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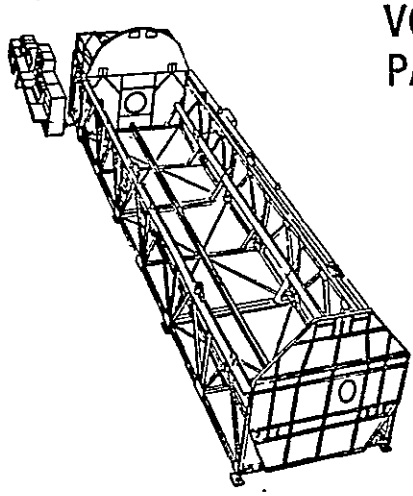
VOLUME II
PART 2



SHUTTLE PAYLOAD INTERFACE VERIFICATION EQUIPMENT STUDY
VOLUME II TECHNICAL DOCUMENT - PART 2 APPENDICES

APRIL 1976

NASA CONTRACT: NAS9-14000 CCA 140 REV. 1

PREPARED BY:
SHUTTLE PAYLOAD
INTERFACE PROJECTS GROUP

APPROVED BY:
H. E. EMIGH
DIRECTOR
STS/PAYLOAD INTEGRATION

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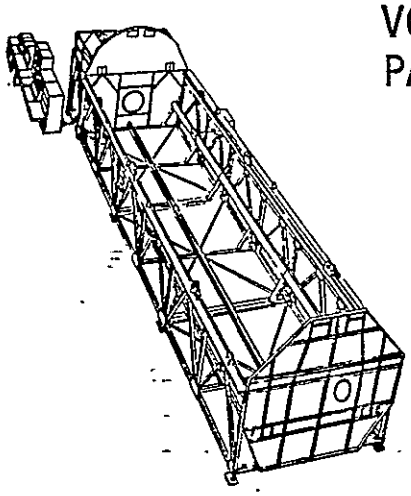

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FOREWORD

This document is a contractual requirement of NAS9-14000, CCA 140 Revision 1 and is provided in response to the contract. The study was conducted by the Space Division of Rockwell International for the Johnson Space Center of the National Aeronautics and Space Administration. It is published in four volumes:

Vol. I	Executive Summary
Vol. II	Technical Document - Part 1 Technical Appendices - Part 2
Vol. III	Specification Data
Vol. IV	Project Plans

TECHNICAL REPORT INDEX/ABSTRACT

ACCESSION NUMBER		DOCUMENT SECURITY CLASSIFICATION	
		Unclassified	

TITLE OF DOCUMENT
Shuttle Payload Interface Verification Equipment(IVE) Study

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CODE	ORIGINATING AGENCY AND OTHER SOURCES	DOCUMENT NUMBER
	Rockwell International Corporation Space Division, Downey Calif.	SD76-SH-0092

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April 1, 1976	NAS9-14000 CCA 140 Rev. 1

DESCRIPTIVE TERMS

Shuttle	Preliminary Design	Data Management
Payloads	Operators Console	Computer
Spacelab	Mission Station	Heat Exchanger
P/L Interface	On-Orbit Station	Development Plans
P/L Interface Verif.	Payload Station	Schedules
Avionics	Electrical Power	
Payload Integration	Communications	

ABSTRACT

Single and mixed payloads must be integrated into the Shuttle Orbiter within the 160 hour turnaround requirement for the Shuttle system. In order to accomplish this integration process some off-line integration capability is required. This report is a preliminary design analysis of a "stand alone" (no facility GSE support required) payload integration device (IVE) capable of verifying payload compatibility in form, fit and function with the Shuttle Orbiter prior to on-line payload/Orbiter operations. The IVE is a high fidelity replica of the Orbiter payload accommodations capable of supporting payload functional checkout and mission simulation. A top level payload integration analysis developed detailed functional flow block diagrams of the payload integration process for the broad spectrum of P/L's and identified degree of Orbiter data required by the payload user and potential applications of the IVE.

This work was performed for Johnson Space Center of the National Aeronautics and Space Administration under contract NAS9-14000 CCA 140 Rev. 1.

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APPENDIX A

INTERFACE VERIFICATION EQUIPMENT HARDWARE UTILIZATION LIST (HUL)

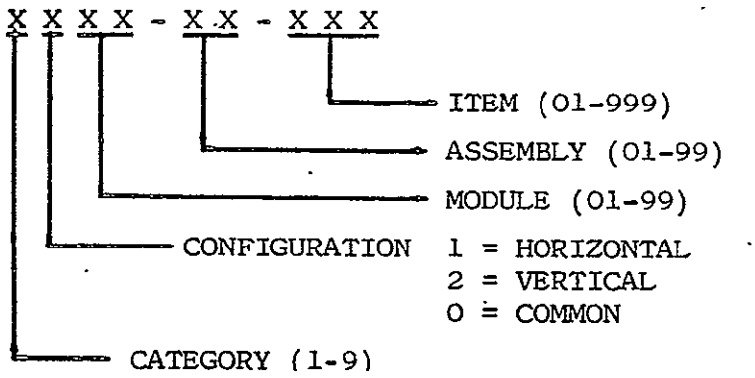
IVE
HARDWARE UTILIZATION LIST
INDEX

HUL I.D.	ITEM	WBS
1001-00-000	MID-BODY STRUCTURE	1.2.1.1.1.a
2101-00-000	MS/PS SUPPORT MODULE	1.2.1.1.1.b
2102-00-000	X_o576 BULKHEAD	1.2.1.1.1.b
2103-00-000	PAYLOAD WIRE TRAY	1.2.1.1.1.g
2004-00-000	X_o679.5 POWER PANEL	1.2.1.1.1.f
2005-00-000	PREFLIGHT UMBILICAL	1.2.1.1.1.h
2106-00-000	X_o1307 CROSS SUPPORT	1.2.3.1.1.n
2007-00-000	X_o576 AVIONICS HARNESS SUPPORT	1.2.1.1.1.b
2108-00-000	MISSION SPECIALIST SECONDARY STRUCTURE	1.2.1.2.2.a.1
2109-00-000	PAYLOAD SPECIALIST SECONDARY STRUCTURE	1.2.1.2.2.a.3
2110-00-000	ON-ORBIT STATION SECONDARY STRUCTURE	1.2.1.2.2.a.2
3001-00-000	OPERATOR'S CONSOLE	1.2.1.2.1
3002-00-000	DC POWER SET	1.2.1.2.3
3004-00-000	AFT FLIGHT DECK SET	1.2.1.2.2
3005-00-000	DELETED	
3006-00-000	DELETED	
3007-00-000	DELETED	
3108-00-000	CABLE SET	1.2.1.2.4
3109-00-000	DELETED - SEE 3108-00-000	
3110-00-000	DELETED - SEE 3108-00-000	
4101-00-000	X_o576 AIRLOCK INTERFACE	1.2.3.1.1.g
4102-00-000	X_o660 TUNNEL INTERFACE	1.2.3.1.1.h
4003-00-000	P/L PRIMARY LONGERON FITTING, NON-DEPLOYABL	1.2.1.1.1.c 1.2.3.1.1.a
4104-00-000	AUXILIARY KEEL FITTING	1.2.1.1.1.e 1.2.3.1.1.c
4105-00-000	P/L UPPER CLEARANCE GAGE	1.2.3.1.1.i

IVE
HARDWARE UTILIZATION LIST
INDEX
(CONT)

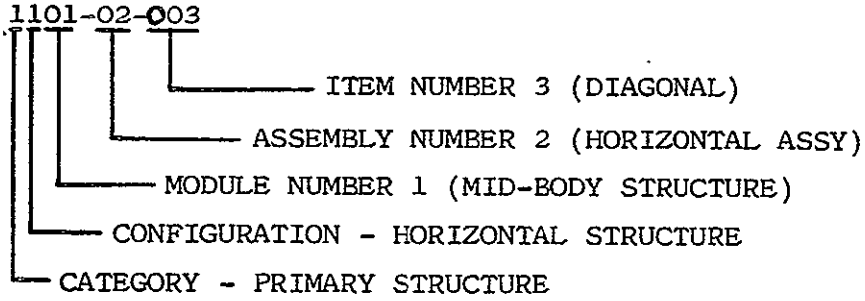
HUL I.D.	ITEM	WBS
4106-00-000	LOWER CLEARANCE GAGE	1.2.3.1.1.j
4107-00-000	OMS DELTA V ENVELOPE	1.2.3.1.1.k
4108-00-000	FLOODLIGHT X_o576 BULKHEAD	1.2.3.3.1.a
4009-00-000	X_o576 PAYLOAD SERVICE PANEL	1.2.1.2.2.a.5 1.2.3.3.1.f
4110-00-000	ENVIRONMENTAL CONTROL UNIT SET	1.2.3.2.1.a
4111-00-000	(DELETED)	
4012-00-000	HOISTING	1.5.1
4013-00-000	(DELETED)	
4014-00-000	TV, X_o576 BULKHEAD	1.2.3.3.1.c
4115-00-000	TV X_o1307 BULKHEAD	1.2.3.3.1.c
4116-00-000	PAYLOAD BAY LINER	1.2.3.1.1.l
4017-00-000	PREFLIGHT UMBILICAL ELECTRICAL PANEL	1.2.3.3.1.d
4018-00-000	PREFLIGHT UMBILICAL FLUID PANEL	1.2.3.2.1.d
4019-00-000	PAYLOAD BAY FLOODLIGHT	1.2.3.3.1.b
4120-00-000	X_o1307 BULKHEAD	1.2.1.1.1.b
4121-00-000	X_o1307 P/L OXIDIZER/FUEL PANELS	1.2.3.2.1.b
4122-00-000	PAYLOAD MASS SIMULATOR	1.5.1
4123-00-000	(DELETED)	
4124-00-000	X_o1307 ELECTRICAL SERVICE PANEL	1.2.3.3.1.e
4125-00-000	(DELETED)	
4126-00-000	STABILIZING LONGERON FITTING, NON-DEPLOYABLE PAYLOAD	1.2.1.1.1.d 1.2.3.1.1.b
4127-00-000	CABLE SETS	1.2.3.3.1.g
4128-00-000	T-O UMBILICAL PROVISIONS	1.2.3.1.1.m
4129-00-000	T-O UMBILICAL FLUID I/F ASSEMBLY	1.2.3.2.1.c

IVE
HARDWARE UTILIZATION LIST
IDENTIFICATION CODE



CATEGORY	CODE
PRIMARY STRUCTURE	1XXX
SECONDARY STRUCTURE	2XXX
ELECTRONICS	3XXX
OPTIONAL EQUIPMENT	4XXX

SAMPLE:



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ITEM NUMBER	WBS NUMBER	SOURCE	CONFIGURATION	QUANITY	IDENTIFICATION NUMBER	PRIMARY STRUCTURE NOMENCLATURE MODULE	ASSEMBLY	ITEM	DESCRIPTION	WEIGHT / ITEM	MATERIAL / SPEC.	DRAWING SEC. 302 PARAGRAPH NUMBER	TEST REQMTS. DEMONSTRATION	QUALIFICATION	ACCEPTANCE	STRUCTURE	SUB-SYSTEM	SYSTEM	SPARES
01	1.2.1.1.1.a	M	C	3	1001-00-000	MID-BODY SECTION			118 x 210 x 240	14,882	(3) - 50,648								
02		M	C	2	1001-01-000		VERTICAL PANEL ASSY.		12 x 118 x 240 WELDED ASSY.	6923									
03		M	C	2	1001-01-001			LONGERON - BOX	6 x 10 x 0.50 x 240 TUBE	947	CARBON STEEL ASTM-A500								
04		M	C	2	1001-01-002			STIFFENER-ANGLE	0.50 x 9½ x 240 ANGLE	439	CARBON STEEL ASTM-A36								
05		M	C	2	1001-01-003			CLEVIS RAIL	2½ x 3½ x 240 BAR	318	1018 STEEL								
06		M	C	2	1001-01-004			BRIDGE RAIL	2½ x 3½ x 240 BAR	291	1018 STEEL								
07		M	C	3	1001-01-005			POST-END & CENTER	6 x 6 x .3125 x 95 TUBE	213	CARBON STEEL ASTM-A500B								
08		M	C	4	1001-01-006			DIAGONAL	4 x 6 x .250 x 103 TUBE	132									
09		M	C	2	1001-01-007			LOWER CORD	6 x 10 x .375 x 240 TUBE	736	CARBON STEEL ASTM-A500B								
10		M	C	4	1001-01-008			GUSSET - END POST	13 x 21 x .50 PLATE	38.6	ASTM-A-572 GRADE 50								
11		M	C	2	1001-01-009			GUSSET - CENTER (UP)	9 x 11 x .250 PLATE	7									
12				2	1001-01-010			GUSSET - CENTER (LOW)	9 x 13 x .250 PLATE	8.2									
13		M	C	4	1001-01-011			GUSSET - DIAGONAL	9 x 11 x .250 PLATE	7									
14		M	C	2	1001-01-012			GUSSET - CORNER	11 x 13 x .50 PLATE	20.2									
15		M	C	4	1001-01-013			GUSSET - HORIZONTAL	6 x 6 x .375 PLATE	3.8	ASTM-A-572 GRADE 50								
16		B	C	35	1001-01-014		VERTICAL PANEL ASSY.	BOLT & NUT	.75 DIA x 3½ LONG	.75									
17		M	C	3	1001-00-001			CROSS BEAM	10 x 5¾ WF x 188 (I)	391	ASTM-A36								
18		M	C	2	1001-00-002			KEEL BEAM	10 x 5¾ WF x 115 (I)	239	ASTM-A36								
19		M	C	2	1001-00-003			TIE ROD	1½ DIA. x 290	177									
20		M	C	6	1001-00-004			KNEE BRACE	4 x 6 x .250 x 71 TUBE	91	ASTM-A500B								
21		M	C	6	1001-00-005			FOOT-KNEE BRACE	6 x 13 x .375 PLATE	4	ASTM-A-572B								
22		M	C	3	1001-00-006			HEAD-KNEE BRACE	5 x 7 x .375 x 10 TUBE	23	ASTM-A500B								
23		M	C	2	1001-00-007			KEEL LONGERON	2 x 3 x 2 11/16 x .250 x 240	SEE 138.6	ASTM-A 36								
24		M	C	6	1001-00-008			CLIP - C' BEAM	7 x 7 x .375 PLATE	5.2									
25	1.2.1.1.1.a	M	C	4	1001-00-009			CLIP - K' BEAM	3½ x 7 x .375 PLATE	2.4	ASTM-A36								
26	1.2.1.1.1.f	B	H	4	1001-00-010			BOLT - LEVELING	1 3/4 DIA. x 14 (UNC-2 THD)	9.5	ASTM-A325								
27	1.2.1.1.1.a	B	C	108	1001-00-011			BOLT - C' BEAM	½ DIA x 1½" LONG	.2									
28	1.2.1.1.1.a	B	C	12	1001-00-012			BOLT - KNEE BRACE	¾ DIA x 7" LONG	1.2									
29	1.2.1.1.1.f	B	C	4	1001-00-013	MID-BODY SECTION		NUT - LEVELING	1 3/4 DIA. (UNC-2 THREAD)										

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	12.1.1.16	M	H	1	2101-00-000	MS/RS SUPPORT MODULE	—	—		3945									
		M	H	2	2101-01-000		SUPPORT ASSEMBLY	—	78X88X120 WELDED ASSEMBLY	1739 (6.8%)									
		M	H	4	2101-01-001			POST-VERTICAL	3X3X.188 X120 TUBE	69	CARBON STEEL ASTM-A36								
		M	H	4	2101-01-002			CROSS TIE-LONGITUDINAL	3X3X.188 X88 TUBE	50									
		M	H	4	2101-01-003			CROSS TIE-TRANSVERSE	3X3X.188 X78 TUBE	45									
		M	H	4	2101-01-004			DIAGONAL-LONGITUDINAL	3X3X.188 X122 TUBE	70	CARBON STEEL ASTM-A36								
		M	H	4	2101-01-005			DIAGONAL-TRANSVERSE	3X3X.188 X120 TUBE	69	CARBON STEEL ASTM-A36								
		M	H	8	2101-01-006			PLATE-STAND	6X6X.58	56	CARBON STEEL ASTM A242(II)								
		M	H	8	2101-01-007			PLATE-FLOOR	8X8X.50	10.									
		M	H	8	2101-01-008			BOLT-ADJUSTING	1" DIA X 8 TPI X 9" LONG	2									
		M	H	8	2101-01-009			NUT-LOCK	1" DIA X 8 TPI	.2									
		M	H	2	2101-01-010			DECK SUPPORT	3X3X.188 X72 TUBE	41	CARBON STEEL ASTM-A36								
		M	H	1	2101-01-011		SUPPORT ASSEMBLY	DECK PLATE	78X88X.125 PLATE DIAMOND PATTERN	293 (6.1%)	HOT ROLLED CARBON STEEL								
		M	H	1	2101-00-001			DECK PLATE	28 X 88 X .125 PLATE DIAMOND PATTERN	105	HOT ROLLED CARBON STEEL								
		M	H	1	2101-03-000		LADDER ASSEMBLY	—	19X26X154 WELDED ASSY.	209 (2.7%)		DELETED - FACILITY PROVIDED							
		M	H	2	2101-03-001			HANDRAIL	1½ O.D(NOM) X.145X168 PIPE	38 (1%)	CARBON STEEL ASTM-A120								
		M	H	2	2101-03-002			VERTICAL SUPPORT	2X1X.188 X120 CHANNEL	23	CARBON STEEL AISI-M-1020								
	DELETED	M	H	8	2101-03-003			CROSS TIE	1½ O.D.(NOM) X.145X115 PIPE	4 (.5%)	CARBON STEEL ASTM-A120								
	—	M	H	9	2101-03-004			STEP	2X1X.188 X24 CHANNEL	5 (1.6%)	CARBON STEEL AISI-M-1020								
		M	H	6	2101-03-005		LADDER ASSEMBLY	BRACKET	2X2X.125 X12 ANGLE	16	CARBON STEEL ASTM-A36								
		M	H	2	2101-04-000		HANDRAIL ASSY-SIDE	—	33X76 WELDED ASSY.	70	CARBON STEEL								
		M	H	4	2101-04-001			POST	1½ O.D (NOM) X .145 X 32 PIPE	7.	ASTM-A120 CARBON STEEL								
		M	H	1	2101-04-002			HANDRAIL	1½ O.D. (NOM) X .145 X 76 PIPE	17	ASTM-A120 CARBON STEEL								
		M	H	3	2101-04-003			CROSS TIE	1 O.D (NOM.) X .133 X 23 PIPE	3 (1%)	ASTM-A120								
		O	H	4	2101-04-004		HANDRAIL ASSY-SIDE	FLOOR FLANGE	1 X 5 X 6	4.									
		M	H	2	2101-05-000		HANDRAIL ASSY-FRONT	—		69 (2.7%)	CARBON STEEL ASTM-A120 CARBON STEEL								
		M	H	3	2101-05-001			POST	1½ OD (NOM) X.145 X 32 PIPE	7.	ASTM-A120 CARBON STEEL								
		M	H	1	2101-05-002			HANDRAIL	1½ O.D(NOM) X.145 X 83 PIPE	18	ASTM-A120 CARBON STEEL								
		M	H	3	2101-05-003			CROSS TIE	1 OD(NOM) X .133 X 27 PIPE	4 (1%)	ASTM-A120								
		O	H	3	2101-05-004		HANDRAIL ASSY-FRONT	FLOOR FLANGE	1 X 5 X 6	4									
		O	H	4	2101-00-002	MS/PS SUPPORT MODULE		EQL-SIDE OUTLET	3 X 3 X 3	15.									

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	12.1.1.b	M	H	1	2102-00-000	X.576 BULKHEAD				105									
		M	H	1	2102-01-000		UPPER BULKHD. ASSY.		2X75X195 RIVETED ASSY.	105									
		M	H	1	2102-01-001			UPPER PANEL	75X196X.060 SHEET	60	AL. SHEET								
		M	H	1	2102-01-002			LOWER ANGLE	1½X1½X.125X195 ANGLE	6	AL. EXTRUSION								
		M	H	1	2102-01-003			UPPER ANGLE	2X2X.125X352 ANGLE	12.7									
		M	H	2	2102-01-004			VERTICAL STIFFENER	2X2X.060X55 ANGLE	1.3									
		M	H	2	2102-01-005			VERTICAL STIFFENER	2X2X.060X71 ANGLE	1.7									
		M	H	4	2102-01-006			STIFFENER-ELEC. PANEL	¾X1¼X.060X19 ANGLE	.2									
		M	H	2	2102-01-007			STIFFENER-SEC. PANEL	1⅛X2⅞X.060X19 H SECTION	6									
		M	H	2	2102-01-008			WINDOW STIFFENER	1½X1½X.060X58 ANGLE	1.0									
		M	H	2	2102-01-009			HORIZ. STIFFENER	1½X1½X.060X9 ANGLE	.1									
		M	H	4	2102-01-010			HORIZ STIFFENER	1½X1½X.060X28 ANGLE	.5									
		M	H	2	2102-01-011			HORIZ. STIFFENER	1½X1½X.060X60 ANGLE	1.1									
		M	H	1	2102-01-012			HORIZ. FLOOR SUPPORT	2X2X.125X52 ANGLE	2.6									
		M	H	2	2102-01-013			VERTICAL FLOOR SUPPORT	2X2X.125X42 ANGLE	2.1									
		M	H	2	2102-01-014			DIAGONAL FLR SUPPORT	2X2X.125X50 ANGLE	2.5	AL EXTRUSION								
		M	H	2	2102-01-015	X.576 BULKHEAD	UPPER BULKHEAD ASSY.	ATTACH BRACKET	5X10X.060 SHEET	.2	AL. SHEET								

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	1.2.1.1.1.g	M	H	2	2103-00-000	PAYLOAD WIRE TRAY				66									
		M	H	1	2103-01-000		TRAY ASSY		3½ X 15 X 220 OPEN MAT' SECTION WITH COVER	66.4									
		M	H	4	2103-01-001			ANGLE - DIVIDER	¾ X 3 X .060 X 220 ANGLE	3.0	AL. SHEET								
		M	H	2	2103-01-002			COVER - TRAY	15 X 120 X .050 SHEET	9	AL. SHEET								
		M	H	1	2103-01-003		TRAY ASSY	WIRE TRAY CHANNEL	22 X 240 X .060 SHEET	32	AL SHEET								
		M	H	6	2103-01-004	PAYLOAD WIRE TRAY		BRACKET ATTACH	1½ X 2 X .188 X 3 ANGLE	2	AL EXTR.								
	1.2.1.1.1f	M	C	1	2004-00-000	X0 6795 POWER PANEL				4.4									
		M	C	1	2004-01-000		POWER PANEL ASSY		5 X 13 X 13 BOLT ON ASSY	1.6									
		M	C	2	2004-01-001			BRACKET	5 X 11 X .060 SHEET	.3	AL. SHEET								
		M	C	1	2004-01-002		POWER PANEL ASSY	PANEL	13 X 13 X .060 SHEET	1.0	AL SHEET								
		B	C	2	2004-01-003	X0 6795 POWER PANEL		CONNECTOR - FEMALE	SHELL # 36 - FOUR '0' GAGE WIRE	.6									
										.700									
	1.2.1.1.1.h	M	C	1	2005-00-000	PREFLIGHT UMBILICAL				6.6									
		M	C	1	2005-01-000		UMBILICAL PANEL ASSY												
		M	C	1	2005-01-001			PANEL - OUTBOARD	22 X 25 X .060 SHEET - 7 (11/15)	1.3	AL. SHEET								
		M	C	1	2005-01-002			BRACKET - FWD	11 X 24 X .060 SHEET	1.6	AL SHEET								
		M	C	1	2005-01-003	PREFLIGHT UMBILICAL	UMBILICAL PANEL ASSY	BRACKET - AFT	23 X 17 X .060 SHEET	3.7	AL. SHEET								

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	1.2.3.1.1.h	M	H	1	2106-00-000	X₀ 1307 CROSS SUPPORT				317									
		M	H	1	2106-00-001			CROSS TIE	3X3X.250X190 TUBE	139	CARBON STEEL ASTM-A500								
		M	H	2	2106-00-002			ATTACH. PLATE	5X7X.50 PLATE	5	CARBON STEEL ASTM-A242(1)								
		M	H	2	2106-00-003			DIAGONAL	2½X2½X.250X110 TUBE	70	CARBON STEEL ASTM-A500								
		M	H	2	2106-00-004			ATTACH ANGLE	5X5X.50X6 ANGLE	8	CARBON STEEL ASTM-A36								
		M	H	1	2106-00-005	X₀ 1307 CROSS SUPPORT		GUSSET	8X15X.375 PLATE	12	CARBON STEEL ASTM-A242(1)								
	1.2.1.1.1.b	M	C	1	2007-00-000	X₀ 576 AVIONICS HARNESS SUPT.				19.5									
		M	C	1	2007-01-000		VERTICAL SUPPORT ASSY.			10.5									
		M	C	1	2007-01-001			SUPPORT - FWD. FACE	15½X59X.040 SHEET	4	AL. SHEET								
		M	C	1	2007-01-002			CENTER DIVIDER	½X1¾X.032X59 CHANNEL	.5	AL. SHEET								
		M	C	2	2007-01-003			EMI DIVIDER	½X1½X.025X59 ANGLE	.3	AL. SHEET								
		M	C	2	2007-01-004			BRACKET - VERTICAL	½X1⅜X2X.050X1 HAT	.1	AL. SHEET								
		M	C	12	2007-01-005			BRACKET - HORIZ.	½X1⅜X2X.050X1 HAT	.1	AL. SHEET								
		M	C	1	2007-01-006		VERTICAL SUPPORT ASSY.	COVER	19X59X.032 SHEET	4	AL. SHEET								
		M	C	1	2007-02-000		TRANSITION HARNESS SUPT. ASSY.		DESIGN IS TBD ~ 28"	9									
		M	C	1	2007-02-001			SUPPORT	15½X28X.040 SHEET	1.0	AL SHEET								
		M	C	1	2007-02-002			CENTER DIVIDER	½X1¾X.032X28 CHANNEL	2.7	AL SHEET								
		M	C	2	2007-02-003			EMI DIVIDER	½X2½X.025X28 ANGE	.5									
		M	C	2	2007-02-004			BRACKET		.2									
		M	C	2	2007-02-005			BRACKET		.5									
		M	C	1	2007-02-006	X₀ 576 AVIONICS HARNESS SUPT.	TRANSITION HARNESS SUPT. ASSY	COVER	19X28X.032 SHEET	2	AL. SHEET								

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	12122a1	M	H	1	2108-00-000	MISSION SPECIALIST SECONDARY STRUCTURE			CONCEPTUAL DESIGN ONLY	67								
		M	H	1	2108-01-000		UPPER SUPPORT STRUCTURE			5.5								
		M	H	1	2108-01-001			CHANNEL SUPPORT	1x1x3x.080x60 CHANNEL	3.6	AL SHEET							
		M	H	1	2108-01-002			BRACKET SUPPORT	4x4x.070x3 ANGLE	.3	AL. EXTRUSION							
		M	H	3	2108-01-003			ATTACH FITTING	1½x3x.090x1½ TEE	.1	AL EXTRUSION							
		M	H		2108-01-004		UPPER SUPPORT STRUCTURE	MISC.		1.5								
		M	H	1	2108-02-000		CENTER SUPPORT STRUCTURE			18.								
		M	H	1	2108-02-001			CHANNEL SUPPORT	1x1x4x.080x60 CHANNEL	3.8	AL SHEET							
		M	H	6	2108-02-002			SECONDARY STRUCTURE	6x14x4x.090 BEAM	1.8	AL BAR							
		M	H	1	2108-02-003			BRACKET SUPPORT	3x4x.070x3 ANGLE	.1	AL EXTRUSION							
		M	H	2	2108-02-004		CENTER SUPPORT STRUCT.	MISC.		1.6								
		M	H	3	2108-03-000		UPPER CABINET ASSY		14x22x19 RIVETED ASSY.	83								
		M	H	2	2108-03-001			END PANEL	14x22x.050 SHEET .057	1.5	AL SHEET							
		M	H	1	2108-03-002			FRONT PANEL	19x19x.050 SHEET	18	AL. SHEET							
		M	H	1	2108-03-003			TOP PANEL	15x19x.050 SHEET	1.5	AL. SHEET							
		M	H	4	2108-03-004			ATTACH ANGLE LONG	1x1x.060x19 ANGLE	.2	AL EXTRUSION							
		M	H	2	2108-03-005			ATTACH ANGLE HORZ	1x1x.060x14 ANGLE	.2								
		M	H	2	2108-03-006			ATTACH ANGLE VERT	1x1x.060x19 ANGLE	.2								
		M	H	4	2108-03-007		UPPER CABINET ASSY.	ATTACH FITTING	1½x3x.090x1½ TEE	.1	AL EXTRUSION							
		M	H	3	2108-04-000		LOWER CABINET ASSY		12x14x19 RIVETED ASSY	6.3								
		M	H	1	2108-04-001			FRONT PANEL	14x19x.050 SHEET	1.3	AL SHEET							
		M	H	2	2108-04-002			END PANEL	12x14x.050 SHEET	.8	AL SHEET							

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		M	H	1	2108-04-003			TOP PANEL	12 X 19 X .050 SHEET	1.2	AL SHEET								
		M	H	4	2108-04-004			ATTACH ANGLE (Long)	1 X 1 X .060 X 19 ANGLE	.2	AL. EXTRUSION								
		M	H	2	2108-04-005			ATTACH ANGLE (Horiz)	1 X 1 X .060 X 14 ANGLE	.2	AL. EXTRUSION								
		M	H	2	2108-04-006			ATTACH ANGLE (Vert)	1 X 1 X .060 X 12 ANGLE	.1	AL. EXTRUSION								
		M	H	4	2108-04-007		LOWER CABINET ASSY	ATTACH FITTING	1½ X 3 X .090 X 1½ TEE	.1	AL. EXTRUSION								
		M	H	2	2108-00-001			FLOOR ATTACH FTG (INBD)	2 X 3 X .090 X 1½ TEE	.1	AL. EXTRUSION								
		M	H	2	2108-00-002	MISSION SPECIALIST SECONDARY STRUCTURE		FLOOR ATTACH. FTG (OUTB)	2 X 3 X .125 X 1½ TEE	.1	AL. EXTRUSION								
	12.12.2.a.3	M	H	1	2109-00-000	PAYLOAD SPECIALIST SECONDARY STRUCTURE	SAME AS 2103-00-000	MISSION SPECIALIST CONSOLE		67									
	12.12.2.a.2	M	H	1	2110-00-000	ON-ORBIT STATION SECONDARY STRUCTURE			CONCEPTUAL DESIGN ONLY.	424									
		M	H	1	2110-01-000		CABINET ASSY.		18 X 56 X 60 REMATED ASSY.	40									
		M	H	1	2110-01-001			FRONT PANEL	60 X 65 X .050 SHEET	197	AL SHEET								
		M	H	2	2110-01-002			SIDE PANEL	18 X 56 X .050 SHEET	5.	AL. SHEET								
		M	H	4	2110-01-003			FRONT SUPPORT ANGLE	1 X 1 X .050 X 65" ANGLE	.7	AL. EXTRUSION								
		M	H	4	2110-01-004			HORIZONTAL SUPPORT-FRONT	1 X 1 X .050 X 60 ANGLE	.6	"								
		M	H	4	2110-01-005			VERTICAL SUPPORT-AFT	1 X 1 X .050 X 56 ANGLE	.6	"								
		M	H	4	2110-01-006		CABINET ASSY	HORIZONTAL SUPPORT-END	1 X 1 X .050 X 18 ANGLE	.2	AL. EXTRUSION								
		M	H	6	2110-00-001	ON-ORBIT STATION SECONDARY STRUCTURE		FLOOR ATTACH	1½ X 2 X .060 X 2 TEE	.4 ea	AL. EXTRUSION								

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	1.2.1.2.1				3001-00-000	OPERATORS CONSOLE				1800					X				
			C	1	3001-01-000		INPUT/OUTPUT CONTROL UNIT											X	
		B	C	1	3001-01-001			TAPE READER								X			
		B	C	1	3001-01-002			DISK DRIVE											
		B	C	1	3001-01-003			MAGNETIC TAPE UNIT								X			
		M	C	1	3001-01-004			CRT/KEYBOARD									X		
		M	C	1	3001-01-005			CONTROL PANEL - TEST SYSTEM									X		
		B	C	1	3001-01-006			CONTROLLER/DATA PROCESSOR UNIT (C/DPU)	128 K PRIMARY							X			
		B	C	1	3001-01-007			C/DPU - I/O UNIT	CONSISTS OF TTY, CRT/KEYBD, LINE PRINTER, I/O ELECTRONICS & AUXILIARY MEMORY										
		B	C	1	3001-01-008			ELECTRONICS RACK								X			
		B	C	1	3001-01-009			CARD READER								X			
		B	C	1	3001-01-010		INPUT/OUTPUT CONTROL UNIT	THERMAL CONTROL UNIT								X			
			C	1	3001-02-000		TEST MEASUREMENT UNIT											X	
		B	C	1	3001-02-001			TIME CODE GENERATOR								X			
		O	C	1	3001-02-002			INPUT PATCH PANEL								X			
		O	C	1	3001-02-003			THERMAL CONTROL UNIT								X			
		O	C	1	3001-02-004			WAVEFORM ANALYZER								X			
		O	C	1	3001-02-005			DIGITAL VOLTMETER								X			
		B	C	1	3001-02-006			FREQUENCY COUNTER								X			
		B	C	1	3001-02-007	OPERATORS CONSOLE	TEST MEASUREMENT UNIT	ELECTRONICS RACK								X			
															X	X			

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						OPERATORS CONSOLE (CONT'D)													
	1.2.1.2.4	M	C	1	3001-03-000		AVIONICS I/F ELEMENT								X			X	
		O	C	1	3001-03-001			IVE LOGIC DC POWER SUPPLY	± 28 VDC / 100 AMPS							X			
		M	C	1	3001-03-002			C&W - DISP. & CONT. PNL.									X		
		M	C	1	3001-03-003			AUDIO UNIT											
		M	C	1	3001-03-004			CCTV UNIT											
		M	C	1	3001-03-005			CONTROL & DISP. PNL (P/L)											
		M	C	1	3001-03-006			AVIONICS I/F SIM. UNIT					X				X		
		B	C	1	3001-03-007			ELECTRONIC RACK WIRING SET								X			
		B	C	1	3001-03-008														
		B	C	1	3001-03-009	OPERATORS CONSOLE	AVIONICS I/F ELEMENT	THERMAL CONTROL UNIT								X			
	1.2.1.2.3		C	1	3002-00-000	DC POWER SET				600						X		X	
		B	C	1	3002-00-001		DC POWER SUPPLY		± 28 VDC @ 400 AMPS							X			
		M	C	1	3002-00-002	DC POWER SET	REMOTE CONTROL PANEL		(EQUIPMENT IN GFE CONSOLE)							X			
																	X	X	X
																	X	X	
																	X	X	
				1												X	X	X	

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	1.2.1.2.2	M	C	1	3004-00-000	AFT FLIGHT DECK SET									X		X	X	
		M	C	1	3004-01-000		PAYLOAD STATION								X			X	
		M	C	1	3004-01-001			ENCLOSURE							X				
		M	C	1	3004-01-002			THERMAL CONTROL ASSEMBLY							X			X	
		M	C	1	3004-01-003			AUDIO ASSEMBLY							X			X	
		M	C	1	3004-01-004		PAYLOAD STATION	PATCH PANEL WIRING										X	
		M	C	1	3004-02-000		ON-ORBIT STATION								X			X	
		M	C	1	3004-02-001			FLOODLIGHT CONTROL PANEL							X			X	
		M	C	1	3004-02-002			CCTV CONTROL PANEL							X			X	
		M	C	1	3004-02-003			CCTV MONITOR							X			X	
		M	C	1	3004-02-004			MISSION TIMER							X			X	
		M	C	1	3004-02-005			PATCH PANEL							X			X	
		M	C	1	3004-02-006		ON-ORBIT STATION	WIRING										X	
		M	C	1	3004-03-000		MISSION STATION								X			X	
		M	C	1	3004-03-001			C & W AND SAFING PANEL							X			X	
		M	C	1	3004-03-002			P/L POWER CONTROL PANEL							X			X	
		M	C	1	3004-03-003			CRT/KEYBOARD & DEU ASSEMBLY							X			X	
		M	C	1	3004-03-004			COMMUNICATION CONTROL PANEL							X			X	
		M	C	1	3004-03-005			ORBITER C & W PANEL							X			X	
		M	C	1	3004-03-006			AUDIO							X			X	
		M	C	1	3004-03-007			FLOODLIGHT CONTROL PANEL							X			X	
		M	C	1	3004-03-008			PATCH PANEL							X			X	
		M	C	1	3004-03-009		MISSION STATION	WIRING										X	
		M	C	2	3004-04-000	AFT FLIGHT DECK SET	AC INVERTER		115/208 VOLT AC, 3 PHASE 400 HZ, 1 KW.										
	1.2.1.2.1		C	1	3007-00-000	EXTERNAL COMMUNICATION SYSTEM													
	DELETED	B	C	1	3007-00-001			MICROPHONE	UNI-DIRECTIONAL DESK MOUNT	DELETED									
		B	C	1	3007-00-002			LOUD SPEAKER											
		B	C	1	3007-00-003			AMPLIFIER											
		M	C	1	3007-00-004	EXTERNAL COMM. SYSTEM		CABLE SET											

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	1.2.1.2.4	M	H	1	3108-00-000	CABLE SET													
		M	H	1	3108-01-000		AFT FLIGHT DECK TO OPERATORS CONSOLE CABLE ASSEMBLY												
		M	H	1	3108-02-000		E-GROUND ASSEMBLY (SUBSYSTEM TO SINGLE POINT GROUND.)												
		M	H	1	3108-03-000		OPERATORS CONSOLE TO D.C. POWER SET CABLE ASSEMBLY												
		M	H	1	3108-04-000		OPERATORS CONSOLE TO PAYLOAD COOLANT UNIT CABLE ASSY.												
		M	H	1	3108-05-000		FACILITY POWER TO SUB-SYSTEMS												
		M	H	1	3108-06-000	CABLE SET	SELF CHECK CABLE ASSEMBLY.												

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	1.2.3.1.1.9	M	H	1	4101-00-000	X0.576 AIRLOCK INTERFACE				108									
		M	H	1	4101-00-001			RING-AIRLOCK/TUNNEL INTERFACE	30"DIA X 2 X .625	68									
		M	H	2	4101-00-002			ATTACH BRACKET	2 X 6 X .200 X 18 CHANNEL	9	CARBON STEEL ASTM-A-36	C6 X 8.2 CHANNEL							
		M	H	2	4101-00-003			ATTACH BRACKET	2 X 6 X .200 X 16 CHANNEL	9	CARBON STEEL ASTM-A-36	C6 X 8.2 CHANNEL							
		B	H	8	4101-00-004			BOLT	1/2 DIA X 13 TPI X 1¼ LONG	.2									
		B	H	12	4101-00-005	X.576 AIRLOCK INTERFACE		BOLT	1/2 DIA X 1¼ LONG - FLAT HEAD	.2									
	1.2.3.1.1.8	M	H	1	4102-00-000	X0.660 TUNNEL INTERFACE				183									
		M	H	1	4102-01-001			RING - TUNNEL INTERFACE	47"DIA X 3.5 X .625 PLATE	30	AL. PLATE								
		M	H	1	4102-01-002			SUPPORT - LEFT	1½ X 4 X .247 X 98 CHANNEL	51	CARBON STEEL ASTM-A-36	C4 X 6.25 CHANNEL							
		M	H	1	4102-01-003			SUPPORT - RIGHT	1½ X 4 X .247 X 98 CHANNEL	51									
		M	H	1	4102-01-004			SUPPORT - FWD	1½ X 4 X .247 X 28 CHANNEL	15									
		M	H	1	4102-01-005	X0.660 TUNNEL INTERFACE		SUPPORT - AFT	1½ X 4 X .247 X 69 CHANNEL	38	CARBON STEEL ASTM-A-36								
	1.2.3.1.1.a 1.2.1.1.c	B/M	C	1	4003-00-000	PRIMARY LONGERON FITTING, NON-DEPLOYABLE PAYLOAD													
		B/M	C	1	4003-01-000		JOURNAL ASSEMBLY												
		B/M	C	1	4003-01-001			UPPER JOURNAL	5 X 5 X 13 FORGING		STEEL								
		B/M	C	1	4003-01-002			LOWER JOURNAL	5 X 6 X 13 FORGING		STEEL								
		B	C	1	4003-01-003			BEARING - BALL *	2.00" X 4.200 SPHERICAL BEARING		INCONEL 718 AMS 5663								
		M	C	2	4003-01-004			SHEAR PIN	.875 DIA X 1 LONG		STEEL A-286 STEEL								
		B	C	1	4003-01-005			BEARING - RACE *	1.750 X 5.375 DIAMETER		AMS 5737								
		M	C	1	4003-01-006			JOURNAL LOCK PIN	2.0 DIA X 3.125 LONG		STEEL								
		M	C	1	4003-01-007			JOURNAL LOCK BOLT	1.0 DIA X 3.0 LONG		STEEL								
		B	C	1	4003-01-008	PRIMARY LONGERON FTG.	JOURNAL ASSEMBLY	BOLT	1.0 DIA. X 4.50 LONG		STEEL								

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ITEM NUMBER	WBS NUMBER	SOURCE	CONFIGURATION	QUANITY	IDENTIFICATION NUMBER	OPTIONAL EQUIPMENT NOMENCLATURE: MODULE	ASSEMBLY	ITEM	DESCRIPTION	WEIGHT	MATERIAL/SPEC.	DRAWING OR PROCUREMENT SPEC. NUMBER	TEST REQMTS.: DEVELOPMENT	QUALIFICATION	ACCEPTANCE	RECEIVING	SUB-SYSTEM	SYSTEM	SPARES
	1.2.3.1.1.c 1.2.4.1.1.e	M	C	1	4104-00-000	AUXILIARY KEEL FITTING			7 x 8½ x 2	21	STEEL								
	1.2.3.1.1.i	M	H	1	4105-00-000	P/L UPPER CLEARANCE GAGE				.73									
		M	H	2	4105-01-000		LEG SUPPORT ASSY.			25									
		M	H	2	4105-01-001			STIFFENER	1½ x 2 x .060 x 92 ANGLE	2	AL. EXTRUSION								
		M	H	2	4105-01-002			STIFFENER	1½ x 2 x .060 x 58 ANGLE	1.2	AL. EXTRUSION								
		M	H	1	4105-01-003			PANEL	15 38 x 97 x .060 SHEET 50%	11	AL. SHEET								
		M	H	1	4105-01-004			GUSSET	4 x 20 x 11 x .060 CHANNEL 50%	.6	AL. SHEET								
		M	H	8	4105-01-005			STIFFENER	1½ x 2 x .060 x 7 ANGLE	.2	AL. EXTRUSION								
		M	H	1	4105-01-006			ROLLER SUPPORT, L.S.	4 x 10 x .250 SHEET	1	AL SHEET								
		M	H	1	4105-01-007			ROLLER SUPPORT, RS	4 x 10 x .250 SHEET	1	AL. SHEET								
		M	H	2	4105-01-008			ROLLER	2.5 DIA x 1.5 LONG	.7	AL. ROD								
		M	H	2	4105-01-009			SPACER	1.5 DIA x 1 LONG	.2	AL. ROD								
		B	H	2	4105-01-010		LEG SUPPORT ASSY.	BOLT	.50 DIA. x 3 LONG	.8	AL. ALLOY								
		M	H	1	4105-02-000		HORIZONTAL SUPPORT ASSY			13.6									
		M	H	1	4105-02-001			PANEL	15 x 92 x .060 SHEET	8	AL SHEET								
		M	H	2	4105-02-002			STIFFENER	1½ x 2 x .060 x 92 ANGLE	2	AL. EXTRUSION								
		M	H	4	4105-02-003		HORIZONTAL SUPPORT ASSY.	STIFFENER	1½ x 2 x .060 x 15 ANGE	0.4	AL EXTRUSION								

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T = TEST REQUIRED
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MFG. PART NUMBER	SOURCE	CONFIGURATION	QUANTITY	ID NO. BY SYSTEM NUMBER	NOMENCLATURE: MODULE	NOMENCLATURE: ASSEMBLY	NOMENCLATURE: ITEM	DESCRIPTION	WEIGHT	MATERIAL/SPEC.	DRAWING OR SPECIFICATION NUMBER	TEST REQMTS: DEVELOPMENT	TEST REQMTS: QUALIFICATION	TEST REQMTS: ACCEPTANCE	TEST REQMTS: REDUCED	TEST REQMTS: SUB-SYSTEM	TEST REQMTS: SYSTEM	TEST REQMTS: SPARE
12.3.11.2				4105-00-000	UPPER CLEARANCE GAGE (CONTD)													
	M	N	4	4105-00-001			PANEL ATTACH ANGLE	9 X 15 X .375 SHEET -94%	5.5	AL SHEET								
	O	N	10	4105-00-002			BOLT	.375 X 1½ LONG	.2	AL ALLOY								
	M	N	2	4105-03-000		SIDE GAGE ASSY			4.2									
	M	N	1	4105-03-001			GAGE SEGMENT	12 X .060 X 87 SHEET 50%	1.6	AL. SHEET								
	M	N	3	4105-03-002			ATTACH CLIP	2 X 2 X .060 X 2 ANGLE	.05	AL EXTRUSION								
	M	N	1	4105-04-000		CENTER GAGE ASSY			6.8									
	M	N	1	4105-04-001			GAGE SEGMENT	12 X .060 X 90 SHEET 50%	6.5	AL. SHEET								
	M	N	5	4105-03-002		CENTER GAGE ASSY.	ATTACH CLIP	SAME AS 4105-03-002 CLIP	.05	AL. EXTRUSION								
	M	N	2	4105-00-003			GUIDE RAIL INSTALLATION TOOL	1½ X 3 X 3 X .188 X 240 SEE DESIGN TBD.	37	AL EXTRUSION								
				4105-00-004	- UPPER CLEARANCE GAGE													
12.3.11.3	M	N	1	4106-00-000	- LOWER CLEARANCE GAGE				154									
	M	N	1	4106-01-000		CENTER GAGE ASSY			92.6									
	M	N	1	4106-01-001			CENTER TEMPLATE	16 X 88 X .188 SHEET -60%	11.6	AL SHEET								
	M	N	1	4104-01-002			TEMPLATE SUPPORT	39 X 73 X .188 SHEET -50%	29.5	AL SHEET								
	M	N	2	4106-01-003			DIAGONAL SUPPORT	11 X 21 X .125 SHEET -62%	2.0	AL SHEET								
	M	N	2	4106-01-004			TRANSVERSE ANGLE	1½ X 1½ X .125 X 57 ANGLE	.10	AL EXTRUSION								
	M	N	2	4106-01-005			BASE SUPPORT	1⅜ X 2 X .125 X 20 CHANNEL	1.5	AL. EXTRUSION								
	M	N	4	4106-01-006			ROLLER	2¾ DIA X 1 ROD	.6	AL ALLOY ROD								
	B	N	4	4106-01-007			AXLE	.250 DIA X 1⅜ LONG BOLT	0.1	AL. ALLOY								
	B	N	4	4106-01-008			NUT	.250 DIA NUT	–	AL ALLOY								
	B	N	9	4106-01-009		CENTER GAGE ASSY	WASHER / SHIM		–	AL ALLOY								
	M	N	1	4106-00-001			CENTER ROLLER GUIDE	⅞ X 3¼ X .281 X 240 CHANNEL	34.	AL. EXTRUSION								
	M	N	1	4106-00-002			OUTER ROLLER GUIDE	⅞ X 1½ X .125 X 240 CHANNEL	10.6	AL EXTRUSION								

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ITEM NUMBER	WBS NUMBER	SOURCE	CONFIGURATION	QUANITY	IDENTIFICATION NUMBER	OPTIONAL EQUIPMENT NOMENCLATURE: MODULE	ASSEMBLY	ITEM	DESCRIPTION	WEIGHT	MATERIAL / SPEC.	DRAWING OR PROCUREMENT SPEC. NUMBER	TEST REQMTS.: DEVELOPMENT	QUALIFICATION	ACCEPTANCE	RECEIVING	SUB-SYSTEM	SYSTEM	SPARES
	1.2.3.1.1.j				4106-00-000	LOWER CLEARANCE GAGE (cont'd)													
		M	H	1	4106-02-000		SIDE GAGE ASSY.			20		80							
		M	H	1	4106-02-001			SIDE TEMPLATE	13x66x.188 SHEET -85%	10.5	AL. SHEET								
		M	H	1	4106-02-002			DIAGONAL SUPPORT (FWD)	11x19x.060 SHEET -50%	.6	AL SHEET								
		M	H	1	4106-02-003			DIAGONAL SUPPORT (AFT)	11x19x.060 SHEET -50%	.6	AL. SHEET								
				1	4106-02-004			TEMPLATE SUPPORT	1½x1½x.125x42 ANGLE	1.6	AL. SHEET								
		M	H	2	4106-01-005			BASE SUPPORT	1⅛x2x.125x20 CHANNEL	1.5	AL. EXTRUSION								
		M	H	4	4106-01-006			ROLLER	2¾ DIA x 1 ROD	.6	AL ALLOY ROD								
		B	H	4	4106-01-007			AXLE	.250 DIA. x 1⅜ LONG BOLT	.1	AL. ALLOY								
		M	H	1	4106-02-005			DIAGONAL	10x16x.060 SHEET -32%	.5	AL. SHEET								
		M	H	1	4106-02-006			DIAGONAL	10x16x.060 SHEET	.5	AL. SHEET								
		B	H	1	4106-01-008			NUT	.250 DIA		AL. ALLOY								
		B	H	-	4106-01-009			WASHER / SHIM											
		M	H	1	4106-00-001		SIDE GAGE ASSY.	ROLLER GUARD	⅛x3½x.250x240 CHANNEL	34	AL. EXTRUSION								
		M	H	3	4106-00-003	LOWER CLEARANCE GAGE		SUPPORT BRACKET	4x8x.188 SHEET 50%	.5	AL. SHEET								

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	12.3.1.1.K	M	C	1	4107-00-000	OMS ΔV ENVELOPE			DESIGN IS TBD. USE TYPICAL JOY ADD ON APPROACH.	—	—								
		M	C	1	4107-01-000		500 FPS Δ VELOCITY												
		M	C	1	4107-02-000		1000 FPS Δ VELOCITY		ADD ON TO BASIC 500 FPS										
		M	C	1	4107-03-000	OMS ΔV ENVELOPE	1500 FPS Δ VELOCITY		ADD ON TO 1000 FPS.										
	12.3.3.1.e	M	H	1	4108-00-000	FLOODLIGHT X0 576 BULKHD.				2.4									
		B	H	1	4108-00-001			DOCKING FLOODLIGHT	LIGHT SELECTION TBD.	2									
		M	H	2	4108-00-002			BRACKET	4 X 8 X .060 SHEET	1.2	AL. ALLOY								
		M	H	1	4108-00-003			WIRE HARNESS											
		B	C	1	4108-00-004	FLOODLIGHT - X0 576 BULKHD.		SWITCH											
	12.1.2.2.05 12.3.3.1.f	M	C	4	4009-00-000	X0 576 PAYLOAD SERVICE PANEL				2.8									
		M	C	1	4009-01-000		SERVICE PANEL ASSY			2.8									
		M	C	1	4009-02-001			PANEL	8 X 16 X .188 SHEET -25%	1.8	AL. SHEET								
		B	C	9	4009-03-002	X0 576 PAYLOAD PANEL	SERVICE PANEL ASSY	CONNECTOR-FEED THRU	NSL 57N FEED-THRU CONNECTOR DEUTSCH ELECTRIC CO.	.1		40M38277 CONTROL SPEC.							
	12.3.2.1.9		H	1	4110-00-000	ENVIROMENTAL CONTROL UNIT SET			DESIGN IS TBD	—									
		B	H	1	4110-01-000		HEAT EXCHANGER												
		M	H	1	4110-02-000		CONTROL & DISPLAY												
		B	H	1	4110-03-000		PURGE & TEST												
		B	H	1	4110-04-000		FLUID LINES SET												
		M	H	1	4110-05-000	ENVIROMENTAL CONTROL UNIT SET	INTERFACE PANEL ASSY.												

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				3	4111-00-000	CASTERS				655									
		B	H	4	4111-01-000		CASTER ASSY - SWIVEL		NO. 503N12-1800 AEROL CO. INC.	90	L.A. CALIF.								
	DELETED	M	H	2	4111-00-001			DIAGONAL-SUPPORT	2X2 X .250 X 43 TUBE	19	CARBON STEEL ASTM-A500								
		M	H	2	4111-00-002			PLATE-SUPPORT	11 X 25 X .375 PLATE	(12.1) EA	CARBON STEEL ASTM A 36(1)	DELETED							
		M	H	4	4111-00-003			ANGLE-ATTACH	8 X 10 X 1 X 11 ANGLE	35	CARBON STEEL ASTM-A36								
		M	H	4	4111-00-004			DIAGONAL	6 X 6 X .75 PLATE		H								
		B	H	12	4111-00-005	CASTERS		BOLT	.50 DIA X 2	.2									
	1.5.1	M	C	1	4012-00-000	HOISTING				761									
		M	C	2	4012-00-001			BEAM-SPREADER	MC10 X 21.9 X 204" CHANNEL	372 (3=6)	CARBON STEEL ASTM-A36								
		M	C	4	4012-00-002			ATTACH LUG	4 X 4 X .750 PLATE	3.4	CARBON STEEL ASTM A 36 (1)								
		B	C	4	4012-00-003			CLEVIS	3/4 DIA BOLT	.5	STEEL ALLOY								
		B	C	6	4012-00-004	HOISTING		BOLT	.50 DIA X 2	.2	STEEL ALLOY								
	1.5.1.	M	H	1	4013-00-000	TOWING	(USE R.I. STANDARD	11EH-B-0244 TOW BAR)		280									
		M	H	2	4013-01-000		ATTACH ASSY (L & R)			195									
		M	H	1	4013-01-001			ATTACH ANGLE	6 X 6 X .375 X 4 ANGLE	5 (14.1)	CARBON STEEL ASTM-A36								
		M	H	1	4013-01-002			LUG	4 X 4 X .75 PLATE	3.4 (14.1)	CARBON STEEL ASTM A 36(1)								
		B	H	4	4013-01-003		ATTACH ASSY.	BOLT	.50 DIA. X 2 LONG	.2	STEEL ALLOY								
	DELETED	M	H	1	4013-02-000		TONGUE ASSY			259		DELETED							
		M	H	2	4013-02-001			TOW BAR (L & R)	3" DIA X .250 X 140" TUBE	(1.34) 86	CARBON STEEL ASTM-A36								
		M	H	1	4013-02-002			CROSS BAR	3" DIA. X .250 X 120" TUBE	74	CARBON STEEL ASTM-A36								
		B	H	2	4013-02-003			CLEVIS	3/4 DIA. BOLT	.5	STEEL ALLOY								
		B	H	1	4013-02-004	TOWING	TONGUE ASSY	RING	1.5 DIA X 6" O.D.	12	STEEL								

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	1.2.3.3.1.C		C	1	4014-00-000	TV, X-576 BULLHEAD													
			C	1	4014-01-000		TV CAMERA ASSY												
		B	C	1	4014-01-001			CAMERA, B & W	COHO MODEL 4440										
		B	C	1	4014-01-002			LENS	CANNON 15-105 MM ZOOM										
		B	C	1	4014-01-003			HEAD-TILT & PAN	PELCO # 550										
		B	C	1	4014-01-004		TV CAMERA ASSY.	VIDICON TUBE	RCA # 8521										
		M	C	1	4014-02-000		REMOTE CONTROL UNIT												
		B	C	1	4014-02-001			ZOOM CONTROL	PELCO										
		B	C	1	4014-02-002			TILT & PAN CONTROL	PELCO										
		M	C	1	4014-02-003		REMOTE CONTROL UNIT	CONTROL PANEL			AL SHEET								
		M	C	1	4014-03-000		CAMERA INSTL.												
		M	C	1	4014-03-001			BASE	15 X 10 X .050		AL SHEET								
		M	C	2	4014-03-002			BRACKET	15 X 6 X .050		AL SHEET								
		M	C	1	4014-03-003		CAMERA INSTL.	CABLE SET	POWER, CONTROL & MONITOR										
		B	C	1	4014-04-000		TV MONITOR, ASSY												
		B	C	1	4014-04-001			MONITOR UNIT	SONY # 980 - 9" SCREEN										
		M	C	1	4014-04-002			BASE	12 X 12 X .050		AL. SHEET								
		M	C	2	4014-05-003	TV, X-576	TV MONITOR ASSY	BRACKET	6 X 12 X .050		AL SHEET								

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	1.2.3.3.1.C		H	1	4115-00-000	TV Xo 1307 BULKHEAD													
		B	H	1	4115-01-000		TV CAMERA ASSY.												
		B	H	1	4115-01-001			CAMERA, C & W	COHO MODEL 4410										
		B	H	1	4115-01-002			LENS	CANNON, 15-105 MM ZOOM										
		B	H	1	4115-01-003			TILT & PAN HEAD	PELCO MODEL 550										
		B	H	1	4115-01-004		TV CAMERA ASSY	VIDICON TUBE	RCA # 8521										
		M	H	1	4115-02-000		REMOTE CONTROL UNIT.												
		B	H	1	4115-02-001			ZOOM CONTROL	PELCO										
		B	H	1	4115-02-002			TILT & PAN CONTROL	PELCO										
		M	H	1	4115-02-003		REMOTE CONTROL UNIT	CONTROL PANEL			AL. SHEET								
		M	H	1	4115-03-000		CAMERA INSTL.												
		M	H	1	4115-03-001			BASE	12 X 18 X .050		AL. SHEET								
		M	H	2	4115-03-002			SUPPORT-VERTICAL	2 X 2 X .060 X 60 ANGLE		EXTRUSION								
		M	H	2	4115-03-003			BRACKET	8 X 18 X .060 SHEET.		AL SHEET								
		M	H	1	4115-03-004		CAMERA INSTL.	CABLE SET	POWER, CONTROL & MONITOR										
		M	H	1	4115-04-000		TV MONITOR ASSY												
		B	H	1	4115-04-001			MONITOR UNIT	SONY 900, 9" SCREEN										
		M	H	1	4115-04-002			BASE	12 X 12 X .050		AL. SHEET								
		M	H	2	4115-04-003	TV, Xo 1307	TV MONITOR ASSY	BRACKET	6 X 12 X .050		AL. SHEET								

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	1.2.3.3.1.1.1	M	H	3	4116-00-000	PAYLOAD BAY LINER				493	X 3 = 1479								
		M	H	14	4116-00-001			FRAME	.90 X 2.40 X .050 X 100 INAT	2.2	N = 2/7 0" ALUM EXTRUSION	M5049-3521-0055							
		M	H	4	4116-00-002			FRAME-END	.75 X .875 X .063 X 100 ZEE	1.5		AND10138-0704							
		M	H	8	4116-00-003			SUPPORT-LONGERON	2.0 X 1.75 X .125 X 840 TEE	11.4		AND10136-2008							
		M	H	8	4116-00-004			SUPPORT-LONGERON	SHEAR 1 X 2.00 X .050 X 60 ANGLE	.9	AL. EXTRUSION								
		M	H	6	4116-00-005			BRACKET No. 1 (L&R)	4 X 4 X .030 SHEET	.1	AL. SHEET								
		M	H	6	4116-00-006			BRACKET NO. 2 (L&R)	6 X 17 X .060 SHEET	.5									
		M	H	6	4116-00-007			BRACKET No. 3 (L&R)	6 X 14 X .060 SHEET	.4									
		M	H	6	4116-00-008			BRACKET, NO. 4 (L&R)	4 X 7 X .050 SHEET	.1 (.2#)	AL. SHEET								
		M	H	4	4116-00-009			LINING NO. 1	48 X 120 RVEX 3/4" - NO. 13	32	L.C. STEEL EXPANDED METAL								
		M	H	8	4116-00-010			LINING NO. 2	36 X 120 RVEX 3/4" - NO. 13	24									
		M	H	2	4116-00-011	PAYLOAD BAY LINER		LINING NO. 3	24 X 120 RVEX 3/4" - NO. 13	16	L.C. STEEL EXPANDED METAL								
	1.2.3.3.1.d	M	C	1	4017-00-000	PREFLIGHT UMBILICAL ELECTRICAL PANEL				5									
		M	C	1	4017-00-001			UMBILICAL PANEL	13 X 18 X .250 SHEET	5	AL. SHEET								
		M	C	TBD	4017-00-002	PREFLIGHT UMBILICA		ELECTRICAL CONNECTOR	LOCATION & NUMBER ARE TBD.										
	1.2.3.3.2.1.d	M	C	1	4018-00-000	PREFLIGHT UMBILICAL FLUID PANEL				5									
		M	C	1	4018-00-001			UMBILICAL PANEL	11 X 18 X .250 SHEET	5	AL SHEET								
		M	C	TBD	4018-00-002	PREFLIGHT UMBILICAL FLUID PANEL		FLUID COUPLING	LOCATION & NUMBER ARE TBD.										
	1.2.3.3.1.6	M	C	1	4019-00-000	PAYLOAD BAY FLOODLIGHT				4.3									
		B	C	6	4019-00-001			FLOODLIGHT	6 X 12 X 4" BOX (LIGHT TBD)	4.									
		M	C	2	4019-00-002			BRACKET } UPPER LIGHT BRACKET }	10 X 10 X .060 SHEET	.6	AL. SHEET								
		M	C	2	4019-00-003				10 X 10 X .060 SHEET	.6	AL. SHEET								
		M	C	8	4019-00-004			BRACKET } LOWER BRACKET } LIGHTS	20 X 22 X .060 SHEET	2.6	AL. SHEET								
		M	C	4	4019-00-005				15 X 18 X .060 SHEET	1.6	AL. SHEET								
		M	C	6	4019-00-006			WIRE HARNESS SWITCH		TBD.									

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TEST REQMTS.: X = TEST REQUIRED, 1 = QUANITY FOR TEST

ITEM NUMBER	WBS NUMBER	SOURCE	CONFIGURATION	QUANITY	IDENTIFICATION NUMBER	OPTIONAL EQUIPMENT NOMENCLATURE: MODULE	ASSEMBLY	ITEM	DESCRIPTION	WEIGHT	MATERIAL/SPEC.	DRAWING OR PROCUREMENT SPEC. NUMBER	TEST REQMTS.: DEVELOPMENT	QUALIFICATION	ACCEPTANCE	RETESTING	SUB-SYSTEM	SYSTEM	SPARES
	1.2.1.1.1.6	M	H	1	4120-00-000	X0 1307 BULKHEAD				325									
		M	H	1	4120-01-000	↓	BULKHEAD ASSY.	SIMILAR TO X0 576 BULKHEAD ASSY IN DESIGN, MATERIAL AND FABRICATION. ALL ESTIMATES SHOULD BE BASED ON X0 576 BULKHEAD PLUS A FACTOR OF 3.										
		M	H	1	4120-02-000	X0 1307 BULKHEAD	BULKHEAD ASSY.												
	1.2.3.2.1.6	M	H	1	4121-00-000	X0 1307 P/L OXIDIZER/FUEL PANELS				50									
		M	H	1	4121-01-000		OXIDIZER PANEL ASSY (LS)			18.6									
		M	H	1	4121-01-001			PANEL	12 X 12 X .250 SHEET	3.6	AL. SHEET								
		B	H	1	4121-01-002			FLUID COUPLING (M)	6" DIA	11	STAINLESS STEEL								
		M	H	1	4121-02-000		OXIDIZER PANEL PANEL (LS)			5.2									
		M	H	1	4121-02-001			PANEL	12 X 12 X .250 SHEET	3.6	AL. SHEET								
		B	H	1	4121-02-002			COUPLING	1" DIA.	1	STAINLESS								
		B	H	1	4121-02-003			COUPLING	1/2" DIA.	.6	STAINLESS								
		M	H	1	4121-03-000		FUEL PANEL ASSY (RS)			15.6									
		M	H	1	4121-03-001			PANEL	12 X 12 X .250 SHEET	3.6	AL. SHEET								
		B	H	1	4121-03-002			FLUID COUPLING (M)	3.5" DIA	7.	STAINLESS								
		B	H	1	4121-03-003			FLUID COUPLING (M)	2.5" DIA	5	STAINLESS								
		M	H	1	4121-04-000		FUEL PANEL ASSY (RS)			14.6									
		M	H	1	4121-04-001			PANEL	12 X 12 X .250 SHEET	3.6	AL SHEET								
		B	H	1	4121-04-002			FLUID COUPLING (M)	4" DIA.	8	STAINLESS								
		B	H	1	4121-04-003			FLUID COUPLING (M)	1 1/2" DIA.	2.	↓								
		B	H	1	4121-04-004	X0 1307 P/L OXIDIZER/FUEL PANELS		FLUID COUPLING (M)	1" DIA.	1	STAINLESS								

IVE HARDWARE UTILIZATION LIST

SOURCE
M = MAKE
B = BUY
O = OFF THE SHELF

CONFIGURATION
H = HORIZONTAL
V = VERTICAL
C = COMMON

TEST REQMTS.
X = TEST REQUIRED
1 = QUANITY FOR TEST

ITEM NUMBER	WBS NUMBER	SOURCE	CONFIGURATION	QUANITY	IDENTIFICATION NUMBER	TEST EQUIPMENT NOMENCLATURE: MODULE	TEST EQUIPMENT NOMENCLATURE: ASSEMBLY	TEST EQUIPMENT NOMENCLATURE: ITEM	DESCRIPTION	WEIGHT	MATERIAL/SPEC.	DRAWING OR PROCUREMENT SPEC. NUMBER	TEST REQMTS.: DEVELOPMENT	TEST REQMTS.: QUALIFICATION	TEST REQMTS.: ACCEPTANCE	TEST REQMTS.: SYNTHESIS	TEST REQMTS.: SUB-SYSTEM	TEST REQMTS.: SYSTEM	REMARKS
	1.5.1.	M	H	1	4122-00-000	PAYLOAD MASS SIMULATOR				65,000									
		M	H	1	4122-01-000		BALLAST ASSEMBLY			62,520 (4)									
		M	H	1	4122-01-001			SUPPORT BEAM	WF 11½ x 16 x 15' I BEAM	1440	STEEL								
		M	H	12	4122-01-002			REINFORCING ROD	1" DIA X 14 FEET 2,67	37.4	STEEL								
		M	H	180	4122-01-003			BALLAST		62,376	CONCRETE								
		M	H	2	4122-01-004			HOIST/END PLATE	15 x 31 x 1 PLATE	132	STEEL								
		M	H	4	4122-01-005		BALLAST ASSEMBLY	GUSSET	8 x 8 x 1 PLATE (30)	9	STEEL								
		M	H	2	4122-02-000		TRUNNION ASSY			69									
		M	H	1	4122-02-001			TRUNNION	DIA X 12 ROD. (804)	28	STEEL								
		M	H	1	4122-02-002		TRUNNION ASSY.	PLATE	12 x 12 x 1. PLATE	41	STEEL								
		M	H	8	4122-00-001	PAYLOAD MASS SIMULATOR		BOLT	1" DIA. x 3"	.7	STEEL								

IVE · HARDWARE UTILIZATION LIST

SOURCE
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V = VERTICAL
C = COMMON

TEST REQMTS.
X = TEST REQUIRED
1 = QUANITY FOR TEST

OPTIONAL EQUIPMENT

ITEM NUMBER	WBS NUMBER	SOURCE	CONFIGURATION	QUANITY	IDENTIFICATION NUMBER	NOMENCLATURE: MODULE	NOMENCLATURE: ASSEMBLY	NOMENCLATURE: ITEM	DESCRIPTION	WEIGHT	MATERIAL/SPEC.	DRAWING OR PROCUREMENT SPEC. NUMBER	TEST REQMTS.: DEVELOPMENT	QUALIFICATION	ACCEPTANCE	RECEIVING	SUB-SYSTEM	SYSTEM	SPARES
	1.2.3.3.1.e	M	H	1	4124-00-000	Xo 1307 ELECTRICAL	SERVICE PANEL			9.4									
		M	H	1	4124-01-000		PANEL ASSY. (LH.)			4.7									
		M	H	1	4124-01-001			PANEL (LH)	12 X 12 X .250 SHEET	3.5	AL ALLOY								
		B	H	1	4124-00-001			CONNECTOR - POWER	36 SHELL SIZE CONNECTOR	.6	AL ALLOY								
		B	H	2	4124-00-002		PANEL ASSY (LH)	CONNECTOR - SIGNAL	22 SHELL SIZE CONNECTOR	.3	AL ALLOY								
		M	H	1	4124-02-000		PANEL ASSY (RH)			4.7									
		M	H	1	4124-02-001			PANEL (RH)	12 X 12 X .250 SHEET	3.5	AL ALLOY								
		B	H	1	4124-00-001			CONNECTOR - POWER	36 SHELL SIZE	.6	AL ALLOY								
		B	H	2	4124-00-002	Xo 1307 SERVICE PNL	PANEL ASSY (RH)	CONNECTOR - SIGNAL	22 SHELL SIZE	.3	AL ALLOY								
	~~1.2.3.1.1.f~~	~~M~~	~~H~~	~~1~~	~~4125-00-000~~	~~KEEL FITTING, X-X AND Y-Y LOADS~~			~~7 X 8½ X 2~~	~~21.~~	~~STEEL~~	DELETED							
	1.2.1.1.1.d 1.2.3.1.1.b	M	H	1	4126-00-000	STABILIZING LONGERON FITTING, NON-DEPLOYABLE PAYLOAD			IDENTICAL TO KIT 4003-00-000 EXCEPT SHEAR PIN (PN 4003-01-004) IS NOT REQUIRED.										
	1.2.3.3.1.g	M	C	1	4127-00-000	CABLE SETS													
		M	C	1	4127-01-000		Xo 1307 POWER CABLE SET	TBD											
		M	C	1	4127-02-000	CABLE SETS	Xo 1307/T-O CABLE SET	TBD											
	1.2.3.1.1.m	M	H	1	4128-00-000	T-O UMBILICAL PROVISIONS													
		M	H	1	4128-01-000		L.H. PANEL ASSEMBLY	TBD											
		M	H	1	4128-02-000	T-O UMBILICAL PROV.	R.H. PANEL ASSEMBLY.	TBD											
	1.2.3.2.1.c	M	H	1	4129-00-000	T-O UMBILICAL FLUID I/F ASSY.		TBD											

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APPENDIX B

HORIZONTAL IVE IN-FIELD ASSEMBLY PROCEDURE

B-1. INTRODUCTION

This Appendix contains an in-field assembly procedure for the Horizontal IVE and assumptions/guidelines employed. The in-field assembly procedure was developed to increase the degree of confidence in the basic IVE design approach by identifying possible problem areas associated with the IVE design. An iterative procedure was used resulting in a compatible design and in-field assembly procedure as discussed in Section B-3 of this appendix.

B-2. COMMENTS

The following comments apply to the procedures discussed in Section B-3 of this appendix.

1. The X, Y, Z coordinate system used in the IVE structure assembly procedure is the same as the Shuttle Orbiter coordinate system.

2. Special tools/aids required during the assembly of the IVE structure consists of two (2) spreader/hoist bars and two (2) master alignment tools which are contractor furnished.

3. No special tools are required to be provided by the User for the assembly of the structure. However, it is assumed that standard facility equipment such as an overhead hoist/crane, forklift, optical transit, targets, and levels will be available during assembly operations.

4. The assembly procedure is predicated upon the premise that the structure has been assembled, aligned, verified and disassembled by the Contractor prior to delivery to the User.

5. Upon completion of assembly and verification of alignment the nuts on all the bolted connections shall be "sealed" with a material similiar to locktite to prevent inadvertant loosening of bolts.

6. It is anticipated that at the 100% drawing completion milestone an identification code will be devised and each part of the IVE structure marked. The coding will be incorporated in the in-field assembly procedure to facilitate assembly by the User.

B-3. IN-FIELD ASSEMBLY PROCEDURE

A. Section 2 Assembly. (See Figure B-1 View B)

A.1. Position 4 floor plates on floor to form rectangle approximately 16 feet by 20 feet.

A.2. Position 3 cross beams on support blocks between floor plates at 10 foot intervals.

A.3. Using overheat hoist, position right hand truss assembly on floor plates. Position end of cross beam between Horizontal attach plates at three places along bottom of truss assembly.

A.4. Bolt cross beams to truss assembly. (Do not torque bolts at this time).

A.5. Position and bolt right hand knee braces to truss assembly and three cross beams. (Do not torque bolts at this time).

A.6. Repeat Steps A.3, A.4 and A.5 for left hand truss assembly.

A.7. Detach overhead hoists from right and left hand truss assemblies.

A.8. Attach spreader bars to longeron at each end of Section assembly as shown in Figure B-1 View C.

A.9. Position diagonal tie rods below cross beams and attach to left and right truss assemblies.

A.10. Level bridge rails with floor screw jacks in the X and Y planes (Use facility optical equipment).

A.11. Square section assembly by adjusting tie rods.

A.12. Plumb truss assemblies in the vertical plane by adjusting knee braces.

A.13. Remove spreader bars from section assembly.

A.14. Position master alignment tool at each end of section assembly as shown in Figure B-1 View D and check alignment of shear pin holes in rails. If no fit, repeat steps A.10, A.11 and A.12 as required.

A.15. Install tooling dowel pins as provided for at the bolted connections.

A.16. Torque all bolts to specified values.

A.17. Position and attach two keel beams at Y_O centerline.

A.18. Position and attach keel longerons to keel and cross beams. Check location using master alignment tool.

A.19. Install tooling dowel pins in keel beams and longerons.

A.20. Torque keel bolts to specified values.

A.21. Remove master alignment tools from section assembly.

A.22. Verify final alignment. (Assembly of Section 2 is complete).

Section 3 Assembly. (See Figure B-1 View E)

B.1. Position 2 floor plates on floor 20 feet aft of and in line with Section 2 assembly.

B.2. Position 3 cross beams on support blocks between floor plates at 10 foot intervals. (The 2 floor plates at Station X_O1063.3 are shared by Sections 2 and 3).

B.3. Using overhead hoist, position right hand truss assembly so upper longeron is in line with splice plate on Section 2 longeron and insert one bolt.

B.3.a Adjust screw jacks to align both upper and lower splice plates between sections 2 and 3 and install remaining bolts. (Do not torque bolts at this time).

B.4. Position end of cross beam between horizontal attach plates at three places along bottom of truss assembly and bolt cross beams to truss. (Do not torque bolts at this time).

B.5. Position and bolt right hand knee braces to truss assembly and three cross beams. (Do not torque bolts at this time).

B.6. Repeat steps B.3., B.3.a, B.4. and B.5 for left hand truss assembly.

B.7. Detach overhead hoist from left and right truss assemblies.

B.8. Attach spreader bar to longerons at aft end of Section 3 as shown in Figure B-1 View F.

B.9. Repeat Steps A.9 through A.13 for Section 3.

B.10. Position master alignment tool to span joint between Section 2 and 3 as shown in Figure B- View A. Position second alignment tool at af end of Section 3.

B.11. Check alignment of shear pin holes in rails a each tool. If no fit, repeat steps A.10, A.1 and A.12 as required.

B.12. Install tooling dowel pins as provided for at the bolted connections.

B.13. Torque all bolts to specified values.

B.14. Position and attach two keel beams to the cross beams at Y_O centerline (Figure B-2 View A).

B.15. Attach Section 3 keel longerons to keel beams and check alignment of keel fitting attach holes with master alignment tool across Section joint at Station X_O 1063.3.

B.16. Install tooling dowel pins in keel beams a longerons.

B.17. Torque keel bolts to specified values.

B.18. Remove master alignment tools from Section assembly.

B.19. Verify alignment of rails and keel longerons fo Section 2 and 3.

C. Section 1 Assembly. (See Figure B-2 View B)

C.1 Position 2 floor plates on floor 20 feet forward of and in line with Section 2 assembly.

C.2 Position 3 cross beams on support blocks between floor plates at 10 foot intervals. (The 2 floor plates at Station X_O819.66 are shared by Sections 1 and 2).

C.3 Using overhead hoist, position right hand truss assembly so upper longeron is in line with splice plate at forward end of Section 2 and insert one bolt.

C.4 Adjust screw jacks to align both upper and lower splice plates between Sections 1 and 2 and install remaining bolts. (Do not torque bolts at this time)

C.5 Position end of cross beam between horizontal attach plates at three places along bottom of truss assembly and bolt cross beams to truss. (Do not torque bolts at this time).

C.6. Position and bolt right hand knee braces to truss assembly and three cross beams. (Do not torque bolts at this time).

C.7. Repeat Steps C.3, C.4, C.5 and C.6 for left hand truss assembly.

C.8. Detach overhead hoist from left and right truss assemblies.

C.9. Attach spreader bar to longeron at forward end of Section 1.

C.10. Repeat Steps A.9 through A.13 for Section 1.

C.10.a Remove spreader bar from Section assembly.

C.11 Position master alignment tool to span joint between Section 1 and 2 as shown in Figure B-2 View C. Position second alignment tool at forward end of Section 1.

C.12. Check alignment of shear pin holes in rails at each tool. If no fit, repeat Steps A.10, A.11 and A.12 as required.

C.13. Install tooling dowel pins as provided for at the bolted connections.

C.14. Torque all bolts to specified values.

C.15. Position and attach two keel beams to cross beams at Y_O centerline.

C.16. Attach Section 1 keel longerons to keel beams and check alignment of keel fitting attach holes with master alignment tool across Section joint at Station X_O819.66.

C.17. Install tooling dowel pins in keel beams and longerons.

C.18. Torque all bolts to specified values.

C.19. Remove master alignment tools from Section 1 assembly.

C.20. Verify alignment of rails and keel longerons Sections 1, 2 and 3 using transit and targets ixed to pin holes. The assembly of Sections 2 and 3 is complete.

MS/PS/OOS Support Structure. (See Figure B-2 View D)

D.1 Position left hand welded support assembly at Station X_O576 and Y_O=100 to index with upper and lower gusset attach plates on forward end of Section 1.

D.2 Position 3 floor plates under screw jacks at corners of support assembly. (The floor plate at the forward corner of Section 1 is shared with the support assembly).

D.3 Level and align L.H. support assembly with screw jacks.

D.4 Bolt gusset plates and vertical member of suppor assembly together at X_O576.

D.5 Install tooling dowel pins in gusset plates.

D.6 Repeat Steps D.1 through D.5 for right hand support assembly.

D.6.a Install floor beams connecting LH & RH support assemblies.

D.7 Install center floor panel between support assemblies at Z_O=419.

D.8 Install lower support assembly braces connecting LH and RH support assemblies.

D.9 Bolt handrails to floor panels on the left and right support assemblies.

X_O576 Bulkhead Assembly. (See Figure B-2 View D)

E.1 Using overhead hoist, position bulkhead assembly on top of MS/PS support assembly with aft face of bulkhead at station X_O=576.

E.2 Bolt lower attach angle of bulkhead to horizontal member of support assembly. (Do not torque bolts at this time).

E.3 Position and bolt 2 diagonal braces to bulkhead and floor structure. (Do not torque bolts at this time).

E.4 Center bulkhead on Y_O=0 scribe line and align aft surface of bulkhead in the vertical plane by adjusting diagonal braces.

E.5 Install tooling dowel pins as provided for in bolted connections.

E.5a Torque bolts to specified values.

E.6 Attach handrails to outboard edge of bulkhead structure.

F. X_O576 Bulkhead Assembly. (See Figure B-2 View E)

F.1 Assemble 3 panels of bulkhead together in a horizontal position.

F.2 Using overhead hoist, position bulkhead assemble at Station X_O1307 to mate with support angle (L and R side) attached to aft end of Section 3 assembly and bolt together. (Do not torque bolts at this time).

F.3 Center bulkhead on Y_O=0 scribe line and align forward surface of bulkhead in a vertical plane at Station X_O=1307.

F.4 Bolt lower half of bulkhead to attach structure on aft end on Section 3 assembly. (Do not torque bolts at this time).

F.5 Install tooling dowel pins as provided for at the bolted connections.

F.6 Torque all bolts to specified values.

G. Payload Wire Tray Assembly

G.1 Install wire tray attach clips to the knee braces on left and right sides of Section 1, 2 and 3 assemblies. Index to scribe lines on knee brace.

G.2 Position master alignment tool at each end of Section 1 assembly engaging rails and keel fitting. Attach wire tray index template to alignment tool.

G.3 Position 20 foot sections of wire tray assemblies between attach clips on knee braces on left and right side of Sections 1, 2 and 3.

G.4 Index wire tray assemblies to template at each end of Section 1 and bolt in place. Also bolt tray to center knee brace.

G.5 Repeat Steps G.2, G.3 and G.4 for Sections 2 and 3.

H. Payload I/F Elements

Install payload I/F elements as required. Include MS, PS, OOS enclosures, mid-body payload I/F's and optional equipment.

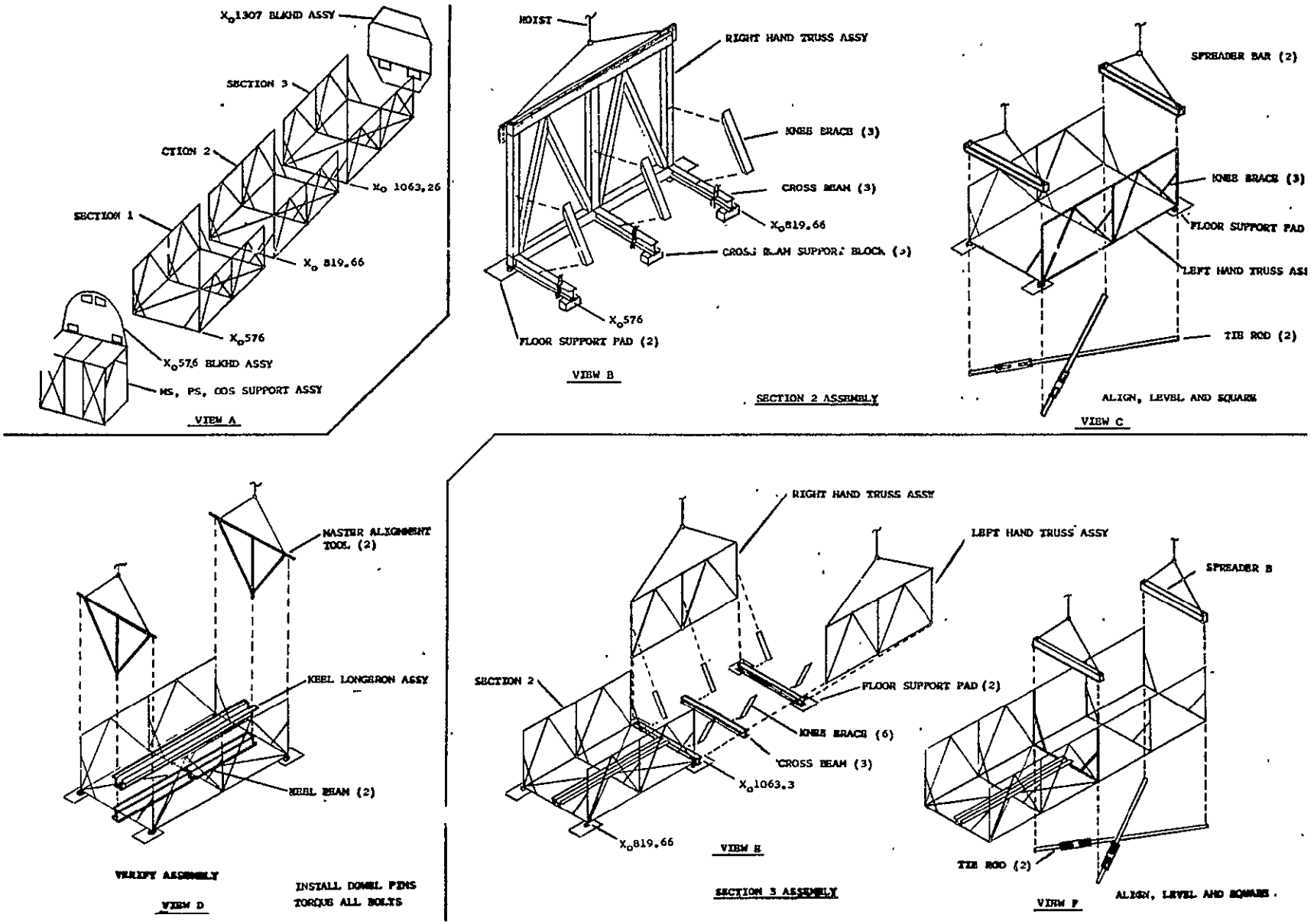

FIGURE B-1 HORIZONTAL IVE IN-FIELD ASSEMBLY PROCEDURE

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Space Division

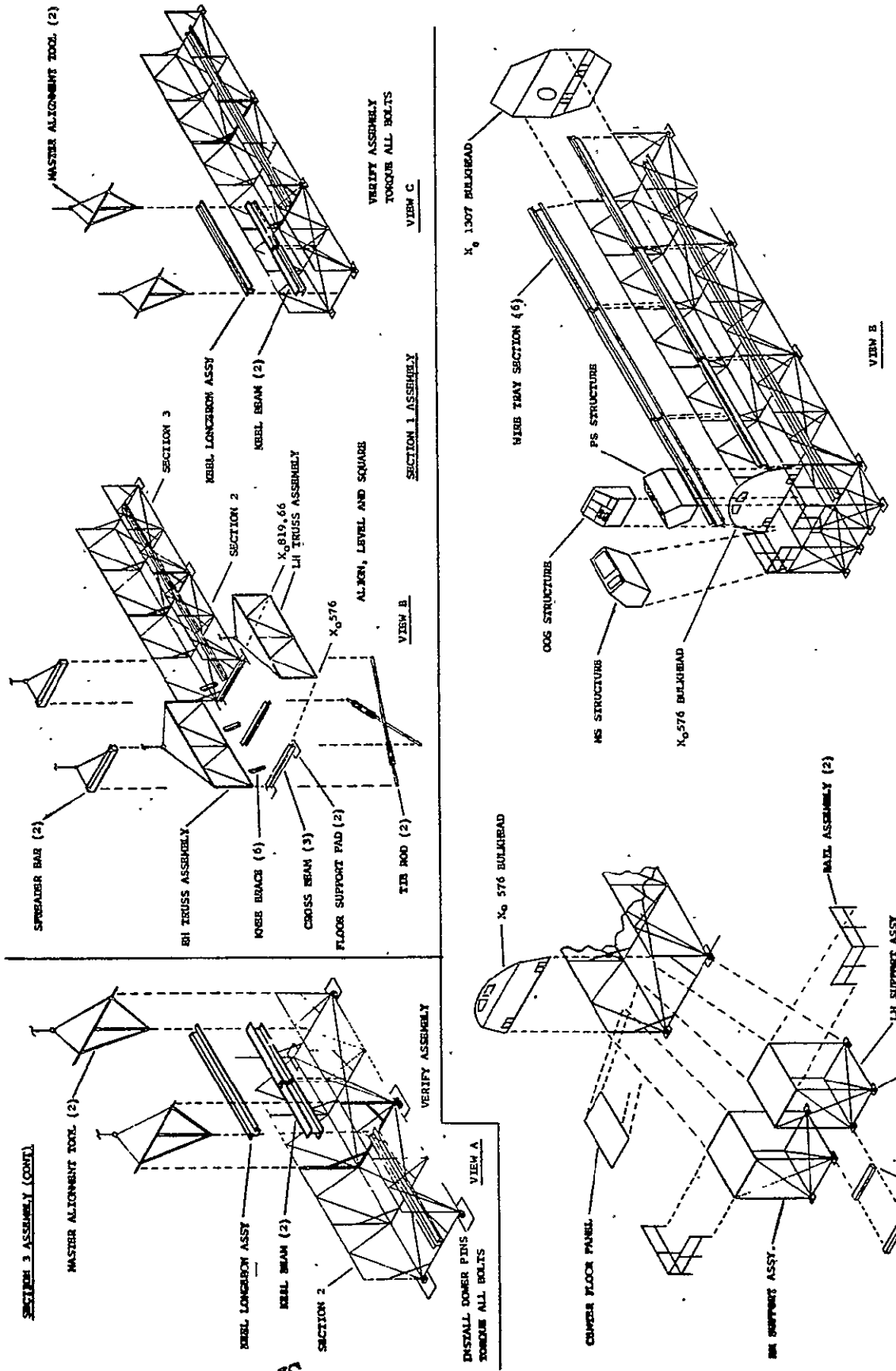

FIGURE B-2 HORIZONTAL IVE IN-FIELD ASSEMBLY PROCEDURE

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APPENDIX C

PAYLOAD INTEGRATION BASELINE FUNCTIONAL FLOW BLOCK DIAGRAMS AND OPTIONS

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APPENDIX C

PAYLOAD INTEGRATION BASELINE FUNCTIONAL FLOW BLOCK DIAGRAMS AND OPTIONS

C.1 CONTENTS

This appendix contains the detailed descriptions of the payload integration functional flow block diagrams as described in Section 9.0 of the report. A baseline and two optional flows are included for the following five payloads representative of the broad payload spectrum:

1. Solar Maximum Mission
2. Solar Physics Dedicated Missi
3. Module With Pallet (Spacelab)
4. Large Space Telescope
5. Mariner Jupiter Orbiter/IUS

Contents include terminology used, baseline payload integration functional flow block diagrams, and interface checkout matrices identifying differences to the baseline flows for the two options.

C.2 TERMINOLOGY

The following terminology and definitions apply to the data presented in the figures and tables in Section 3, of this appendi:

Cargo	The total complement of payloads carried on any one flight.
Payload	The total complement of specific instruments, space equipment and support hardware carried in the Orbiter to accomplish a certain task in space.
Subsystem	The next functional subdivision of a system.
Assembly	The next functional subdivision of a component (two or more parts or subassemblies).
Subassembly	An assembly within a larger assembly.

Part	A basic element of component, assembly or subassembly.
Acceptance Tests	Acceptance tests are the required formal tests, conducted to demonstrate acceptability of an item for delivery.
Block Numbers in FFBD's	This indicates a sequential number of a block, as shown in the Functional Flow Block Diagram (FFBD) for a given payload processing operation.
Description	Title identification of the blocks in the FFBD's, the functions to be performed, and the operation level (subsystem, system, payload and cargo.)
I/F Knowledge	Four different categories of interface related requirements are reflected. They are as follows:

(1) Orbiter I/F Not Required - This category does not interface with Orbiter.

(2) Orbiter I/F Knowledge Required - This category does not interface with Orbiter, but knowledge of Payload/Orbiter interface data is required.

(3) Direct Orbiter Function Simulated - In this category some of the Orbiter functions are required to be simulated.

(4) Direct Orbiter I/F - This category requires that the payload interfaces directly with Orbiter.

Baseline Location — Operational site location for the function identified as determined from the NASA payload data base.

Option 1 (User Oriented) — Operational site location for the function identified with maximum integration to be accomplished prior to payload delivery to the launch site.

Option 2 (Launch site oriented) — Operational site location for the function identified with maximum integration to be accomplished at the launch site.

GSE Simulators — Identifies integration functions requiring usage of IVE or GSE simulators.

IVE — Identifies interface functions, in the interface checkout matrix tables that can be accomplished by standardized IVE.

Special Facility — A special facility (thermo/vac, vibration or other) is required to perform a given function.

Remarks

Either Site - A given function may be performed at either User or Launch Site. The decision where to perform the function will depend on the results of a trade stud of other relevant functions, showing that the chosen site will not affect the operat However, if the function does not depend on a trade study, it can be performed at the site equipped with the required GSE simulators or IVE, taking into consideration the effects of factors like handling, transportation, risk, availability of personne etc.

Remarks (Cont)

Both Sites - A given function is to be performed at both sites (User & Launch). Final decision whether the function is to be performed at both sites depends on I/F verification philosophy such as: Whether minimum checkout is performed initially at User site, and maximum checkout at Launch site, or vice verse. Transportation and subsequent checkout and I/F verification requirements will influence the decision.

Trade Study — A study, required to determine the preferable site to perform a given function. Determination of site wil depend on evaluation of the factors, presented in the Criteria Table, such as risk, cost, schedule impact, availability of personnel and equipment, etc.

C.3. PAYLOAD INTEGRATION ANALYSIS - FUNCTIONAL FLOW BLOCK DIAGRAMS AND INTERFACE CHECKOUT MATRICES

The FFBD's and I/F checkout matrix tables are included for the five payloads identified above. These data support the discussion in Section 9.0 of this report. Data presented in Figures C-1 through C-5 and Tables C.1 through C.5 reflect the next level definition of the payload integration processes described in Figure 9-2.

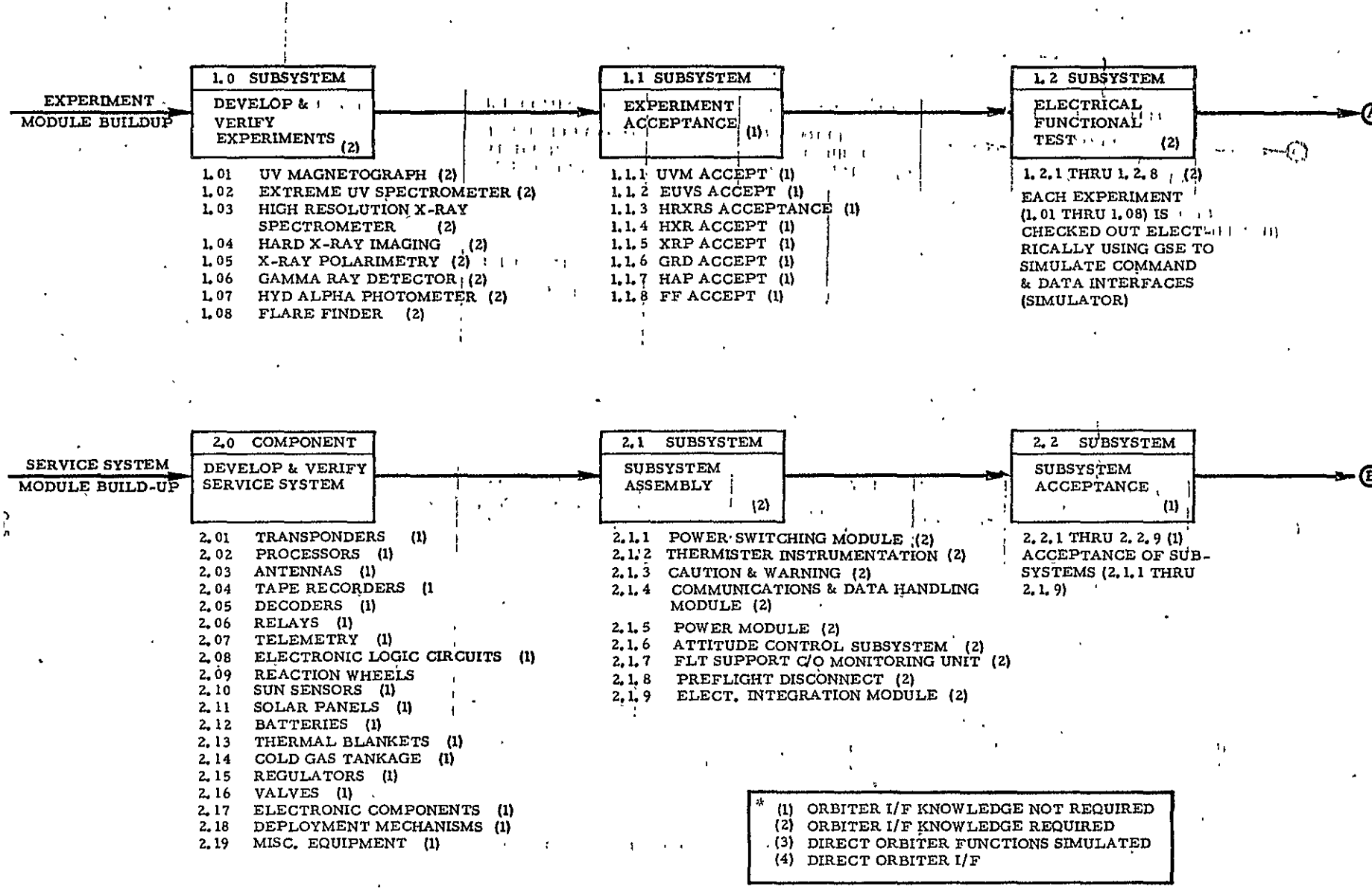

Figure C-1. Solar Maximum Mission FFBD

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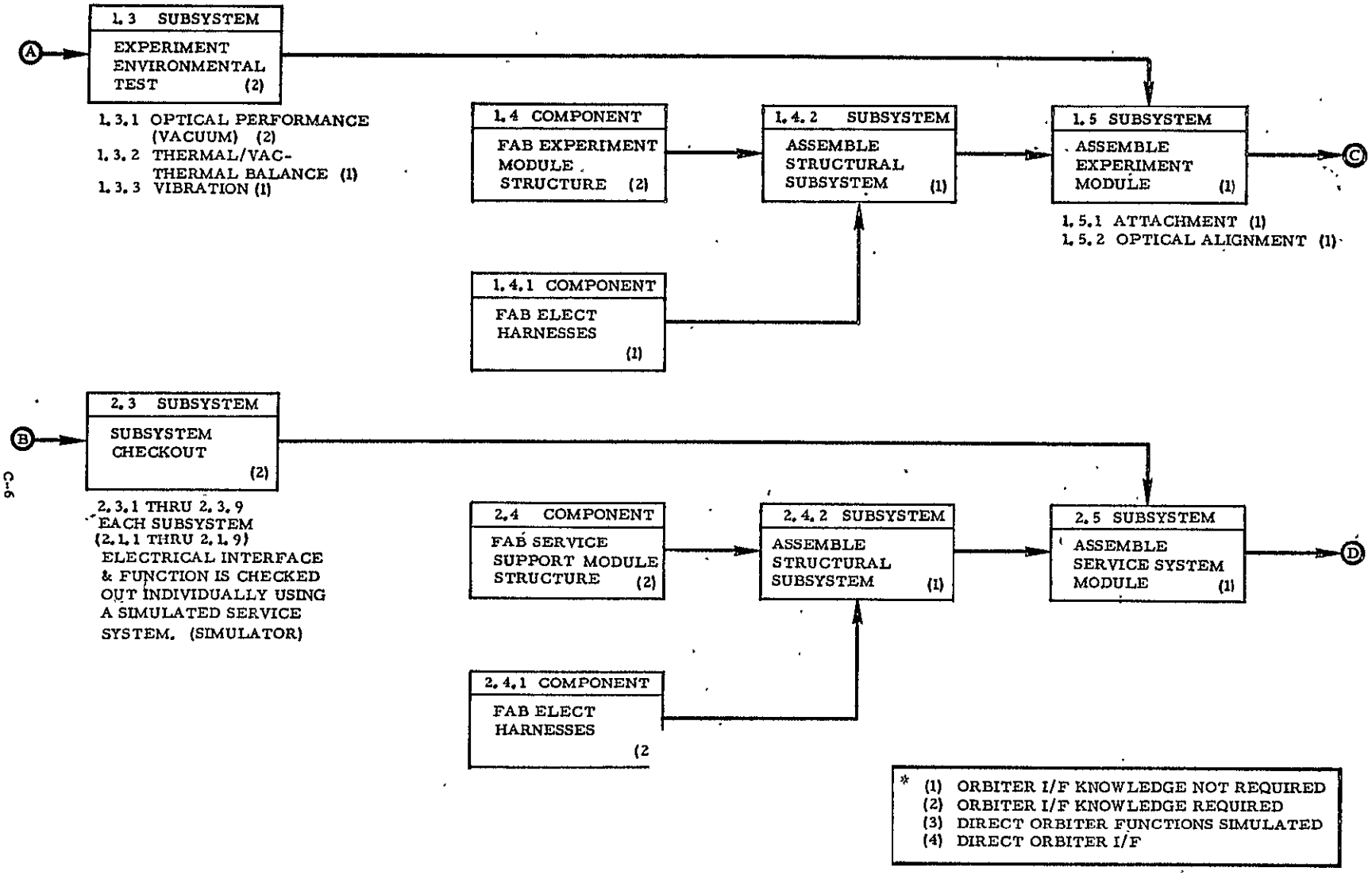

Figure C-1. Solar Maximum Mission FFBD (Cont)

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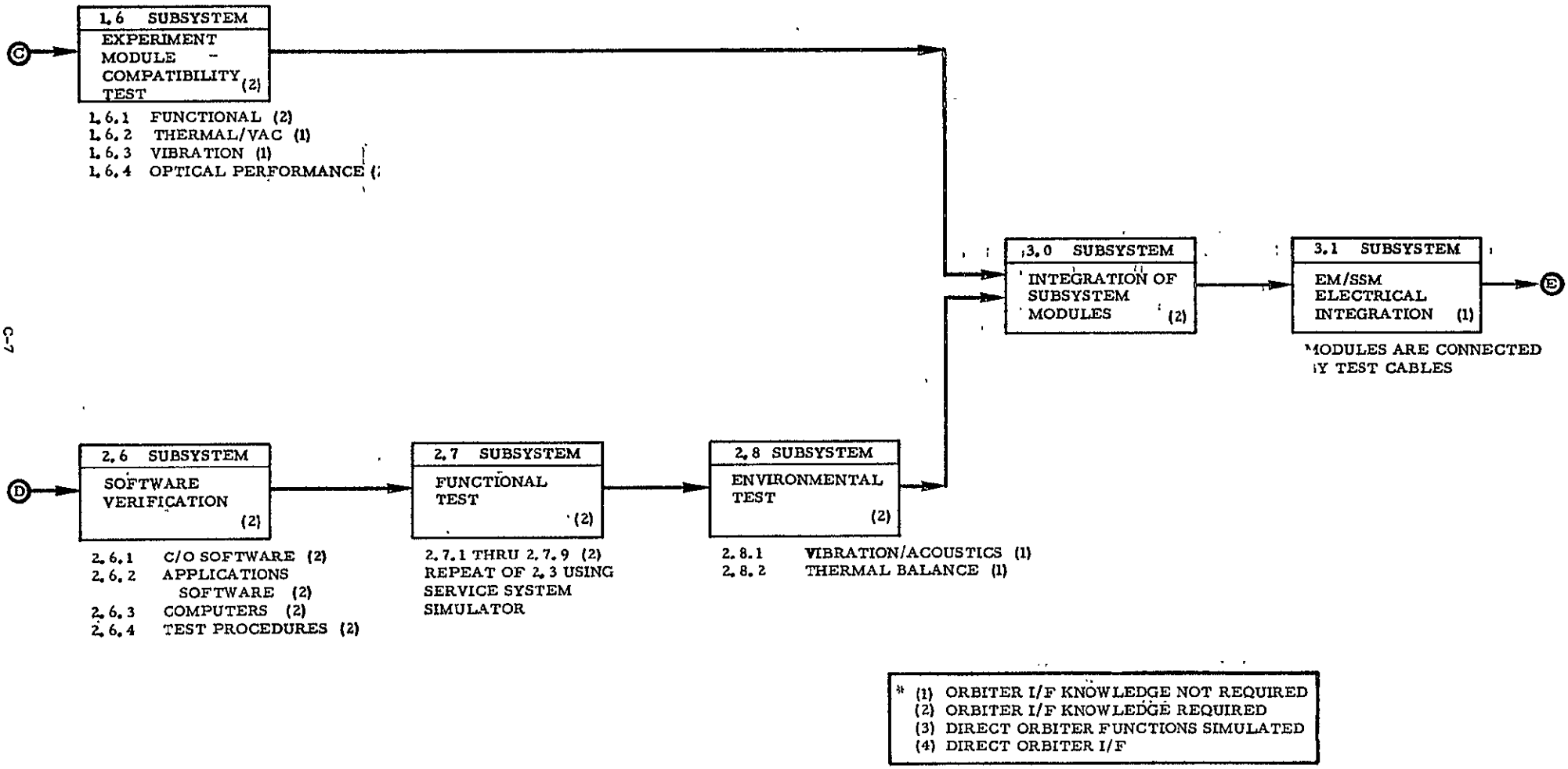

Figure C-1. Solar Maximum Mission FFBD (Cont)

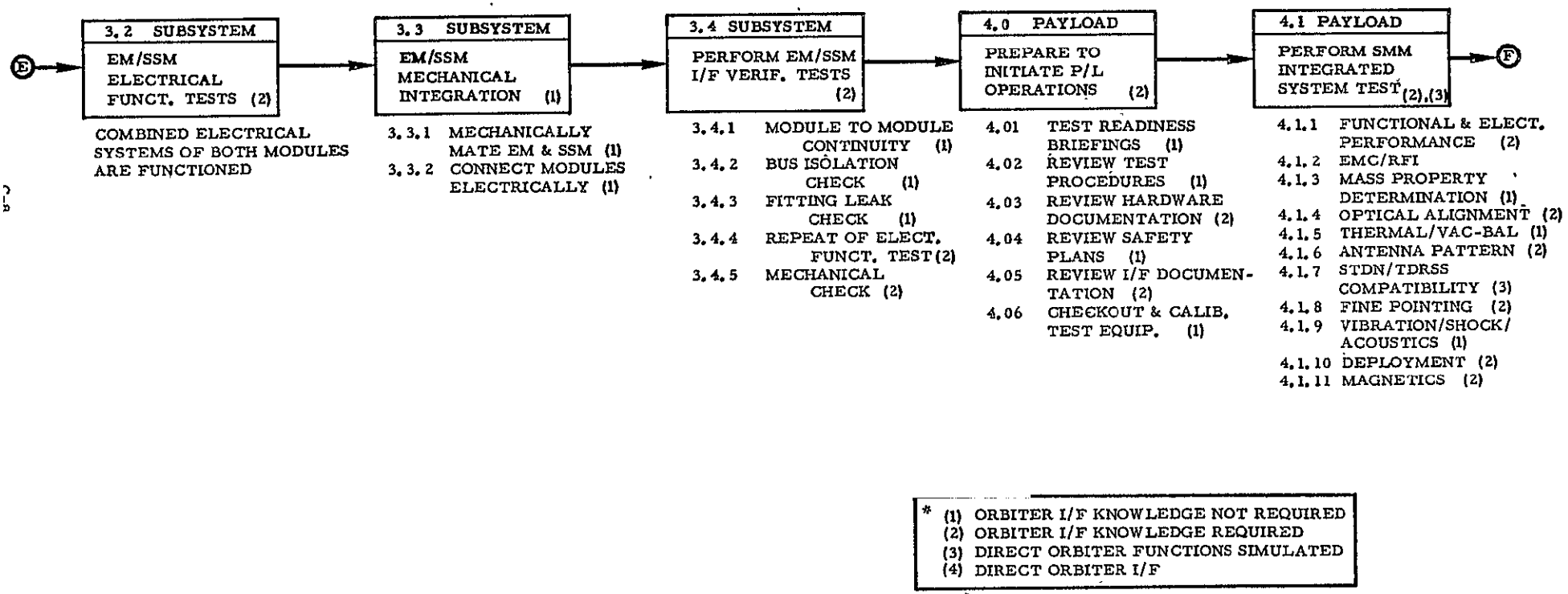

Figure C-1. Solar Maximum Mission FFBD (Cont)

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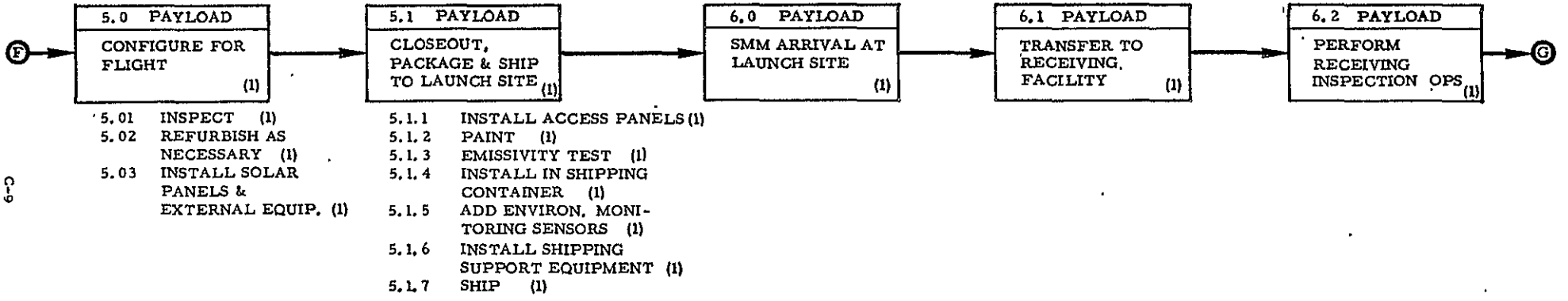

* (1) ORBITER I/F KNOWLEDGE NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-1. Solar Maximum Mission FFBD (Cont)

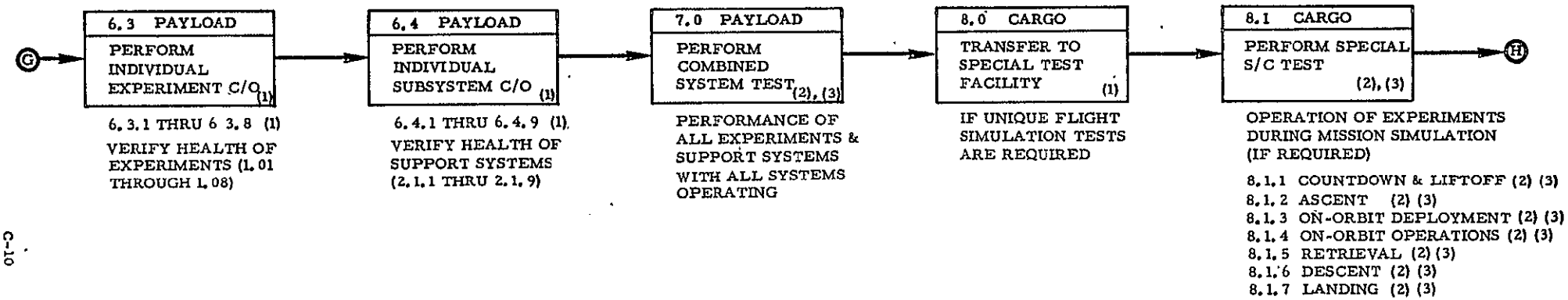

Figure C-1. Solar Maximum Mission FFBD (Cont)

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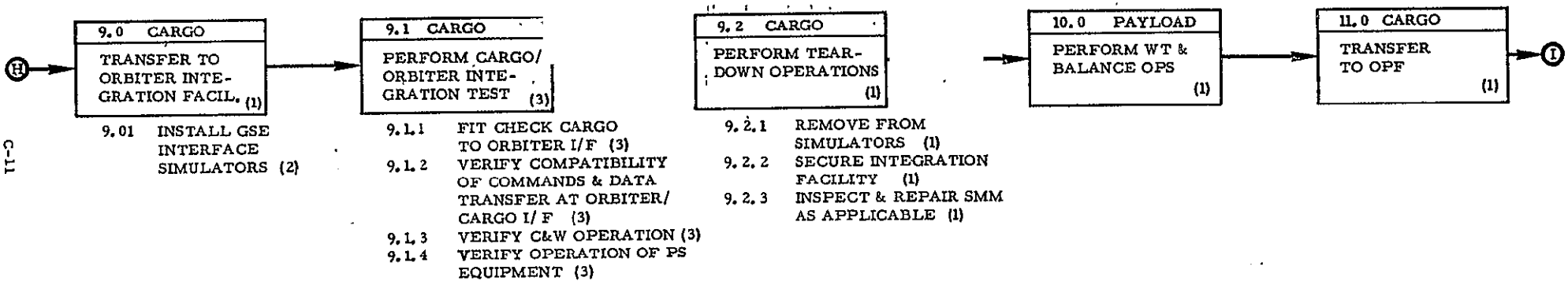

* (1) ORBITER I/F KNOWLEDGE NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-1. Solar Maximum Mission FFBD (Cont)

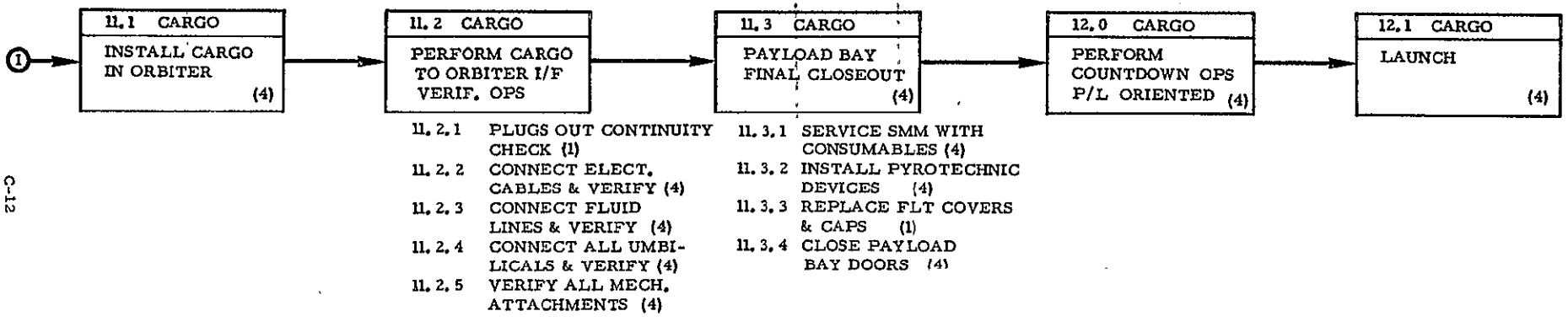

Figure C-1. Solar Maximum Mission FFBD (Cont)

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Table C.1 SMM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE C&M.	IVE		
1.0	Develop & verify experiments	(2)	User	X					Various sources
1.01	UV magnetograph	(2)		X					
1.02	Extreme UV spectrometer	(2)		X					
1.03	High resolution X-Ray spectrometer	(2)		X					
1.04	Hard X-Ray imaging	(2)		X					
1.05	X-Ray polarimetry	(2)		X					
1.06	Gamma ray detector	(2)		X					
1.07	Hydrogen Alpha photometer	(2)		X					
1.08	Flare finder	(2)		X					
1.1	Experiment acceptance	(1)		X					
1.1.1	UV magnetograph acceptance	(1)		Y					
1.1.2	Extreme UV spectrometer acceptance	(1)		X					
1.1.3	H R X R S acceptance	(1)		X					
1.1.4	Hard X-Ray imaging acceptance	(1)		X					
1.1.5	X-Ray polarimetry acceptance	(1)		X					
1.1.6	Gamma ray detector acceptance	(1)		X					
1.1.7	Hydrogen Alpha photometer acceptance	(1)		Y					
1.1.8	Flare finder acceptance	(1)		X					

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.1 (Cont) SSM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.2	Electrical functional tests	(2)	User	X		X			
1.2.1	UVM electrical functional tests	(2)		X		X			
1.2.2	EUVS electrical functional tests	(2)		X		X			
1.2.3	HHORS electrical functional tests	(2)		X		X			
1.2.4	HXRI electrical functional tests	(2)		X		X			
1.2.5	XRP electrical functional tests	(2)		X		X			
1.2.6	GRD electrical functional tests	(2)		X		X			
1.2.7	HAP electrical functional tests	(2)		X		X			
1.2.8	FF electrical functional tests	(2)		X		X			
1.3	Experiment environmental tests	(2)		X					
1.3.1	Optical performance (vacuum)	(2)		X				X	
1.3.2	Thermal/Vac-thermal balance	(1)		X				X	
1.3.3	Vibration	(1)		X				X	
1.4	Fabricate experiment module structure	(2)		X					
1.4.1	Fabricate electrical harnesses	(1)		X		X			ORB/P/L I/F harnesses included in SSM harnesses
1.4.2	Assemble structural subsystem	(1)		X					
1.5	Assemble experiment module	(1)		X					
1.5.1	Attachment	(1)		X					
1.5.2	Optical alignement	(1)		X					

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

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Table C.1 (Cont) . SMM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.6	Experiment module compatibility test	(2)	User	X					
1.6.1	Functional	(2)		X	X	X	X		Trade study (risk, sched., cost)
1.6.2	Thermal/Vac	(1)		X				X	
1.6.3	Vibration	(1)		X				X	
1.6.4	Optical performance	(2)		X	X	X	X		Trade study (risk, sched., cost)
2.0	Develop & verify service system components	(1)	User	X					Various sources
2.01	Transponders	(1)		X					
2.02	Processors	(1)		X					
2.03	Antennas	(1)		X					
2.04	Tape recorders	(1)		X					
2.05	Decoders	(1)		X					
2.06	Relays	(1)		X					
2.07	Telemetry	(1)		X					
2.08	Electronic logic circuits	(1)		X					
2.09	Reaction wheels	(1)		X					
2.10	Sun sensors	(1)		X					
2.11	Solar panels	(1)		X					
2.12	Batteries	(1)		X					

*(1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.1 (Cont) SMM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
2.13	Thermal blankets	(1)	User	X					Various sources
2.14	Cold gas tankage	(1)		X					
2.15	Regulators	(1)		X					
2.16	Valves	(1)		X					
2.17	Electronic components	(1)		X					
2.18	Deployment mechanisms	(1)		X					
2.19	Miscellaneous equipment	(1)		X					
2.1	Subsystem assembly	(2)		X					
2.1.1	Power switching module	(2)		X					
2.1.2	Thermistor instrumentation	(2)		X					
2.1.3	Caution & warning	(2)		X					
2.1.4	Communications & data handling module	(2)		X					
2.1.5	Power module	(2)		X					
2.1.6	Attitude control subsystem	(2)		X					
2.1.7	Flight support c/o monitoring unit	(2)		X					
2.1.8	Preflight disconnect	(2)		X					
2.1.9	Electrical integration module	(2)		X					

*(1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION STIMULATED

(4) DIRECT ORBITER I/F

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Table C.1 (Cont) SSM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
2.2	Subsystem acceptance	(1)	User	X					
2.2.1	Power switching module acceptance	(1)		X					
2.2.2	Thermistor instrumentation acceptance	(1)		X					
2.2.3	Caution & warning acceptance	(1)		X					
2.2.4	C&DH module acceptance	(1)		X					
2.2.5	Power Module acceptance	(1)		X					
2.2.6	Attitude control subsystem acceptance	(1)		X					
2.2.7	Flt support c/o monitoring unit acceptance	(1)		X					
2.2.8	Preflight disconnect acceptance	(1)		X					
2.2.9	Electrical integration module acceptance	(1)		X					
2.3	Subsystem checkout	(2)		X		X			
2.3.1	Power switching module checkout	(2)		X		X			
2.3.2	Thermistor instrumentation checkout	(2)		X		X			
2.3.3	Caution & warning checkout	(2)		X		X			
2.3.4	C&DH module checkout	(2)		X		X			
2.3.5	Power module checkout	(2)		X		X			
2.3.6	Attitude control subsystem checkout	(2)		X		X			
2.3.7	Flt support c/o monitoring unit checkout	(2)		X		X			
2.3.8	Preflight disconnect checkout	(2)		X		X			

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.1 (Cont) SSM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
2.3.9.	Electrical integration module checkout	(2)	User	X		X			
2.4	Fabricate SSM structure	(2)		X					
2.4.1	Fabricate electrical harnesses	(2)		X		X			ORB/P/L I/F knoledge for I/F Harnesses
2.4.2	Assemble structural subsystem	(1)		X					
2.5	Assemble service system module	(1)		X					
2.6	Software verification	(2)		X		X			Can be accomplished at remote locat
2.6.1	Checkout software	(2)		X					
2.6.2	Applications software	(2)		X					
2.6.3	Computers and processors	(2)		X					
2.6.4	Test procedures	(2)		X					
2.7	SSM functional test	(2)		X	X	X	X		To be accomplished at both sites
2.7.1	Power switching module checkout	(2)		X	X	X	X		
2.7.2	Thermistor instrumentation checkout	(2)		X	X	X	X		
2.7.3	Caution & warning checkout	(2)		X	X	X	X		
2.7.4	C&DH module checkout	(2)		X	X	X	X		
2.7.5	Power module checkout	(2)		X	X	X	X		
2.7.6	Attitude control system checkout	(2)		X	X	X	X		
2.7.7	Flt support c/o monitoring unit checkout	(2)		X	X	X	X		
2.7.8	Preflight disconnect checkout	(2)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

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(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.1 (Cont) SSM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
2.7.9	Electrical integration module checkout	(2)	User	X	X	X	X		At either or both sites
2.8	Environmental test	(1)		X		X			
2.8.1	Vibration/acoustics	(1)		X		X		X	
2.8.2	Thermal balance	(1)		X		X		X	
3.0	Integration of subsystem modules	(2)		X	X	X	X		Trade study
3.1	EM/SSM electrical integration	(1)		X					Connect cables-no power
3.2	EM/SSM electrical functional tests	(2)		X	X	X	X		Trade study
3.3	EM/SSM mechanical integration	(1)		X					
3.3.1	Mechanically mate EM & SSM	(1)		X	X	X	X		Trade study
3.3.2	Connect modules electrically	(1)		X	X	X	X		
3.4	Perform EM/SSM interface verification tests	(2)		X	X	X	X		
3.4.1	Module to module continuity	(1)		X	X	X	X		
3.4.2	Bus isolation check	(1)		X	X	X	X		
3.4.3	Fitting leak check	(1)		X	X	X	X		
3.4.4	Repeat of electrical functional tests	(2)		X	X	X	X		At either or both sites
3.4.5	Mechanical fit check	(2)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.1 (Cont) SMM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
4.0	Prepare to initiate payload operations	(2)	User	X	X				
4.01	Test readiness briefings	(1)		X	X				
4.02	Review test procedures	(1)		X	X				Both sites
4.03	Review hardware documentation	(2)		X	X				
4.04	Review safety plans	(1)		X	X				
4.05	Review interface documentation	(2)		X	X				
4.06	Checkout & calibrate test equipment	(1)		X	X	X	X		
4.1	Perform SMM integrated system tests	(1), (2), (3)		X	X	X	X		
4.1.1	Functional & electrical performance	(2)		X	X	X	X		
4.1.2	EMC/RFI tests	(2)		X	X				Monitor EMI/RFI during funct. tests
4.1.3	Mass property determination	(1)		X				X	Special facility
4.1.4	Optical alignement	(2)		X	X	X	X		Both sites
4.1.5	Thermal/vac balance	(1)		X		X		X	Special facility required
4.1.6	Antenna pattern	(2)		X	X	X	X		Both sites
4.1.7	STDN/TDRSS compatibility	(3)		X	X				Direct link communications
4.1.8	Fine pointing	(2)		X	X	X	X		Both sites
4.1.9	Vibration/shock/acoustics	(1)		X	X	X		X	Special facility required
4.1.10	Deployment	(2)		X	X	X	X		
4.1.11	Magnetics	(2)		X		X			

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

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Table C.1 (Cont) SMM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
5.0	Configure for flight	(1)	User	X	X				Either site (trade study)
5.01	Inspect	(1)		X	X				
5.02	Refurbish	(1)		X	X				
5.03	Install solar panels & external equipment	(1)		X	X				
5.1	Closout, package & ship to launch site	(1)		X					
5.1.1	Install access panels	(1)		X					
5.1.2	Paint	(1)		X					
5.1.3	Emissivity tests	(1)		X					
5.1.4	Install in shipping container	(1)		X					
5.1.5	Add environment monitoring sensors	(1)		X					
5.1.6	Install shipping support equipment	(1)		X					
5.1.7	Ship	(1)		X					
6.0	SMM arrival at launch site	(1)	Launch St.		X				
6.1	Transfer to receiving facility	(1)			X				
6.2	Perform receiving inspection operations	(1)			X				
6.3	Perform individual experiment checkout	(1)			X	X	X		Post shipping requirement
6.3.1	UV magnetograph checkout	(1)			X	X	X		
6.3.2	Extreme UV spectrometer checkout	(1)			X	X	X		

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS STIMULATED
(4) DIRECT ORBITER I/F

Table C.1 (Cont) SMM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
6.3.3	High resolution X-Ray spectrometer checkout	(1)	Launch Site		X	X	X		Post shipping requirement
6.3.4	Hard X-Ray imaging checkout	(1)			X	X	X		
6.3.5	X-Ray polarimetry checkout	(1)			X	X	X		
6.3.6	Gamma ray detector checkout	(1)			X	X	X		
6.3.7	Hydrogen Alpha photometer checkout	(1)			X	X	X		
6.3.8	Flare finder checkout	(1)			X	X	X		
6.4	Perform individual subsystem checkout	(1)			X	X	X		
6.4.1	Power switching module checkout	(1)			X	X	X		
6.4.2	Thermistor instrumentation checkout	(1)			X	X	X		
6.4.3	Caution & warning module checkout	(1)			X	X	X		
6.4.4	C&DH module checkout	(1)			X	X	X		
6.4.5	Power module checkout	(1)			X	X	X		
6.4.6	Attitude control system checkout	(1)			X	X	X		
6.4.7	Flt support c/o monitoring unit checkout	(1)			X	X	X		
6.4.8	Preflight disconnect checkout	(1)			X	X	X		
6.4.9	Electrical integration module checkout	(1)			X	X	X		
7.0	Perform combined system test	(2), (3)		X	X	X	X		7.0,8.1,&9.0 tests could be combined & tests conducted in IVE. Need trade study.

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.1 (Cont)' SMM' INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
8.0	Transfer to special test facility	(1)	Launch Site		X	X	X		7.0,8.1& 9.0 tests could be combined & tests conducted in IVE. Need trade study
8.1	Perform special S/C test	(2), (3)			X	X	X		
8.1.1	Countdown and liftoff simulation	(2), (3)			X	X	X		
8.1.2	Ascent simulation	(2), (3)			X	X	X		
8.1.3	On orbit deployment simulation	(2), (3)			X	X	X		
8.1.4	On orbit operations simulation	(2), (3)			X	X	X		
8.1.5	Retrieval simulation	(2), (3)			X	X	X		
8.1.6	Descent simulation	(2), (3)			X	X	X		
8.1.7	Landing simulation	(2), (3)			X	X	X		
9.0	Transfer to orbiter integration facility	(1)			X				Q & C (MSOB)
9.01	Install GSE interface simulators	(2)		X	X	X	X		Orbiter simulator required
9.1	Perform cargo/orbiter integration test	(3)		X	X	X	X		7.0,8.1,&9.0 tests could be combined & tests conducted in IVE. Need trade study for cost effectiveness
9.1.1	Fit check cargo to orbiter interface	(3)		X	X	X	X		
9.1.2	Verify compatibility of command & data X-fer at orbiter/cargo interface	(3)		X	X	X	X		
9.1.3	Verify caution & warning operation	(3)		X	X	X	X		
9.1.4	Verify operation of PS equipment	(3)		X	X	X	X		User site could be used if Orbiter Simulator is available

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.1 (Cont) SMM INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
9.2	Perform tear down operations	(1)	Launch Site	X	X	X	X		User site could be used if orbiter simulator is available
9.2.1	Remove from simulators	(1)		X	X	X	X		
9.2.2	Secure integration facility	(1)		X	X	X	X		
9.2.3	Inspect & repair SMM, as applicable	(1)		X	X	X	X		
10.0	Perform weight & balance operations	(1)		X	X			X	Specialized facility required
11.0	Transfer to OPF	(1)			X				
11.1	Install cargo in orbiter	(4)			X				
11.2	Perform cargo to orbiter I/F verification ops.	(4)			X				
11.2.1	Plugs out continuity check	(1)			X				
11.2.2	Connect electrical cables & verify	(4)			X				
11.2.3	Connect fluid lines & verify	(4)			X				
11.2.4	Connect all umbilicals & verify	(4)			X				
11.2.5	Verify all mechanical attachments	(4)			X				
11.3	Payload bay final closeout	(4)			X				
11.3.1	Service SMM with consumeables	(4)			X				
11.3.2	Install pyrotechnic devices	(4)			X				
11.3.3	Replace flight covers & caps	(4)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.1 (Cont.)

BLOCK NO.	DESCRIPTION	* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE	SPECIAL FACILITY	REMARKS
11.3.4	Close payload bay doors	(4)	Launch Site		X				
12.0	Countdown operations	(4)			X				
12.1	Launch	(4)			X				

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

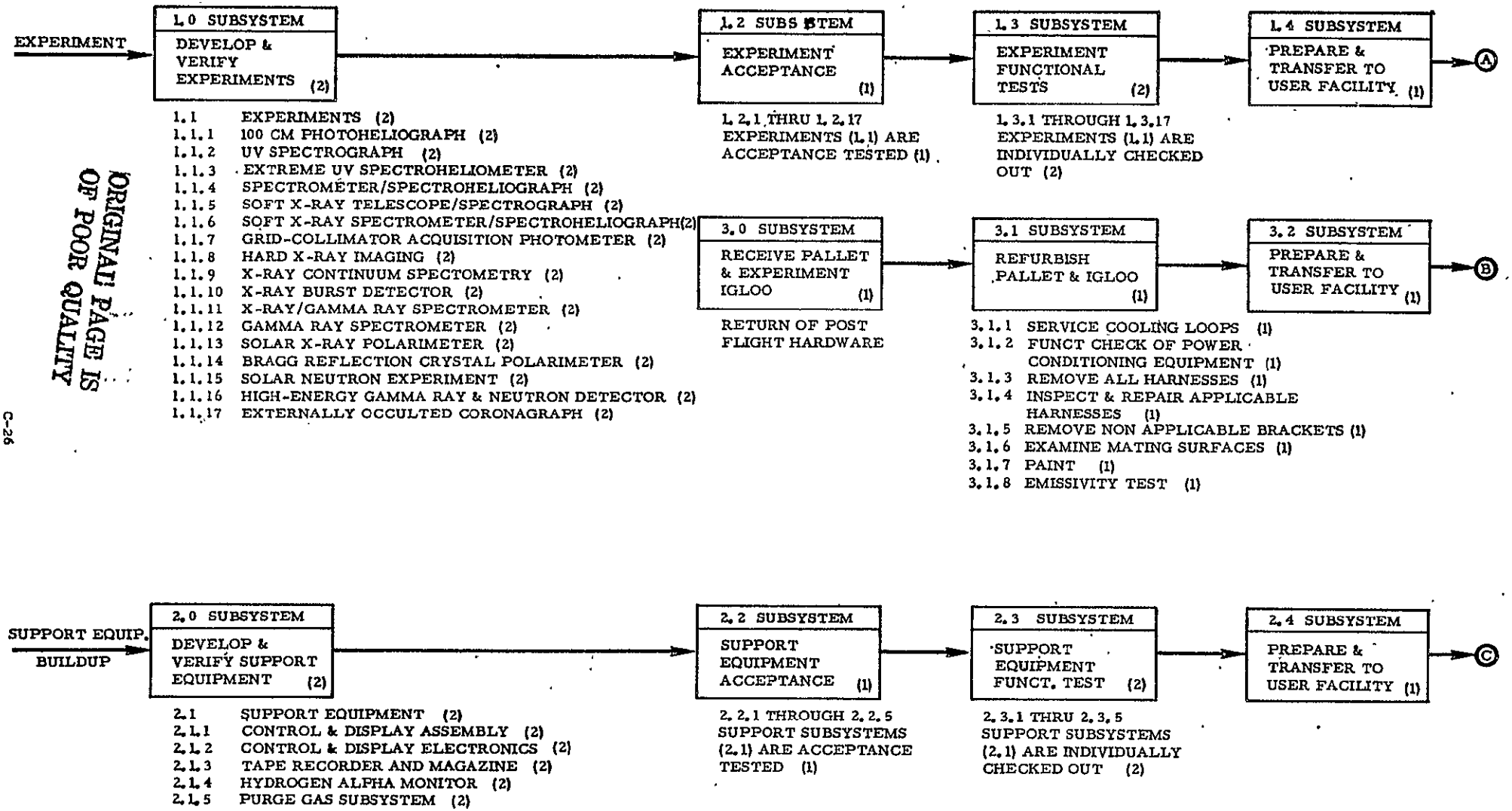

Figure C-2 Solar Physics Dedicated Mission FFBD

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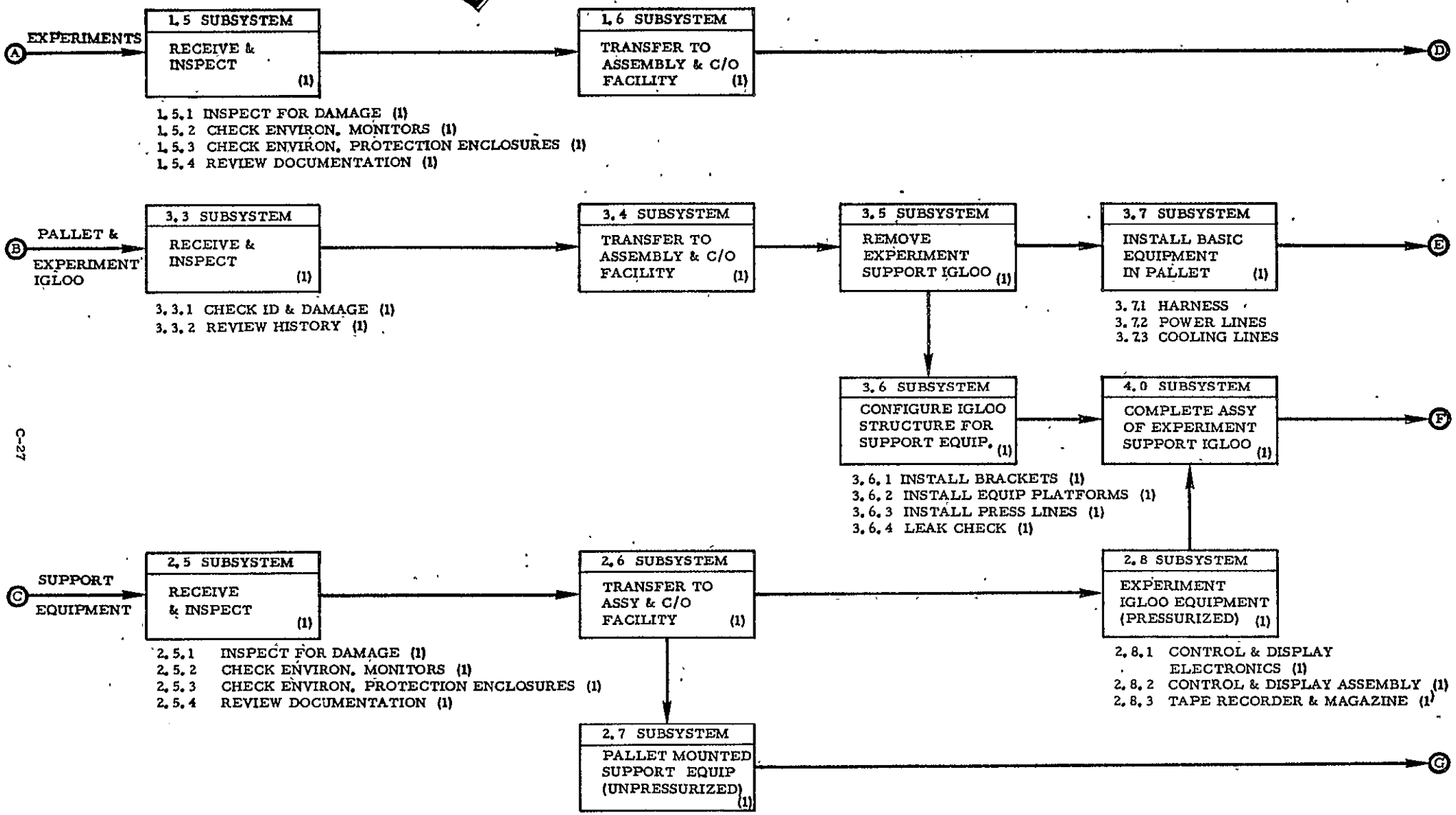

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

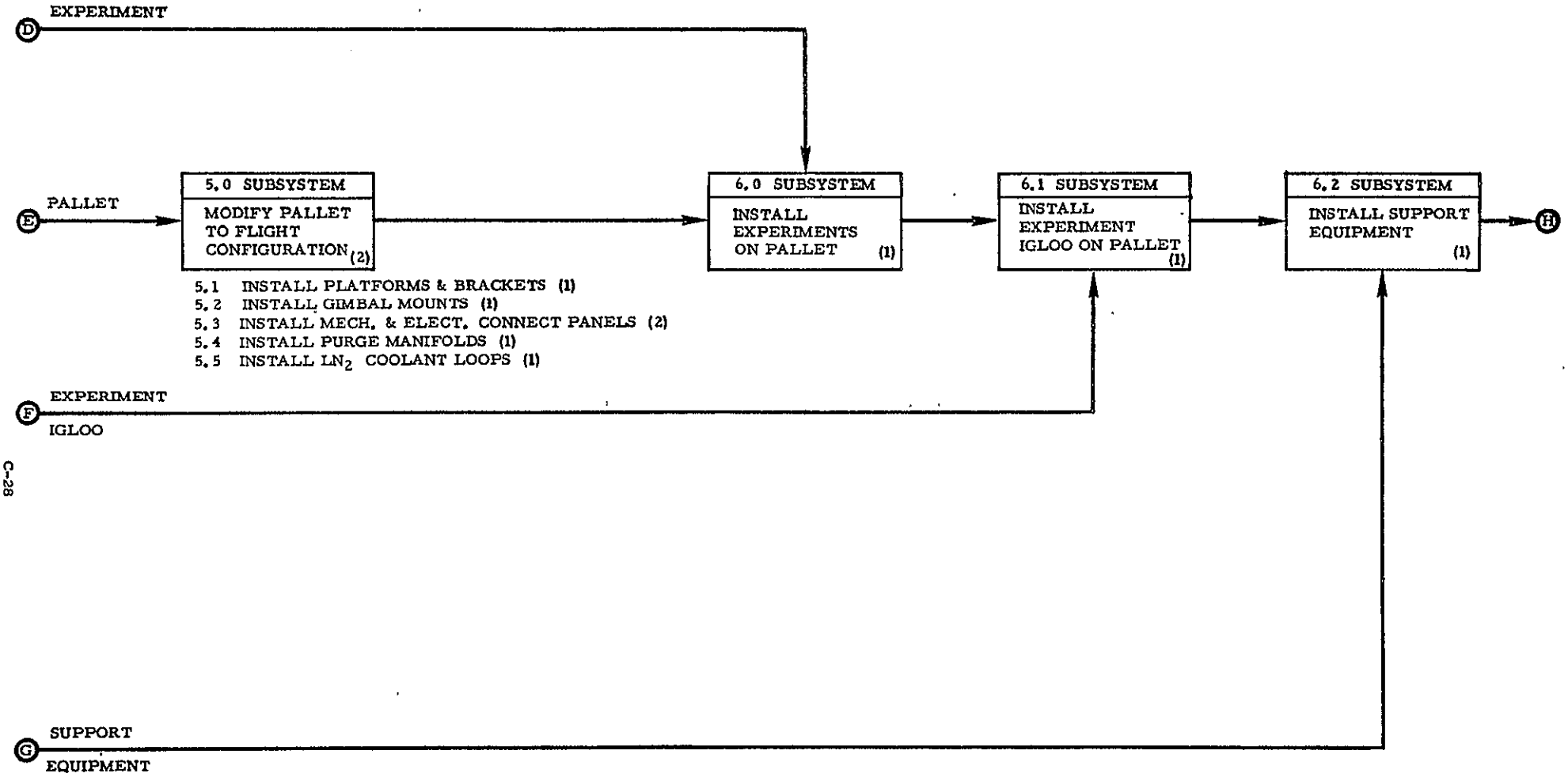

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

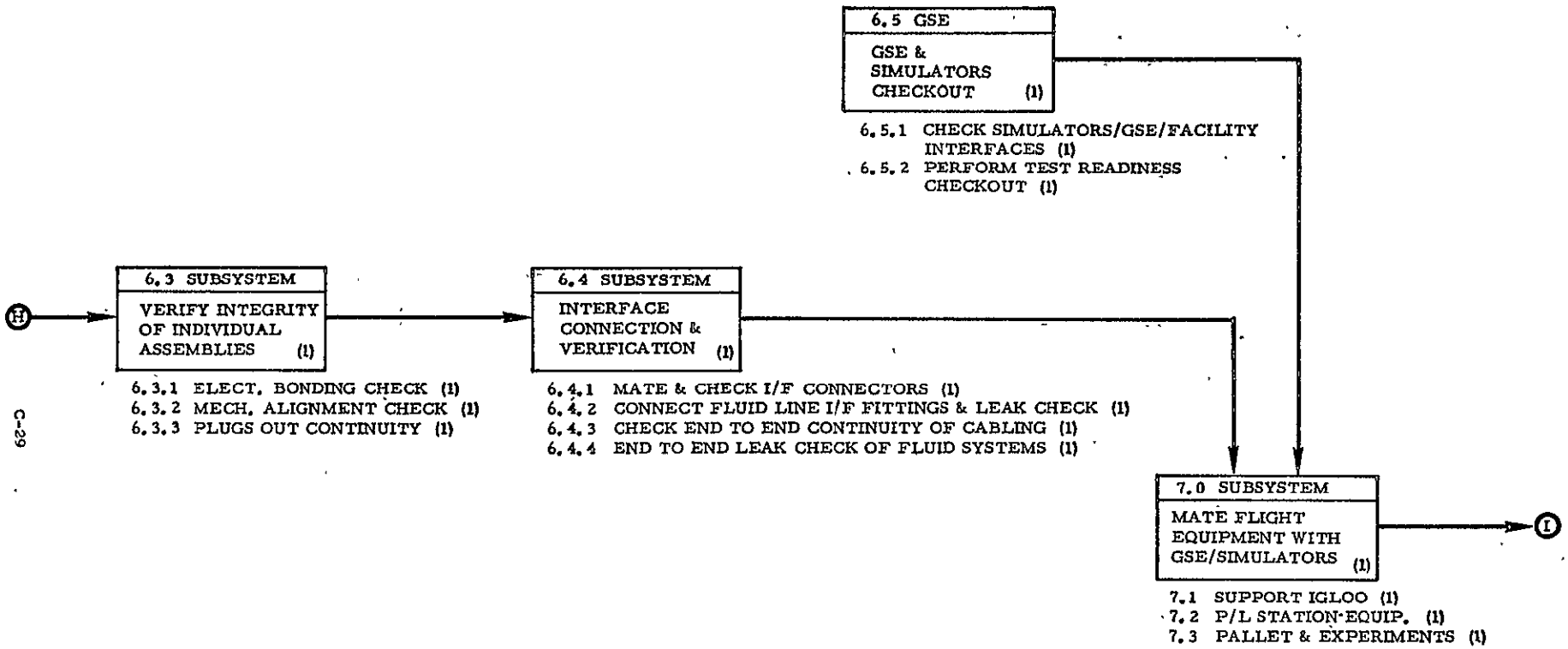

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

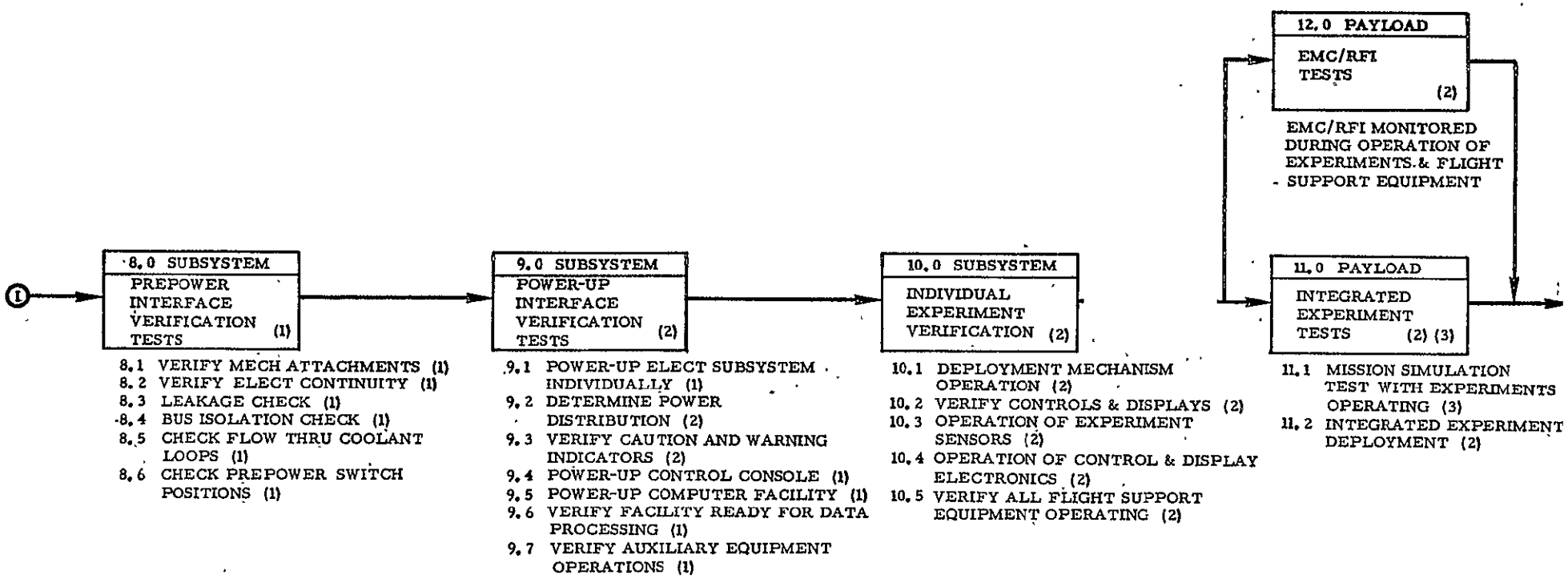

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

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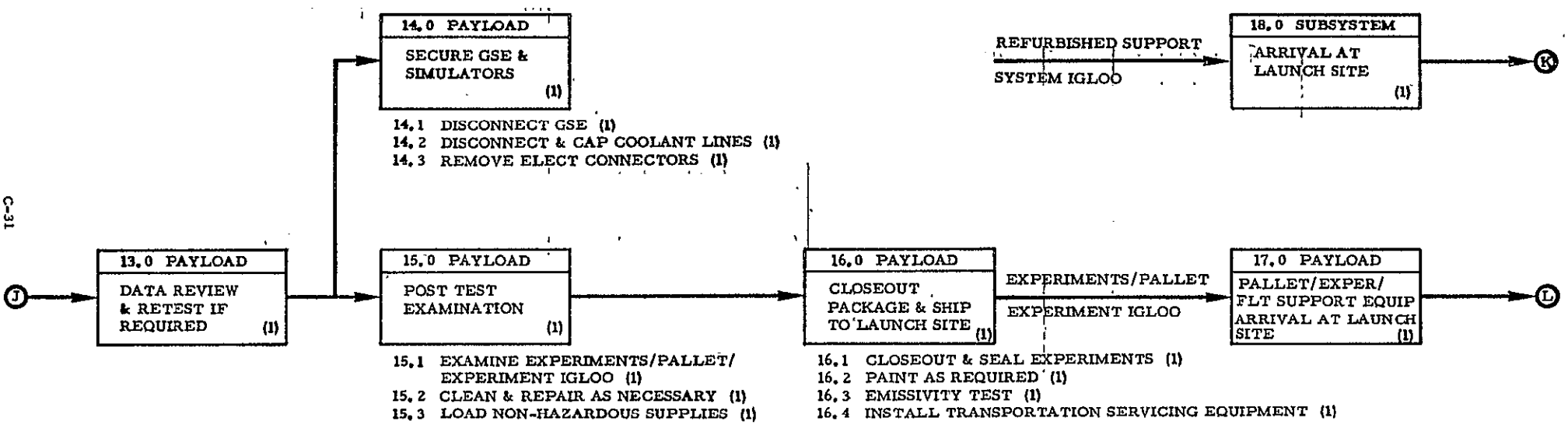

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

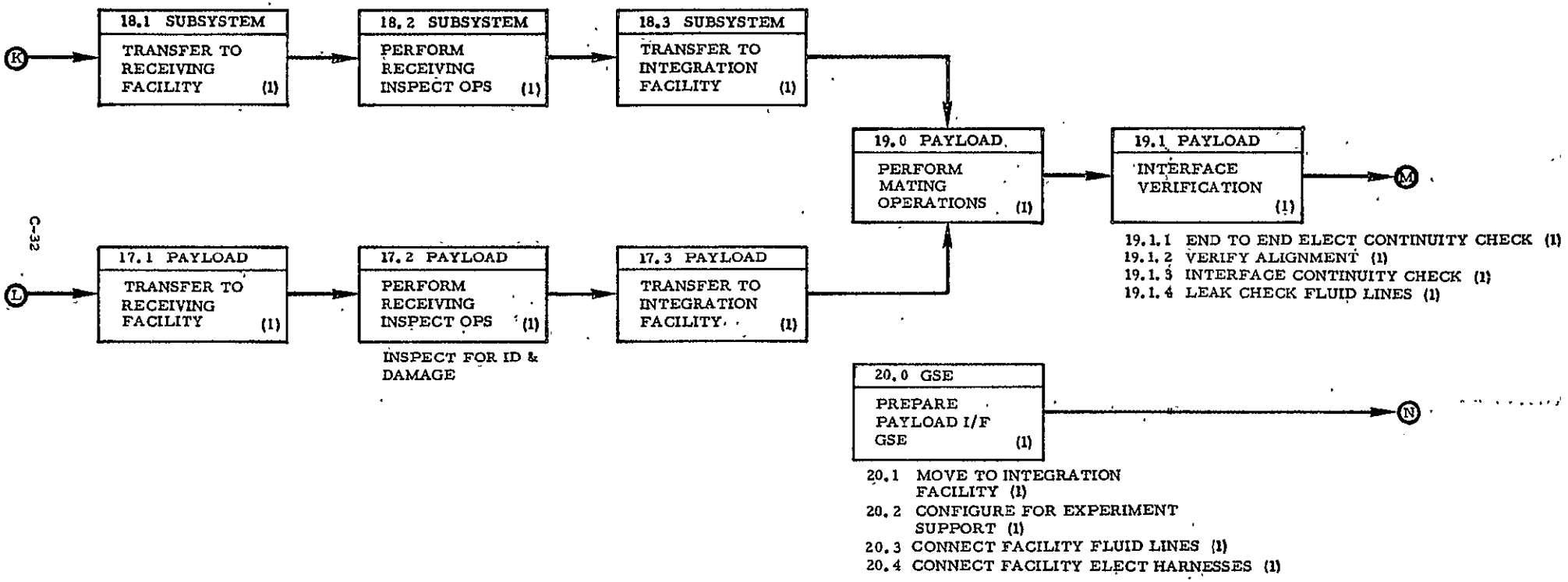

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

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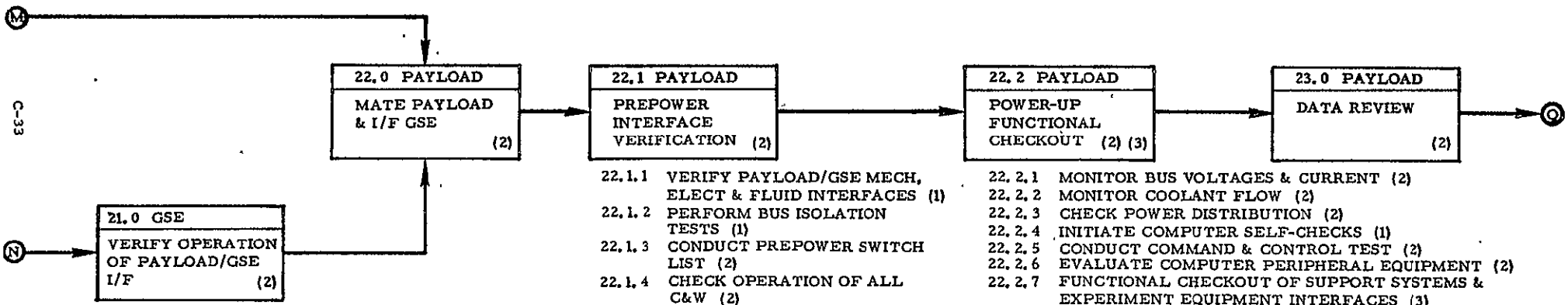
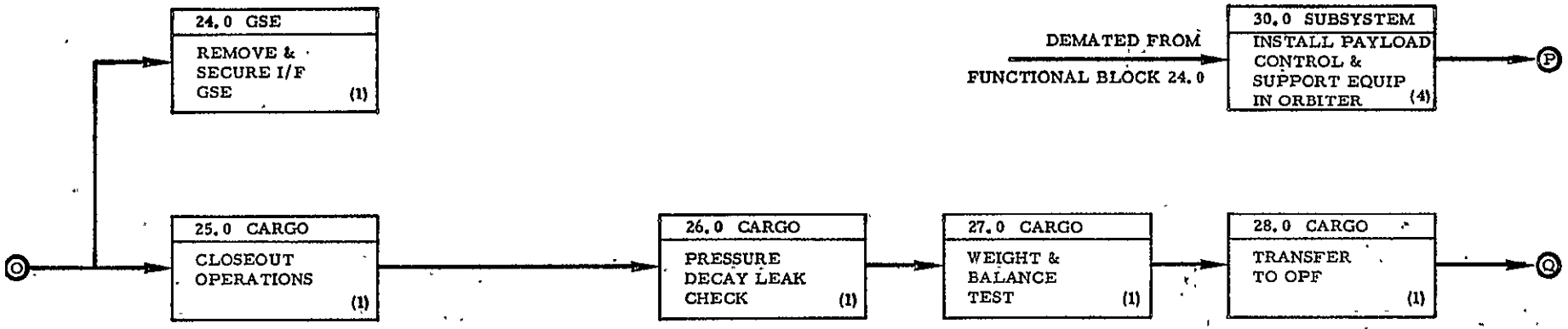


21.1 FUEL CELL/POWER DISTRIBUTION SIMULATION
21.2 ORBITER SIGNAL SIMULATION (2)
21.3 PAYLOAD SPECIALIST STATION EQUIPMENT OPERATIONS (2)
21.4 VERIFY UMBILICAL INTERFACES
21.5 VERIFY OPERATION OF DATA MANAGEMENT SUBSYSTEMS (2)
21.6 VERIFY OPERATION OF COMPUTER PERIPHERAL EQUIPMENT (1)
21.7 VERIFY OPERATION OF OPERATOR CONSOLE (1)

22.1.1 VERIFY PAYLOAD/GSE MECH, ELECT & FLUID INTERFACES (1)
22.1.2 PERFORM BUS ISOLATION TESTS (1)
22.1.3 CONDUCT PREPOWER SWITCH LIST (2)
22.1.4 CHECK OPERATION OF ALL C&W (2)

22.2.1 MONITOR BUS VOLTAGES & CURRENT (2)
22.2.2 MONITOR COOLANT FLOW (2)
22.2.3 CHECK POWER DISTRIBUTION (2)
22.2.4 INITIATE COMPUTER SELF-CHECKS (1)
22.2.5 CONDUCT COMMAND & CONTROL TEST (2)
22.2.6 EVALUATE COMPUTER PERIPHERAL EQUIPMENT (2)
22.2.7 FUNCTIONAL CHECKOUT OF SUPPORT SYSTEMS & EXPERIMENT EQUIPMENT INTERFACES (3)
22.2.8 EVALUATE MANUAL EMERGENCY BACKUP MODES (3)

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)



25.1 LOAD NON-HAZARDOUS SUPPLIES (1)
25.2 INSTALL ACCESS PANELS & COVER PLATES (1)
25.3 TOUCH UP PAINT (1)
25.4 EMISSIVITY TEST (1)

Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

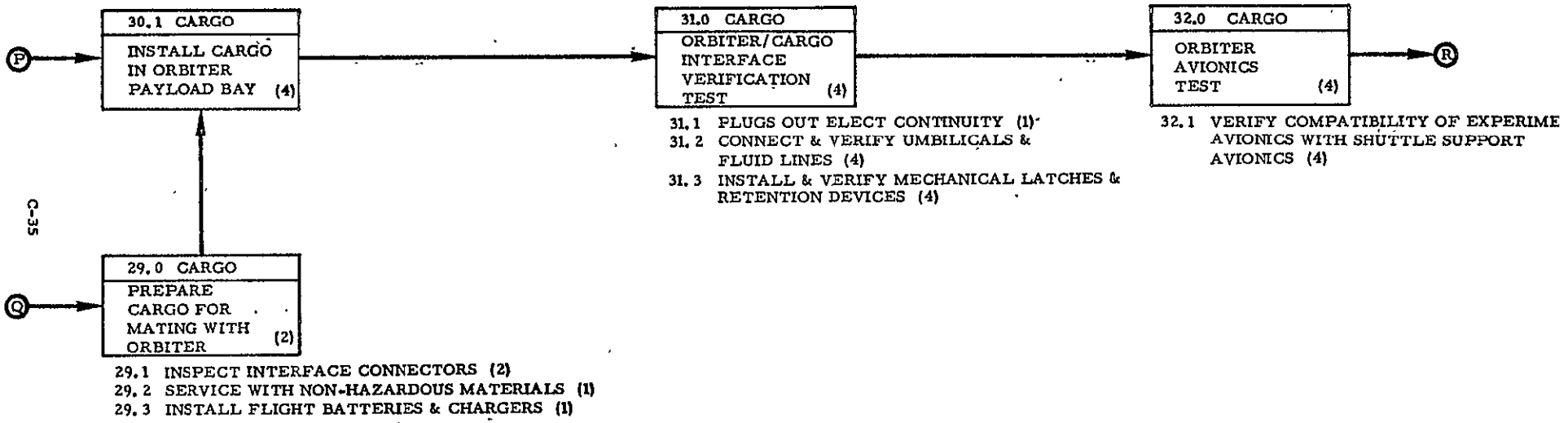


Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

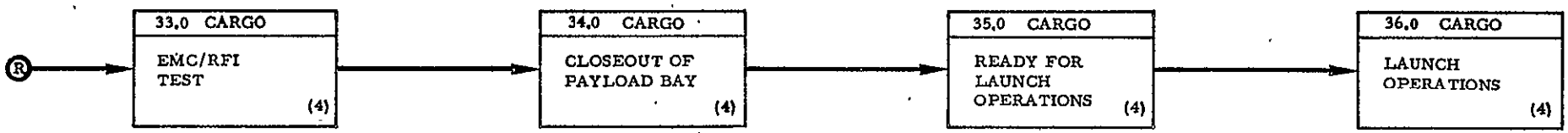


Figure C-2 Solar Physics Dedicated Mission FFBD (Cont)

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Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.0	Develop & verify experiments	(2)	User	X					Various sources
1.1	Experiments	(2)		X					
1.1.1	100 cm photoheliograph	(2)		X					
1.1.2	UV spectrograph	(2)		X					
1.1.3	Extreme UV spectro heliometer	(2)		X					
1.1.4	Spectrometer/spectro heliograph	(2)		X					
1.1.5	Soft X-Ray telescope/spectrograph	(2)		X					
1.1.6	Soft X-Ray spectrometer/spectro heliograph	(2)		X					
1.1.7	Grid collimator acquisition photometer	(2)		X					
1.1.8	Hard X-Ray imaging	(2)		X					
1.1.9	X-Ray continuum spectrometry	(2)		X					
1.1.10	X-Ray burst detector	(2)		X					
1.1.11	X-Ray/gamma ray spectrometer	(2)		X					
1.1.12	Gamma ray spectrometer	(2)		X					
1.1.13	Solar X-Ray polarimeter	(2)		X					
1.1.14	Bragg reflection crystal polarimeter	(2)		X					
1.1.15	Solar neutron experiment	(2)		X					
1.1.16	High energy gamma ray & neutron detector	(2)		X					
1.1.17	Externally occulted coronagraph	(2)		X					

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.2	Experiment acceptance	(1)	User	X					
1.2.1 through 1.2.17	experiments, same as in (1.1) are acceptance tested	(1)		X					
1.3	Experiment functional tests	(2)		X					
1.3.1 through 1.3.17	experiments, same as in (1.1) are individually checked out	(2)		X		X			
1.4	Prepare & transfer to User facility	(1)		X					
1.5	Receive & inspect	(1)		X					
1.5.1	Inspect for damage	(1)		X					
1.5.2	Check environmental monitors	(1)		X					
1.5.3	Check environmental protection enclosures	(1)		X					
1.5.4	Review documentation	(1)		X					
1.6	Transfer to assembly & checkout facility	(1)		X					
2.0	Develop & verify support equipment	(2)		X					
2.1	Support equipment	(2)		X					
2.1.1	Control & display assembly	(2)		X					
2.1.2	Control & display electronics	(2)		X					
2.1.3	Tape recorder & magazine	(2)		X					

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
2.1.4	Hydrogen Alpha monitor	(2)	User	X					
2.1.5	Purge gas subsystem	(2)		X					
2.2	Support equipment acceptance	(1)		X					
2.2.1 through	2.2.5 support subsystems, same as in (2.1)	(1)		X					
	are acceptance tested								
2.3	Support equipment functional test	(2)		X		X			
2.3.1 through	2.3.5 support subsystems, same as in (2.1)	(2)		X		X			
	are individually checked out								
2.4	Prepare and transfer to User facility	(1)		X					
2.5	Receive & inspect	(1)		X					
2.5.1	Inspect for damage	(1)		X					
2.5.2	Check environmental monitors	(1)		X					
2.5.3	Check environmental protection enclosures	(1)		X					
2.5.4	Review documentation	(1)		X					
2.6	Transfer to assembly and checkout facility	(1)		X					
2.7	Pallet mounted support equipment(unpressurized	(1)		X					
2.7.1	Hydrogen Alpha monitor	(1)		X					
2.7.2	Purge gas subsystem	(1)		X					
2.7.3	Payload station equipment	(1)		X					

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
2.8	Experiment igloo equipment (pressurized)	(1)	User	X					
2.8.1	Control & display electronics	(1)		X					
2.8.2	Control & display assembly	(1)		X					
2.8.3	Tape recorder and magazine	(1)		X					
3.0	Receive pallet & experiment igloo	(1)		X					
	(return of post flight hardware)								
3.1	Refurbish pallet & igloo	(1)		X					
3.1.1	Service cooling loops	(1)		X					
3.1.2	Functional check of power conditioning equip.	(1)		X					
3.1.3	Remove all harnesses	(1)		X					
3.1.4	Inspect & repair applicable harnesses	(1)		X					
3.1.5	Remove non applicable brackets	(1)		X					
3.1.6	Examine mating surfaces	(1)		X					
3.1.7	Paint	(1)		X					
3.1.8	Emissivity test	(1)		X					
3.2	Prepare & transfer to User facility	(1)		X					
3.3	Receive & inspect	(1)		X					
3.3.1	Check ID & damage	(1)		X					

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES			CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
3.3.2	Review history	(1)	User	X					
3.4	Transfer to assembly & checkout facility	(1)		X					
3.5	Remove experiment support igloo	(1)		X					
3.6	Configure igloo structure for support equip.	(1)		X					
3.6.1	Install brackets	(1)		X					
3.6.2	Install equipment platforms	(1)		X					
3.6.3	Install pressure lines	(1)		X					
3.6.4	Leak check	(1)		X					
3.7	Install basic equipment in pallet	(1)		X					
3.7.1	Harnesses	(1)		X					
3.7.2	Purge lines	(1)		X					
3.7.3	Cooling lines	(1)		X					
4.0	Complete assembly of experiment support igloo	(1)		X					
5.0	Modify pallet to flight configuration	(2)		X					
5.1	Install platforms and brackets	(1)		X					
5.2	Install gimbal mounts	(1)		X					
5.3	Install mech. & electr. connect panels	(2)		X					

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
5.4	Install purge manifolds	(1)	User	X					
5.5	Install LN2 coolant loops	(1)	↓	X					
	—								
6.0	Install experiments on pallet	(1)		X					
6.1	Install experiment igloo on pallet	(1)		X					
6.2	Install support equipment	(1)		X					
6.3	Verify integrity of individual assemblies	(1)		X					
6.3.1	Electrical bonding check	(1)		X					
6.3.2	Mechanical alignment check	(1)		X					
6.3.3	Plugs out continuity	(1)		X					
6.4	Interface connection & verification	(1)		X					
6.4.1	Mate & check interface connectors	(1)		X					
6.4.2	Connect fluid line I/F fittings & leak check	(1)		X					
6.4.3	Check end to end continuity of cabling	(1)		X					
6.4.4	End to end leak check of fluid systems	(1)		X					
6.5	GSE & simulators checkout	(1)		X	X	X	X		Trade study
6.5.1	Check simulators/GSE/facility interfaces	(1)		X	X	X	X		↓
6.5.2	Perform test readiness checkout	(1)	↓	X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
7.0	Mate flight equipment with GSE/simulators	(1)	User	X	X	X	X		Trade study
7.1	Support igloo	(1)		X	X	X	X		
7.2	Payload station equipment	(1)		X	X	X	X		
7.3	Pallet & experiments	(1)		X	X	X	X		
8.0	Pre-power interface verification tests	(1)		X	X	X	X		
8.1	Verify mechanical attachments	(1)		X	X	X			
8.2	Verify electrical continuity	(1)		X	X	X	X		
8.3	Leakage check	(1)		X	X	X			
8.4	Bus isolation check	(1)		X	X	X			
8.5	Check flow through coolant loops	(1)		X	X	X	X		
8.6	Check pre-power switch positions	(1)		X	X	X	X		
9.0	Power-up interface verification tests	(2)		X	X	X	X		
9.1	Power-up elect. subsystems individually	(1)		X	X	X	X		
9.2	Determine power distribution	(2)		X	X	X	X		
9.3	Verify Caution & warning indicators	(2)		X	X	X	X		
9.4	Power-up control console	(1)		X	X	X	X		
9.5	Power-up computer facility	(1)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
9.6	Verify facility ready for data processing	(1)	User	X	X	X	X		Trade study
9.7	Verify auxiliary equipment operating	(1)		X	X	X	X		
10.0	Individual experiment verification	(2)		X	X	X	X		
10.1	Deployment mechanism operation	(2)		X	X	X			
10.2	Verify controls & displays	(2)		X	X	X	X		Trade study
10.3	Operation of experiment sensors	(2)		X	X	X	X		
10.4	Operation of control & display electronics	(2)		X	X	X	X		
10.5	Verify all flt support equipment operating	(2)		X	X	X	X		
11.0	Integrated experiment tests	(2),(3)		X	X	X	X		Both sites; trade study
11.1	Mission sim. test with experiments operating	(3)		X	X	X	X		
11.2	Integrated experiment deployment	(2)		X	X	X	X		
12.0	EMC/RFI tests (EMC/RFI monitored during operation of experiments & flight support equipment)	(2)		X	X	X	X		
13.0	Data review & retest, if required	(1)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS STIMULATED

(4) DIRECT ORBITER I/F

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Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
14.0	Secure GSE & simulators	(1)	User	X	X	X	X		Either site
14.1	Disconnect GSE	(1)		X	X	X	X		
14.2	Disconnect & cap coolant lines	(1)		X	X	X	X		
14.3	Remove electrical connectors	(1)		X	X	X	X		
15.0	Post-test examination	(1)		X	X				
15.1	Examine experiments/pallet/experiment igloo	(1)		X	X				
15.2	Clean & repair, as necessary	(1)		X	X				
15.3	Load non-hazardous supplies	(1)		X	X				
16.0	Closeout, package & ship to Launch Site	(1)		X					
16.1	Closeout & seal experiments	(1)		X					
16.2	Paint as required	(1)		X					
16.3	Emissivity test	(1)		X					
16.4	Install transportation servicing equipment	(1)		X					
17.0	Pallet/exper./flt. support equip. arr. @LS	(1)	Launch site		X				
17.1	Transfer to receiving facility	(1)			X				
17.2	Perform receiving inspection operations	(1)			X				

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITF ORIENTED	GSE SIM.	IVE		
17.3	Transfer to integration facility	(1)	Launch site	X	X				
18.0	Refurbished support system igloo arrival	(1)			X				
	at Launch Site								
18.1	Transfer to receiving facility	(1)			X				
18.2	Perform receiving inspection operations	(1)			X				
18.3	Transfer to integration facility	(1)			X				
19.0	Perform mating operations	(1)			X				
19.1	Interface verification	(1)			X	X			
19.1.1	End to end electrical continuity check	(1)			X	X	X		
19.1.2	Verify alignment	(1)			X	X			
19.1.3	Interface continuity check	(1)			X	X			
19.1.4	Leak check fluid lines	(1)			X	X			
20.0	Prepare payload interface GSE	(1)		X	X	X	X		Either site
20.1	Move to integration facility	(1)		X	X	X	X		
20.2	Configure for experiment support	(1)		X	X	X	X		
20.3	Connect facility fluid lines	(1)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
20.4	Connect facility electrical harness	(1)	Launch site	X	X	X	X		Either site
21.0	Verify operation of payload/GSE interface	(2)		X	X	X	X		
21.1	Fuel cell/power distribution simulation	(2)		X	X	X	X		
21.2	Orbiter signal simulation	(2)		X	X	X	X		
21.3	Payload specialist station equipment operation	(2)		X	X	X	X		
21.4	Verify umbilical interfaces	(2)		X	X	X	X		
21.5	Verify oper. of data management subsystems	(2)		X	X	X	X		
21.6	Verify oper. of computer periph. equipment	(1)		X	X	X	X		
21.7	Verify operation of operator console	(1)		X	X	X	X		
22.0	Mate payload & interface GSE	(2)		X	X	X	X		Either site; trade study
22.1	Pre-power interface verification	(2)		X	X	X	X		
22.1.1	Verify payload/GSE mech., elect. & fluid I/F	(1)		X	X				
22.1.2	Perform bus isolation tests	(1)		X	X	X	X		
22.1.3	Conduct pre-power switch list	(2)		X	X	X	X		
22.1.4	Check operation of all caution & warning	(2)		X	X	X	X		
22.2	Power-up functional checkout	(2),(3)		X	X	X	X		
22.2.1	Monitor bus voltages & current	(2)		X	X	X	X		
22.2.2	Monitor coolant flow	(2)		X	X	X	X		
22.2.3	Check power distribution	(2)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
22.2.4	Initiate computer self-checks	(1)	Launch site	X	X	X	X		Either site; trade study
22.2.5	Conduct command & control test	(2)		X	X	X	X		
22.2.6	Evaluate computer peripheral equipment	(2)		X	X	X	X		
22.2.7	Functional c/o of support systems and experiment equipment interfaces	(3)		X	X	X	X		
22.2.8	Evaluate manual emergency backup modes	(3)		X	X	X	X		
23.0	Data review	(2)		X	X				Trade study, see 22.2
24.0	Remove and secure interface GSE	(1)		X	X	X	X		
25.0	Close-out operations	(1)			X				
25.1	Load non-hazardous supplies	(1)			X				
25.2	Install access panels & cover plates	(1)			X				
25.3	Touch-up paint	(1)			X				
25.4	Emissivity test	(1)			X				
26.0	Pressure decay leak check	(1)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
27.0	Weight & balance test	(1)	Launch site		X			X	
28.0	Transfer to OPF	(1)			X				
29.0	Prepare cargo for mating with orbiter	(2)			X				
29.1	Inspect interface connectors	(2)			X				
29.2	Service with non-hazardous materials	(1)			X				
29.3	Install flight batteries and chargers	(1)			X				
30.0	Install payload control & support equip. in Orb.	(4)			X				
30.1	Install cargo in orbiter payload bay	(4)			X				
31.0	Orbiter/cargo interface verification test	(4)			X				
31.1	Plugs out electrical continuity	(1)			X				
31.2	Connect & verify umbilicals & fluid lines	(4)			X				
31.3	Install & verify mech. latches & retention dev.	(4)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.2 Solar Physics Dedicated Mission Interface Checkout Matrix (Cont)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
32.0	Orbiter avionics test	(4)	Launch site		X				
32.1	Verify compatibility of experiment avionics with shuttle support avionics	(4)			X				
33.0	EMC/RFI test	(4)			X				
34.0	Closeout of payload bay	(4)			X				
35.0	Ready for Launch Operations	(4)			X				
36.0	Launch Operations	(4)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS STIMULATED

(4) DIRECT ORBITER I/F

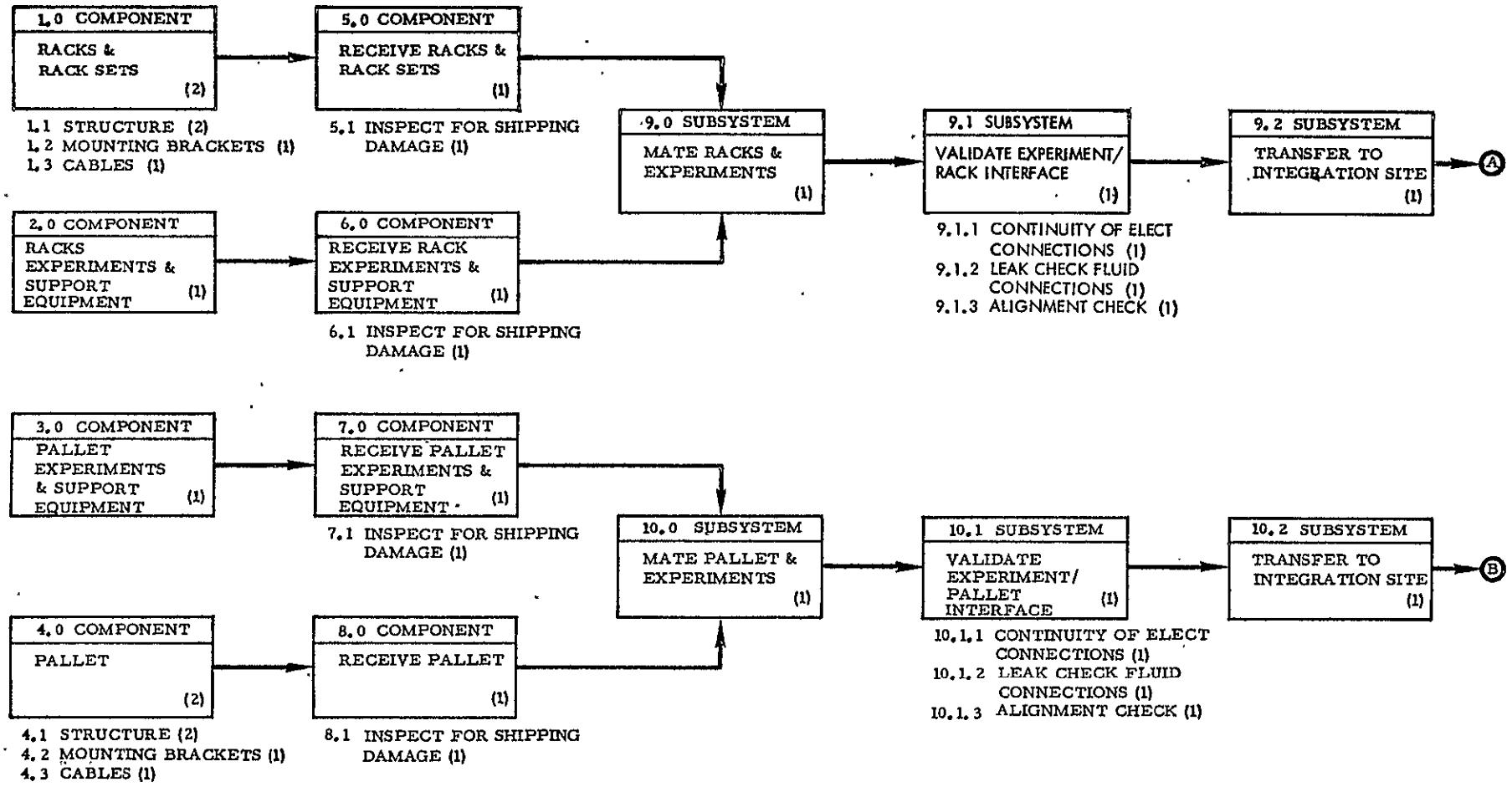

Figure C-3 Module with Pallet (Spacelab)

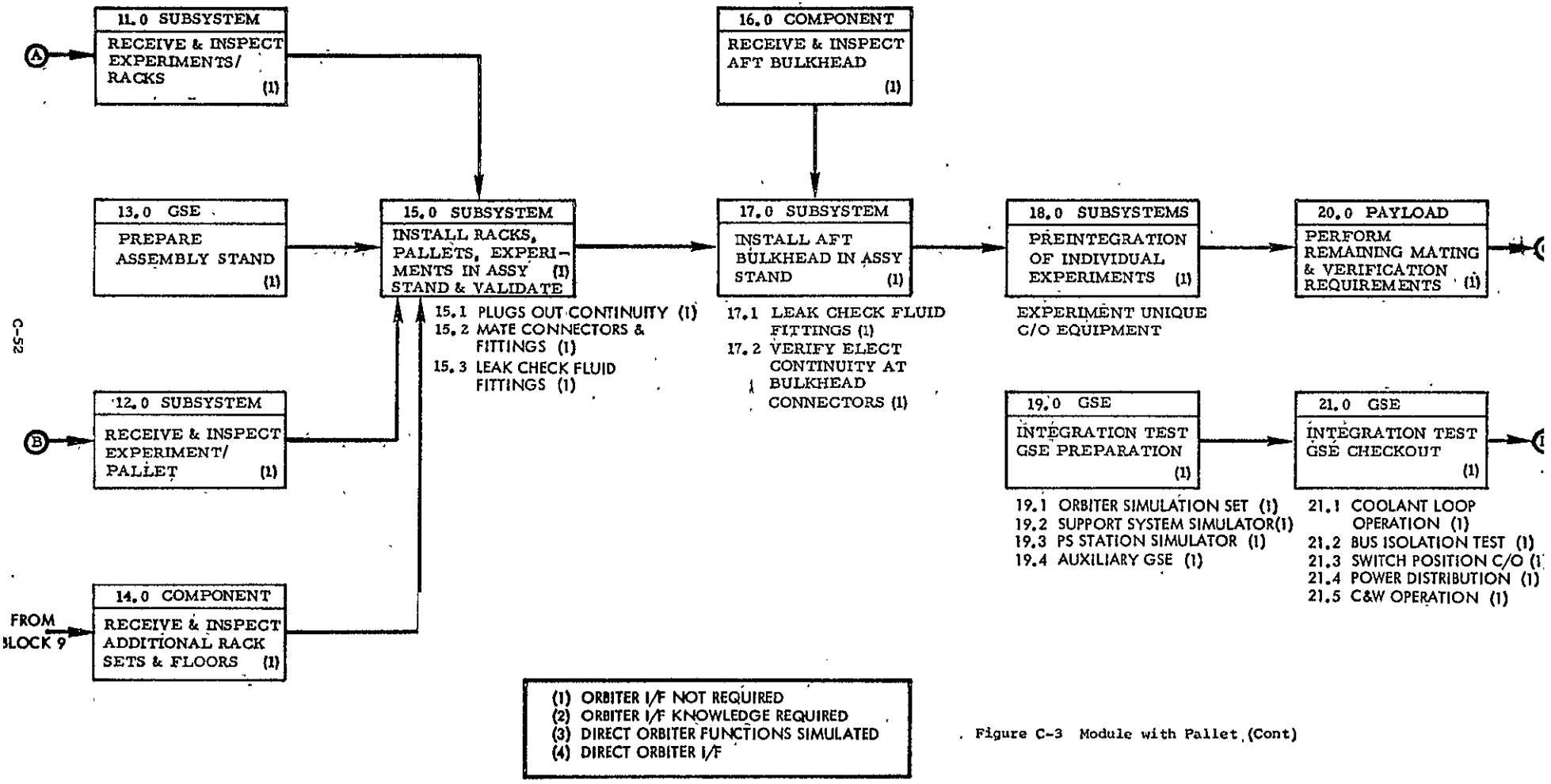

Figure C-3 Module with Pallet (Cont)

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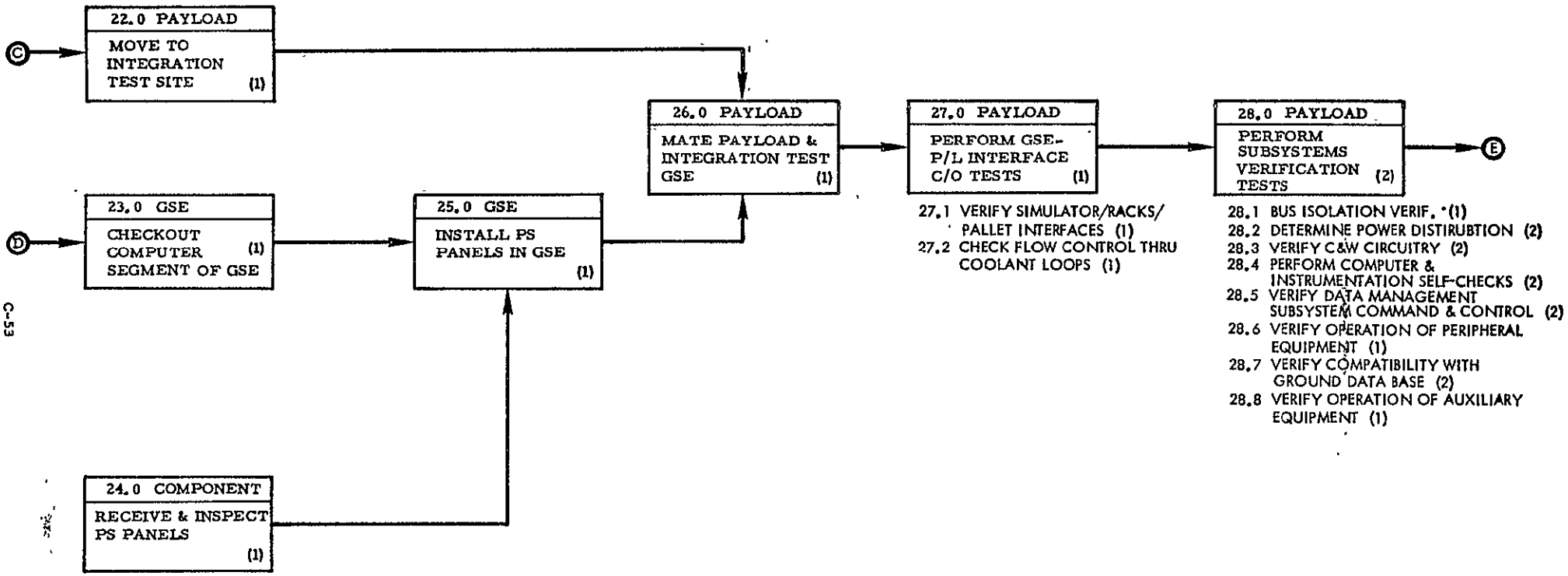

Figure C-3 Module with Pallet (Cont)

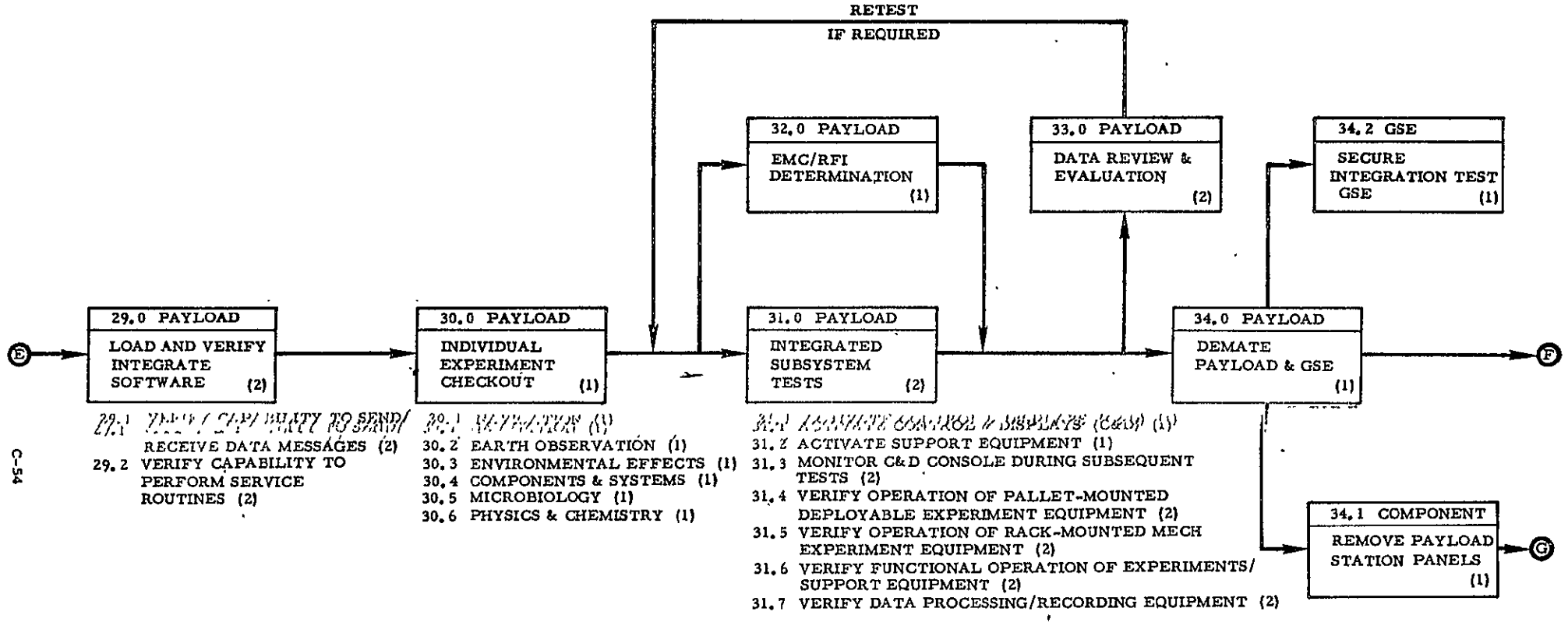

Figure C-3 Module with Pallet (Cont)

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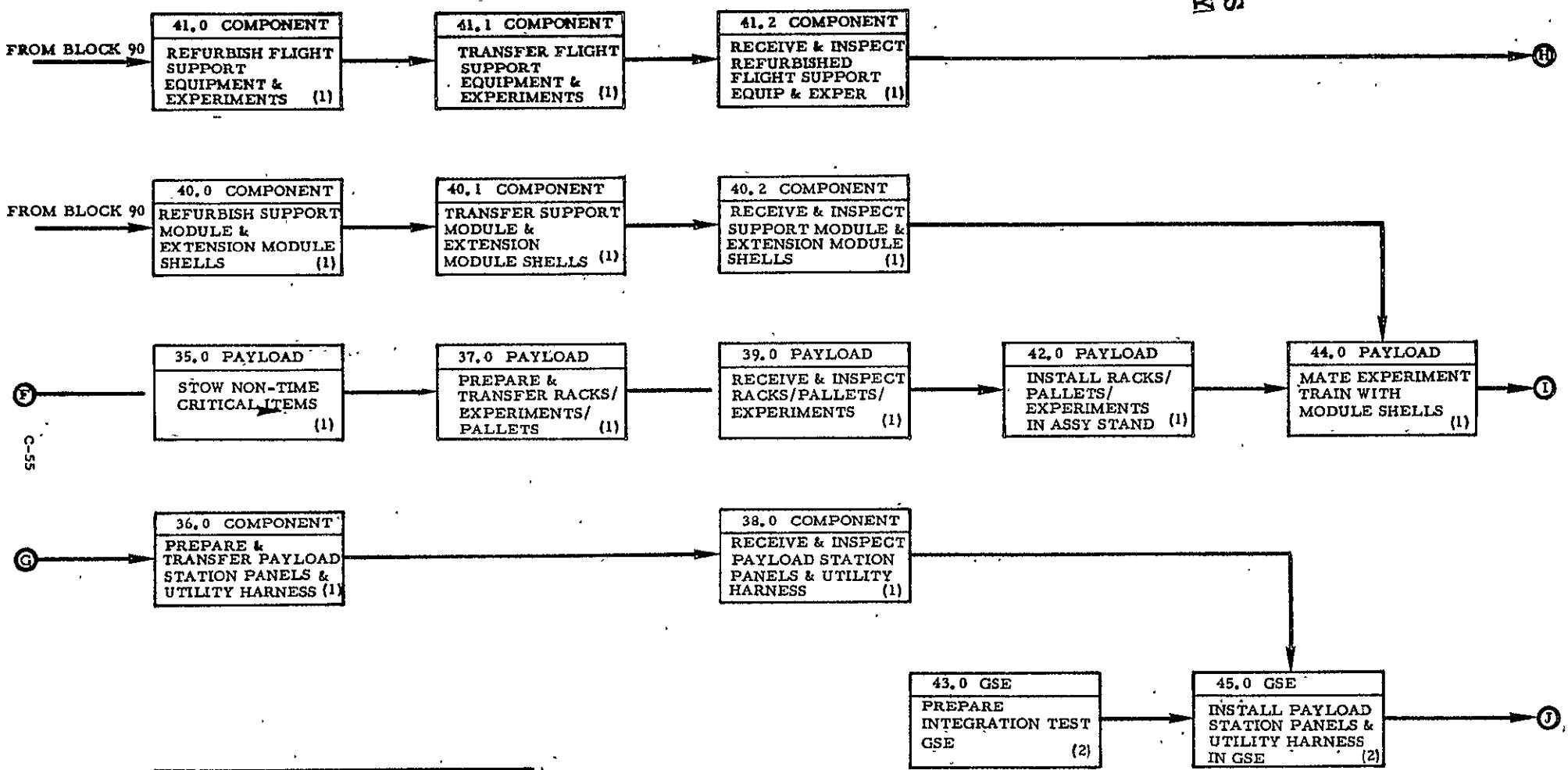

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(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

43.1 ORBITER ELECT I/F SIMULATORS (2)
43.2 ORBITER MECH I/F SIMULATORS (2)
43.3 SERVICING UNITS (1)
43.4 FACILITY I/F EQUIPMENT (1)
43.5 PAYLOAD STATION SIMULATORS (2)

Figure C-3 Module with Pallet (Cont)

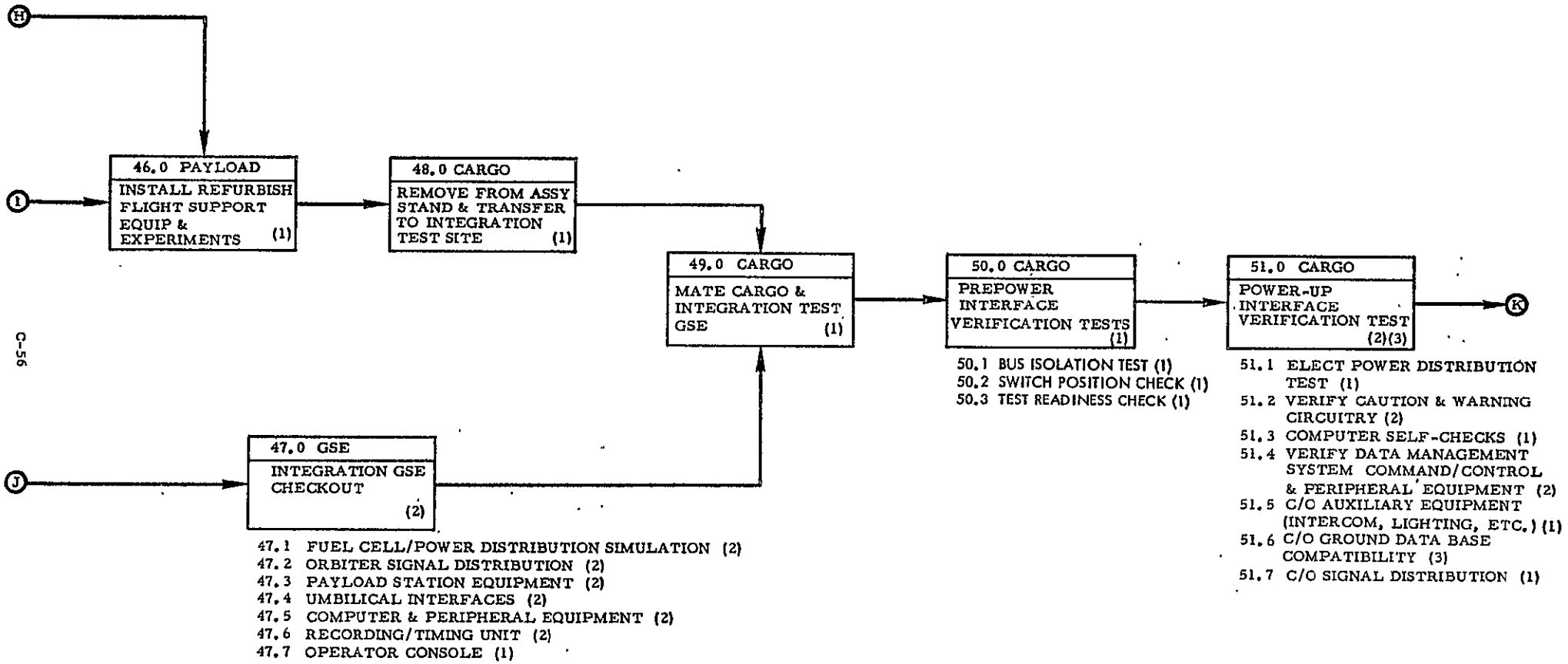
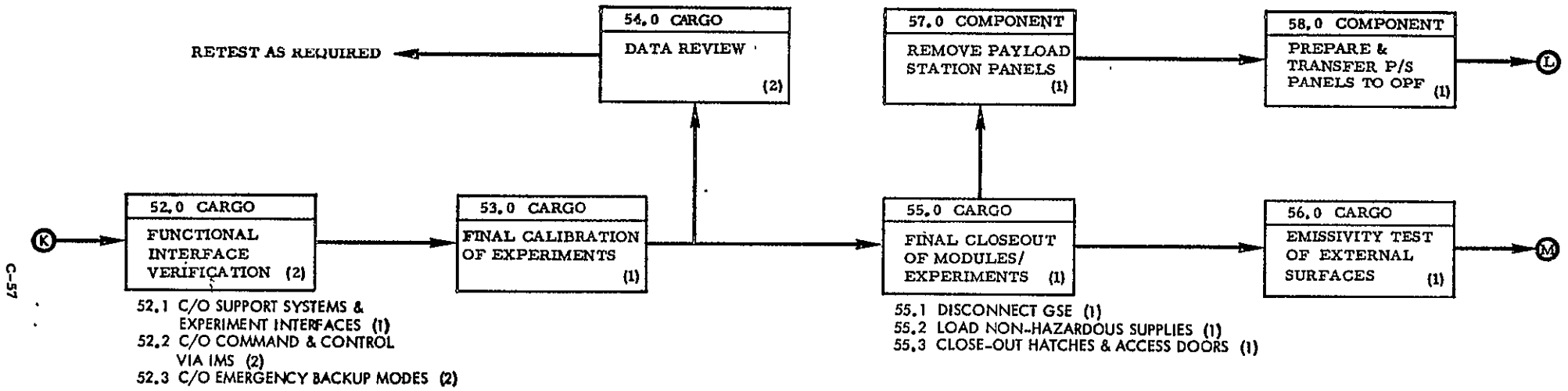
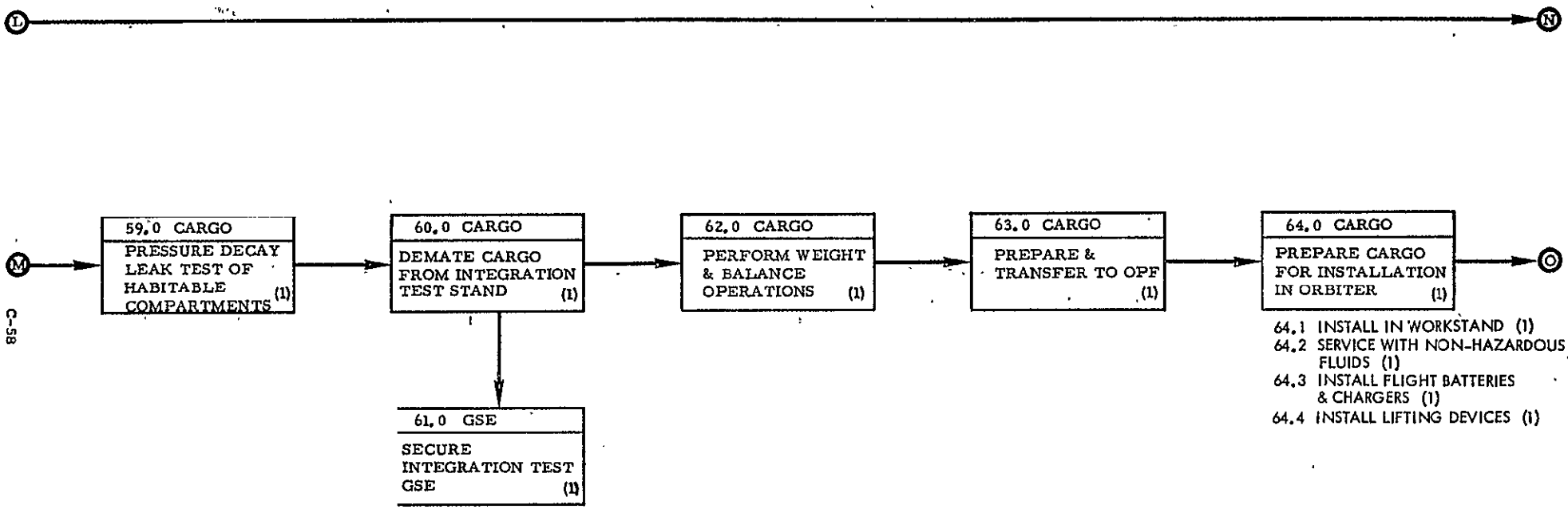


Figure C-3 Module with Pallet (Cont)



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-3 Module with Pallet (Cont)



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-3 Module with Pallet (Cont)

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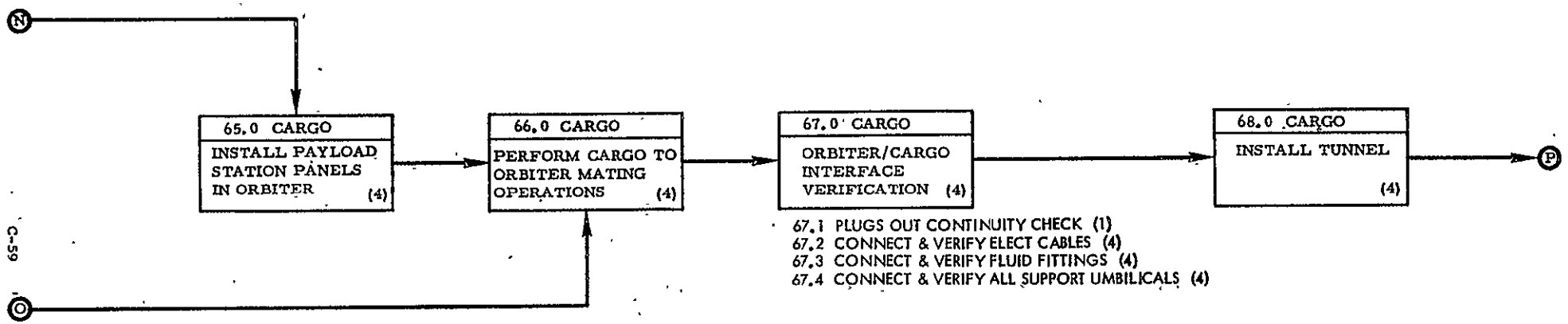

(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-3 Module with Pallet (Cont)

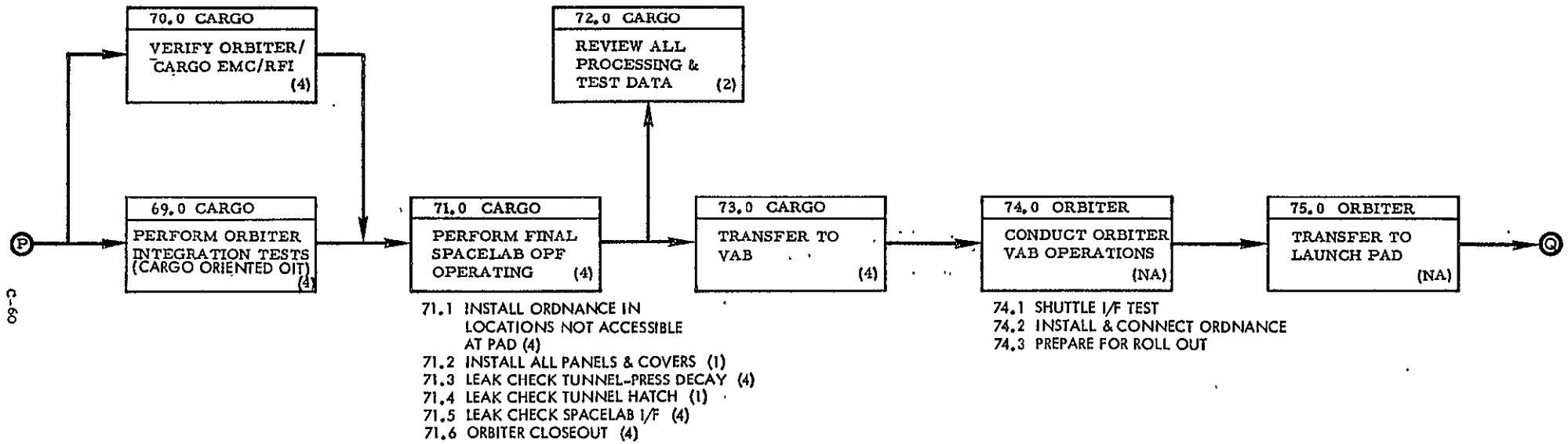

Figure C-3 Module with Pallet (Cont)

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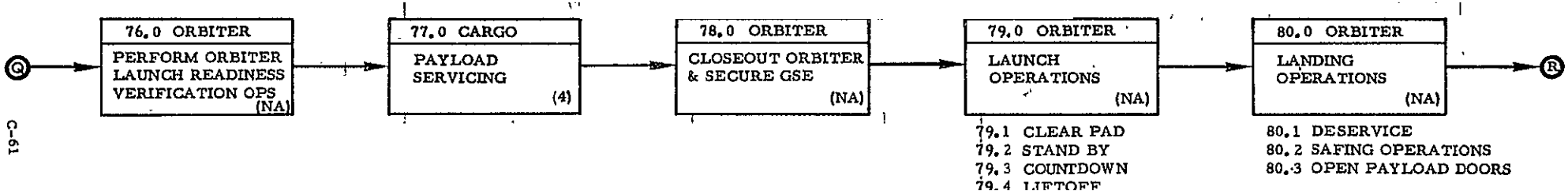
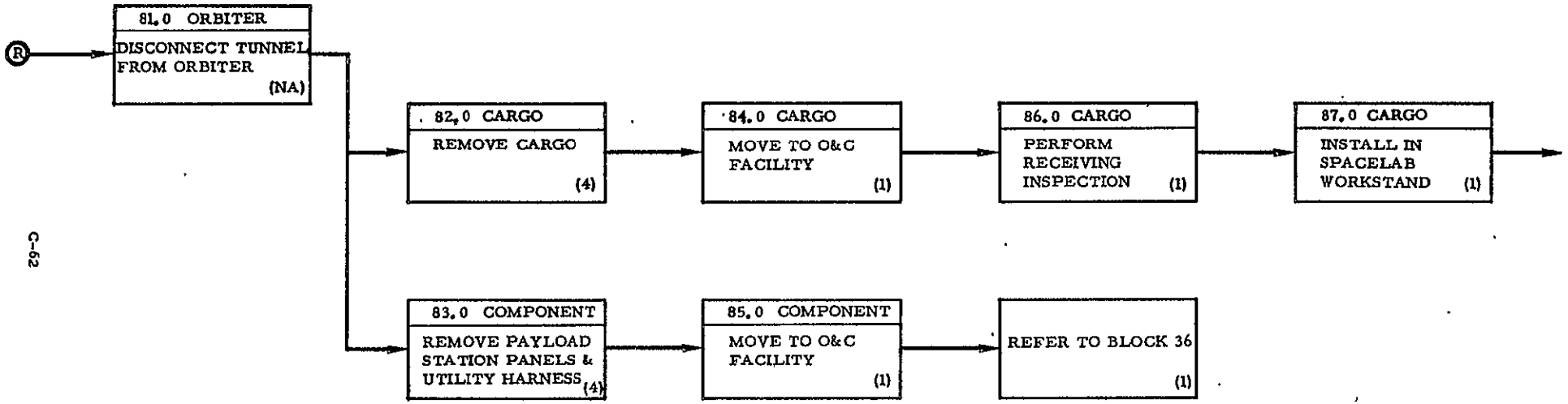


(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-3 Module with Pallet (Cont)



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-3 Module with Pallet (Cont)

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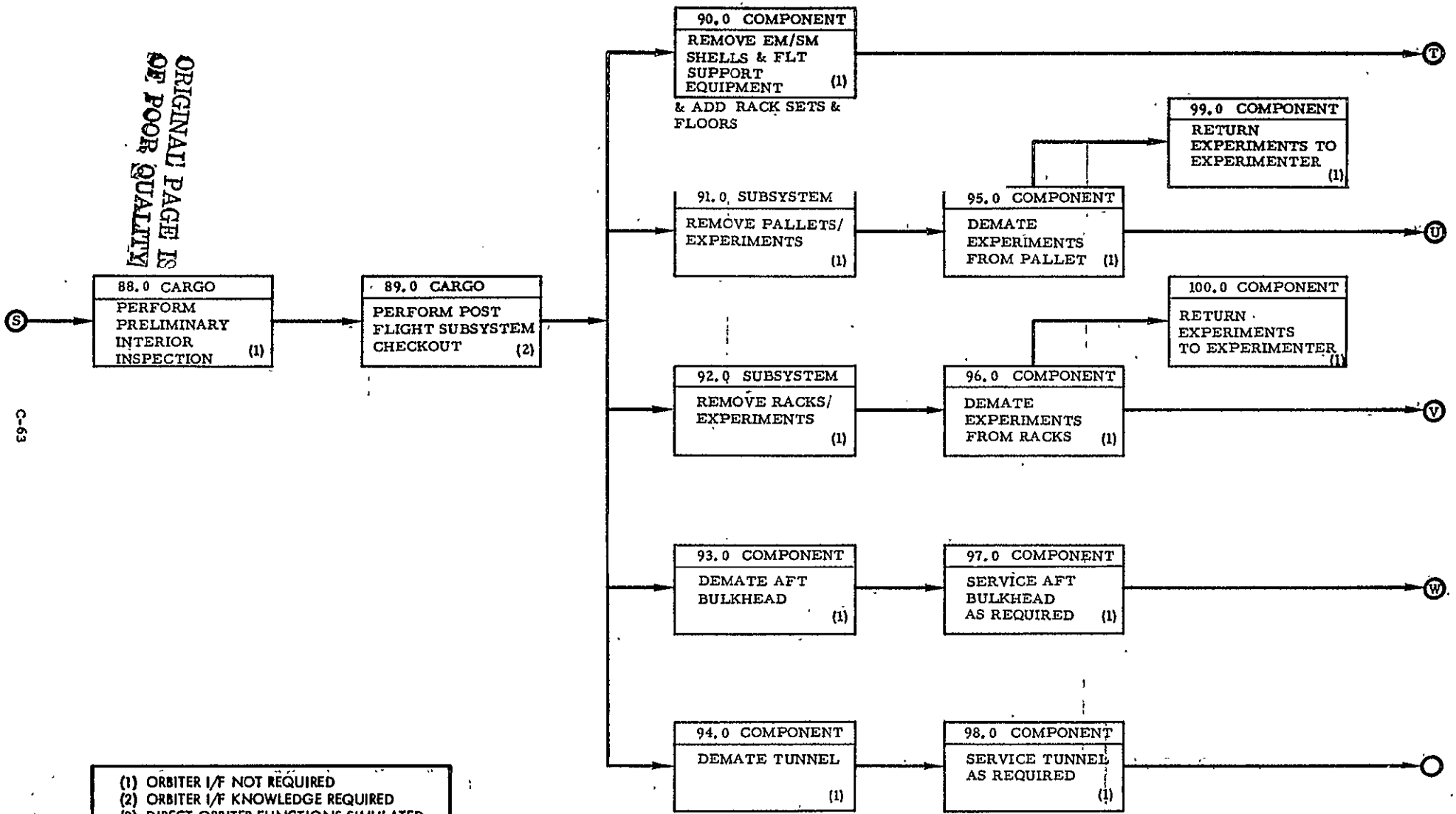

Figure C-3 Module with Pallet (Cont)

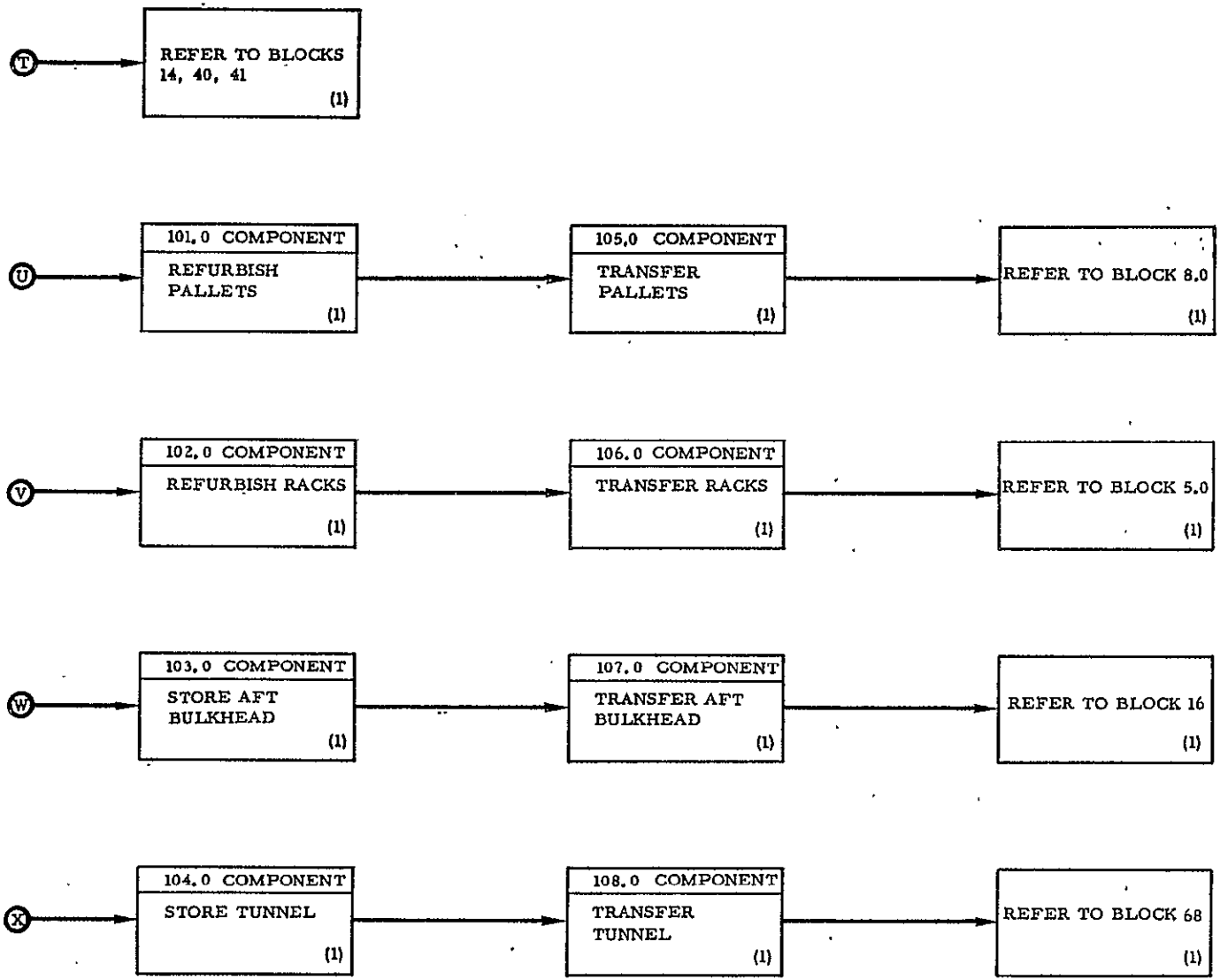

Figure C-3 Module with Pallet (Cont)

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Table C.3 MODULE WITH PALLET (SPACE)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	MATES
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.0	Racks and rack sets	(2)	User	X					Various sources
1.1	Structure	(2)		X					
1.2	Mounting brackets	(1)		X					
1.3	Cables	(1)		X					
2.0	Racks experiments & support equipment	(1)		X					
3.0	Pallet experiments & support equipment	(1)		X					
4.0	Pallet	(2)		X					
4.1	Structure	(2)		X					
4.2	Mounting brackets	(1)		X					
4.3	Cables	(1)		X					
5.0	Receive racks & rack sets	(1)		X					
5.1	Inspect for shipping damage	(1)		X					
6.0	Receive racks experiments & support equipment	(1)		X					
6.1	Inspect for shipping damage	(1)		X					

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
7.0	Receive pallet experiments & support equipment	(1)	User	X					Various sources
7.1	Inspect for shipping damage	(1)		X					
8.0	Receive pallet	(1)		X					
8.1	Inspect for shipping damage	(1)		X					
9.0	Mate racks and experiments	(1)		X					
9.1	Validate experiment/rack interface	(1)		X					
9.1.1	Continuity of electrical connections	(1)		X					
9.1.2	Leak check fluid connections	(1)		X					
9.1.3	Alignement check	(1)		X					
9.2.	Transfer to integration site (user)	(1)		X					
10.0	Mate pallet and experiments	(1)		X					
10.1	Validate experiment/pallet interface	(1)		X					
10.1.1	Continuity of electrical connections	(1)		X					
10.1.2	Leak check of fluid connections	(1)		X					
10.1.3	Alignement check	(1)		X					
10.2	Transfer to integration site	(1)		X					

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
11.0	Receive & inspect experiments/racks	(1)	User	X					
12.0	Receive & inspect experiment/pallet	(1)		X					
13.0	Prepare assembly stand	(1)		X					
14.0	Receive & inspect additional rack sets & floor	(1)		X					
15.0	Install racks, pallets, experiments in assembly stand & validate	(1)		X					
15.1	Plugs out continuity	(1)		X					
15.2	Mate connectors and fittings	(1)		X					
15.3	Leak check fluid fittings	(1)		X					
16.0	Receive and inspect aft bulkhead	(1)		X					
17.0	Install aft bulkhead in assembly stand	(1)		X					
17.1	Leak check fluid fittings	(1)		X					
17.2	Verify electrical continuity at bulkh. conn.	(1)		X					

(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
18.0	Pre-integration of individual experiments	(1)	User	X	X				Unique C/O equipment required. Either site:trade study.
19.0	Integration test GSE preparation	(1)		X	X	X			Either site.
19.1	Orbiter simulation set	(1)		X	X	X			
19.2	Support system simulator	(1)		X	X	X			
19.3	PS station simulator	(1)		X	X	X			
19.4	Auxiliary GSE	(1)		X	X	X			
20.0	Perform remaining mating & verif. requirements	(1)		X	X				Either site: trade study.
21.0	Integration test GSE checkout	(1)		X	X				Either site.
21.1	Coolant loop operation	(1)		X	X				
21.2	Bus isolation test	(1)		X	X				
21.3	Switch position checkout	(1)		X	X				
21.4	Power distribution	(1)		X	X				
21.5	Caution & warning operation	(1)		X	X				
22.0	Move to integration test site	(1)		X	X				Either site

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

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Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
23.0	Checkout computer segment of GSE	(1)	User	X	X				Either site
23.1	Console operation	(1)		X	X				
23.2	Computer/instrumentation selfcheck	(1)		X	X				
23.3	Verify command/control capability	(1)		X	X				
24.0	Receive & inspect PS panels	(1)		X	X				
25.0	Install PS panels in GSE	(1)		X	X				
26.0	Mate payload and integration test GSE	(1)		X	X				
27.0	Perform GSE/payload interface c/o tests	(1)		X	X	X	X		Either site; trade study
27.1	Verify simulator/racks/pallet interfaces	(1)		X	X	X	X		
27.2	Check control loops flow control	(1)		X	X	X	X		
28.0	Perform subsystem verification tests	(2)		X	X	X	X		Trade study
28.1	Bus isolation verivication	(1)		X	X	X	X		
28.2	Determine power distribution	(2)		X	X	X	X		
28.3	Verify caution & warning circuitry	(2)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
28.4	Perform computer & instrumentation selfchecks	(2)	User	X	X	X	X		Trade study
28.5	Verify data management subsystem com.& control	(1)		X	X	X	X		
28.6	Verify operation of peripheral equipment	(1)		X	X	X	X		
28.7	Verify compatibility with ground data base	(2)		X	X	X	X		
28.8	Verify operation of auxiliary equipment	(1)		X	X	X	X		
29.0	Load and verify integrated software	(2)		X	X	X	X		Either site
29.1	Verify capability to send/receive data messages	(2)		X	X	X	X		
29.2	Verify capability to perform service routines	(2)		X	X	X	X		
30.0	Individual experiment checkout	(1)		X	X				Unique experiment equipment
30.1	Navigation	(1)		X	X				
30.2	Earth observation	(1)		X	X				
30.3	Environmental effects	(1)		X	X				
30.4	Components & systems	(1)		X	X				
30.5	Microbiology	(1)		X	X				
30.6	Physics and chemistry	(1)		X	X				

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

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Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
31.0	Integrated subsystem tests	(2)	User	X	X	X	X		Trade study
31.1	Activate control and displays	(1)		X	X	X	X		
31.2	Activate support equipment	(1)		X	X	X	X		
31.3	Monitor C&D console during subsequent tests	(2)		X	X	X	X		
31.4	Verify operation of pallet-mtd deployable experiment equipment	(2)		X	X	X	X		
31.5	Verify operation of rack-mtd mechanical experiment equipment	(2)		X	X	X	X		
31.6	Verify functional operation of experiments/support equipment	(2)		X	X	X	X		
31.7	Verify data processing/recording equipment	(2)		X	X	X	X		
32.0	EMC/RFI determination	(1)		X	X				Special equipment required
33.0	Data review and evaluation	(2)		X	X				Can be accomplished anywhere
34.0	De-mate payload & GSE	(1)		X	X				
34.1	Remove payload station panels	(1)		X	X				
34.2	Secure integration test GSE	(1)		X	X				

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
35.0	Stow non time-critical items	(1)	User	X	X				Either site
36.0	Prepare & transfer P/L staion panels & util.harn.	(1)	↓	X	X				↓
37.0	Prepare & transfer racks/experiments/pallets	(1)		X	X				
38.0	R & I payload station panels & utility harness	(1)		X	X				
39.0	R & I racks/pallets/experiments	(1)	↓	X	X				
40.0	Refurbish SM & extension module shells	(1)	Launch site		X				
40.1	Transfer SM & extension module shells	(1)	↓		X				
40.2	R & I SM & extension module shells	(1)			X				
41.0	Refurbish FS equipment & experiments	(1)			X				
41.1	Transfer FS equipment & experiments	(1)			X				
41.2	R & I refurbished FS equipment & experiments	(1)			X				
42.0	Install racks/pallets/experiments in assy stand	(1)			X				
43.0	Prepare integration test GSE	(2)		X	X	X	X		Either site; trade study
43.1	Orbiter electrical I/F simulators	(2)		X	X	X	X		↓
43.2	Orbiter mechanical I/F simulators	(2)		X	X	X	X		
43.3	Servicing units	(1)		X	X	X	X		
43.4	Facility I/F equipment	(1)		X	X	X	X		
43.5	Payload station simulator	(2)		X	X	X	X		↓
44.0	Mate experiment train with module shells	(1)	↓	X	X				Either site

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
45.0	Install P/L station panels & utility Harness in GSE	(2)	Launch site	X	X				Either site
46.0	Install refurbished FS equipment & experiments	(1)			X				
47.0	Integration GSE checkout	(2)		X	X	X	X		Either site
47.1	Fuel cell/power distribution simulation	(2)		X	X	X	X		
47.2	Orbiter signal distribution	(2)		X	X	X	X		
47.3	Payload station equipment	(2)		X	X	X	X		
47.4	Umbilical interfaces	(2)		X	X	X	X		
47.5	Computer & peripheral equipment	(2)		X	X	X	X		
47.6	Recording/timing unit	(2)		X	X	X	X		
47.7	Operator console	(1)		X	X	X	X		
48.0	Remove from assy stnd & transfer to int.test site	(1)			X				
49.0	Mate cargo & integration test GSE	(1)			X	X	X		GSE simulator Vs IVE trade study
50.0	Pre-power interface verification tests	(1)		See remarks	X		X		If accomplished at User site, demate, ship, remate and reverify at launch site
50.1	Bus isolation test	(1)			X		X		
50.2	Switch position check	(1)			X		X		
50.3	Test readiness check	(1)			X		X		
51.0	Power-up interface verification test	(2),(3)			X	X	X		
51.1	Electrical power distribution test	(1)			X	X	X		
51.2	Verify caution &warning circuitry	(2)			X	X	X		

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
51.3	Computer self checks	(1)	Launch site		X	X	X		If accomplished at User site, demate, ship, remate and reverify at launch site
51.4	Verify data mangement system command/control & peripherel equipment	(2)			X	X	X		
51.5	Checkout auxiliary equipment (intercom, lighting, etc.)	(1)			X	X	X		
51.6	C/O ground data base compatibility	(3)			X	X	X		
51.7	Checkout signal distribution	(1)			X	X	X		
52.0	Functional interface verification	(2)			X	X	X		
52.1	C/Osupport systems & experiment interfaces	(1)			XX	X	X		
52.2	Checkout command & control via IMS	(2)			X	X	X		
52.3	Checkout emergency backup modes	(2)			X	X	X		
53.0	Final calibration of experiments	(1)			X				Experiment unique equipment
54.0	Data review	(2)			X				Can be accomplished anywhere
55.0	Final closeout of modules/experiments	(1)			X				
55.1	Disconnect GSE	(1)			X				
55.2	Load non-hazardous supplies	(1)			X				
55.3	Closeout hatches & access doors	(1)			X				
56.0	Emissivity test of external surfaces	(1)			X				
57.0	Remove payload station panels	(1)			X				
58.0	Prepare & transfer P.S panels to OPF	(1)			X				
59.0	Pressure decay leak test of habitable compartment	(1)			X				

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

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Table C.3 (Cont) MODULE WITH PALLET (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
60.0	Demate cargo from integration stand	(1)	Launch site		X				
61.0	Secure integration test GSE	(1)			X				
62.0	Perform weight & balance operations	(1)			X			X	
63.0	Prepare & transfer to OPF	(1)			X			X	Special handling equipment
64.0	Prepare cargo for installation in orbiter	(1)			X				
64.1	Install in workstand	(1)			X				
64.2	Service with non-hazardous fluids	(1)			X				
64.3	Install flight batteries and chargers	(1)			X				
64.4	Install lifting devices	(1)			X				
65.0	Install payload station panels in orbiter	(4)			X				
66.0	Perform cargo to orbiter mating operations	(4)			X				
67.0	Orbiter/cargo interface verification	(4)			X				Orbiter responsibility
67.1	Plugs out continuity check	(1)			X				
67.2	Connect & verify electrical cables	(4)			X				
67.3	Connect & verify fluid fittings	(4)			X				
67.4	Connect & verify all support umbilicals	(4)			X				
68.0	Install tunnel	(4)			X				
69.0	Perform orbiter integration test (cargo oriented OIT)	(4)			X				

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.3 (Cont) MODULE WITH PALLETS (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
70.0	Verify orbiter/cargo EMC/RFI	(4)	Launch site		X				Orbiter responsibility
70.1	Monitor during OIT functional tests	(4)	↓		X				↓
71.0	Perform final spacelab OPF operations	(4)			X				Use OPF equipment
71.1	Install ordnance in locations not accessible at pad	(4)			X				↓
71.2	Install all panels and covers	(1)			X				
71.3	Leak-check tunnel pressure decay	(4)			X				
71.4	Leak check tunnel hatch	(1)			X				
71.5	Leak check spacelab interface	(4)			X				
71.6	Orbiter closeout	(4)			X				↓
72.0	Review all processing & test data	(2)			X				
73.0	Transfer to VAB	(4)			X				Orbiter responsibility
74.0	Conduct orbiter VAB operations	NA			X				
74.1	Shuttle interface test	NA			X				
74.2	Install & connect ordnance	NA			X				
74.3	Prepare for roll out	NA			X				
75.0	Transfer to launch pad	NA			X				
76.0	Platform orbiter launch readiness verif. ops.	NA			X				
77.0	Payload servicing	(4)			X				As required
78.0	Closeout orbiter & secure GSE	NA	↓		X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

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Table C.3 (Cont) MODULE WITH PALLETS (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
79.0	Launch operations	NA	Launch site		X				
79.1	Clear pad	NA			X				
79.2	Stand by	NA			X				
79.3	Countdown	NA			X				
79.4	Liftoff	NA			X				
80.0	Landing operations	NA			X				
80.1	De-service	NA			X				
80.2	Safing operations	NA			X				
80.3	Open payload doors	NA			X				
81.0	Disconnect tunnel from orbiter	NA			X				
82.0	Remove cargo	(4)			X				
83.0	Remove P/L station panels & utility harness	(4)			X				
84.0	Move to O & C facility	(1)			X				
85.0	Move to O & C facility	(1)			X				
86.0	Perform receiving inspection	(1)			X				
87.0	Install in spacelab workstand	(1)			X				
88.0	Perform preliminary interior inspection	(1)			X				
89.0	Perform post-flight subsystem checkout	(2)			X				
90.0	Remove EM/SM shells & FS equipment & additional rack sets and floors	(1)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.3 (Cont). MODULE WITH PALLETS (SPACELAB)

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
91.0	Remove pallets/experiments	(1)	Launch site		X				
92.0	Remove racks/experiments	(1)			X				
93.0	Demate aft bulkhead	(1)			X				
94.0	Demate tunnel	(1)			X				
95.0	Demate experiments from pallet	(1)			X				
96.0	Demate experiments from racks	(1)			X				
97.0	Service aft bulkhead as required	(1)			X				
98.0	Service tunnel as required	(1)			X				
99.0	Return experiments to experimenter	(1)		X					
100.0	Return experiments to experimenter	(1)		X					
101.0	Refurbish pallets	(1)			X				
102.0	Refurbish racks	(1)			X				
103.0	Store aft bulkhead	(1)			X				
104.0	Store tunnel	(1)			X				
105.0	Transfer pallets	(1)			X				
106.0	Transfer racks	(1)			X				
107.0	Transfer aft bulkhead	(1)			X				
108.0	Transfer tunnel	(1)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

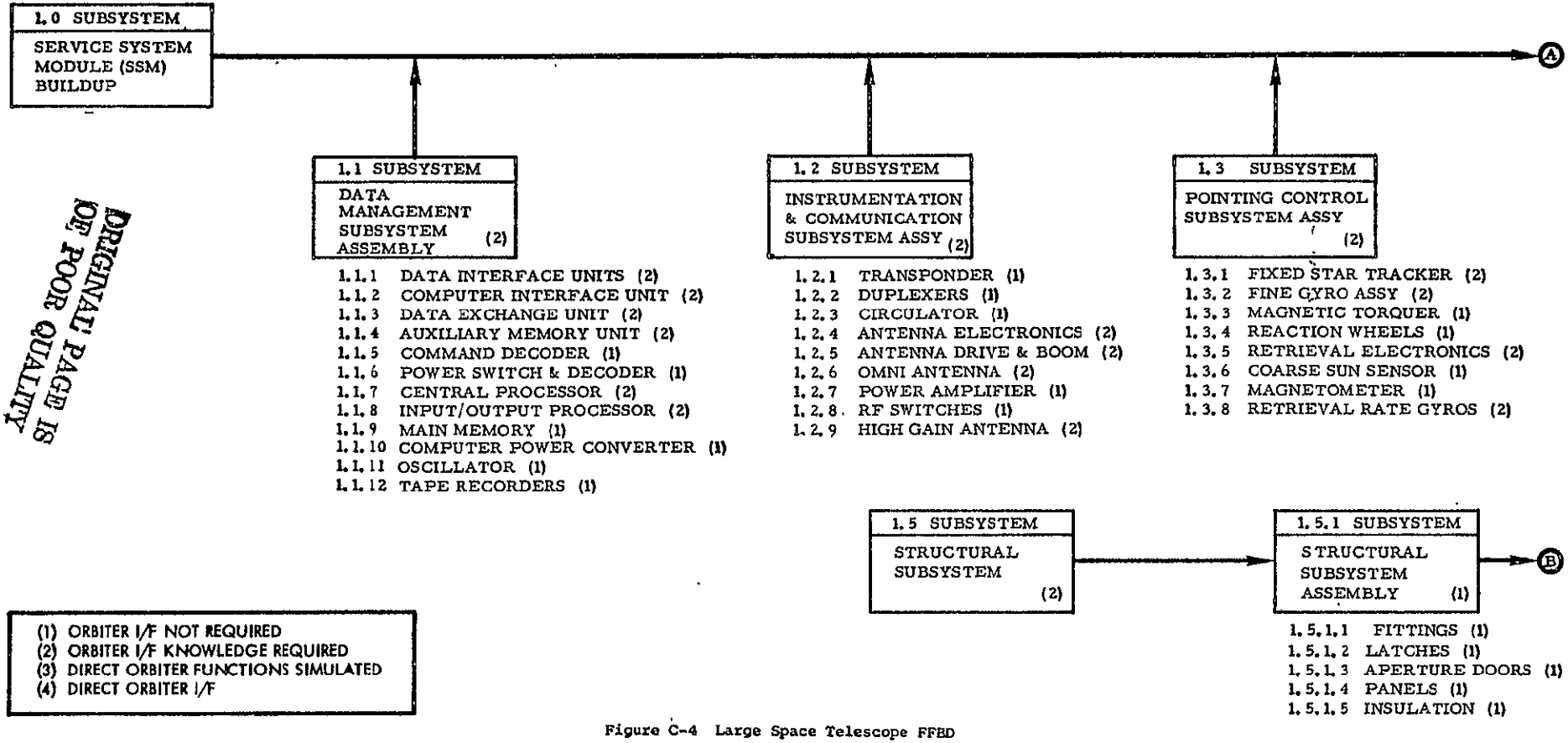

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Figure C-4 Large Space Telescope FFBD

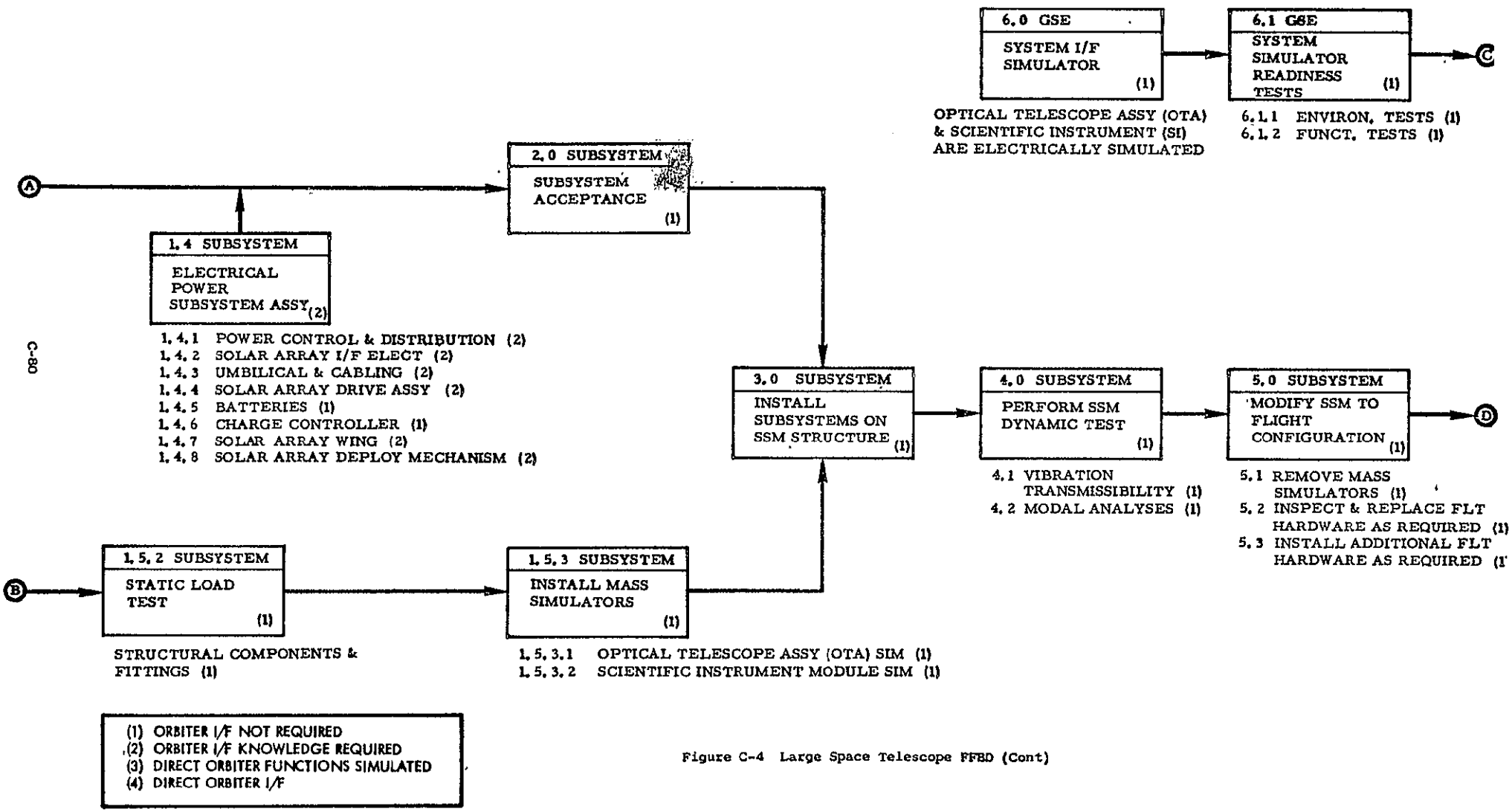

Figure C-4 Large Space Telescope FFBD (Cont)

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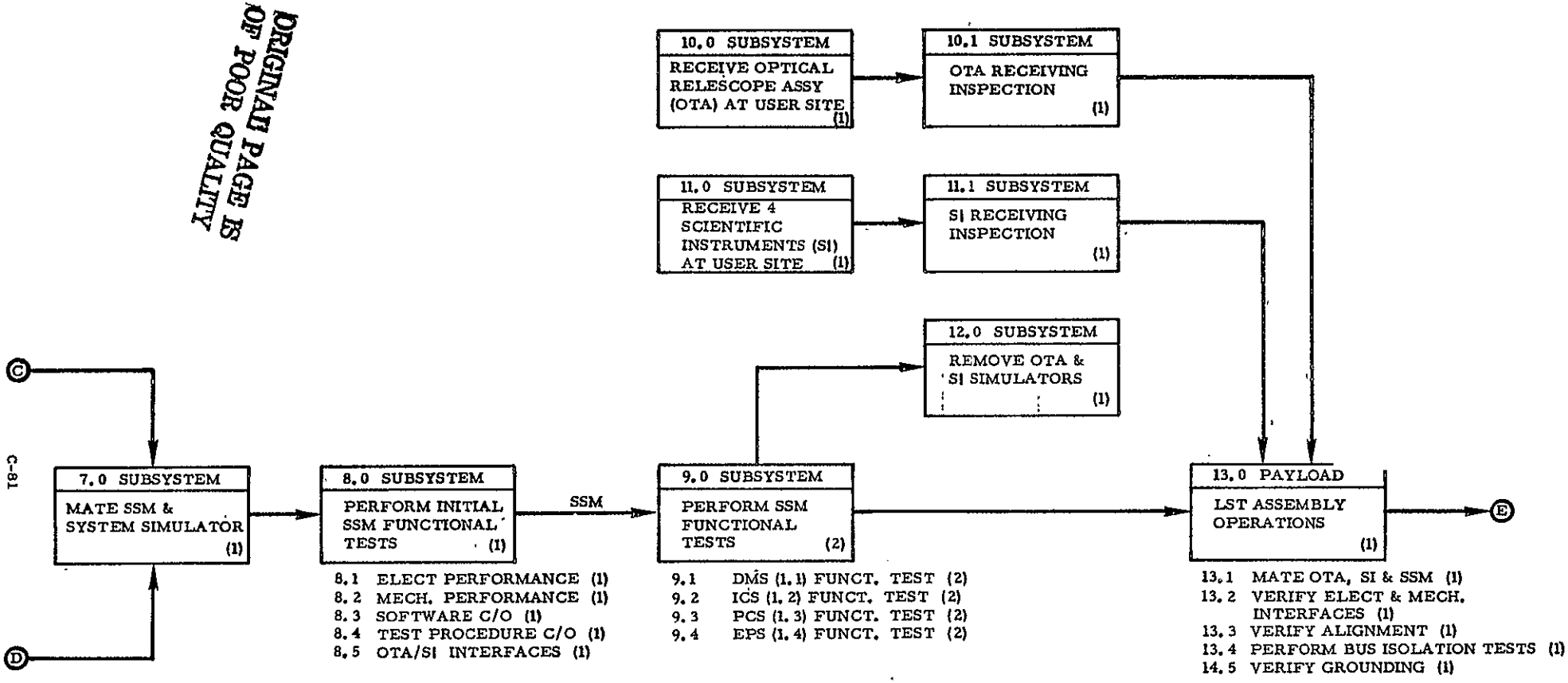
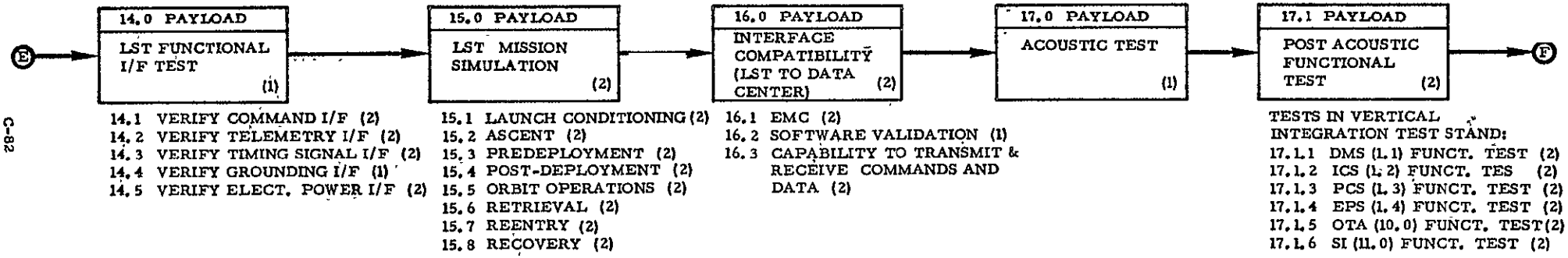


(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIERD
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-4 , Large Space Telescope FFBD (Cont)



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-4 Large Space Telescope FEBD (Cont)

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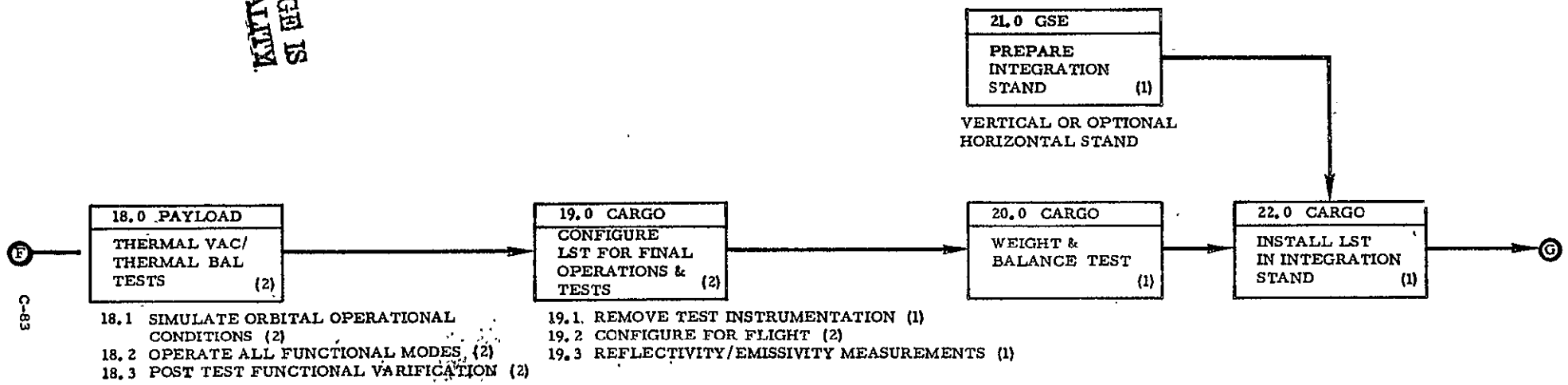

(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-4 Large Space Teleccope FFBD (Cont)

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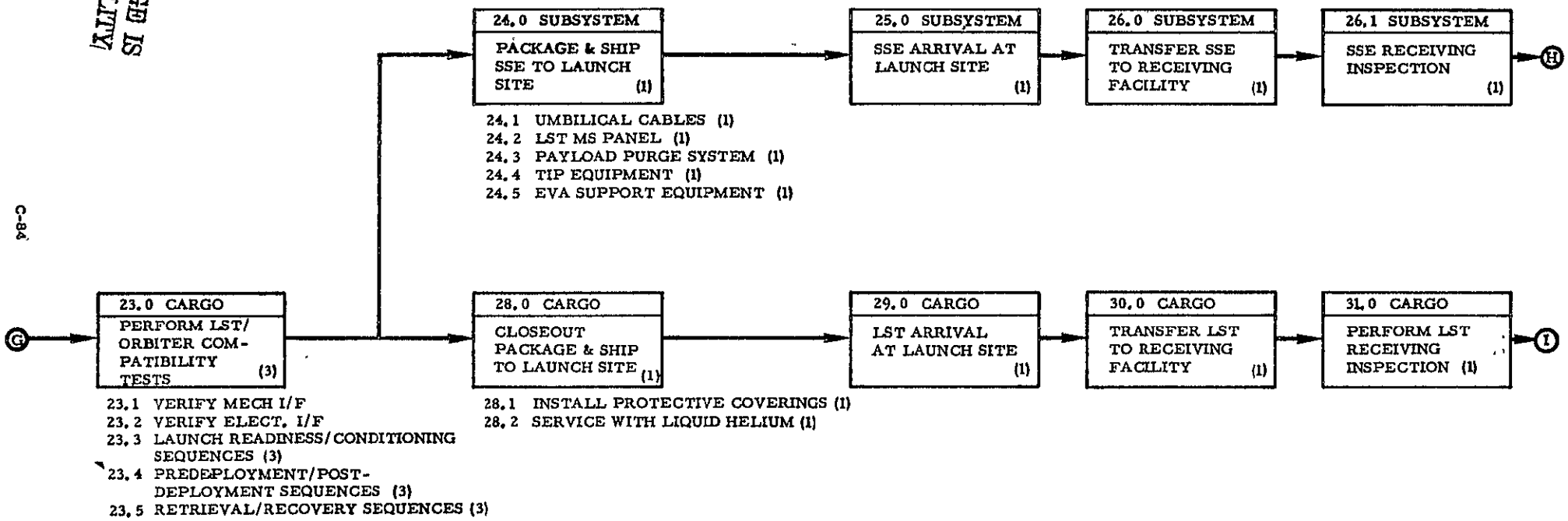
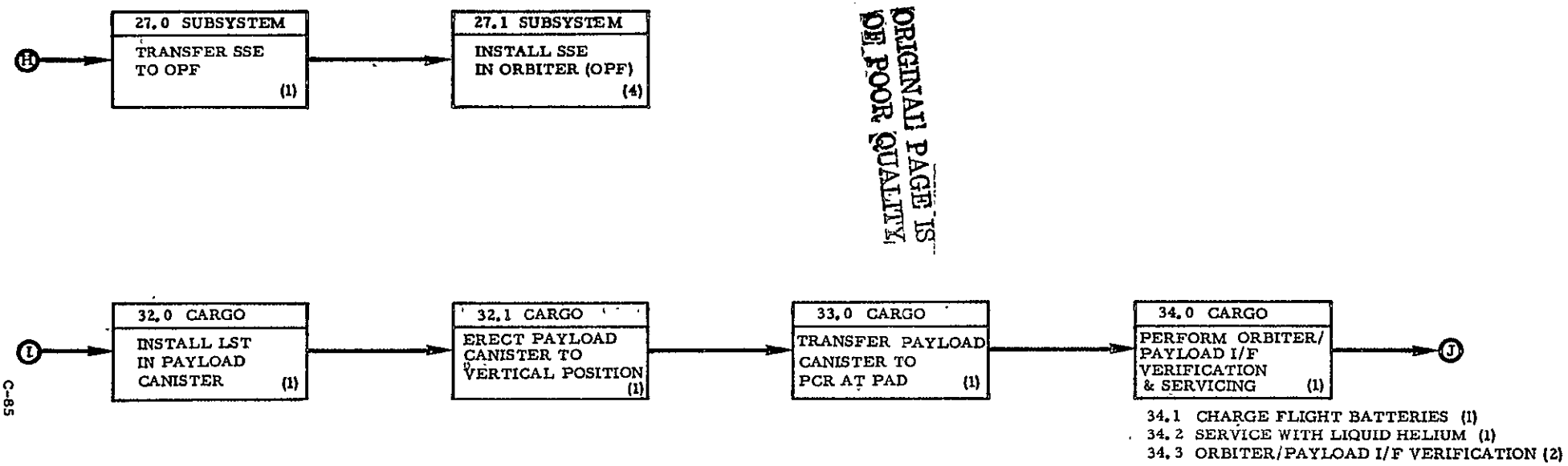


(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-4 Large Space Telescope FFBD (Cont)



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(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-4 Large Space Telescope FFBD (Cont)

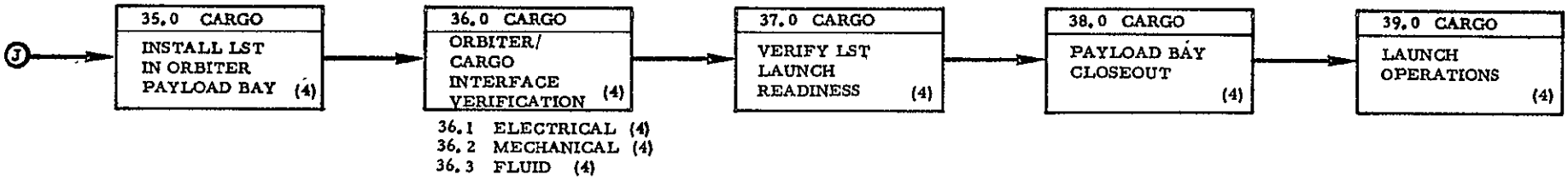

Figure C-4 Large Space Telescope FFBD (Cont)

(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNWOLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

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Table C.4 LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.0	Service system module (SSM) buildup	(2)	User	X					Various sources
1.1	Data management subsystem assembly	(2)		X					
1.1.1	Data interface units	(2)		X					
1.1.2	Computer interface unit	(2)		X					
1.1.3	Data exchange unit	(2)		X					
1.1.4	Auxiliary memory unit	(2)		X					
1.1.5	Command decoder	(1)		X					
1.1.6	Power switch & decoder	(1)		X					
1.1.7	Central processor	(2)		X					
1.1.8	Input/output processor	(2)		X					
1.1.9	Main memory	(1)		X					
1.1.10	Computer power converter	(1)		X					
1.1.11	Oscillator	(1)		X					
1.1.12	Tape recorders	(1)		X					
1.2	Instrumentation & communication subsystem assy	(2)		X					
1.2.1	Transponder	(1)		X					
1.2.2	Duplexers	(1)		X					
1.2.3	Circulator	(1)		X					
1.2.4	Antenna electronics	(2)		X					

(1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.2.5	Antenna drive and boom	(2)	User	X					Various sources
1.2.6	Omni antenna	(2)		X					
1.2.7	Power amplifier	(1)		X					
1.2.8	RF switches	(1)		X					
1.2.9	High gain antenna	(2)		X					
1.3	Pointing control subsystem assembly	(2)		X					
1.3.1	Fixed star tracker	(2)		X					
1.3.2	Fine gyro assembly	(2)		X					
1.3.3	Magnetic torquer	(1)		X					
1.3.4	Reaction wheels	(1)		X					
1.3.5	Retrieval electronics	(2)		X					
1.3.6	Coarse sun sensor	(1)		X					
1.3.7	Magnetometer	(1)		X					
1.3.8	Retrieval rate gyros	(2)		X					
1.4	Electrical power subsystem assembly	(2)		X					
1.4.1	Power control & distribution	(2)		X					
1.4.2	Solar array electrical interface	(2)		X					
1.4.3	Umbilical & cabling	(2)		X					
1.4.4	Solar array drive assembly	(2)		X					

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION STIMULATED

(4) DIRECT ORBITER I/F

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Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
1.4.5	Batteries	(1)	User	X					Various sources
1.4.6	Charge controller	(1)		X					
1.4.7	Sol ar array wing	(2)		X					
1.4.8	Solar array deploy mechanism	(2)		X					
1.5	Structural subsystem	(2)		X					
1.5.1	Structural subsystem assembly	(1)		X					
1.5.1.1	Fittings	(1)		X					
1.5.1.2	Latches	(1)		X					
1.5.1.3	Aperture doors	(1)		X					
1.5.1.4	Panels	(1)		X					
1.5.1.5	Insulation	(1)		X					
1.5.2	Static load test of struct. components & fitt.	(1)		X					
1.5.3	Install mass simulators	(1)		X		X			
1.5.3.1	Optical telescope assy (OTA) mass simulator	(1)		X		X			
1.5.3.2	Scientific instrument module mass simulator	(1)		X		X			
2.0	Subsystem acceptance	(1)		X					

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.6 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
3.0	Install subsystems on SSM structure	(1)	User	X					
4.0	Perform SSM dynamic test	(1)		X				X	
4.1	Vibration transmissibility	(1)		X				X	
4.2	Modal analyses	(1)		X					
5.0	Modify SSM to flight configuration	(1)		X					
5.1	Remove mass simulators	(1)		X					
5.2	Inspect & replace flight Hardware as required	(1)		X					
5.3	Install additional flight hrdwr as required	(1)		X					
6.0	System I/F simulator-OPA & SI are electrically simulated	(1)		X		X			
6.1	System simulator readiness tests	(1)		X		X		X	
6.1.1	Environmental tests	(1)		X				X	
6.1.2	Functional tests	(1)		X					
7.0	Mate SSM & system simulator	(1)		X		X			

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.6 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
8.0	Perform initial SSM functional tests	(1)	User	X	X	X	X		Either site
8.1	Electrical performance	(1)		X	X	X	X		
8.2	Mechanical performance	(1)		X	X	X	X		
8.3	Software checkout	(1)		X	X	X	X		
8.4	Test procedures checkout	(1)		X	X	X	X		
8.5	OTA/SI interfaces	(1)		X	X	X	X		
9.0	Perform SSM functional tests	(2)		X	X	X	X		
9.1	DMS functional test	(2)		X	X	X	X		
9.2	ICS functional test	(2)		X	X	X	X		
9.3	RCS functional test	(2)		X	X	X	X		
9.4	EPS functional test	(2)		X	X	X	X		
10.0	Receive OTA at user site	(1)		X					
10.1	OTA receiving inspection	(1)		X					
11.0	Receive 4 scientific instr. at user site	(1)		X					
11.1	SI receiving inspection	(1)		X					

(1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
12.0	Remove OTA & SI simulators	(1)	User	X	X				Either site
13.0	LST assembly operations	(1)		X	X				
13.1	Mate OTA, SI & SSM	(1)		X	X				
13.2	Verify electrical & mechanical interfaces	(1)		X	X				
13.3	Verify alignement	(1)		X	X				
13.4	Perform bus isolation tests	(1)		X	X				
13.5	Verify grounding	(1)		X	X				
14.0	LST functional interface test	(2)		X	X	X	X		Trade study
14.1	Verify command interface	(2)		X	X	X	X		
14.2	Verify telemetry interface	(2)		X	X	X	X		
14.3	Verify timing signal interface	(2)		X	X	X	X		
14.4	Verify grounding interface	(1)		X	X	X	X		
14.5	Verify electrical power interface	(2)		X	X	X	X		
15.0	LST mission simulation	(2)		X	X	X	X		
15.1	Launch conditioning	(2)		X	X	X	X		
15.2	Ascent	(2)		X	X	X	X		
15.3	Pre-deployment	(2)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
15.4	Post-deployment	(2)	User	X	X	X	X		Trade study
15.5	Orbit operation	(2)		X	X	X	X		
15.6	Retrieval	(2)		X	X	X	X		
15.7	Reentry	(2)		X	X	X	X		
15.8	Recovery	(2)		X	X	X	X		
16.0	LST to data center interface compatibility	(2)		X	X	X	X		
16.1	EMC	(2)		X	X	X	X		
16.2	Software validation	(1)		X	X	X	X		
16.3	Capability to transmit & receive commands & data	(2)		X	X	X	X		
17.0	Acoustic test	(1)		X	X			X	
17.1	Post-acoustic functional test	(2)		X	X	X	X		
17.1.1	DMS functional test	(2)		X	X	X	X		
17.1.2	ICS functional test	(2)		X	X	X	X		
17.1.3	FCS functional test	(2)		X	X	X	X		
17.1.4	EPS functional test	(2)		X	X	X	X		
17.1.5	OTA functional test	(2)		X	X	X	X		
17.1.6	SI functional test	(2)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
18.0	Thermal vac/thermal balance test	(2)	User	X	X			X	Trade study
18.1	Simulate orbital operational conditions	(2)		X	X			X	
18.2	Operate all functional modes	(2)		X	X	X	X	X	
18.3	Post-test functional verification	(2)		X	X	X	X		
19.0	Configure LST for final operations & tests	(2)		X	X				Either site
19.1	Remove test instrumentation	(1)		X	X				
19.2	Configure for flight	(2)		X	X				
19.3	Reflectivity/emissivity measurements	(1)		X	X				
20.0	Weight and balance test	(1)		X	X			X	
21.0	Prepare vertical or optional horizontal integration stand	(1)		X	X		X	X	Assuming IVE is adaptable to assy.
22.0	Install LST in integration stand	(2)		X	X				Either site
23.0	Perform LST/orbiter compatibility tests	(3)		X	X	X	X		Trade study
23.1	Verify mechanical interface	(3)		X	X	X	X		
23.2	Verify electrical interface	(3)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

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Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	OPF SIM.	IVE		
23.3	Launch readiness/conditioning sequences	(3)	User	X	X	X	X		Trade study
23.4	Pre-deployment/post-deployment sequences	(3)		X	X	X	X		
23.5	Retrieval/recovery sequences	(3)		X	X	X	X		
24.0	Package & ship SSE to Launch site	(1)		X					
24.1	Umbilical cables	(1)		X					
24.2	LST MS panel	(1)		X					
24.3	Payload purge system	(1)		X					
24.4	TIP equipment	(1)		X					
24.5	EVA support equipment	(1)		X					
25.0	SSE arrival at Launch site	(1)	Launch site		X				
26.0	Transfer SSE to receiving facility	(1)			X				
26.1	SSE receiving inspection	(1)			X				
27.0	Transfer SSE to OPF	(1)			X			X	
27.1	Install SSE in orbiter (OPF)	(4)			X			X	

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
28.0	Closeout, package & ship to Launch site	(1)	User	X					
28.1	Install protective covers	(1)	↓	X					
28.2	Service with liquid helium	(1)	↓	X					
29.0	LST arrival at Launch site	(1)	launch site		X				
			↓						
30.0	Transfer Lst to receiving facility	(1)			X			X	
31.0	Perform LST receiving inspection	(1)			X			X	
32.0	Install payload in canister	(1)			X				
32.1	Erect payload canister to vertical position	(1)			X				
33.0	Transfer Payload canister to FCR at pad	(1)			X			X	
34.0	Perform orbiter/payload interface verification and servicing	(1),(2)		X	X	X	X		Both sites; trade study
34.1	Charge flight batteries	(1)		X	X				↓
34.2	Service with liquid helium	(1)		X	X				
34.3	Orbiter/payload interface verification	(2)	↓	X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

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Table C.4 (Cont) LST INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
35.0	Install LST in orbiter bay	(4)	Launch site		X				
36.0	Orbiter/cargo interface verification	(4)			X				
36.1	Electrical	(4)			X				
36.2	Mechanical	(4)			X				
36.3	Fluid	(4)			X				
37.0	Verify LST launch readiness	(4)			X				
38.0	Payload bay closeout	(4)			X				
39.0	Launch operations	(4)			X				

(1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

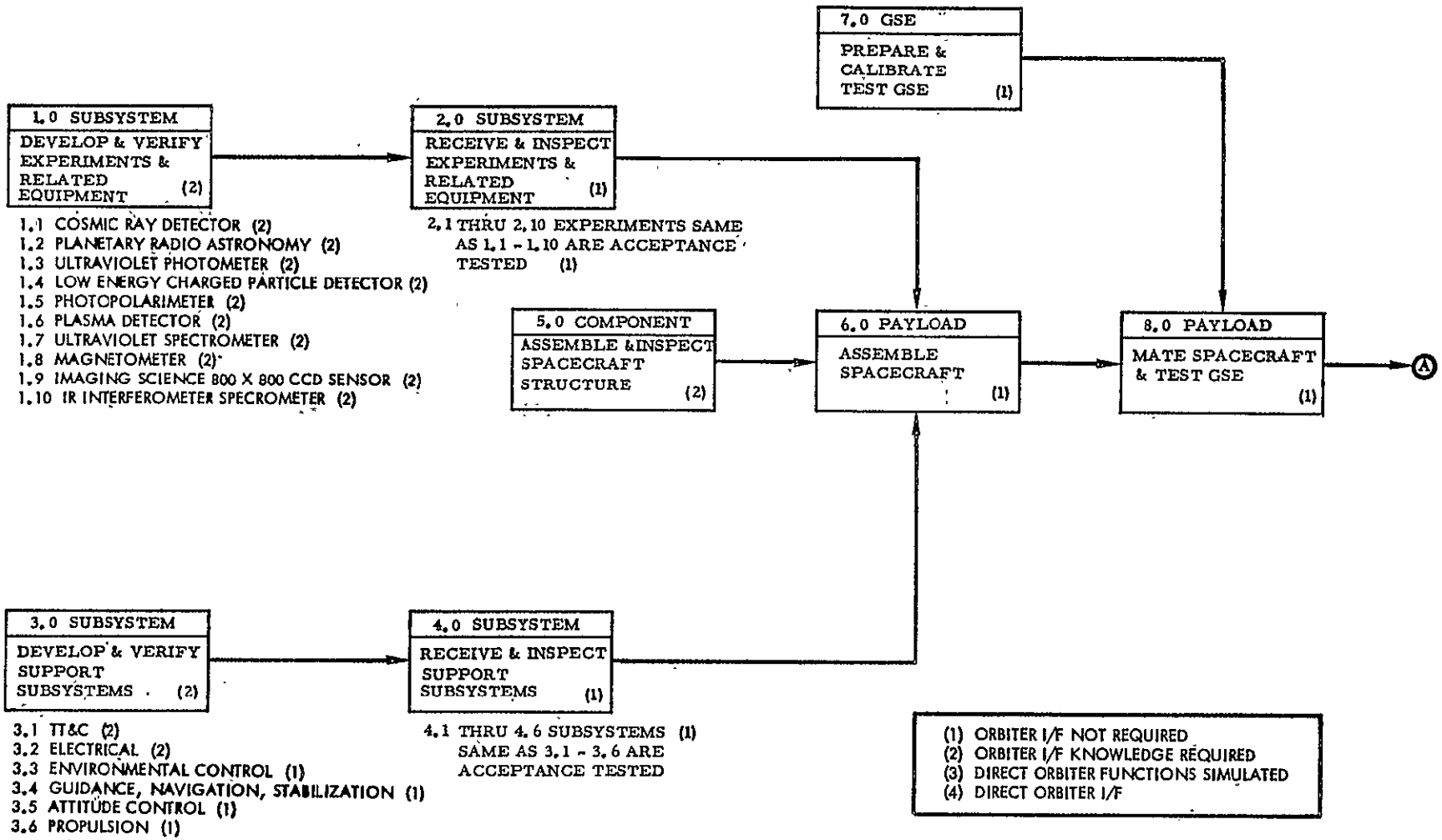

Figure C-5 Mariner Jupiter Orbiter/IUS

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9.1 MECHANICAL ATTACHMENT OF EXPERIMENTS & SUBSYSTEMS (1)
9.2 LOCATION OF MOUNTING POINTS (2)
9.3 CLEARANCES (2)
9.4 UMBILICAL LOCATIONS (2)
9.4 ALIGNMENT (1)

10.1 GROUNDING (1)
10.2 BUS ISOLATION (1)
10.3 CONTINUITY (1)

11.1 LEAK CHECK FLUID FITTINGS (1)
11.2 LEAK CHECK FLUID SYSTEMS (1)

12.1 POWER DISTRIBUTION & ELECTRICAL LOAD (2)
12.2 CAUTION & WARNING OPERATION (2)
12.3 GUIDANCE, NAVIGATION, STABILIZATION (2)
12.4 ATTITUDE CONTROL (2)
12.5 TELEMETRY (2)
12.6 TRACKING (2)
12.7 COMMAND RFS (2)
12.8 TAPE RECORDER (2)
12.9 ANTENNA (2)
12.10 PYROSYSTEMS (1)
12.11 TYPICAL PAYLOAD EXPERIMENTS (10) (1)
12.21 EMC (1)

(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

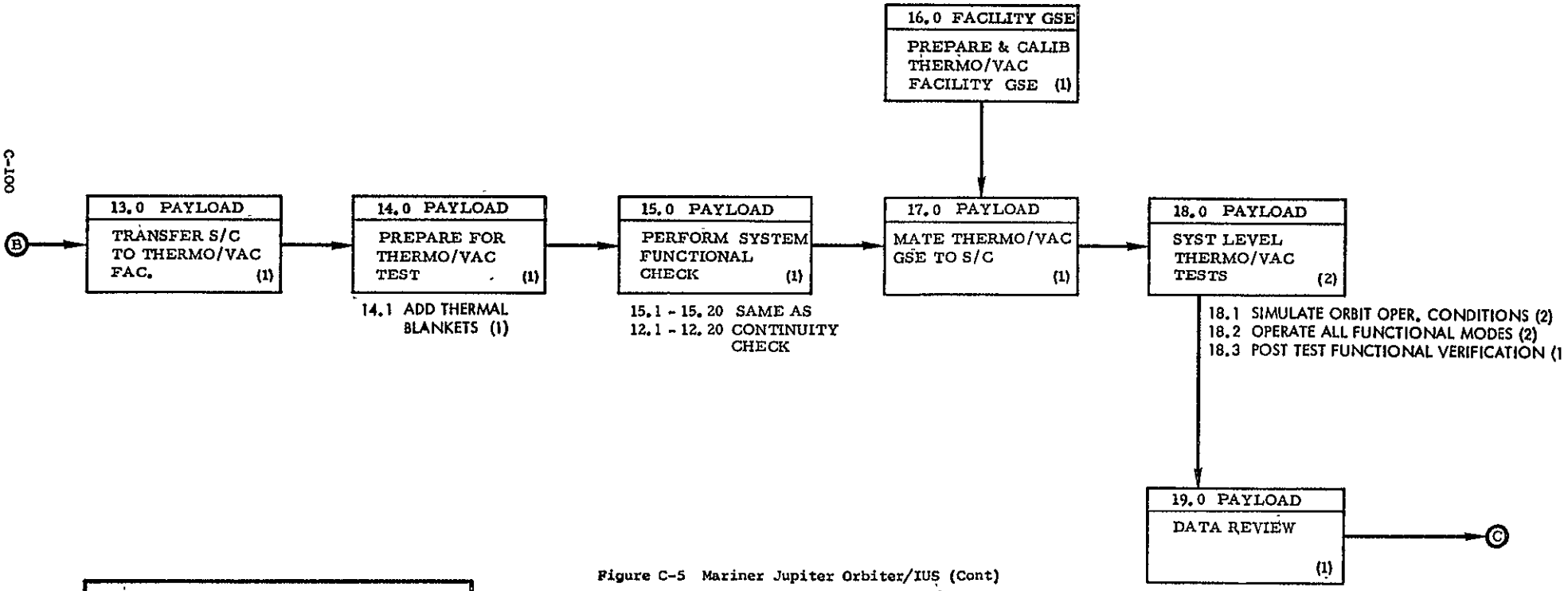
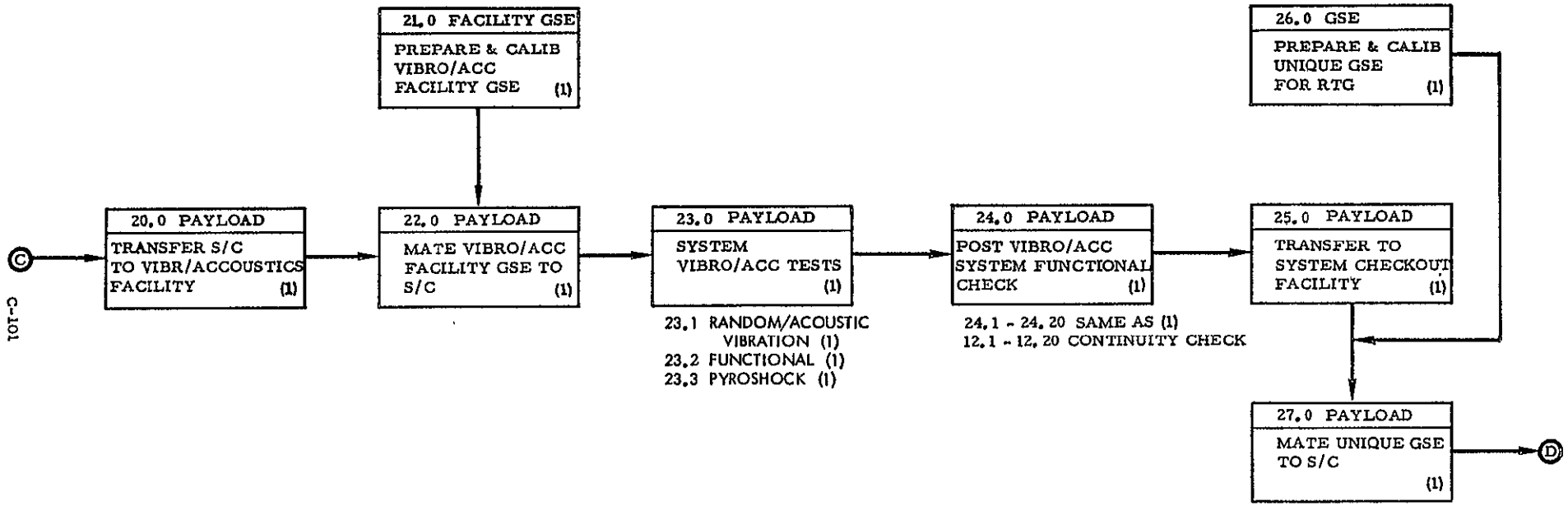


Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F



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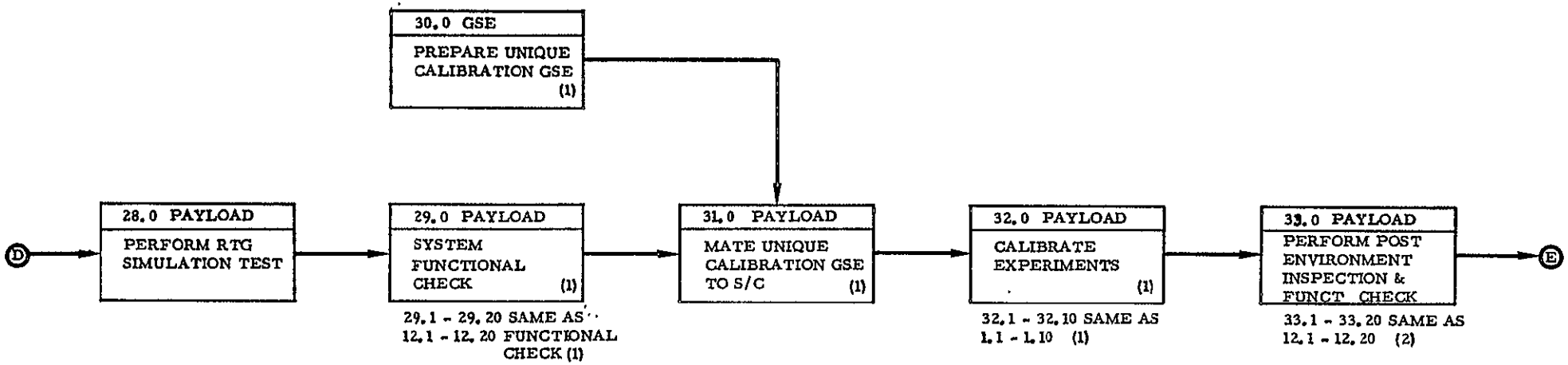
(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

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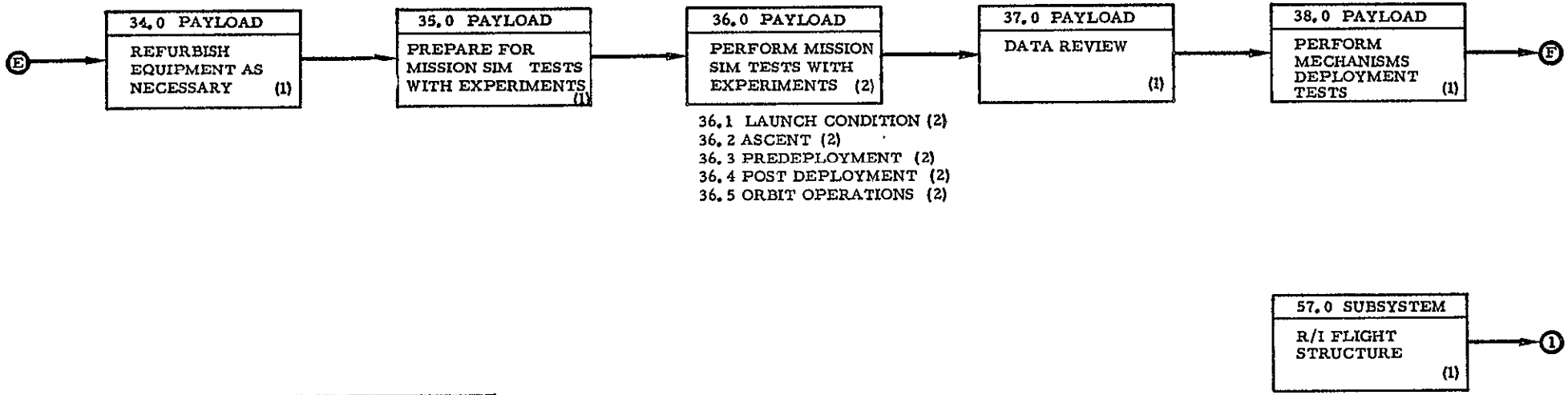

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

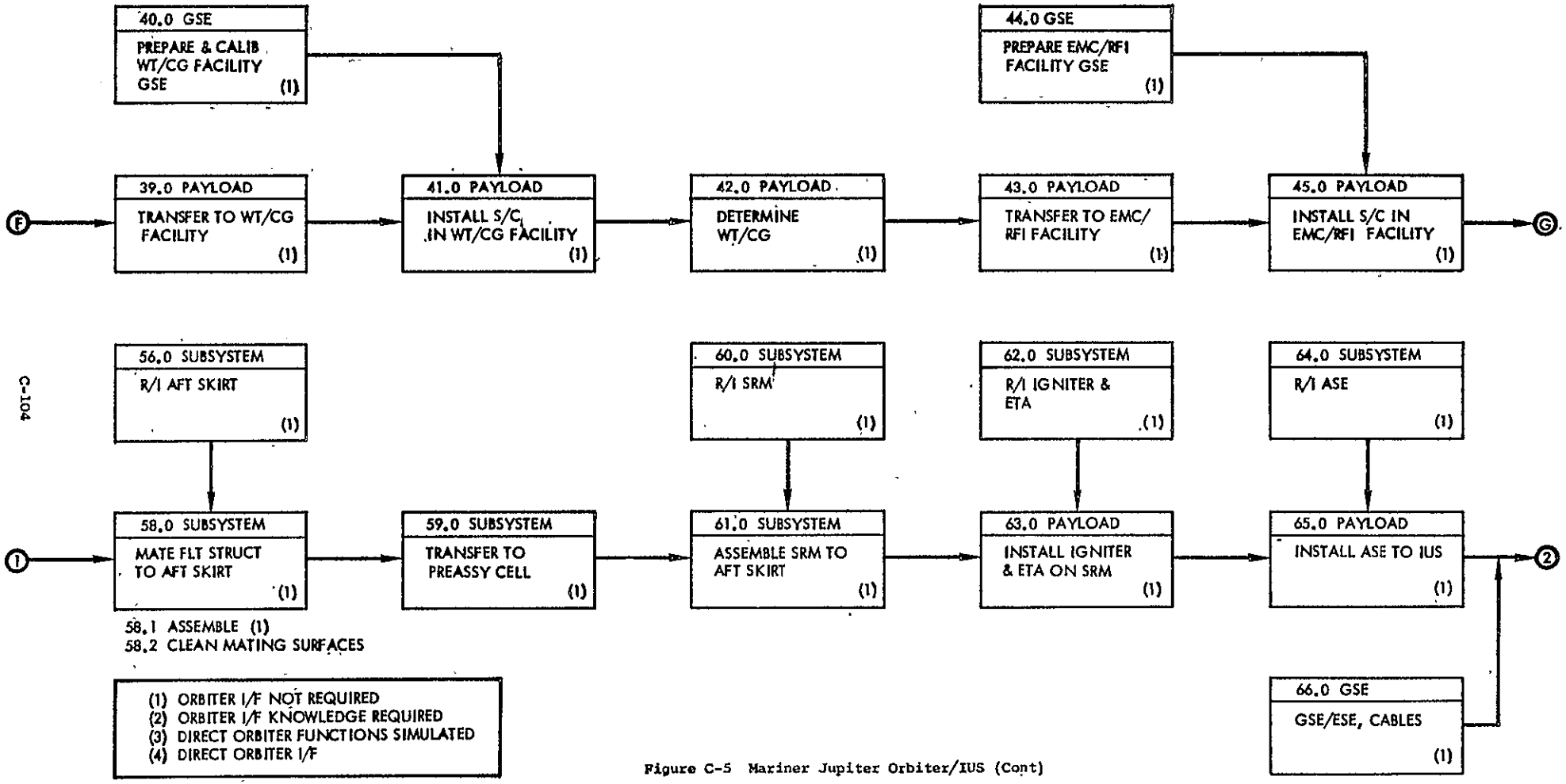

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

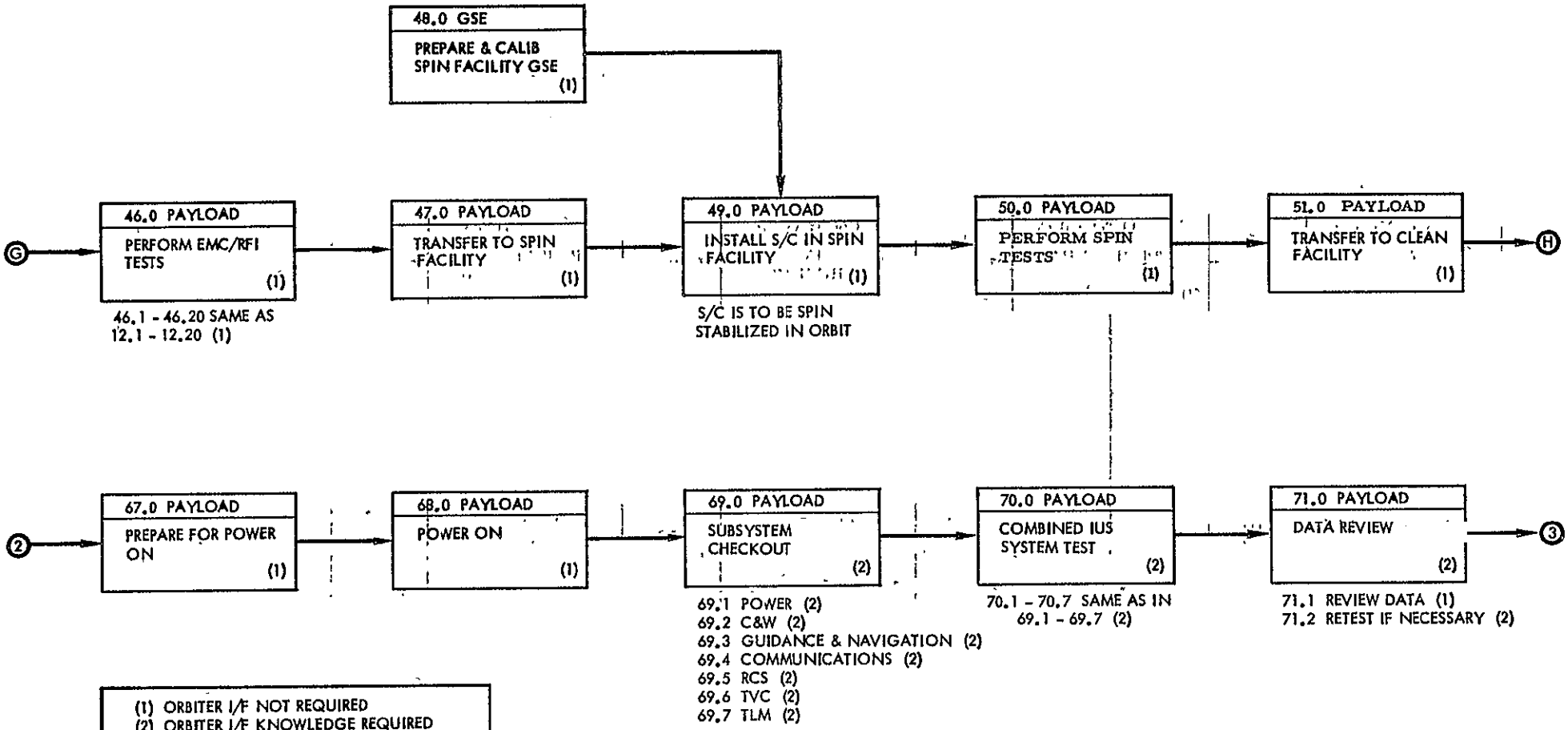

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

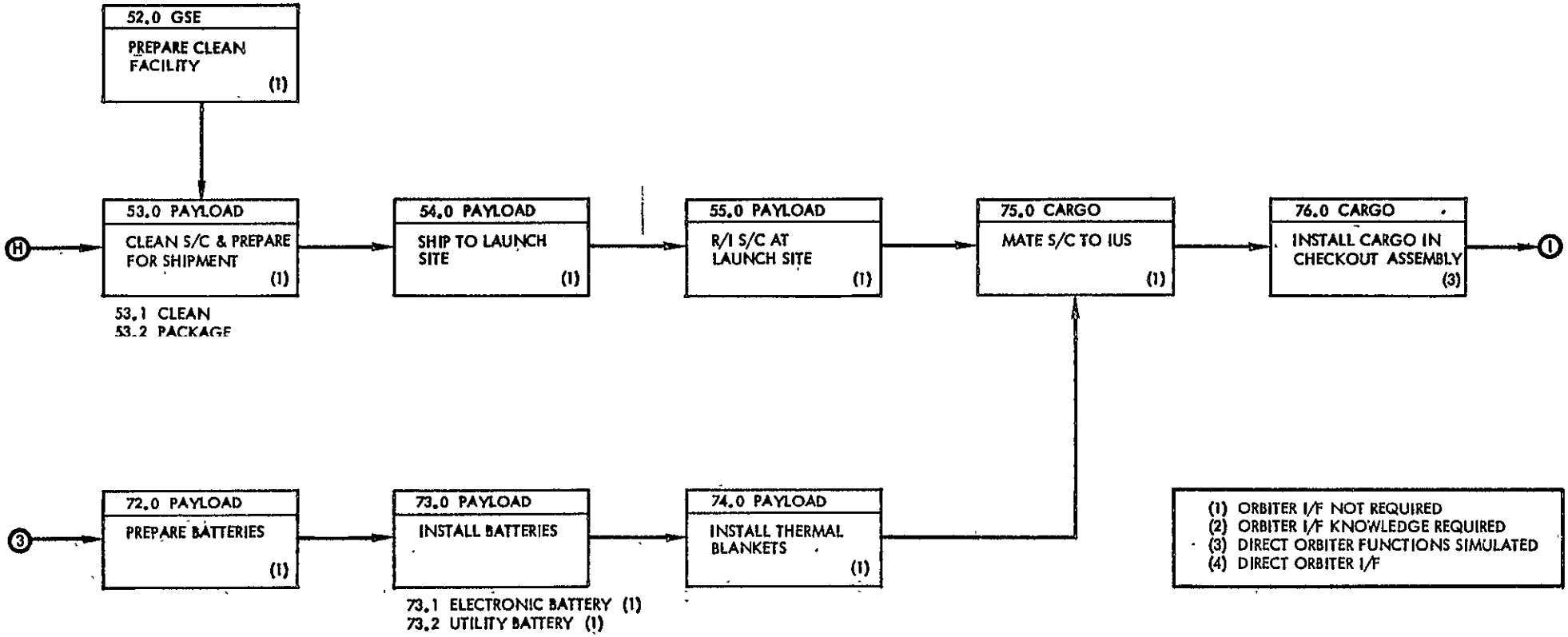

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

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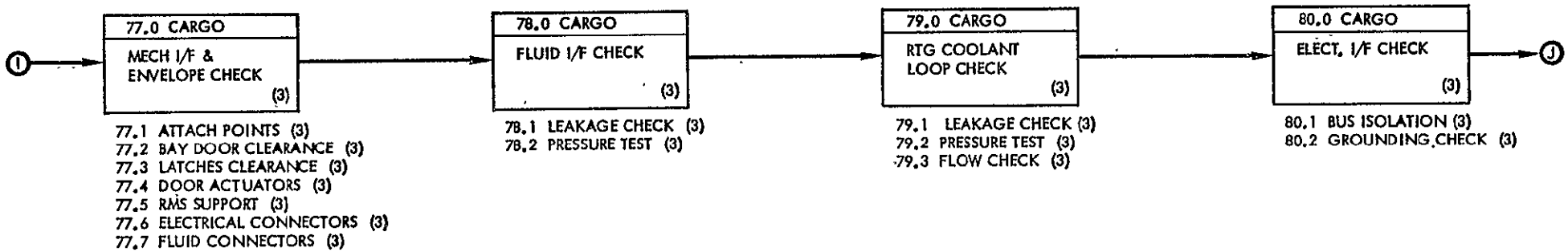
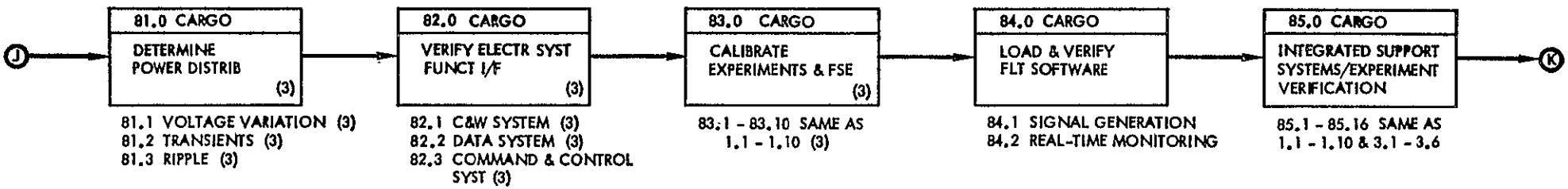


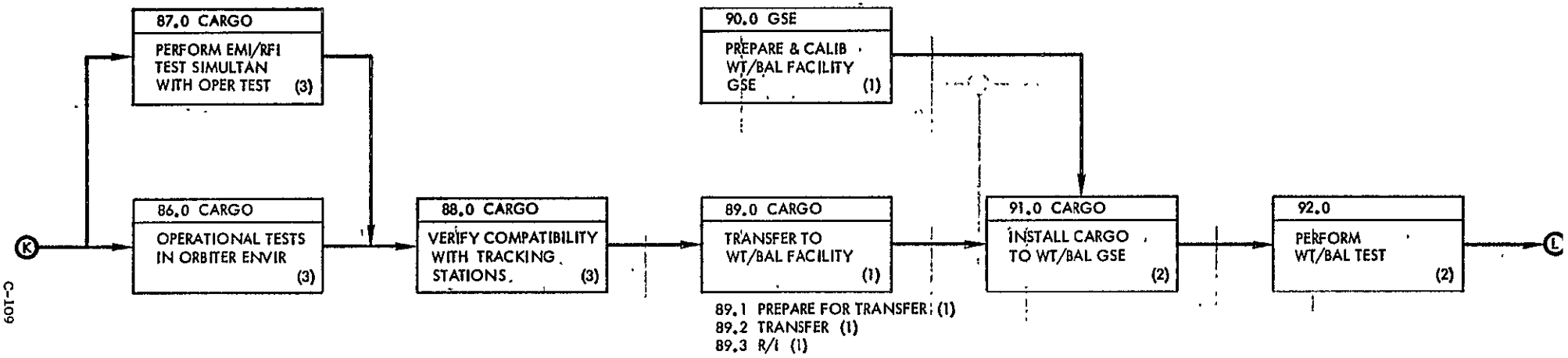
(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)



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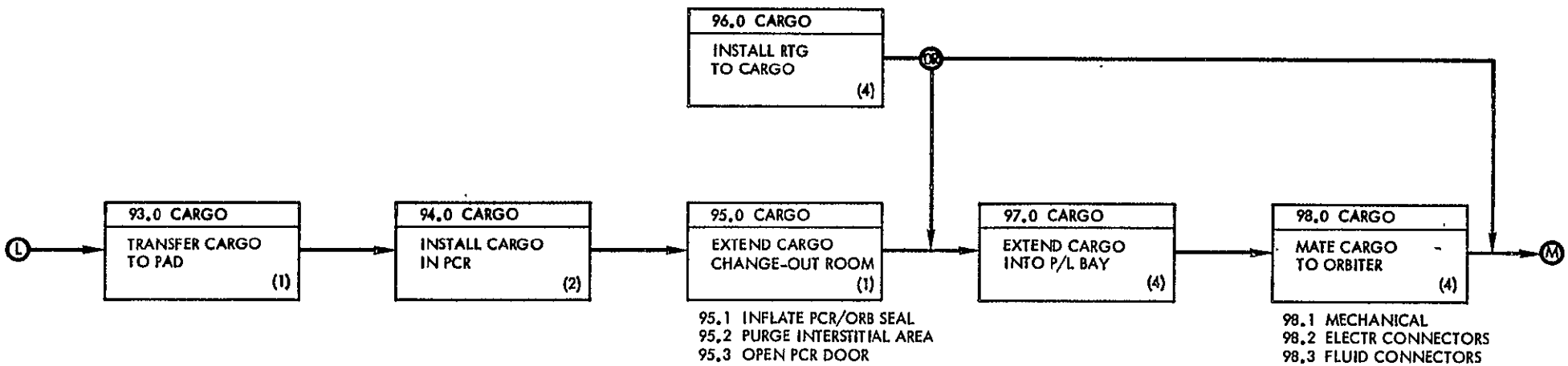
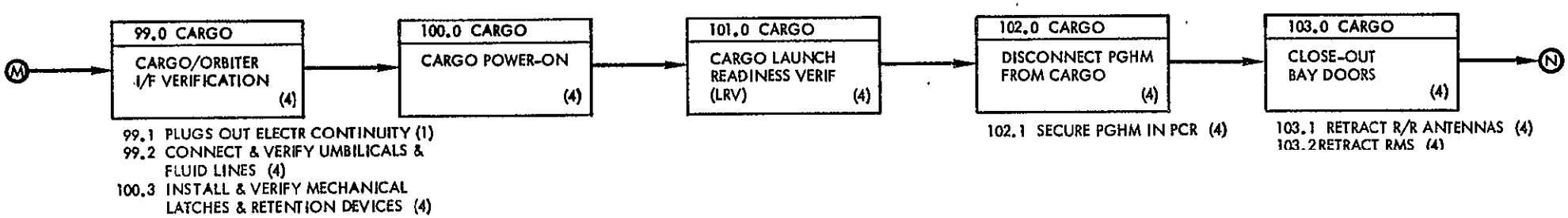
(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)



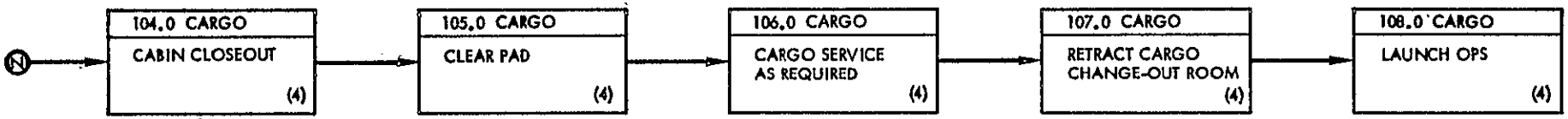
(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Con



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)



(1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Figure C-5 Mariner Jupiter Orbiter/IUS (Cont)

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Table C.5 MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHKCOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITF ORIENTED	GSE SIM.	IVE		
1.0	Develop & verify experiments & related equipment	(2)	User	X					Various sources
1.1	Cosmic ray detector	(2)		X					
1.2	Planetary radio astronomy	(2)		X					
1.3	Ultraviolet photometer	(2)		X					
1.4	Low energy charged particle detector	(2)		X					
1.5	Photopolarimeter	(2)		X					
1.6	Plasma detector	(2)		X					
1.7	Ultraviolet spectrometer	(2)		X					
1.8	Magnetometer	(2)		X					
1.9	Imaging science 800x800 CCD sensor	(2)		X					
1.10	IR interferometer spectrometer	(2)		X					
2.0	Receive & inspect experiments & related equip.	(1)		X					
2.1	2.1 through 2.10 experiments same as 1.1 through 1.10 are acceptance tested	(1)		X					
3.0	Develop & verify support subsystems	(2)		X					
3.1	TT & C	(2)		X					
3.2	Electrical	(2)		X					
3.3	Environmental control	(1)		X					
3.4	Guidance, navigation & stabilization	(1)		X					

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
3.5	Attitude control	(1)	User	X					Various sources
3.6	Propulsion	(1)		X					
4.0	Receive & inspect support subsystems	(1)		X					
4.1	4.1 through 4.6 subsystems same as								
	3.1 through 3.6 are acceptance tested	(1)		X					
5.0	Assemble & inspect spacecraft structure	(2)		X					
6.0	Assemble spacecraft	(1)		X	X				Either site; trade study
7.0	Prepare & calibrate test GSE	(1)		X	X				
8.0	Mate spacecraft & test GSE	(1)		X	X				
9.0	Verify mechanical interfaces	(2)		X	X				
9.1	Mechanical attachment of experim. & subsystems	(1)		X	X				
9.2	Location of mounting points	(2)		X	X				
9.3	Clearances	(2)		X	X				
9.4	Umbilical locations	(2)		X	X				
9.5	Alignment	(1)		X	X				
10.0	Verify electrical interfaces	(1)		X	X				
10.1	Grounding	(1)		X	X				
10.2	Bus isolation	(1)		X	X				
10.3	Continuity	(1)		X	X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

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Table C.5 (Cont) MLO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
11.0	Verify fluid interfaces	(1)	User	X	X				Either site; trade study
11.1	Leakcheck fluid fittings	(1)		X	X				
11.2	Leakcheck fluid systems	(1)		X	X				
12.0	Perform system level functional tests	(2)		X	X	X	X		
12.1	Power distribution & electrical load	(2)		X	X	X	X		
12.2	Caution & warning operation	(2)		X	X	X	X		
12.3	Guidance, navigation & stabilization	(2)		X	X	X	X		
12.4	Attitude control	(2)		X	X	X	X		
12.5	Telemetry	(2)		X	X	X	X		
12.6	Tracking	(2)		X	X	X	X		
12.7	Command RFS	(2)		X	X	X	X		
12.8	Tape recorder	(2)		X	X	X	X		
12.9	Antenna	(2)		X	X	X	X		
12.10	Pyrosystems	(1)		X	X	X	X		
12.11	Typical payload experiments (10 total)	(1)		X	X	X	X		
12.21	EMC	(1)		X	X	X	X		
13.0	Transfer spacecraft to thermo/vac facility	(1)		X	X			X	
14.0	Prepare for thermo/vac tests	(1)		X	X			X	
14.1	Add thermal blankets	(1)		X	X			X	

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTIONS SIMULATED
(4) DIRECT ORBITER I/F

Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
15.0	Perform system continuity check	(1)	User	X	X				
15.1	15.1 through 15.20 same as 12.1 through 12.20 functional check	(1)		X	X				
16.0	Prepare & calibrate thermo/vac facility GSE	(1)		X	X			X	
17.0	Mate thermo/vac GSE to spacecraft	(1)		X	X			X	
18.0	System level thermo/vac tests	(2)		X	X	X	X		
18.1	Simulate orbit operational conditions	(2)		X	X	X	X		
18.2	Operate all functional modes	(2)		X	X	X	X		
18.3	Post test functional verification	(1)		X	X	X	X		
19.0	Data review	(1)		X	X				Alternate site
20.0	Transfer S/C to vibr/accoustic facility	(1)		X	X			X	
21.0	Prepare & calibrate vibro/acc. facility GSE	(1)		X	X			X	
22.0	Mate vibro/acc facility GSE to spacecraft	(1)		X	X			X	
23.0	System vibro/accoustic tests	(1)		X	X			X	
23.1	Random/accoustic vibration tests	(1)		X	X			X	
23.2	Functional check	(1)		X	X			X	
23.3	Pyroshock	(1)		X	X			X	
24.0	Post vibro/acc system continuity check	(1)		X	X			X	
24.1	24.1 through 24.20same as 12.1 through 12.20 functional check	(1)							

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

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Table C.5 (Cont) MIO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
25.0	Transfer to system checkout facility	(1)	User	X	X				
26.0	Prepare & calibrate unique GSE for RTG	(1)		X	X	X			Unique GSE
27.0	Mate unique GSE to spacecraft	(1)		X	X	X			
28.0	Perform RTG simulation test	(1)		X	X	X			
29.0	Systems functional check	(1)		X	X	X	X		
29.1	29.1 through 29.20 same as 12.1 through 12.20 functional check	(1)		X	X	X	X		
30.0	Prepare unique calibration GSE	(1)		X	X				Unique GSE
31.0	Mate unique calibration GSE to spacecraft	(1)		X	X				
32.0	Calibrate experiments	(1)		X	X				
32.1	32.1 through 32.10 same as 1.1 through 1.10	(1)		X	X				
33.0	Perform post environmental insp. & funct. check	(2)		X	X	X	X		
33.1	33.1 through 33.20 same as 12.1 through 12.20	(2)		X	X	X	X		
34.0	Refurbish equipment as necessary	(1)		X	X				
35.0	Prepare for mission sim. tests with experiments	(2)		X	X				
36.0	Perform mission sim. tests with experiments	(2)		X	X	X	X		Either site; trade study
36.1	Launch conditions	(2)		X	X	X	X		
36.2	Ascent	(2)		X	X	X	X		
36.3	Predeployment	(2)		X	X	X	X		
36.4	Post deployment	(2)		X	X	X	X		

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
36.5	Orbit operations	(2)	User	X	X	X	X		Either site; trade study
37.0	Data review	(1)		X	X				Alternate site
38.0	Perform mechanisms deployment tests	(1)		X	X	X			
39.0	Transfer to WT/CG facility	(1)		X	X				
40.0	Prepare & calibrate WT/CG facility GSE	(1)		X	X			X	
41.0	Install spacecraft in WT/CG facility	(1)		X	X			X	
42.0	Determine WT/CG	(1)		X	X			X	
43.0	Transfer to EMC/RFI facility	(1)		X	X				
44.0	Prepare EMC/RFI facility GSE	(1)		X	X				
45.0	Install spacecraft in EMC/RFI facility	(1)		X	X				
46.0	Perform EMC/RFI tests	(1)		X	X				
46.1	46.1 through 46.20 same as 12.1 through 12.20	(1)		X	X				
47.0	Transfer to spin facility	(1)		X	X				
48.0	Prepare & calibrate spin facility GSE	(1)		X	X			X	
49.0	Install spacecraft in spin facility, (spacecraft to be spin stabilized in orbit)	(1)		X	X			X	
50.0	Perform spin tests	(1)		X	X			X	
51.0	Transfer to clean facility	(1)		X	X				
52.0	Prepare clean facility	(1)		X	X			X	
53.0	Clean spacecraft & prepare for shipment	(1)		X	X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS STIMULATED

(4) DIRECT ORBITER I/F

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Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
53.1	Clean	(1)	User	X	X				
53.2	Package	(1)	↓	X	X				
54.0	Ship to launch site	(1)	↓	X	X				
55.0	R/I spacecraft at launch site	(1)	Launch site		X				
56.0	R/I aft skirt	(1)	↓		X				
57.0	R/I IUS flight structure	(1)	↓		X				
58.0	Mate flight structure to aft skirt	(1)	↓		X				Option: IUS could be shipped to user site ready to mate with S/C & transfered as a unit to LS
58.1	Assemble	(1)	↓		X				
58.2	Clean mating surfaces	(1)	↓		X				
59.0	Transfer to preassembly cell	(1)	↓		X				
60.0	R/I solid rocket motor (SRM)	(1)	↓		X				
61.0	Assemble SRM to aft skirt	(1)	↓		X				
62.0	R/I igniter & explosive train assembly (ETA)	(1)	↓		X				
63.0	Install igniter & ETA on SRM	(1)	↓		X				
64.0	Receive & inspect ASE	(1)	↓		X				
65.0	Install ASE to IUS	(1)	↓		X				
66.0	GSE/ ESE , cables	(1)	↓		X				
67.0	Prepare for power on	(1)	↓		X				
68.0	Power on	(1)	↓		X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
69.0	Subsystem checkout	(2)	Launch site		X	X	X		Trade study
69.1	Power	(2)			X	X	X		
69.2	Caution & warning	(2)			X	X	X		
69.3	Guidance & navigation	(2)			X	X	X		
69.4	Communications	(2)			X	X	X		
69.5	Reaction control system (RCS)	(2)			X	X	X		
69.6	Thrust vector control (TVC)	(2)			X	X	X		
69.7	Telemetry (TLM)	(2)			X	X	X		
70.0	Combined IUS system tests	(2)			X	X	X		
70.1	70.1 through 70.7 same as 69.1 through 69.7	(2)			X	X	X		
71.0	Data review	(2)			X				
71.1	Review data	(1)			X				
71.2	Retest if necessary	(2)			X				
72.0	Prepare batteries for installation	(1)			X				
73.0	Install batteries	(1)			X				
73.1	Electronic battery	(1)			X				
73.2	Utility battery	(1)			X				
74.0	Install thermal blankets	(1)			X				
75.0	Mate S/C to IUS	(1)			X		X		IVE may be used for mating

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTIONS SIMULATED

(4) DIRECT ORBITER I/F

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Table C.5 (Cont). MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
76.0	Install cargo in checkout assembly	(3)	Launch site		X	X	X		Could be IVE or assembly structure
77.0	Mechanical interface and envelope check	(3)			X		X		
77.1	Attach points	(3)			X		X		
77.2	Bay door clearance	(3)			X		X		
77.3	Latches clearance	(3)			X		X		
77.4	Door actuators	(3)			X		X		
77.5	RMS support	(3)			X		X		
77.6	Electrical connectors	(3)			X		X		
77.7	Fluid connectors	(3)			X		X		
78.0	Fluid interface check	(3)			X	X	X		
78.1	Leakage check	(3)			X	X	X		
78.2	Pressure test	(3)			X	X	X		
79.0	RTG coolant loop check	(3)			X		X		IVE cooling system will accommodate RTG
79.1	Leakage check	(3)			X		X		
79.2	Pressure test	(3)			X		X		
79.3	Flow check	(3)			X		X		
80.0	Electrical interface check	(3)			X				
80.1	Bus isolation	(3)			X				
80.2	Grounding check	(3)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

(3) DIRECT ORBITER FUNCTION SIMULATED

(4) DIRECT ORBITER I/F

Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
81.0	Determine power distribution	(3)	Launch site		X	X	X		Either one; trade study
81.1	Voltage variation	(3)			X	X	X		
81.2	Transients	(3)			X	X	X		
81.3	Ripple	(3)			X	X	X		
82.0	Verify electrical system functional interface	(3)			X	X	X		
82.1	C&W system	(3)			X	X	X		
82.2	Data system	(3)			X	X	X		
82.3	Command & control system	(3)			X	X	X		
83.0	Calibrate experiments & FSE	(3)			X	X	X		Unique GSE
83.1	83.1 through 83.10 same as 1.1 through 1.10	(3)			X	X	X		
84.0	Load & verify flight software	(3)			X	X	X		Either one; trade study
84.1	Signal generation	(3)			X	X	X		
84.2	Real time monitoring	(3)			X	X	X		
85.0	Integrated support system/experiment verific.	(3)			X	X	X		
85.1	85.1 through 85.16 same as 1.1 through1.10 and 3.1 through 3.6	(3)			X	X	X		
86.0	Operational tests in orbiter environment	(3)			X	X	X		
87.0	Perform EMI/RFI tests simultaneously with operational tests	(3)			X	X	X		
88.0	Verify compatibility with tracking stations	(3)			X	X	X		Unique equipment/facility
89.0	Transfer to WT/BAL facility	(1)			X				

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(4) DIRECT ORBITER I/F

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Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
89.1	Prepare for transfer	(1)	Launch site		X				
89.2	Transfer	(1)			X				
89.3	Receiving inspection	(1)			X				
90.0	Prepare & calibrate WT/BAL facility GSE	(1)			X				
91.0	Install cargo to WT/BAL GSE	(1)			X				
92.0	Perform WT/BAL test	(2)			X				
93.0	Transfer cargo to pad	(1)			X				
94.0	Install cargo in PCR	(2)			X			X	Specilized handling equipment
95.0	Extend cargo changeout room	(4)			X			X	
95.1	Inflate PCR/orbiter seal	(4)			X			X	
95.2	Purge interstitial area	(4)			X			X	
95.3	Open PCR door	(1)			X			X	
96.0	Install RTG to cargo	(4)			X				Specialized handling equipment
97.0	Extend cargo into payload bay	(4)			X				
98.0	Mate cargo to orbiter	(4)			X				
98.1	Mechanical	(4)			X				
98.2	Electrical connectors	(4)			X				
98.3	Fluid connectors	(4)			X				
99.0	Cargo/orbiter interface verification	(4)			X				

* (1) ORBITER I/F NOT REQUIRED
(2) ORBITER I/F KNOWLEDGE REQUIRED
(3) DIRECT ORBITER FUNCTION SIMULATED
(4) DIRECT ORBITER I/F

Table C.5 (Cont) MJO/IUS INTERFACE CHECKOUT MATRIX

BLOCK NO.	DESCRIPTION	INTERFACES				CHECKOUT/TEST EQUIPMENT		SPECIAL FACILITY	REMARKS
		* I/F KNOWLEDGE	BASELINE LOCATION	OPTION 1 USER ORIENTED	OPTION 2 LAUNCH SITE ORIENTED	GSE SIM.	IVE		
99.1	Plugs out electrical continuity	(4)	Launch site		X				
99.2	Connect & verifyumbilicals and fluid lines	(4)			X				
99.3	Install and verify mechanical latches and retention devices	(4)			X				
100.0	Cargo power on	(4)			X				
101.0	Cargo Launch Readiness Verification (LRV)	(4)			X				
102.0	Disconnect payload ground handling mechanisms (PGHM) from cargo	(4)			X				
102.1	Secure PGHM in PCR	(4)			X				
103.0	Closeout bay doors	(4)			X				
103.1	Retract Rendezvous radar (R/R) antennas	(4)			X				
103.2	Retract RMS	(4)			X				
104.0	Cabin closeout	(4)			X				
105.0	Clear pad	(4)			X				
106.0	Cargo services (as required)	(4)			X				
107.0	Retract cargo changeout room	(4)			X				
108.0	Launch operations	(4)			X				

* (1) ORBITER I/F NOT REQUIRED

(2) ORBITER I/F KNOWLEDGE REQUIRED

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(4) DIRECT ORBITER I/F