Shuttle/Payload Standard Integration Plan for Attached Payloads

Space Shuttle Program Office

April 1999

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

DESCRIPTION OF CHANGES TO

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

ATTACHED PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
--	Baseline issue/B21000-SIP-ATT-01	11/01/88	All
1	Update sections 4.2.3.1, 6.4, 9.0, 9.2, 10.5, 11.0, and 16.0/B21000-SIP-ATT-03A;-04; -05;-06;-07;-08	04/21/89	viii,ix, 9,23,34, 35,35A,41, 42,42A,46, 46A
	Pagination errata	06/01/89	description of change page,vi,vii, viii,ix,33 through B-1
2	Update section 4.0 and globally change NHB 1700.7 to NSTS 1700.7/ B-21000-SIP-ATT-09;-010	06/14/89	2,13,23,23A, 39,40,45
3	Update table of contents, sections 8.3, 9.0, and figure 15-1/B21000-SIP-ATT-02;-012;-013	10/10/89	viii,29,29A, 34,49,50,51, 52
4	Update table of contents, sections 4.2.3, 4.2.3.1, 4.2.4, 5.5, 5.8, 8.2.1, 8.3; add sections 4.2.4.1, 4.2.4.2, 4.2.4.3, 4.2.4.4, and 4.2.4.5; repaginate pages 49 thru 52 to correct print shop error/B21000-SIP-ATT-011;-014;-015;-017; -018	11/01/89	vii,9,10,13, 13A,18,20, 26,29A

DESCRIPTION OF CHANGES (CONTINUED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

ATTACHED PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
5	Update sections 5.4, 5.5, 5.8, 6.3, 9.0, 9.4, 9.5; renumber tables 5-1 to 5-2 and 5-2 to 5-3; add table 5-1/B21000-SIP-ATT-016;-019; -022;-023;-024	01/03/90	15,16,17,18, 19,20,23,34, 36,36A,37
6	Update table of contents, sections 2.3, 4.2.3.4, 8.5, 10.1, 16.0 and figure 15-1/ B21000-SIP-ATT-020;-025;-026A; -027;-028	03/09/90	vi,4,4A,11, 30,31,39,46A, 49,50,51,52, 53
7	Update tables of contents, sections 2.2, 5.2, 5.3, 7.1, 8.3, 9.4, 9.5.1, 9.5.2, 16.0, and tables 5-1 and 5-2; add sections 2.5, 2.5.1, and 2.5.2/B21000-SIP-ATT-029A -032;-033;-036;-037A;-038; -041	07/03/90	vi,vii,viii, ix,4,4A,15, 15A,16,16A, 17,17A,19,26, 27,27A,36,37, 46A
8	Update table of contents and section 6.7/B21000-SIP-ATT-030	03/13/90	viii,25
9	Update table of contents, sections 4.2.4.1, 8.5, 9.6, and tables 8-1a, 8-1b, and 8-1c, and add section 9.7; B21000-SIP-ATT-035C;-039; -040;-045;-048	10/10/90	viii,ix,13, 28,28A,30,31, 32,33,33A, 38,38A,51
	Errata to correct section 8.5 and tables 8-1a and 8-1b	12/27/90	31,32,33

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CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
10	Update table of contents, sections 2.1.2, 4.2.1.2, and figure 15-1; add new section 2.5 and renumber existing sections 2.5, 2.5.1, and 2.5.2 to 2.6, 2.6.1, and 2.6.2, respectively/B21000-SIP-ATT-051;-052;-053;-054	05/28/91	vi,3,4A,4B, 8,50
11	Update the foreword and section 2.1.1/B21000-SIP-ATT-049	12/07/90	iii,2,3
12	Update section 4.2.1.2/ B21000-SIP-ATT-056	08/13/91	8,9,9A
REV A	General revision/B21000-SIP-ATT-050	09/20/91	All
1	Update section 4.1.1/ B21000-SIP-ATT-058	11/19/91	8,8A
2	Update sections 4.2.1.1 and 9.4/B21000-SIP-ATT-057A	01/31/92	9,44
3	Update sections 9.3 and 9.5.1/B21000-SIP-ATT-059	03/06/92	43,44
4	Update table of contents and section 4.1.2/ B21000-SIP-ATT-061A	07/07/92	vii,8,8A

DESCRIPTION OF CHANGES (CONTINUED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

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CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
5	Update sections 6.4, 9.0, 6.4, 9.0, and 10.3 and appendix C/ B21000-SIP-ATT-046A;-063	08/18/92	26,40,47, C-1
6	Update sections 4.1.1, 6.3, and 6.6 and figure 15-1; add new section 4.2.3.8 and renumber remaining section/ B21000-SIP-ATT-055A;-064; -065A	11/17/92	8,8A,15, 15A,26, 26A,28, 28A,61,62
7	Update sections 9.0 and 10.3/ B21000-SIP-ATT-069	05/25/93	40,47
8	Update sections 6.3, 8.2.2, and 16.0 and figure 15-1/ B21000-SIP-ATT-067A;-070;-074	08/10/93	26,30,30A,55, 58,59,60,61, 62
9	Update section 4.2.1.2/B21000-SIP-ATT-073A	12/17/93	9,10
10	Update table of contents, section 4.2.4.5, 10.1, and figure 15-1/B21000-SIP-ATT-076A;-078	01/11/94	ix,15A,46, 46A,58,59,60, 61,62
11	Add new section 4.2.3.9 and renumber existing section 4.2.3.9 as 4.2.3.10/B21000-SIP-ATT-077	01/25/94	15,15A
12	Update figure 15-1/B21000-SIP-ATT-080	02/08/94	59

DESCRIPTION OF CHANGES (CONTINUED)

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CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
13	Update section 4.2.3.10 to 4.2.3.11 and add a new 4.2.3.10 and update section 6.3 and figure 15-1/B21000-SIP-ATT-079;-082	03/08/94	15,15A,26,60, 61
14	Add new section 4.2.3.11 and renumber remaining section/ B21000-SIP-ATT-083	04/12/94	15,15A
15	Update section 10.4/B21000-SIP-ATT-084B	06/13/94	48
16	Update sections 6.1, 8.4.3, figure 15-1, and appendix C/B21000-SIP-ATT-085;-086	07/26/94	24,25,25A,34, 61,62,C-1, C-2,C-4
17	Update table of contents, section 4.1.2, appendix C, and add new section 4.2.3.12; renumber existing section 4.2.3.12 as 4.2.3.13/B21000-SIP-ATT-087;-088	10/25/94	vii,8,8A,15, 15A,C-1
18	Update sections 9.0 and 10.3/B21000-SIP-ATT-089	11/28/94	40,47
19	Update table of contents, section 16.0, appendix C, and add new section 10.6/B21000-SIP-ATT-090	12/09/94	ix,49,49A,55, C-3
20	Update table of contents, section 13.0 and delete figure 13-1/B21000-SIP-ATT-092	07/11/95	ix,51,52,56,57

DESCRIPTION OF CHANGES (CONTINUED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

ATTACHED PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
21	Update figure 15-1/B21000-SIP-ATT-093	08/08/95	58
REV B	Pagination revision to include updates to sections 2.6.1 and 2.6.2/B21000-SIP-ATT-094	09/08/95	All
1	Update sections 8.2.2 and 8.3/B21000-SIP-ATT-091	10/24/95	33A,37,37A
2	Update section 4.1.2/B21000-SIP-ATT-0096	12/05/95	9,9A
3	Update sections 2.1.1 and 16.0/B21000-SIP-ATT-0098	01/19/96	2,58
4	Update sections 5.3 and 16.0/B21000-SIP-ATT-0099	04/30/96	19,20,60
5	Update sections 4.2.3.8 and 4.2.3.10/B21000-SIP-ATT-0100	06/28/96	16
6	Update table of contents, sections 2.6.2, 4.2.3.1, 5.3, 5.5, 5.6, 8.2, 8.2.2, 8.4.2, 8.5, 14.0, and 16.0, figure 15-1, and appendix C; add new table 8-1 and section 8.2.4/B21000-SIP-ATT-0102;-0104	09/03/96	viii,5,13,19, 23,25,33,33A, 33B,34,34A, 37A,39,57,60, 62,C-3
REV C	General revision/B21000-SIP-ATT-0105	10/30/96	All
1	Update sections 4.1.2, 5.3, and 14.0/B21000-SIP-ATT-0106	09/09/97	8,18,57

DESCRIPTION OF CHANGES (CONCLUDED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR ATTACHED PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
REV D	General revision/B21000-SIP-0108A	04/08/99	All
	Errata to correct cover	06/11/99	

Note: Dates reflect latest approval date of CR's received by PILS.

PAYLOAD INTEGRATION PLAN

SPACE SHUTTLE PROGRAM

AND

(PAYLOAD NAME)

(DATE)

Prepared by
Payload Integration Manager

APPROVED:

Date	Date
SPACE SHUTTLE PROGRAM OFFICE	(payload organization)

FOREWORD

This Standard Integration Plan (SIP) is intended for preparation of the primary agreement for management and technical activities required for integrated flight and ground operations of an attached payload with the Space Shuttle Program (SSP). Use of the standard format will provide a consistent definition of the required integration agreements for the payload organization and SSP implementation.

PREFACE
(For commercial or outside NASA customer)

This Payload Integration Plan (PIP) is the customer and National Aeronautics and Space Administration (NASA) agreement on the responsibilities and tasks which directly relate to integration of the payload into the Space Shuttle and includes identification of tasks that the NASA considers as standard and nonstandard services.

Signature of this document constitutes technical agreement on tasks to be performed, including standard and nonstandard services, but does not obligate the customer to the reimbursement price and schedule payment or the NASA to the funding and implementation of standard or nonstandard services. Upon completion of negotiations and signature of the (Launch Services Agreement (LSA) or amendments thereto, Joint Endeavor Agreement (JEA), Memorandum of Agreement (MOA), etc.) by the NASA and (payload organization) or provision of required funding under a separate letter agreement, the standard and nonstandard services identified will be implemented by the Space Shuttle Program (SSP). The launch date shown in this PIP is for planning purposes only.

Further understanding of SSP operations and the associated payload-unique requirements may indicate the need for additions to or deletions from the nonstandard services. This can be accommodated by amendment of the PIP and the launch service agreement.

[Any instructional information contained in this Standard Integration Plan (SIP) is enclosed in brackets [ ]. All instructional information will be removed for the flight-specific PIP’s. Information to be supplied is enclosed in parentheses ( ).]

Issues which are yet To Be Resolved will be designated "TBR" in this PIP with the specific details of this issue(s) documented in appendix A. Information not at issue but which is yet To Be Determined is designated "TBD" and documented in appendix B.

PREFACE
(For NASA payloads)

This Payload Integration Plan (PIP) represents the payload-to-Space Shuttle Program (SSP) agreement on the responsibilities and tasks directly related to integration of the payload into the Space Shuttle, and includes a definition of standard and nonstandard services.

Upon provision of the required funding by the National Aeronautics and Space Administration (NASA) Headquarters SSP, the identified standard and nonstandard services will be implemented according to the PIP schedule.

Further understanding of SSP operations and the associated payload-unique requirements may indicate the need for addition or deletion of nonstandard services. This can be accomplished by amendment of the PIP and provision of funding by NASA Headquarters SSP. The official commitment for the launch date is reflected in the NASA Headquarters flight assignment. The launch date shown in this PIP is for planning purposes only.

[Any instructional information contained in this Standard Integration Plan (SIP) is enclosed in brackets [ ]. All instructional information will be removed for the flight-specific PIPs. Information to be supplied is enclosed in parentheses ( ).]

Issues which are yet To Be Resolved will be designated "TBR" in this PIP with the specific details of this issue(s) documented in appendix A. Information not at issue but which is yet To Be Determined is designated "TBD" and documented in appendix B.

CONTENTS

1.0 INTRODUCTION

The National Aeronautics and Space Administration (NASA) and the (customer organization) plan to launch and operate in orbit a (payload name), using the Space Shuttle.

The (payload) will fly on a shared flight as a (standard secondary, nonstandard secondary, complex secondary, primary) payload.

[Note: If additional launches of this payload are planned, add the following statement: (no.) additional launches of this payload are planned.]

The Space Shuttle Program (SSP) shall be composed of and represented by the Lyndon B. Johnson Space Center (JSC) and the John F. Kennedy Space Center (KSC). The (payload name) shall be represented by (responsible organization).

[If the payload is reimbursable, use this sentence with the appropriate agreement selected: This PIP is the document identified in the (Launch Services Agreement (LSA), Joint Endeavor Agreement (JEA), Memorandum of Agreement (MOA), etc.), between the NASA and the (payload organization)]. This PIP provides the management roles and responsibilities, and a definition of the technical activities, interfaces, and schedule requirements to accomplish the integration, launch, and flight operations and postlanding operations of the (payload organization) payload with the Space Shuttle. All services to be furnished by the SSP to the customer under this PIP shall be furnished by the SSP using its best efforts.

2.0 MANAGEMENT RESPONSIBILITIES

The responsibility for assuring the definition, control, implementation, and accomplishment of activities identified in this document is vested with the SSP at the JSC and for (payload name) with the (responsible organization). Hereafter in this PIP, the (payload name) will be referred to as the payload and the (payload organization) will be referred to as the customer.

2.1 Joint Responsibilities

The SSP and the customer will support the necessary integration activities, both analytical and physical, identified in this plan and according to the schedule contained in section 15.0. The SSP

and the customer will staff interface working groups with technical personnel responsible for accomplishment of integration tasks. Interface working groups include management, structural/mechanical, avionics, thermal, flight planning, flight operations, and ground operations.

2.1.1 Documentation.- Primary documentation for payload integration into the Orbiter consists of the PIP, PIP annexes, data submittals, and appropriate Interface Control Documents (ICDs).

The PIP, PIP annexes, data submittals, payload-unique ICD (or ICD addendum), and associated changes will be jointly approved by the SSP and the customer [except as otherwise stated in the launch service agreement.] Configuration control will be initiated upon signature approval. The SSP will maintain configuration control of the cited documentation in accordance with Program Definition and Requirements, NSTS 07700, Volume IV, Space Shuttle Configuration Management Requirements, with the exception of Launch Site Support Plan Annex, Annex 8, which will be maintained by KSC in accordance with Payloads Configuration Management Handbook, KHB 8040.4.

Unless otherwise stated within this document, all inconsistencies shall be resolved by giving precedence in the following order:

a. Safety Policy and Requirements for Payloads Using the Space Transportation System, NSTS 1700.7B, and Space Transportation System Payload Ground Safety Handbook, 45 SPW HB S-100/KHB 1700.7, as modified by any SSP-approved waivers.

[If applicable, insert:

b. Launch Services Agreement, Joint Endeavor Agreement, etc.]

c. Payload Integration Plan

d. Payload Interface Control Documents referenced in the Payload Integration Plan

e. Annexes/data submittals to the Payload Integration Plan

f. Applicable documents of the Payload Integration Plan other than those above

2.1.2 Reviews.- The customer participates in the following reviews which will be implemented to assess the cargo integration

process as described in Space Shuttle System Payload Accommodations, NSTS 07700, Volume XIV:

a. Payload Safety Reviews (PSRs)

b. Cargo Integration Review (CIR)

c. Flight Operations Review (FOR)

d. Ground Operations Review (GOR)

e. Payload Readiness Review (PRR)

f. Launch Readiness Review (LRR)

g. Flight Readiness Review (FRR)

h. Integrated Product Team (IPT)- periodically

i. Payload Director Countdown Review (PDCR), if required

j. Prelaunch Mission Management Team (MMT) Review (L-1 or L-2 Days)

2.2 Space Shuttle Program Responsibilities

The SSP is responsible for integration of the payload into the Space Shuttle, including analytical integration, integrated flight design, integrated flight operations and compatibility with other cargo elements that share the same flight. The SSP is also responsible for assuring that any other SSP activities required to support the payload flight are accomplished. The SSP is responsible for specifying to the customer all SSP requirements in the appropriate timeframe.

The KSC is responsible for Space Shuttle Launch and Landing (L&L) support which includes agreed-upon facilities and services, physical integration of payload(s) and integrated checkout, ground integration of the payload and Space Shuttle, and postlanding activities.

2.3 Customer Responsibilities

The customer is responsible for the design, development, test, performance, and safety of the payload and Ground Support Equipment (GSE), as well as for providing support to the SSP

analytical and physical integration activities identified in this PIP. The customer is also responsible for the preintegration preparation of the payload and is responsible for responding in the appropriate timeframe to SSP requirements set forth in this document. The customer is responsible for identifying to the SSP all payload problems which may affect SSP milestones, as identified in section 15.0, and shall discuss with the SSP a plan to resolve the problem(s).

The customer will support the Certification of Flight Readiness (COFR) process as described in NSTS 07700, Volume XIV.

2.4 Authority and Responsibilities of the Space Shuttle Commander

The authority and responsibilities of the Space Shuttle commander are as stated in The Authority of the Space Shuttle Commander, 14 CFR 1214.7. The Space Shuttle commander has absolute authority to take whatever action is necessary to ensure the safety and well being of all personnel and equipment onboard.

2.5 Authority and Responsibilities of the Payload Commander

For missions with extensive crew training requirements and/or complex crew interactions, a payload commander may be designated. The payload commander will be responsible for working with the payload mission managers to identify and resolve issues associated with experiment assignment, training, crewmember qualification, and operational constraints. Per paragraph 2.4, ultimate onboard authority for the successful execution of the flight rests with the Space Shuttle commander.

2.6 Authority and Responsibilities of the Mission Management Team and the Cargo Management Team

2.6.1 Mission Management Team.- The authority and responsibilities of the MMT are established in Space Shuttle Operations, NSTS 07700, Volume VIII. The MMT will function as a program-level oversight group to review the status of countdown and flight activities and to make programmatic decisions outside the authority of the launch and flight teams. When necessary to deviate from established Launch Commit Criteria (LCC) or flight rules to safely conduct SSP operations or to meet mission objectives, the single approval authority for such actions is the

MMT chairman. The single representative to the MMT on matters involving the Shuttle cargo is the Flight Manager, Space Shuttle Program.

2.6.2 Cargo Management Team.- The customer's interface to the MMT is through membership on the Cargo Management Team (CMT). This team, which is chaired by the Flight Manager, Space Shuttle Program, consists of SSP and customer management representatives who have the authority and technical knowledge to make final programmatic recommendations to the MMT on issues which affect the payload. CMT membership, responsibilities, and functions are payload specific and are addressed further in the Payload Operations Workbook, JSC-27508.

3.0 PAYLOAD DESCRIPTION AND MISSION OVERVIEW

This section contains a general payload description and mission overview. It is not intended to specify requirements or constraints.

3.1 Payload Description

[Briefly describe the overall payload. A figure showing launch configuration of the payload should also be included.] The payload configuration is shown in figure 3-1.

3.2 Ground and Mission Overview

3.2.1 Integrated Ground Operations.- After the payload is initially prepared, it is transported to the payload integration facility (Vertical Processing Facility (VPF)/Operations and Checkout (O&C)/Space Station Processing Facility (SSPF) at KSC where the SSP performs interface verification tests to verify Orbiter/payload compatibility. With completion of this testing and the PRR, the payload is transported to the Orbiter integration facility (Payload Changeout Room (PCR)/Orbiter Processing Facility (OPF)). The payload is installed into the Orbiter, interfaces are verified, and the payload is prepared for launch.

3.2.2 Flight Operations.- The mission scenario should cover the following general subjects in sequence:

RESERVED FOR FIGURE 3-1

TITLE: THE PAYLOAD CONFIGURATION

a. After the Payload Bay Doors (PLBDs) are opened, any required payload preoperation activities will be initiated.

b. Crew-initiated operations from (Aft Flight Deck (AFD) control panel or keyboard).

3.2.3 Postlanding.- After landing, the Orbiter returns to the OPF where the payload is removed for return to the customer.

4.0 MISSION OPERATIONS

The mission operations section includes a definition of requirements and constraints by mission phase.

4.1 Orbital Requirements and Payload Control Parameters

4.1.1 Orbital Requirements.- The payload requires to be operated from a near-circular orbit, where the difference between apogee (Ha) and perigee (Hp) is no more than (no.) n. mi., ((no.) km.), with an inclination of (no.) plus or minus 0.1 degree. The maximum orbital altitude is (no.) n. mi. ((no.) km). The minimum orbital altitude is (no.) n. mi.((no.) km).

[If the targeted inclination is higher than 28.45 degrees, add the following: If an Abort-to-Orbit (ATO) occurs, the minimum desired altitude and inclination is (no.) n. mi. ((no.) km) and (no.) degrees respectively, with increased (altitude/inclination) given preference over increased (inclination/altitude). These payload desires will be accommodated once crew and Orbiter safety requirements are met.]

[To minimize the possibility of damage to the Orbiter from impact with orbital debris, the maximum allowable Orbiter altitude to meet a payload's highly desirable objectives is 200 n. mi.]

4.1.2 Control Parameters.- The payload control weight and payload control length define maximum weight and length of the payload for SSP mission planning purposes. A payload may not exceed its control weight or control length without SSP approval.

Table 4-1.- CONTROL WEIGHTS

	Launch (lb/kg)	Landing (lb/kg)
Cargo Bay:		
Payload	(no.), ((no.))	(no.), ((no.))
Unique integration hardware	(no.), ((no.))	(no.), ((no.))
Subtotal		
Crew Compartment:		
Payload	(no.), ((no.))	(no.), ((no.))
Unique integration hardware	(no.), ((no.))	(no.), ((no.))
Subtotal	(no.), ((no.))	(no.), ((no.))
Total	(no.), ((no.))	(no.), ((no.))

The status weights for the cargo bay items (required hardware aft of Xo=576.00, including hard wired cable installations for payload panels forward of Xo=576.00) are documented in the PIP Annex 1.

The status weights for the Crew Compartment items (locker stowed hardware and panels required by the payload) are documented in the PIP Interface Control Annex (ICA).

Payload control length, including dynamic and access clearances, is (no.) inches ((no.) m).

The customer shall provide the configuration drawings and sequenced mass properties of the payload as part of Payload Data Package, Annex 1.

For payload items to be stowed or installed in the middeck, the payload customer at the time of manifesting, will submit engineering drawings of all payload-provided hardware to ICA. To support final stowage for flight and the Flight Crew Bench Review, the payload customer will provide the flight hardware to JSC no later than 6 weeks prior to launch.

The customer shall exclude from the payload mass property data all SSP integration hardware and Orbiter Mission Kits noted in section 7.0 except where the hardware is incorporated into the payload, as defined herein.

The customer shall perform a weight and center of gravity (c.g.) measurement of the payload prior to delivery to the KSC

integration facility. A payload Weight Log shall be maintained and verified by the customer's Quality Assurance organization subsequent to the weight measurement. The Weight Log shall note all elements/assemblies added or removed through final configuration for flight.

Required updates of the annex data shall be made as described in the annex and shall be submitted according to the schedule in section 15.0.

4.2 Operational Requirements and Constraints

The following payload operational requirements and constraints will be used in flight planning and implementation of the Space Shuttle and payload mission.

4.2.1 Launch Readiness.-

4.2.1.1 Launch Commit Criteria: [For payloads that have no LCC, state so and delete remaining paragraphs.] Payload LCC will be developed in accordance with NSTS 07700, Volume XIV, Appendix 5, requirements and constraints. All LCCs must be monitored via ground systems and must not rely on flightcrew monitoring. Any function whose failure results in a hold must be monitored such that no single failure will result in a loss of visibility into the status of that function. (Exceptions to this requirement must be negotiated and identified in the PIP.)

Payload safety and mission success LCC will be submitted to the Payload Integration Manager (PIM) by L-7 months in accordance with the format and guidelines specified in NSTS 16007, Shuttle Launch Commit Criteria and Background, Appendix C, identifying the parameters, limits, and rationale used as a basis for a launch hold. After review and approval, Payload Safety LCC will be documented in NSTS 16007 by the SSP and are to be baselined by L-5 months.

a. Safety LCC - [For payloads that have no safety LCC, state so and delete remaining text of item a.]

   Payload safety holds may be called until L-31 seconds.

   Payload safety holds will be called by (specify the responsible organization and location, such as KSC console or

Ground Launch Sequencer (GLS)). [For a payload with multiple flights, safety LCC to be called after L-5 minutes must be in the GLS.]

b. Mission Success LCC - [For payloads that have no mission success LCC, state so and delete remaining text of item b.] Mission success LCC holds to be called by the Mission Control Center (MCC) [e.g., requirements that support on-orbit operations facilities or communication networks] will be documented by the SSP in the Flight Rules. Mission success LCC holds to be called by either KSC or the customer will be documented by the SSP in NSTS 16007.

Mission success holds may be called until T-9 minutes.

Mission success LCC holds will be called by (specify the responsible organization and location, such as KSC console or Payload Operations Control Center (POCC) facility).

[Mission success related launch holds may be called only by customers with primary payloads. The customer may call a mission success hold until T-9 minutes for a confirmed loss of redundancy of a flight function which would affect a primary mission objective. If a specific redundant system failure would jeopardize a majority of the primary mission objectives, an exception may be considered by the SSP for holds until T-5 minutes. For confirmed loss of a total function which would cause the loss of primary mission objectives, the customer may call a hold until T-5 minutes.]

4.2.1.2 Launch Window: [Define launch window requirements]

4.2.2 Ascent.- [Any payload-unique constraints during ascent should be specified.]

4.2.3 On-orbit.- [Include any general payload constraints and requirements affecting operations.] The PLBDs should be assumed to be opened no sooner than 1 hour after launch and no later than 3 hours after launch. If the doors are not opened by 3 hours after launch, the Orbiter will return and landing will be completed by launch plus * hours.

*Select the appropriate number:

6.5 for a 28.5-degree orbital inclination
11.5 for a 57-degree orbital inclination

4.2.3.1 Thermal Environment: This section defines the thermal requirements for which the customer is responsible.

4.2.3.1.1 Attitude Capability: For beta angles ≤60 degrees, the Orbiter will normally be oriented with the payload bay facing Earth (+ZLV). For Beta angles ≥60 degrees, the Orbiter will normally be in a Passive Thermal Control (PTC) attitude. PTC is defined as the Orbiter X-axis perpendicular to the solar vector and rolling about the X-axis at a rate of 2 to 5 revs/hour. All cargo elements will be designed to allow deep-space excursions that include a 35-minute Inertial Measurement Unit (IMU) alignment occurring approximately every 12 hours.

Table 4-2 specifies payload attitude capability and payload recovery times for excursions from the preferred attitude prior to repeat of that same attitude.

Table 4-2.- PAYLOAD ATTITUDE CAPABILITY

Attitude	Duration	Payload recovery time at +ZLV to repeat attitude (β ≤60 degrees)	Payload recovery time at PTC to repeat attitude (β ≥60 degrees)
+ZLV (SSP Preferred) for β </=60 degree	Continuous	N/A	TBD
PTC β ≤60 degrees (SSP Preferred)	Continuous	N/A	N/A
β ≥60 degrees (End of Mission)	12 hours	TBD	N/A
+Z Space	35 minutes every 12 hours	TBD	TBD
+Solar Inertial (End of Mission)	3 hours	TBD	TBD
± XLV/± ZVV (Rendezvous) (1)	7 hours	TBD	TBD

(1) Must be included for any payload requiring or manifested with a payload requiring rendezvous

4.2.3.1.2 Payload Attitude Requirements: The payload/cargo element may specify in table 4-3 unique attitudes and durations that are required to accomplish the payload/cargo element mission objectives. Payload attitudes that are constrained by beta angle should also be specified here.

Table 4-3 Payload Attitude Requirements

ATTITUDE	DURATION
(Payload to Specify)	(Payload to Specify)

(Payload to specify nominal mission attitudes/durations required to accomplish mission objectives.)

In the event of an anomaly, the Orbiter will observe the attitude constraints of table 4-2 to the extent possible. In the event these constraints must be violated, payload safety constraints will be observed. The customer will perform the necessary analysis to define these safety constraints in terms of maximum solar and deep-space exposure times and will document these in the flight rules submittal to the Lead Payload Officer.

If floodlight operation (reference Shuttle Orbiter/Cargo Standard Interfaces, NSTS 07700, Volume XIV, Attachment 1 (ICD 2-19001) for floodlight characteristics) impacts mission success, operational constraints and appropriate safeguards will be negotiated between the SSP and the customer and will be documented in the flight rules submittal to the Lead Payload Officer.

4.2.3.2 Ground Communications: For on-orbit attached Radio Frequency (RF) checkout, (no.) minutes of real-time telemetry coverage are required. [Specify Space Network (SN), Remote Tracking Station (RTS), Tracking and Data Relay Satellite (TDRS), etc.] The command and data interface is discussed in sections 5.5 and 5.6 (if required). The antenna pointing and attitude requirements are (TBD).

4.2.3.3 Remote Manipulator System Operations: [Add the following if applicable: The payload must comply with the Remote Manipulator System (RMS) requirements documented in System Description and Design Data - Payload Deployment and Retrieval System, NSTS 07700, Volume XIV, Appendix 8.]

4.2.3.4 Photographic Coverage: Photographic and/or Television (TV) coverage of the payload operations from the Orbiter will be initiated by the SSP. [Specify any unique photographic or TV coverage requirements.]

4.2.3.5 Ku-band System: The payload must be compatible with the Ku-band environment in the payload bay as specified in section 6.3. The payload bay environment is protected by a firmware obscuration mask for antenna pointing, a pointing error limit circuit, and ground controller/crew control. In the event of unlikely hardware failures, the payload may be exposed to the main beam.

4.2.3.6 Extravehicular Activity Requirements: [If payload extravehicular activity requirements exist, include the following information as appropriate: [Note: A maximum of two payload extravehicular activities can be considered.] The following Extravehicular Activity (EVA) requirements will be implemented by the SSP as nonstandard services.

(One, Two) scheduled EVA(s) will be required to conduct [identify task(s) to be performed and, if known, their sequence].

The payload requires the Space Shuttle to have the capability to perform (one, two) unscheduled EVA(s) for backup operation of mechanical functions. The EVA tasks are [list tasks to be conducted with their flight activity associated and any time limitations].

Payloads requiring unscheduled EVA(s) will be designed to accommodate next day EVA after the failure occurrence. This capability will allow the implementation of nominal EVA procedures and timeliness.

Planning for a contingency EVA is required to [list each task to be performed, approximate mission time it must be performed, and an explanation of its criticality].

Task	*Duration*	*Criticality*
[Example: PRLA	*One Hour*	*PRLA must be released to eject payload so payload bay doors can be closed]*

The payload must comply with the EVA requirements documented in System Description and Design Data - Extravehicular Activities, NSTS 07700, Volume XIV, Appendix 7.

Detailed descriptions of EVA scenarios, tasks, and worksites are contained in Extravehicular Activity (EVA) Annex, Annex 11.

4.2.3.7 Primary Reaction Control System Compatibility: The payload will be compatible with a Primary Reaction Control System (PRCS) mode of control for all required operations with the exception of short term payload activities or configuration change periods.

4.2.3.8 Payload Orbiter Attitude Requirements: Payload-specific attitude requirements as identified in this Integration Plan (IP) or in the Flight Planning Annex, Annex 2, will be incorporated into a mission-integrated attitude timeline. The SSP will assess this integrated timeline at CIR for probability of Orbiter damage due to orbital debris. Payload attitude requirements that subject the Orbiter to undue risk will be negotiated with the customer.

4.2.3.9 Orbit Adjust Windows of Opportunity: The SSP desires two daylight landing opportunities at both the primary and alternate landing sites on the nominal end of mission day and subsequent planned extension days. To support development of these landing opportunities, customers are required to identify windows of opportunity in their operations for or constraints prohibiting orbit adjust maneuvers. The customer shall provide this information in Annex 2, Part II.

4.2.3.10 Debris Resulting from Payload Operations: The payload customer is responsible for implementing the requirements of NASA Policy Directive (NPD) 8710, Policy for Limiting Orbital Debris Generation, to limit and manage orbital debris. The SSP will provide support to the customer in response to NPD 8710 in those areas where integrated Shuttle/payload planning and/or operations could result in orbital debris.

4.2.3.11 Primary End of Mission Landing Site Requirements: The primary End of Mission (EOM) landing site will be the KSC Shuttle Landing Facility (SLF). Orbital and entry operational plans will be developed based on this requirement unless a mission-specific exception to land at Edwards Air Force Base (EAFB) is approved by the SSP.

4.2.3.12 Flash Evaporator System and Water Dump Operations: [Specify operational constraints.]

4.2.3.13 Other Constraints: [Include other required payload constraints.]

4.2.4 Operational Safety Constraints.-

4.2.4.1 Safe Without Services: The SSP-provided services such as power, cooling, ventilation, etc., may not be available under certain conditions; i.e., postlanding, ferry flights, or certain KSC operations. In this event, the customer is responsible to ensure that the payload does not present a hazard to the Space Shuttle or to personnel. For loss of normal services during the mission, the payload design must comply with the safety requirements as defined in NSTS 1700.7B, with contingency safing power as defined in section 5.4.

4.2.4.2 Floodlights: The payload must be designed to be safe with any payload bay floodlight failed on. (Reference ICD 2-19001 for floodlight characteristics.)

4.2.4.3 Abort Descent and Landing: The payload shall be designed so that the thermal conditions resulting from an abort and subsequent entry/descent and landing present no hazard to the Orbiter, the flightcrew, or ground personnel.

4.2.4.4 Vent Doors: The thermal environment in the payload bay resulting from an Orbiter vent door failing to close during entry is documented in ICD 2-19001. The customer must assess that environment and certify that the payload will not present a hazard to the crew or the Orbiter under such conditions.

4.2.5 Associated Non-SSP Program Launch Vehicles.- When non-SSP vehicles are launched in conjunction with any of the payload/experiment tasks (cooperative launches), the customer is responsible for ensuring the cooperative launch does not add risk to the Shuttle. This includes informing the SSP of these activities and establishing points of contact so that launch vehicle targets can be discussed between the SSP and the non-SSP launch vehicle’s responsible organization.

5.0 PAYLOAD-TO-SPACE SHUTTLE INTERFACES

The payload must be compatible with the Space Shuttle mechanical, electrical, avionics, and environmental interfaces as defined in ICD 2-19001. The Space Shuttle-to-payload (and carrier if appropriate) standard and unique interfaces are specified in the Shuttle/Orbiter (payload or carrier) ICD (no.). The payload bay electrical and fluid interfaces, except for the RF interface, are physically located above the Orbiter Z-axis 410 station, at or near the trunnion interface, on an Orbiter standard interface panel.

5.1 Structural/Mechanical Interfaces

The structural/mechanical interface between the payload and the Space Shuttle consists of (no.) longeron trunnions and (no.) keel trunnions that will attach to the SSP-provided longeron and keel attach fittings. The mechanical interface between the Orbiter and the payload will be specified in the Shuttle/Orbiter (payload or carrier name) ICD (no.).

5.2 Cable Interfaces

The payload will use one section of the standard AFD and cargo harnesses in accordance with NSTS 07700, Volume XIV and ICD 2-19001.

[If the Payload and General Support Computer is used, add the following: The SSP will provide, as a nonstandard service, a cable from the Payload Station Distribution Panel to the Computer Interface Panel (CIP) for the RS-422A interface to the Payload and General Support Computer (PGSC).]

Specific wiring pin function assignments will be defined in the Shuttle/Orbiter (payload or carrier) ICD (no.).

5.3 Display and Control Interfaces

Display and Control (D&C) functions are accomplished using the following crew-controlled equipment:

a. One section of the standard switch panel

b. One section of console L-10 or L-11 (for customer-provided panel)

c. [If the PGSC is requested, add the following: The SSP will provide the use of a PGSC to support inflight payload operations. The SSP will also provide a CIP in the AFD, the necessary power cable, and an RS-422A data cable from the PGSC to the CIP. The customer is responsible for providing similar commercial computers and cables for ground development and customer-provided training. The SSP will provide a flightlike unit for a period of 2 weeks to be used for hardware/software verification test purposes. All payload software will be developed and provided by the customer. Success of PGSC software is considered the responsibility of the customer. If the customer requires the

use of SSP facilities for the testing of PGSC software, it must be negotiated with the SSP and documented in the PIP. In no case will PGSC software be verified in the Orbiter itself. If customers will be using 3.5-in. diskettes, the customer is responsible for providing diskettes to support their payload. Diskette information can be located in Shuttle/Payload Interface Definition Document for Payload and General Support Computer (PGSC), NSTS 21000-IDD-486.]

Operational D&C nomenclature will be defined in the payload-unique Interface Control Annex, ICA.

5.4 Electrical Power Interfaces

Before installation in the Orbiter, power will be supplied to the payload using customer-provided or SSP-provided GSE as negotiated in Annex 8. [If required, add the following: After installation in the Orbiter, Orbiter bus power will be supplied by the SSP; T-0 umbilical power will be supplied by the payload GSE when required. When supplying T-0 umbilical power, the payload GSE shall meet the Electromagnetic Compatibility (EMC) requirements specified in ICD 2-19001.]

The payload shall provide means for its power activation/deactivation via crew control.

The payload electrical power requirements shall not exceed the allocations defined in ICD 2-19002. The maximum continuous and peak power requirements are listed in table 5-1, and the Space Shuttle/payload interface voltage for the peak power value is defined in ICD 2-19001.

Table 5-1.- ELECTRICAL POWER REQUIREMENTS

	Power	Prelaunch		Ascent	On-orbit			Descent	Post-flight
		PLBD closure			Pre	Opera-tion	Post		
		Pre	Post						
a.	Orbiter bus	(cont)W (peak)	(cont)W (peak)	(cont)W (peak)	(cont)W (peak)	(cont)W (peak)	(cont)W (peak)	(cont)W (peak)	N/A
b.	Hardwire thru T-0 umbil-ical*	(cont)W (peak)	(cont)W (peak)	N/A	N/A	N/A	N/A	N/A	N/A

c. Safing**	N/A	N/A	N/A	(TBD)W (peak)	(TBD)W (peak)	(TBD)W (peak)	N/A	N/A
[d. PGSC	N/A	N/A	N/A				N/A	N/A]

(cont - continuous; Value inserted where interface is required; N/A inserted where interface is not available; and N/R inserted where interface is not required; peak power values are identified by parenthesis.)

*From 30 minutes before launch until launch, the amount of current being transferred through T-0 umbilical shall be limited to 500 milliamps/circuit (wire pair).
**Fill in if necessary. Safing power is that power required by the payload to reconfigure from a nonsafe mode to a safe mode before permanent termination of power. Time limits shall be specified.

[If the PGSC is used, list power requirements separately (refer to Shuttle/Payload Interface Definition Document for the Payload and General Support Computer (PGSC), NSTS 21000-IDD-486).]

The specific flight power profile will be defined by the customer in Annex 2.

For loss of Orbiter-supplied power to the payload during ascent, power reconfiguration will be attempted when the Orbiter has achieved a safe orbit.

Loss of Orbiter-supplied on-orbit power to the payload shall, as a minimum, require manual reconfiguration of Orbiter power to restore power to the payload. This power will nominally be restored within 15 minutes of payload power loss detection.

The total energy shall not exceed TBD kWh/day.

5.5 Command Interfaces

Command interfaces are as follows in table 5-2.

Table 5-2.- COMMAND INTERFACES

Command I/F route	Prelaunch PLBD closure		Ascent	On-orbit			Descent	Post-flight*
	Pre**	Post		Pre	Opera-tion	Post		
a. Hardwire through T-0 umbilical			N/A	N/A	N/A	N/A	N/A	N/A
b. Orbiter GPC to payload BTU via data bus		N/A	N/A			N/A	N/A	
c. Discretes from Orbiter PF-1 MDM		N/A	N/A				N/A	N/A
d. Hardwire from standard switch panel			N/A				N/A	*
e. PSP		N/A	N/A				N/A	N/A
f. PI/PSP		N/A	N/A				N/A	N/A
g. PGSC via CIP (RS-422A)	N/A	N/A	N/A				N/A	N/A
h. RF direct from the ground	N/A	N/A	N/A				N/A	N/A

(X inserted where interface is required; N/A inserted where interface is not available; and N/R inserted where interface is not required.)

*Service available until Orbiter powerdown
**No entry required for Interface Verification Test (IVT) or end-to-end test

Payload commanding will be constrained as follows:

a. Prelaunch - Before PLBD closure for flight, all payload RF transmitters will be turned off. All payload commanding after PLBD closure will be through the T-0 umbilical or via Orbiter standard switch panel and nominally will be completed no later than the start of Space Shuttle cryogenic propellant

loading at 11 hours before launch. Payload commanding will not be permitted via Orbiter standard switch panel after crew ingress (approximately L-3 hours). If commands are required between L-11 hours and T-9 minutes, they must be specifically approved by the SSP and provided in the Operations Support Timeline (OST) submittal to the Lead Payload Officer; if the commands are mandatory-for-launch, redundancy in communications links, ground command systems, and telemetry verification capability will be required. In no case will payload commanding be permitted after the start of the T-9 minute hold which nominally is 10 minutes in duration.

b. Ascent - No commanding will be permitted during ascent.

c. Descent and landing - No commanding will be permitted during entry through wheel stop.

The commands in table 5-2 (items b, c, e, and f) are defined by the customer in Command and Data Annex, Annex 4. The phased sequence of operational usage of the commands will be provided in the OST submittal to the Lead Payload Officer.

Payloads which use a remote POCC for commanding are required to certify that protection is provided to prohibit the inadvertent sending of commands. This includes both encrypted and unencrypted commands. The POCC hardware, software, and operational mechanisms for hazardous command protection, as well as a hazardous command list, must be documented in a hazard report for approval by the SSP safety panel. The hazardous command bit pattern and bit structure will be documented in Annex 4. A complete set of all SSP requirements placed on the customer for remote POCC command procedures is documented in Command Requirements and Guidelines for NSTS Customers, NSTS 19943. Remote POCCs that use encrypted commands, or commands that bypass the normal hazardous command checks must demonstrate the capability to provide the same level of hazardous command software protection accomplished by the MCC as described in the POCC Capabilities Document Payload Support Capabilities Description: MCC, JSC POCC, Remote POCC Interface, NSTS 21063-POC-CAP.

5.6 Telemetry and Data Interfaces

Telemetry and data interfaces are as follows in table 5-3.

Table 5-3.- TELEMETRY AND DATA INTERFACES

Telemetry I/F route	Prelaunch		Ascent	On-orbit			Descent	Post-flight*
	PLBD closure			Pre	Opera-tion	Post		
	Pre**	Post						
a. Hardwire through T-0 umbilical			N/A	N/A	N/A	N/A	N/A	N/A
b. Discretes/ analogs to Orbiter PF-1 MDM		N/A	N/A				N/A	N/A
c. PDI via hardwire	(kbps)	(kbps)***	(kbps)	(kbps)	(kbps)	(kbps)	(kbps)	(kbps)
d. PDI via PI	(kbps)	N/A	N/A	(kbps)	(kbps)	(kbps)	N/A	N/A
e. Hardwire to Orbiter payload recorder		N/A				N/A		N/A*
f. Hardwire to standard switch panel			N/A				N/A	*
g. Payload BTU to Orbiter GPC via data bus		N/A	N/A				N/A	N/A
h. RF direct to GND		N/A	N/A			N/A	N/A	N/A
i. PGSC via CIP (RS-422A)	N/A	N/A	N/A				N/A	N/A

(X inserted where interface is required; N/A inserted where interface is not available; and N/R inserted where interface is not required.)

*Service available until Orbiter powerdown.
**No entry required for IVT or end-to-end test.
***Available only on a noninterference basis.

The phased sequence of operational usage of the data systems will be specified in the OST submittal to the Lead Payload Officer.

All data streams (and where applicable, individual parameters) processed by the SSP will be described in Annex 4.

5.7 Fluid Interfaces

[Specify any special spigot, vent, AFD equipment cooling, etc., interface requirements.]

5.8 Orbiter General Purpose Computer Software Services

The General Purpose Computer (GPC) software support for commands from the ground to the payload and data from the payload to the ground will be provided for the applicable interfaces defined in tables 5-2 and 5-3.

The above command/data processing is in addition to that required for the standard carrier.

Guidance, Navigation, and Control (GN&C) data transfer (is/is not) required.

Standard command/data processing services are defined in NSTS 07700, Volume XIV. Detailed payload requirements will be specified in Annex 4.

6.0 ENVIRONMENTAL ANALYSES AND INTERFACES

Standard Space Shuttle/payload natural and induced environmental interfaces, including structural, thermal, contamination, shock, vibration, and acoustics, are contained in ICD 2-19001. Interfaces for crew compartment hardware are defined in NSTS 21000-IDD-MDK.

Environmental interface analyses are conducted to determine physical and functional interface compatibility between the payload and the Space Shuttle for all flight regimes. Specific analyses are described in the following paragraphs.

6.1 Structural Loads and Deflections

Preliminary design guidelines for the payload are provided in ICD 2-19001. These guidelines correspond to the Space Shuttle loading environments and are recommended as the minimum conditions to which the customer should develop the preliminary

payload design. Final design shall be based upon coupled dynamic and quasi-static analyses performed using current payload and Space Shuttle Vehicle (SSV) Structural Math Models and Forcing Functions. The customer is responsible for assuring that the payload is designed to be compatible with the Space Shuttle environments resulting from these analyses and any subsequent SSP Structural Math Model and Forcing Function updates. The payload design must accommodate any Orbiter payload bay location. The customer is also responsible for assuring that the cargo element/Orbiter interface forces and deflections (including pressure, thermal, misalignment, and manufacturing effects) do not exceed the constraints in ICD 2-19001 or the Shuttle Orbiter/payload-unique ICD.

All payload bay structural math model deliveries, analyses, and documentation will be in accordance with the requirements of NSTS 37329, Structural Integration Analyses Responsibility Definition for Space Shuttle Vehicle and Cargo Element Developers, and provided per the schedule in section 15.0.

A schedule for anticipated SSV Structural Math Model and Forcing Function updates will be provided to the customer. Upon request the SSP will provide to the customer one set of SSV structural design math models and forcing functions. Additional models or forcing functions will be provided as a nonstandard service. The customer is responsible for applying appropriate conservatism to the structural analysis results to account for anticipated payload and SSV structural math models and forcing function updates. The SSP will advise the customer regarding the status of Space Shuttle activities that could affect payload loads; however, the responsibility for payload compatibility with the final flight loads remains with the customer.

If a complex Verification Loads Analysis (VLA) (e.g., nonlinear, component damping) must be performed for a particular mission, a mission-unique VLA schedule will be developed. This unique schedule, in general, will require payload test verified math models to be delivered 13 months prior to launch. The requirement for a complex analysis shall be identified by the customer to the SSP as early as possible and no later than 18 months prior to launch.

The Payload Verification Requirements Document, NSTS 14046, specifies that the customer will submit verification plans for the payload as part of the Safety and Payload Design Review process. The expected content of these deliveries with respect to structural verification is summarized in the following table.

Milestone	Structural Verification Plan Submittal
Phase 0/Payload Preliminary Design Review (PDR)	Conceptual approach to verification a. Structural verification tests b. Math model verification
Phase I/Payload (Critical Design Review (CDR)	Written verification plans a. Strength and dynamic math model verification testing b. Math model verification c. Analysis methodologies to incorporate nonstandard math modeling content (e.g., structural nonlinearity's or nonstandard damping)
Two months prior to start of testing	Detailed Verification Testing Plans a. Strength structural testing b. Dynamic structural testing
Prior to Verification Loads Analysis (VLA) math model delivery date	Modal Test and Dynamic Model Correlation Report
Six months prior to launch	Static Test and Strength Model Correlation Report

The detail requirements for each submittal are specified in NSTS 14046. Each submittal shall be made directly to the SSP Structures Working Group (SWG) and will be reviewed and approved per the NSTS 14046 requirements. Payload verification plans should specifically address all math model verification and analysis methodologies used to incorporate nonstandard math modeling content such as structural nonlinearity or nonstandard damping. NSTS 14046 structural verification requirements are applicable for all payload flight configurations while attached to the Orbiter including launch, on-orbit, normal landing, and contingency landing configurations.

All payload hardware items that protrude outside the standard 90-in. cargo bay thermal and dynamic envelope, whose dynamic or static deflection could be within 3 in. of the envelope, or are within 3 in. of any Orbiter protrusions into the envelope must be clearly identified in the unique ICD. These items should be closely monitored for dynamic clearance assessments during the payload design loads analysis and will require grid points for each item to be supplied as part of the VLA math model submittal.

For the payload, (no.) design loads analyses will be performed by the customer and documented in a Space Shuttle/payload Design Loads Report which will be provided to the SSP. The final payload design loads analysis report will be delivered to the SSP

13 months prior to launch. This loads report will be discussed with the SWG to ensure understanding and agreement with the results, and the report will be referenced in the payload-unique ICD. This loads report is required to support the SSP Cargo Compatibility Review (CCR), CIR, and Pre-Verification Loads Review (PVLR). As a nonstandard service, the SSP can perform a design loads analysis in support of the customer's design activity.

The SSP will perform a VLA using final test-verified math models provided by the customer. The PVLR will be conducted approximately 10.5 months prior to the start of VLA to review the payload design loads report, dynamic math model development, dynamic clearance assessment results, and determine the analysis and schedule details for the VLA. The VLA will include the lift-off; ascent and descent quasi-static; abort, emergency, nominal, and contingency landing; and Orbiter alone on-orbit flight regimes as deemed appropriate during the PVLR. All test-verified math models must be delivered at least 8.5 months prior to launch. For those math models that do not comply with this delivery schedule or with the math model verification requirements specified in NSTS 14046, the SWG will specify a model uncertainty factor that will be utilized in the VLA until data is available to warrant its elimination or reduction. All uncertainty factors will be documented in the Verification Analysis Data Acceptability Review (VADAR) minutes. The VLA results will be provided to the customer approximately 6.0 months prior to launch. The results delivered to the customer will include payload loads and deflections for Orbiter-induced transient and quasi-static mechanical loads, Orbiter-induced thermal loads, and payload specific data products identified by the customer prior to the start of the VLA and documented in the VADAR minutes. The VLA results will be documented in a VLA Report that will be published approximately 5.0 months prior to launch.

The customer is responsible for computing payload loads and deflections due to cargo bay vibro-acoustics, pressure differentials, trunnion friction, payload thermal distortions, etc., and combining them as appropriate with the VLA results. The customer shall include in this assessment loads from all sources (e.g., low frequency transient, quasi-static, thermal, pressure, acoustics, random vibration, preloads, and friction) for all mission segments during which the payload hardware is attached to the Orbiter. The customer is also responsible for verifying that the payload thermal/dynamic envelope (including pressure, thermal, misalignment, and manufacturing tolerance effects) does not exceed the constraints as specified in ICD 2-19001 or the payload unique ICD.

The Verification Acceptance Review (VAR) will be conducted approximately 3.5 months prior to launch to discuss and approve the results of the VLA. The customer will certify during this review that all margins of safety, considering all in-flight configurations, are positive and that the launch configuration, on-orbit configuration, all contingency landing configurations, and the nominal landing configuration are safe for all flight phases including all applicable uncertainty factors. The SSP will use the VLA results to ensure that the interface loads and relative deflections are within the Orbiter capabilities.

6.2 Thermal Environments and Interfaces

The customer is responsible for the design and analysis of the payload to assure compliance with the thermal and attitude requirements defined in section 4.0. The SSP will furnish Orbiter thermal models to the customer. Results of supporting design analyses accomplished by the (customer/SSP as a nonstandard service) will be documented in a Space Shuttle/payload thermal report to be provided to the (SSP/customer). This report will be discussed by the joint working groups to assure understanding and agreement and will be the basis for support of the CIR. Thermal models, including critical nodes and temperature limits for these nodes, shall be furnished by the customer to the SSP and in accordance with Criteria/Guidelines for Payload Thermal Math Models for Integration Analysis, JSC 14686. The schedule for furnishing the various payload thermal models and results of the integrated analyses are contained in section 15.0. The SSP will conduct an integrated thermal analysis or assessment as part of the flight verification cycle. The results of the verification thermal analysis will be used by the SSP to ensure that the resulting thermal environment is compatible with the Orbiter and other cargo elements. The customer is responsible for verifying payload compatibility with this environment.

6.3 Electromagnetic Interference/Electromagnetic Compatibility

The customer is responsible for assuring that the payload interfaces meet the induced electromagnetic interference environment and that the payload complies with the radiation requirements defined in ICD 2-19001. The specific characteristics of the payload Radio Frequency (RF) Systems Data, EMC Test Data, and Thermal Blanket Data as defined in NSTS 21288, Required Data/Guidelines for Payload/Shuttle Electromagnetic Compatibility

Analysis, shall be delivered to Payload Integration Engineering for review and evaluation. The required data submittal dates shall be defined in the schedule in section 15.0. The SSP will perform an intentional radiated RF interference assessment for mutual compatibility as a standard service; however, the customer is responsible for assuring that the payload operates properly in the specified environment. Payload intentional transmitter radiated levels incident on other cargo elements shall be limited to those levels specified in ICD 2-19001.

6.4 Contamination Control

The customer is responsible for assuring that the payload is compatible with the induced contamination environment and complies with outgassing requirements defined in ICD 2-19001. In addition, certain materials and equipment requirements apply during ground operations in (or close proximity of) the Orbiter. The customer will comply with these requirements as defined in Limitations For Nonflight Materials and Equipment Used in and Around the Space Shuttle Orbiter Vehicles, NSTS 08242; and conversely, the customer shall assure that the presence of any allowed material, chemical, or gas will have no adverse effect on the payload.

The facility input air at the OPF and the PCR will be nominally class 100, guaranteed class 5000 (High Efficiency Particle Air (HEPA) filtered) as specified in Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones, FED-STD-209E, and will contain less than 15 ppm hydrocarbons based on methane equivalent. Nonvolatile Residue (NVR) levels of less than 1 mg/0.1 meter squared/month will be maintained. Other KSC facilities have different levels of cleanliness and these operational requirements and capabilities are contained in KSC Payload Facility Contamination Control Requirements/Plan, K-STSM-14.2.1; Shuttle Facility/Orbiter Contamination Control Plan, KVT-PL-0025; and Payload Facility Contamination Control Implementation Plan, KCI-HB-5340.1.

Internal surfaces of a payload canister will be inspected, and cleaned if required, to establish a cleanliness level equivalent to the payload bay cleanliness level.

Payload bay surface contamination will be controlled as follows:

[For all mixed cargo payloads and payloads which require standard environment, use the following:

Prior to payload installation, prior to PLBD closure for OPF rollout, prior to PLBD closure for flight, and at other selected points in the Space Shuttle-cargo integrated processing flow, exposed and accessible payload bay surfaces will be visually inspected from 5-10 feet with a minimum incident light level of 50 ft-c and cleaned as necessary.]

[For sensitive payloads, use the following:

The payload is sensitive to contamination and requires nonstandard service cleaning of the payload bay which will result in serial impact time in the Orbiter flow of up to one day. A payload bay liner will be installed. Prior to payload installation, prior to PLBD closure for OPF rollout, prior to final PLBD closure for flight, and at other selected points in the Space Shuttle-cargo integrated processing flow, accessible payload bay surfaces will be visually inspected from 2-4 feet with a minimum incident light level of 50 foot candles (ft-c) and cleaned as required.]

[For highly-sensitive payloads, use the following:

The payload is highly sensitive to contamination and requires nonstandard service cleaning of the payload bay which will result in serial impact time in the Orbiter flow of up to two days. A payload bay liner will be installed. In the OPF, or launch pad at SSP's option and prior to payload installation, the entire exposed payload bay surface will be cleaned. This cleaning process consists of vacuuming and damp wipe of all surfaces with lint-free cloths to a level sufficient to produce particle-free and film-free surfaces as determined visually from 6-18 inches with a minimum incident light level of 100 ft-c. Subsequent to this cleaning through PLBD closure for flight at selected points in the Space Shuttle-cargo integrated processing flow, payload bay exposed, and accessible surfaces will be visually inspected and verified free of contamination to the extent practical within the limits of the facility and schedule. Minimum criteria for this visual inspection will be no contamination detected from 6-18 inches with a minimum incident light level of 100 ft-c.]

[For all payloads, use the following:

The customer is responsible for cleaning the payload to a cleanliness level equivalent to that specified for the payload bay prior to delivery to the SSP for integrated operations. Subsequent inspection and cleaning of accessible surfaces will be mutually agreed between the customer and the SSP. When a launch site facility or the payload bay is shared by payloads, unique

contamination control measures may be required. Implementation of these measures will be agreed upon and documented by KSC at least 3 months prior to hardware delivery to KSC.]

6.5 Shock, Vibration, and Acoustic Environments

For all payload hardware mounted in the Orbiter Crew Module, the customer is responsible for assuring compatibility with the shock, vibration, acceleration, and acoustic environments defined in NSTS 21000-IDD-MDK.

For each active middeck payload, a report shall be provided by the customer to reflect compliance with the middeck environmental requirements of NSTS 21000-IDD-MDK. An acoustical analysis of the flight hardware shall be provided by the customer at least 4 months prior to launch.

For all payload hardware mounted in the cargo bay, the customer is responsible for assuring compatibility with the shock, vibration, acceleration, and acoustic environments as defined in ICD 2-19001.

6.6 Ground Environmental Requirements

The environment of the ground operations facilities at the launch site is specified in Launch Site Accommodations Handbook for Payloads, K-STSM-14.1.

At the pad, purge temperatures at the payload bay inlet can be provided between 45 degrees to 100 degrees F but, in the OPF and Vehicle Assembly Building (VAB), the inlet temperature is only selectable throughout the range of 65 degrees to 85 degrees F controllable to plus or minus 5 degrees F. However, at all locations the payload bay purge inlet temperature nominal setpoint is 65 degrees F controllable to plus or minus 5 degrees F. Deviations from this setpoint must be negotiated with the SSP based on the total flight configuration requirements. The details of the payload bay purge outages and variations will be stated in NSTS 08171, Operations and Maintenance Requirements and Specifications Document (OMRSD).

Ground handling loads are always less than flight loads.

6.7 Payload/Orbiter Flight Control System Compatibility Analysis

The payload nominal fundamental vibration frequency is (TBD) Hz. An assessment will be made by the SSP to determine if an analysis is required. If an analysis is required, it will be conducted by the SSP (according to the schedule in section 15.0) to assess the interaction between the payload and the Orbiter Flight Control System (FCS) in all appropriate flight control modes.

7.0 INTEGRATION HARDWARE

Responsibilities for integration hardware are defined in the following paragraphs.

7.1 Space Shuttle Program-provided Hardware

The following unique hardware will be provided by the SSP. [List any unique items required, including cargo integration test equipment hardware, and identify the item's use. Examples are listed below:

a. Two spigot ducts (one flight) (one spare)

b. Three cable harnesses (one flight) (one spare) (one Cargo Integration Test Equipment (CITE))

c. Manipulator Foot Restraint (MFR)

d. If applicable, PGSC, CIP, and power and data cables]

7.2 Customer-provided Hardware

The following unique hardware will be provided by the customer. [List any unique items required including CITE hardware, and identify the item's use. Examples are listed below:

a. Two cable harnesses (one flight) (one CITE)

b. One power supply (ground)

c. Star Tracker (STRK) cover]

8.0 FLIGHT OPERATIONS

This section defines the flight design, flight activity planning, flightcrew and flight controller training, and flight operations support activities required for Space Shuttle/payload integration.

8.1 Flight Design

The SSP will be responsible for performing integrated flight design from liftoff through payload operation. Constraints for flight design are defined in section 4.0. The customer will provide flight design information in Annex 2.

8.2 Flight Activity Planning and Flight Operations Integration

8.2.1 Flight Plan.- The JSC will be responsible for all crew activity planning and will develop an integrated Space Shuttle/payload flight plan to support the flight. The plan will be developed using customer-supplied payload crew activity requirements. The customer will provide these requirements as part of Annex 2.

8.2.2 Data Submittal Requirements for Flight Operations Integration.- The customer is responsible for development and verification of the payload data submittals as specified in table 8-1. The customer is to provide this data to the Lead Payload Officer per the schedule in table 8-1. At the FOR, the customer will verify and sign a written statement that all necessary payload data is implemented into the flight documentation. Details on these data submittals are available in the Payload Operations Workbook, JSC-27508.

Table 8-1.- DATA SUBMITTAL REQUIREMENTS

Payload data	Submittal deadline	Flight document containing data
Customer Flight Control Team & Launch OPS Team/Customer Support	L-12 months	Joint Operations Interface Procedures (JOIPs)
Specify MCC/JSC POCC/CSR support facility requirements	L-12 months	Annex 5
Keyset/loop requirements	L-12 months	JOIP/POCC Annex
Flight rules & payload facility LCC	L-12 months	Flight Rules Annex
JOIP procedures	L-12 months	JOIP
Operations support timeline	L-12 months	OST

Nominal, backup, and contingency procedures	L-12 months	a. Payload Operations Checklist b. Payload Systems and Data Malfunction Procedures c. Remote Manipulator Assisted Checklist
Payload switch configuration requirements (Ascent/Entry/ Postlanding)	L-12 months	a. Ascent Switchlist b. Payload Operations Checklist
Malfunction procedures	L-12 months	Payload Systems and Data Malfunction Procedures
IFM procedures	L-12 months	Payload Systems and Data Malfunction Procedures
Hazardous, MOC, Prelaunch commands	L-12 months	a. JOIP b. OST c. Hazardous Command List in Payload Hazard Report
Formal letter listing all operational hazard controls jointly signed between payload organization and JSC Payload Operations	L-12 months	a. Payload Operations Checklist b. Remote Manipulator Assisted Checklist c. Flight Rules Annex
Unique payload data collection requirements	L-12 months	a. Flight Plan b. Flight Rules Annex
PGSC/microcomputer requirements & user's guide	L-12 months	N/A

[For customers who develop payload procedures as part of a standalone Payload Flight Data File (PFDF), use the following:

Customer-developed PFDF procedures will be developed in accordance with Crew Procedures Management Plan, Appendix F, Space Shuttle Flight Data File Preparation Standards, JSC 09958, or equivalent. Up to 8 hours of training on procedures writing is available from the SSP upon customer request.]

The customer is required to provide schematics/diagrams in fulfillment of the requirements of Annex 1 to support the following processes:

a. Cargo Systems Manuals

b. Flight Crew procedures development

c. Simulator Model Development

8.2.3 MCC/JSC PCC/CSR Support Facility Requirements.- [Identify any requirement for telemetry, command, JSC POCC Workstations (WSs), or voice loops in the MCC, JSC POCC, or MCC Customer Support Room (CSR). Detailed support requirements for the JSC MCC, JSC Payload Control Center (PCC), or the MCC CSR will be provided by the customer to the Lead Payload Officer per the schedule in table 8-1. Instructions for providing these requirements are contained in the Payload Operations Workbook, JSC-27508.]

8.3 Training

[If an annex is required, add the following: The detailed utilization requirements and planning schedule of these resources will be documented in Annex 7.]

8.3.1 Responsibilities.- The Mission Operations Directorate (MOD) has the overall responsibility for training of the flightcrew and flight controllers in all aspects of payloads systems and payload operations for the payload. The customer is responsible for training the flightcrew and flight controllers in all aspects of the experiments associated with the payload.

MOD and the payload customer will jointly identify the training objectives including critical training objectives that are required to be successfully completed by the flightcrew and support personnel. Critical payload training objectives are those that are required for mission safety and payload mission success.

MOD will develop a flight crew training flow which provides the appropriate number of sessions for the flightcrew.

The customer is responsible for providing the necessary lessons to sufficiently train the flightcrew to support their operational roles and responsibilities directly associated with operating the payload experiment and/or experiment software that is provided by the customer.

The customer will provide details for payload systems operations as required to satisfy the training objectives for the flightcrew and flight controllers.

The customer is responsible for providing payload specific training for the payload support personnel residing in the JSC PCC or the payload remote POCC.

[If the customer plans to supply a Payload Specialist (PS)(s) for the flight, add the following statement: The MOD will provide training for the payload prime and backup PSs as a nonstandard service to the customer. MOD will provide full mission preparation training to the primary PS and will accommodate one backup PS to the fullest extent possible at the discretion of the mission commander. This service will include training for Orbiter habitability, crew systems (communications, lighting, and Flight Data File (FDF) familiarization), operations and safety. The details of this training will be found in Annex 7; the Payload Specialist Flight Preparation Plan, JSC 23194; and Payload Specialist Operations and Integration Plan, JSC 19936.]

During the COFR process, MOD will certify that the flightcrew and flight controllers have been trained and are ready to support flight of this payload. The payload customer will certify that they have provided the required information and training for proper operation of the payload.

8.3.2 Schedule.- The customer should be prepared to define their payload training requirements (e.g., lesson sequence, lesson content, and facility requirements) to the SSP no later than L-8 months.

All payload procedures and training hardware/software shall be ready to begin flightcrew training no later than L-6 months.

All customer-provided training, or customer-required training, must be completed no later than L-13 weeks.

8.3.3 Familiarization Training.- The customer shall provide a payload familiarization briefing at JSC to the flight crewmembers, flight controllers, support personnel, and instructors. This briefing will be conducted according to guidelines established in the Payload Familiarization Briefing Guidelines, SFOC FL2121.

The customer will provide a payload familiarization briefing at the launch site when the hardware arrives. Topics shall include (but not be limited to):

a. Safety hazards which may be encountered during processing

b. Payload-to-Space Shuttle interface testing

c. Special requirements (e.g., cleanliness) of the payload

8.3.4 Simulations.- The customer is encouraged and may be required to support Joint Integrated Simulations (JISs) at JSC when their payload timelines are exercised.

For each flight, MOD convenes a JIS Working Group (JISWG) composed of members of the payload training team, the simulation supervisor, and representatives from the manifested payloads. This JISWG establishes JIS training goals and objectives and is the basis for detailed plans, scripts, and scenarios developed for the JISs.

The payload customer will provide a representative who is familiar with the technical details of the payload and the payload interfaces with the Orbiter and who can assist with the implementation of the payload training requirements, agreements, and who can support JISs and the pre-JIS scripting process.

MOD will provide generic MCC facility training for customer representatives resident in the MCC during a mission. This training will be conducted by the use of workbooks and hands-on training for each representative.

The Shuttle Mission Simulator (SMS) will model payload Payload Data Interleaver (PDI) downlinked telemetry data only to the extent of providing bit sync and lock which will allow on-board and ground data handling systems to indicate data lock. The payload customer will provide any payload simulators required to train payload flight controllers in their respective POCCs.

The customer will provide the necessary information to MOD if any payload telemetry data is required to be simulated to meet flightcrew or flight controller training objectives. The customer will provide moments and products of inertia of any object deployed.

[If the customer requires use of a remote POCC, add the following statement: The customer will participate in JISs to exercise joint operating procedures and payload malfunction/contingency operations and planning. The customer will support these simulations by providing a flight configured POCC, flight POCC operators, and management support personnel in the MCC.]

MOD will determine to what extent and fidelity the SMS will model the payload and its interfaces with the Orbiter. The customer will provide this information either in Annex 1 or directly to MOD. Due dates for submittal of this information will be

determined by the amount of time required by MOD to develop the SMS model.

[If the payload requires usage of the PGSC for operation but does not interact with a General Payload Model (GPM), add the following statement: The PGSC training hardware and the PGSC-compatible connecting cable will be supplied by the SSP for training use in the SMS. The customer will supply the payload or payload emulator. [If the customer requires instructor/payload interaction during training, include the following: The SSP will supply the compatible cabling from the PGSC to the CIP and from the CIP to the instructor station for connection to the payload or emulator. The customer or the customer's designated representative will provide a training instructor at the SMS for interactive payload training lessons.] All training software will be supplied by the customer.]

[If the payload requires usage of the PGSC/CIP combination for operational control and must interact with a GPM, add the following statement: The PGSC training hardware, the CIP in the SMS, and the compatible cable to connect the PGSC to the CIP will be supplied by the SSP for use during training. Any PGSC training software will be supplied by the customer; GPM software will be provided by the SSP. This training interface will be defined in the reference PGSC Training Guide, which will be supplied by the SSP.]

[If the payload requires usage of the RMS and typical RMS payload handling techniques have not been previously validated and the SSP determines that technique development requires an RMS trainer, add the following statement: A mockup of the payload for techniques/procedures development and crew training in the Manipulator Development Facility (MDF) shall be provided by the (customer/SSP, as a nonstandard service to the customer).] Training for rendezvous/proximity operations or RMS retrieval will be provided by the SSP as a nonstandard service to the customer.]

[If the payload requires a scheduled or unscheduled EVA, add the following statement: A mockup of the payload for use in the Sonny Carter Training Facility Neutral Buoyancy Lab for development of EVA techniques/procedures and flightcrew training will be provided by the (customer/SSP, as a nonstandard service to the customer]. Mockup high fidelity is required only in the EVA crewmember worksite(s). All payload-related EVA crew training will be provided by the SSP as a nonstandard service to the customer.]

[If the customer uses the PGSC, use the following words: The payload customer will provide a PGSC compatible emulator that

will allow the flightcrew to exercise payload operating procedures that are performed using the PGSC. Depending upon crew payload training objectives, the customer may provide training software that can be integrated with the PGSC training load which would allow the crew to accomplish the same training objectives as would be with a payload emulator.]

8.3.5 Unique Training.- [If the SSP determine that a Payload Prelaunch Simulation (PPS) is required, add the following: the SSP requires that the customer participate in a Payload Prelaunch Simulation (PPS) to exercise the launch commitment decision process established for the mission. The PPS will be scheduled in conjunction with the mission Terminal Countdown Demonstration Test (TCDT) which occurs after the Orbiter's arrival at the launch pad. Planning for the PPS will be developed during one of the JISWG meetings. The PPS procedures will be incorporated into the JIS procedures document.]

The customer is required to provide schematics/diagrams to support the following processes:

a. Simulator model development (as applicable)

b. Crew and flight controller training

Specific diagram/schematic requirements and delivery dates will be defined in the PIP and/or Annex 1.

8.4 Flight Operations Control

8.4.1 Responsibility.- The SSP will be responsible for integration of flight operations.

8.4.2 Mission Decision Planning.- The customer is required to support a preflight decision process to define, to the maximum extent possible, responses to off-nominal situations that may be encountered in a real-time environment during both the launch countdown and flight. The customer will identify alternate plans or courses of action which include the following:

a. GO/NO-GO criteria for specific flight phases (launch, activation, etc.)

b. Alternate mission plans

c. Priorities of payload operations

d. Inflight management of payload systems for off-nominal conditions

The purpose is to minimize the amount of required real-time rationalization required. Payload decision points and agreements, including necessary procedures, will be identified in the flight rules submittal to the Lead Payload Officer.

8.4.3 Operations Support.- The SSP flight control operations will be conducted from the MCC using the SN. The customer flight control operations and control will be conducted from (location and control center).

A payload program manager will be identified with authority to make real-time programmatic decisions. This representative will be available in the CSR, or in continuous voice communication with the CSR, via established voice loops (Program Manager, and Prime Operations (OPS) or OPS Support) in the launch countdown and flight phases leading up to and during key mission events. It is required that this customer representative be identified no later than the CIR and that the customer representative support the CIR, FOR rules reviews, LCC reviews, JISs, key pad tests, PRR, LRR, and FRR. When the Program Manager is remotely located from the CSR, a representative, with delegated authority in the event the Program Manager is not available, will be located in the CSR to provide onsite MCC coordination for payload decisions to the SSP, to assess flight progress, and to coordinate interfaces between the SSP and the customer.

Flight operations communications will be provided by the SSP. Use of an Air-to-Ground (A/G) voice loop by the customer, if required to support experiment operations, will be approved on a case-by-case basis. If approved, customer use of an A/G voice loop will be per procedures and constraints documented in the Flight Rules and JOIP’s.

8.5 Ground Command and Control - Mission Control Center and Payload Operations Control Center Interface

During the mission, the (payload name) will be controlled from the (name) POCC located at (specific location). The payload identification code is (assigned by JSC) (decimal) and the payload acronym is (assigned by JSC) (four characters). The POCC Source/Destination Codes (S/DCs) are documented in the POCC Annex, Annex 5.

In support of the command and control functions of the payload, the Space Shuttle shall be configured to provide data as defined in section 5.0 of the PIP.

The SSP shall support and manage payload data and communications as defined in premission plans and procedures. Payload requirements detailing MCC local capabilities for use in the JSC PCC and MCC data, voice, television routing to remote POCC interfaces will be documented in Annex 5. These capabilities are defined in NSTS 21063-POC-CAP. The procedural use of these capabilities will be defined in the JOIP document.

The customer is required to support MCC/POCC interface testing of command and data capabilities.

Table 8-2.- CUSTOMER REQUIREMENTS CHECKLIST - JSC CUSTOMER NONSTANDARD SERVICES

PCD reference section	
10.0	Nonstandard Services [List each required service individually.] a. MCC/Remote POCC Interface Nonstandard Services b. JSC POCC/MCC Nonstandard Services Note: Each nonstandard service, including SSP-provided voice and data circuits, must be defined in sufficient detail for evaluation, implementation, and costing.

9.0 LAUNCH AND LANDING SITE OVERVIEW

Payload-unique activities and an overview of L&L site activities are presented in this section. Overall SSP policy and requirements are shown in NSTS 07700, Volume XIV, Appendix 5. Ground processing details and customer requested ground support (both nominal and contingency) are documented in Annex 8, by the Launch Site Support Manager (LSSM), according to the schedule shown in section 15.0.

Specific payload requirements will be documented in Annex 8, the Time Critical Ground Handling Requirements (TGHR) table, or the

OMRSD. In support of Annex 8 development, the customer participates in ground operations working group meetings that further define the payload L&L requirements and plan for the payload's implementation. The customer also makes input to and supports the review schedule for SSP development of L&L operational procedures. All customer Technical Operating Procedures (TOPs) will be submitted no later than 55 days before use to the LSSM for KSC review/approval.

During the launch site processing of the payload, the SSP will conduct an inspection of the payload for sharp edges/corners/surfaces or protrusions which may damage a crewmember's EVA suit or associated equipment. This inspection will be coordinated with the customer and corrective actions will be taken by the customer or customer's representatives. Hazards not correctable will be identified and documented.

The SSP will take required photographs of the payload before and after installation in the Orbiter, including closeout photographs to support ground operations, FDF development, flightcrew, and flight controller training, and for possible inflight contingencies. Photographic activities will be scheduled and coordinated with the customer.

Training or certification of training will be required for customer personnel performing certain payload ground processing activities. Health reports or physical examinations will also be required for certain operations. Typical activities having these requirements are unescorted access to designated areas, crane operations, payload fueling, use of specified KSC systems, and deployment to non-Continental United States (CONUS) landing sites. Details will be documented in Annex 8.

The customer's management will establish work-time policies and rules that meet realistic human factors, personnel safety, and quality assurance goals. The purpose of this policy is to minimize the probability of mishaps caused by personnel in critical positions working excessive hours during operations at KSC. Certification of compliance is required in some instances. Details will be documented in Annex 8.

9.1 Customer Processing

Upon arrival at the launch site, payload hardware is delivered to an assigned area (provided as a nonstandard service for non-NASA payloads) for postshipment customer inspection, functional checkout, and preparation for the next phase of integration.

Typically the customer is responsible for the preintegration activities and utilizes payload-provided GSE.

After these activities are completed, the payload is transferred to KSC control to begin the ground integration process.

9.2 Payload Integration

[Note: Not applicable if KSC does not perform payload assembly or pre-Orbiter-installation testing.] Payload integration begins in the (TBD) facility. Once this activity begins, all operations and testing are scheduled, performed, and controlled by L&L personnel and supported by the customer.

The customer is responsible for providing/funding a second set of payload-unique equipment and/or mission integration hardware as defined in section 7.0, whenever an overlapping requirement for the use of this equipment is identified for concurrent payload integration and Orbiter integration. For example, one set might be installed in the simulated Orbiter test equipment in a payload integration facility; while the other set is installed in the Orbiter at the OPF for flight.

Any payload-peculiar task (e.g., test, servicing) to be performed in the PCR/Orbiter will be reviewed by KSC to determine whether it must be simulated or demonstrated prior to being attempted in the Orbiter. The simulation or demonstration may be at the customer's facility or the launch site as appropriate. When the task involves a fit check with the Orbiter, the requirement will be specified in the PIP. Tests and payload servicing activities that are required in CITE and/or the Orbiter will be documented in the OMRSD.

[If SSP-provided payload carrier is used, add the following: Preparation of SSP-provided payload carrier is begun by L&L personnel prior to the completion of preintegration activities. The ground integration process begins with the integration of the payload with the payload carrier (as a nonstandard service for non-NASA payloads).]

Throughout the payload integration process, newly mated or re-established interfaces are verified. As agreed in Annex 8, space will be provided for the customer to monitor payload parameters using payload-provided GSE.

The SSP will provide telemetry verification via a payload Data Flow Verification Test (DFVT) from the MCC to the POCC. This

test will utilize an Orbiter simulator (CITE) or Orbiter telemetry obtained during the first payload/CITE/Orbiter IVT. The DFVT requirements will be documented in Annex 5. The SSP will only provide an end-to-end test (nonstandard service) for a POCC with a command uplink via the Space Shuttle.

Agreed-upon nonstandard services to be performed in the (TBD) for this payload: [List as required.]

Once testing is completed, standard payload servicing is performed. The payload is then installed in the environmentally-conditioned payload canister for transport to the Orbiter for installation.

9.3 Orbiter Integration

During up-mission processing, flight kits and any unique payload equipment are installed into the Orbiter in the OPF prior to payload installation. These interfaces and all other Orbiter interfaces to be used by a payload are verified by the SSP prior to payload installation.

[If the payload will be installed in the OPF, add the following: The payload arrives at the OPF in the payload canister, is removed from the canister, and is installed into the Orbiter. Before the PLBDs are closed, the payload-to-Orbiter interfaces will be verified and closeout procedures will be completed. Agreed-upon servicing will be scheduled on a noninterference basis up until PLBD closure for OPF rollout, the last time that payload access is expected before liftoff. The details of interface verification and closeout requirements will be documented in the OMRSD.

The Orbiter is towed to the VAB for integration with the other Space Shuttle elements and transported to the pad for launch.]

[If the payload is to be installed on the pad, add the following: Prior to the Orbiter's arrival at the launch pad, the payload canister is hoisted into position and the payload(s) extracted from the canister by the Payload Ground Handling Mechanism (PGHM) in the PCR. With the PGHM in the rollback position, and prior to the Orbiter arrival at the pad the payload will be accessible on a noninterference basis. After the Mobile Launcher Platform (MLP) is hard-down on the pad, the PCR is moved into position and the payload(s) inserted into the Orbiter's payload bay. Before the PLBDs are closed, the payload-to-Orbiter interfaces are verified and closeout procedures completed. Agreed-upon

servicing can be scheduled on a noninterference basis up until PLBD closure for Orbiter hypergol servicing, which normally occurs at L-19 days, the last time that payload access is expected before liftoff. The payload-to-Orbiter test and service requirements will be documented in the OMRSD.]

[Use, with either choice:

Agreed-upon payload nonstandard services to be performed are: [List as required.]]

9.4 Late Payload Operations and Scrub Turnaround Operations

The payloads in the payload bay will be in final liftoff configuration at PLBD closure for flight. At this time, the payload will be capable of sustaining this configuration without physical access in the event of weather/equipment holds and launch scrubs for a minimum accumulated time of 120 hours following the first planned liftoff. [If there are late payload installation requirements, so state.] The details of these requirements will be documented in the OMRSD.

9.5 Postlanding

9.5.1 Landing Processing.- A conditioned GSE purge will be provided to the payload bay approximately 30 minutes after safety assessment completion. If landing occurs at an abort site, an emergency site, or the White Sands Space Harbor (WSSH), payload bay purge will not be available.

9.5.2 Postmission Payload Removal.- After the Orbiter has been returned to the OPF, the payload and/or ASE are removed from the payload bay and transported to the appropriate area for deintegration and return to the customer. Details of the return of payload/equipment to the customer are contained in Annex 8. Payload removal and return to the VPF/O&C is normally completed 7 days after the Orbiter arrives at the OPF. If the Orbiter lands at the SLF, it is towed to the OPF within 8 hours of landing. If the Orbiter lands at EAFB, it will undergo approximately 6 days of ferry flight preparation followed by a ferry flight from EAFB to KSC (1 to 10 days, weather dependent) on top of the Shuttle Carrier Aircraft (SCA). If the Orbiter lands at an abort site, an emergency site, or the WSSH, the ferry flight preparation will take approximately 6 to 8 weeks.

9.5.3 Ferry Flight Operations.- The payload will be compatible with ferry flight operations. Reference ICD 2-19001 for payload bay ferry flight environment.

9.6 Space Shuttle Program-provided Transportation of Oversize Payloads

[If the Payload Environmental Transportation System is required, insert the following paragraph:

The SSP will provide Payload Environmental Transportation System (PETS) transport of the payload as a nonstandard service in accordance with the schedule indicated in section 15.0.]

9.7 Contingency Shuttle Rollback

The payload shall comply with the contingency rollback from the pad to the VAB requirements of NSTS 07700, Volume XIV, Appendix 5. Specific requirements and interfaces are in ICD-19001. Payload-unique rollback requirements shall be specified by the customer in Annex 8.

10.0 SAFETY

10.1 General

[For customers without prior safety review experience, or if requested by the customer, add the following: Prior to the first phase safety review, the SSP shall provide an initial contact safety briefing to explain the safety review process and documentation.]

The customer is responsible for ensuring that all payloads, ASE, and GSE, including interfaces and operations, are safe. Payload, ASE, and GSE design and operations must comply with the safety requirements defined herein. The JSC Payload Safety Review Panel (PSRP) will assess the payload design and flight operations; the KSC Ground Safety Review Panel (GSRP) will assess the GSE design and ground operations. The responsibility of these two panels is to:

a. Assure that the payload organization’s interpretation of safety requirements is consistent with SSP-payload safety policy.

b. Conduct safety reviews as appropriate during the development of the payload, associated GSE, and related operations.

c. Evaluate hazard analyses and Noncompliance Reports (NCRs).

d. Negotiate the resolution of safety issues involving design and operation to ensure compliance with applicable safety requirements.

e. Assess payload design features that have been implemented for controlling identified hazards and the verification approach that confirms intended system performance.

Payload compliance with the safety requirements is assessed by the SSP through up to four phases of flight and ground safety reviews (Phases O, I, II, III) and safety certification. Successful completion of these safety reviews and of the safety certifications by the customer will result in approval by the SSP for ground processing and flight.

In order to preclude hazardous operations, full disclosure of all operating parameters, including but not limited to pressures, temperatures, and voltages and power, will be required. In addition the customer will provide full disclosure of the contents of all substances including proprietary material used in or produced by any payload or experiment. These disclosures will be made to the safety review panel in the normal submittal of payload hazard reports.

10.2 Payload Design and Flight Operations Requirements

The payload design, including interfaces and operations, will comply with the requirements of NSTS 1700.7B. The payload and Airborne Support Equipment (ASE) shall meet these requirements at the launch/landing sites and during flight operations, orbital operations, and ferry flights.

All interaction/interface safety analyses will be performed by the customer for the payload interfaces with the Orbiter. In this analysis, failures identified in Shuttle Orbiter Failure Modes and Fault Tolerances for Interface Services, NSTS 16979, and the flight operations will be assessed by the customer. The analysis will define assumptions made by the customer with respect to Orbiter services and operations associated with hazardous payload functions. The analysis will identify potential payload failures which could propagate to the Orbiter

and exceed the design criteria in Shuttle/Orbiter/(payload or carrier) ICD(s) (no.('s)).

During real-time SSP operations, the SSP has final safety responsibilities. Payload organizations have the responsibility to support the SSP reporting changes in the payload safety status and providing expert advice on safety matters affecting the payload or its operation. [If applicable, add the following: The PS is responsible for reporting payload safety status changes to the Space Shuttle commander.]. The customer is responsible for reporting payload safety status changes to the payload officer.

10.3 Ground Support Equipment Design and Ground Operations Requirements

Payload, ASE, and GSE designs, including interfaces and operations, will comply with the requirements of NSTS 1700.7B and 45 SPW HB S-100/KHB 1700.7, for launch site processing and postlanding operations including abort, contingency, and emergency landings. Other launch/landing site safety requirements may be applicable, depending upon assessment by the SSP of payload, ASE, and GSE operations.

Changes to GSE design and ground operations must be approved by the Launch Site Safety Office (LSSO) and KSC safety panel prior to use of the GSE or procedure.

Hazardous and nonhazardous TOPs will be submitted to the LSSM for Launch Site Safety Office (LSSO) review. Hazardous TOPs must be approved by LSSO no later than 10 days before first use.

All lifting and hoisting operations shall comply with Occupational Safety and Health Administration (OSHA) Safety and Health Standards 29 CFR 1910.180 (h) (3) (vi), 29 CFR 1910.180 (h) (4) (ii), and other applicable sections regarding personnel working under suspended loads.

10.4 Safety Review Requirements

Implementation of the safety requirements of NSTS 1700.7B and 45 SPW HB S-100/KHB 1700.7 will be accomplished in accordance with Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station, NSTS/ISS 13830. Safety documentation will be provided by the customer to the appropriate SSP organization for each safety review: JSC for flight design/operations; KSC for ground

design/operations. The safety review meeting will be scheduled approximately 45 days after receipt of an acceptable data submittal. Flight design and operations safety reviews will be coordinated/scheduled by the JSC Safety Office; ground design and operations safety reviews will be coordinated by the KSC LSSM.

Flight and ground Phase III Safety Reviews, including closure of ground safety verification, and ground safety certification must be completed 30 days prior to payload, ASE, and GSE delivery to the launch site. The customer will be required to identify any open verification status items from the flight Phase III Safety Review, as reported in the Payload Flight Safety Verification Tracking Log, and provide rationale for acceptance of this condition prior to commencement of ground processing. Flight safety certification must be completed 10 days prior to the FRR.

For hazardous operations and functions identified in the safety review process, the customer shall provide detailed end-to-end schematics and diagrams of the respective electrical and mechanical systems and interfaces, including any software-driven interfaces. These schematics and drawings should be consistent with the data input to Annex 1.

When changes to the design or operations of the payload/GSE are required subsequent to Phase III, the customer shall assess those changes for possible safety implications, including their effect on all interfaces. The assessment shall be forwarded to the JSC and/or KSC safety panel for review and approval. The assessment shall include the reason for the change and the safety impact, if any. New or revised hazard reports and support data shall be prepared when applicable and also submitted for approval. The need for a delta Phase III Safety Review will be determined by hazard potential involved. Satisfactory completion of all this activity is mandatory prior to launch.

All verification activities including post-Phase III safety review operations will be reported to the SSP Payload Safety Review Panel by procedure numbers, location where performed, and date as described in NSTS 13830.

In conjunction with the FOR, the payload configuration (including systems and procedures) will be reviewed by the SSP with customer participation to highlight safety concerns and resulting operations decisions. In support of this review, the customer will provide the Lead Payload Officer and the JSC SSP Payload Safety Review Panel with any additional safety-related data which may impact flight operations decisions.

10.5 Safety-Critical Mechanical System Requirements

A mechanical system is considered safety critical if its failure to function or premature function will lead to a critical or catastrophic hazard as defined in NSTS 1700.7B. Supplemental mechanical system safety requirements for payloads are provided in Interpretation of NSTS/ISS Payload Safety Requirements, NSTS/ISS 18798. These are the minimum requirements, along with NSTS 1700.7B, to which the customer shall develop their hardware. Safety design guidelines for critical mechanical systems are provided in Assemblies, Moving Mechanical for Space and Launch Vehicle, General Specification, MIL-A-83577. These guidelines should be used in conjunction with the safety requirements to ensure mechanical systems safety. The payload organizations shall present to the SSP Mechanical Systems Working Group (MSWG) a safety-critical mechanical systems verification plan per the requirements defined in NSTS 14046.

10.6 Hazardous Materials in the Crew Compartment

For all hardware to be carried inside the crew compartment or any habitable volume, the customer is responsible for certifying that controls of hazardous material are consistent with the methods/designs approved by the SSP Payload Safety Review Panel. The JSC Toxicologist will develop and manage the Hazardous Materials Summary Table (HMST) from the customer-supplied list as required for the SSP review. The customer will verify that (1) materials that are planned to be loaded are listed on the HMST, and (2) the materials loaded are on the approved planned loading list. Following the Flight Safety Phase III Review, the JSC Toxicologist will provide the customer with the preliminary HMST. The customer will return the HMST with the signed Verification 1 form which represents the final loading plan. Following SSP approval, corrections will be incorporated into the final HMST at L-2 months and provided to the customer. Since loading will occur at various times, the customer will return Verification 2 forms and the as-loaded HMST when material loading actually occurs. Review and concurrence of the as-loaded list by the JSC Toxicologist will constitute the as-loaded list of materials for use by the flight team. Between Verification 1 and Verification 2, the SSP policy is to limit changes to the HMST to only allow deletions and/or reductions of concentration of the materials. The requirements and process are documented in JSC 27472, Requirements for Submission of Test Sample Materials for Shuttle Payload Safety Evaluations.

11.0 INTERFACE VERIFICATION AND TESTING

The customer is responsible for verifying compatibility with the interfaces and environments specified in this PIP and applicable ICDs. The interface verification requirements and planning will be negotiated and concurred with the SSP and customer.

All payload-to-Orbiter interface verification requirements are to be identified and submitted by the customer in the OMRSD in accordance with the schedule in section 15.0 and the requirements specified in NSTS 14046. Interfaces that cannot be verified prior to flight shall also be documented in the OMRSD with supporting rationale.

The utilization of CITE for payload testing shall be mutually agreed to on a case-by-case basis by the SSP and the customer and documented in this PIP and Annex 8.

When Orbiter software is utilized by the payload, the applicable mission phase software (latest version) will be used to support interface testing.

All payload-peculiar tasks (e.g., tests, servicing) to be completed before installation in the Orbiter will be done prior to CITE testing. When CITE testing is not required, these tasks will be completed prior to transport to the Orbiter location. Exceptions must be approved by the SSP and documented in Annex 8. Interface verification tests will be conducted in the Orbiter by the SSP. These tests will verify all payload-to-Orbiter interfaces.

12.0 POSTFLIGHT DATA REQUIREMENTS

The SSP is responsible for Space Shuttle system monitoring and anomaly resolution. In the event of a Space Shuttle anomaly which would influence the execution of payload objectives, SSP will supply the Space Shuttle data as available to the customer for evaluation.

In the event of a payload anomaly, Space Shuttle data may be required for evaluation of the payload problem.

[If the payload requires postflight Orbiter ancillary data, add the following statement: Orbiter ancillary data will be provided only during real-time mission operations to (location). A

calibration tape for these parameters will be provided to the customer prior to the flight.]

The Orbiter ancillary data is a fixed data base and is defined in NSTS 21063-POC-CAP and, if required, will be noted in table 8-2 telemetry.

Postflight data listed below will be provided. [Mark as appropriate]

	Reqd	N/R	Remarks
a. Closed Circuit Television (CCTV)			
b. Photography			
c. On-orbit Postflight Attitude Trajectory History (PATH)			
d. Voice cassettes			
e. SSP Anomaly Report/ Analysis			

Note: Detailed listing of CCTV and photographic requirements will be defined in the column labeled "Remarks" (i.e., number of copies of photographic prints, transparencies, etc.).

13.0 SUMMARY OF NONSTANDARD AND CUSTOMER-FUNDED SERVICES

This section of the PIP identifies and sets forth all services to be performed by the SSP for the customer that are currently identified as nonstandard or customer-funded services. Except for additional nonstandard SSP services identified in the future [Note: For reimbursable payloads, insert: in accordance with the launch service agreement], all other services to be provided by the SSP for the customer are standard services.

A summary of nonstandard services identified herein to be provided and priced to the customer for payload integration and operations follows:

[Note: When assembling the list of nonstandard services, all ground processing-related nonstandard services will be

individually listed under the one main title, Launch and Landing Site Support.]

[Example:

1. Reference section 6.1 - The SSP will conduct the (no.) structural coupled dynamic loads analysis cycle for the customer as a nonstandard service. The loads analysis will be accomplished using the customer-provided spacecraft mathematical models. The results will be provided to the customer (if specified in section 6.1).

2. Etc.]

Prior to initiation of individual nonstandard service(s), the performing SSP organization and the customer will jointly scope tasks, and the performing SSP organization will establish the estimate of governmental costs, and provide it to the customer. The SSP will not initiate nonstandard service(s) until funding is authorized and customer approval of the requirement is received.

14.0 PAYLOAD INTEGRATION PLAN ANNEXES/DATA SUBMITTALS

As identified in other sections of this PIP, the following annexes/data submittals are required from the customer in the SSP standard format. [Include those annexes defined in the body of the PIP.]

Annex 1 - Payload Data Package

Annex 2 - Flight Planning

Table 8-1 - Data Submittal

Annex 4 - Command and Data

Annex 5 - Payload Operations Control Center (POCC), Volume II

ICA - Interface Control Annex

Annex 7 - Training (if required)

Annex 8 - Launch Site Support Plan

15.0 SCHEDULE

The attached schedule provides a summary of various technical areas requiring data exchange and/or products in support of Space Shuttle/payload integration activities. The schedule is provided in Appendix E.

16.0 APPLICABLE DOCUMENTS

The following documents are applicable to the extent stated herein:

a. CFR 1214.7, The Authority of the Space Shuttle Commander

b. CFR 1910, OSHA Safety and Health Standards

c. FED-STD-209E, Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones

d. JSC 14686, Criteria/Guidelines for Payload Thermal Math Models for Integration Analysis*

e. JSC 19936, Payload Specialist Operations and Integration Plan*

f. JSC 23194, Payload Specialist Flight Preparation Plan*

g. JSC 27472, Requirements for Submission of Test Sample Materials Data for Shuttle Payload Safety Evaluations*

h. JSC 27508, Payload Operations Workbook*

i. KCI-HB-5340.1, Payload Facility Contamination Control Implementation Plan*

j. KHB 8040.4, Payloads Configuration Management Handbook*

k. K-STSM-14.1, Launch Site Accommodations Handbook for Payloads*

l. K-STSM-14.2.1, KSC Payload Facility Contamination Control Requirements/Plan*

m. KVT-PL-0025, Shuttle Facility/Orbiter Contamination Control Plan*

n. MIL-A-83577, Assemblies, Moving Mechanical, for Space and Launch Vehicles, General Specification*

o. NPD 8710.3, NASA Policy for Limiting Orbital Debris Generation

p. NSTS 07700, Volume IV, Program Definition and Requirements, Space Shuttle Configuration Management Requirements*

q. NSTS 07700, Volume VIII, Space Shuttle Operations*

r. NSTS 07700, Volume XIV, Space Shuttle System Payload Accommodations, including Attachment 1 (ICD 2-19001) and Appendices 1-10*

s. NSTS 08171, Operations and Maintenance Requirements and Specifications Document (OMRSD)*

t. NSTS 08242, Limitations for Nonflight Materials and Equipment Used in and Around the Space Shuttle Orbiter Vehicles*

u. NSTS 16007, Shuttle Launch Commit Criteria*

v. NSTS 1700.7B, Safety Policy and Requirements for Payloads Using the Space Transportation System*

w. NSTS/ISS 13830, Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station*

x. NSTS 14046, Payload Verification Requirements*

y. NSTS 16979, Shuttle Orbiter Failure Modes and Fault Tolerances for Interface Services*

z. NSTS/ISS 18798, Interpretations of NSTS/ISS Payload Safety Requirements*

aa. NSTS 19943, Command Requirements and Guidelines for NSTS Customers*

bb. NSTS 21000-IDD-486, Shuttle/Payload Interface Definition Document for PGSC*

cc. NSTS 21000-IDD-MDK, Middeck Interface Definition Document*

dd. NSTS 21063-POC-CAP, POCC Capabilities Document Payload Support Capabilities Description: MCC, JSC POCC, Remote POCC Interface*

ee. NSTS 21288, Required Data/Guidelines for Payload/Shuttle EMC Analysis*

ff. (OSHA) Safety and Health Standards 29 CFR 1910.180

gg. NSTS 37329, Structural Integration Analyses Responsibility Definition for Space Shuttle Vehicle and Cargo Element Developers

hh. SFOC FL2121 Payload Familiarization Briefing Guidelines*

ii. SPW HB S-100/KHB 1700.7, Space Transportation System Payload Ground Safety Handbook*

*Current issue includes all future changes and revisions.

APPENDIX A

TO-BE-RESOLVED ITEMS

TBR No. 1 Subject: (reference section XX)

[Text of issue explaining Space Shuttle Program (SSP) and customer positions and any course of action identified to resolve.]

TBR No. 2

TBR No. 3

APPENDIX B

TO-BE-DETERMINED ITEMS

APPENDIX C

ACRONYMS AND ABBREVIATIONS

ACS	Attitude Control System
AFD	Aft Flight Deck
ASE	Airborne Support Equipment
ATO	Abort to Orbit
BTU	Bus Terminal Unit
c.g.	center of gravity
CCR	Cargo Compatibility Review
CCTV	Closed Circuit Television
CDR	Critical Design Review
CIP	Computer Interface Panel
CIR	Cargo Integration Review
CITE	Cargo Integration Test Equipment
CMT	Cargo Management Team
COAS	Critical Optical Alignment Sight
COFR	Certification of Flight Readiness
CONUS	Continental United States
CR	Change Request
CSR	Customer Support Room
D&C	Display and Control
DAP	Digital Auto Pilot
deg/sec	degrees per sec
E	East
EAFB	Edwards Air Force Base
EMC	Electromagnetic Compatibility
EOM	End of Mission
EVA	Extravehicular Activity
EFGF	Electrical Flight Grapple Fixture
F	Fahrenheit
FCS	Flight Control System
FDF	Flight Data File
FES	Flash Evaporator System
FOIG	Flight Operations Integration Group
FOR	Flight Operations Review
FRR	Flight Readiness Review
ft-c	foot-candles

G.m.t.	Greenwich mean time
GHz	Gigahertz
GLS	Ground Launch Sequencer
GN&C	Guidance, Navigation, and Control
GOR	Ground Operations Review
GPC	General Purpose Computer
GPM	General Payload Model
GSE	Ground Support Equipment
HEPA	High Efficiency Particle Air
HMST	Hazardous Materials Summary Table
HPF	Hazardous Processing Facility
Hz	Hertz (cycles per second)
I/F	Interface
ICA	Interface Control Annex
ICD	Interface Control Document
IFM	Inflight Maintenance
IMU	Inertial Measurement Unit
IPT	Integrated Product Team
IRB	Institutional Review Board
IVT	Interface Verification Test
JEA	Joint Endeavor Agreement
JIS	Joint Integrated Simulations
JISWG	Joint Integrated Simulation Working Group
JOIP	Joint Operations Integration Procedures
JOIP	Joint Operations Interface Procedure
JSC	Lyndon B. Johnson Space Center
kbps	kilobits per second
kg	kilograms
km	kilometers
KSC	John F. Kennedy Space Center
Ku-band	15.25 to 17.25 GHz
kWh/day	kilowatt hours per day
L-	Launch Minus
lb/sec	pounds per second
L&L	Launch and Landing
LCC	Launch Commit Criteria
LRR	Launch Readiness Review
LSA	Launch Services Agreement
LSSM	Launch Site Support Manager
LSSO	Launch Site Safety Office
LVLH	Local Vertical/Local Horizontal

m	meter(s)
m/sec	meters per second
MCC	Mission Control Center
MDF	Manipulator Development Facility
MFR	Manipulator Foot Restraint
mg	milligram
MLP	Mobile Launcher Platform
MMT	Mission Management Team
MOA	Memorandum of Agreement
MOC	Mission Operations Computer
MOD	Mission Operations Directorate
MSWG	Mechanical Systems Working Group
n. mi.	nautical miles
N/A	Not Applicable
N/R	Not Required
NASA	National Aeronautics and Space Administration
no.	number
NVR	Nonvolatile Residue
O&C	Operations and Checkout
OPF	Orbiter Processing Facility
OSHA	Occupational Safety and Health Administration
OST	Operations Support Timeline
PATH	Postflight Attitude Trajectory History
PCR	Payload Changeout Room
PDCR	Payload Director’s Countdown Review
PDI	Payload Data Interleaver
PDR	Preliminary Design Review
PETS	Payload Environmental Transportation System
PF	Postflight
PF-1	Payload Forward
PGHM	Payload Ground Handling Mechanism
PGSC	Payload and General Support Computer
PI	Payload Interrogator
PIM	Payload Integration Manager
PIP	Payload Integration Plan
PLBD	Payload Bay Door
POCC	Payload Operations Control Center
PPF	Payload Parameter Frame
ppm	parts per million
PPS	Payload Prelaunch Simulation
PRCS	Primary Reaction Control System

PRLA	Payload Retention Latch System
PRR	Payload Readiness Review
PS	Payload Specialist
PSP	Payload Signal Processor
PSR	Payload Safety Review
PTC	Passive Thermal Control
PVLR	Pre-Verification Loads Review
rev/hr	revolutions per hour
RAAN	Right Ascension of Ascending Node
RCS	Reaction Control System
RF	Radio Frequency
RMS	Remote Manipulator System
RSGF	Rigidize Sensing Grapple Fixture
RSS	Root Sum Squared
RTS	Remote Tracking Station
S/DC	Source/Destination Code
SES	Shuttle Engineering simulator
SIP	Standard Integration Plan
SLF	Shuttle Landing Facility
SMS	Shuttle Mission Simulator
SSP	Space Shuttle Program
SSRP	System Safety Review Panel
STRK	Star Tracker
SSV	Space Shuttle Vehicle
SWG	Structure Working Group
TBD	To Be Determined
TBR	To Be Resolved
TBS	To Be Supplied
TCDT	Terminal Countdown Demonstration Test
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TGHR	Time Critical Ground Handling Requirements
TOP	Technical Operating Procedures
TV	Television
V/m	Volts per meter
VAB	Vehicle Assembly Building
VADAR	Verification Analysis Data Acceptability Review
VAR	Verification Acceptance Review
VLA	Verification Loads Analysis
VPF	Vertical Processing Facility
VRCS	Vernier Reaction Control System
W	West, Watt
WETF	Weightless Environment Training Facility
WSSH	White Sands Space Harbor
+ZLV	Payload bay facing Earth

APPENDIX D

DEFINITIONS

Definitions applicable for this PIP are as follows:

a. Pre-PLBD closure - Period of time from payload insertion into the payload bay to PLBD closure for flight.

b. Post-PLBD closure - Period of time from PLBD closure for flight to Solid Rocket Booster (SRB) ignition.

c. Ascent - The period of time from SRB ignition through the establishment of a stable orbit (typically post-Orbital Maneuvering System (OMS) second burn).

d. Payload preoperation - The period of time from just after the establishment of a stable orbit until the start of payload operation sequence.

e. Payload operation - The period of time from the start of the operation sequence until the completion of the postoperation reconfiguration.

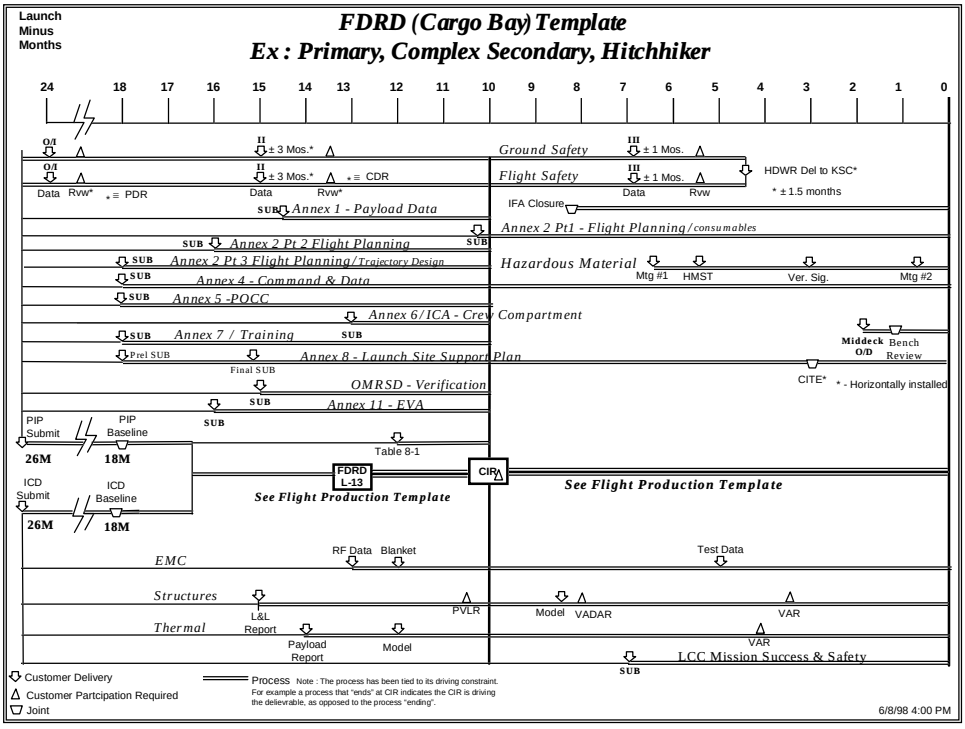
f. Payload postoperation - The period of time from the completion of the postoperation reconfiguration to start of preparation for entry.

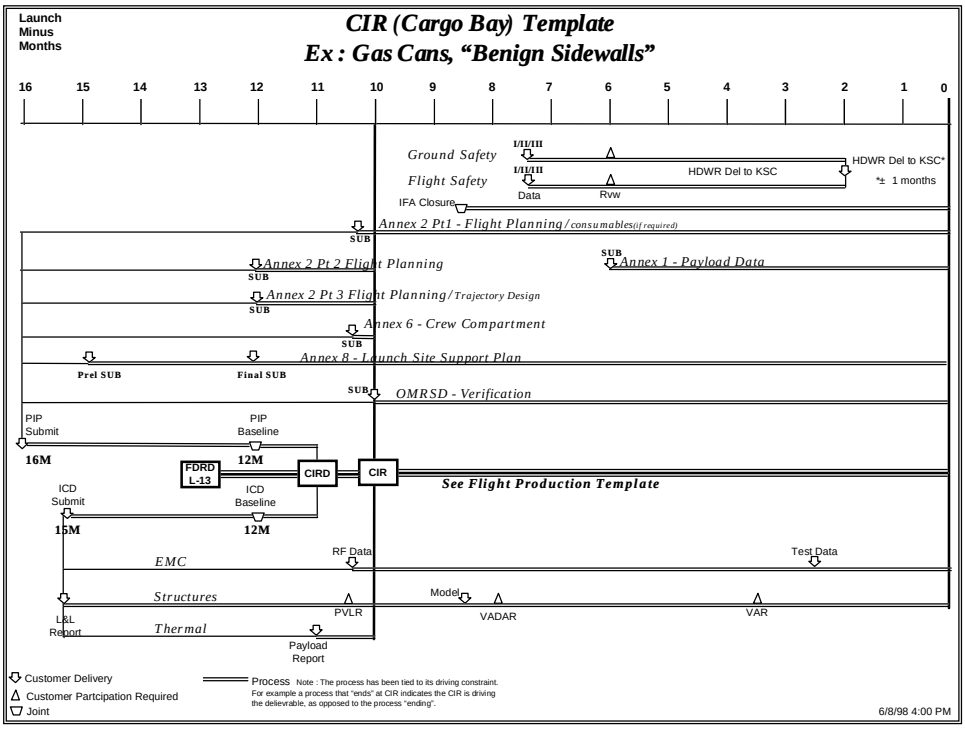
g. Descent - The period of time from start of preparation for entry through wheel stop.

h. Postflight - The period of time from wheel stop to the removal of the payload from the Orbiter.

APPENDIX E

SCHEDULES





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