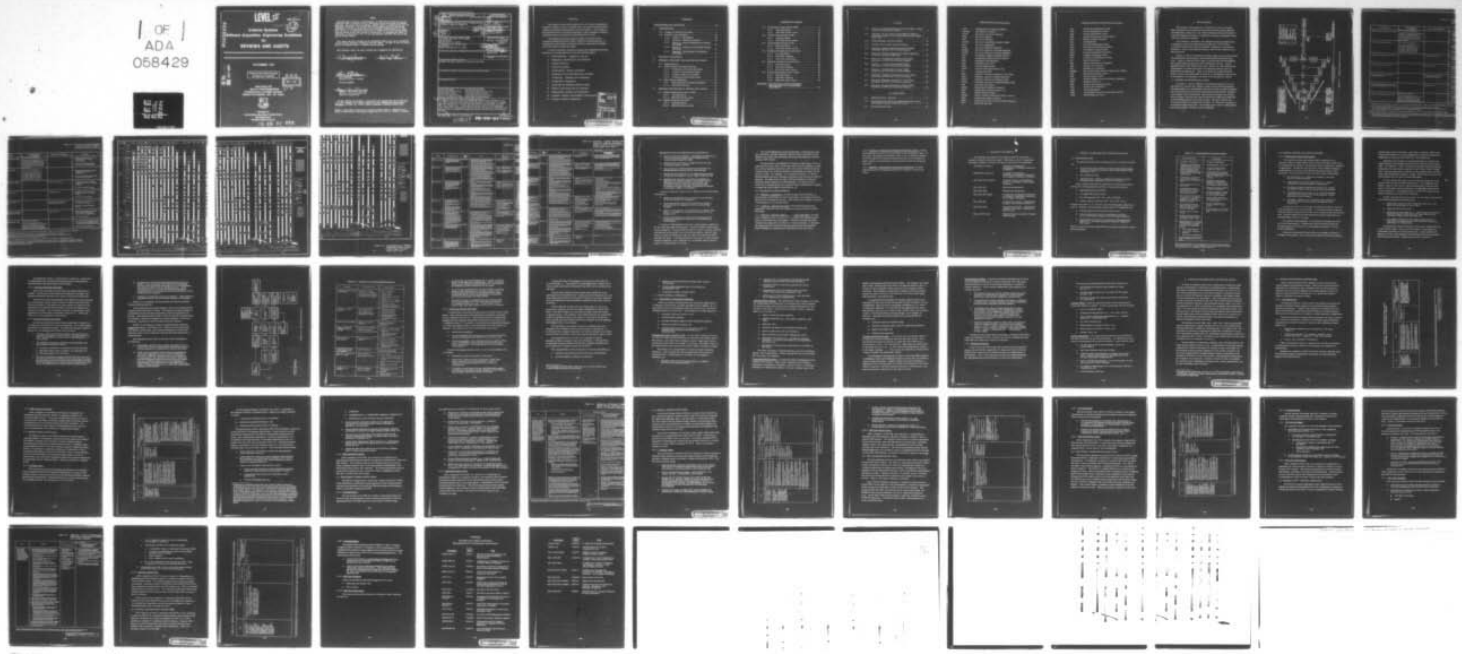
AD-A058 429 TRW DEFENSE AND SPACE SYSTEMS GROUP REDONDO BEACH CALIF F/G 5/1
AIRBORNE SYSTEMS SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK FOR--ETC(U)
NOV 77 T RODRICK, T KAMPE F33657-76-C-0677
UNCLASSIFIED TRW-30323-6006-TU-00 ASD-TR-78-7 NL

OF
ADA
058429



END
DATE
FILMED
11 78
DDC

LEVEL III

ASD TR-78-7

AD58429

12

Airborne Systems Software Acquisition Engineering Guidebook for REVIEWS AND AUDITS

NOVEMBER 1977

PREPARED FOR
DEPUTY FOR ENGINEERING
AERONAUTICAL SYSTEMS DIVISION
WRIGHT-PATTERSON AFB, OH 45433

PREPARED BY
TRW DEFENSE AND SPACE SYSTEMS GROUP
ONE SPACE PARK
REDONDO BEACH, CA 90278

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

C. Paul Johnson
C. PAUL JOHNSON ASD/ENAIA

E. C. Gangl
ERWIN C. GANGL ASD/ENAI

Louis J. Urban
LOUIS J. URBAN
Technical Director, ASD/ENA

FOR THE COMMANDER

George L. Von Tersch
GEORGE L. VON TERSCH, COL, USAF
Director, Avionics Engineering
Deputy for Engineering

"If your address has changed, if you wish to be removed from our mailing list, or if the addressee is no longer employed by your organization please notify ASD/ENAIA, W-PAFB, OH 45433 to help us maintain a current mailing list".

Copies of this report should not be returned unless return is required by security considerations, contractual obligations, or notice on a specific document.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: ASD-TR-78-7	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): AIRBORNE SYSTEMS SOFTWARE ACQUISITION ENGINEERING GUIDEBOOK FOR REVIEWS AND AUDITS	5. TYPE OF REPORT & PERIOD COVERED: FINAL rept.,
6. PERFORMING ORG. REPORT NUMBER: 30323-6006-TU-00	
7. AUTHOR(s): T. RODRICK, T. RAMPE	8. CONTRACT OR GRANT NUMBER(s): F33657-76-C-0677
9. PERFORMING ORGANIZATION NAME AND ADDRESS: TRW DEFENSE AND SPACE SYSTEMS GROUP, ONE SPACE PARK, REDONDO BEACH, CA 90278	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: PE64740F PROJECT 2238
11. CONTROLLING OFFICE NAME AND ADDRESS: HQ ASD/ENAI, WRIGHT-PATTERSON AFB, OH 45433	12. REPORT DATE: NOV 1977
	13. NUMBER OF PAGES: 172
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
APPROVED FOR PUBLIC RELEASE, DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Reviews and Audits	Critical Design Review
System Requirements Review	Preliminary Qualification Tests
System Design Review	Formal Qualification Tests
Preliminary Design Review	Functional Configuration Audit
Physical Configuration Audit	Formal Qualification Review

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report is one of a series of guidebooks which provide guidance for ASD and SAMSO Program Office and engineering personnel in the acquisition management and engineering of Airborne Systems software procured under Air Force 800 series regulations. It provides information that will help personnel plan, prepare for, and conduct technical reviews and audits in connection with the acquisition of Computer Program Configuration Items (CPCIs) for Airborne Systems.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

409637

78 09 01 018

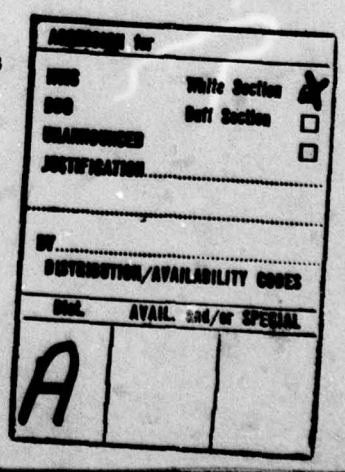
PREFACE

This report on reviews and audits is one in a series of guidebooks intended to assist Air Force Program Office and engineering personnel in software acquisition engineering for airborne systems. The contents of the guidebooks will be revised periodically to reflect changes in software acquisition policies and practices and feedback from users.

This guidebook has been prepared under the direction of the Aeronautical Systems Division (ASD), Deputy for Engineering (EN), in coordination with the Space and Missile Systems Organization (SAMSO), Air Force Systems Command (AFSC).

A series of Software Acquisition Engineering Guidebooks (Airborne Systems) is currently planned to cover the following topics:

1. SAE Guidebooks - Application and Use
2. Regulations, Specifications, and Standards
3. Quality Assurance
4. Reviews and Audits
5. Contracting for Software Acquisition
6. Statements of Work and Requests for Proposal
7. Verification, Validation and Certification
8. Configuration Management
9. Measuring and Reporting Software Status
10. Software Cost Measuring and Reporting
11. Requirements Analysis and Specification
12. Computer Program Documentation Requirements
13. Computer Program Maintenance



CONTENTS

CONTENTS (Concluded)

TABLES

ILLUSTRATIONS

ABREVIATIONS AND ACRONYMS

ACO	Administrative Contracting Officer
ADCOM	Air Defense Command
AFLC	Air Force Logistics Command
AFM	Air Force Manual
AFP	Air Force Pamphlet
AFPRO	Air Force Plant Representative Office
AFR	Air Force Regulation
AFSC	Air Force Systems Command
AFSCP	Air Force Systems Command Pamphlet
AFSCR	Air Force Systems Command Regulation
ALD	Acquisition Logistics Division (AFLC)
ASD	Aeronautical System Division (AFSC)
ATE	Automatic Test Equipment
C&C	Command and Control
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CI	Configuration Item
CPC	Computer Program Component (of a CPCI)
CPCI	Computer Program Configuration Item
CPDP	Computer Program Development Plan
CRISP	Computer Resources Integrated Support Plan
DID	Data Item Description
DODD	Department of Defense Directive
DODI	Department of Defense Instruction
DPR	Design Problem Report
DSARC	Defense Systems Acquisition Review Council
ECP	Engineering Change Proposal
ESDR	Electronic Systems Division (AFSC) Regulation
EW	Electronic Warfare

ABREVIATIONS AND ACRONYMS (Concluded)

FCA	Functional Configuration Audit
FQR	Formal Qualification Review
FQT	Formal Qualification Tests
IRB	(Contractor) Internal Review Board
MAC	Military Airlift Command
N/A	Not Applicable
PCA	Physical Configuration Audit
PCO	Procurement Contracting Officer
PDR	Preliminary Design Review
PMD	Program Management Directive
PMP	Program Management Plan
PQT	Preliminary Qualification Tests
QA	Quality Assurance
ROC	Required Operational Capability
RFP	Request For Proposal
SAC	Strategic Air Command
SAMSO	Space And Missile Systems Organization (AFSC)
SCN	Specification Change Notice
SDR	System Design Review
SETA	Systems Engineering and Technical Assistance
SOW	Statement Of Work
SRR	Systems Requirements Review
TAC	Tactical Air Command
TBD	To Be Determined
TRR	Test Readiness Review (Contractor Internal)
USAF	United States Air Force

1. INTRODUCTION

The purpose of this guidebook is to provide Air Force Program Office engineering and management personnel with information that will help them plan, prepare for, and conduct technical reviews and audits in connection with the acquisition of Computer Program Configuration Items (CPCI's) for airborne systems.

The guidelines, checklists, and references in this guidebook serve to supplement the formal requirements in MIL-STD-1521A (USAF), "Technical Reviews and Audits for Systems, Equipment, and Computer Programs," and are directed specifically to reviews and audits for computer programs.

Figure 1-1 shows an idealized life cycle model of an airborne system and indicates the relationship of reviews and audits to the system life cycle. Table 1-1 lists the major types of reviews and audits and depicts their relationship to steps in the CPCI acquisition process. A more detailed picture of the software life cycle, Figure 1-2, also indicates the relationships of reviews and audits to the life cycle phases and to an example documentation set. Table 1-2 presents in greater detail the formal reviews and audits listed in Table 1-1, with summary information on the purpose, prerequisites, and items to be reviewed or audited.

1.1 PURPOSE OF REVIEWS AND AUDITS

As Tables 1-1 and 1-2 indicate, the purpose of technical reviews and audits is to monitor the orderly evolution of the CPCI's through the sequential steps in the development process by means of positive definition and control of documents and code (performance requirements, interface requirements, test requirements, test definition, design requirements, design solution, code and test results) reviewed at benchmark points and corresponding baselines during the process. The major features of reviews and audits are summarized in Table 1-2, which also serves as a convenient checklist and guide. More detail on the conduct of the reviews and audits is given in Section 4 of this guidebook.

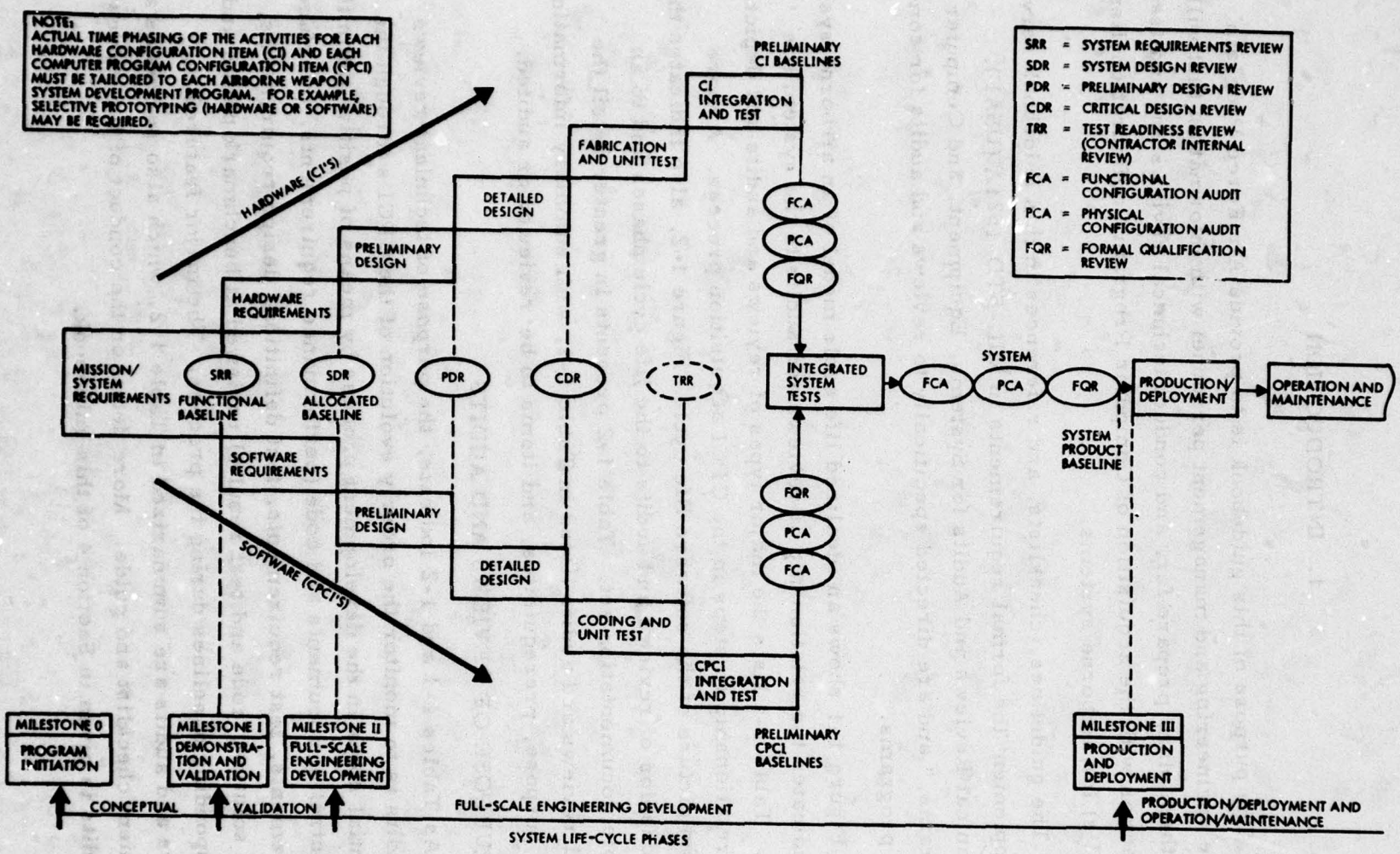


Figure 1-1. Idealized System Life Cycle

Table 1-1. Over
of Re
the C

Review/Audit *	Formal Baseline * * Established	Intermediate Milestones	
System Requirements Review (SRR)	FUNCTIONAL BASELINE The system/subsystem "functional baseline" is established by an acceptable SRR and formal customer approval (authentication) of the System/System Segment Specification.		• Adequ requi requi • Proce alloca
System Design Review (SDR)	ALLOCATED BASELINE The "allocated baseline" for a CPCI is established by an acceptable SDR and formal customer approval (authentication) of the CPCI Part I Development Specification.		• Adequ requir requir • Proce design
Preliminary Design Review (PDR)		Preliminary Design	• Adequ requir appro • Proce
Critical Design Review (CDR)**		Detailed Design	• Adequ requir design • Proce
Test Readiness Review (TRR)**** (Informal Review)		CPCI Code Under Internal Configuration Control	• Satisfa develo • Proce testing
Functional Configuration Audit (FCA) Formal Qualification Review (FQR)		Qualified CPCI	• CPCI q test me Specifi • Proce
Physical Configuration Audit (PCA)	PRODUCT BASELINE The "product baseline" for a CPCI is established by an acceptable PCA and formal customer approval (authentication) of the CPCI Part II Product Specification.		• "As bu its tech configu • CPCI A

* The purpose, prerequisites, and items to be reviewed are summarized in Table 1-2 and discussed in detail in Section 4.

** The two elements that distinguish "Formal Baselines" from "Intermediate Milestones" are that
(1) formal baselines involve formal customer approval of configuration documentation (specifications), and
(2) approved specifications are put under formal configuration control.

*** For complex CPCI's, or if top-down development is followed, a series of "incremental" CDR's should be held.

**** Test Readiness Review (TRR): Internal review by CPCI development contractor (customer attendance optional) to establi preparedness (adequate test procedures, availability of tools, facilities and personnel, adequate CPCI configuration contr etc.) to commence qualification/acceptance testing.

Table 1-1. Overview of the Relationship of Reviews/Audits to Steps in the CPCI Acquisition Process

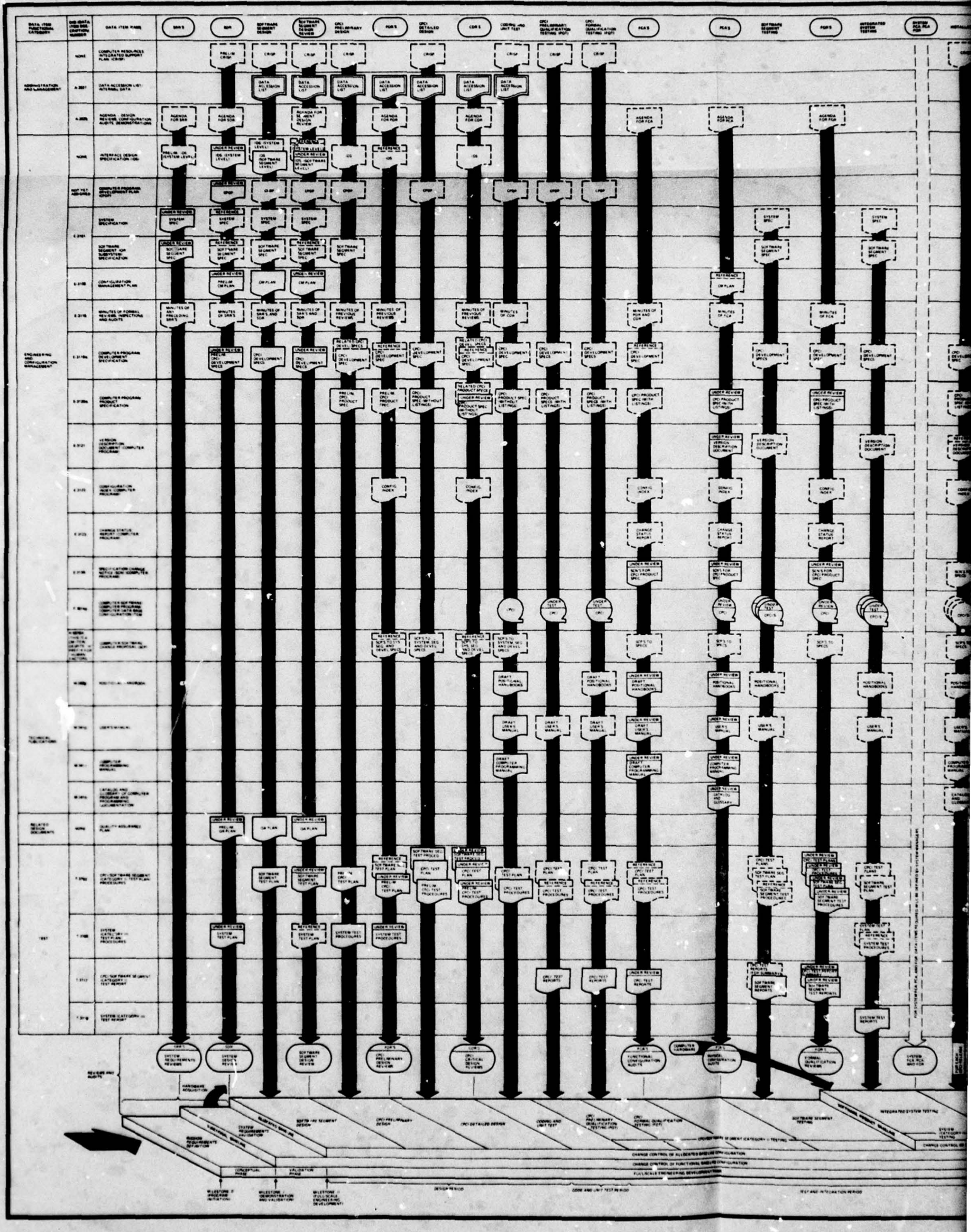
/Audit *	Formal Baseline * * Established	Intermediate Milestones	Comment
nts Review (SRR)	FUNCTIONAL BASELINE The system/subsystem "functional baseline" is established by an acceptable SRR and formal customer approval (authentication) of the System/System Segment Specification.		• Adequate allocation of mission requirements to system requirements • Proceed with requirements allocation to CI's and CPCI's
view (SDR)	*ALLOCATED BASELINE* The "allocated baseline" for a CPCI is established by an acceptable SDR and formal customer approval (authentication) of the CPCI Part I Development Specification.		• Adequate allocation of system requirements to CPCI requirements • Proceed with CPCI preliminary design (design analysis)
gn Review (PDR)		Preliminary Design	• Adequate allocation of CPCI requirements to a basic design approach • Proceed to detailed design
Review (CDR)**		Detailed Design	• Adequate allocation of CPCI requirements to a detailed design • Proceed to code and test
Review (TRR)****)		CPCI Code Under Internal Configuration Control	• Satisfactory completion of development testing • Proceed with qualification testing
guration Audit (FCA) tion Review (FQR)		Qualified CPCI	• CPCI qualification/acceptance test meets Development Specification requirements • Proceed with PCA
ration Audit (PCA)	PRODUCT BASELINE The "product baseline" for a CPCI is established by an acceptable PCA and formal customer approval (authentication) of the CPCI Part II Product Specification.		• "As built" CPCI compatible with its technical documentation and configuration management records • CPCI Acceptance/Delivery

rerequisites, and items to be reviewed are summarized in Table 1-2 and discussed in detail in Section 4.

ts that distinguish "Formal Baselines" from "Intermediate Milestones" are that
lines involve formal customer approval of configuration documentation (specifications), and
ecifications are put under formal configuration control.

PCI's, or if top-down development is followed, a series of "incremental" CDR's should be held.

Review (TRR): Internal review by CPCI development contractor (customer attendance optional) to establish
dequate test procedures, availability of tools, facilities and personnel, adequate CPCI configuration control,
nce qualification/acceptance testing.



DOCUMENTATION FOR SOFTWARE ACQUISITION

THIS CHART SHOWS THE DEVELOPMENT AND LIFE CYCLE USAGE OF A BASIC DOCUMENTATION SET FOR SOFTWARE ACQUISITION. THE DOCUMENTATION SET MAY BE USED AS THE STARTING POINT FOR SOFTWARE DOCUMENTATION PLANNING. WITH THE NUMBER OF DATA ITEMS BY ONE INCREASED OR REDUCED ACCORDING TO THE SIZE AND NATURE OF THE PROGRAM. IN ADDITION, TAILORING OF THE STANDARD DATA ITEM FORMATS TO THE SPECIFIC NEEDS OF EACH PROGRAM IS ESSENTIAL FOR MAXIMUM EFFECTIVENESS. FOR THE DATA ITEMS THAT HAVE A DID NUMBER ASSOCIATED WITH THEM IN THIS CHART, THE DATA ITEM DESCRIPTIONS ARE AVAILABLE TO GOVERNMENT OR PRIVATE USERS FROM THE NAVAL PUBLICATIONS AND FORMS CENTER (NPFC) IN PHILADELPHIA, PA. COMPLETE INSTRUCTIONS FOR ORDERING DIDs ARE GIVEN IN PART V OF THE DEPARTMENT OF DEFENSE DOCUMENT DOD 5000.19-L, VOLUME II, ENTITLED ACQUISITION MANAGEMENT SYSTEMS AND DATA REQUIREMENTS CONTROL LIST (AMSDL). THE AMSDL ALSO LISTS ABOUT A THOUSAND STANDARD DIDs, BUT ONLY A SMALL NUMBER ARE APPLICABLE TO SOFTWARE ACQUISITION.

LEGEND

- MAJOR DOCUMENT PRODUCT OF AN ACTIVITY
- MAJOR DOCUMENT PRODUCT UNDER REVIEW
- MAJOR REFERENCE DOCUMENT IN REVIEW OF OTHER DOCUMENTS, OR AS A BASIS FOR DESIGN OR IMPLEMENTATION
- SUPPORTING DOCUMENT FOR ACTIVITY UNDER TEST
- DOCUMENT PROVIDING VISIBILITY INTO DESIGN BASELINE OR DEVELOPMENT PROGRESS

DOCUMENTATION

ALL CDRL DOCUMENTS ARE ASSUMED TO BE AVAILABLE AS REFERENCES AFTER THEY ARE PUBLISHED, EXCEPT AS SHOWN ON THIS CHART.

- MAJOR SOFTWARE PRODUCT OF AN ACTIVITY
- MAJOR SOFTWARE PRODUCTS UNDER TEST OR UNDER REVIEW
- SOFTWARE PRODUCT BEING MODELLED OR OPERATED

SOFTWARE

ACRONYMS

CDR	CRITICAL DESIGN REVIEW
CM	CONFIGURATION MANAGEMENT
CPC	COMPUTER PROGRAM CONFIGURATION ITEM
CPDP	COMPUTER PROGRAM DEVELOPMENT PLAN
CRISP	COMPUTER RESOURCES INTEGRATED SUPPORT PLAN
FCA	FUNCTIONAL CONFIGURATION AUDIT
FQR	FORMAL QUALIFICATION REVIEW
IDS	INTERFACE DESIGN SPECIFICATION
PCA	PHYSICAL CONFIGURATION AUDIT
PDR	PRELIMINARY DESIGN REVIEW
QA	QUALITY ASSURANCE
SCN	SPECIFICATION CHANGE NOTICE
SCP	SOFTWARE CHANGE PROPOSAL
SDR	SYSTEM DESIGN REVIEW
SRR	SYSTEM REQUIREMENTS REVIEW

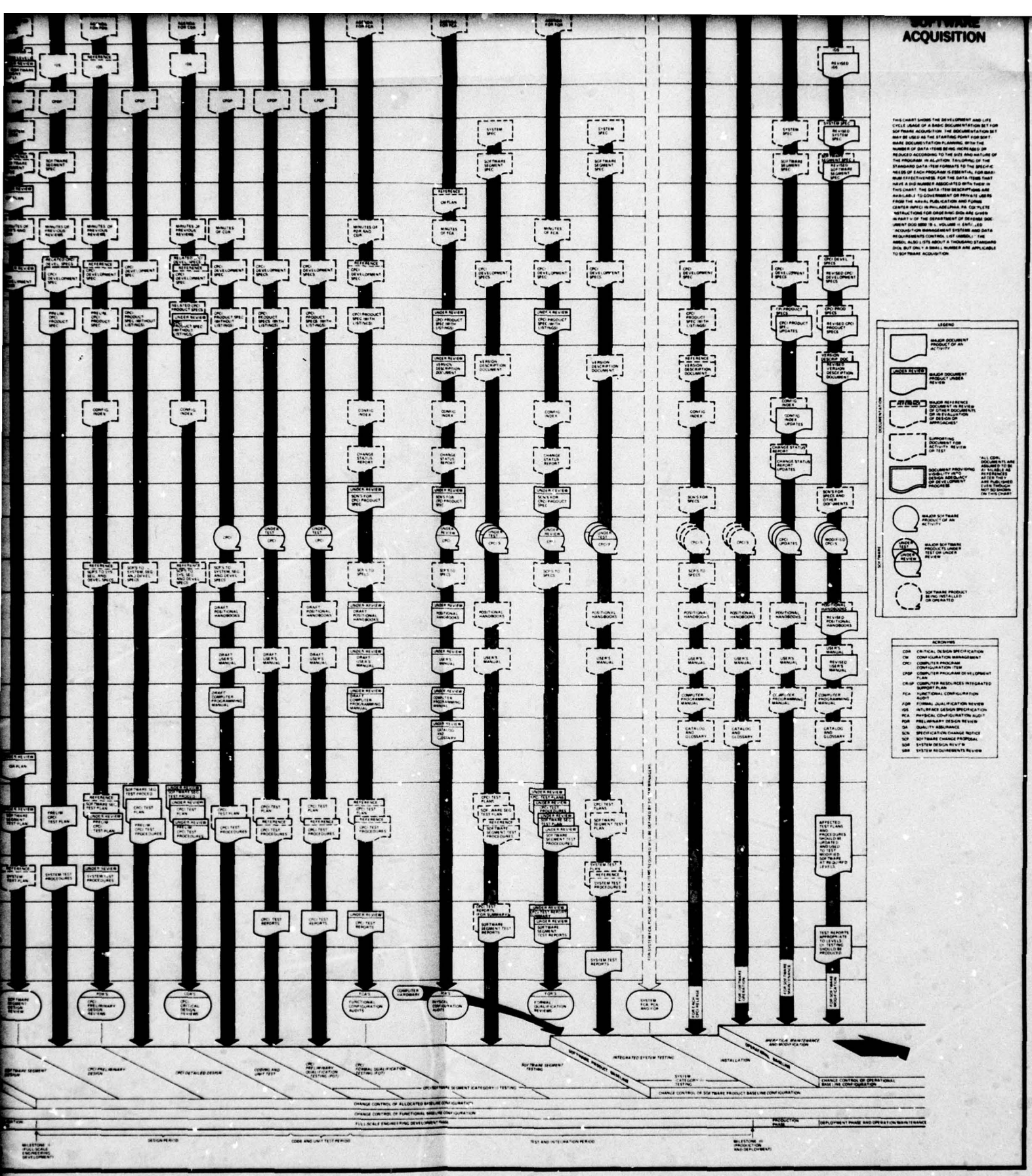


Figure 1-2. Documentation for Software Acquisition (larger version of this Figure in pouch inside back cover)

Table 1-2. Overv
Audit
(large
pouch

Review/Audit	When Review/Audit Is Conducted	Formal Baseline Established	Purpose	Items to b	
				Formal Documentation	
SRR (System Requirements Review)	• In-process reviews usually conducted at the end of the System Conceptual Phase and early in the System Validation Phase if the Conceptual Phase effort was performed in-house by the government.	Functional Baseline	• Establish System/System Segment requirements (System Functional Baseline) as a basis for the allocation of requirements to hardware Configuration Items (CI's) and Computer Program Configuration Items (CPCI's) in the System Validation Phase. • Evaluate the total systems engineering activity for responsiveness to the Statement of Work and the System/System Segment requirements. • Provide Procuring Activity direction as necessary, to the contractor for continuing the technical program and system optimization.	• System/System Segment Specification • Statement of Work	• Totality of requirement allocation, management
SDR (System Design Review)	• Final review prior to submittal of the Validation Phase products or as the initial review in the Full-Scale Development Phase for systems/subsystems not requiring a formal Validation Phase. • Availability of draft Part I Development Specifications, for all CPCI's, is a prerequisite for this review.	Allocated Baseline	• Evaluate the optimization, traceability, correlation, completeness and risk of the allocated functional requirements (Allocated Baseline), including the corresponding test requirements, in fulfilling the System/System Segment Specification requirements. • Ensure that the updated System/System Segment Specification is adequate and cost effective in satisfying validated mission requirements. • Ensure that a technical understanding of requirements and supporting systems engineering results has been attained, and Procuring Activity technical direction, as necessary, provided to the contractor. • Evaluate the contractors concept for development/support of the CPCI's for completeness, adequacy, and schedule/cost realism. • Upon approval of each CPCI Part I Development Specification, satisfaction of this review establishes the Allocated Baseline for individual CPCI's and provides the basis to proceed with preliminary design of the CPCI's.	• Updated System/System Segment Specification • Preliminary Part I Development Specification for each CPCI • Computer Program Development Plan (CPDP) • Computer Program Configuration Management Plan (may be a component of the CPDP)	• Additional mission/sys allocation, bility, risk costing, tra • Summary allocation t • Description
PDR (Preliminary Design Review)	• The PDR for each CPCI (may be grouped) is held early in the Full-Scale Development Phase (between SDR and CDR) when sufficient design analysis has been accomplished to arrive at a computer program architecture and overall modular structure which will provide the basis for detailed design. • Availability of an authenticated Part I Development Specification is a prerequisite for any CPCI to be PDR'd.	N/A	• Evaluate the basic design approach for completeness, adequacy, and compatibility with allocated requirements (Part I Development Specification). • Review all changes to the System/System Segment Specification and Part I Development Specification to ensure that they are properly incorporated in the basic design approach, the draft Part II Product Specification, and test planning. • Review all detailed functional interfaces and corresponding test requirements with hardware CI's and other CPCI's. • Review the CPCI interactions with Human Factor requirements. Review all man-machine interfaces for feasibility, adequacy, and completeness. • Review test planning documentation to ensure that the test program satisfies the test requirements specified in Section 4 of the System/System Segment Specification and Section 4 of the Part I Development Specification. • Review status of all negative and provisional entries such as "not applicable" (N/A) or "to be determined" (TBD) in Section 4 of the System/System Segment Specification and Part I Development Specification. Review all positive entries for technical adequacy.	• Updated System/System Segment Specification (if necessary). • Final Part I Development Specification for each CPCI. • Partial Part II Product Specification for each CPCI. • Preliminary Qualification (Acceptance) Test Plan for each CPCI. • Preliminary Data Base Document for each CPCI.	• Available s • CPCI fu • CPCI st • Sizing a • CPCI co • Overall • Data ba • Signific • Interfa • Identif to satis • Identifi and test • Descrip facilitie • Descrip are pla • Status
CDR (Critical Design Review)	• Conducted between PDR and FCA when detailed design is complete for the CPCI components (appropriate subset if incremental CDR's are scheduled). • Draft Part II Product Specification (excluding code listings) is available if single CDR for total CPCI. • Appropriate portions of Part II Product Specification is available if review is scheduled as an incremental CDR. In this case complete draft Part II Product Specification (excluding code listings) available at final CDR.	N/A	• Review/evaluation of the detailed design of the CPCI (selected components if incremental CDR) for adequacy and completeness. • Formal identification of specific computer programming ("build to") documentation which will be released for coding and testing. • Approval of Qualification (acceptance) Test Plan provides a controlled definition of the project's acceptance test program. • Review/evaluate plans for supporting and maintaining the CPCI including all necessary hardware, support software, and documentation.	• Part I Development Specification including all approved ECP's. • Preliminary Part II Product Specification (excluding code listings). If an incremental CDR, only components under review would be included. • Final Qualification (Acceptance) Test Plan • Updated Data Base Document • Preliminary Computer Programming Manual • Preliminary Operator's (User's) Manual • PDR Minutes	• Updated s analyses, scientific/a • Applicable (ECP'S) to • Design Pro • Status of s • Planning u • Developm
FCA (Functional Configuration Audit)	• Conducted after CDR and prior to PCA when sufficient qualification/acceptance testing has been performed to verify all of the Part I Development Specification requirements. • May be conducted on a progressive (incremental) basis if so designated by the Procuring Activity. • For situations where CPCI qualification can only be determined through integrated systems testing, FCA's for such CPCI's will not be considered complete until completion/audit of such testing. This normally requires a separate FQR post-PCA. • Authentication by the Procuring Activity of the Functional and/or Allocated Baselines is a prerequisite to FCA.	N/A	• Verify that the CPCI actual (test) performance totally complies with the Part I Development Specification requirements. • Determine adequacy of analysis or simulation results where performance parameters cannot completely be verified by test. • Evaluate the contractor's proposed solutions for any requirements stated in the Part I Development Specification that could not be met. • Examine and evaluate all approved ECP's to ensure that they were incorporated and verified during qualification/acceptance testing. • Examine the Qualification/Acceptance Test Report to verify it is an accurate and complete description of the qualification/acceptance testing. • Examine PDR and CDR minutes to assure that all findings have been incorporated and completed.	• Authenticated System/System Segment Specification and Part I Development Specification. • Draft CPCI Part II Product Specification (complete). • CPCI Test Plans, Test Procedures, and Test Results. • PDR and CDR minutes.	• CPCI conf • Briefings t • Identifica during te satisfy th • A complet but not ye • Identifica contracto
PCA (Physical Configuration Audit)	• Conducted between PCA and FQR (when separate FQR is required) when all required audit data is available (nominally) 30 days after submittal of the draft Final Part II Product Specification to the Procuring Activity.	Product Baseline	• Formal examination of coded ("as built") version of the CPCI against its technical documentation and of the configuration management records pertinent to the CPCI to establish the CPCI Product Baseline. • Evaluate all CPCI configuration differences between FCA and PCA versions to ensure CPCI functional characteristics are not degraded. • Review FCA minutes to assure that all findings have been incorporated and completed. • Audit the contractor's engineering release and change control system to ensure that it is adequate to properly control the processing and formal release of engineering changes after CPCI acceptance/delivery. • Satisfactory completion of the PCA and formal approval by the Procuring Activity of the CPCI Part II Product Specification establishes the CPCI Product Baseline. • Accepted CPCI's are delivered in accordance with contract requirements.	• Authenticated CPCI Part I Development Specification. • Draft Final CPCI Part II Product Specification. • CPCI Test Plans, Test Procedures, and Test Reports. • Draft Final Operator's (User's) Manual. • Draft Final Computer Programming Manual. • Version Description Document (VDD). • FCA Minutes. • Prepared DD Form 250 or equivalent.	• List of all awaiting • List defini • List of all • List of all • CPCI conf • CPCI mas • Descripti

FQR
(Formal Qualification Review)
	• When feasible, the FQR is combined with the FCA.
	• For situations in which the Part I Development Specification requirements cannot totally be verified by the testing evaluated at FCA (e.g., CPCI qualification dependent on integrated system testing), a separate FQR will be conducted post-PCA, when the necessary tests have been satisfactorily completed, to enable CPCI certification.
		N/A	• Same as FCA, but for FQR separate from FCA, the following must be accomplished:
			  • Review FCA minutes to ensure that all findings have been incorporated and completed; the FQR is considered an extension of the FCA.
			  • Review and evaluate additional qualification/acceptance test data, together with the FCA findings, to ensure qualification of the CPCI against the total set of requirements in the CPCI Part I Development Specification.
				• Same as FCA, plus:
				  • Additional test results.
				  • FCA Minutes
					• Same as P

Table 1-2. Overview: Formal Reviews and Audits for Software Acquisition (larger version of this table in pouch inside back cover)

Review/Audit Is Conducted	Formal Baseline Established	Purpose	Items to be Reviewed	
			Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)
...ews usually conducted at the end ...e Conceptual Phase and early in the ...tion Phase if the Conceptual ...ies performed in-house by the	Functional Baseline	• Establish System/System Segment requirements (System Functional Baseline) as a basis for the allocation of requirements to hardware Configuration items (CI's) and Computer Program Configuration Items (CPCI's) in the System Validation Phase. • Evaluate the total systems engineering activity for responsiveness to the Statement of Work and the System/System Segment requirements. • Provide Procuring Activity direction, as necessary, to the contractor for continuing the technical program and system optimization.	• System/System Segment Specification • Statement of Work	• Totality of system engineering efforts to date, for example, mission/system requirements analyses, functional flow analyses, preliminary requirements allocation, life cycle cost studies, integration and test planning, configuration management and data management planning, etc.
...rior to submittal of the Validation ...ts or as the initial review in the Full-...ment Phase for systems/subsystems ...a formal Validation Phase. ...of draft Part I Development Specifi-...all CPCI's, is a prerequisite for this	Allocated Baseline	• Evaluate the optimization, traceability, correlation, completeness and risk of the allocated functional requirements (Allocated Baseline), including the corresponding test requirements, in fulfilling the System/System Segment Specification requirements. • Ensure that the updated System/System Segment Specification is *adequate and cost effective in satisfying validated mission requirements.* • Ensure that a technical understanding of requirements and supporting systems engineering results has been attained, and Procuring Activity technical direction, as necessary, provided to the contractor. • Evaluate the contractors concept for development/support of the CPCI's for completeness, adequacy, and schedule/cost realism. • Upon approval of each CPCI Part I Development Specification, satisfaction of this review establishes the Allocated Baseline for individual CPCI's and provides the basis to proceed with preliminary design of the CPCI's.	• Updated System/System Segment Specification • Preliminary Part I Development Specification for each CPCI • Computer Program Development Plan (CPDP) • *Computer Program Configuration Management Plan* (may be a component of the CPDP)	• Additional and updated systems engineering analyses and studies, for example, mission/system requirements analyses, functional analyses, requirements allocation, system/cost effectiveness, system synthesis, system growth capability, risk analyses, system interface studies, sizing/timing analyses, life cycle costing, trade studies, etc. • *Summary presentation of the mission/system requirements and requirement* allocation to CI's and CPCI's. • Description of the CPCI development/support concept.

...each CPCI (may be grouped) is ...the Full-Scale Development Phase ...R and CDR) when sufficient design ...been accomplished to arrive at a ...gram architecture and overall ...ture which will provide the ...iled design.
...of an authenticated Part I Develop-...tion is a prerequisite for any ...DR'd.
	N/A	• Evaluate the basic design approach for completeness, adequacy, and compatibility with allocated requirements (Part I Development Specification).
		• Review all changes to the System/System Segment Specification and Part I Development Specification to ensure that they are properly incorporated in the basic design approach, the draft Part II Product Specification, and test planning.
		• Review all detailed functional interfaces and corresponding test requirements with hardware CI's and other CPCI's.
		• Review the CPCI interactions with Human Factor requirements. Review all man-machine interfaces for feasibility, adequacy, and completeness.
		• *Review test planning documentation to ensure that the test program* satisfies the test requirements specified in Section 4 of the System/System Segment Specification and Section 4 of the Part I Development Specification.
		• Review status of all negative and provisional entries such as "not applicable" (N/A) or "to be determined" (TBD) in Section 4 of the System/System Segment Specification and Part I Development Specification. Review all positive entries for technical adequacy.
			• Updated System/System Segment Specification (if necessary).
			• Final Part I Development Specification for each CPCI.
			• Partial Part II Product Specification for each CPCI.
			• Preliminary Qualification (Acceptance) Test Plan for each CPCI.
			• Preliminary Data Base Document for each CPCI.
				• Available systems engineering/design data, for example:
				  • CPCI functional flows
				  • CPCI storage allocation charts.
				  • Sizing and timing estimates and budgets
				  • CPCI control functions, including executive control and start/recovery features
				  • Overall hierarchical structure for each CPCI and accompanying rationale
				  • Data base structure and organization
				  • Significant design tradeoff studies
				  • Interface definition between the CPCI, hardware CI's and other CPCI's
				  • Identification of unique security requirements, if any, and design approach to satisfy them
				  • Identification of any reentrancy requirements and approach for implementation and test.
				  • Description of the availability, adequacy, and planned utilization of tools and facilities for CPCI development including System/CPCI exercising.
				  • Description of any special tools, non-deliverable under the contract, but which are planned to be used during CPCI development.
				  • Status of all ECP's and DPR's against the CPCI.

...tween PDR and FCA when ...n is complete for the CPCI ...ppropriate subset if incremental ...heduled). ...Product Specification (excluding ...) is available if single CDR for ...portions of Part II Product Speci-...ilable if review is scheduled as an ...CDR. In this case complete draft ...t Specification (excluding code ...ble at final CDR.	N/A	• Review/evaluation of the detailed design of the CPCI (selected components if incremental CDR) for adequacy and completeness. • Formal identification of specific computer programming ("build to") documentation which will be released for coding and testing. • Approval of Qualification (acceptance) Test Plan provides a controlled definition of the project's acceptance test program. • Review/evaluate plans for supporting and maintaining the CPCI including all necessary hardware, support software, and documentation.	• Part I Development Specification including all approved ECP's. • Preliminary Part II Product Specification (excluding code listings). If an incremental CDR, only components under review would be included. • Final Qualification (Acceptance) Test Plan • Updated Data Base Document • Preliminary Computer Programming Manual • Preliminary Operator's (User's) Manual • PDR Minutes	• *Updated systems engineering* or design analyses/studies, e.g., sizing/timing analyses, performance studies, accuracy analyses, algorithm tradeoffs, scientific/environment simulation results, etc. • Applicable configuration management records related to approved changes (ECP'S) to the Part I Development Specification. • Design Problem Reports (DPR's). • Status of all ECP's and DPR's (approved, outstanding, rejected). • Planning data for supporting (maintaining) CPCI post-deployment. • Development Test Plan.
...ter CDR and prior to PCA when ...ification/acceptance testing has ...ed to verify all of the Part I ...Specification requirements. ...ted on a progressive (incremental) ...gnated by the Procuring Activity. ...where CPCI qualification can only ...through integrated systems test-...such CPCI's will not be considered ...completion/audit of such testing. ...requires a separate FQR post-PCA. ...by the Procuring Activity of the ...and/or Allocated Baselines is a ...FCA.	N/A	• Verify that the CPCI actual (test) performance totally complies with the Part I Development Specification requirements. • *Determine adequacy of analysis or* simulation results where performance parameters cannot completely be verified by test. • Evaluate the contractor's proposed solutions for any requirements stated in the Part I Development Specification that could not be met. • Examine and evaluate all approved ECP's to ensure that they were incorporated and verified during qualification/acceptance testing. • Examine the Qualification/Acceptance Test Report to verify it is an accurate and complete description of the qualification/acceptance testing. • Examine PDR and CDR minutes to assure that all findings have been incorporated and completed.	• Authenticated System/System Segment Specification and Part I Development Specification. • Draft CPCI Part II Product Specification (complete). • CPCI Test Plans, Test Procedures, and Test Results. • PDR and CDR minutes.	• CPCI configuration management status records. • Briefings to the FCA team delineating the test results and findings for each CPCI. • *Identification of any performance parameters that cannot be completely verified* during testing and demonstrated adequacy of analysis or simulation results to satisfy these requirements. • A complete list of functional tests required by the Part I Development Specification but not yet performed (e.g., to be performed during integrated system testing). • Identification of requirements of the Part I Development Specification that the contractor was not able to satisfy, if any, and a proposed solution for each item.
...tween PCA and FQR (when sepa-...quired) when all required audit ...ds (nominally) 30 days after sub-...draft Final Part II Product ...to the Procuring Activity.	Product Baseline	• Formal examination of coded ("as built") version of the CPCI against its technical documentation and of the configuration management records pertinent to the CPCI to establish the CPCI Product Baseline. • Evaluate all CPCI configuration differences between FCA and PCA versions to ensure CPCI functional characteristics are not degraded. • Review FCA minutes to assure that all findings have been incorporated and completed. • Audit the contractor's engineering release and change control system to ensure that it is adequate to properly control the processing and formal release of engineering changes after CPCI acceptance/delivery. • Satisfactory completion of the PCA and formal approval by the Procuring Activity of the CPCI Part II Product Specification establishes the CPCI Product Baseline. • Accepted CPCI's are delivered in accordance with contract requirements.	• Authenticated CPCI Part I Development Specification. • Draft Final CPCI Part II Product Specification. • CPCI Test Plans, Test Procedures, and Test Reports. • Draft Final Operator's (User's) Manual. • Draft Final Computer Programming Manual. • Version Description Document (VDD). • FCA Minutes. • Prepared DD Form 250 or equivalent.	• List of all deviations/waivers against the CPCI, either approved, or outstanding awaiting approval by the Procuring Activity. • List delineating both approved and outstanding changes (ECP's) against the CPCI. • *List of all required changes not yet completed.* • List of all changes actually made during test. • CPCI configuration management status accounting records. • CPCI master tape and current listing and flowcharts. • Description of contractor's engineering release and configuration control systems.

...the FQR is combined with the
...in which the Part I Development ...requirements cannot totally be ...testing evaluated at FCA (e.g., ...tion dependent on integrated ..., a separate FQR will be con-...CA, when the necessary tests ...factorily completed, to enable ...tion.
	N/A	• Same as FCA, but for FQR separate from FCA, the following must be accomplished:
		  • Review FCA minutes to ensure that all findings have been incorporated and completed; the FQR is considered an extension of the FCA.
		  • Review and evaluate additional qualification/acceptance test data, together with the FCA findings, to ensure qualification of the CPCI against the total set of requirements in the CPCI Part I Development Specification.
			• Same as FCA, plus:
			  • Additional test results.
			  • FCA Minutes
				• Same as FCA.

2

Structured reviews and audits allow the government to

- ascertain that the contractor is developing the CPCI's in an orderly process based on well-thought-out and clearly defined sequential steps;
- determine that each step is complete before the next development step is started;
- ensure that the contractor has not misinterpreted or misunderstood the government's requirements;
- ensure that the contractor is not neglecting some facet of software development such as support software; and
- identify major problem areas without attempting to determine the absolute technical correctness of each document from the contractor (in particular, the government contractually approves requirements, acceptance test plan, and final configuration but should not formally "approve" the design).

From the contractor's point of view, effective reviews and audits allow him to:

- determine periodically that all agencies involved agree on the correctness of his approach,
- obtain appropriate technical direction early enough to avoid the need for expensive rework of downstream products,
- obtain formal approval of requirements, acceptance test plans, and adequacy of qualification testing (but not of design), and
- close out the project by obtaining formal approval and acceptance of the final product and its accompanying documentation.

A review or audit should be viewed as a mini-project, subject to all the rules that apply to any project. The first of these is that a plan must be prepared. The government program manager or project engineer must identify the personnel to be involved and prepare a plan for each review or audit; he should also make sure that his contractor counterpart does the same. A detailed agenda for the review or audit meeting should be prepared by the contractor and coordinated with the government 3 to 4 weeks before the review.

The overall definition of reviews and audits, indicating how many there should be, nominal schedules, and the content and scope of each, should be included in the governing contractual documentation (contract clauses, SOW, CDRL).

The government representative in charge of supporting a review or audit should be aware that reviews and audits can serve purposes in addition to those explicitly stipulated in MIL-STD-1521A (USAF) and should consider these when selecting attendees and planning his support for the review or audit. For example, it is important to assure: (1) system familiarization and timely exchange of technical data between government agencies. (2) using command (TAC, SAC) participation in decisions involving mission operation and effectiveness, (3) using command (AFLC/ALD and appropriate Air Logistics Center) involvement in support concepts and unique support requirements, etc.

1.2 CONTENTS OF THE GUIDEBOOK

1.2.1 Section 1: Introduction provides background information, in particular the relationship of reviews and audits to the system life cycle and the CPCI development process. This section also contains a summary of the purposes of reviews and audits.

1.2.2 Section 2: Relevant Documents references the government regulations, specifications, and standards relevant to formal reviews and audits.

1.2.3 Section 3: General Guidelines for Reviews and Audits provides general guidance to the Air Force Program Office and engineering personnel in the preparation and conduct of technical reviews and audits relating to the acquisition of CPCI's for airborne systems. It identifies the responsibilities of the participating organizations and describes useful techniques for planning and conducting reviews and audits.

1.2.4 Section 4: Guidance for Individual Reviews and Audits provides detailed guidance for each review and audit in the development cycle. In each case, the purpose and objective of the review or audit are defined, the documentation and technical/management data to be evaluated are listed, specific requirements are given and post-review activities are described.

1.2.5 Appendix: Bibliography of Government Documents provides additional sources of background information related to reviews and audits.

2. RELEVANT DOCUMENTS

The following documents are important sources of information relevant to formal reviews and audits. Additional sources of background information related to reviews and audits are provided in the Appendix.

AFR 800-14 Volume I	Acquisition Management; Management of Computer Resources in Systems
AFR 800-14 Volume II	Acquisition Management; Acquisition and Support Procedures for Computer Resources in Systems
MIL-STD-1521A (USAF)	Technical Reviews and Audits for Systems, Equipment, and Computer Programs
MIL-STD-490	Specification Standards
MIL-STD-499A	Engineering Management
MIL-STD-483 (USAF)	Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs
MIL-STD-480	Configuration Control - Engineering Changes, Deviations and Waivers
MIL-STD-481A	Configuration Control - Engineering Changes, Deviations, and Waivers (Short Form)
MIL-S-52779 (AD)	Software Quality Assurance Program Requirements

3. GENERAL GUIDELINES FOR REVIEWS AND AUDITS

3.1 RESPONSIBILITIES

The agencies having direct responsibilities for reviews and audits are

- the procuring agency (with any direct support organizations such as Aerospace Corporation, Mitre Corporation, SETA contractors, etc.),
- the contractors; and
- subcontractors, vendors, suppliers (if software is being developed under subcontract to prime contractor).

Other organizations that are important in avionics procurement and that may be appropriately involved in reviews and audits are

- appropriate ACO and AFPRO,
- the supporting agency (AFLC),
- the using agency (TAC, SAC, MAC, ADCOM)
- system external interfaces (EW, ATE, C&C, etc.),

Reviews and audits are co-chaired by the procuring agency and the contractor. However, the government project officer is responsible for

- defining goals and ensuring that they are met,
- keeping affected government organizations involved (e.g., providing for supporter and user representation),
- ensuring that the review is carried out to the appropriate depth (e.g., providing appropriate technical support for the review).

Table 3-1 summarizes the responsibilities of both the contractor and the procuring agency.

Table 3-1. Responsibilities (Reviews/Audits)

Procuring Activity	Contractor(s)
• Provide Co-Chairperson	• Provide Co-Chairperson
• Establish review/audit team, schedule review of advance material and provide coordinated comments to the contractor in advance of the review/audit meeting; assure continuity in the review team where possible	• Establish agenda, time, place
• Provide name, organization, and security clearance of each member of review/audit team	• Furnish meeting facilities (conference rooms, etc.)
• Define goals and ensure that they are met	• In advance of the review/audit, provide appropriate documentation and supporting engineering data (i.e., items to be reviewed)
• Keep affected government organizations involved (e.g., provide for user and supporter representation)	• Ensure that review/audit schedule is compatible with availability of contract articles and necessary supporting data
• Ensure that the review/audit is carried out to the appropriate depth (e.g., provide appropriate technical support for the review/audit)	• Prepare and present expository briefings as appropriate
• Review daily minutes and ensure that they accurately reflect all significant procuring activity inputs	• Provide stenographer or other acceptable method to record inputs to meeting minutes
• Co-sign * official meeting minutes	• Perform daily compilation, and coordination with customer, of meeting minutes
• Provide technical direction, as necessary (within scope of contractual requirements)	• Co-sign * and publish and distribute official meeting minutes

• Provide formal (i.e., written) acknowledgement to contractor of review/audit accomplishment after receiving official minutes
  • Review/audit approval
  • Review/audit contingent approval
  • Review/audit disapproval
	• Perform follow-up on all action items resulting from review/audit

• Perform follow-up on all action items resulting from review/audit	

*MIL-STD-1521A (USAF) does not explicitly require that the official minutes be co-signed; however, it is recommended as a prudent practice and evidence of mutual agreements, acceptance of action items, etc.

3.2 GENERAL REVIEW AND AUDIT FUNCTIONS

3.2.1 Preparing for Reviews and Audits

The required reviews and audits should be specified in the contract (contract clauses, SOW, CDRL); MIL-STD-1521A (USAF) may be incorporated by reference with program unique exceptions or extension as appropriate. In addition, the Air Force project engineer/manager should prepare a review plan that details the program office review procedure. For each formal review and audit the plan should define

- the objectives (e.g., determine whether or not interfaces are clearly defined)
- requirements to meet the objectives (e.g., require contractor to submit interface documentation)
- personnel needed to conduct the review (e.g., solicit an interface expert from the engineering organization)
- responsibilities of reviewers (e.g., read the interface documents and submit a list of discrepancies 15 days before the review meeting)
- an agenda, schedule and a list of the data available for the review (this document should be prepared by the contractor).

Review and audit activities begin well before the review: material must be prepared and a plan developed. A meeting should be conducted with the contractor before this activity starts to agree on the review/audit plan. The participant who is least prepared for this meeting will be at a disadvantage; don't let it be you.

For certain reviews/audits, it is difficult for everyone to review all of the documentation. Organize the available forces and split the job up into pieces that can be done thoroughly (see Section 3.3.1 for useful techniques).

Selection of personnel for the review is not simply a matter of making a list of names. It is important that those selected be available

for the whole review cycle (plan, read, listen, comment, follow-up); obtain commitments from your management or from the organizations supplying the reviewers (see Section 3.3.2 for guidelines).

Significant "homework" is recommended prior to receiving the explicit advance data package associated with a specific review and/or audit. For example, review or audit team members should familiarize themselves with such items as the ROC, PMD, PMP, CPDP, CRISP, RFP, contractor proposals, resulting contracts (particularly the SOW, CDRL and specifications/exhibits, if any), and the official minutes and data packages from any prior reviews and audits.

Formal reviews and audits are tied to major milestones on the project and to the related CDRL deliverables. Your superiors will expect a report on the review, and you should learn in advance what areas are of primary concern and place corresponding requirements on your contractor. The applicable parts of MIL-STD-1521A are discussed in Section 4 for each review and audit.

As part of preparing the review plan, you will need to evaluate the review/audit and determine the following:

- goals of the review or audit in specific terms (i.e., not goals that could apply to any review);
- skills needed on your team;
- decisions you must make (e.g., authorization to proceed to detailed design) and what the review must show for you to be able to make those decisions; and
- who might be affected by the results of the review or audit (this will suggest persons who should be invited for information or concurrence).

Recognize that a good review/audit costs money; include the cost in your project budget. Be sure your contractor is financially and technically prepared to do his part of the job. A major pitfall is to skimp on reviews in the mistaken belief that this will save the government money and schedule. Experience has shown otherwise.

In planning the review or audit with your contractor, request that he bring people who can define the situation and deal with problems, otherwise much time (and money) will be wasted.

3.2.2 Location of Reviews and Audits

Hold review and audit meetings where the needed information is located. In most cases, this means at the contractor's facility, and, unless you otherwise specify in the contract, they must be held there.

There may be some complications if the software is being developed by a subcontractor and the prime contractor wishes to hold the review at his own facility. If the software is very complex it is better for the government if at least the PDR and CDR are held at the software subcontractor's facility. Try to make the decision on subcontractor participation prior to finalization of pertinent contracts (i.e., SOW's and CDRL's). Get the contractor's commitment.

3.2.3 Conduct of Reviews and Audits

As previously mentioned and as shown graphically in Figure 3-1, a review does not consist of a review meeting only. It is a mini-project and should be managed accordingly. The following elements, shown in Figure 3-1, are essential parts of the review process.

- The plan, which includes the schedule, the material to be reviewed, the objectives of the review, the participants and their responsibilities, and the means of following up on action items.

- The schedule and agenda, published and distributed to all participants at least three times:

  1. as early as possible to let them know what is expected;
  2. just before their action is needed, as a reminder; and
  3. with the material to be reviewed.

- The pre-review/audit planning meetings with your contractor (to work out details) and with your own review team (to ensure that all bases are covered and all participants know their jobs). These meetings should cover the topics to be discussed at the review and administrative details, and the follow-up plan.

- Distribution of review/audit material supplied by the contractor. You must decide if the contractor should handle the distribution or should send copies to you for distribution. The former is faster, but you should follow up. Action requests should be sent to the reviewers identifying the material they are responsible for reviewing and should include a form for their response.

- Collection of comments from your reviewers. These should be consolidated before the review/audit meeting (or meetings).

Table 3-2 is a summary of the personnel and actions associated with pre-meeting activities.

If the preparations have been adequate, the review meeting will be productive and will achieve its goals. The meeting normally consists of presentations by the contractor personnel, followed by questions and answers. Side meetings may be held to work any special technical issues and, perhaps, detailed interchange on necessary changes to draft documentation. Agreements and action items close the meeting.

NOTE: It is important to obtain co-signed minutes containing written agreements, action items, etc. before the review/audit ends. If it runs for several days, they should be obtained on a daily basis; otherwise, there will be confusion on the last day about agreement on specific points.

Some general points to bear in mind for review meetings are the following:

- Keep proper records of the meeting (see Section 4.1.3.4 of MIL-STD-1521A); all action items should be in writing, clearly assigned to an organization, and have due dates.

- Avoid verbal agreements without formal documentation; contractual implications must be clearly understood in each case; otherwise, the agreement may be forgotten or misconstrued, the contractor may believe that he has received technical direction when you had no such intent, and, your technical support may be pre-empting your responsibility (review all data communicated to the contractor). Obtain assistance (e.g., PCO, ACO) for potential contractual implications.

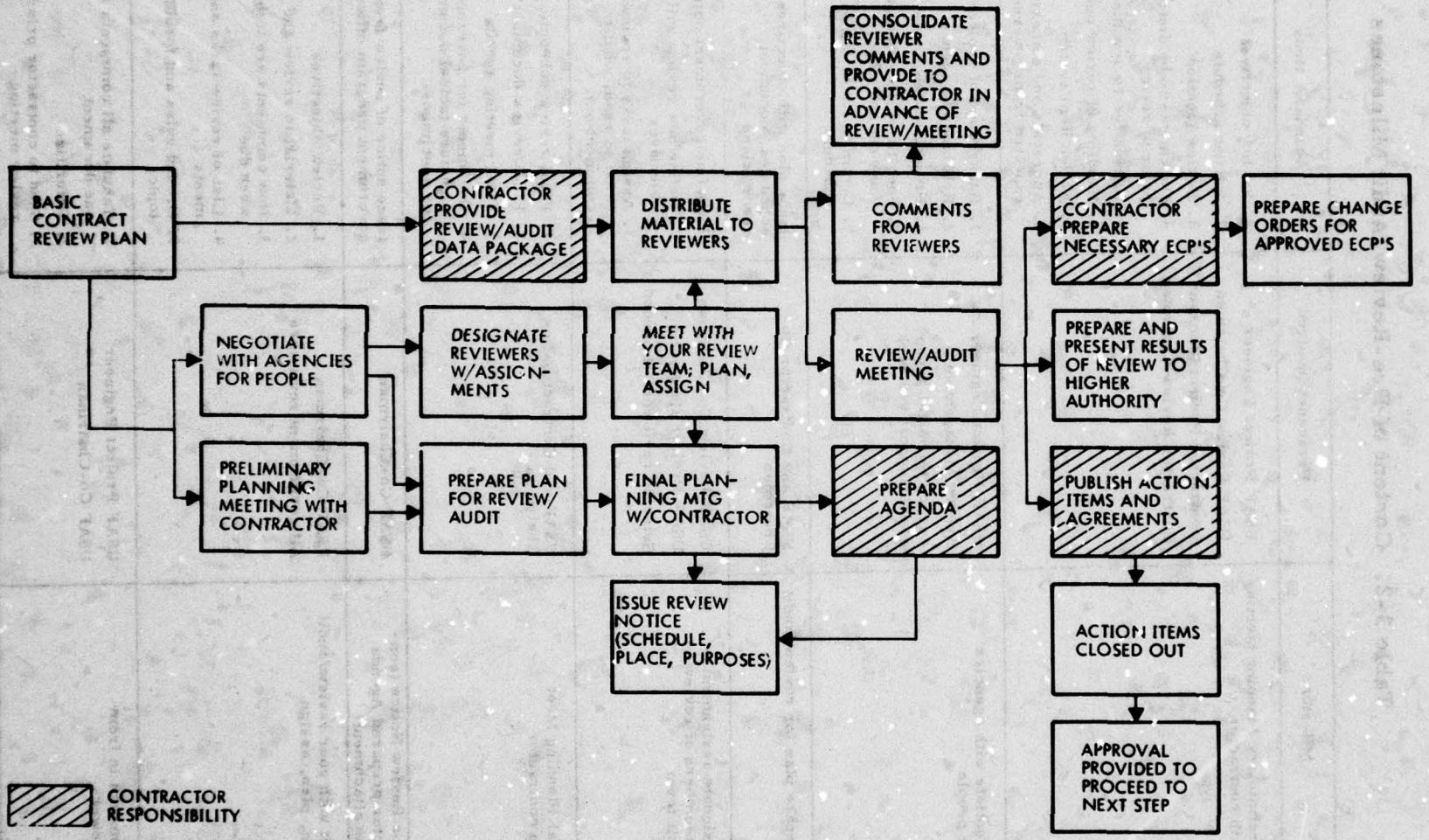


Figure 3-1. Review/Audit Process

Table 3-2. Content of Pre-Review/Audit Milestones

Milestone	Personnel Involved	Agenda/Actions
Preliminary Planning Meeting with contractor	USAF Project Engineer USAF Review Co-Chairman Contractor Project Manager Contractor Review Chairman	1. Review objectives 2. Review schedule 3. Review location 4. Documents to be distributed prior to review 5. Agenda for review meeting 6. Handling of review comments 7. Action item system 8. Approvals and authorizations expected from government
Negotiate with agencies for people	USAF Project Engineer Agency Management Agency technical groups whose support you seek	1. Background of project 2. Relevance to agency 3. Project review needs 4. Specific skills or names you want and why 5. Commitment of names to a schedule
Prepare plan for review/audit	USAF and Contractor Co-Chairman	Issue plan with objectives, schedules, document descriptions
Designate assignments to members of review/audit team	USAF Review Co-Chairman USAF Project Manager Selected reviewers if needed	1. Define government objectives 2. Define how review will meet objectives 3. Assign tasks to reviewers (what to read, what to comment on).
Final Planning Meet with contractor	USAF and Contractor Co-Chairman	1. Final review schedule 2. Final review document list 3. Final meeting agenda 4. Documents for government signature (actual documents, or specimens).
Issue Review Notice (contractor prepared Agenda is an attachment)	USAF Co-Chairman	Issue notice of review from government program office.
Meet with your review/audit team, plan, assign	USAF Co-Chairman All government reviewers	1. Review objectives 2. Material to review and schedule 3. How comments are to be written; when due 4. List of review tasks and assignments 5. Ground rules and forbidden topics
Comments in from reviewers	USAF Project Engineer USAF Co-Chairman	1. Tabulate all comments into one document 2. Prioritize 3. Send to contractor prior to review meeting

- Do not let the review meeting get out of control; brief your people on the objectives of the project. Define "forbidden" areas (such as discussing design before the requirements are defined); ask the contractor to do the same.

- Do not let the contractor keep you from finding out what is going on with subcontractors, suppliers, and vendors. If he takes the position that it is his responsibility, gently remind him that it is your responsibility to see that the government's interests are being served.

- Ask each reviewer to summarize for you in advance how he will know whether or not all applicable specifications and regulations have been met. If your project is too small to have individual reviewers do this, do it yourself.

3.2.4 Closing Out Reviews and Audits

A review does not end when the flip charts are folded and the crowd leaves. Most reviews uncover discrepancies and problems, and some action is required for each one. Only when the action is satisfactorily assigned and the response evaluated as satisfactory can the review be considered closed out. In general, the government is expected to evaluate work done and authorize future work and provide technical direction as required. The outcome of a review of particular item can be

1. review fully acceptable;

2. review acceptable with discrepancies noted and action items covering discrepancies accepted by the contractor; and

3. review unacceptable, the contractor told to try again (in this case, the schedule must be revised and a date for a new review determined). Rescheduling should be documented in the minutes.

For each discrepancy noted in case 2, one of the following actions is required.

1. Rejected (you and the contractor must agree).

2. Deferred to a future review (such action is often taken when a comment is valid but premature, such as a comment on a design concept made at a review of requirements).

3. A solution is generated; it is then reviewed and accepted (or iterated; if necessary) by the contractor and the government program office and suitably documented.

A particular type of discrepancy to be wary of is the "TBD" (to be determined) i.e., some value to be determined later. Keep track of these; assign action items with dates for the TBD's to be converted into real data.

Be sure your contractor has an action items system to record agreements and verify follow-up.† Assign someone to follow up on action items status; the review is not closed out until all action item responses have been evaluated to the government's satisfaction and items formally closed out.

Review both the contract and the project plan to see if any agreements reached at the review require modification to either document. Even when changes are financially in scope, they may require a contract change. (For example, the contract calls for use of SIN/COS routine X; agreement made to use routine Y at no cost to the government, but the provisions of the contract have changed and need updating, even though it has no cost impact).

The final step in any review or audit is to evaluate the work completed and to authorize work on the next phase of the project. If the review/audit is judged unsatisfactory it may be necessary to reschedule the review or audit for a later date when the contractor will be ready.

If an additional formal review is not required, it may be advisable to hold a meeting to close out action items. This procedure is especially important where work has been accepted contingent upon the completion of a number of major action items.

The responsibilities of the government in reviews and audits are:

- Evaluate work performed (documents and informal data),
- Provide technical direction as necessary,

---

†If you put MIL-S-52779 (AD) on the contract, you will require this as part of the contractor's QA activity.

- Approve review/audit official minutes (after iteration as required)
- Written acknowledgement that review/audit was accomplished, and
- Followup to closeout of action items.

3.3 OTHER GENERAL GUIDELINES

3.3.1 Some Effective Reviewing Techniques

There are several techniques that can increase the effectiveness of reviews; in most cases, all these techniques can be applied. It is a good idea to go over the techniques with your reviewers as a means of helping them give you their best. The techniques to be discussed are:

- assigning reviewers' points of view,
- outlining before opening,
- tracing a stimulus-response chain through the software,
- decision-oriented reviewing, and
- commenting on reviews in writing and in terms of specifics rather than general satisfaction or dissatisfaction.

Assigning Reviewers' Points of View. An easy way to manage a review is to give all of the review material to all reviewers and let them read as they choose. It is a bad way to manage a review. Some topics will be covered too much; some, not enough, or not at all. The sheer volume of the material may cause reviewers to browse instead of reading carefully.

The solution is to assign different "points-of-view" to different reviewers. Each reviewer can then carefully select the portions he needs to review. Typical points of view that can be assigned to reviewers are:

- feasibility (Can it be built within budget, on schedule, and run on the selected machine?),

- interfaces (Do we understand correctly just how the software connects to the rest of the system?),
- operability (Will it really do the job the Air Force needs done?),
- supportability (Can it be operated and maintained by the kinds of personnel proposed?), and
- adversary (Are there deficiencies or weak spots that can be exploited by an adversary?).

Outlining Before Opening. The general idea of this technique is to check for completeness and to keep you in command of the review material. The process begins when you get your reviewing assignment (or lay out your review plan). At that point you decide, a priori, what you expect to see in terms of:

- topics covered and topics omitted,
- depth of treatment (e.g., flow charts, equations, final code),
- pages per topic,
- problems you expect to see defined and dealt with,
- topics on which you expect no problems,
- type of document (first-draft, engineering, final),
- coherency of document (e.g., all software packages consistent, or is some inconsistency to be expected at this point), and
- traceability of requirements (should they be traceable at this point).

Now when you begin to read the material, you will be checking against a set of expectations. These expectations keep you alert and give you a basis for judgment.

Tracing Stimulus-Response. A common method of analyzing avionics software is by function: sensor input, alignment and calibration, instrument compensation, navigation, and fire control. An alternate technique is to examine the software in terms of stimuli input to the

system and responses generated by the system. For example, you might take a radar tracking return and follow it through the software until it results in some externally visible action such as a weapons release command. This technique is effective for analyzing avionics software because the major function of such software is to close control loops either directly or through the pilot.

A complete check (desireable for critical software) would mean examining all input stimuli and tracing them through to outputs, but this completeness may be too time-consuming and expensive for a review. An alternative approach is to select four to six inputs and trace them; half should be from the most critical loops, with the other half chosen at random. If you find problems with this sample, more analysis is indicated. The types of problems likely to be uncovered with this technique are:

- undefined actions for special cases,
- incorrect responses under some (or maybe all) conditions,
- inputs never used, and
- outputs never generated.

Decision-Oriented Reviewing. An excellent way to ensure the value of a review is to orient it toward the decisions that must result. First, list the decisions that you will have to make after the review (e.g., authorization to code). For each decision, define what you need to know to reach that decision (e.g., are there plans and standards for coding. . . is the design complete. . .). Then review the material (or structure the review) to produce the information needed.

One advantage of this approach is that it avoids the embarrassment of finishing a review and finding that you did not learn what you needed to support a logical decision. Another is that it is a test of relevance, allowing you to avoid topics that are useless to the purpose of the review. Table 1-2 (Section 1) provides capsule summaries of the purposes, and hence the decisions required, for each type of review.

Commenting in Writing. A good set of written comments can be one of the most valuable products of a review; conversely, one of the least useful products of a review is unrecorded comments or worthless written comments. Your reviewers should have some guidelines on writing comments.

- All comments must be written, and the person making the comment is responsible for putting it in writing (unless that action is specifically assigned to someone else).
- A comment must clearly identify the problem, as opposed to stating only a proposed solution; any solutions proposed must be clearly separated from the problem.
- A problem must relate to some defined system issue. For example, the comment "has inadequate comments in the code" is not acceptable; it should read "violates the requirements for code commenting standards in Section 3.6.1 of the project plan" or "violates the requirements for maintainability in Section 4.7 of the statement of work."
- Comments should be ranked in some order of importance either by ranking directly or by some scoring scheme such as: Level 1, violates contract or will cause system failure; Level 2, results in marginal system performance; Level 3, results in suboptimal system performance; Level 4, other.

Unless you, the project engineer/manager in charge of the review, create such guidance for your reviewers you may be inundated by comments that you cannot use or that are irrelevant.

3.3.2 Selecting Reviewers

Many reviews fail before they start simply because the project engineer did not devote enough effort to lining up the right reviewers. Poorly chosen reviewers can actually decrease the effectiveness of review team. Thus, a few extra hours spent at the beginning getting the right people has great leverage for downstream performance.

The three basic considerations in selecting reviewers are:

- determining the technical skills needed to conduct the review,
- finding people who know how to review and will spend the time, and
- identifying people who must be invited for information or concurrence.

Technical Skills. Study the objectives of the review/audit and then decide what skills are needed. You have seven main sources of skills:

1. your own program office,
2. supporting/using agencies (e.g., TAC, SAC, AFLC),
3. your internal engineering organization (e.g., ASD/EN, SAMSO/AW, and SAMSO/YC),
4. Air Force laboratories,
5. SETA agency (Aerospace, Mitre, etc.),
6. SETA contractor (if there is one), and
7. AFPRO, ACO, etc.

Review Capabilities. You cannot always control reviewer selection, and ideal reviewers are not always available. You should try to get at least a few key people who are good reviewers. A good reviewer will

- see how well it will work as designed, not how he would design it;
- take clear positions and stand by them;
- conduct himself professionally and inspire trust (otherwise, contractor personnel may withhold information for fear of personal consequencies);
- focus on identifying problems, not on solving them in real time during the review meeting;
- be capable of identifying errors of omission as well as of commission; and
- write pertinent comments.

4. GUIDANCE FOR INDIVIDUAL REVIEWS AND AUDITS

A series of technical reviews and configuration management audits should be scheduled and conducted at meaningful points (corresponding with formal "baselines" and intermediate milestones, see Table 1-1) in the CPCI acquisition process to permit assessment of progress and prepare for the next development step and to establish new baseline configuration identifications for the product. This section discusses the seven reviews and audits specified by MIL-STD-1521A (USAF) and an additional informal (contractor internal) Test Readiness Review (TRR), see Table 1-1 and subsection 4.5, which corresponds to a meaningful intermediate milestone. For each airborne systems acquisition, the specific number, content and scope, and conduct of the reviews and audits should be included in the governing contractual documentation (SOW and CDRL) to assure contractor committment of adequate technical and financial resources to support meaningful reviews and audits.

The technical reviews (SSR, SDR, PDR, CDR, TRR) are primarily systems engineering or design oriented and focus on CPCI requirements definition/allocation, design and test preparation.† The audits (FCA, PCA and FQR) are primarily configuration management oriented and focus on CPCI performance qualification and configuration identification verification. Time phasing of the reviews and audits versus system and CPCI life cycle activities is shown in Figures 1-1 and 1-2.

General guidance in planning, preparing, and conducting reviews and audits was provided in Section 3 (e.g., responsibilities of the participating organizations, specific techniques for effective reviews and audits, etc.) This section provides detailed guidance for each review and audit to the Air Force Project Office and engineering personnel responsible for the acquisition of CPCI's for airborne systems. The approach in subsections 4.1 through 4.8 is to provide a summary "checklist" table accompanied by a brief narrative highlighting leverage issues, unique preparations, etc. for each individual review and audit.

---

†Throughout this guidebook, reference to a CPCI Development Specification includes the interface and data requirements specification if these volumes are produced separately.

4.1 SYSTEM REQUIREMENTS REVIEW (SRR)

System Requirements Reviews (SRR's) are also called system/system segment requirements reviews. SRR's are in-process reviews which may be conducted any time consistent with contract provisions; however, they are usually conducted on concept definition contracts or early in concept validation contracts for a new large-scale system. Table 4-1 provides a summary of SRR.

4.1.1 Leverage Issues

The primary objective of this review is to evaluate and approve the allocation of system/system segment requirements against validated mission requirements. Another major objective is to evaluate the progress of the systems engineering analyses/studies and design synthesis efforts toward convergence to an optimum system/subsystem configuration.

From the viewpoint of eventual CPCI acquisition, the major objective is to evaluate the preliminary approach to allocating system/subsystem requirements to embedded computer resources and validating the application; e.g.,

- Requirements definitive and unambiguous? How many "TBD's"?
- Technically feasible? For example, interface rates versus "real time" constraints. High risk elements?
- Number and complexity of interfaces?

Other considerations include: responsiveness to SOW, traceability to requirements (possible contractor gold plating), and testability of requirements.

Satisfactory completion of SRR and formal customer approval of the System/System Segment Specification establishes the system/system segment Functional Baseline.

Table 4-1. Summary: System Requirements Review (SRR); Acquisition of CPCI's for Airborne Systems

SRR	Purpose	Items to be Reviewed	
		Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)
• In-Process reviews usually conducted at end of System Conceptual Phase and early in System Validation Phase if the Conceptual Phase effort was performed in-house by the Government.	• Establish System/System Segment requirements (System Functional Baseline) as a basis for the allocation of requirements to hardware Configuration Items (CI's) and Computer Program Configuration Items (CPCI's) in the System Validation Phase. • Evaluate the total systems engineering activity for responsiveness to the Statement of Work and the System/System Segment requirements. • Provide Procuring Activity direction, as necessary, to contractor for continuing technical program and system optimization. • Satisfactory completion of SRR and formal approval of the System/System Segment Specification, establishes the System/System Segment Functional Baseline*.	• System/System Segment Specification • Statement of Work	• Totality of systems engineering efforts to date, e.g., mission/system requirements analyses, functional flow analyses, hardware/software tradeoffs, preliminary requirements allocation, life cycle cost studies, integrated logistics support analysis, integration and test planning, configuration management and data management planning, etc.

*The two elements that distinguish "formal baselines" from "intermediate milestones" are that (1) formal baselines involve formal customer approval of configuration documentation (specifications), and (2) approved specifications are put under formal configuration control.

Formal Baseline* Established:	Intermediate Milestone
Functional Baseline	N/A

4.1.2 SRR Post-Review Action

After completion of the SRR the contractor is responsible for publishing and distributing the official (co-signed by customer and contractor) SRR minutes. The minutes should clearly record all agreements and all action items, including suspense dates, and assign specific responsibility to the Procuring Activity and/or the contractor. The Procuring Activity provides formal acknowledgement to the contractor of the accomplishment of the SRR after receipt of SRR minutes.

4.2 SYSTEM DESIGN REVIEW (SDR)

The System Design Review (SDR) evaluates the system/system segment synthesis, including the supporting systems engineering analyses and studies, resulting in the allocation of system/system segment requirements (System/System Segment Specification) to individual equipment configuration items (CI's) and computer program configuration items (CPCI's), to establish a requirements baseline as reflected in a Part I Development Specification for each CI and CPCI. SDR is usually the final review prior to submittal of the Validation Phase products or as the initial review in the Full-Scale Development Phase for systems/subsystems not requiring a formal Validation Phase. Table 4-2 provides a summary of SDR.

4.2.1 Leverage Issues

The Procuring Activity should evaluate any changes to the System/System Segment Specification (Functional Baseline) for consistency with validated mission requirements and ensure that all System/System Segment Specification requirements, including performance and test requirements, are optimally assigned, and traceable to, CI's and CPCI's.

Table 4-2. Summary: System Design Review (SDR); Acquisition of CPCI's for Airborne Systems

SDR	Purpose	Items to be Reviewed	
		Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)

• Final review prior to submittal of Validation Phase products or as the initial review in the Full-Scale *Development Phase* for systems/subsystems not requiring a formal Validation Phase.
• Availability of draft Part I Development Specifications, for all CPCI's, is a prerequisite for this review.
	• Ensure that updated System/System Segment Specification adequate and cost effective in satisfying validated mission requirements
	• Evaluate optimization, traceability, correlation, completeness and risk of allocated functional requirements (Allocated Baseline), including the corresponding test requirements, in fulfilling the System/System Segment Specification requirements.
	• Ensure that allocated requirements represent a complete and optimal synthesis of system/subsystem requirements.
	• Ensure that technical program risks are identified, ranked, avoided, and reduced through adequate tradeoffs and a responsive test program.
	• Evaluate contractors concept for development/support of CPCI's for completeness, adequacy, and schedule/cost realism.
	• Identify effect of final combinations of operations, maintenance, test, and activation requirements on overall program concepts and computer programs; evaluate use of government assets, such as government furnished computer time or equipment.
	• Ensure that technical understanding of requirements and supporting systems engineering results has been attained and that Procuring Activity technical direction, as necessary, provided to the contractor.
	• Upon approval of each CPCI Part I Development Specification, satisfaction of this review establishes the Allocated Baseline* for individual CPCI's and provides basis to proceed with preliminary design of the CPCI's.
		• Updated System/System Segment Specification
		• Preliminary Part I Development Specification for each CPCI
		• Computer Program Development Plan (CPDP)
		• Computer Program Configuration Management Plan (may be a component of the CPDP)
			• Additional and updated systems engineering and analyses and studies, e.g., mission/system requirements analyses, functional analyses, requirements allocation, system/cost effectiveness, system synthesis, system growth capability, risk analyses, system interface studies, sizing/timing analyses, life cycle costing, trade studies, etc.
			• Summary presentation of mission/system requirements and requirement allocation to CI's and CPCI's including analyses demonstrating the completeness of the requirements and consistency with system requirements and external interfaces
			• Description of CPCI development/support concept
			  • Management controls and methodology that will ensure satisfactory design/development/deployment of CPCI's
			  • Identification of all CPCI's required throughout system; e.g., operational programs, maintenance/diagnostic programs, test/debug programs, exercise and analysis programs, simulation programs, compilers, assemblers, loaders, etc.
			  • General description of size and operating characteristics of all CPCI's
			  • Schedule for developing each CPCI; procedure for monitoring and reporting status
			  • Identification of all computer programming languages to be utilized in system and description of impact of each language on development, test, operations, and maintenance
			  • Computer programming standards and conventions (enforced by contractor)
			  • Procedures for monitoring and reporting CPCI sizing and timing data
			  • Descriptions of requirements for tools and facilities to support CPCI design/coding/test and System/CPCI exercising. Plan to acquire/qualify these tools and facilities including identification of all required Government Furnished Property (GFP) and access/usage of Government facilities
			  • Identification of facilities to support (maintain) CPCI's in deployment phase, e.g., requirements for an Avionics Integrated Support Facility (AISF) and extent to which these facilities will be provided

The two elements that distinguish "formal baselines" from "intermediate milestones" are that (1) formal baselines involve formal customer approval of configuration documentation (specifications), and (2) approved specifications are put under formal configuration control.

Formal Basline* Established:	Intermediate Milestone:
Allocated Baseline	N/A

The development/support concept for each CPCI, as specified in the Computer Program Development Plan, should be carefully evaluated to ensure:

- completeness (nothing has been overlooked)
- technical/management adequacy, and
- schedules and projected costs are realistic.

The key decision at *SDR, associated with CPCI acquisition,* is approval* of the CPCI Part I Development Specification. Requirements problems (inconsistent requirements, incomplete requirements, missing requirements, over-constraining requirements, incorrect requirements, etc.) not detected in the approved Part I Development Specification may not surface until very late in the acquisition cycle (e.g., integrated systems testing or operational use) with resulting major re-work required and corresponding cost and schedule impacts. The Procuring Activity should

- ensure that Part I Development reflects an understanding of the operational mission;
- require that the contractor produce analyses demonstrating the completeness, feasibility and testability of the requirements set and consistency with system/subsystem requirements and external interfaces;
- analyze each individual requirement to verify
  - proper and clear statement which distinguishes between mandatory requirements and design goals or options,
  - compatibility with system level objectives, where appropriate,
  - technical feasibility and risk

---

* Satisfactory completion of the SDR plus formal customer approval (authentication) of a CPCI Part I Development Specification establishes an Allocated Baseline for the CPCI as the basis for the ensuing preliminary design effort. The objective is to review a complete draft of the Part I Development Specification at SDR and make any required changes as part of the SDR action item close-out process permitting an approved (authenticated) Development Specification as soon as possible after SDR. The risk associated with delaying the authentication of the Development Specification until PDR, as has been done on some projects, is the potential compromise of some or all of the CPCI preliminary design effort.

- testability.
- completeness (i.e., identify TBD's, explicit or implicit), and
- identification of any necessary design constraints.

- require that the contractor justify all "not applicable" and explain all "to be determined" entries including an approach to resolve them;
- ensure that the allocated interfaces are explicitly identified and detailed in terms of message formats, update rates, etc.;
- determine the compatibility of the requirements set with contract schedule and funding, and other project resources (personnel, facilities, etc.);
- ensure every requirement will be tested (i.e., Development Specification, Section 4 accounts for every requirement in Section 3); and
- ensure that the total requirement set provides an adequate basis to begin preliminary design.

4.2.2 SDR Post-Review Action

After completion of the SDR, the contractor is responsible for publishing and distributing the official (co-signed by customer and contractor) SDR minutes. The minutes should record all agreements and all action items, including suspense dates, and assign specific responsibility to the Procuring Activity and/or the contractor. The Procuring Activity provides formal acknowledgement to the contractor of the accomplishment of the SDR after receipt of the SDR minutes.

4.3 PRELIMINARY DESIGN REVIEW (PDR)

The PDR is a formal review of the basic design concept for a CPCI, which establishes a preliminary design approach and the implementation and test plans necessary to proceed into detailed design and development. Table 4-3 provides a summary of PDR.

4.3.1 Leverage Issues

The key decision at the PDR for a CPCI is to determine if the contractor's basic design approach and associated implementation and test planning provide an adequate basis for proceeding to detailed design.

The following actions should be considered by the Procuring Activity.

a. Require the contractor to demonstrate that every requirement in the Part I Development Specification (including approved ECP's) has been properly accounted for (and is traceable) in the design.

b. Ensure that the design is valid (complete, consistent, feasible, maintainable, and testable).

c. Require the contractor to demonstrate that the aggregate design budgets (e.g., storage, timing, accuracy) satisfy the Part I Development Specification, and additionally, do not exceed the limitations of the CPCI's physical and functional environments.

d. Evaluate the adequacy of design tradeoff studies and preliminary performance estimates substantiating basic design approach and algorithm selection. Identify high risk areas, if any, and approach to risk reduction.

e. Ensure adequate interface definition with equipment CI's and other CPCI's, including corresponding test requirements.

f. Ensure Part I Development Specification is adequate and complete. Evaluate any proposed/approved changes to previously authenticated version.

g. Review implementation planning (e.g., required tools and facilities) and test planning for adequacy and completeness.

h. Identify any open issues of a technical or contractual nature, (e.g., any requirements not satisfied) including disposition and/or approach to resolve the issues documented in the PDR minutes).

4.3.2 PDR Post-Review Action

After completion of the PDR, the contractor is responsible for publishing the official (co-signed by customer and contractor) PDR minutes. The minutes should clearly record all agreements and all action items, including suspense dates, and assign specific responsibility to the Procuring Activity and/or the contractor. The Procuring Activity provides formal acknowledgement to the contractor of the accomplishment of the PDR after receipt of the PDR minutes, but should not formally "approve" the preliminary design.

Table 4-3. Summary: Preliminary Design Review (PDR): Acquisition of CPCI's for Airborne Systems

PDR	Purpose	Items to be Reviewed	
		Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)

• The PDR for each CPCI (may be grouped) is held early in the Full Scale Development Phase (between SDR and CDR) when sufficient design analysis has been accomplished to arrive at a computer program architecture and overall modular structure which will provide the basis for detailed design.
• Availability of an authenticated Part I Development Specification is a prerequisite for any CPCI to be PDR'd.
	• Evaluate the basic design approach for completeness, adequacy and compatibility with allocated requirements (Part I Development Specification), e.g.,
	  • Ensure compatibility of the design approach with the Part I Development Specification.
	  • Evaluate the progress, technical adequacy and risk resolution (on a technical, cost, and schedule basis) of the selected design approach.
	  • For each CPCI, establish the existence and compatibility of the physical and functional interfaces between the CPCI, other CPCI's, hardware CI's, and facilities.
	• Review all changes to the System/System Segment specification and Part I Development Specification to ensure that they are properly incorporated in the basic design approach, the draft Part II Product Specification, and test planning.
	• Review status of all negative and provisional entries such as "not applicable" (N/A) or "to be determined" (TBD) in Section 4 of the System/System Segment Specification and Part I Development Specification. Review all positive entries for technical adequacy.
	• Review all detailed functional interfaces, and corresponding test requirements, with hardware CI's and with other CPCI's. Review word lengths, message formats, transfer rates, timing, storage implications, etc. At this time, applicable interfaces between a CPCI and system hardware CI's should be sufficiently defined to permit CPCI design to proceed independently.
	• Review the CPCI interactions with Human Factor requirements. Review all man-machine interfaces for feasibility, adequacy and completeness.
	• Review/evaluate the overall structure of the CPCI for completeness and adequacy, with emphasis on the following:
	  • Allocation of Computer Program Components (CPC's) to the functions (requirements) delineated in the Part I Development Specification and functional flows.
	  • Storage requirements and allocation.
	  • Computer program operating sequences.
	  • Design of the data base.
	• Analyze critical timing requirements of the system as they apply to the CPCI to ensure that the proposed CPCI design approach satisfies the timing requirements. Review execution time estimates for reasonableness and compatibility with timing requirements.
	• Review interface test requirements specified in Section 4 of the development specification for compatibility, currency, technical adequacy, elimination of redundant test. Ensure that all associated test documents reflect these interface requirements.
	• Review test planning documentation to ensure that the test program satisfies the test requirements specified in Section 4 of the System/System Segment Specification and Section 4 of the Part I Development Specification.
	• Ensure that all test planning documentation has been updated to include any new test support requirements.
		• Updated System/System Segment Specification (if necessary).
		• Final Part I Development Specification for each CPCI.
		• Partial Part II Product Specification for each CPCI missing only the detailed component level flow charts; "build to" flows will be in CDR draft, "as built" flows will be in final version prior to PCA.
		• Preliminary Qualification (Acceptance) Test Plan for each CPCI.
		• Preliminary Data Base Document for each CPCI.
			• CPCI functional flows to the level of flow charting that identifies allocation of Part I Development Specification requirements to individual Computer Program Components (CPC's) and depicts the sequence of operations within the CPCI and within a computer program component at least to a Part I processing requirement level.
			• Storage allocation charts detailed for each CPCI as a whole, describing the allocation of available storage to individual Computer Program Components (CPC's). Identification of timing requirements, sequencing requirements, and relevant equipment constraints used in determining the allocation should be provided.
			• Sizing and timing estimates and budgets.
			• Description of CPCI control functions including the executive control and start/recovery features for the computer program system, method of initiating system operation, and features that permit recovery from system malfunction.
			• Description of the overall hierarchial structure of each CPCI and the rationale for the indicated functional decomposition into components, routines, etc.
			• Description of the data base structure/organization to a level that identifies data types and characteristics, structure layout, and allocation of data storage
			• Design trade-off studies, e.g., synchronous, asynchronous, or hybrid executive; algorithm alternatives; etc.
			• Preliminary performance estimates.
			• Interface definition between the CPCI, hardware CI's and other CPCI's.
			• Identification of unique security requirements, if any, and a description of the techniques to be used for satisfying them.
			• Identification of any reentrancy requirements and a description of the technique for implementing and testing reentrant routines.
			• Description of the availability, adequacy, and planned utilization of tools and facilities for CPCI development, including System/CPCI exercising.
			• Description of any special simulation, data reduction, or utility tools that are not deliverable under terms of contract, but which are planned for use during program development.
			• Status of all ECP's and DPR's against each CPCI.

*The two elements that distinguish "formal baselines" from "intermediate milestones" are that (1) formal baselines involve formal customer approval of configuration documentation (specifications), and (2) approved specifications are put under formal configuration control.

Formal Baseline* Established:	Intermediate Milestone:
N/A	Preliminary Design Approach

4.4 *CRITICAL DESIGN REVIEW (CDR)*

The Critical Design Review (CDR) is a formal review conducted on each computer program component (CPC) of the CPCI before translating the engineering language, logic, and algorithms to coded instructions. The CDR ensures that the detailed design solution and associated implementation plans and qualification/acceptance test planning satisfies the requirements of the Part I Development Specification and establishes the detailed design basis for the CPCI.

If top-down development is specified, where upper levels of the CPCI hierarchy are designed/developed before lower levels, a series of progressive (incremental) CDR's is required. For large, complex CPCI's, regardless of development methodology, incremental CDR's are a common practice to review logical groupings of CPC'S. Table 4-4 provides a summary of CDR.

4.4.1 Leverage Issues

The key decision at CDR for a CPCI is whether or not the contractor's detailed design baseline and associated implementation and test planning provide an adequate basis to proceed to coding and testing the CPCI. The Procuring Activity should:

a. Require that the contractor demonstrate that every requirement (Part I Development Specification) has been properly accounted for, and is traceable to, the detailed design.

b. Ensure that the detailed design is valid (complete, consistent, feasible, maintainable, and testable).

c. Ensure that the detailed design and critical parameter budgets (e.g., storage, timing, accuracy) for the CPCI's do not collectively exceed the limits given in the Part I Development Specification, and additionally, do not exceed the limitations of the CPCI physical and functional environments.

d. Evaluate the design evaluation and tradeoff studies and performance estimates substantiating the detailed design.

Table 4-4. Summary: Critical Design Review (CDR); Acquisition of CPCI's for Airborne Systems

CDR	Purpose	Items to Be Reviewed	
		Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)

• Conducted between PDR and FCA when detailed design is complete for the CPCI (selected components if incremental CDR's are scheduled).
• *Draft Part II Product* Specification (excluding code listings) is available if single CDR for total CPCI.
• Appropriate portions of Part II Product Specification are available if review is scheduled as an incremental CDR. In this case complete draft Part II Product Specification (excluding code listings) available at final CDR.
	• Review/evaluation of CPCI (or selected components for incremental CDR's) detailed design for adequacy and completeness.
	  • Establish compatibility of the design with the Part I Development Specification (including all approved ECP's).
	  • Establish system compatibility of design and review all interfaces between CPCI's and between CPC's within a CPCI.
	  • Analyze interactions with data base.
	  • Establish design integrity by review of available test and analytical data in the form of logic diagrams, scientific simulation results, algorithms, storage allocation charts, detailed flow charts, etc.
	  • Review interfaces between CPCI and applicable hardware CI's to ensure that changes since PDR have not affected compatibility.
	  • Review updating changes to the system and development specifications subsequent to the PDR, to determine whether the draft product specification adequately reflects these changes.
	  • Review all available test documentation for currency, technical adequacy, and compatibility with Section 4 of the system and development specification requirements.
	  • Ensure that plans are initiated for reallocation of specific CPCI functions to different CPC's, when such reallocation is made necessary by actions occurring prior to or during CDR.
	• Formal identification of specific computer programming ("build to") documentation which will be released for coding and testing.
	• Approval of Qualification (Acceptance) Test Plan provides a controlled definition of the project's acceptance test program.
	• Review/evaluate plans for supporting (maintaining) CPCI's including all necessary hardware, support software and documentation.
		• Part I Development Specification including all approved ECP's.
		• Preliminary Part II Product Specification (excluding code listings).
		  • If an incremental CDR, only components under review would be included.
		  • May include "prototype" code for critical items
		• Final Qualification (Acceptance) Test Plan
		• Preliminary Test Procedures (optional)
		• Updated Data Base Document
		• Preliminary Computer Programming Manual
		• Preliminary Operator's (User's) Manual
		• PDR Minutes
			• Updated systems engineering or design analyses/studies, e.g., sizing/timing analyses, performance studies, accuracy analyses, algorithm tradeoffs, scientific/environment simulation results, etc.
			• Applicable configuration management records related to approved changes (ECP's) to the Part I Development Specification.
			• Design Problem Reports (DPR's)
			• Status of all ECP's and DPR's (approved, outstanding, rejected).
			• Planning data for supporting (maintaining) CPCI post-deployment.
			• Development Test Plan

*The two elements that distiguish "formal baselines" from "intermediate milestones" are that (1) formal baselines involve formal customer approval of configuration documentation (specifications), and (2) approved specifications are put under formal configuration control.

Formal*Baseline Established:	Intermediate Milestone:
N/A	Detailed Design

e. Review current, detailed implementation planning and qualification/acceptance test planning for adequacy and completeness. Approval of the Qualification (Acceptance) Test Plan provides a controlled definition of the project's acceptance test program.

f. Identify and discuss any critical issues, e.g., any requirements not satisfied, and provide a resolution of the issues.

g. Identify specific computer programming ("build to") documentation which will be released for coding and testing.

4.4.2 CDR Post-Review Action

After completion of the CDR, the contractor is responsible for publishing and distributing the official (co-signed by customer and contractor) CDR minutes. The minutes should clearly record the disposition of all critical issues, other agreements and all action items, including suspense dates, and assign specific responsibility to the Procuring Activity and/or the contractor. The Procuring Activity provides formal acknowledgement to the contractor of the accomplishment of the CDR after receipt of the CDR minutes, but should not formally "approve" the design.

4.5 TEST READINESS REVIEW (TRR)

The Test Readiness Review is an informal review and is not required by MIL-STD-1521A (USAF). The TRR is a commonly used internal review by the development contractor to review development test results and evaluate preparations for qualification testing, including the CPCI configuration control approach/procedures, prior to commencing qualification/acceptance testing. Customer attendance is optional, but as a minimum the procuring activity should be apprised of the results of the internal review. Table 4-5 provides a summary of the TRR.

Many CPCI development contractors establish an Internal Review Board (IRB), at the outset of a CPCI development, composed of appropriate senior personnel not otherwise involved in the project activity. This group conducts the TRR, dry runs the formal reviews and audits, and schedules other internal technical reviews at significant milestones (e.g., review PQT results) intermediate to baselines, at the discretion of the IRB chairman. A contractor project office representative may serve as IRB Secretary.

Table 4-5. Summary: Test Readiness Review (TRR); Acquisition of CPCI's for Airborne Systems

TRR*	Purpose	Item to Be Reviewed	
		Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)

• Conducted between CDR and FCA, when development testing accomplished; before commencing qualification/acceptance testing.	• Review/evaluate, for adequacy and completeness, the testing accomplished and planning qualification/acceptance testing against the requirements of the CPCI Part I Development Specification.
	• Evaluate the preparedness to commence qualification/acceptance testing.
	  • Realistic schedules and necessary tools, facilities, and personnel available.
	  • Adequate configuration control approach and procedures.
		• Authenticated System/System Segment Specification and CPCI Part I Specification.
		• Development Test Plan/Procedures/Results
		• Qual (Acceptance) Test Plan/Test Procedures
			• Results and findings of development testing, including:
			  • Any problems uncovered and proposed solutions.
			  • Modifications to Development Test Plan that were necessary.
			  • Modifications to CPCI design that were necessary.
			o Traceability of performance requirements and quality assurance requirements (Sections 3 and 4, respectively, of CPCI Part I Development Specification) to development testing accomplished and planned qualification/acceptance testing.
			• Availability of required tools, facilities and personnel.
			• Approach/procedures for configuration control:
			  • Informal (internal).
			  • Formal.

*The Test Readiness Review (TRR) is a CPCI development contractor internal review (customer attendance optional).

**The two elements that distinguish "formal baselines" from "intermediate milestones" are: (1) Formal baselines involve formal customer approval of configuration documentation (Specifications), and (2) Approved Specifications are put under formal configuration control.

Format Baseline** Established:	Intermediate Milestone:
N/A	CPCI Code Under Internal Configuration Control

4.5.1 Leverage Issues

The key decision at the TRR for a CPCI is whether or not project preparations to commence qualification/acceptance testing are adequate. The Internal Review Board (IRB)

a. Ensures the adequacy, traceability and completeness of accomplished development testing and planned qualification/acceptance testing against the requirements of the Part I Development Specification.

b. Evaluates the preparations for qualification/acceptance testing (procedures, tools/facilities, personnel, CPCI configuration control approach/procedures, etc.).

4.5.2 TRR Post-Review Action

After completion of the TRR, minutes are prepared, signed by the IRB chairman and distributed to project personnel and top management. The minutes should clearly record all action items, assignment and suspense dates, and the board's recommendations.

4.6 FUNCTIONAL CONFIGURATION AUDIT (FCA)

The Functional Configuration Audit (FCA) verifies the CPCI's actual (test) performance compliance with the Part I Development Specification requirements. Test data are reviewed to verify that the CPCI met all of the requirements associated with its Allocated Baseline. For CPCI's developed at government expense, a satisfactory FCA is a prerequisite to CPCI acceptance. The FCA for a complex CPCI may be conducted on a progressive basis, when so specified by the Procuring Activity, throughout the CPCI development and culminates at the completion of qualification testing of the CPCI with a review of all discrepancies at the final FCA. For CPCI's that can be validated only through integrated systems testing, the FCA cannot be completed until such testing has been completed and audited. This usually implies a separate Formal Qualification Review (FQR) (see subsection 4.8). Table 4-6 provides a summary of the FCA.

Table 4-6. Summary: Functional Configuration Audit (FCA); Acquisition of CPCI's for Airborne Systems

FCA	Purpose	Items to Be Reviewed	
		Formal Documentation	*Other Technical/Management Data* (Contractor Presentations, Internal Reports, etc.)
• Conducted after CDR and prior to PCA when sufficient qualification/acceptance testing has been performed to verify all of the Part I Development Specification Requirements. • May be conducted on a progressive (incremental) basis if so designated by the Procuring Activity. • For situations where CPCI qualification can only be determined through integrated systems testing, FCA's for such CPCI's will not be considered complete until satisfactory completion/audit of such testing. This normally requires a separate FQR post-PCA. • Authentication by the Procuring Activity of the Functional and/or Allocated Baselines is a prerequisite to FCA.	• Verify that the CPCI actual (test) performance complies with the Part I Development Specification requirements. As a minimum: • Examine test procedures and test results for compliance with the Part I Development Specification. Testing must verify that data, procedures, and results are sufficient to ensure CPCI performance to Section 3 and that quality assurance provisions in Section 4 are met. • Determine adequacy of analysis or simulation *results where performance parameters* cannot completely be verified by test. • Evaluate the contractor's proposed solution for any requirements stated in the Part I Development Specification that could not be met. • Examine the Qualification (Acceptance) test plans/procedures for comparison against the official test data. Results are checked for completeness, accuracy, etc. Deficiencies are documented and completion dates of corrective actions established and documented (FCA Minutes). • Review interface requirements and testing against the requirements. • Examine and evaluate all approved ECP's to ensure that they were incorporated and verified during qualification/acceptance testing. • Examine the qualification/acceptance test report to verify it is an accurate and complete description of the qualification/acceptance testing. • Examine PDR and CDR minutes to assure that all findings have been incorporated and completed.	• Authenticated System/System Segment Specification and Part I Development Specification. • Draft CPCI Part II Product Specification (Complete) • CPCI Test Plan, Test Procedures, and Test Results. • PDR and CDR Minutes.	• CPCI configuration management status accounting records. • Briefing for each CPCI being FCA's delineating the test results and findings for each CPCI. As a minimum, the discussion shall include: • Requirements of the Part I Development that contractor was not able to meet (if any) including a proposed solution for each item. • An account of the ECP's incorporated and tested as well as proposed. • General presentation of the CPCI development test effort delineating problem areas as well as accomplishments. • A complete list of successfully accomplished functional tests during which pre-acceptance data was recorded. • A complete list of successful functional tests if detailed test data are not recorded. • A complete list of functional tests required by the Part I Development Specification but not yet performed(to be performed during integrated system testing). • Identification of any performance parameters that cannot be completely verified during testing and demonstrated adequacy of analysis or simulation results to satisfy these requirements.

*The two elements that distinguish "formal baselines" from "intermediate milestones" are that (1) formal baselines involve formal customer approval of configuration documentation (specifications), and (2) approved specifications are put under formal configuration control

Formal Baseline * Established:	Intermediate Milestone:
N/A	Qualified CPCI

4.6.1 Leverage Issues

The key decision associated with FCA is whether or not the ensemble of CPCI testing satisfies all requirements of the Part I Development Specification (see Table 4-6 for details).

4.6.2 FCA Data Packages

The contractor provides two FCA data packages to the customer:

1. data items to be delivered 20 days or some negotiated lead time prior to FCA; i.e.,
    - a list of contractor representatives, including the test manager or equivalent; and
    - identification of the CPCI to be audited, including
        - nomenclature (name or descriptive title of the CPCI,
        - specification identification number and the CDRL identifier of the document, and
        - CPCI identifier;
2. documentation and data to be provided and made available to the customer at the FCA (Table 4-6, "Items to be Reviewed").

4.6.3 FCA Post-Audit Action

After completion of the FCA, the contractor is responsible for publishing and distributing the official (co-signed by customer and contractor) FCA minutes. The minutes should clearly record all results and findings, including a discussion of all deficiencies. The Procuring Activity provides formal acknowledgement to the contractor of the accomplishment of the FCA after receipt of the FCA minutes.

4.7 PHYSICAL CONFIGURATION AUDIT (PCA)

The PCA is a formal examination of the coded version of a CPCI against its technical documentation and of the configuration management records pertinent to the CPCI in order to establish the Product Baseline.

The PCA cannot be conducted unless the customer has the final draft of the Part II Product Specification (nominally at least 30 days prior to PCA). After successful completion of the PCA and formal customer approval of the Product Specification, all subsequent changes are processed by ECP. Table 4-7 provides a summary of the PCA.

4.7.1 Leverage Issues

The key decision at the PCA is whether to approve the Part II Product Specification establishing the CPCI product baseline, thus formally "accepting" the CPCI. The procuring activity should

a. Conduct a detailed audit of the Part II Product Specification, including its flow charts, listings, and design narrative. Also review, for format and completeness, the Operator's (User's) Manual, Computer Programming Manual and any other manuals and handbooks specified in the contract; these manuals and handbooks are reviewed and analyzed for final approval after integrated systems test has verified that procedures are accurate.

b. Review configuration management status accounting records related to the CPCI to ensure that all approved changes are incorporated and that unapproved changes are not incorporated, but properly logged.

c. Evaluate all CPCI configuration differences between FCA and PCA to ensure CPCI functional characteristics are not degraded.

Satisfactory completion of the PCA and formal approval (DD Form 250 or equivalent) of the CPCI Part II Product Specification establishes the CPCI Product Baseline.

4.7.2 PCA Data Packages

The contractor provides three PCA data packages to the customer:

1. Final draft Part II Product Specification for the CPCI to by PCA'd nominally at least 30 days prior to the PCA;

2. Data items to be delivered 20 days or some negotiated lead time prior to PCA:

   - PCA date and location
   - agenda

Table 4-7. Summary: Physical Configuration Audit (PCA); Acquisition of CPCI's For Airborne Systems

PCA	Purpose	Items to Be Reviewed	
		Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)

• Conducted between FCA and FQR (when separate FQR is required) when all required audit data is available and (nominally) at least 30 days after submittal of the draft Final Part II Product Specification to the Procuring Activity.	• Formal examination of coded ("as build") version of the CPCI against its technical documentation and of the configuration management records pertinent to the CPCI to establish the Product Baseline.
	  • Review Part II Product Specification for format and completeness.
	  • Review FCA minutes for recorded discrepancies that require action.
	  • Review Computer Program Component (CPC) description and flow charts.
	  • Review CPC Interface requirements.
	  • Review data base characteristics, storage allocation charts, and timing and sequencing characteristics.
	  • Review flow charts for proper entries, symbols, and label tags.
	  • Review acceptance test procedures/results for compliance with Part II Product Specification.
	  • Compare top level CPCI flow charts with CPC flow charts.
	  • Compare detailed CPC flow charts with coded program (listings) for accuracy and completeness. Comparison may be performed using a sampling rather than exhaustive techniques. The sampling rate should be adjusted based upon observed compatibility.
	  • Check Computer Programming Manual, Operator's (User's) Manual, and Version Description Document for format, completeness and conformance with applicable data items. (Formal verification/acceptance of these handbooks/manuals should be withheld until system testing to ensure that the procedural contents are correct).
	  • Cross-check current (code) listing with the listing in the Part II Product Specification. The listing may be corss-checked using a sampling rather than an exhaustive technique. The sampling rate should be adjusted according to the observed compatibility.
	  • Examine actual CPCI (card decks, tapes, etc.) for conformance with Section 5 of the Part II Product Specification
	• Evaluate all CPCI configuration differences between FCA and PCA versions to ensure CPCI functional characteristics are not degraded. (PCA Minutes).
	• Audit the contractor's engineering release and change control system to ensure that it is adequate to properly control the processing and formal release of engineering changes. As a minimum, assure the capability to accomplish:
	  • Identification of changes and retaining records of superseded configuration formally accepted by the Processing Activity.
	  • Identification and accountability of all Class I and II engineering changes released for incorporation. These changes should be completely released and incorporated prior to formal acceptance of the CPCI.
	  • Determination of the configuration release for each CPCI at the time for formal acceptance.
	  • Processing and release of engineering data through a central authority to ensure coordinated action and preclude unilateral release of data.
	• Satisfactory completion of the PCA and formal approval by the Procuring Activity of the CPCI Part II Product Specification establishs the CPCI Product Baseline.
	• Accepted CPCI's are delivered in accordance with contract requirements.
		• Authenticated CPCI Part I Development Specification.
		• Draft Final CPCI Part II Product Specification.
		• CPCI Test Plans, Test Procedures, and Test Reports.
		• Draft Final Operator's (User's) Manual.
		• Draft Final Computer Programming Manual.
		• Version Description Document (VDD).
		• FCA Minutes.
		• Prepared DD Form 250 or equivalent.
			• List of all deviations/waivers against the CPCI, either approved, or outstanding awaiting approval by the Procuring Activity.
			• List delineating both approved and outstanding changes (ECP's) against the CPCI.
			• List of all required changes not yet completed.
			• List of all changes actually made during test.
			• CPCI configuration management status accounting records.
			• CPCI master tape and current listings and flow charts.
			• Description of contractor's engineering release and configuration control system.

*The two elements that distinguish "formal baselines from a "intermediate milestones" are that (1) formal baselines involve formal customer approval of configuration documentation (specification), and (2) approved specifications are put under formal configuration control.

Formal Baseline*Established:	Intermediate Milestone:
Product Baseline	N/A

- list of contractor representatives, including the test manager or equivalent
- identification of CPCI to be audited/accepted:
  - nomenclature (name or descriptive title of the CPCI)
  - specification identification number and the CDRL identifier of the document
  - CPCI identifier
  - CPC, module and/or routine identifiers
- list of all deviations/waivers against the CPCI, either requested or Procuring Activity approved; and

3. documentation and data to be provided and made available at the PCA (Table 4-7, "Items to be Reviewed").

4.7.3 PCA Post-Audit Action

After completion of the PCA, the contractor is responsible for publishing and distributing the official (co-signed by customer and contractor) PCA minutes. The minutes should clearly record all results and findings, including a tabulation/discussion of all deficiencies; action item assignments should address all deficiencies (e.g., make corrections, prepare/execute waivers, etc.). The Procuring Activity provides formal acknowledgement to the contractor that PCA took place after receipt of the PCA minutes.

Procuring Activity acceptance or rejection of the CPCI and the CPCI Part II Product Specification must be furnished to the contractor in writing by the responsible contract management agency or other designated agency after completion of PCA.

4.8 FORMAL QUALIFICATION REVIEW (FQR)

When feasible, the FQR is combined with the FCA. For situations in which the CPCI Part I Development Specification requirements cannot totally be verified by the testing accomplished at FCA (e.g., CPCI qualification dependent on integrated system testing), a separate FQR should be conducted post-PCA, when the necessary tests have been satisfactorily completed, to enable CPCI certification. Table 4-8 provides a summary of the FQR.

Table 4-8. Summary: Formal Qualification Review (FQR); Acquisition of CPCI's for Airborne Systems

FQR	Purpose	Items to be Reviewed	
		Formal Documentation	Other Technical/Management Data (Contractor Presentations, Internal Reports, etc.)

• When feasible, the FQR is combined with the FCA.
• For situations in which the Part I Development Specification requirements cannot totally be verified by the testing evaluated at FCA (e.g., CPCI qualification dependent on integrated system testing), a separate FQR will be conducted post-PCA, when the necessary tests have been satisfactorily completed, to enable CPCI certification.
	• Same as FCA, but for FQR separate from FCA, the following must be accomplished:
	  • Review FCA minutes to ensure that all findings have been incorporated and completed; the FQR is considered an extension of the FCA.
	  • Review and evaluate additional qualification/acceptance test data, together with the FCA findings, to ensure qualification of the CPCI against the total set of requirements in the CPCI Part I Development Specification.
		• Same as FCA, plus:
		  • Additional test results
		  • FCA minutes.
			• Same as FCA.

*The two elements that distinguish "formal baselines" from "intermediate milestones" are that (1) formal baselines involve formal customer approval of configuration documentation (specifications), and (2) approved specifications are put under formal configuration control.

Formal Baseline* Established:	Intermediate Milestone:
N/A	Qualified CPCI

4.8.1 Leverage Issues

The key decision associated with the FQR for a CPCI, assuming a separate FQR is required, is whether or not the combination of the qualification/acceptance testing audited at FCA and the post-FCA testing satisfies all requirements of the Part I Development Specification. The Procuring Activity should

a. review FCA minutes to ensure that all findings have been incorporated and completed (the FQR is considered an extension of the FCA); and

b. review and evaluate additional qualification/acceptance testing data acquired post-FCA. (This additional data and the FCA findings should verify that the CPCI satisfies all of the requirements in the CPCI Part I Development Specification).

4.8.2 FQR Data Packages

These are the same as the data packages for FCA, plus:

- additional test results, and
- FCA minutes.

4.8.3 FQR Post-Audit Action

The required post-audit activities are identical to those required for the FCA.

APPENDIX

REVIEWS AND AUDITS GUIDEBOOK
BIBLIOGRAPHY OF GOVERNMENT DOCUMENTS

Designator	Version Date	Title
DODD 5000.19	6/02/71	Policies for the Management and Control of DoD Information Requirements
DODD 5000.29	4/26/76	Management of Computer Resources in Major Defense Programs
DODD 5010.28	10/02/72	Department of Defense Management Review and Improvement Program
DODI 4105.64	8/05/70	Technical Representation at Contractor Facilities
AFR 173-1	6/29/73	Management of the Cost Analysis Program
AFR 174-2	5/17/68	Follow-Up on Internal Reports of Audit (AFSC Supplement 11/27/72 and ESC Supplement 6/15/72)
AFR 175-4	11/14/72	Auditing in the Air Force
AFR 800-5	7/27/73	Selected Acquisition Reports (SARs)
AFR 800-14 Volume I	5/10/74	Management of Computer Resources in Systems (AFSC Supplement 9/25/74)
AFR 800-14 Volume II	9/26/75	Acquisition and Support of Computer Resources in Systems
AFP 70-14	3/01/74	PIECOST (Probability of Incurring Estimated Cost)
AFM 175-118	5/17/74	Air Force Audit/Management System
AFSCR 70-12	11/29/74	AFSC Procurement Summary Report
AFSCR 800-1	4/24/74	Command Review of Systems Acquisition Programs and Test Resources
AFSCR 800-18	9/20/74	Joint Operational and Technical Review (JOTR)

Designator	Version Date	Title
AFSCP 800-3	4/09/76	A Guide for Program Management
ESDR 27-4	5/10/73	Documentation for System Program Reviews
MIL-S-52779(AD)	4/05/74	Software Quality Assurance Program Requirements
MIL-STD-480	10/31/68	Configuration Control-Engineering changes, Deviations and Waivers
MIL-STD-481A		Configuration Control - Engineering Changes, Deviations, and Waivers (Short Form)
MIL-STD-483 (USAF)	6/01/71	Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs
MIL-STD-490	10/30/68	Specification Practices
MIL-STD-499A (USAF)	5/01/74	Engineering Management
MIL-STD-1521A (USAF)	6/01/76	Technical Reviews and Audits for Systems, Equipment, and Computer Programs
MIL-STD-1602	6/08/73	Requirements for Progress Reports for R&D Equipment