicable functional requirements in their design;
2. prime contractor, to assess conformance of lower level detailed design with the overall system functional architecture.

c. Functional analysis shall continue to support definition of new design items. The allocation of subfunctions between hardware, software and human operations shall be supported by this analysis.

d. At the end of this phase functional analysis shall support:

1. finalization of the procurement specifications for all lower level components;
2. finalization of the interface control documents;
3. validation of the overall functional architecture;

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4. definition of the user manual, operational handbook and associated procedures (e.g. in-orbit operations, ground operations, telemetry and telecommand lists, human tasks' definition).

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Bibliography

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ECSS Document Improvement Proposal		
1. Document I.D. ECSS-E-10-05A	**2. Document Date** 13 April 1999	**3. Document Title** Functional analysis
4. Recommended Improvement (identify clauses, subclauses and include modified text and/or graphic, attach pages as necessary)		
5. Reason for Recommendation		
6. Originator of recommendation		
Name:	Organization:	
Address:	Phone: Fax: E-Mail:	**7. Date of Submission:**
8. Send to ECSS Secretariat		
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Note: The originator of the submission should complete items 4, 5, 6 and 7.

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