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Configuration Management Plan

System Definition and Project Development

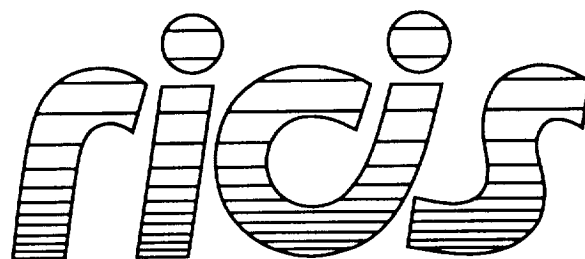
Repository Based Software Engineering (RBSE) Program

GHG Corporation

October 31, 1991

**Cooperative Agreement NCC 9-16
Research Activity No. SE.18
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**NASA Johnson Space Center
Information Systems Directorate
Information Technology Division**



*Research Institute for Computing and Information Systems
University of Houston-Clear Lake*

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DEVELOPMENT, REPOSITORY BASED SOFTWARE
ENGINEERING (RBSE) PROGRAM (RESEARCH INST.
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Configuration Management Plan

***System Definition and
Project Development***

***Repository Based
Software Engineering (RBSE) Program***

Preface

This research was conducted under auspices of the Research Institute for Computing and Information Systems by GHG Corporation. Dr. Charles McKay served as RICIS research representative.

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The views and conclusions contained in this report are those of the author and should not be interpreted as representative of the official policies, either express or implied, of NASA or the United States Government.

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Repository Based Software
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Project No. RICIS No. SE.18

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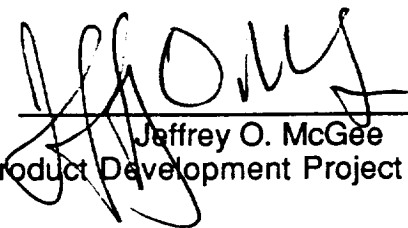
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October, 1991

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CHANGE/ REVISION	PAGES CHANGED	REASON FOR CHANGE
	All	Initial Release

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1.0 INTRODUCTION

1.1 IDENTIFICATION OF VOLUME

This is the Configuration Management Plan for the AdaNet Repository Based Software Engineering (RBSE) contract. This document establishes the requirements and activities needed to ensure that the products developed for the AdaNet RBSE contract are accurately identified, that proposed changes to the product are systematically evaluated and controlled, that the status of all change activity is known at all times, and that the product achieves its functional performance requirements and is accurately documented.

1.2 SCOPE OF VOLUME

The Configuration Management policies and processes documented in this plan are applicable to the GHG Corporation personnel working on the AdaNet RBSE contract.

1.3 PURPOSE AND OBJECTIVE OF VOLUME

This document defines the configuration management policies, plans, and procedures to be utilized by GHG Corporation personnel in satisfying the requirements of the Repository Based Software Engineering (RBSE) Program.

1.4 STATUS AND SCHEDULE

This document shall be updated, and new revisions shall be published, as program plans become available from the other contractors and changes in the requirements are deemed necessary to meet the interfacing needs between the contractors working on the AdaNet RBSE contract.

2.0 RELATED DOCUMENTATION

2.1 PARENT DOCUMENT

This Configuration Management Plan derives its parentage from the Program Management Plan of the Repository Based Software Engineering (RBSE) Program, Document Number RBSE-FD-PO-003-1, dated July 31, 1991.

3.0 RESOURCES, BUDGETS, SCHEDULES, AND ORGANIZATION

Refer to the Program Management Plan of the Repository Based Software Engineering (RBSE) Program for information related to the resources, budgets, schedules, and organization.

3.1 EQUIPMENT

A computer system and data base handler capable of storing, under controlled access, all company and vendor produced source code is required. The computational system shall be capable of generating reports as required by configuration management personnel. The format and content of the reports shall be capable of being tailored by configuration management personnel with a minimum of training. The computational system shall be capable of receiving input data, in the form of page inputs, from remote terminals. Security provisions shall be in place to ensure the integrity of the data and source code under configuration control. The security system shall be capable of preventing unauthorized modification of the source code and data.

3.2 MATERIALS, FACILITIES, AND OTHER RESOURCES

At minimum, normal working equipment shall be available, including, but not limited to, the following:

- a) Desks, chairs, and bookcases
- b) Filing cabinets sufficient to store one program's change related papers in each
- c) Telephones

4.0 CONFIGURATION MANAGEMENT PROCESS OVERVIEW

4.1 INTRODUCTION

Configuration Management is the discipline that applies technical and administrative direction and surveillance to:

- a) Identify and document the functional and physical characteristics of a configuration item,
- b) Control changes to those characteristics, and
- c) Record and report change processing and implementation status

As such, the discipline of configuration management typically includes the functions of identification and release, change control, status accounting, and the preparation and performance of configuration audits. Configuration Management is thus the means through which the integrity and continuity of the design, engineering and cost trade-off decisions made between technical performance, producibility, operability, and supportability are recorded, communicated, and controlled by the program and functional managers for a given program or project.

A more detailed description of the process and related flow diagrams can be found in Section 5.0 and Appendix I to this plan.

4.2 CONFIGURATION IDENTIFICATION AND RELEASE FUNCTIONS

4.2.1 Configuration Identification Function

Configuration Identification occurs in ever increasing levels of detail from the initial functional and physical performance requirements, specifications, and characteristics established by the engineering staff for a given product. As the contractually required deliverable document requirements and specifications are received from engineering, they are assigned a unique identification number and are placed under configuration control.

Configuration Identification numbers shall be assigned to all documentation and source code developed or modified by GHG personnel. Items purchased by GHG for use on this contract (Operating Systems, computational equipment, Editors, etc.) shall be identified and placed under configuration control.

Once assigned, the numbers will not be reassigned to any other engineering document or items of hardware or software.

4.2.2 Configuration Release Function

Internal release of design and development documents, as well as Configuration Units (CUs) of software and hardware, occurs prior to official authentication of the documents or CUs. Internal release requires GHG CCB review and approval. Authentication (customer approval) of configuration items occurs at predetermined milestones in the contract. Typically, development and high-level design documents are authenticated by the customer at Preliminary Design Review (PDR). Detailed design documents are authenticated at Critical Design Review (CDR).

4.3 CONFIGURATION CHANGE CONTROL FUNCTION

Change control exists for the protection of both the contractor and the customer by establishing a means of formally communicating the need for a change as well as the review and approval or disapproval a proposed change. This approach ensures the accurate, effective communication of changes to requirements and specifications and is needed to ensure that the product meets the customer's changing needs and the contractor's business requirement to recover costs involved in meeting the new requirements.

Once the formal identification for a configuration item has been established, all proposed changes to that identification are systematically evaluated to ensure traceability, contain costs, schedule future release activities, and provide for the development of a quality product.

Configuration change control involves the use of a Configuration Control Board (CCB). CCBs exist at both the contractor and customer levels. Changes to configuration items not yet delivered to the customer are evaluated within the contractor CCB. Items that have been delivered or authenticated by the customer require approval by the contracting agency's CCB as well.

4.4 CONFIGURATION STATUS ACCOUNTING FUNCTION

As new identification data is made available or changes to existing configuration data are proposed, the status of the changes are tracked by configuration management. This activity ensures visibility into the change activity and assists in the management of the product.

4.5 CONFIGURATION AUDITS

Configuration audits fall into two categories, functional and physical. Together they ensure that the product functions as specified and that all changes to the initial identification of the product have been documented. Although not contractually required, GHG routinely performs both FCAs and PCAs as a matter of good business practice and total quality management.

4.5.1 Functional Configuration Audit (FCA)

The Functional Configuration Audit (FCA) is the formal examination of the functional characteristics' test data for a configuration item, prior to acceptance by the contracting agency, to verify that the item has achieved the performance specified in its functional or allocated configuration identification.

4.5.2 Physical Configuration Audit (PCA)

The Physical Configuration Audit (PCA) is the formal examination of the "as-built" configuration of a unit or item against its technical documentation in order to establish the item's initial product configuration identification.

5.0 CONFIGURATION MANAGEMENT ACTIVITIES

5.1 CONFIGURATION IDENTIFICATION AND RELEASE

Configuration identification occurs in ever increasing levels of detail from the initial functional and physical performance requirements, specifications, and characteristics established by the engineering staff for a given product. As the requirements and specifications are authenticated and approved by the customer, they are assigned a unique identification number and are placed under configuration control.

Detailed process flow diagrams for both the identification and release functions may be found in Appendix I to this plan.

5.1.1 Identification

The level at which a configuration item number is assigned is critical for management visibility into the design and development activity. To ensure proper selection for configuration identification, the designation of a configuration item shall be the responsibility of engineering, with the assistance of configuration management personnel. Selection shall be based on complexity, size, number of other projects using the CI, and contractual obligations.

Configuration identification numbers shall be assigned to each specification, hardware, or software unit developed or purchased by GHG for use on this contract.

Once assigned, the configuration item numbers will not be reassigned to any other engineering document or items of hardware or software.

5.1.2 Release

Upon completion of internal GHG engineering testing and a successful GHG CCB review, a CI is ready to be placed under configuration control. CM issues a release notice, formal notification to all applicable organizations to inform them that the configuration item is available for use in design, procurement, fabrication, coding, integration, and test. Items placed under configuration control shall include all source code, documentation, and hardware developed or purchased and modified for the RBSE contract, as well as the specifications for those items.

5.2 CONFIGURATION CHANGE CONTROL

Configuration Management is responsible for ensuring that the identification and change status of CIs is maintained at all times. To ensure this activity occurs, GHG has implemented a configuration change control procedure that tracks the reasons for a change, approval for change activity to begin, identification of impacts on cost

and schedule, and the identification and evaluation of the individual changes at the Configuration Control Board (CCB).

Detailed process flow diagrams for the change control process may be found in Appendix I to this plan.

5.2.1 Controlled Storage and Release Management

Upon receipt of a configuration item, configuration management personnel shall perform a 'receipt PCA' to ensure that the product to be placed under configuration control matches its product specifications. Upon successful completion of the audit, the CI shall be placed in a secure location to prevent unauthorized changes to the master. Access to configuration controlled items shall be restricted and only copies of items shall be issued for change activities.

5.2.2 Change Control Flow

5.2.2.1 Initiation and Tracking of Problem Reports

Change activity begins with a documented need for change called a Problem Report (PR). The documentation of the need for a change may take the form of a Review Item Discrepancy (RID), a Change Request (CR), or a Discrepancy Report (DR). Anyone may initiate a Change Request or Discrepancy Report.

Upon receipt of a problem report, Configuration Management personnel shall assign the problem report a unique tracking number and shall enter the data received into a CM controlled tracking data base. All tracking efforts related to the status of the problem report shall be performed by CM personnel.

Once the initial tracking data is entered, the problem report data is analyzed and evaluated by engineering for impact assessment, alternate solutions, and a list of the CIs that will require modification. The proposed change package is then reviewed by an engineering review group to ensure that the proposed change package meets the requirements established by the problem report.

A summary of the proposed change is documented and entered into the CM tracking data base.

5.2.2.2 Engineering Change Request/Notices (ECR/Ns)

Engineering Change Request/Notices are used to identify and document those CIs that must be modified to satisfy any new requirements or repair a problem. ECR/Ns may be initiated against either software or hardware items and their associated specifications. Each ECR/N shall be assigned a unique tracking number and each ECR/N shall be 'tied' to the reason for a change, be it a DR, RID, or CR, by means of

the unique tracking number assigned to the report by CM. The problem report number shall appear on each ECR/N.

Upon receipt of an approved ECR/N, configuration management shall issue a copy of the CI from the CM controlled archives. In no instance shall the original be issued for change.

Once the copy of the CM controlled CI is made available for change, engineering designs, develops, implements, and tests the change. When engineering is satisfied that the change package is ready for incorporation into CM's archives, the package shall be forwarded to the Configuration Control Board (CCB) for review. No change to configuration controlled items may be implemented without CCB approval.

Upon CCB approval, the changed CIs are incorporated into the CM controlled archives and the package is forwarded to the initiator for recheck. If customer recheck of the change package is required, CM shall forward the package, with the modified CIs, to the agency responsible for performing the recheck.

5.2.3 Change Documentation

As noted above, change activity can only begin with a documented need for a change; a DR, CR, or RID is required. Each problem identification form shall contain, at minimum, data such as the following:

- a) A statement of the problem, discrepancy, or requirements change
- b) An analysis of the problem including alternate solutions
- c) A list of the CIs to be modified, including all associated specifications and documentation
- d) An estimate of the time required to develop, implement, and test the change

For each Configuration Item listed on the problem report, an Engineering Change Request/Notice shall be required before CM will issue a copy of the CI for change. The engineer requesting the copy of the CI shall initiate the ECR/N. Each ECR/N shall contain, at minimum, the following data:

- a) The problem report number
- b) The identification of the CI requested
- c) The current revision or change level

Once the proposed change has been developed and tested, a description of the change shall be entered on the ECR/N prior to CCB review.

5.2.4 Change Review Process

All proposed changes to configuration items under configuration control shall be reviewed and approved, or disapproved with comments, by the cognizant CCB.

Proposed changes to items that are under CM control but not yet authenticated by the customer shall require GHG CCB approval prior to implementation into the CM controlled archives. Proposed changes to items authenticated by the customer shall require CCB review and approval at a level commensurate with the level of change requested.

5.2.4.1 Engineering Design Review Board

GHG shall establish an Engineering Design Review Board to review all identified and documented problems and associated change packages. The design review board shall review each problem report to ensure that the problem is adequately documented, and is, in fact, a problem rather than an operator or user error. The design review board shall also review the analysis of the problem and the proposed change package to ensure the completeness and adequacy of the change.

5.2.4.2 Configuration Control Board

All changes to configuration items under configuration control shall be reviewed by the cognizant CCB. Proposed changes to items that are under CM control but not yet authenticated by the customer shall require GHG CCB approval prior to implementation into the CM controlled archives. Proposed changes to items authenticated by the customer shall require CCB review and approval at a level commensurate with the level of change requested.

The minutes for each CCB shall be recorded and retained by configuration management.

The internal GHG CCB shall comprised of the following functional representatives:

- a. Configuration Manager (CCB Chairperson)
- b. Quality Assurance
- c. Engineering
- d. Program Management
- e. CM Status Accounting (CCB secretary)

Members of other disciplines may be requested to attend on an as-required basis.

5.3 CONFIGURATION STATUS ACCOUNTING

Configuration Status Accounting records shall be maintained by configuration management personnel. These records shall contain listings of problems reports, their associated engineering change request/notices, the date of initiation, completed development date, and approval signatures authorizing the incorporation of the change into the CM controlled archives. From the data contained in the reports, an accurate status of each proposed change, as well as the status of the problem report, shall be known at all times.

5.4 CONFIGURATION AUDITS

Configuration audits shall be performed to ensure the configuration items meet functional requirements (that each performs according to its test criteria) and to ensure that each CI is completely documented.

Although not contractually required, GHG routinely performs both FCAs and PCAs on deliverable products as a matter of good business policy and a means of ensuring a quality product.

5.4.1 Functional Configuration Audit (FCA)

The Functional Configuration Audit (FCA) is the formal examination of the functional characteristics' test data for a configuration item, prior to acceptance by the contracting agency, to verify that the item has achieved the performance specified in its functional or allocated configuration identification.

5.4.2 Physical Configuration Audit (PCA)

The Physical Configuration Audit (PCA) is the formal examination of the "as-built" configuration of a unit or item against its technical documentation in order to establish the item's initial product configuration identification.

6.0 SUPPORT ENVIRONMENT REQUIREMENTS AND TOOLS

Configuration Management will require computational equipment capable of storing, under controlled access conditions, all vendor supplied software as well as all software developed or purchased and modified by GHG personnel. The computational system shall be capable of generating status reports as needed by program management, quality assurance, engineering, and configuration management personnel.

Report generation tools will be capable of being tailored by CM personnel with a minimum of engineering assistance. Reports will be generated for configuration status accounting and configuration identification purposes.

Configuration status accounting reports will be capable of identifying all problem reports with an indentured listing of all engineering change request/notices.

Configuration Identification reports will be capable of generating indentured parts lists from any CI level requested.

7.0 ABBREVIATIONS AND ACRONYMS

CCB:	Configuration Control Board
CI:	Configuration Item
CR:	Change Request
DR:	Discrepancy Report
DRB:	Design Review Board
ECR/N:	Engineering Change Request/Notice (Form)
FCA:	Functional Configuration Audit
PA:	Problem Analysis (Form)
PCA:	Physical Configuration Audit
PR:	Problem Report (Form)
RID:	Review Item Discrepancy

8.0 GLOSSARY

BASELINE: A configuration Identification document or a set of documents formally designated and fixed at a specific time during a CI's life cycle. Baselines, plus approved changes from those baselines, constitute the current configuration identification.

For configuration management there are typically three baselines, as follows:

- a) **Functional Baseline.** The initial approved functional configuration identification.
- b) **Allocated Baseline.** The initial approved allocated configuration identification.
- c) **Product Baseline.** The initial approved or conditionally approved product configuration identification.

A fourth baseline is frequently utilized by engineering to establish the developmental configuration identification for a given product. The 'developmental' baseline is under engineering control and is not considered deliverable or official.

CONFIGURATION: The functional and/or physical characteristics of hardware, software, or firmware as set forth in technical documentation and achieved in a product.

CONFIGURATION CONTROL: The systematic evaluation, coordination, approval or disapproval, and implementation of all approved changes in the configuration of a CI after formal establishment of its configuration identification.

CONFIGURATION IDENTIFICATION: The current approved or conditionally approved technical documentation for a configuration item as set forth in specifications, drawings and associated lists, and the documents referenced therein.

CONFIGURATION ITEM (CI): An aggregation of hardware, software, firmware, or any of its discrete portions, which satisfies an end use function and is designated by the customer for configuration management. CIs may vary widely in complexity, size and type.

CONFIGURATION STATUS ACCOUNTING: The recording and reporting of the information that is needed to manage configuration effectively, including a listing of the approved configuration identification, the status of proposed changes to configuration, and the implementation status of all approved changes.

9.0 NOTES

10.0 APPENDIX I

10.1 IDENTIFICATION AND RELEASE PROCEDURES

10.1.1 Introduction

As the design of a product becomes more detailed, engineering begins to lay down the structure of the final product in terms of what configuration units are required, how many, and how they are to be organized. Once this data becomes relatively firm, configuration management is notified and the data tracked to ensure traceability to requirements, scheduled performance, and to ensure that the configuration items begin to enter the tracking data base in an organized manner. The vehicle used to obtain this data from engineering, enter it into the tracking data base, and ensure review of the final product prior to release is the Configuration Unit Identification and Release Notice (CUID). Refer to Figure 10.1.1-1, Configuration Identification and Release Notice. Figure 10.1.1-2, Configuration Unit Identification and Release Process depicts the process for the identification and release of internally developed or modified products.

10.1.2 Identification

10.1.2.1 Internally Developed Products

Engineering initiates the identification process for internally developed products by identifying the unit on the CUID form and forwarding it to CM. The data supplied by engineering consists of the following:

- a) Program or project title
- b) Estimated release date
- c) Proposed nomenclature
- d) Specification number
- e) Title
- f) Next higher assembly
- g) Item type (either H/W or S/W)
 - 1) If the type is Hardware, the drawing type and size must be entered
 - 2) If the type is Software, the proposed Callname must be entered
- h) Security classification
- i) Description of the unit
- j) Where the unit is used if more than on just this project
- k) The engineer responsible for creating the CI, and the date of the request

**Configuration Unit Identification
and Release Notice No. [REDACTED]**

Program _____ Est. Rel. Date _____
Part No. _____ Rev. Level _____
Nomen. _____ Serial No. _____
Specification No. _____ Title _____

Vendor/Subcont. Cage Code _____

Next Higher Assembly _____

Item Type:

H/W DWG Type _____ Sheet Size _____

Sheet Count _____ DWG Dash No. _____

S/W Callname _____ Rev. Level _____

Security Classification _____

Description _____

Used On _____

Engineer _____ Date _____

QA Rep. _____ Date _____

CCB Chair _____ Date _____

CCB Clerk _____ Date _____

Figure 10.1.1-1

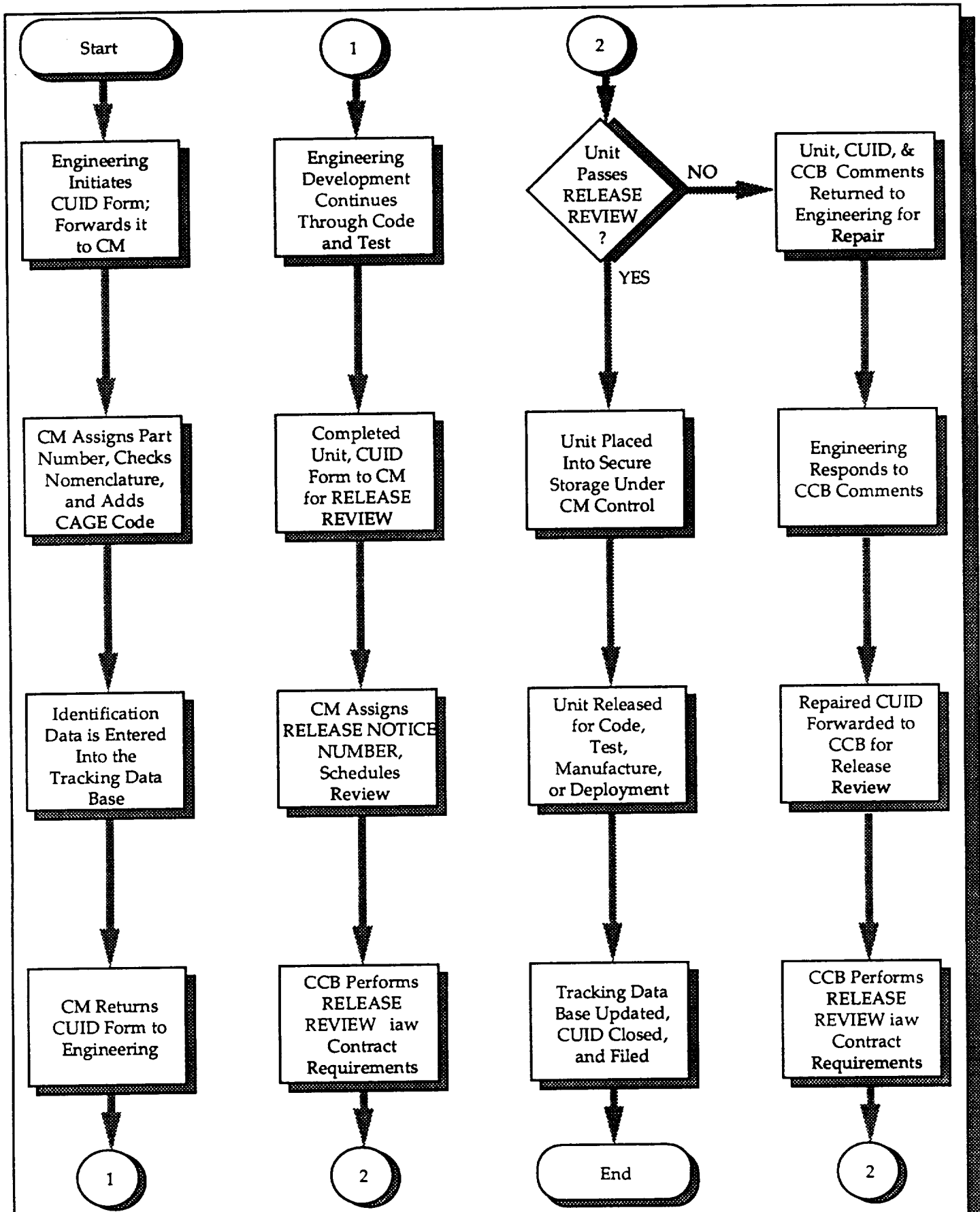


Figure 10.1.1-2 Configuration Unit Identification and Release

Upon receipt of the CUID form, CM personnel shall:

- a) Assign the unit a Part Number in accordance with GHG CM policy
- b) Ensure that the proposed nomenclature meets GHG CM policy and requirements and make corrections as necessary
- c) Add the CAGE Code

This data shall be entered into the CM tracking data base and the form shall be returned to engineering. When engineering has completed the development of the unit and the unit has successfully completed unit test, the remainder of the identification and release process shall be completed.

Engineering shall complete the CUID form by entering the following data:

- a) Revision level, (if applicable)
- b) For Hardware units, the sheet count and drawing dash number
- c) For software units the revision level (if applicable)

The form, together with a copy of the completed source code or drawing, shall be forwarded to Configuration Management for update to the data base and release review.

During the release review process, Quality Assurance and the Configuration Manager review the data describing the unit and inspect the unit to ensure compliance with the applicable contractual requirements. If all requirements are met the release process described in paragraph 10.1.3 shall begin. If release requirements are not met, the forms and the units will be returned to engineering for repair.

10.1.2.2 Numbering of Configuration Units

Configuration Units shall be assigned unique identification numbers. Identification numbers shall not exceed 15 characters in length, including dashes, and shall not have blank spaces imbedded. Identification numbers shall consist of numbers, letters, or a combination thereof. The letters I, O, Q, S, X, and Z shall not be used. Numbers shall be Arabic and shall not include fractions, decimals, or Roman numerals. Parenthesis, (), asterisks, *, virgule, /, degree, and plus or minus symbols shall not be used. The revision level of the unit or part shall not be considered part of the identification number.

10.1.2.3 Documentation Numbering

Documentation generated by GHG personnel as deliverables to the customer shall be uniquely identified. CM personnel shall assign identification numbers in accordance with the following schema:

```
PROG. - DOC - SEQ
|           |     |
|           |     | Sequence Number
|           |     |
|           |     | Document Type
|           |     |
|           |     | Program Name
```

The Program Name is a six character field containing the program name or abbreviation. The Document Type is a six character field containing the abbreviation for the document. Appendix 2 to this plan contains a list of documents and their abbreviations. The Sequence Number is a six character numeric field containing the document number as assigned by CM. The sequence number shall be assigned for a log generated by CM. Each field will be separated a dash. The Revision and Change level fields shown in Appendix 2 are not considered part of the identification of the document.

10.1.2.4 Vendor/Subcontractor Developed Products

Upon receipt of materials from vendors or subcontractors, and prior to issuance for use, an inspection of all incoming material shall be conducted to ensure the completeness of the delivery. During the inspection, CM personnel shall record all part numbers and serial numbers for hardware items, specification numbers, document numbers, revision levels, and titles for all User's Guides, Operating Systems, etc. This data shall be entered into the CM tracking data base along with information regarding the vendor or subcontractor, including the CAGE code, address, contract number, and other information deemed pertinent to maintaining accurate and adequate identification and tracking of vendor/subcontractor supplied items. The unit(s) shall then be released for use. Figure 10.1.2.4-1 CUID and Release of Vendor/Subcontractor Items depicts the process.

This identification process, for either internally developed or vendor/subcontractor supplied units, will probably not be completed on the first pass because the design and development of a product can be extremely complex. Identification of configuration items at subordinate levels shall continue until the structure and content of the product is known. However, the release of units will not be held up pending the complete identification of each unit within the product.

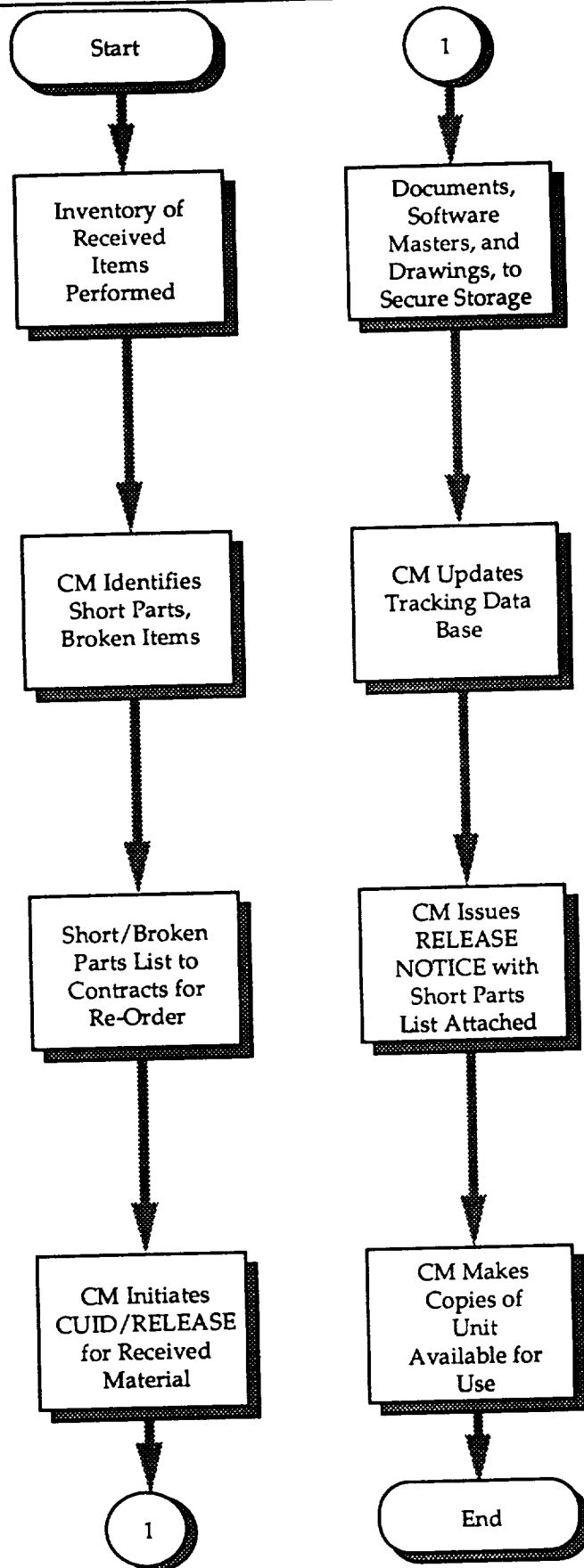


Figure 10.1.2.4-1 CUID and Release of Vendor/Subcontractor Items

The result of the identification process is an indented parts list that depicts the skeleton of the product, in its entirety, from the top down.

10.1.3 Release

Upon completion of the engineering drawing development effort, engineering shall update the CUID form with the sheet size and count for hardware units. The completed software configuration unit or hardware drawing, with the CUID form, shall be forwarded to Configuration Management for review and release. The CM clerk shall assign a release notice number for the unit from a sequential log and schedule the unit for CCB review.

The Configuration Control Board shall review the proposed release. If approved, the members of the CCB shall enter their signatures and the date of their approval in the appropriate spaces. The CM clerk shall update the data base with the approvals and dates. The unit itself shall be placed under configuration control, either in a CM-controlled data base for software units, or a secure drawing vault for hardware drawings. The clerk shall sign each form after the data base update and the securing of the units is completed. The form shall be placed on file.

From this point on, all changes to the unit shall be placed under strict configuration control.

10.1.3.1 Release of Vendor/Subcontractor Products

Copies of vendor or subcontractor supplied software and documentation shall be released for use upon completion of inventory and inspection. CM personnel shall enter all data received in a timely manner. The originals shall be placed under CM control and shall not be issued except for the purposes of creating another usable copy. This activity ensures the availability of a deliverable quantity and quality of the items purchased for use by GHG prior to delivery of the product to the customer.

10.2 CHANGE CONTROL

10.2.1 Introduction

Changes occur for either evolutionary or revolutionary reasons. In an evolutionary change, either the performance or functional requirements for a unit have been modified by the customer or an enhancement to the performance or functional capabilities for the unit has been proposed by GHG personnel. In short, an evolutionary change can be typified as growth from one stage to its next logical stage. Revolutionary changes occur to repair a problem identified by either the customer or GHG's Engineering or Quality personnel.

If the unit has already been accepted by the customer, a Contract Change Proposal (CCP) is usually required to document the changes to the unit. If the unit has not

been formally accepted by the customer, a Discrepancy Report (DR), or a Review Item Discrepancy (RID) will suffice to initiate the change action needed to modify configuration units under configuration control. The data provided GHG on the CR, DR, or RID will be transferred to a Problem Report (PR) for tracking internally to GHG. The reporting documentation used to request a change to an individual configuration unit is an Engineering Change Request/Notice (ECR/N).

Good business practice presupposes that the management team be involved in the review and approval-for-work process. This step ensures management visibility into the changes proposed for a configuration unit and provides the data management needs to make informed decisions relative to tradeoffs in cost, schedule, technical feasibility, etc. GHG uses a Problem Analysis (PA) form as a vehicle for providing management that data.

To implement a change into a unit under Configuration Management control thus requires a reason for the change (a DR, RID, or CR), approval from Program Management in the form of an approved Problem Analysis form, and a vehicle for tracking the change, an ECR/N.

In no instance will CM implement a change to configuration units under their control without having one of the problem reporting vehicles, authorization for change activity, and the Engineering Change Request/Notice forms on file.

The change control process requires six phases; initiation, analysis, change development, change review, change implementation, and change testing. During the initiation phase the problem or change is identified and the tracking of the repair or modification begins. During analysis, the possible courses of action are identified, including the cost in manhours, and the best path is recommended to program management. After program management review and approval of a particular course of action, change development within the engineering discipline occurs, followed quickly by change review at the GHG internal CCB level. If the proposed change package is approved it is implemented and the tracking of the reason for change and the change tracking vehicles themselves are closed out. Figure 10.2.1-1, Change Management Process Overview depicts the change process at a high level.

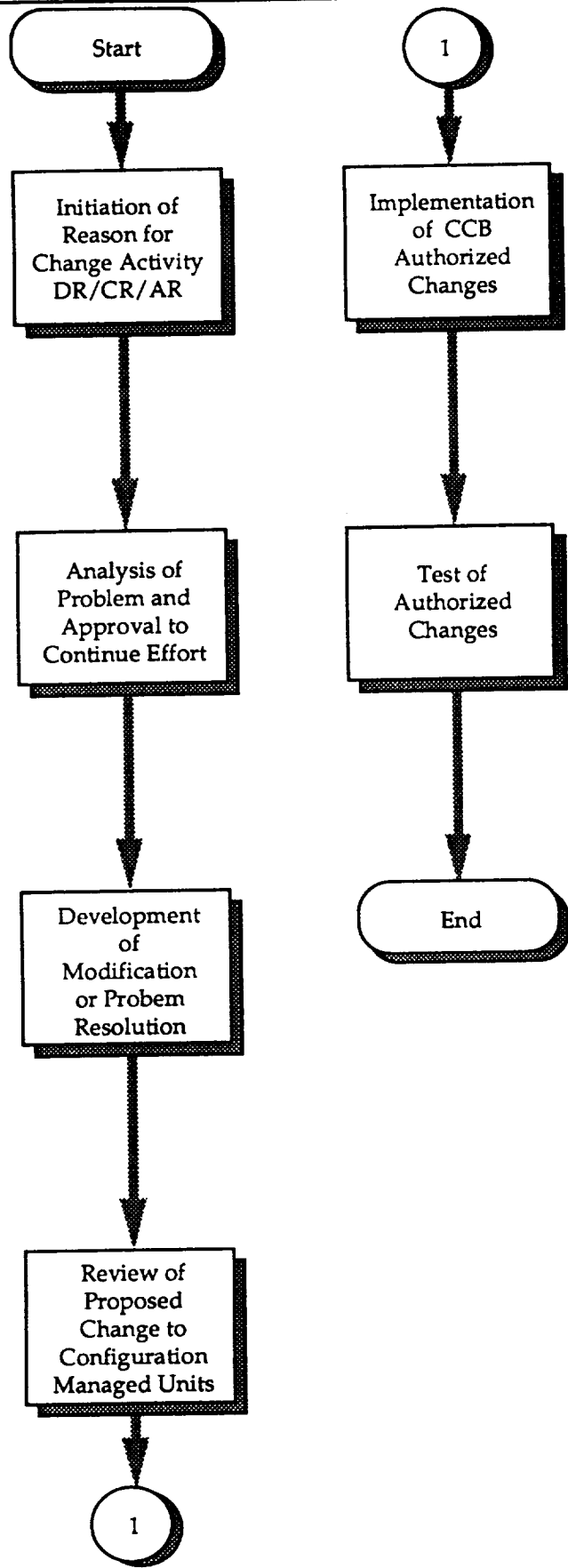


Figure 10.2.1-1 Change Management Process Overview

10.2.2 Initiation

Discrepancy Reports, Change Requests, Review Item Discrepancies share common data. This common data, describing the reason for a change, is entered on the Problem Report form. Refer to Figure 10.2.2-1, Problem Report Form. At the time of initiation, the following data, supplied by the originator, is required:

- a) Problem type, either DR, CR, or RID
- b) The DR, CR, or RID identification number
- c) A short title for the report
- d) The date the reason for change was discovered
- e) A description of the reason for change
- f) The name of the originator, phone number, and the company or agency, for whom they work

The partially completed form is forwarded to GHG configuration management personnel who assign the report a unique Change Activity Number (CAN), enter the data into the tracking data base, initiate the Problem Analysis (PA) form with the problem number and CAN, and forward the package to the program manager for review.

Assuming that changes are required, the program manager next assigns the work package a priority, an analyst or mid-level engineer, and a due date for the analysis of the problem. The package is forwarded to the analyst and program management informs CM of the priority, analyst, and due date. CM personnel add this data the tracking data base for change package tracking reports. Figure 10.2.2-2, Change Initiation and Analysis, provides a detailed picture of the initiation and analysis phases.

10.2.3 Analysis

During the analysis phase, the analyst determines what the cause of the discrepancy is, which units under CM control will require modification, how long the modifications will take, alternate solutions, if any, and the best course of action in his judgement. This data is entered on the Problem Analysis form and the package is then handed off to CM for data collection. CM then forwards the package to the program manager for analysis review. Refer to Figure 10.2.3-1, Problem Analysis Form.

If the program manager agrees with the analysis of the problem and the proposed changes, the analysis review portion of the PA form is completed and the package is returned to CM. At this point, the change development phase is started.

Problem Report

Type DR CR AR RID CAN _____

Report No. _____ Can Date _____

Priority _____

Short Title _____

Date Discovered _____ Description _____

Originator _____ Date _____

Agency _____ Telephone No. (____) _____

Corrective Action _____

Pgm Manager _____ Date Submitted _____

Retest Results _____

Disposition Pass Fail Withdrawn Hold

Comments _____

Originator _____ Date _____

Figure 10.2.2-1

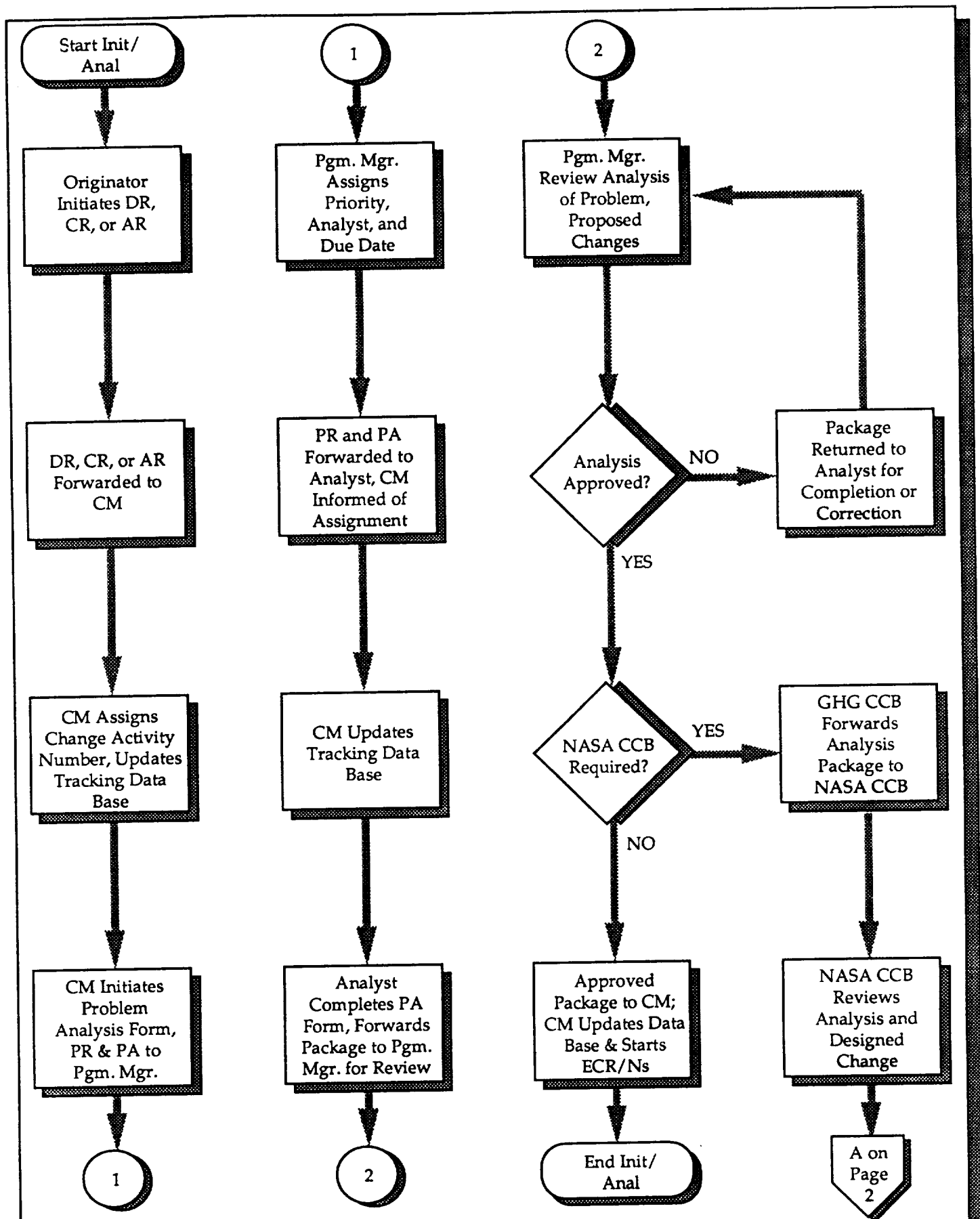


Figure 10.2.2-2 Change Initiation and Analysis

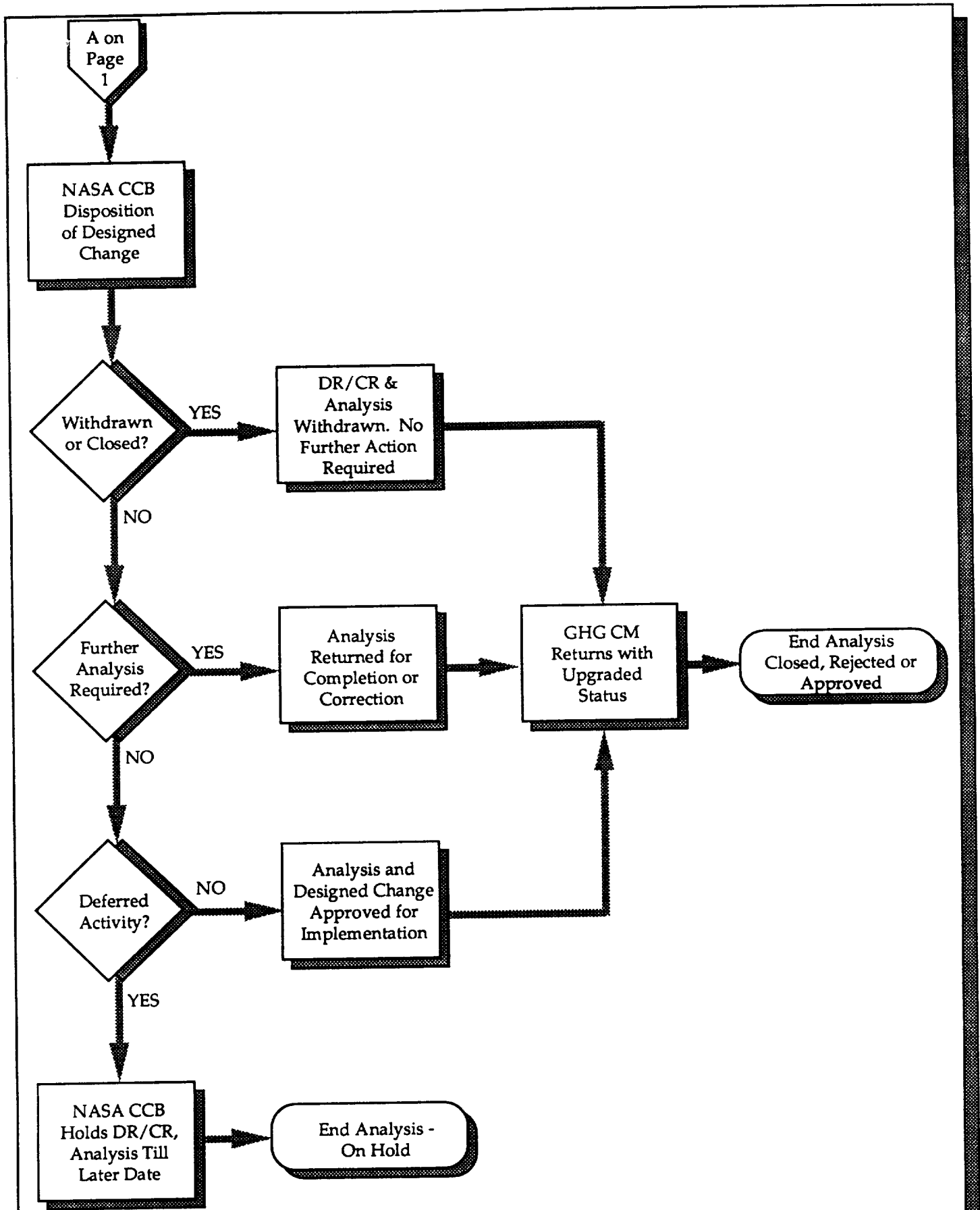


Figure 10.2.2-2 Change Initiation and Analysis (Continued)

Problem Analysis

Problem No. _____ CAN _____

Problem Analysis _____

Units Affected: (Include Revision Level)

S/W _____

Specifications _____

H/W _____

Drawing No. _____ Dash No. _____

_____ Dash No. _____

Estimated Repair Time _____ MHRS

Alternate Solutions _____

Recommended Course Of Action _____

Analyst _____ Date _____

Analysis Review

Program Manager _____ Date _____

Approval Rejection Comments _____

Figure 10.2.3-1

10.2.4 Change Development

When CM receives the work package from program management, Engineering Change Request/Notices (ECR/Ns) are started for each of the units identified on the PA form. Refer to Figure 10.2.4-1, Engineering Change Request/Notice. Figure 10.2.4-2, Change Development, provides a detailed picture of the change development process. CM enters the following data for each ECR/N into the tracking data base:

- a) The problem identification number, and CAN from the Problem Report form
- b) A unique ECR/N number and the date the ECR/N was assigned
- c) The unit part number and the current revision or dash level
- d) The call name or title of the unit or specification
- e) The next higher assembly for the unit and the system the unit is part of

At this point, CM searches the tracking data base to determine if any of the units requested for change are already under modification. If there is a conflict between the requested units, CM makes the data available to program management. Program management determines which package has the higher priority or the greater need for completion and informs CM. CM then either makes the unit available to the requesting engineer for change activity or places the ECR/N in a holding stack pending completion of the ECR/N currently in work. Copies of those units that are available for change are, with the change package, are forwarded to engineering. When the changes to the units in work are implemented, CM frees the current version and again, makes copies available to the engineer.

At no time will CM issue the master, controlled copy, for modification. CM will not issue copies of units that are under modification to other engineers. This policy precludes multiple changes to the same unit under one ECR/N and serves to protect the engineer from wasting time and effort in modifying what will not be the most current version of the unit.

Engineering then develops the modifications necessary to satisfy the problem or request for change. Information related to the changes are entered on the ECR/Ns as follows:

- a) Any related changes that are required to ensure proper implementation of the change. This would include such items as updates to the symbol dictionary prior to the update and compilation of the software unit

Engineering Change Request/Notice

Problem No. _____ CAN _____
ECR/N No. _____ Date _____

Unit Part No. _____ Rev/Dash No. _____
Call Name/Title _____
Specification _____
Next Higher Ass'y _____ System _____

Related Changes

Symb. Dict. Constants Other

Description of Change _____

Engineer _____ Date _____

Review/Approval/Implementation

Temp Loaded By _____ Date _____
QA _____ Date _____
CCB _____ Date _____
Perm Loaded By _____ Date _____
Master Loaded By _____ Date _____
Closed By _____ Date _____

Figure 10.2.4-1

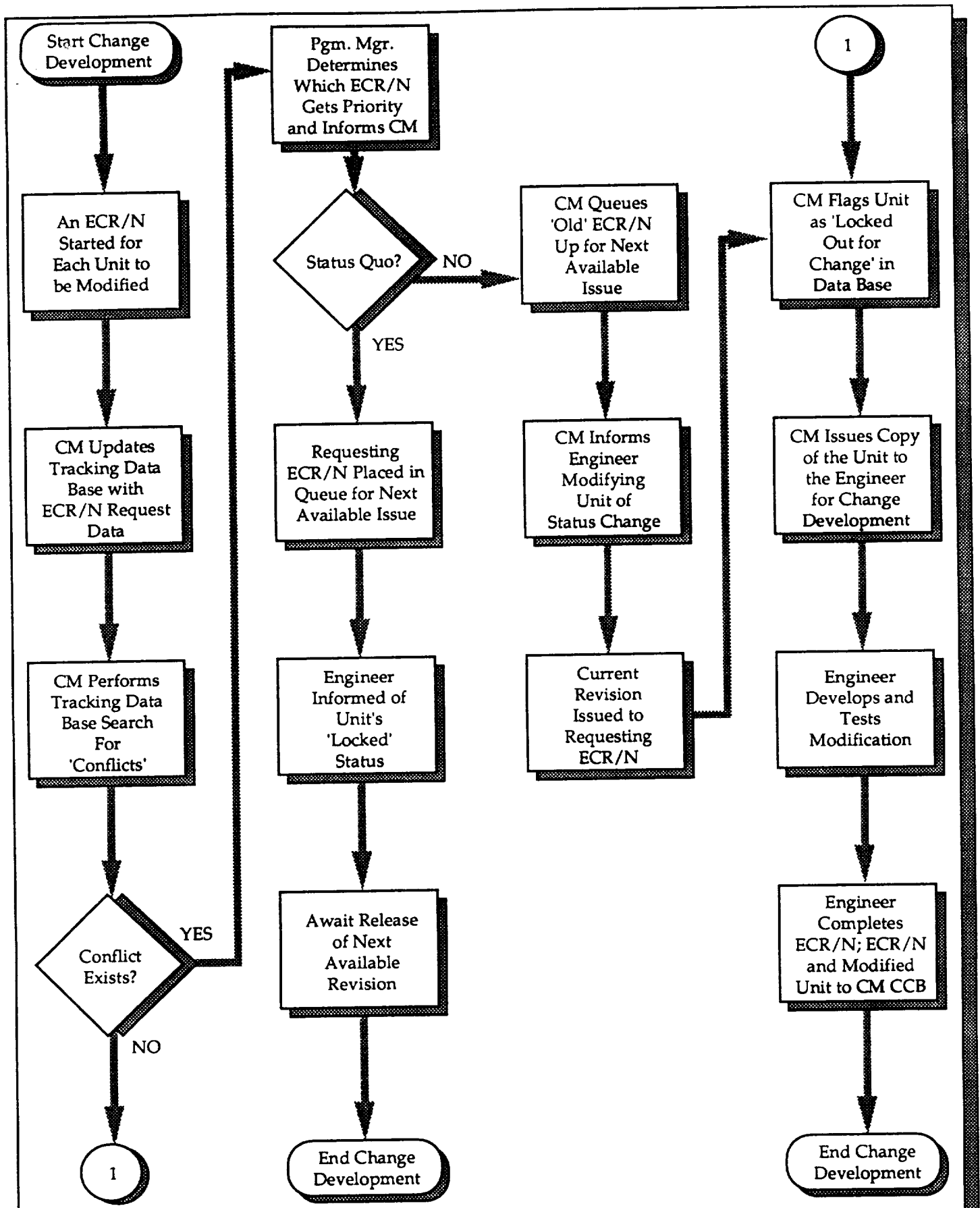


Figure 10.2.4.2-2 Change Development

- b) A brief description of the change, the engineer's signature, and the date the change was temporarily loaded into a test environment

Assuming GHG internal engineering testing of the modifications discloses no new problems and that the problem or request for change was satisfied, the engineer next completes a brief description of the entire change package on the Problem Report form and forwards the entire package, with the modified units, to CM for change review.

10.2.5 Change Review

Upon receipt of the change package, CM logs the package in for internal CCB review and notifies the members of the CCB that the package is available for inspection. The CCB members perform their inspections of the proposed change prior to the convening of the formal CCB. Figure 10.2.5-1, Change Review and Implementation, depicts the process for the review, approval or disapproval, and subsequent implementation of proposed changes to controlled software and documentation.

At the time and place determined by CM, the CCB convenes and dispositions all packages scheduled. Their approval or disapproval with comments, of the package is noted in the minutes of the CCB. If the package is approved, the ECR/N forms are updated and CM updates the tracking data base with the new data.

If any part of the package is disapproved the entire package is returned to engineering for repair and engineering development begins again. The policy of implementing only entire packages serves to preclude the implementation and test of partial changes, and reduces the possibility of GHG generating a bad product together with the resulting cost of unnecessary repairs. If the package requires CCB review at the next higher level above GHG, CM forwards it and makes the appropriate updates to the data base to schedule the package for review at that level. Assuming CCB approval, the package is ready for implementation.

10.2.6 Change Implementation

With approval for incorporation of modifications, CM forwards the ECR/Ns and changes to the appropriate agency for implementation. As the changes are incorporated, CM is notified and the newly updated unit is placed under CM control. Upon completion of this step, the ECR/Ns are closed out and a copy of the change package, including the Problem Report, Problem Analysis, the ECR/Ns, and the newly modified system or hardware is forwarded to the originator for retest.

10.2.7 Change Testing

Upon receipt of the change package, the originator tests the modified units in accordance with established acceptance test procedures. Assuming no new problems

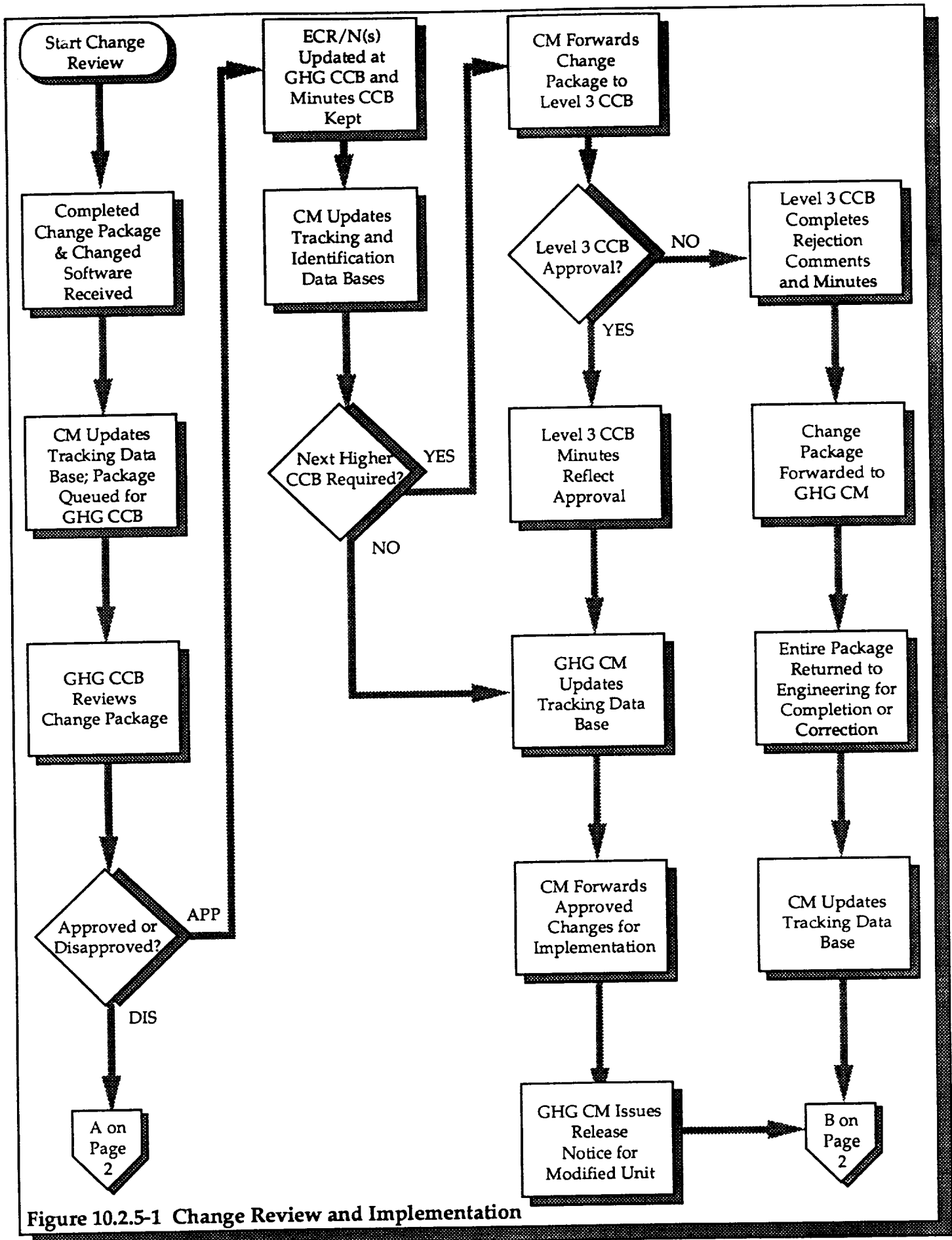


Figure 10.2.5-1 Change Review and Implementation

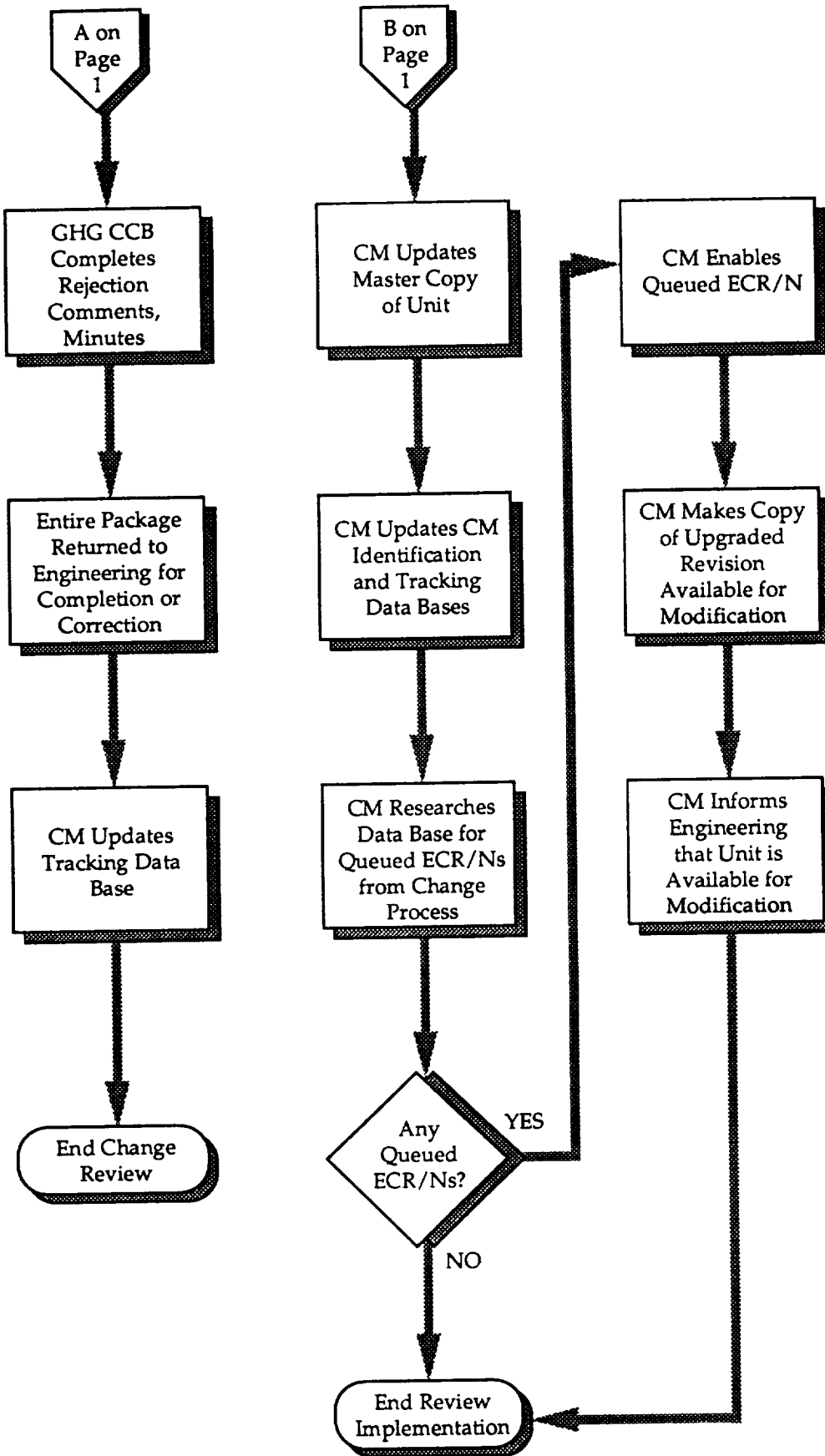


Figure 10.2.5-1 Change Review and Implementation (Continued)

were introduced and the package satisfies requirements, the originator completes the Disposition section of the problem report and returns it to CM. CM then updates the data base showing the completed status of the package and informs program management that the process is complete.

10.2.8 Summary

Part of Configuration Management's task is to provide management the visibility into change development. Placing CM at the focal point for all transactions regarding the identification and tracking of problems, the authorization for further efforts from engineering and the issuance of controlled copies of the units for modification and subsequent review and test, ensures that the data is made available because the status of any change is known by CM at all times.

20.0 APPENDIX II

20.1 DOCUMENTATION IDENTIFICATION SCHEMA FOR GHG-DEVELOPED DOCUMENTATION

PROG - DOC - SEQ - REV. __ CHG. __

| | | | |

| | | | | Change Level (2 char., numeric)

| | | | |

| | | | | Revision Level (2 char., alphabetic)

| | | | |

| | | | | Sequence Number (6 char., numeric, CM-assigned)

| | | | |

| | | | | Document Type (6 char., alphabetic, from list below)

|

Program Title (6 char., alpha-numeric, may be abbreviation)

ABBREVIATION	DOCUMENT & TYPE
1. ATP	Acceptance Test Plan
2. CIDR	Configuration Item Development Record
3. CIDS	Critical Item Development Specification
4. CCP	Contract Proposal or Contract Change Proposal
5. CMAR	Configuration Management Accounting Report
6. CMP	Configuration Management Plan
7. CRISD	Computer Resources Integrated Support Document
8. CSAR	Configuration Status Accounting Report
9. CSOM	Computer System Operator's Manual
10. DEV	Request for Deviation
11. DMP	Data Management Plan
12. ECP	Engineering Change Proposal
13. FSM	Firmware Support Manual
14. ICD	Interface Control Document
15. IDD	Interface Design Document
16. IRS	Interface Requirements Specification
17. ISD	Integrated Support Document
18. PID	Prime Item Development Specification
19. PMP	Program Management Plan
20. RFP	Request for Proposal
21. SCN	Specification Change Notice
22. SDD	Software Design Document

DOCUMENTATION IDENTIFICATION SCHEMA FOR GHG-DEVELOPED DOCUMENTATION (CONTINUED)

PROG - DOC - SEQ - REV. __ CHG. __
 | | | | |
 | | | | | Change Level (2 char., numeric)
 | | | | | Revision Level (2 char., alphabetic)
 | | | | | Sequence Number (6 char., numeric, CM-assigned)
 | | | | | Document Type (6 char., alphabetic, from list below)
 | | | | | Program Title (6 char., alpha-numeric, may be abbreviation)

ABBREVIATION	DOCUMENT & TYPE
23. SDDD	Software Detailed Design Document
24. SDP	Software Development Plan
25. SEM	System Engineering Management Plan
26. SPM	Software Programmer's Manual
27. SPS	Software Product Specification
28. SQA	Software Quality Assurance Plan
29. SRS	Software Requirements Specification
30. SSDD	System / Segment Design Document
31. SSS	System / Segment Specification
32. STD	Software Test Description
33. STLD	Software Top Level Design Document
34. STP	Software Test Plan
35. STPR	Software Test Procedure
36. STR	Software Test Report
37. SUM	Software User's Manual
38. VDD	Version Description Document
39. WAV	Request for Waiver

