Syscience

System Engineering Science

Concept of Operation

Needs capture and operational analysis for the production

System: G02

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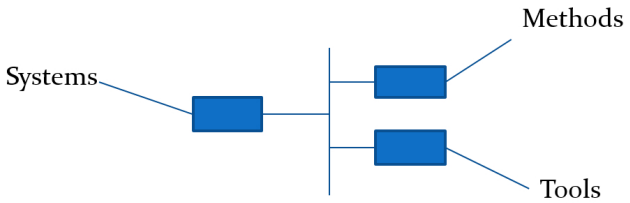

Reference: Syscience R001, V2

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1 Introduction

1.1 Object of the document

The purpose of this document is to establish the operational view of the production. It covers use-case identification, operational scenarios, needs capture and requirements definition.

1.2 References

- IEEE1220 (ISO1220): Standard for Application and Management of the Systems Engineering Process
- IEEE15288 (ISO15288): Systems Engineering - System Life Cycle Processes
- IEEE1471 (ISO1471): Recommended Practice for Architectural Description of Software-Intensive Systems
- EIA 632: Processes for engineering a system
- NASA SEH: NASA Systems Engineering Handbook

1.3 Terminology

1.3.1 Terms

- Diagram: Graphical representation of a view of a system.
- Durability: capacity of the system to keed its desired properties during time.
- Lifecycle: Succession of phases characterizing the system evolution, from the elaboration of its concept until its end of life.
- Lifecycle phase: A phase of the lifecycle of a system.
- Regulation: laws, rules or standards, defined by authorities, whose application is mandatory.
- Requirement: Formalized description of some characteristic.
- Sequence diagram: diagram representing actors and the succession of actions, events, messages and state changes. Sequence diagrams are used to represent scenarios.
- Stakeholder: Tangible or intangible entity, including persons, organizations, and company departments, likely to express needs, expectations or constraints about the system of interest [IEEE1220] 6.1.1, 6.1.2, 6.1.3.

1.3.2 Acronyms definitions

- COTS: Commercial Off The Shelf
- HMI: Human Machine Interface
- MBSE: Model Based System Engineering
- ppm: part per million
- SaaS: Software as a Service
- SOP: Start of Production
- TGA: Tooling Go Ahead

1.4 Document overview

This document describes an external view of the production system a whole, without details about its internal design, using graphical model views. It defines the requirements that the production system shall satisfy.

2 System overview

2.1 Missions

The mission of the production system consists in producing products at a target rate and with targeted quality. The mission is characterized in detail by diagrams and requirements which are described in the following paragraphs.

Figure 1:

CallDiag: Figure(s) not found

2.2 Key measures of effectiveness

Key measures of effectiveness reflect the overall satisfaction level of stakeholder expectations [IEEE1220] Â§6.1.5. They are identified in the following list.
The project identifies the technical performance measures (TPMs), which are key indicators of system performance. Selection of TPMs are usually limited to critical characteristics that, if not met, put the project at cost, schedule, or performance risk. Specific TPM activities are integrated into the project report to periodically determine achievement to date and to measure progress against a planned value profile [IEEE1220] Â§6.1.13.

- Percentage of lifecycle phases without identified stakeholder expectation
- Number of expectations without link to system requirements
- Number of system requirements without link to stakeholder expectation

2.3 Lifecycle

The production system lifecycle is adapted from the standard [IEEE15288].
Whether they are individuals or organisations (enterprise departments, associations, â), stakeholders express needs and expectations for one or even several lifecycle phases. The following diagram gives a synthetic view of the lifecycle phase and corresponding stakeholders. Hyperlink give connections to diagrams listing stakeholder needs.

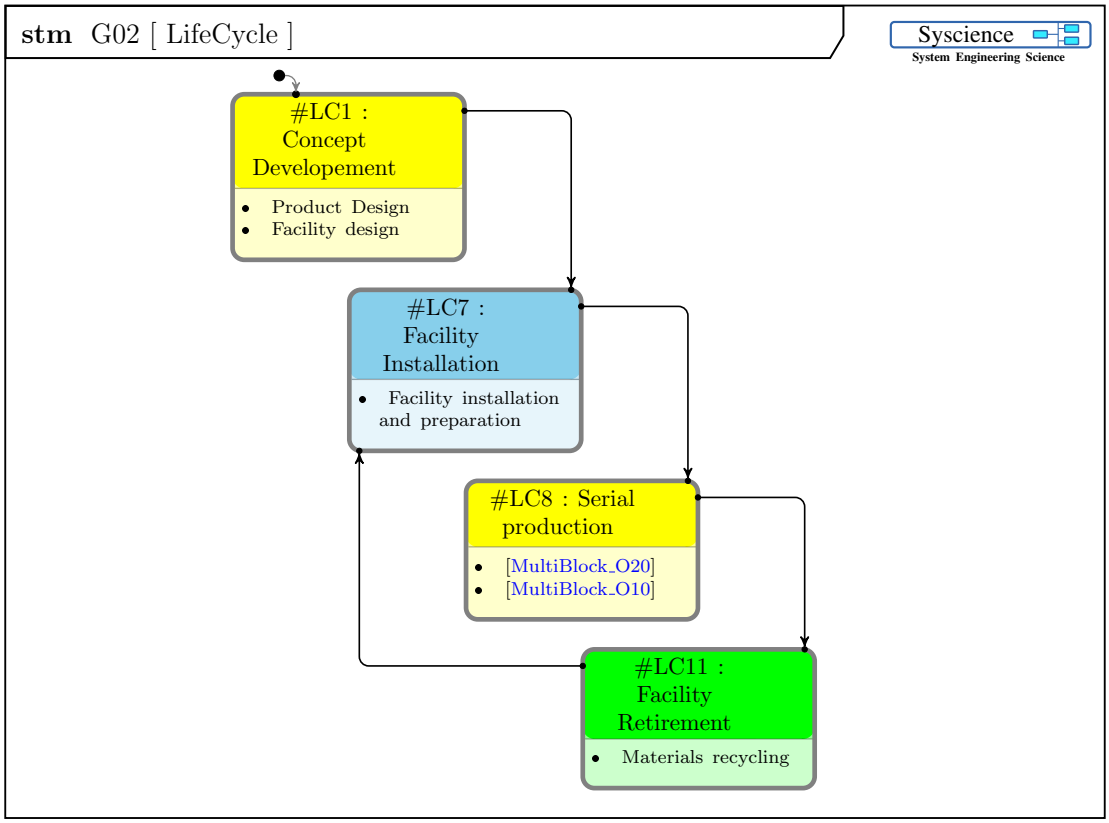

Figure 2: **State_LifeCycle**

2.4 Stakeholders

Stakeholders for the production system are identified in the following diagram.

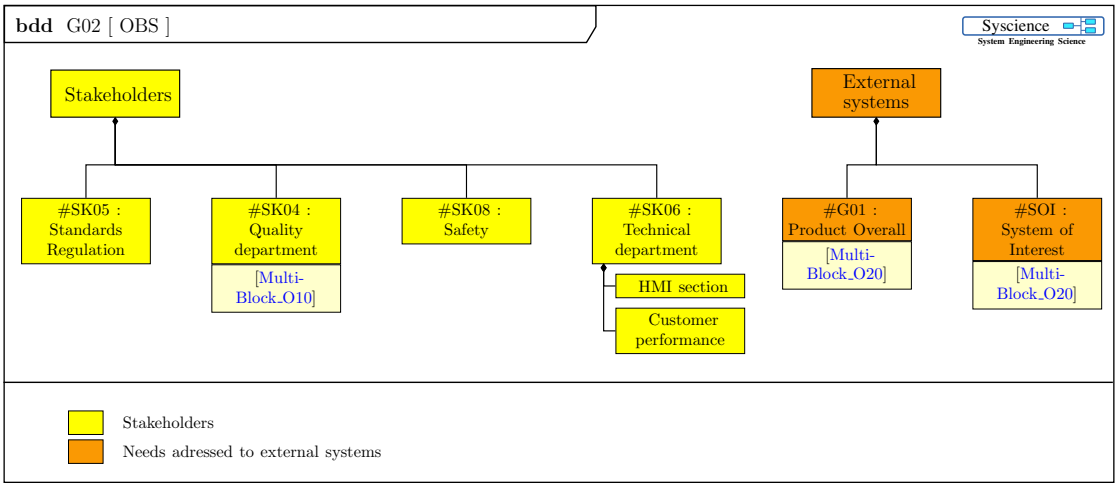

Figure 3: **Tree_OBS**

3 Operational analysis

3.1 Use case analysis

Use cases summarize the way people and external elements interact with the SOI [IEEE1220] Â§6.1.6. Expectations about each use case have to be captured.

3.1.1 Use case identification

A use case diagram represents utilization targets for the system. The following diagram is generated automatically from the system operational scenarios and contains hypertext links to the corresponding sequence diagrams.

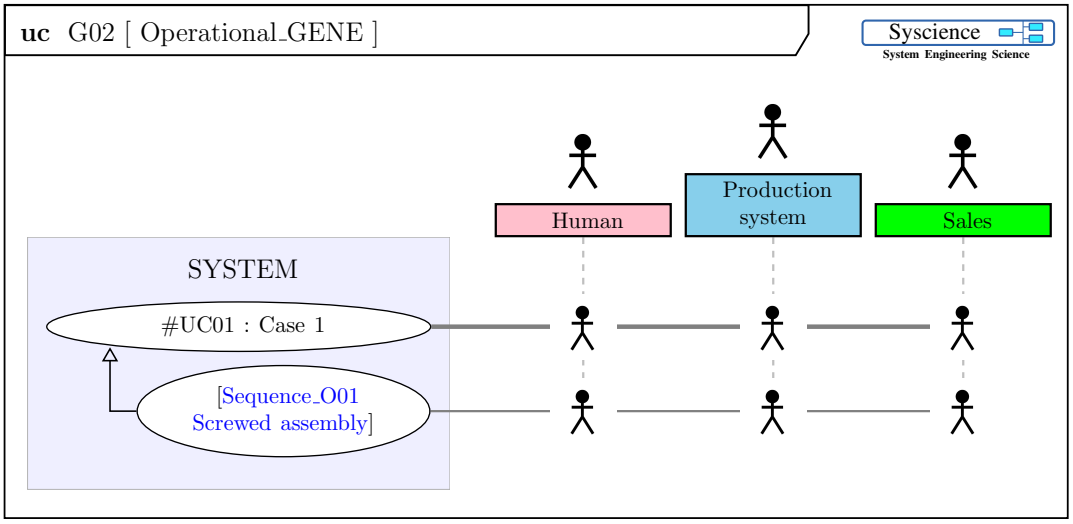

Figure 4: **UseCase_Operational_GENE**

3.2 Scenarios

An operational scenario is a description of the succession of activities done by the system and external actors exchanging messages between each other. They are described by sequence diagrams. Activities are represented by rectangular boxes centered on the lifeline associated to each actor. Arrows represent messages exchanged between actors. In each scenario, activities are described in text boxes on the left of the diagram. Hypertext links give access to automatically generated requirements.

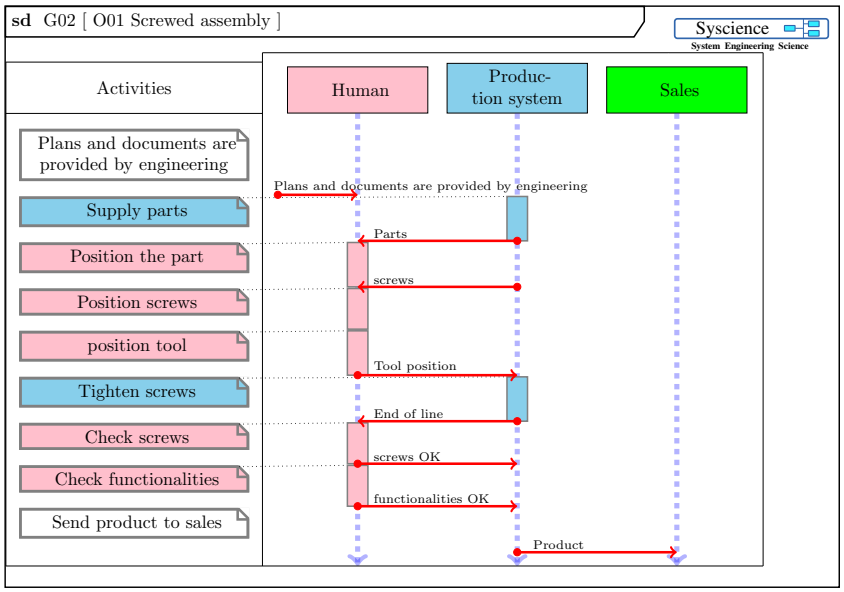

Figure 5: **Sequence_O01 Screwed assembly**

This figure was cited in UseCase_Operational_GENE.

4 Requirements synthesis

4.1 Requirement formulation

High level system requirements result from the capture of needs. Many authors insist on the statement of system requirements in the form "The system shall do something". A few people say that such requirements shall be described from the user point of view and shall be stated "The user shall. . . " or "The user expects. . . ". However, a system engineer has to describe what his system shall do to answer userâ?s needs and expectations. He will not focus on userâ?s expectations that are about other systems. Thus, we think that the system under investigation shall be mentioned in the requirement. Stated "The user shall", requirements may be uderstood as limitations imposed to the user. Therefore, we decided to write these requirements as statements concerning the system of interest.

Visual diagrams have been used to capture and represent needs about the system of interest. This approach is referred to as model based system engineering. Requirements based system engineering refers to an approach in which requirements about the system of interest are managed as textual requirements. These both aprroaches complement each other: while MBSE is useful to check completeness of needs capture, RBSE allows to state clearly the engagement of the system owner. System requirements define unambiguously

what has to be tested, while visual diagrams do not always distinguish the system engagement and informative description of the environment.
This chapter collects requirements build upon the needs capture. Each requirement shall be:

- Specific: the requirement is a usefull description of a system feature. Something would be missing if the requirement is not satisfied.
- Measurable: a measurement action (a test or a process check) can be defined to decide wheather a given system satisfies the requirement or not.
- Attainable: the defined target shall not be unreachable. The target is defined to be attained.
- Realistic: requirements are coherent with the state of the art.
- Traceable: it is possible to identify why this requirement has been defined, and which needs it satisfies.

4.2 Operational requirements

Operational requirements describe how the system is operated. They detail the mission of the system as well as specific use cases. Corresponding system requirements are listed in this paragraph.

4.2.1 HMI requirements

HMI requirements define the characteristics of the system HMI. Corresponding system requirements are listed in this paragraph.

4.2.2 Durability

Durability requirement define the system mission profile and the ability of the system to maintain its characteristics during the lifecycle depending on mission profile. Corresponding system requirements are listed in this paragraph.

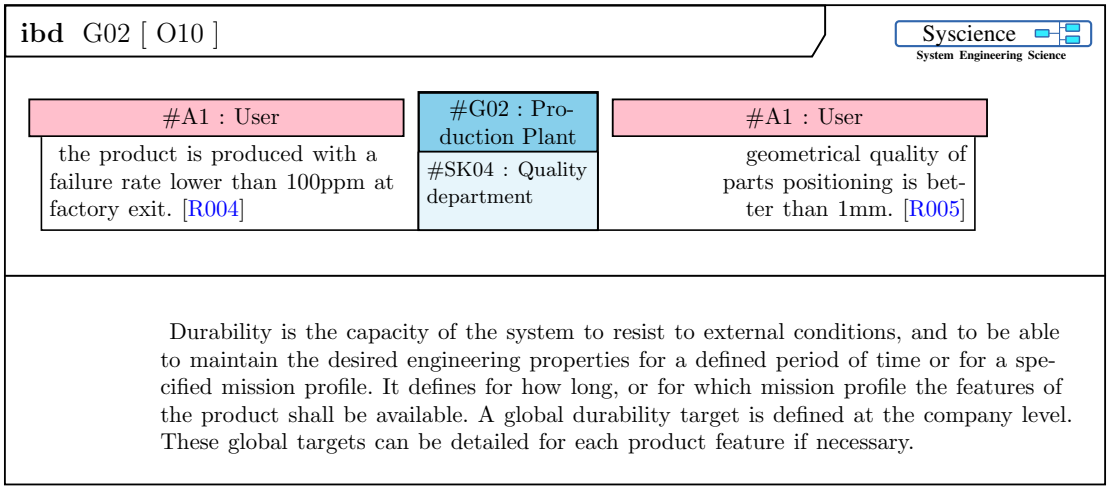

Figure 6: **MultiBlock_O10**

This figure was cited in State_LifeCycle, Tree_OBS.

Requirement identifier	MultiBlock_O10 R004
Requirement Text	The #G02 : Production Plant shall ensure that the product is produced with a failure rate lower than 100ppm at factory exit..
Diagram	MultiBlock_O10
Id	R004
Link	[G01:MultiBlock_O10 R004]
Type	HLR

Table 1: **MultiBlock_O10 R004**, cited in the figure MultiBlock_O10

Requirement identifier	MultiBlock_O10 R005
Requirement Text	The #G02 : Production Plant shall ensure that geometrical quality of parts positioning is better than 1mm..
Diagram	MultiBlock_O10
Id	R005
Link	[G01:MultiBlock_O10 R005]
Type	HLR

Table 2: **MultiBlock_O10 R005**, cited in the figure MultiBlock_O10

4.2.3 Regulation requirements

Regulation requirements describe system engagement concerning the compliance with regulations and standards. Corresponding system requirements are listed in this paragraph.

4.2.4 Assembling constraints

Assembling contraints requirements describe the requests from product concerning assembling. Corresponding requirements are listed in this paragraph.

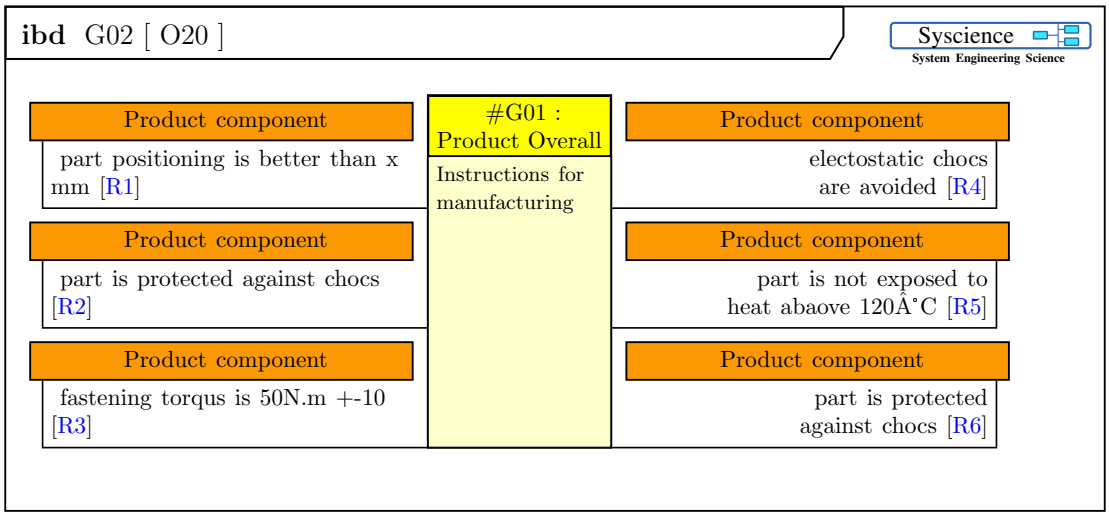

Figure 7: **MultiBlock_O20**

This figure was cited in State_LifeCycle, Tree_OBS.

Requirement identifier	MultiBlock_O20 R1
Requirement Text	Product component requires that part positioning is better than x mm .
Diagram	MultiBlock_O20
Id	R1
Link	Company policy
Type	Stakeholder Need

Table 3: **MultiBlock_O20 R1**, cited in the figure MultiBlock_O20

Requirement identifier	MultiBlock_O20 R2
Requirement Text	Product component requires that part is protected against chocs.
Diagram	MultiBlock_O20
Id	R2
Link	Company policy
Type	Stakeholder Need

Table 4: **MultiBlock_O20 R2**, cited in the figure MultiBlock_O20

Requirement identifier	MultiBlock_O20 R3
Requirement Text	Product component requires that fastening torqus is 50N.m +-10.
Diagram	MultiBlock_O20
Id	R3
Link	Company policy
Type	Stakeholder Need

Table 5: **MultiBlock_O20 R3**, cited in the figure MultiBlock_O20

Requirement identifier	MultiBlock_O20 R4
Requirement Text	Product component requires that electostatic chocs are avoided.
Diagram	MultiBlock_O20
Id	R4
Link	Company policy
Type	Stakeholder Need

Table 6: **MultiBlock_O20 R4**, cited in the figure MultiBlock_O20

Requirement identifier	MultiBlock_O20 R5
Requirement Text	Product component requires that part is not exposed to heat abaove 120Â°C.
Diagram	MultiBlock_O20
Id	R5
Link	Company policy
Type	Stakeholder Need

Table 7: **MultiBlock_O20 R5**, cited in the figure MultiBlock_O20

Requirement identifier	MultiBlock_O20 R6
Requirement Text	Product component requires that part is protected against chocs.
Diagram	MultiBlock_O20
Id	R6
Link	Company policy
Type	Stakeholder Need

Table 8: **MultiBlock_O20 R6**, cited in the figure MultiBlock_O20

4.2.5 Maintenance constraints

Maintenance contraints requirements describe the system engagement concerning maintenance and repairing needs and expectations. Corresponding system requirements are listed in this paragraph.

4.2.6 Recycling constraints

Recycling contraints requirements describe the system engagement concerning the end of life of the system, and needs and expectations concerning recycling and reuse. Corresponding system requirements are listed in this paragraph.