
# IMAGE

## Interoperable Management of Aeronautical Generic Executive software

**PROPOSAL N°: GRD1-2001-40137**
**PROJECT CONTRACT N°:G4RD-CT-2002-00850**

# D5.1:Software Validation Plan

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## Acronyms and abbreviations

| | |
|---|---|
| ISO | International Standards Organisation |
| QR | Qualification Review |
| SVP | Software Validation Plan |
| SVVP | Software Verification and Validation Plan |

# 1. Introduction

## *1.1 General SVP considerations*

In the ISO 9000:2000 standard, **Validation** means confirmation. Therefore, in the context of Software, the validation process means confirmation that the requirements baseline functions and performances are correctly and completely implemented in the final product.

In the ISO 9000:2000 standard, **Verification** means confirmation. Therefore in the context of Software, the verification process means confirmation that adequate specifications and inputs exist for any activity, and that the outputs of the activities are correct and consistent with the specifications and input.

The Software Validation Plan (SVP) must ensure that the following aspects will be addressed during the validation of the software development in the context of the IMAGE project:

- Forward traceability
- Backwards traceability
- Functional audits:
- Documentation
- Software criticality
- Testing
- Non-functional requirements
- User requirements traceability
- Design traceability
- Test plan
- Code evaluation
- Integration test plan
- Unit test plan
- Test designs description
- Test cases description
- Test procedures
- Test reports

## *1.2 Activities*

In IMAGE project, the technical process of software verification and validation are combined into a single document named “Software Validation Plan (SVP)”. The IMAGE SVP will also include all aspects related to testing.

Validation process consists of the following activities:

- **Validation with respect to the requirements baseline:** The IMAGE customers shall evaluate the software with respect to the requirements baseline, invoking the IMAGE validation process.
- **Validation milestones:** A qualification review (QR) shall be conducted in accordance with to verify that the software meets all the requirements, and in particular that verification and validation process outputs enable transition to a qualified state for the IMAGE software products.
- **Software delivery and installation**
- **Preparation and updating of the IMAGE software:** Within WP4, the deliverable IMAGE software will be update as established in the requirements specification for system integration, system validation testing and software installation.
- **Installation planning:** WP4 shall develop a plan to install the software product in the target environment.
- **Installation activities reporting:** The resources and information to install the IMAGE software shall be determined and be available. The installation events and results shall be documented.

## *1.3 Evolution of plan during IMAGE project*

## *1.4 Purpose of SVP*

The software verification and validation engineering processes consist of:

- Verification process implementation
- Validation process implementation
- Verification activity
- Validation activity

### 1.4.1 Verification process implementation

#### 1.4.1.1 Determination of the verification effort for the project

The IMAGE requirements shall be analysed for criticality. Criticality shall be considered in terms of the maturity of and risks associated with the software technology to be used and the availability of funds and resources.

#### 1.4.1.2 Establishment of the verification process, methods and tools

Verification activities and tasks, including associated methods, techniques, and tools for performing the tasks, shall be selected for the target life cycle activities and IMAGE software. This verification shall be determined based upon the scope, magnitude, complexity, and criticality analysis.

#### 1.4.1.3 Development and documentation of a verification plan covering the software verification activities

Based upon the verification tasks a verification plan shall be developed and documented, addressing the following items:

- The life cycle activities and software products subject to verification;
- The required verification tasks for each life cycle activity, software product and schedule.

### 1.4.2 Validation process implementation

#### 1.4.2.1 Establishment of a validation process

The validation process shall be established to validate the software product.

#### 1.4.2.2 Development and documentation of a validation plan

A validation plan shall be developed and documented, including, as a minimum the following:

- Items subject to validation;
- Validation tasks to be performed;
- Resources and schedule for validation;
- Procedures for forwarding validation reports to the customer and other.

### 1.4.3 Verification activity

#### 1.4.3.1 Verification of software

The software requirements, the software architectural design and the software detailed design shall be verified considering the criteria listed below:

- Traceability
- External and internal consistency
- Verifiability
- Feasibility of:

- ⇒ software design
- ⇒ operations and maintenance
- ⇒ producing a detailed design
- ⇒ testing

- The design is correct with respect to requirements and interfaces;
- The design implements proper sequence of events, inputs, outputs, interfaces, logic flow, allocation of timing and sizing budgets, and error definition, isolation, and recovery;
- The chosen design can be derived from requirements

#### 1.4.3.4 Verification of code

The code shall be verified considering the criteria listed below:

- the code is traceable to design and requirements, testable, correct, and in conformity to software requirements and coding standards;
- the code implements proper event sequence, consistent interfaces, correct data and control flow, completeness, appropriate allocation timing and sizing budgets, and error definition, isolation, and recovery;
- the chosen code can be derived from design or software requirements;
- external consistency with the requirements and design of the software item;
- internal consistency between software units;
- test coverage of units;
- feasibility of software integration and testing;
- feasibility of operation and maintenance.

#### 1.4.3.5 Verification of software integration

The software integration shall be verified considering that the software components and units of each software item are completely and correctly integrated into the software item. In addition, it is needed to evaluate software integration test plan, design, code, tests, test results and software user manual.

#### 1.4.3.6 Verification of software documentation

The documentation shall be verified considering the criteria listed below:

- the documentation is adequate, complete, and consistent;
- documentation preparation is timely

#### 1.4.3.7 Evaluation of test specifications

Test requirements, test cases, and test specifications shall demonstrate the coverage of all software requirements of the technical specification or the requirements specification.

#### 1.4.3.8 Verification of software validation with respect to the technical specifications and the requirements specification

The validation tests shall be verified considering the criteria listed below:

- test coverage of the requirements of the software item;
- conformance to expected results;
- feasibility of system integration and testing, if conducted

#### 1.4.3.9 Problem and non-conformance handling

Problems and non-conformances detected by the software verification effort shall be entered into a problem resolution process All problems and non-conformances shall be resolved. Results of the verification activities shall be made available.

### 1.4.4 Validation activity

#### 1.4.4.1 Development and documentation of a software validation testing specification

IMAGE shall develop and document, for each validation requirement of the software item, a set of tests, test cases, and test procedures for conducting software validation testing.

#### 1.4.4.2 Conducting the validation tests

The validation tests shall be conducted as specified above, including:

- testing with stress, boundary, and singular inputs;
- testing the software product for its ability to isolate and minimize the effect of errors;
- testing that the software product can perform successfully in a representative operational environment.

#### 1.4.4.3 Evaluation of the design, code, tests, test results, and software user manual

The supplier shall evaluate the design, code, tests, test results, and software user manual in accordance with the criteria listed below:

- test coverage of the requirements of the software item;
- conformance to expected results;
- feasibility of system integration and testing, if conducted;
- feasibility of operation and maintenance.

#### 1.4.4.4 Problem and non-conformance handling

Problems and non-conformances detected during the validation shall be the subject of a problem resolution process and shall be resolved. Results of the validation activities shall be made available

#### 1.4.4.5 Test readiness review

Test readiness reviews and joint technical review processes shall be held before the commencement of key test activities.

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#### 1.4.4.6 Joint technical review process

The joint review process is a process for evaluating the status and products of an activity of a project as appropriate. Joint reviews shall be held throughout the lifecycle of the software.

#### 1.4.4.7 Support to software reviews

The software support of to joint technical reviews shall be related to project phasing and planning.

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#### 1.4.4.8 Technical reviews

Technical reviews shall be held to evaluate the software products or services under consideration.
Reviews shall be planned of each identified software product within its defined software life cycle according to the criteria above.

# 2. IMAGE System Validation Items

The following IMAGE system requirements will need to be validated:

Security:
- Information Hiding
- Authentication
- Access Control
- Integrity
- Non-repudiation
- Security Administration

Administration and Supervision:
- Declaration Management Services
- Ownership Management Services
- Time Management (including Time Advancement)
- Data Distribution
- Transportation
- Configuration Management
- Configuration Maintenance
- Simulation Entity
- Simulation Time
- Simulation State
- Simulation Recording and Replaying
- Simulation Management
- Assembling and Deploying Simulation Component
- Simulation Controlling Tools
- Simulation Testing Tools
- Clustering
- Load Balancing
- Error Handling
- Fault Tolerance

Middleware:
- Event
- Publish and Subscribe
- Scheduler
- Network Protocols
- Communication
- Data management
- Analysis and Statistics
- Repository
- Interface
- Wrapper
- Gateway
- Naming & Trader
- Marshalling/Demarshaling
- Remote Procedure Calling

With respect to the IMAGE System architecture it will also be necessary to validate the integration of various of the above system requirements through their integration in larger IMAGE System modules

Full IMAGE System validation will be performed in WP 5 through the use of the IMAGE System for the identified Test Bench Applications.

# 3. Test Plan

## *3.1 Test items*

List the items to be tested

## *3.2 Features to be tested*

Identify the features to be tested.

## *3.3 Test deliverables*

List the items that must be delivered before testing starts and when testing ends.

## *3.4 Testing tasks*

Describe the tasks needed to prepare for and carry out the tests

## *3.5 Environmental needs*

Describe the properties required of the test environment.

## *3.6 Test case pass/fail criteria*

Define the criteria for pass or failing a test case.

# 4 Test Case Specifications (for each test case)

## *4.n Test Case n*

### 4.n.1 Test case identifier

Give a unique identifier for the test case.

### 4.n.2 Test items

List the items to be tested.

### 4.n.3 Input specifications

Describe the input for the test case.

### 4.n.4 Output specifications

Describe the output required from the test case.

### 4.n.5 Environmental needs

Describe the test environment.

# 5. Test Procedures (for each test procedure)

## *5.n Test Procedure n*

### 5.n.1 Test procedure identifier

Give a unique identifier for the test procedure.

### 5.n.2 Purpose

Describe the purpose of the procedure.
List the test cases this procedure executes.

### 5.n.3 Procedure steps

Describe how to log, setup, start, proceed, measure, shut down, restart, stop, wrap-up the test, and how to handle contingencies.

# 6. Test Report template

## *6.n Test Report n*

### 6.n.1 Test report identifier

Give a unique identifier for the test report.

### 6.n.2 Description

List the items being tested.

### 6.n.3 Activity and event entries

Identify the test procedure.