Advanced IP

QueenField

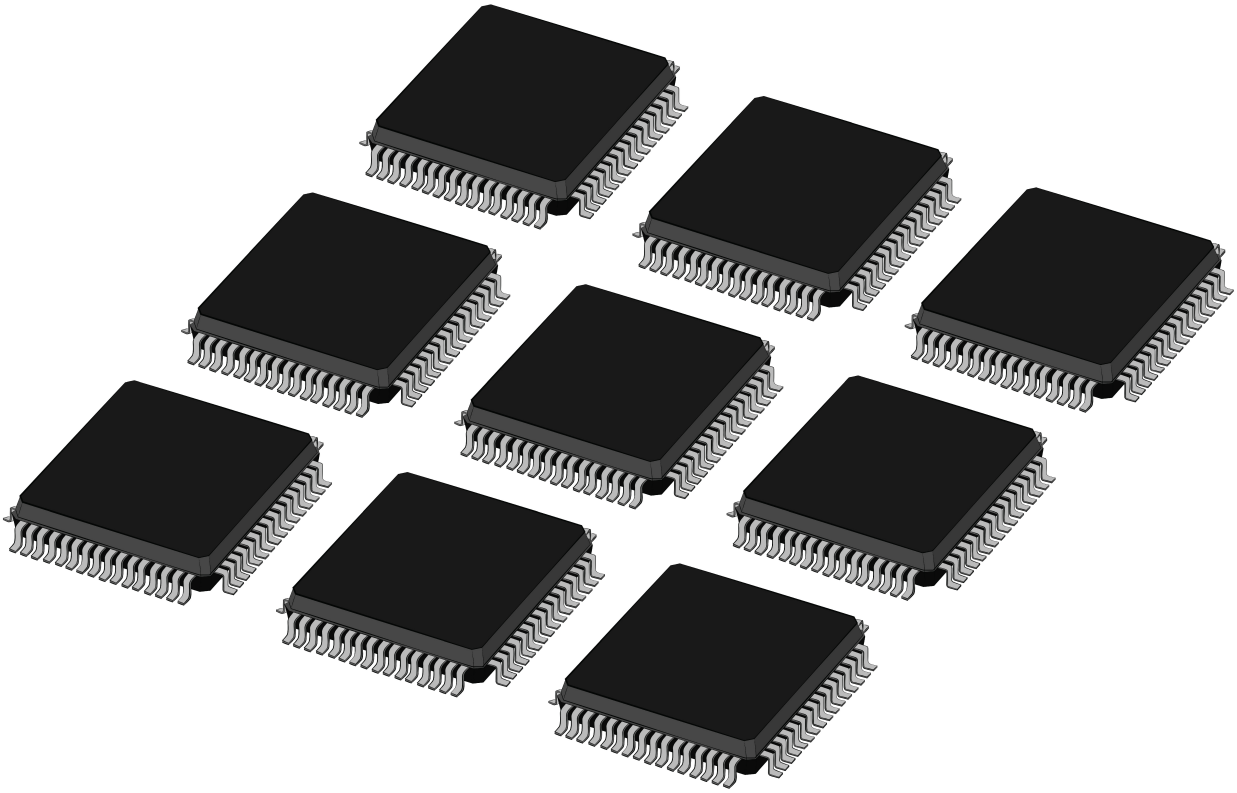

Figure 1: QueenField

1. PLANNING PROCESS

This section describes the hardware planning process used to control the development of the hardware item. This process produces the hardware plans, which may be contained in one or more documents. If multiple documents are used, the main plan should contain appropriate references to the supporting documents. Standard documents covering specific hardware design life cycle processes, such as configuration management or process assurance, are acceptable provided they meet the planning objectives for the applicable process.

1.1. Planning Process Objectives

The purpose of the hardware planning process is to define the means by which the functional and airworthiness requirements are converted into a hardware item with an acceptable amount of evidence of assurance that the item will safely perform its intended functions.

1.2. Planning Process Activities

2. HARDWARE DESIGN PROCESS

The hardware design processes produce a hardware item that fulfills the requirements allocated to hardware from the system requirements. These are Requirements Capture, Conceptual Design, Detailed Design, Implementation and Production Transition. These design processes may be applied at any hierarchical level of the hardware item, such as LRUs, circuit board assemblies and ASICs/PLDs. The following sections describe each process, its objectives and the related activities that should be addressed to reduce the probability of design and implementation errors that affect safety. It is important that each of these processes is planned and the details recorded in a hardware design plan.

2.1. Requirements Capture Process

The requirements capture process identifies and records the hardware item requirements. This includes those derived requirements imposed by the proposed hardware item architecture, choice of technology, the basic and optional functionality, environmental, and performance requirements as well as the requirements imposed by the system safety assessment. This process may be iterative since additional requirements may become known during design.

2.2. Conceptual Design Process

The conceptual design process produces a high-level design concept that may be assessed to determine the potential for the resulting design implementation to meet the requirements. This may be accomplished using such items as functional block diagrams, design and architecture descriptions, circuit card assembly outlines, and chassis sketches.

2.3. Detailed Design Process

The detailed design process produces detailed design data using the hardware item requirements and conceptual design data as the basis for the detailed design.

2.4. Implementation Process

The implementation process uses the detailed design data to produce the hardware item that is an input to the testing activity.

2.5. Production Transition

In this process, manufacturing data, test facilities and general resources should be examined to ensure availa bility and suitability for production. The production transition process uses the outputs from the implementation and verification processes to move the product into production.

2.6. Acceptance Test

An acceptance test demonstrates that the manufactured, modified or repaired product performs in compliance with the key attributes of the unit on which certification is based. These key attributes are chosen using engineering judgement and are indicative that the product is capable of meeting the requirements to which the unit was developed.

2.7. Series Production

This process is not within the scope of this document, but elements impacting design assurance are briefly described to complete the life cycle.

This process reproduces the hardware item on a routine basis that complies with the production data and requirements.

3. VALIDATION AND VERIFICATION PROCESS

This section describes the validation process and the verification process. The validation process provides assurance that the hardware item derived requirements are correct and complete with respect to system requirements allocated to the hardware item. The verification process provides assurance that the hardware item implementation meets all of the hardware requirements, including derived requirements.

3.1. Validation Process

The validation process discussed here is intended to ensure that the derived requirements are correct and complete with respect to the system requirements allocated to the hardware item through the use of a combination of objective and subjective processes. Validation may be conducted before or after the hardware item is available, however, validation is typically conducted throughout the design life cycle.

3.2. Verification Process

The verification process provides assurance that the hardware item implementation meets the requirements. Verification consists of reviews, analyses and tests applied as defined in the verification plan. The verification process should include an assessment of the results.

3.3. Validation and Verification Methods

This section describes some methods that may be applicable to both validation and verification.

4. CONFIGURATION MANAGEMENT PROCESS

The configuration management process is intended to provide the ability to consistently replicate the configuration item, regenerate the information if necessary and modify the configuration item in a controlled fashion if modification is necessary. This section describes the objectives for hardware configuration management and activities that support those objectives.

4.1. Configuration Management Objectives

4.2. Configuration Management Activities

4.3. Data Control Categories

5. PROCESS ASSURANCE

Process assurance ensures that the life cycle process objectives are met and activities have been completed as outlined in plans or that deviations have been addressed. This section describes the objectives for process assurance and the activities that support those objectives. There is no intent to impose specific organizational structures.

5.1. Process Assurance Objectives

5.2. Process Assurance Activities

6. CERTIFICATION LIAISON PROCESS

The purpose of the certification liaison process is to establish communication and understanding between the applicant and the certification authority throughout the hardware design life cycle to assist in the certification process. In addition, liaison activities may include design approach presentation for timely approval, negotiations concerning the means of compliance with the certification basis, approval of design approach, means of data approval, and any required certification authority reviews and witnessing of tests.

6.1. Means of Compliance and Planning

The applicant proposes a means of compliance for hardware. The PHAC defines the proposed means of compliance.

6.2. Compliance Substantiation

The applicant provides evidence that the hardware design life cycle processes have satisfied the hardware plans. Certification authority reviews may take place at the applicant's facilities or applicant's supplier's facilities. The applicant arranges these reviews and makes hardware design life cycle data available as needed.

7. HARDWARE DESIGN LIFECYCLE DATA

This section describes the hardware design life cycle data items that may be produced during the hardware design life cycle for providing evidence of design assurance and compliance with certification requirements. The scope, amount and detail of the life cycle data needed by the certification authorities as design assurance evidence will vary depending on a number of factors. These factors include the applicable certification authority requirements for the airborne system, the assigned design assurance levels, the complexity and the service experience of the hardware. Details of the design assurance evidence should be identified, recorded in the PHAC and agreed to with the certification authorities.

7.1. Hardware Plans

The hardware plans describe the processes, procedures, methods, and standards to be used for the hardware certification, design, validation, verification, process assurance and configuration control.

7.1.1. Plan for Hardware Aspects of Certification

The PHAC defines the processes, procedures, methods and standards to be used to achieve the objectives of this document and obtain certification authority approval for certification of the system containing hardware items. The PHAC, once approved, represents an agreement between the certification applicant and the certification authority on the processes and activities to be conducted and the resultant evidence to be produced to satisfy the hardware aspects of certification. The PHAC may be part of another plan, such as the airborne system certification plan.

7.1.2. Hardware Design Plan

The hardware design plan describes the procedures, methods and standards to be applied and the processes and activities to be conducted for the design of the hardware item. This plan may be included in the PHAC and may reference design policies and standards to be applied.

7.1.3. Hardware Validation Plan

The validation plan describes the procedures, methods and standards to be applied and the processes and activities to be conducted for the validation of the hardware item derived requirements to achieve the validation objectives of this document. This plan may be included in the PHAC and may reference validation standards to be applied.

7.1.4. Hardware Verification Plan

The verification plan describes the procedures, methods and standards to be applied and the processes and activities to be conducted for the verification of the hardware items to achieve the verification objectives of this document. This plan may be included in the PHAC and may reference verification policies and standards to be applied.

7.1.5. Hardware Configuration Management Plan

The hardware configuration management plan describes the policies, procedures, standards and methods to be used to satisfy the configuration management objectives of this document.

7.1.6. Hardware Process Assurance Plan

The hardware process assurance plan describes the procedures, methods and standards to be applied and the processes and activities to be conducted for achieving the process assurance objectives of this document.

7.2. Hardware Design Standards and Guidance

7.2.1. Requirements Standards

7.2.2. Hardware Design Standards

7.2.3. Validation and Verification Standards

7.2.4. Hardware Archive Standards

7.3. Hardware Design Data

7.3.1. Hardware Requirements

7.3.2. Hardware Design Representation Data

7.3.2.1. Conceptual Design Data

7.3.2.2. Detailed Design Data

7.3.2.2.1. Top-Level Drawing

7.3.2.2.2. Assembly Drawings

7.3.2.2.3. Installation Control Drawings

7.3.2.2.4. Hardware/Software Interface Data

7.4. Validation and Verification Data

7.4.1. Traceability Data

7.4.2. Review and Analysis Procedures

7.4.3. Review and Analysis Results

7.4.4. Test Procedures

7.4.5. Test Results

7.5. Hardware Acceptance Test Criteria

7.6. Problem Reports

7.7. Hardware Configuration Management Records

7.8. Hardware Process Assurance Records

7.9. Hardware Accomplishment Summary

8. ADDITIONAL CONSIDERATIONS

This section provides guidance on additional considerations of design assurance that are not covered in the previous sections. Any use of additional considerations should be agreed with the certification authority.

8.1. Use of Previously Developed Hardware

This section discusses the issues associated with the use of previously developed hardware. Guidance includes the assessment of modifications to the hardware, to the aircraft installation, to the application environment, or to the design environment and upgrading design baselines. Guidance for COTS component usage, a special case of previously developed hardware, is covered. Configuration Management and Process Assurance considerations should also be addressed for each use of previously developed hardware.

8.2. Commercial Components Usage

COTS components are used extensively in hardware designs and typically the COTS components design data is not available for review. The certification process does not specifically address individual components, modules, or subassemblies, as these are covered as part of the specific aircraft function being certified. As such, the use of COTS components will be verified through the overall design process, including the supporting processes, as defined in this document. The use of an electronic component management process, in conjunction with the design process, provides the basis for COTS components usage.

8.3. Product Service Experience

Service experience may be used to substantiate design assurance for previously developed hardware and for COTS components. Service experience relates to data collected from any previous or current usage of the component. Data from non-airborne applications is not excluded.

8.4. Tool Assessment and Qualification

Tools, both hardware and software, will normally be used during hardware design and verification. When design tools are used to generate the hardware item or the hardware design, an error in the tool could introduce an error in the hardware item. When verification tools are used to verify the hardware item, an error in the tool may cause the tool to fail to detect an error in the hardware item or hardware design. Prior to the use of a tool, a tool assessment should be performed. The results of this assessment and, if necessary, tool qualification should be recorded and maintained.