Procedures and Guidelines

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APPROVED BY Signature: original signed by
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Responsible Office: 573 / Component and Hardware Systems Branch

Title: Design of Non-Flight Embedded Software

1 PURPOSE

This procedure establishes guidelines for the design of Non-Flight Guidance Navigation and Control (GN&C) Embedded Software. Employees will use this process in support of the design, verification, and review of GSFC products.

2 REFERENCE

GPG 8730.4, The GSFC Quality Manual
GPG 8700.1, Design Planning and Interface Management
GPG 8700.2, Design Development and Configuration Control
GPG 8700.3, Design Validation
GPG 8700.4, Technical Review Program
570 8700.2.3, Design of Flight Component Embedded S/W
570 8700.2.5, Analytical Design of S/C Missions
570 8700.3.5, GN&C Component Verification Testing
570 8700.2.6, Analytical Design of sub-Orbital Missions
570 8700.2.7, Design of S/C Propulsion Systems

3 SCOPE

This procedure defines the guidelines for the design of Non-Flight GN&C Embedded Software. These guidelines apply to any Product Design Team members providing Non-Flight Embedded Software support to GN&C projects covered by the scope of the GSFC Quality Management System.

4 DEFINITIONS

Non-Flight Embedded Software includes ground embedded software. This software is intended for non-flight purposes only. The term does not refer to sub-orbital, balloon, aircraft-based, or software used in or beyond earth orbit: either on attached/free-flying shuttle missions, on attached/free-flying space station missions, or on expendable launch vehicle missions.

5 AUTHORITIES & RESPONSIBILITIES

5.1 AETD Employees: All AETD employees are responsible for adherence to this procedure.
5.2 Product Design Lead: Because many steps of this procedure are noted as being optional, it is the responsibility of the Product Design Lead, in partnership with the customer, to determine and document in the design plan (see GPG 8700.1 and GPG 8700.2) which specific steps will be executed. Furthermore, guidelines contained herein may be waived at the discretion of the Product Design Lead and the customer due to extenuating circumstances such as limitation on time and/or resources, or by customer request. These procedures may also be waived in favor of existing contractor ISO 9000 procedures. Such waivers must be documented.

6 IMPLEMENTATION

Note: All procedure steps are the responsibility of the Product Design Lead unless stated otherwise. The implementation procedures in sections 6.3 through 6.7 will normally be repeated iteratively, as needed, to support the design plan. This list is not intended to represent a required order of execution

6.1 Requirements Definition

Generate a mutual understanding between the project, users, designers, and customer of the initial definition of the software to be developed. Agree on the requirements with the customer and generate a written requirements document.

6.2 Initial Planning

6.2.1 The Product Design Lead ensures that the Product Design Team is composed of individuals, both civil servants and contractors, with the required discipline skills.
6.2.2 Identify high-risk items and develop a risk mitigation plan (optional, per design plan).
6.2.3 Identify any required items (such as compilers).
6.2.4 Develop a budget and a schedule for review and approval by functional management and the customer.

6.3 Documentation

6.3.1 Develop a block diagram of the system, which illustrates all software subsystems, I/O devices, special purpose hardware, and the flow of all data throughout the system.
6.3.2 Define all project formats such as programming language(s), design methodology, naming conventions, component prototypes, I/O files and records, output products, global storage areas, inter-task communication packets, interactive user language, and any other software constructs other than actual code.
6.3.3 Define and record any engineering test unit (ETU) interface differences (optional, per design plan).
6.3.4 Generate any user, operation, and maintenance manuals needed.
6.3.5 Perform one or more Peer Reviews of the flight software requirements, flight ICDs, and non-flight software requirements.

6.4 Procurement

Order any required items (such as compilers).

6.5 Ground Software Reviews

6.5.1 Participate in the project Preliminary Design Review (per customer requirements).
6.5.2 Participate in the project Critical Design Review (per customer requirements).
6.5.3 Participate in Pre-Environment Review (per customer requirements).
6.5.4 Participate in Pre-Shipment Review (per customer requirements).
6.5.5 Participate in Safety Review (per customer requirements).

6.6 Test Plans

Generate and execute functional test procedures (as required by the design plan).

6.7 Software Development

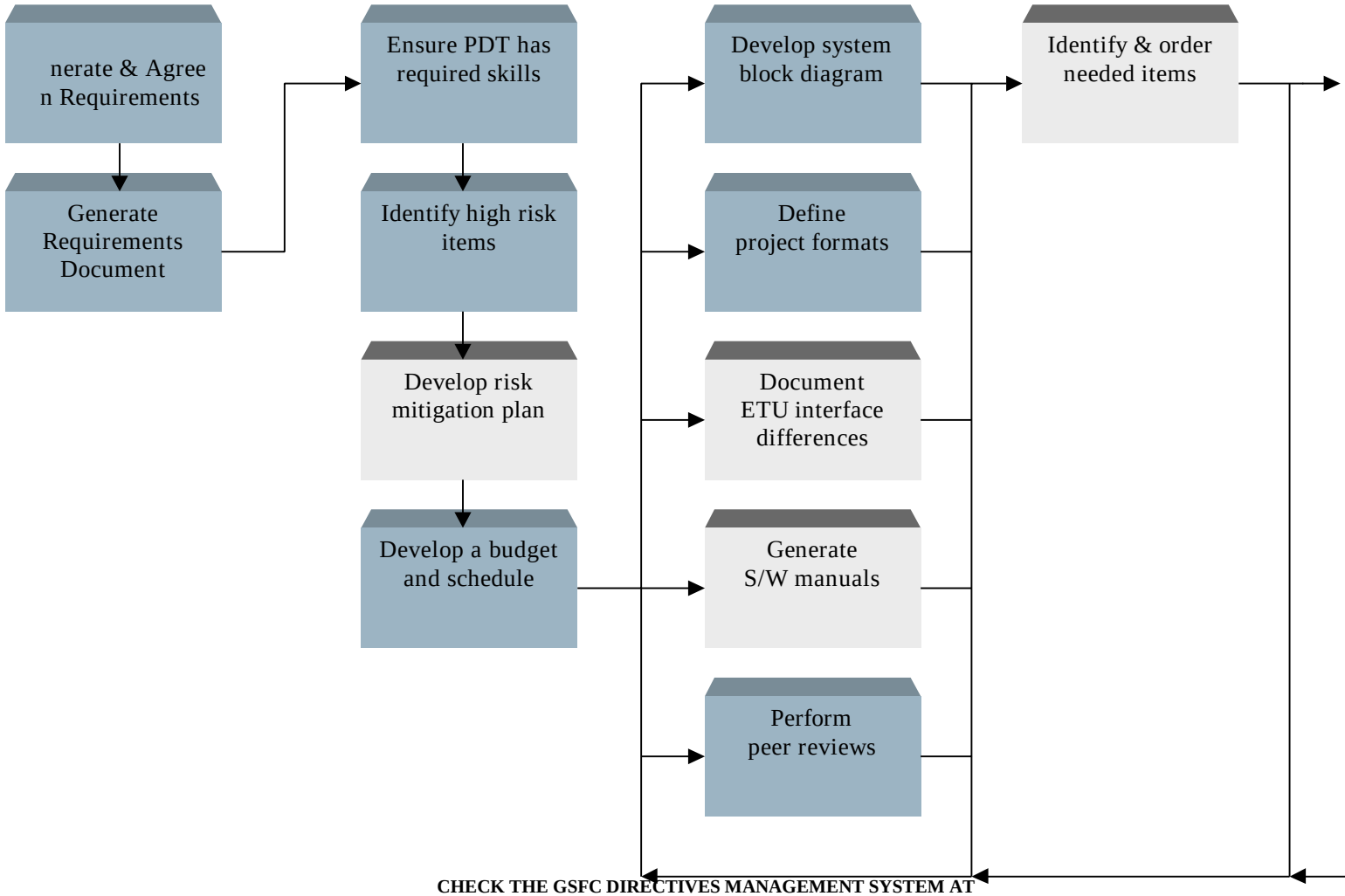
Perform coding of non-flight software based on design methodology employed.

6.8 Non-Flight Software Integration

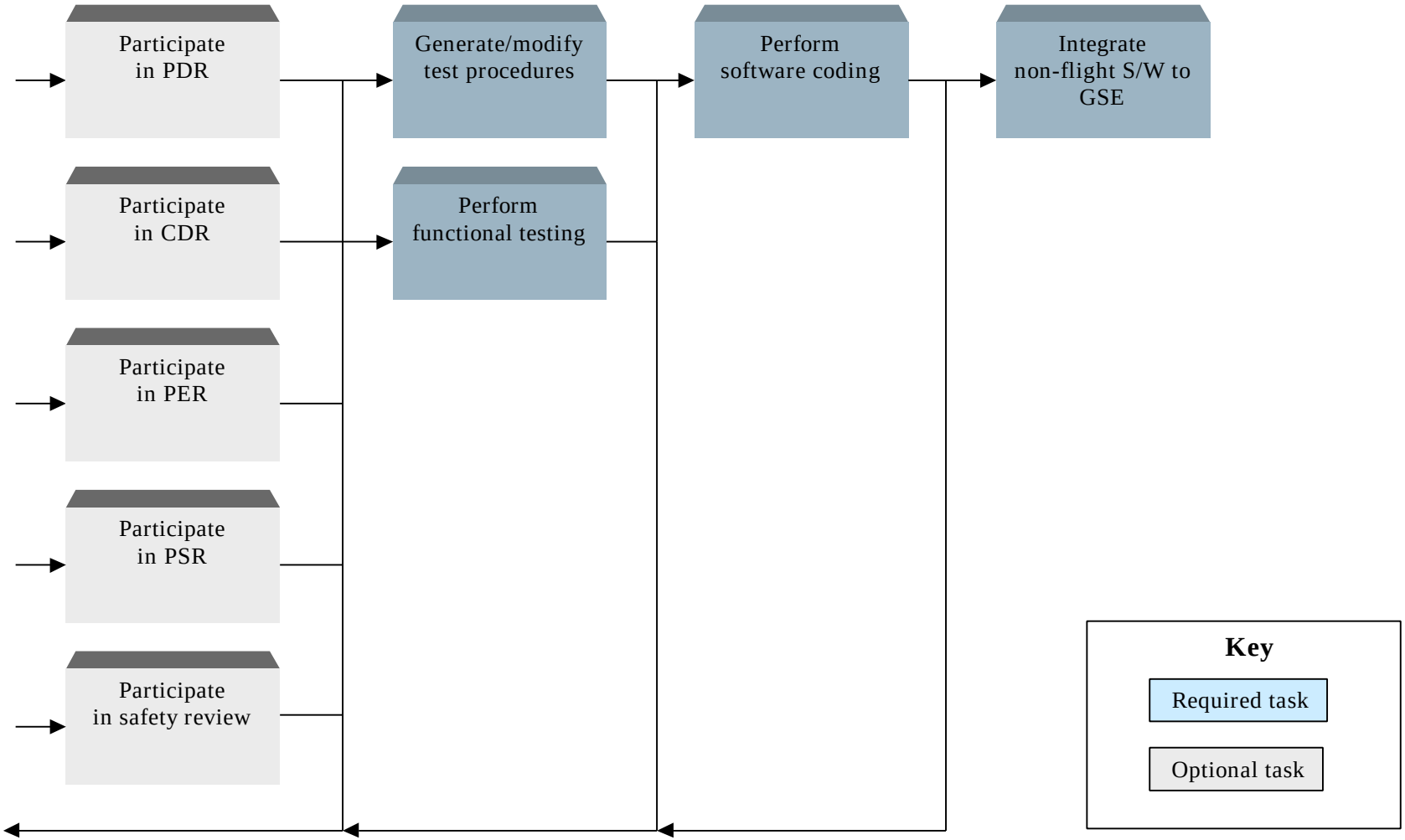
The Product Design Lead and Product Design Team participate, possibly significantly, in the integration of flight components. Any newly identified requirements are added in accordance with normal development methods from sections 6.3 through 6.7.

FLOW DIAGRAM

Non-Flight Embedded S/W Development Flow Diagram



Non-Flight Embedded S/W Development Flow Diagram



CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	08/27/1998	Initial Release