DOCUMENT NUMBER VOY-CO-FR 28 JULY 1967

VOLUME 5 DATA MANAGEMENT STUDY

APPENDIX G CONTRACTOR DATA PACKAGE RELIABILI TY ASSURANCE (RA)

PREPARED BY:

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J.B. SILVERWOOD K.R. THOMAS

RELIABILITY ASSURANCE MANAGEMENT Voyager Spacecraft System Project APPROVED BY:

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A. FRANK, COGNIZANT ENGINEER DATA MANAGEMENT AND CONTROL TASK

VOYAGER SPACECRAFT SYSTEM PROJECT

PREPARED FOR

JET PROPULSION LABORATORY CALIFORNIA INSTITUTE OF TECHNOLOGY 4800 Oak GROVE DRIVE Pasadena California

UNDER JPL CONTRACT No. 951112



Valley Forge Space Technology Center P. O. Box 8555 • Philadelphia, Penna. 19101

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IN TRODUCTION

This appendix presents the Contractor Data Package (Data Item Matrix, Data Requirement Descriptions, User Flow Diagram, Document Relationship Tree, and Frequency and Phasing Charts) for Reliability Assurance (RA).

These data include plans, procedures, reports, and related information necessary to ensure that a system, subsystem, component, or part will perform its required functions under defined conditions at a designated time and for a specified operative period. This category also includes reliability assessment of test results and tests of a statistical sampling nature.

The complete list of Contractor Data Package appendixes is as follows:

Appendix A	-	Technical Description and System Engineering (SE)
Appendix B	-	Planetary Quarantine (PQ)
Appendix C	-	Manufacturing (MG)
Appendix D	-	Configuration Management (CM)
Appendix E	-	Quality Assurance (QA)
Appendix F	-	Test (TE) and Mission Operations (MP)
Appendix G	-	Reliability Assurance (RA)
Appendix H	-	Logistics and Support (LS)
Appendix I	-	Overall Management (MA), Scheduling (SC), and Manning
		and Financial (MF)
Appendix J	-	Procurement and Contracting (PC)
Appendix J Appendix K	-	Procurement and Contracting (PC) Data Management (DM)
	- -	
Appendix K	- - -	Data Management (DM)
Appendix K Appendix L*	- - - -	Data Management (DM) Facilities (FA)
Appendix K Appendix L* Appendix M*		Data Management (DM) Facilities (FA) Safety (SA)
Appendix K Appendix L* Appendix M* Appendix N*		Data Management (DM) Facilities (FA) Safety (SA) Site Activation for Launch (AL)
Appendix K Appendix L* Appendix M* Appendix N* Appendix O*		Data Management (DM) Facilities (FA) Safety (SA) Site Activation for Launch (AL) Science (SI)

* Appendixes L through Q prepared under Contract NAS 7-584

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,	1 of 3	
DATA ITEM	DATA ITEM	DESCRIPTION
NUMBER	RELIABILITY ASSURANCE	
·		
	DIRECTIVES	
·	DIRECTIVES	
RA-		Formal means of communicating to cognizant groups
001	*Reliability Action Directives	uals regarding required actions to be performed in cc with reliability actions or tasks.
		with remanify actions or tasks.
	LISTS	
RA-	List, Critical and Limited Life	Provides identification and description of critical and life items as proposed for use, serves as a design gu
002	Item	selection, test, etc.
RA-		Provides a common reference for established failure
RA- 003	List, Failure Rate Data	both component or piece part level, used to dissemina
		rate data to design and analysis groups.
RA- 004	List, Flight Critical Processes and Practices	Provides identification of flight critical processes and as a basis for reliability assurance, audits, and appri
RA-	The Amplitudian Data	Provides application data for parts contained on appro
005	List, Parts Application Data	lists, serves as a design guide in selection of items.
	LOGS	
RA- 006	Log, Problem/Failure Summary	
		· · · · · · · · · · · · · · · · · · ·
	MINUTES	
RA- 007	*Minutes, Failure Analysis Review Board (FARB)	Reviews, monitors, and determines the status of the s causes of discrepancies and the required corrective a

* KEY INFORMAL DATA

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DATA ITEM LIST/USER MATRIX

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limited																
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practices uisals.	U	U	U	I	U	U	A	-	U	-	U	1	R	-	-	U
ved parts	A	U	U	U	U	U	R	U	-	-	-	-		-	-	-
	U	U	U	-	U	U	A	U	U	-	-	-	-	-	-	-
pecific tion.	U	U	U	-	U	U	A	U	U	-	-	-	U	-	-	U

U - USE R - REVIEW AUTHORITY

A - APPROVAL AUTHORITY

PM - PROJECT MANAGER APPROVAL

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PAGE NO. 1 of 3

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									APPLICABILITY TO PROJECT BOARDS												
AL	SI	RP	Ам	PRINCIPAL SUB- CONTRACTORS	MAJOR SUB- CONTRACTORS	KEY SUBCON AND VENDORS	OTHER VENDORS	KEY SUPPLIERS	KEY SUBSUPPLIERS	CONFIGURATION CONTROL	CONFIGURATION MANAGEMENT	DATA REVIEW	DESIGN REVIEW	FAILURE REVIEW	INTEGRATED SAFETY	INTEGRATED TEST	MAKE OR BUY	MATERIAL REVIEW	SOURCE EVALUATION	SOURCE SELECTION	
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-	U	-	-	NA	NA	NA	NA.	NA	NA	-	-	-	-	Α	-	U	-	U	-	-	

DATA ITEM	2 of 3 DATA ITEM	DESCRIPTION
NUMBER	RELIABILITY ASSURANCE	
	PLANS	
RA- 008	Plan, Reliability Assessment	
RA- 009	Plan, Reliability Program	Provides a totally integrated definition of the reliab requirements and controls to be implemented on bot and day-by-day basis.
R A- 010	Plan, Parts Control Program	
	PROCEDURES	
RA- 011	Procedure, Reliability Operating	
	RECORDS	
RA- 012	Card, Parts Data	
RA- 013	Chart, Reliability Assurance Control	
	REPORTS	
RA- 015	Report, Failure Review	

* KEY INFORMAL DATA

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DATA ITEM LIST/USER MATRIX

	APPLICABILITY TO FUNCTIONAL USERS AT CONTRACTOR LEVEL															
	SE	PQ	MG	см	QA	TE	RA	LS	ма	sc	PC	MF	мр	DM	FA	SA
	R	U	_	-	U	U	R	U	РМ	-	U	-	U	-	-	-
ility program th milestone	R	U	U	-	U	U	R	U	A	U	U	-	U	-	-	-
	R	-	U	-	R	-	R	-	РМ	-	U	-	-	_	-	-
	U	U	U	-	U	υ	A	U	R	-	-	-	U	-	-	U
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	U	- USE	.I R -	REVIEW		RITY	<u>і</u> А-	APPROV	AL AUTH	IORITY	<u>т</u> Р	M - PRO	JECT M	ANAGER	APPROV	м'

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PAGE NO. 2 Of 3

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	APPLICABILITY AT SUBCONTRA TOR/VENDOR/SUPPLIER LEVEL								RAC-		AP	PLIC	ABIL	ITY	TO F	ROJE	ECT E	BOAR	DS	
AL	SI	RP	Ам	PRINCIPAL SUB- CONTRACTORS	CONTRACTORS MAJOR SUB- CONTRACTORS CONTRACTORS KEY SUBCON AND VENDORS OTHER VENDORS KEY SUPPLIERS KEY SUBSUPPLIERS					CONFIGURATION CONTROL	CONFIGURATION MANAGEMENT	DATA REVIEW	DESIGN REVIEW	FAILURE REVIEW	INTEGRATED SAFETY	INTEGRATED TEST	MAKE OR BUY	MATERIAL REVIEW	SOURCE EVALUATION	SOURCE SELECTION
U	-	-	-	(C/S)	(C/S	(C)	NA	NA	NA	-	-		-	-	-	U	-	-	1	-
U	1	1	-	s	S	(S)	NA	(C /S)	NA	1	-	-	U	ł	1	U	-	-	-	-
U	-	-	-	c⁄s	c⁄s	(C/S)	NA	(C/S)	(C/S)	-	-	· _		-	-	-	-	-		-
U	-	-	-	(C/S)	(C/S	(C/S	NA	(C/S)	NA	-	-	-	U	U	-	U	-	-	-	-
-	-	-	-	NA	NA	NA	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-
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-	U	-	-	NA	NA	NA	NA	NA	NA	-	-	-	U	R	-	U	-	-	-	-
																	-			

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DATA ITEM NUMBER	3 of 3 DATA ITEM <u>RELIABILITY ASSURANCE</u>	DESCRIPTION
	REPORTS (Cont'd)	
RA- 016	Report, Summary, Audit and A p praisal	Provides a summary of audit and appraisal activities processes and practices) which could have a detrime reliability aspects of the program.
RA- 017	Report, Design Review	
RA- 018	Report, Reliability Assessment	Provides periodic growth assessment (evaluation) of as a comparison against reliability design goals.
RA- 019	Report, Reliability Program Status	Provides preestablished control points in the program review, hard design review), a complete summary a status.
	STANDARDS_	
RA- 014	Standard, Rework	Provides description of and allowable limits to rewo components, equipment.

* KEY INFORMAL DATA

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. DATA ITEM LIST/USER MATRIX

	APPLICABILITY TO FUNCTIONAL USERS AT CONTRACTOR LEVEL															
	SE	PQ	MG	см	QA	TE	RA	LS	ма	sc	PC	MF	мр	DM	FA	SA
<u> </u>																
(i.e., critical ntal effect on the	U	-	U	-	U	U	R	-	РМ	_	U	-	-	-	-	-
	U	U	U	-	U	U	A	-	U	-	U	-	U	-	-	-
systems reliability	U	_	U	-	U	U	A		U	-	υ	-	-	_	-	-
n (e.g., precontract data ssessment of reliability	U - U - U U R - PM - U -													-	-	-
k of parts,	R	-	U	υ	R	υ	R	R	РМ	-	-	_	_	-	_	U
· · ·															+	
			 						 							
														<u> </u>		
	U - USE R - REVIEW AUTHORITY A - APPROVAL AUTHORITY PM - PROJECT MANAGER APPROVAL $2 - 6 - 1$															

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PAGE NO. 3 of 3

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	APPLICABILITY AT SUBCONTR TOR/VENDOR/SUPPLIER LEVE										AP	PLIC	ABIL	ITY	TO F	ROJE	ECT E	BOAR	DS	
AL	SI	RP	Ам	PRINCIPAL SUB- CONTRACTORS	CONTRACTORS MAJOR SUB- CONTRACTORS KEY SUBCON AND VENDORS OTHER VENDORS KEY SUPPLIERS KEY						CONFIGURATION MANAGEMENT	DATA REVIEW	DESIGN REVIEW	FAILURE REVIEW	INTEGRATED SAFETY	INTEGRATED TEST	MAKE OR BUY	MATERIAL REVIEW	SOURCE EVALUATION	SOURCE SELECTION
										CONFIGURATION										
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This section contains User Flow Diagrams, which include functional tracks for those activities considered to be the major contributors to reliability. The design of these diagrams shows the progressive nature of most reliability functions when the activity continues over an extended period of time or when the documents continually become more complete and complex. Several items are influenced by the various program milestones (e.g., formal design reviews cease when the design is frozen with the HDR, reliability program status reports are periodic entities, and reliability review and approval of engineering documentation or monitoring of manufacturing activities is sporadic in nature). Key interfaces with the functional groups are also shown.

Individual tracks of the major activities are as follows:

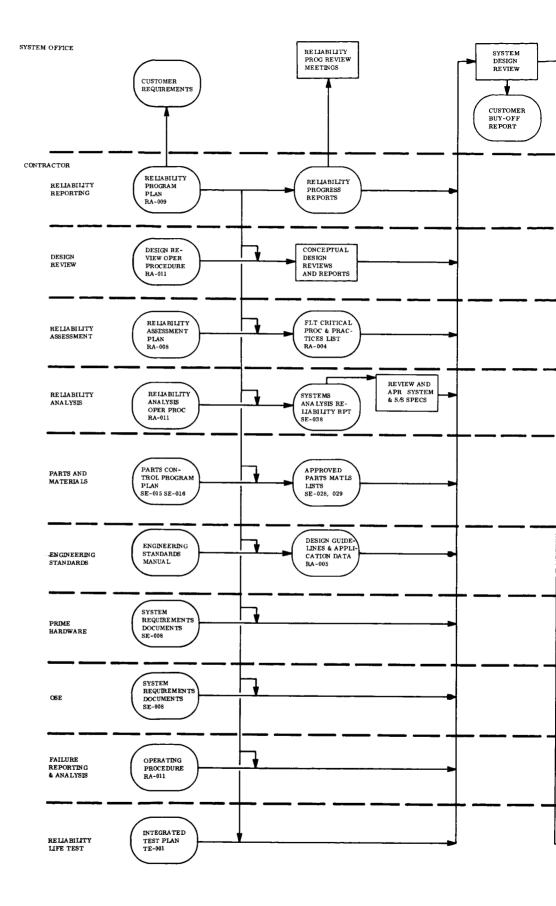
- a. <u>System Office</u> Emphasizes key points of review and control of reliability program.
- b. <u>Reliability Reporting</u> Highlights major reports provided to the customer. These documents accumulate all important reliability data into a few key reports.
- c. <u>Design Review</u> Indicates the period over which contractor design reviews will be held. Beyond the HDR, formal reliability reviews will be ineffective. However, design reviews may be called in case of required critical design changes.
- d. <u>Reliability Assessment</u> Portrays the wide variety of data (reliability analysis reports, performance and failure data, audit and appraisal results, design review results, etc.) which will contribute to the reliability (probability of success) assessment of the system.
- e. <u>Reliability Analysis</u> Illustrates how the initial analysis provides apportioned requirements to the elements of the system and shows how the various data items are used to update the analysis of the inherent reliability of the system. The analysis serves as an input to the reliability assessment until the HDR, when the design is essentially frozen.
- f. <u>Parts and Materials</u> Depicts the growth of activities involved with parts and materials. Quality Assurance is a major contributor to this program due to the extensive test and vendor control requirements. All parts and materials in the final configuration must appear on the Approved Parts and Materials Lists.
- g. <u>Engineering Standards</u> Shows the engineering standards effort which is carried out early in the program, i.e., prior to detailed engineering model design.

3-1

Reliability User Flow Diagrams

Figure Number	Title
G-1	Reliability Assurance User Flow Diagram - Summary
G-2	Reliability Assurance User Flow Diagram - Contract Award Through Preliminary Design Review
G-3	Reliability Assurance User Flow Diagram - Preliminary Design Review Through Critical Design Review
G-4	Reliability Assurance User Flow Diagram - Critical Design Review Through Joint Flight Acceptance Composite Test

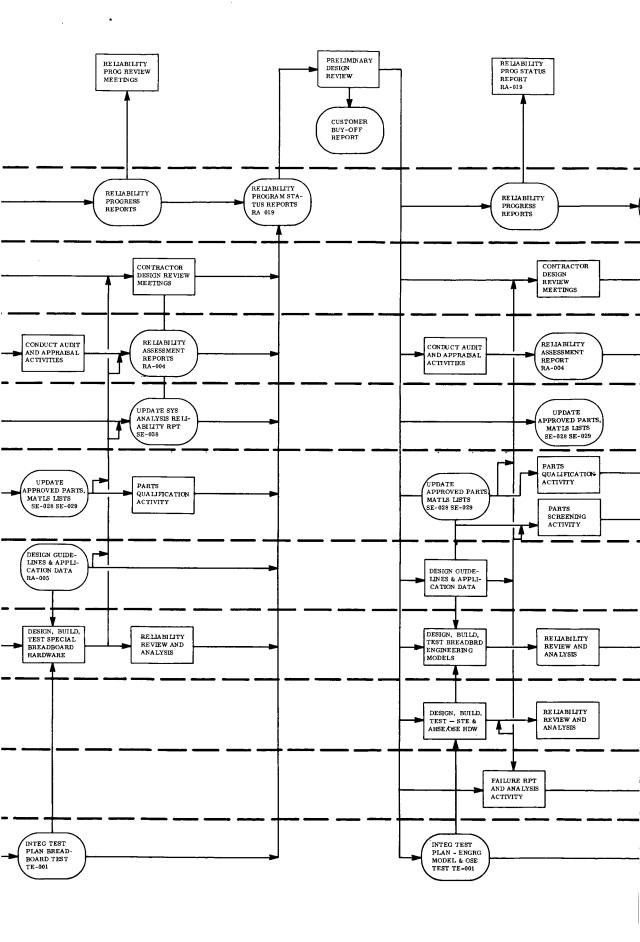
3-3/4

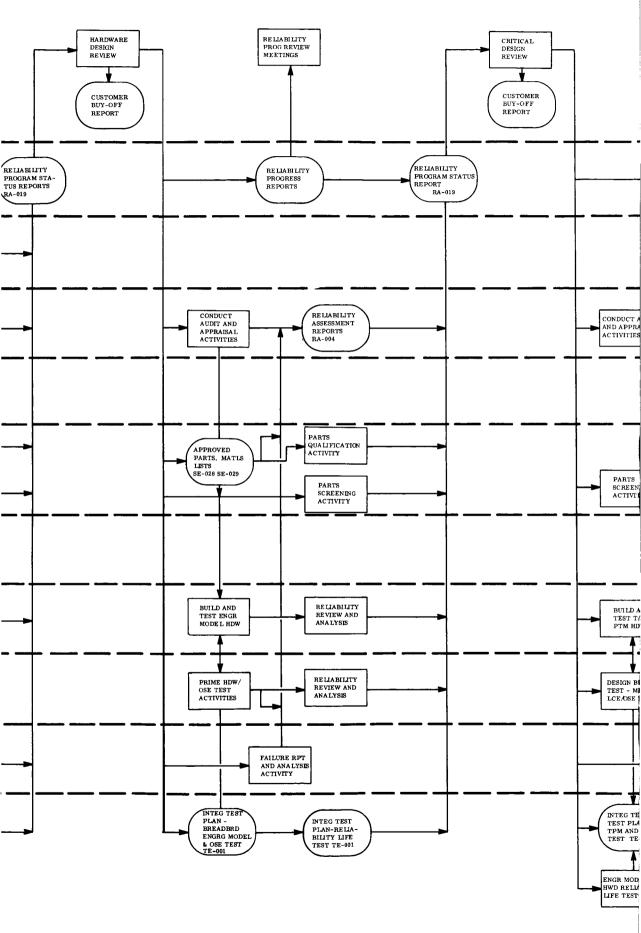


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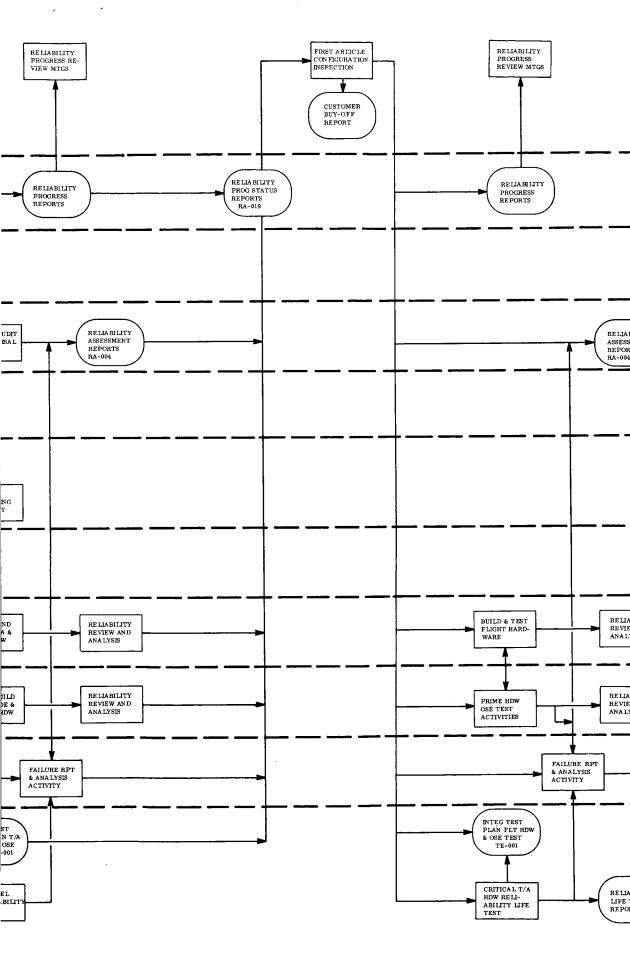
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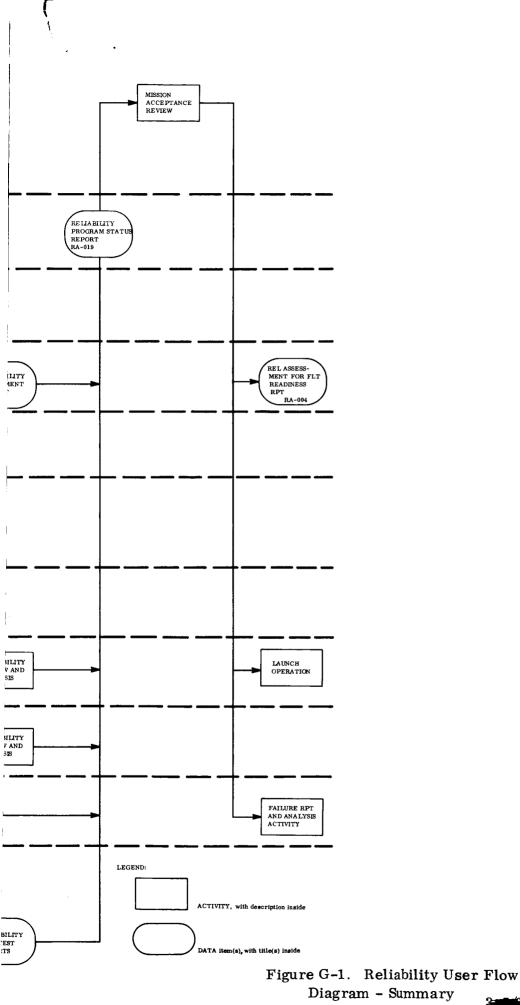




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3-6-3



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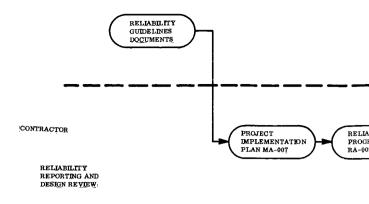
3-6-4

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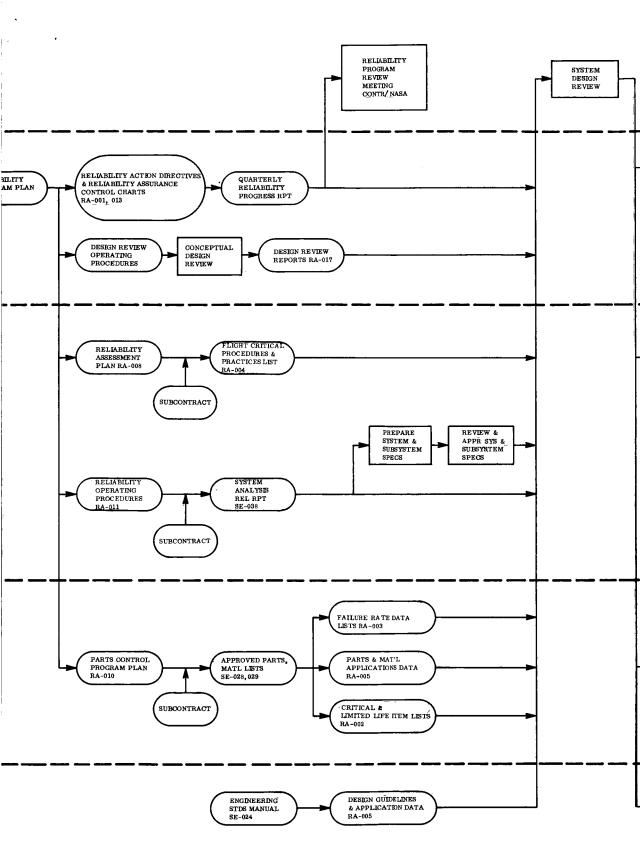
SYSTEM OFFICE

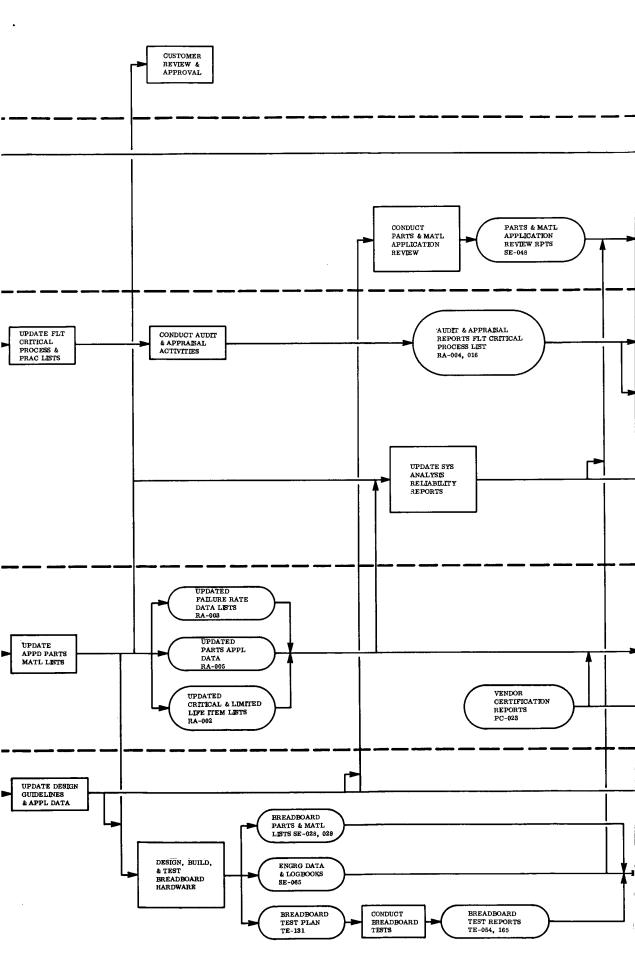


RELIABILITY ASSESSMENT AND ANALYSIS

PARTS & MATERIAL

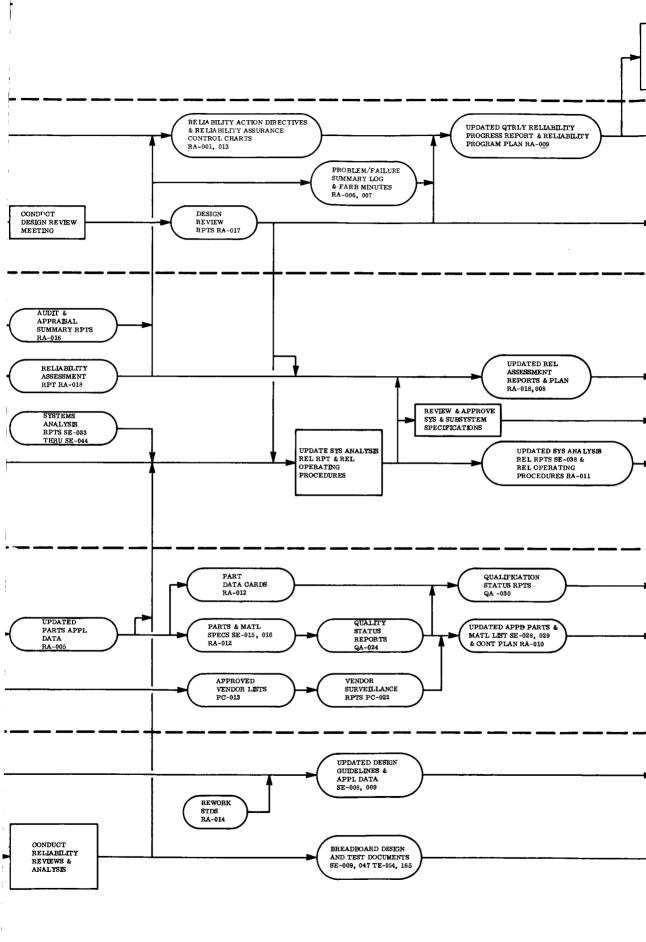
ENGINEERING STANDARDS AND HARDWARE (INCLUDING OSE)



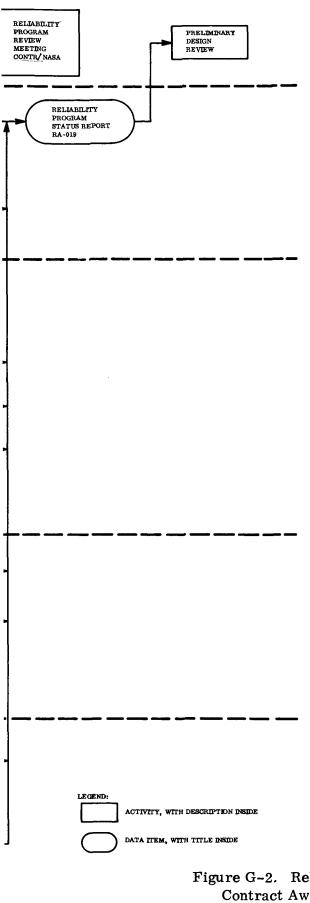


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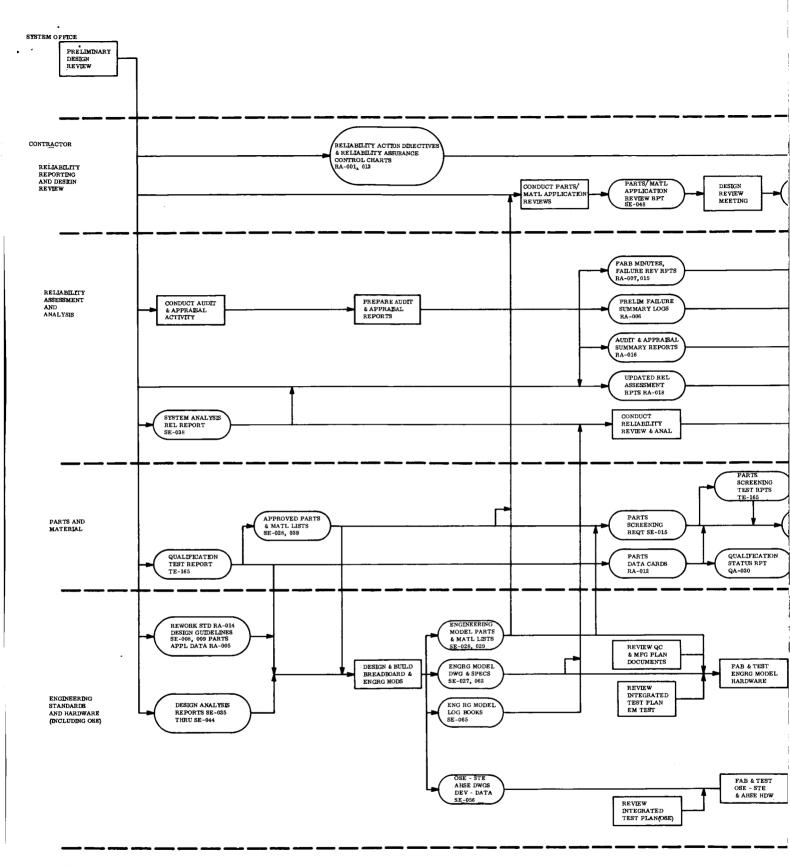
3-8-3



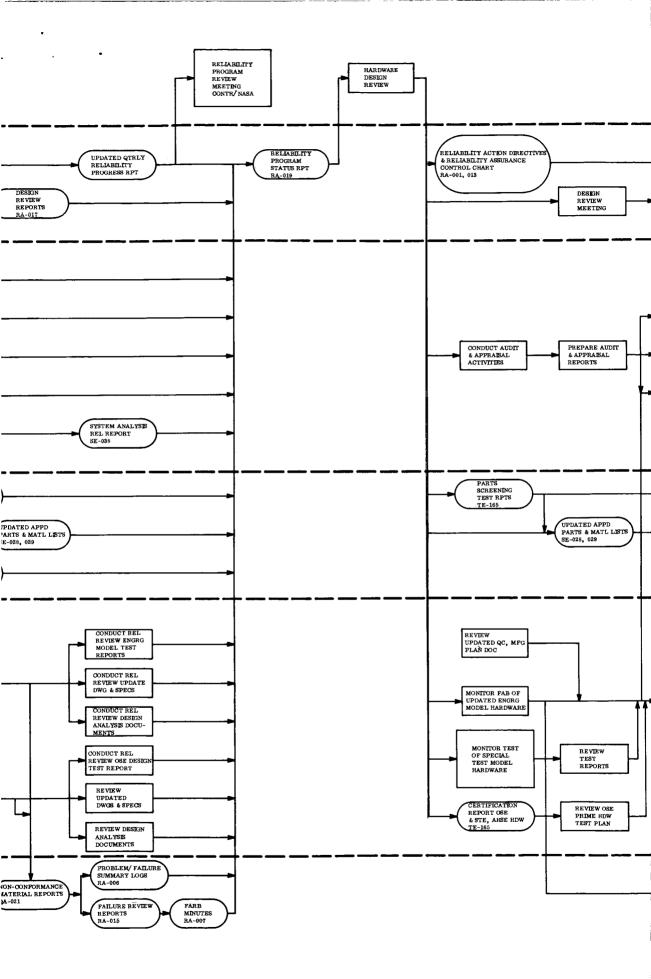
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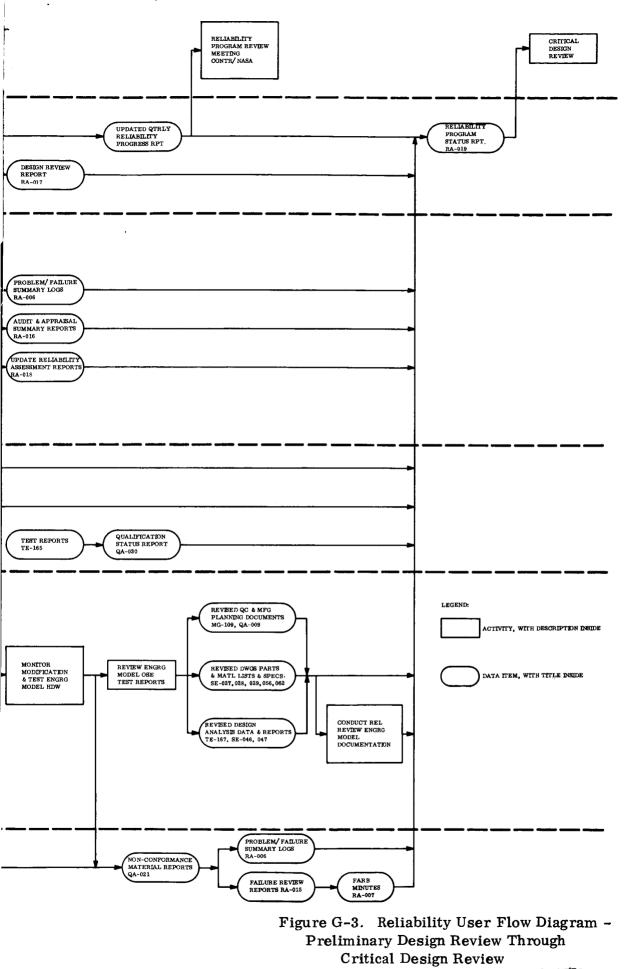
Figure G-2. Reliability User Flow Diagram -Contract Award Through Preliminary Design Review



FAILURE REPORTING & ANALYSIS

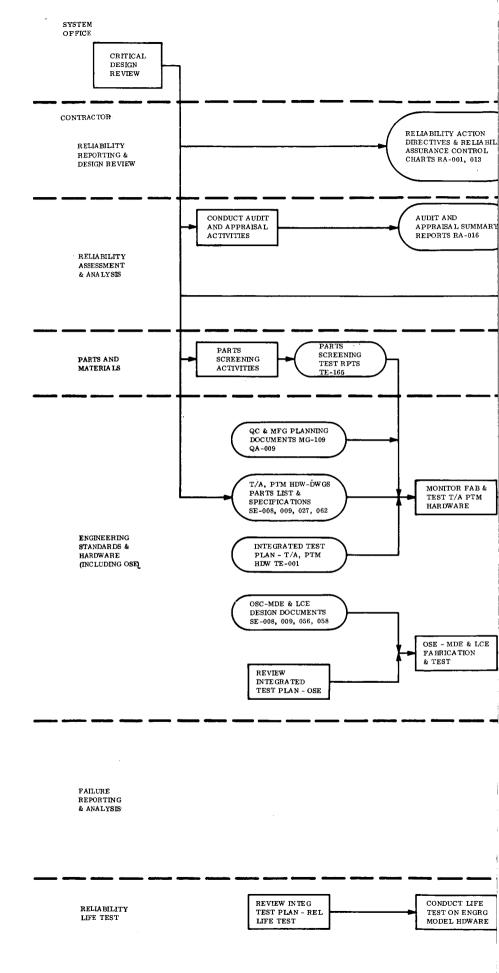


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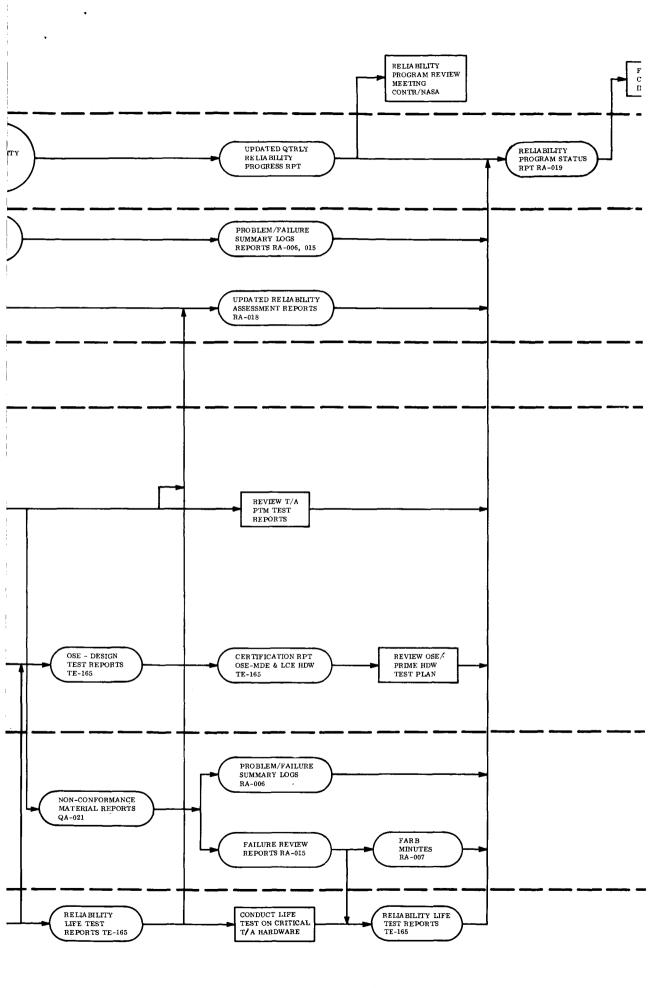
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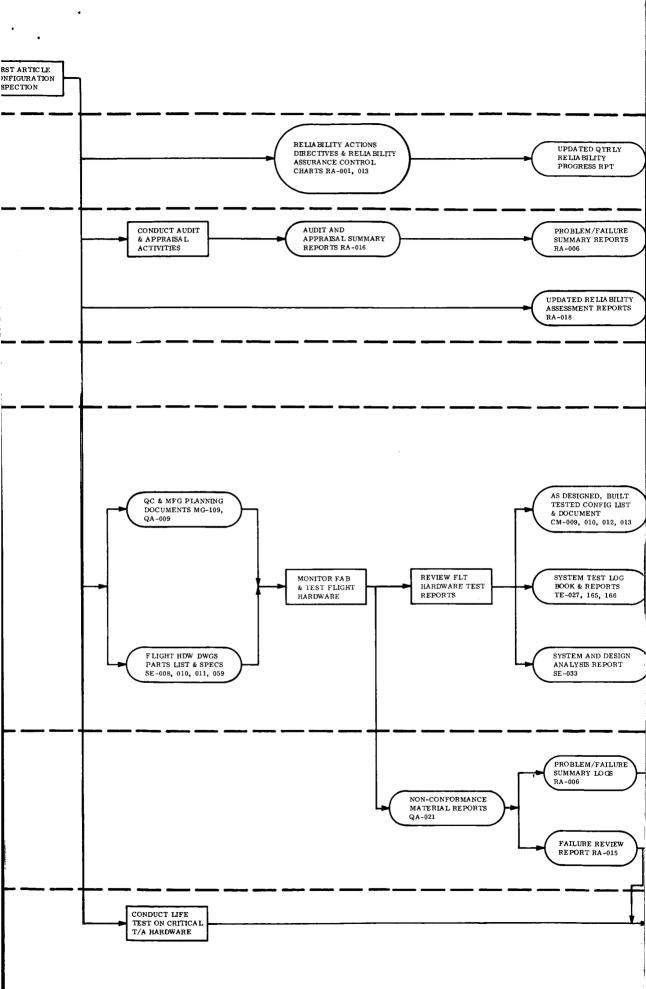


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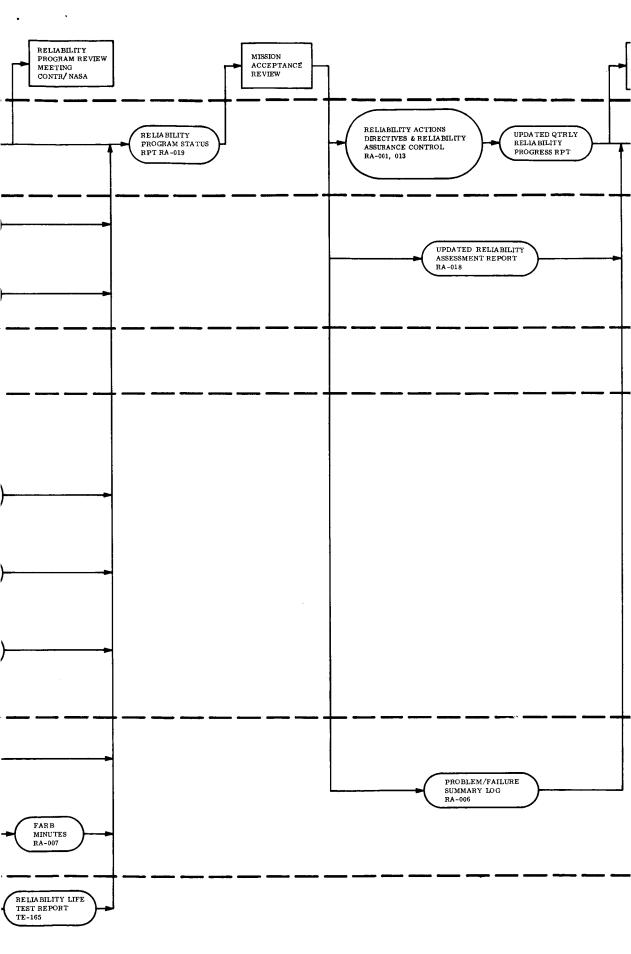
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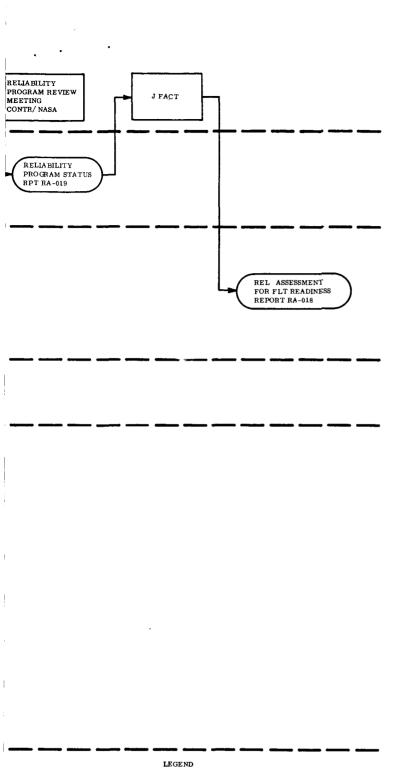


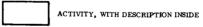


3-12-2



3-12-3







DATA ITEM, WITH TITLE INSIDE

Figure G-4. Reliability User Flow Diagram -Critical Design Review Through Joint Flight Acceptance Composite Test



Reliability Assurance Data Requirement Descriptions

DRD <u>Number</u>	Title
RA-001	*Reliability Action Directives
RA-002	List, Critical and Limited Life Item
RA-003	List, Failure Rate Data
RA-004	List, Flight Critical Processes and Practices
RA-005	List, Parts Application Data
RA-006	Log, Problem/Failure Summary
RA-007	*Minutes, Failure Analysis Review Board (FARB)
RA-008	Plan, Reliability Assessment
RA-009	Plan, Reliability Program
RA-010	Plan, Parts Control Program
RA-011	Procedure, Reliability Operating
RA-012	Card, Parts Data
RA-013	Chart, Reliability Assurance Control
RA-014	Standard, Rework
RA-015	Report, Failure Review
RA-016	Report, Summary, Audit and Appraisal
RA-017	Report, Design Review
RA-018	Report, Reliability Assessment
RA-019	Report, Reliability Program Status

* Key Informal Data

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GE EXHIBIT DRD RA-001

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VOYAGER DATA REQUIREMENT DESCRIPTION						DRD APPROVED BY		DATE:	DATA CATEGORY:
	LOODE:			oor I	DRD PREPA		1 0 175	CONTRACT	DRD NO.
ORGANIZATION ORIGINATING REQUIREMENT:	CODE: RA	OFFICE RESPONSIBLE FOR		ODE		• Thomas	DATE: 7/28/67	NO.:	RA-001
TITLE OF DOCUMENT:						ORGANIZATION R		TASK OR	DRL ITEM
						FOR DOCUMENT		SUBTASK:	NO.:
						ReliabilityA	ssurance		
*RELIABILITY ACTION DIRECTIVES						ORGANIZATION F		DRL NO.	LEVEL NO
						ORGANIZATION F		DDL NO.;	FILE NO.
TYPE OF DOCUMENT:	FOR DOCUMENT	DISTRIBUTION							
U		EACTION DREFERENCE		FORMA					
USE OF DOCUMENT: Th	is DRD v	will be used as a	forma	al m	ethod	ORGANIZATION F FOR DOCUMEN		NO OF	COPIES
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actions to be per	formed	in connection with	n ior h moli	req	uirea				
actions to be performed in connection with reliability problems or tasks, to ensure the success of the Relia- bility Program. Directives will also provide a record and a basis for follow-up.						ESTIMATED MANHOURS FOR SINGLE PREPARATION		INFORMATION SUTOFF DATE OR MILESTONE	
						ESTIMATED C	OST (\$)	DATE DATA CUE	
INTERRELATIONSHIP WITH RA-009, Plan, F	Reliabilit	ty Program				FOR SINGLE PREPARATION		TO USER	
RA-013, Chart,	Reliabil	ity Assurance Co	ntrol			FREQUENCY OF ISSUE		PUBLICATION DATE	
RA-016, Report,	Audit 8	& Appraisal Sumn	nary			D ANNUALLY			
RA-017, Report,	Design	Review	·			G SEMI-ANNUALLY		SDR	
						BI-MONTHLY		UPDATE (FREQUENCY OR MILESTONE)	
CLASSIFICATION:		GROUP I				SEMI-MONTH	LY	Not app	
CONFIDENTIAL		GROUP 2			ANDLING	BI-WEEKLY			
SECRET RESTRICTED D CONFIDENTIAL RESTRICTED		GROUP 4	D NASA DISCREET D JPL DISCREET SE PROJECT DISCREET			DAILY		ESTIMATED EXPIRATION DATE	
QUNCLASSIFIED	NOILD DAIA	D PUBLIC DOMAIN			DISCREET	One time			
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		CATALOG		_0G					
E FILM (STATIC OR I	NOTION)	CONTRACT		ANUA	L				
ILLUSTRATION		DIRECTIVE		EMOR	ANDUM				
D MODEL		DISCLOSURE		MINUTI	ES		- <u></u>		
RECORDING (TAPE OR DISC)				PLAN		APPLICABLE STA	NDARDS		
COMPUTER CARD		ORDER		ROCE					
		REQUEST FOR ENGINE							
MICROFILM (W/OR OTHER	W/Q LARD)			CHED					
		PROPOSAL	-		ICATION				
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REVIEWS AND/OR APPROV (LIST IN ORDER OF SUBMI									
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SUBMIT FOR REVIEW TO: -									
-		BY						B Y	
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-						······································			<u>,,</u>
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APPROVAL TO:		BY						BY	
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GE EXHIBIT DRD RA-001

VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

This DRD is applicable to the prime contractor and principal subcontractors as a method of communicating reliability actions to be taken throughout the period of the contract.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

Although this document will not have a fixed format, it will contain the following minimum requirements:

- a. Identity of the area or item for action
- b. Mechanism (source) generating requirement for action (i.e., design reviews)
- c. Responsibility for accomplishing action
- d. Schedule for completion
- e. Step-by-step direction
- f. Control number
- g. Authorizing signatures

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

DRD NO .:

RA-001

GE EXHIBIT DRD RA-002

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GE EXHIBIT DRD RA-002	•
VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET	
SPECIAL INSTRUCTIONS This DRD is applicable to the prime contractor and principal subcontractors responsible for the design of subsystem or components unique to this program.	DRD NO.: RA-002
SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)	

OUTLINE OF CONTENTS:

Critical and limited life item lists will identify all items (components or parts) used on the Program which are limited to a specified number of operations, or time period, and which have critical parameters. The list as a minimum shall identify the item by name; common designation; part, drawing, or model number; manufacturer; where used; and description of the limitation (i.e., maximum operating time (hours), number of cycles or other limitations).

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

This DRD applies to the prime contractor and to principal subcontractors. The document is to be applicable to designs throughout the system. It is to be a growth document, maturing as additional failure rate data is available.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

Documents will initially contain failure rate data covering part types on the approved parts list. As the design stages progress, failure rates will be established at the component level and listed by that designation. The list will contain as a minimum the following:

- a. Description of part or component
- b. Common designation (part, or drawing number)
- c. Specification
- d. Characteristics
- e. Failure rate (percent per 1000 hours)
- f. Data source

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

The flight critical processes and practices list is developed as a result of a detailed review of all processes and practices to be implemented on the Program. The list is dynamic — subject to revision as new conditions develop.

This DRD is applicable to the prime contractor, and in preparation, would be coordinated with major subcontractors.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The list will include those processes and practices which contribute to the reliability of the system and which by audit and appraisal would provide a measure of their accomplishment in terms of reliability. Typical examples of items to be listed include:

- a. Vendor rating system
- b. Problem/failure reporting, analysis system
- c. Traceability procedures
- d. Test monitoring plans

The list will cross-reference published documents used to specify and control the processes and procedures.

The list is a working decover at within reliability assurance. Therefore, specific format is not required.

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

Prime contractor will be responsible for document preparation, coordination with affected subcontractors, and dissemination of documents. The document will be released as an original issue and updated as additional data becomes available.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

This document contains application data for each item covered by the Approved Parts Lists. Format for the different types of items varies depending upon the specific information to be presented. The data shall be of sufficient detail to ensure a clear understanding of content and ultimate achievement of system design goals. As a guideline document for the application of parts, the document will include the following:

- a. Description of part or material
- b. Common designation
- c. Specification
- d. General application criteria and constraints
- e. Conservative design limit data
- f. Derating data

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

The log will be initiated with problems resulting from preliminary design reviews, and failures commencing with engineering model tests, and will be concluded at the end of mission operations. Problems/failures will be listed chronologically with problems being deleted as corrective actions are finalized. Working reports will be developed bi-weekly. Formal printings will be included in quarterly reliability progress reports.

This DRD is applicable to the prime contractor and principal subcontractors which requires operation and testing at the subcontractors facility.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Problem/Failure Summary Log is an EDP printout consisting of a chronological listing of all "open problems" and failures experienced on the prime equipment. Problem summaries will include pertinent information such as: problem identification (title), problem analysis report number, operation/hardware affected, proposed solution, expected completion date. Failure summaries will include coded information such as: item identification (nomenclature), failure report number, failure analysis report number, description of failure, test in which failure occurred, environmental condition at time of failure, operating mode at the time of failure, class of failure, accumulated operating hours of item, time to recover, apparent cause of failure. Failure summaries shall be of sufficient scope to permit analysis and implications of composite failures on systems reliability.

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

drd no.: RA-006

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS

This DRD is applicable to the prime contractor and principal subcontractors. FARB minutes will be prepared for each session of the board. DRD NO.: RA-007

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Failure Analysis Review Board Minutes will contain the following:

- 1. Review of open action items from prior meetings.
- 2. Identification of new failure analysis reports and the corrective actions pending or completed.
- 3. Conclusions, recommendations and assigned action items based on an "in depth" evaluation of the failure analysis reports by the board.
- 4. Concurrence with the analysis and/or corrective action to designate closing a failure analysis report.
- 5. Identify deficient analysis or corrective action, and cause the report to remain open for further action.
- 6. Identify members designated to follow-up on open items.

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

Document is applicable to the prime contractor, and to principal subcontractors, responsible for the design of subsystems, or components unique to this program.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Reliability Assessment Plan will provide a description of the techniques, materials (data) and controls to be utilized in the periodic assessment of system, subsystem and components. The plan will define: organizational (functional) responsibilities; identification of test programs from which performance data, failure data and operating times will be accumulated; description of computer programs for risk assessment, and systems modeling techniques for reliability assessment; statistical handling of reliability data; methods of utilizing design review, quality assurance, manufacturing, etc., data; and means of calculating and presenting the assessed reliability of the items.

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

DRD NO.: RA-009

This DRD is applicable to the prime contractor and to principal subcontractors (i.e., those responsible for design, fabrication and test of subsystems or components unique to the Program).

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Reliability Program Plan must provide a mutually agreed (i.e., JPL/contractor major subcontractor) contractually binding, clearly defined Reliability Program requirement which can be effectively implemented within cost and time constraints of the overall Program. It must include a definition of:

- a. Reliability organization and its interrelation to customer, in-house, and subcontractor management, and the various other functional operations.
- b. Milestone tasks and schedules.
- c. Reliability deliverable items.
- d. Reliability activities to be implemented throughout the Program (i.e., analysis, design review, test, etc.)
- e. Reliability surveillance, monitoring and program control requirements.

The plan should also include a recognition of potential problem areas and predetermined action alternatives to eliminate or control the problem should it occur.

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JPL 2568 OCT 65

VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

DRD NO.: RA-010

This DRD is applicable to the prime contractor, and to principal subcontractors responsible for the design, fabrication and test of subsystems or components unique to this Program.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Parts Control Program Plan will provide a comprehensive outline of the controls and procedures to be implemented and continued throughout the parts activity period of the Program. As a minimum the plan will include:

- a. Organization responsibilities and management
- b. Procedures for fulfilling the requirements of NPC 250-1
- c. Part selection and qualification
- d. Supplier/selection and qualification
- e. Part specifications and standards
- f. Part screening
- g. Part derating and application
- h. Approved parts list

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

Procedures covered by this document are applicable to prime contractor and to principal subcontractors coordinated.

DRD NO.: RA-011

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Reliability Operating Procedures will cover the major activities of the reliability program as outlined in the approved reliability program plan and other contractual reliability items as applicable. The total set of documents will include the policies and procedures associated with the preparation and utilization of the reliability data items as listed for this Program. Where needed, specific subjects may be covered in more detail, e.g., reliability assessment, reliability analysis, etc.

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

This DRD is applicable to the prime contractor and to principal subcontractors (i.e., those responsible for design, fabrication and test of subsystems and components unique to this Program.)

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The part data card shall be prepared for each part selected for use on the Program. The data provided will become the basis for the part classification as required by the parts control program. In addition to complete part identification, name, description, source, etc., the card will provide data on characteristics, acceptance parameters, rejection criteria, screening requirements, test data and complete part qualification data. This card with completed data is the basic record for the parts control procedure.

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

RA-013 Data on Reliability Assurance Control Charts is accrued from many sources throughout the Program. It is reduced to those elements which have a major impact upon the success of the Program, maintained accurate through close surveillance by reliability project personnel. Format for the control charts is not specifically defined, but must be compatible with other project control charts.

This DRD is applicable to the prime contractor and to principal subcontractor (i.e., those responsible for design, fabrication and test of subsystems or components unique to the Program).

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

Reliability Assurance Control Charts must provide that information necessary to achieve management decisions required to eliminate sources of unreliability. The standard indicators to be provided are divided into three categories:

- Items for action and decision relating to outstanding current problems, a. ancitipated critical problems, and actions for solution as required.
- Information relating to technical performance versus requirements. b.
- Information relating to program activity versus schedule. c.

Examples of indicators to be maintained on control charts are:

- Current estimate of mission success probability versus goal. a.
- Proportion of delinquent or suspected program activities under surveillance, and b. number cleared, versus previous period showing trend of exceptions taken to standards conformity.
- Specific areas currently under appraisal, categorized by criticality and reason c. for appraisal; i.e., random selection, suspect problem, or known problem.
- Problem/failures to date, percent cleared, and forecast of trend. d.
- Piece-part count trend curves; planned versus actual, preferred versus nonpreferred e. high versus low usage.

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JPL 2568 OCT 65

VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

This DRD is applicable to the prime contractor and principal subcontractors. These documents, are prepared coincident with the design or manufacturing and quality control planning cycle for the hardware.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

Rework Standards will be formally prepared, published and controlled documents providing:

- a. Standards (limitations) for rework (i.e., what elements may or may not be reworked) as applicable to various elements of hardware.
- b. Standards (limitations) for extent (i.e., complexity) of rework as applicable to various elements of hardware.
- c. Standards (limitations) for frequency (i.e., number of times) of rework for various elements of hardware.
- d. Standards (procedures) for methods and equipment for rework as applicable for various elements of rework.
- e. Standards (controls) for acceptance criteria (i.e., inspection and test) of rework as applicable to various elements of hardware.

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS

This DRD applies to all failure analysis reports whether issued against prime contractor's hardware or that manufactured and being tested by principal subcontractors.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Failure Review Report will document the results of the FARB's review and evaluation of all failure analysis and corrective action reports. The report will include an analysis of:

- a. The completeness of the cause and effect analysis of the failure (discrepancy);
- b. The adequacy of the recommended or implemented corrective action, and the means of verifying its effectiveness;
- c. The criticality of the failure and its impact on other elements of the system;
- d. The conclusions, recommendations and assigned action items.

The Failure Review Report will also include identifying information such as: identification number, cross-reference to failure analysis reports, cross-reference to other supporting documentation, corrective action implementation schedule, authorized signatures.

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SPECIAL INSTRUCTIONS:

This DRD is applicable to the prime contractor who will maintain "audit and appraisal" responsibility for both contractor and principle subcontractor activities.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Audit and Appraisal Summary Report must serve as a management control and awareness document over "critical processes and practices" (i.e., sources of unreliability) which could materially affect the success of the program. The report, therefore, must provide:

- 1. Identification of the subject critical processes and practices audited during the period.
- 2. Summary of appraisal results both "pro" and "con".
- 3. Discussion of the detected potential problem areas.
- 4. Recommendations for corrective actions and status of in-process corrective actions.
- 5. Recommended follow-up plan and responsible parties.

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

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SPECIAL INSTRUCTIONS:

This DRD is applicable to the prime contractor and to principal subcontractors (i. e., those responsible for design, fabrication and test of subsystems or components unique to the program)

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

All attendees of specific design review meetings. Managers of individual assigned action items.

OUTLINE OF CONTENTS:

The Design Review Reports must provide a comprehensive report of all proceedings and results in the design review meeting. It must include:

- a. Identification of all attendees of the review meeting.
- b. Identification of item being reviewed.
- c. A summary of the various presentations and identification of responsible parties.
- d. A brief description of questions and ensuing discussions.
- e. Description of all detected problems and recommendations.
- f. Identification of all action items, responsible parties, and due dates.
- g. Review of status of previous design review action items.

The Design Review Report must serve as a suitable record of all design review activities and follow-up on "actions".

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SPECIAL INSTRUCTIONS:

This DRD is applicable to the prime contractor with inputs from principal subcontractors. Reliability Assessment Reports will be released at major review points in the Program

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Reliability Assessment Report will be developed around a basic set of reliability growth curves which reflect reliability probability of success values at the successive assessment intervals. Basically, the report will **provide a** comprehensive assessment of the inherent/operational reliability of the system, subsystem and components in quantitative terms on a comparative basis with the apportioned reliability design goals. Initially, the assessment will be dependent upon reliability analysis (predictions) design reviews, and related engineering inputs. As test data, operating time and failure date become available, the assessment will be operationally oriented. Continued engineering judgement will be applied to the reliability assessment. The report will include: identification of any serious reliability problems, a description of the consequences, and the degree of risk involved.

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VOYAGER DATA REQUIREMENT DESCRIPTION - 2ND SHEET

SPECIAL INSTRUCTIONS:

The Reliability Program Status Report is developed for accumulative data provided by all available Program data items. The data is analyzed and formalized into a measure of its impact on probability of success of the mission from both a subjective and objective viewpoint. These reports are to provide management with sufficient data to equate reliability growth (status) to time and cost curves for the Project.

SPECIAL DISTRIBUTION: (IF DISTRIBUTION IS NOT COVERED BY AN EXISTING DDL WRITE IN DISTRIBUTION BELOW)

OUTLINE OF CONTENTS:

The Reliability Program Status Report need not conform to any specific format requirements. However, it must present to management a concise appraisal of the total Program activities as they affect, or potentially affect, reliability growth during the specified assessment period. The report may include: narrative discussion, summary data tables, charts, graphs, computer printouts, etc. The report will include summary information from sources such as:

- a. Design review status of design reviews and approvals, identification of problem areas, corrective actions, etc.
- b. Reliability assessment quantitative or statistical assessment resulting from existing data, design margin analysis, etc.
- c. Reliability analysis analytical prediction of inherent reliability, failure mode, effects and criticality analysis, redundancy analysis, etc.
- d. Problem/failure summary logs identification of manufacturing inconsistencies and impact of rework.

(CONTINUE ON THIRD SHEET, IF NECESSARY, AND AFFIX TO THIS DRD.)

DRD NO .:

- e. Manufacturing degradation analysis reports deficiencies in the production cycle which require corrective actions.
- f. Quality assurance inspection records identification of manufacturing inconsistencies and impact of rework.
- g. Parts and materials qualification status determine percentage of items qualified to those specified and used in early stage hardware.

All information must be reducible to an indicator of "risk" resulting from the activity if full conformance to established performance standards is not maintained.

1

DOCUMENTATION RELATIONSHIP TREES

A documentation relationship tree has been prepared to show the relationships of data items within each functional category as well as their relationships across categories.

Relationships within each functional category are shown by constructing a tier pattern beginning with the top-level (or governing) data item and relating in descending order all data items within the category to this top-level data item. (The location of a data item at a given level on the diagram does not necessarily indicate the importance of that specific item but iden-tifies and defines its relation to all other data items in that category.)

Relationships between data items in one category and data items in other functional categories are shown by (1) shaded arrows to indicate the direction of the relationship and (2) an alphabetic code to indicate the nature of the interrelationship as follows:

- a. Data items needed for preparation and/or support of the referenced item. (I)
- b. Data items that are supported or needed by this data item. (S)
- c. Data items that relate "to" and provide information of a general nature but are not required in an input or support role. (G)

Each data item appearing on the Data Item List (DIL) was examined and evaluated with respect to its contribution to, or dependence upon, data items appearing in other categories and is included in the diagrams. Additionally, certain data elements indicated in the user flow diagrams (but currently not identified as individual data items) have been shown within a dashed rectangle to clarify relationships.



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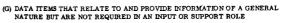
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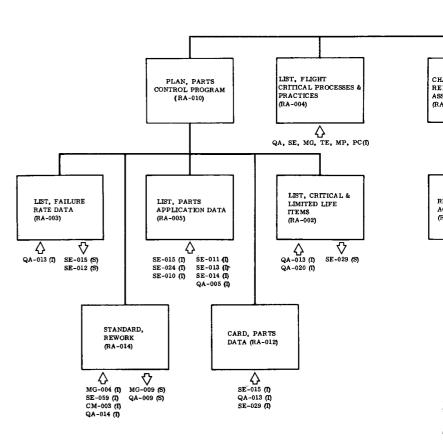


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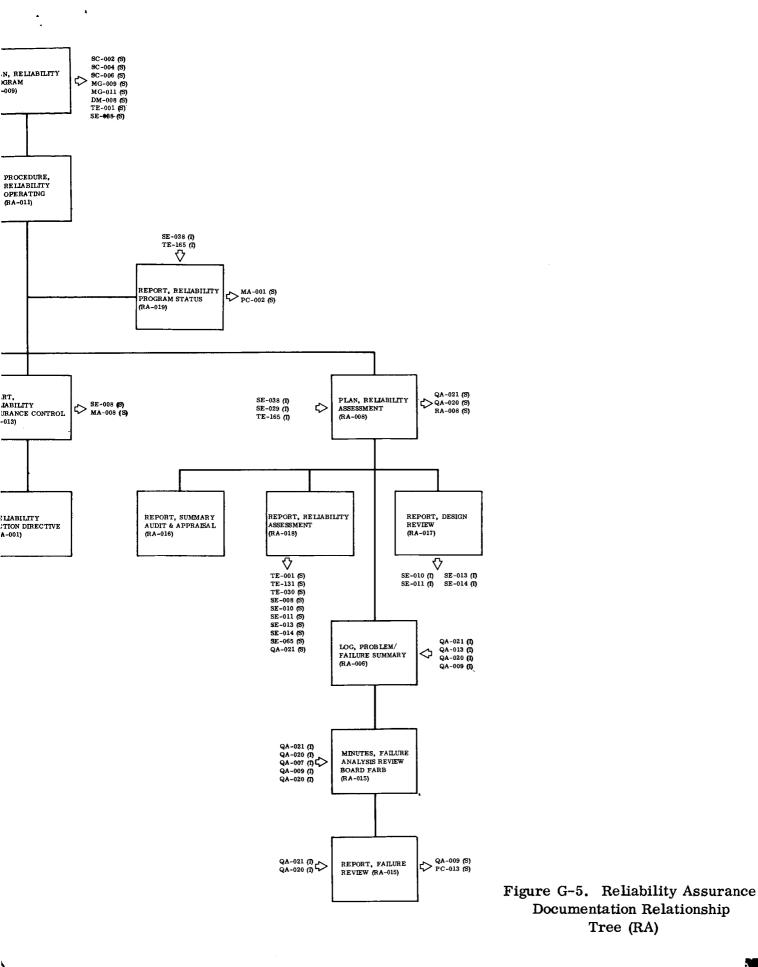
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 \bigtriangleup indicates principal relationship (I, S, or G) between data items in other functional categories.



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5-4

DATA ITEM PHASING/FREQUENCY

Figure G-6, Reliability Assurance Data Item Phasing and Frequency Matrix, provides a detailed picture of data item preparation requirements by the reliability function. Control and reporting requirements are of particular significance. Not reflected, however, but of equal significance, is the interrelationship with and surveillance by reliability of the engineering, manufacturing, and quality, assurance functions.

Figure G-7, Reliability Assurance Data Item Density Profile, reflects the distribution and density of data item preparation requirements in monthly averages by major project review periods.

Requirements for preparation of Parts Data Cards (RA-012) early in the project cause some distortion to an otherwise well-distributed data item preparation cycle.

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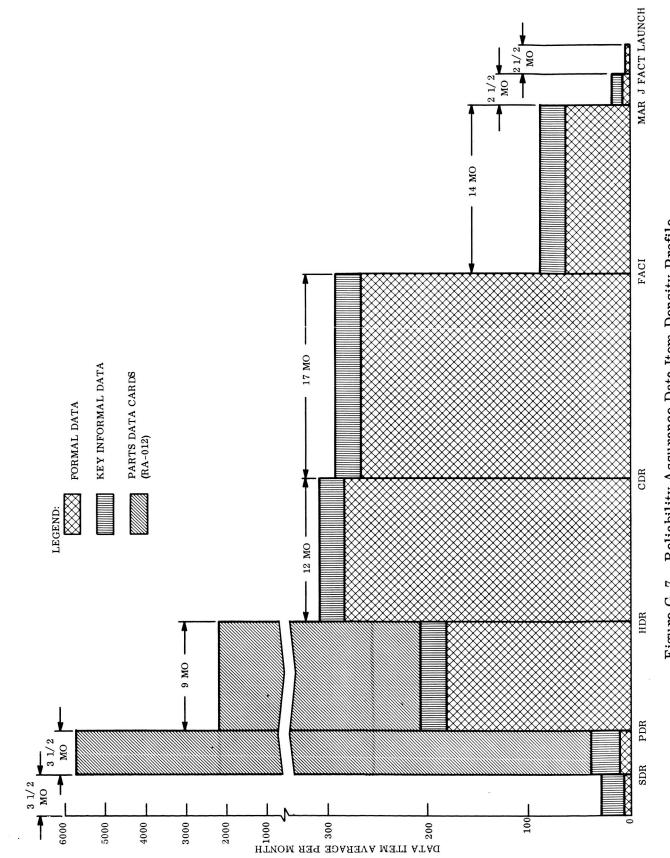
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Figure G-6. Reliability Assurance Data Item Phasing and Frequency Matrix

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Figure G-7. Reliability Assurance Data Item Density Profile