NSTS 21000-SIP-DRP
Revision D

Shuttle/Payload Standard Integration Plan for Deployable/Retrievable-Type Payloads

Space Shuttle Program Office

June 2002

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

DESCRIPTION OF CHANGES TO

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR DEPLOYABLE/RETRIEVABLE-TYPE PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
--	Baseline issue/B21000-SIP-DRP-1	05/12/88	All
1	Update Table of Contents, sections 4.2.1.2, 4.2.3.1, 6.4, 9.0, 9.2, 11.0, and 16.0; add section 10.5/ B21000-SIP-DRP-2A;-3;-4; -06A;-08;-09;-10	04/21/89	ix,9,09A, 10,34,34A, 47,48,48A, 54,54A,55, 55A,59
	Pagination errata	05/30/89	description of changes page,viii, ix,x
2	Update sections 4.2.4.4, 6.4, and 16.0/B21000-SIP-DRP-012;-13	05/19/89	21,34,59
3	Update table of contents, sections 6.7, 9.0, and globally change NHB 1700.7 to NSTS 1700.7/ B21000-SIP-DRP-05;-014; -018	10/10/89	viii,3,22, 24,36,47, 52,53,58

DESCRIPTION OF CHANGES (CONTINUED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

DEPLOYABLE/RETRIEVABLE-TYPE PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
4	Update table of contents, sections 2.1.2, 4.1.2, 4.2.3, 4.2.3.1, 4.2.3.4, 4.2.11, 7.1; add sections 4.2.11.1, 4.2.11.2, 4.2.11.3, 4.2.11.4, 4.2.11.5, and 8.2.1; editorial errata to include page 21 of change 2/B21000-SIP-DRP -017;-019;-020;-022;-023; -024;-025	11/01/89	vii,viii,3, 3A,7,10,12, 14,24,24A, 29,31,37, 37A,38,41, 41A
5	Update table of contents, sections 4.2.3.4, 4.2.9, 6.1, 6.3, 8.4.3, 9.0; add section 4.2.3.6/ B21000-SIP-DRP-021;-026; -028;-029;-030;-031	12/05/89	vii,14,17, 17A,24,32, 33,34,41A, 42,47
6	Update sections 4.2.7, 5.4, 8.3, 8.5, 10.1 and 16.0; pagination errata to include page 21/ B21000-SIP-DRP-015;-027; -033A;-035;-036	01/30/90	21,23,23A, 27,39,39A, 42,52,52A, 59
7	Update and correct table of contents, sections 2.2, 2.3, 5.4, 5.5, 5.6, 5.8 and 9.5.1, and tables 5-1, 5-2, and 5-3; add sections 2.5, 2.5.1, and 2.5.2/B21000-DIP-DRP -034;-037;-038A;-042;-044	03/28/90	vi,vii,viii, ix,x,4,4A, 26,27,28,29, 30,31,50

DESCRIPTION OF CHANGES (CONTINUED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

DEPLOYABLE/RETRIEVABLE-TYPE PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
8	Update table of contents, sections 4.2.3, 4.2.3.3, 4.2.3.4, 4.2.4.4, 7.1, and 9.5.2/B21000-SIP-DRP-040;-041;-045;-048	07/03/90	viii,10,10A, 12,13,14,15, 22,37,37A, 50
9	Update sections 4.2.11.1, 8.3, and 8.5, and tables 8-1a, 8-1b, and 8-1c/ B21000-DIP-DRP-046;-053; -056	10/10/90	24,40,40A, 42,43,44,45 46
10	Update table of contents, sections 2.1.2, 4.2.1.2, 4.2.4, 4.2.4.1, and 4.2.4.3 and figure 15-1; add new sections 2.5 and 9.7; 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-DRP-032;-043C; -058;-059;-060;-061;-062	05/28/91	vi,ix,3,4A, 4B,9,18,19, 21,51,51A, 62,63,64,65, 66
11	Update the foreword and section 2.1.1/B21000-SIP-DRP-057	12/07/90	iii,2,3
12	Update section 4.2.3.3/ B21000-SIP-DRP-063	07/02/91	12,13,13A
13	Update section 4.2.1.2/ B21000-SIP-DRP-065	08/13/91	9,9A
14	Update section 4.1.1/ B21000-SIP-DRP-067	11/19/91	7

DESCRIPTION OF CHANGES (CONTINUED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

DEPLOYABLE/RETRIEVABLE-TYPE PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
REV A	General revision/B21000-SIP-DRP-068	11/04/91	All
1	Update sections 4.2.1.1 and 9.4/B21000-SIP-DRP -066A	01/31/92	9,10,59
	Errata to add second paragraph inadvertently left out of section 4.1.1 in revision A		8,8A
2	Update sections 9.3 and 9.5.1/B21000-SIP-DRP-069	03/06/92	59,60
3	Update section 4.2.8/ B21000-SIP-DRP-070	03/10/92	27
4	Update table of contents and section 4.2.1/ B21000-SIP-DRP-071A	06/23/92	vii,9,9A
5	Update sections 6.4, 9.0, and 10.3 and appendix C/ B21000-SIP-DRP-054A;-072	08/18/92	40,56,62, 63,C-1
6	Update sections 6.3 and 6.6 and figure 15-1/ B21000-SIP-DRP-064A;-073	11/17/92	39,42,42A, 74,75
7	Update section 4.2.1.1/ B21000-SIP-DRP-052	07/16/90	10

DESCRIPTION OF CHANGES (CONTINUED)

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DEPLOYABLE/RETRIEVABLE-TYPE PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
8	Update sections 9.0 and 10.3/ B21000-SIP-DRP-077	05/25/93	56,56A,62, 63
9	Update section 6.3 and figure 15-1/B21000-SIP-DRP-075A;-079	08/10/93	39,72,73,74, 75,76
10	Update section 4.2.1.2/B21000-SIP-DRP-078A	12/17/93	10,11,12
11	Update sections 4.2.11.5, 4.2.4.3, and 10.1 and figure 15-1/B21000-SIP-DRP-081A; -083A;-084	01/21/94	24,29,29A, 61,61A,72, 73,74,75,76
12	Add in new section 4.2.3.7/ B21000-SIP-DRP-082	01/25/94	21A
13	Update figure 15-1/B21000-SIP-DRP-086	02/08/94	73
14	Update table of contents, section 4.2.10 to 4.2.11 and add new 4.2.10 and renumber remaining sections and update 6.3 and figure 15-1/B21000-SIP-DRP-085;-087	03/08/94	vii,28,29, 39,74,75
15	Add new section 4.2.3.8/B21000-SIP-DRP-088	04/12/94	21A
16	Update section 10.4/B21000-SIP-DRP-090B	06/13/94	63

DESCRIPTION OF CHANGES (CONTINUED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

DEPLOYABLE/RETRIEVABLE-TYPE PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
17	Update sections 6.1 and 15.0; and appendix C/B21000-SIP-DRP-089	07/06/94	37,38,38A, 75,76,C-4, C-5
18	Update table of contents, section 4.1.2 and add new section 4.2.3.9/B21000-SIP-DRP-093;-095	10/25/94	vii,9,9A,21A
19	Update table of contents, sections 9.0, 10.3, and 16.0, and appendix C; add new section 10.6/B21000-SIP-DRP-094;-096	12/06/94	x,56,62,64, 64A,69,C-3
20	Update table of contents and section 13.0 and delete figure 13-1/B21000-SIP-DRP-098	07/11/95	x,66,67,70, 71
21	Update figure 15-1/B21000-SIP-DRP-0100	08/08/95	72
22	Update section 4.1.1/B21000-SIP-DRP-099	08/22/95	8
REV B	Pagination revision to include updates to sections 2.6.1 and 2.6.2/B21000-SIP-DRP-101	09/08/95	All
1	Update sections 8.2.2 and 8.3/B21000-SIP-DRP-097	10/24/95	47,47A,50, 50A
2	Update section 4.1.2/B21000-SIP-DRP-0102	12/05/95	10,10A

DESCRIPTION OF CHANGES (CONCLUDED)

SHUTTLE/PAYLOAD STANDARD INTEGRATION PLAN FOR

DEPLOYABLE/RETRIEVABLE-TYPE PAYLOADS

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
3	Update sections 2.1.1 and 16.0/B21000-SIP-DRP-0104	01/19/96	2,71
4	Update table of contents and sections 5.3 and 16.0/B21000-SIP-DRP-0105	04/30/96	vii,32,32A, 73
5	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, 16.0, appendix A, and figure 15-1; add new section 8.2.4 and new table 8-1/B21000-SIP-DRP-0108;-0109	09/03/96	viii,ix,6, 16,32A,35, 36,37,46,47, 47A,47B,50, 51,70,73,75, C-3
REV C	General revision/B21000-SIP-DRP-0112C;-0113	10/14/98	All
1	Update appendix E/B21000-SIP-DRP-0115	10/17/00	E-1,E-2
REV D	General revision/B21000-SIP-DRP-0116A	06/06/02	All
1	Update section 5.4/B21000-SIP-DRP-0117	09/17/02	34
2	Update sections 5.5 and 16.0/B21000-SIP-DRP-0118	10/10/02	37,66

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

PAYLOAD INTEGRATION PLAN

SPACE SHUTTLE PROGRAM

AND

(PAYLOAD NAME)

Prepared by

(NAME)
PAYLOAD INTEGRATION MANAGER

APPROVED:

Date	Date
MANAGER, SPACE SHUTTLE PROGRAM	(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 a deployable and/or retrievable-type 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 customer-funded services.

Signature of this document constitutes technical agreement on tasks to be performed, including standard and customer-funded 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 customer-funded services. Upon completion of negotiations and signature of the (Launch Services Agreement (LSA) or amendments thereto, Joint Endeavor Agreement (JEA), or Memorandum of Agreement (MOA), etc.) by the NASA and (payload organization) or provision of required funding under a separate letter agreement, the standard and customer-funded 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 customer-funded services. This can be accommodated by amendment of the PIP and launch service agreement.

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

Issues which are yet To Be Resolved (and designated "TBR" in this PIP) and additional details are 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 customer-funded services.

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

Further understanding of SSP operations and the associated customer-unique requirements may indicate the need for addition or deletion of customer-funded 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 []. All instructional information will be removed for the flight-specific PIPs.]

Issues which are yet To Be Resolved (and designated "TBR" in this PIP) and additional details are documented in appendix A. Information not at issue but which is yet To Be Determined is designated "TBD" and documented in appendix B.

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1.0 INTRODUCTION

The National Aeronautics and Space Administration (NASA) and the (payload organization) plan to launch and (deploy, retrieve, service) in orbit a (payload name), using the Space Shuttle. [Select the applicable sentence:

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

b. The (payload) is a primary payload requiring a dedicated flight.]

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

[Note: If retrieval or servicing of this payload is planned, add the following statement: Retrieval or servicing of this payload is planned for (this/this, and subsequent) flight(s).]

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 Payload Integration Plan (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 (deployment/retrieval/service) 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. Herein, the term payload will include the spacecraft and/or its Airborne Support Equipment (ASE), carriers, upper stage, etc.

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 Appendix E. 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, and appropriate Interface Control Documents (ICDs).

The PIP, PIP annexes, 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]. When the customer requests new requirements in a PIP annex or an ICD, these requirements will be subject to SSP approval. 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 the Launch Site Support Plan Annex, Annex 8, which will be maintained by the KSC in accordance with Payloads Configuration Management Handbook, KHB 8040.4.

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

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

b. [If applicable, insert: LSA, JEA, MOA, etc.]

c. Payload Integration Plan

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

e. Annexes 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) - if required

e. Payload Readiness Review (PRR)

f. Launch Readiness Review (LRR)

g. Flight Readiness Review (FRR)

h. Integrated Product Team (IPT) - periodically

i. Payload Director’s 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 before deployment or after retrieval, 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. 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 flight spacecraft, ASE, 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 buildup and checkout 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 the performance of appropriate payload systems tests per NSTS 14046, Payload Verification Requirements, and to include Government Furnished Equipment (GFE) hardware, if applicable. The customer is responsible for identifying to the SSP all payload problems which may affect SSP milestones, as identified in Appendix E, 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. This payload commander will be an experienced Mission Specialist (MS) and will be assigned at approximately Launch minus 22 (L-22) months. Prior to the assignment of the Space Shuttle commander, the payload commander will have full authority to represent the Flight Crew Operations Directorate and the Astronaut Office on all matters specific to the assigned flight. 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. After assignment of a Space Shuttle commander, the payload commander will continue to retain payload responsibility throughout the preflight preparation and flight. 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 or designated representative. 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, identifying modules and type of propulsion and/or control systems used. Figures showing (launch, free-flying, retrieval, etc.) 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)) at KSC where the SSP performs Interface Verification Tests (IVTs) to verify Orbiter/payload compatibility. With completion of this testing and the PRR, the payload is transported to the Orbiter integration facility (Orbiter Processing Facility (OPF)/Payload Changeout Room (PCR)). The payload is installed into the Orbiter, interfaces are verified, and the payload is prepared for launch.

RESERVED FOR FIGURE 3-1

TITLE: THE PAYLOAD CONFIGURATIONS

3.2.2 Flight Operations.- [For deploy operations, include when and how the payload predeployment activities will be initiated, when and how the payload will be deployed from the payload bay, when and how the payload appendages will be deployed, and when and how the payload will be controlled after separation from the Space Shuttle.]

[For retrieval operations, include when the Space Shuttle will be launched to the retrieval orbit, when and how the payload will achieve the retrieval orbit, what payload attitude will be at retrieval, and when and how the payload appendages will be stowed or removed.]

[For service operations, include when and how the payload is berthed to the Space Shuttle, what Space Shuttle interface connections are required, how the payload appendages are managed, when and how the payload will be serviced, and the amount of time required to service the payload.]

[For redeploy operations, include when and how the payload predeployment activities will be initiated, when and how the payload is redeployed from the Space Shuttle, when and how the payload appendages will be redeployed, and when and how the payload will be controlled after separation from the Space Shuttle.]

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 will be deployed from a near-circular orbit with an inclination of (no.), in an Earth fixed coordinate system, plus or minus 0.1 degree. The maximum deployment altitude is (no.) n. mi. ((no.) km). The minimum deployment 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.]

The payload will be retrieved from a near-circular orbit with an inclination of (no.), in an Earth fixed coordinate system, plus mi. ((no.) km). The minimum retrieval altitude is (no.) n. mi. ((no.) km).

Note: The standard inclination for all deployments and retrievals is 28.5 degrees. The standard altitude for deployment is 160 plus or minus 3 n. mi. The standard retrieval altitude for deployment and retrieval during the same mission is 160 plus or minus 3 n. mi. The standard retrieval altitude for payloads with active rendezvous capability is defined by the rendezvous control box described in System Description and Design Data - Mission Planning and Flight Design, NSTS 07700, Volume XIV, Appendix 6.

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. The control volume for Orbiter stowage defines the maximum Middeck Locker Equivalents (MLEs) for Orbiter middeck stowage items. A payload may not exceed its control parameters without SSP approval.

Payload control weights in number (no.) of pounds (lb), kilograms ((kg)):

Table 4-1.- CONTROL WEIGHTS

	Launch	Landing
Cargo Bay:		
Spacecraft/Upper Stage*	(no.), ((no.))	(no.), ((no.))
ASE	(no.), ((no.))	(no.), ((no.))
Unique integration hardware	(no.), ((no.))	(no.), ((no.))
Subtotal	(no.), ((no.))	(no.), ((no.))
Crew Compartment:		
Payload	(no.), ((no.))	(no.), ((no.))
Unique integration hardware	(no.), ((no.))	(no.), ((no.))
Subtotal	(no.), ((no.))	(no.), ((no.))
Total	(no.), ((no.))	(no.), ((no.))

*All other items will remain onboard with the Orbiter after the spacecraft is deployed or retrieved.

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 Interface Control Annex (ICA).

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

The customer shall provide 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 the ICA. The payload customer will provide the flight hardware to JSC no later than 6 weeks prior to launch to support final stowage for flight and the Flight Crew Bench Review.

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 customers 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 Appendix E.

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 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 and mission-success 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 for 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 for 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:

a. Deployment - The payload launch window requirements shall be defined by the right ascension limits for both ascending and descending node payload deployments. The customer will provide right ascension limits for a 60-day period starting with the opening of the launch window for the initial launch date.

   Payload constraints must allow launch windows of approximately 3-hours duration for any given calendar date, one near noon Greenwich mean time (G.m.t.) and the other near midnight G.m.t. The 3-hour launch windows are time-of-year dependent and are defined in Flight Planning Annex, Annex 2.

b. For rendezvous with active payloads - The rendezvous launch window is defined by a phase window, controlled by the payload, and a plane window controlled by the SSP. The phase window shall include or coincide with the plane window. Payload phasing capability shall provide at least a 60-minute, continuous phase window on each day of the launch period. Space Shuttle yaw steering capability shall provide a plane window of up to 60 minutes on each day of the launch period.

c. For other constraints - [Define any unique constraints that control launch window or launch period duration.]

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

4.2.3 On-orbit.- [Include any general payload constraints affecting operations through deployment/retrieval.] The Payload Bay Doors (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 * hour.

[*Select the appropriate number:

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

[Select the applicable section, a or b:

a. Ejectable payloads - [Include any general payload constraints affecting operations up to deployment or through reberth.]

b. Remote Manipulator System (RMS) payloads - RMS operations will not be scheduled prior to 3 hours after launch or later than 1 day prior to deorbit.]

The payload shall not exceed the criteria defining the maximum envelope for RMS payloads located within the payload bay.

During RMS operations, Orbiter attitude is nominally adjusted using the Vernier Reaction Control System (VRCS) per the guidelines established in System Description and Design Data - Payload Deployment and Retrieval System, NSTS 07700, Volume XIV, Appendix 8.

The SSP will determine mutually acceptable payload maneuvering sequences and payload positions, attitudes, and timelines which satisfy payload requirements within Orbiter operational and safety constraints.

RMS single joint procedures will be developed by the SSP for the (unberth/maneuver/deploy/retrieve/berth) sequences to meet the payload's primary objectives.

[Identify any payload contingency scenarios requiring supportive RMS procedures development.]

[Include any general payload constraints affecting RMS operations up to deployment or through reberth and after capture through berth, as applicable (e.g., clearances with other structure, unique visual cues, photo surveys, appendage operations, umbilical management, payload-induced forces, Extravehicular Activity (EVA) Support, etc.).]

Designated payload characteristics (used for generating RMS flight software constants) shall be submitted by the customer as part of Annex 1. Annex 4 includes parameters the customer may require for real-time monitoring to determine payload attitude vs. time, etc.

The payload will comply with the Payload Deployment and Retrieval System (PDRS) constraints and requirements as defined in NSTS 07700, Volume XIV, Appendix 8, and in Shuttle Orbiter/Cargo Standard Interfaces, NSTS 07700, Volume XIV, Attachment 1 (ICD 2-19001).

4.2.3.1 Thermal Environment: The payload design and operation shall be compatible with the following attitude conditions.

This section defines the thermal environment, attitude, and analysis requirements that the customer is responsible for to ensure mission compatibility. For mission planning considerations, payload-preferred attitude requirements and constraints are also addressed in this section.

All cargo elements will be designed to allow deep-space excursions that include a 35-minute Inertial Measurement Unit (IMU) alignment occurring approximately every 24 hours.

4.2.3.1.1 SSP Required Attitude Capability for Beta Angles Less Than or Equal to 60 Degrees: The SSP-required attitudes and durations are shown in table 4-2 for beta angles less than or equal to 60 degrees. The Orbiter will normally be oriented with the payload bay facing Earth (+ZLV).

The table also specifies the payload recovery times for these excursions, so that repeat of the required attitudes can be planned.]

Table 4-2.- SSP REQUIRED ATTITUDES
(Beta Angles less than or equal to 60 degrees)

Attitude	Required time	Payload recovery time at +ZLV to repeat attitude	Payload recovery time at +ZLV before deploy/retrieval
+Z Earth (SSP preferred)	Continuous	N/A	N/A
+Z Space	35 minutes every 24 hours	TBD	TBD
±XLV/±ZVV (Rendezvous)(1)	7 hours	TBD	TBD
+X Solar Inertial (End of Mission)	3 hours	TBD	TBD
-Z Solar Inertial (End of Mission)	12	TBD	TBD
PTC(2) (End of Mission, FOR 45° < |Beta| <60°)	12 hours	TBD	TBD

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

(2) Passive Thermal Control (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

4.2.3.1.2 SSP Required Attitude Capability For Beta Angles Greater than 60 Degrees: The SSP required attitudes and durations are shown in table 4-3 for beta angles greater than 60 degrees. The Orbiter may be nominally oriented in a PTC attitude.

Table 4-3.- SSP REQUIRED ATTITUDES
(Beta angles greater than 60 degrees)

Attitude	Required time	Payload recovery time at PTC to repeat attitude	Payload recovery time at PTC before payload deploy or retrieval
PTC (SSP preferred)	Continuous	N/A	N/A
+Z Local Vertical	Continuous	N/A	N/A
+Z Space	35 minutes every 24 hours	TBD	TBD
±XLV/±ZVV (Rendezvous)(1)	7 hours	TBD	TBD
-Z Solar Inertial (End of Mission)	12 hours	TBD	TBD
+X Solar Inertial (End of Mission)	3 hours	TBD	TBD

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

4.2.3.1.3 Payload Attitude Requirements: In addition to the minimum SSP attitude requirements, the payload/cargo element may specify in table 4-4 unique attitudes and durations that are required to accomplish the payload mission objectives. Payload attitudes that are constrained by beta angle should be specified here.

Table 4-4.- PAYLOAD ATTITUDE REQUIREMENTS

Attitude	Duration
(Payload to specify)	(Payload to specify)

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

4.2.3.1.4 Payload Attitude Capability: In order to ensure SSP operations will not violate payload constraints, the payload shall define their nonoperational capability for the +Z Solar Inertial (±ZSI), +Z Deep-space viewing (+Z Space), and Rendezvous (±XLV/±ZVV) attitudes as specified in table 4-5. The analysis to define the allowable times should be initialized with the applicable SSP or payload-preferred attitude steady-state conditions. The table also specifies the payload recovery times in the SSP/payload-preferred attitude for these attitudes, so that repeat of the required attitude can be planned.

Table 4-5.- PAYLOAD ATTITUDE CAPABILITY

Attitude	Beta angle less than or equal to 60 degrees		Beta angle greater than 60 degrees	
	Allowable time (to non-ops limit)	Recovery time in +ZLV to repeat attitude	Allowable time (to non-ops limit)	Recovery time in PTC to repeat attitude
+ZSI(1)	TBD	TBD	TBD	TBD
+Z Space(2)	TBD	TBD	TBD	TBD
±XLV/± ZVV	TBD	TBD	TBD	TBD

(1) SSP requires minimum time of 30 minutes if payload is manifested with a deployable payload

(2) SSP requires minimum time of 90 minutes if payload is manifested with a deployable payload

In the event of an anomaly, the Orbiter will observe the attitude constraints of table 4-5 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.

The ASE, remaining in the payload bay after deployment of the payload shall have thermal attitude capability equal to the Orbiter as defined in ICD 2-19001. However, this requirement shall not require an active cooling system.

If floodlight operation (reference 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 telemetry interface is discussed in sections 5.5 and 5.6 (if required). The antenna pointing and attitude requirements are TBD.

4.2.3.3 Deployment Requirements: The SSP shall provide one primary opportunity and one backup opportunity at least 1 flight day later. Planning for the primary opportunity shall incorporate all customer requirements and constraints that are consistent with Space Shuttle operations. Planning for the backup opportunity shall incorporate as many customer requirements as possible, provided such requirements are not inconsistent with those of the Space Shuttle or shared payloads.

a. Payloads with injection maneuvers - Deployment opportunities shall be planned approximately one-half orbit before injection. Injection shall occur at or near an orbital node over Earth longitude bands specified by the customer in Annex 2, Part III. Injection on launch day shall not occur before the sixth ascending node. In accordance with crew timeline constraints and the Right Ascension of Ascending Node (RAAN) data requirements of section 4.2.1.3, the bands for deploy missions requiring approximately 2 hours of preinjection payload activity on deploy day (e.g., upper stage type) are defined as follows (longitude bands measured west to east):

   1. For low (28.5 degree) inclination deploy missions

      (a) With RAAN data for an injection near an ascending node, the customer shall specify at least a 25-degree longitude band between 65 degrees E and 145 degrees W.

      (b) With RAAN data for an injection near a descending node, the customer shall specify at least a 25-degree longitude band between 115 degrees W and 35 degrees E.

2. For high (57 degree) inclination deploy missions

   (a) With RAAN data for an injection near an ascending node, the customer shall specify at least a 25-degree longitude band between 105 degrees E and 75 degrees W.

   (b) With RAAN data for an injection near a descending node, the customer shall specify at least a 25-degree longitude band between 75 degrees W and 105 degrees E.

   Note: Ascending injection between 105 degrees E and 135 degrees E or descending injection between 45 degrees W descending landing opportunities for End of Mission (EOM). Use of these ranges will preclude launch day injections.

3. For an option of deploying one orbit late, the customer shall specify at least a 50-degree longitude band within the appropriate range or ranges defined above.

4. For deployment missions requiring preinjection payload activity periods of other than 2 hours, the customer shall specify those unique criteria that define the location of payload deployment.

b. Payloads without injection maneuvers - [The customer shall specify those unique criteria that define the location of payload deployment.]

4.2.3.4 Space Shuttle/Payload Deployment Accuracy and Timing: [Select the applicable set of paragraphs, a or b:

a. Ejectable payloads - The Orbiter will be oriented to within 1 degree of the customer-specified inertial deployment attitude, referenced to the plane of the payload longeron/cradle interface. The SSP will deploy the payload within 2 seconds of the specified deployment time.

   Maximum angular rates of the Orbiter at the time of payload deployment shall not exceed 0.01 degrees/second in each axis. This accuracy is dependent upon all vernier thrusters being operable. Failure of a vernier thruster will cause the angular rate to be as great as 0.2 degrees/second in each axis.

The SSP shall compute the time of payload deployment based on designated equatorial crossings of the Shuttle orbital trajectory. During flight the orbital trajectory shall be updated as close to the time of a designated crossing as possible, given the constraints of tracking data, Orbiter data, and computational time.

If, for a given opportunity, predicted deployment parameters fall outside the limits specified in section 4.0, the payload will not be deployed at that opportunity and will be scheduled for deployment at the next planned opportunity.

b. RMS payload release (if applicable) - The payload release will be scheduled during the (day/night).

   [A night release must be negotiated with the SSP. Include any unique assessments which may be required.]

   Prior to release, Orbiter attitude will be adjusted as required using the VRCS to configure the Orbiter/RMS/payload system for release. A loss of VRCS will result in using the Primary Reaction Control System (PRCS) for attitude control.

   Then, the Orbiter enters a Digital Auto Pilot (DAP) free-drift period prior to release (typically between 15 and 120 seconds) to minimize the release errors due to RMS oscillations.

   The following prerelease stabilization errors are based on VRCS attitude control. The errors will be larger if PRCS attitude control adjustments are used prior to release. (A mission-specific assessment can be performed to determine the release error values using PRCS.)

   1. An attitude error of a total of 5.0 degrees Root Sum Squared (RSS) for all three axes between the payload and the (TBD inertial/Local Vertical Local Horizontal (LVLH)) reference frame.

   2. An angular rate error of 0.1 degrees/second RSS for all three axes between the payload and the (TBD inertial/LVLH) reference frame.

   The error values are based on the following contributing factors: frequency of IMU alignments, a tight vernier rate control DAP, grapple fixture interface frequencies, the free-drift time, and orbital altitude.

Additional errors can be introduced during end effector mechanical release and separation from the grapple fixture. A linear impulse of up to 1.5 pound-second can be applied to the grapple fixture in any direction.]

[Include any payload-unique release requirements.]

[For navigation accuracy, select the applicable set of paragraphs, a or b. These accuracies apply to either RMS or ejectable payload deployment.

a. (This nominal perturbation case is appropriate for many payloads which rely on the Orbiter's state vector at deployment.)

   The accuracy of the ground-determined state vector varies with orbit activity and is timeline dependent. The expected navigation uncertainties (3 sigma) for a nominal perturbation case are presented in table 4-6. The data assumes full Tracking and Data Relay Satellite (TDRS) coverage and a 2-hour 15-minute data gathering arc. Automatic vernier thruster attitude control is assumed and no Orbiter or payload vents, dumps, or purges, other than normal Flash Evaporator System (FES) operations are assumed between the start of the tracking arc and the critical event time (e.g., deployment or vector transfer). The accuracies are valid up to 3 hours after the end of the tracking arc for orbits of 110 n. mi. or higher and are available no earlier than 4 hours 30 minutes after liftoff.

   The nominal perturbation case assumes no more than one Orbiter attitude change maneuver (using either PRCS or VRCS) each revolution, no attitude maneuvers between the end of the tracking arc and 1 hour 30 minutes prior to the critical event time, and no multiple attitude maneuver sequences (such as landmark tracking) between the start of the tracking arc and the critical event time.

   Note: The nominal perturbation cases are not valid if any of the above assumptions are false.

Table 4-6.- ORBITER STATE VECTOR UNCERTAINTY FOR NOMINAL PERTURBATION CASE

Minimum perigee (n. mi.)	Position, feet (m) Radial	In-track	Cross-track	Velocity ft/sec (m/sec) Radial	In-track	Cross-track
110	3,600 (1,097)	18,500 (5,639)	4,000 (1,219)	22.1 (6.7)	3.3 (1.0)	4.0 (1.2)

b. (This minimum perturbation case is appropriate for some payloads which are provided a state vector transfer.) The accuracy of the ground-determined state vector varies with orbit activity and is timeline-dependent. The expected navigation uncertainties (3-sigma) for minimum perturbation cases are presented in table 4-7, for minimum perigees of 110 and 150 n. mi. The data assume full TDRS coverage and a 2-hour 15-minute data gathering arc. Automatic, vernier thruster attitude control is assumed and no Orbiter or payload vents, dumps, or purges, other than normal FES operations, are assumed between the start of the tracking arc and the critical event time (e.g., deployment or vector transfer). The accuracies are valid up to 3 hours after the end of the tracking arc and are available no earlier than 4 hours 30 minutes after liftoff.

   Note: The minimum perturbation case accuracies are not valid if any Orbiter attitude change maneuvers occur between the start of the tracking arc and the critical time event. The minimum perturbation case accuracies are not valid if any of the assumptions are false.

Table 4-7.- ORBITER STATE VECTOR UNCERTAINTY FOR MINIMUM PERTURBATION CASE

Minimum perigee (n. mi.)	Position, feet (m) Radial	In-track	Cross-track	Velocity, ft/sec (m/sec) Radial	In-track	Cross-track
150	800 (244)	5000 (1,524)	1,500 (457)	5.1 (1.6)	0.9 (0.3)	2.1 (0.6)
110	1,800 (549)	10,000 (3,048)	2,000 (610)	11.0 (3.4)	1.8 (0.5)	2.9 (0.9)

4.2.3.5 Space Shuttle/Payload Separation: The payload shall separate from the Orbiter at no less than 1 ft/sec (0.3 m/sec) (unless otherwise agreed) and the payload motor ignition shall not occur earlier than 45 minutes after deployment. During the payload deployment operations, the Orbiter attitude control will nominally be maintained by the VRCS. The VRCS (will/will not) be inhibited during deployment. Should the VRCS fail, the PRCS will be selected for attitude control. The PRCS will be inhibited prior to the payload deployment until (no.) seconds after deployment while the payload clears the payload bay. The payload

Attitude Control System (ACS) shall not be activated prior to a separation distance of (no.) feet ((no.) m).

The Orbiter separation maneuver will be designed to minimize Reaction Control System (RCS) plume impingement on the payload, consistent with achieving a safe separation distance.

The customer will be required to provide the SSP with the payload system separation data to allow the SSP to conduct an independent separation analysis at the time identified in the payload integration schedule.

4.2.3.6 Primary Reaction Control System Compatibility: The payload will be compatible with a PRCS mode of control for all required operations with the exception of short term payload activities or configuration change periods. The following specific conditions require payload design compatibility:

a. The payload will be compatible with PRCS closed loop auto attitude control (attitude hold and attitude maneuvers) for any configuration which is planned to be held for greater than a 2-hour duration (including docked or berthed configurations).

b. For short-term activities or configurations (maintained less than 2 hours), the payload must be compatible with both VRCS auto and, as a minimum, PRCS manual minimum impulse attitude control. Multiple activities or reconfigurations requiring manual minimum impulse attitude control are limited to a cumulative 2-hour period per crew work day.

c. During payload reconfiguration phases or operation of deploy system mechanisms, limited periods of Orbiter attitude free drift can be provided to meet payload requirements. The specific use of free-drift periods must be negotiated in the PIP. During such times, payload attitude constraints may not be guaranteed (i.e., communications or thermal) and onboard reconfiguration command capability may be necessary depending on the specific requirements. Allowable durations of attitude free drift are a function of Orbiter and comanifested payload constraints and must be analyzed on a flight-specific basis. For preliminary payload design and operations planning activities, times of up to 1 hour can be considered for dedicated missions.

d. In the event of failures which preclude attitude control, the payload must be compatible with the provisions of NSTS 1700.7.

4.2.3.7 Orbit Adjust Windows of Opportunity: The SSP desires two daylight landing opportunities at both the primary and alternate landing sites on the nominal EOM 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.

4.2.3.8 Primary End of Mission Landing Site Requirements: The primary 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.

4.2.3.9 FES and Water Dump Operations: [Specify operational constraints.]

4.2.4 Rendezvous Requirements.- [For payloads with active rendezvous capability only: Prior to the start of the flight design cycles, the customer shall specify a predicted delta-RAAN profile covering the period from the deployment (or rendezvous of the previous mission) until 90 days after the planned rendezvous. The delta-RAAN profile shall be supplied in Annex 2, Part III.]

To prepare for rendezvous, the payload must meet the energy, phase, plane, and eccentricity constraints of a control box designated by the SSP. Control box constraints are defined in NSTS 07700, Volume XIV, Appendix 6. The SSP shall specify a control box start-time with respect to launch time, which will specify the time at which all control box constraints must be met. The start-time shall remain fixed with respect to launch time.

4.2.4.1 Retrieval (or Revisit) Interval: For passive, retrievable payloads, the launch of a retrieval (or rendezvous) mission shall be planned to occur during a 90-day period beginning (no.) days (not less than 6 months) after the deployment (or previous rendezvous).

For deployment and retrieval during the same mission, the interval between planned deployment and retrieval shall be at least (no.) hour(s) and no greater than (no.) hour(s).

For payloads with active rendezvous capability, the launch of a retrieval (or rendezvous) mission shall be planned to occur during a 90-day period beginning (no.) days (not less than 6 months) after the deployment (or previous rendezvous). The SSP shall provide an initial and updated estimate of the launch date for the retrieval (or rendezvous), each of which shall fall within this 90-day period.

a. Preliminary Rendezvous Target - After deployment, the SSP will provide the customer with the actual RAAN, date, and time of the deployment, and preliminary predictions of the date and time of launch for the rendezvous being planned. The retrieval launch window will be defined such that no prelaunch planar adjustments are required by the customer's spacecraft.

   The customer shall provide the SSP with a planned RAAN profile after the customer's spacecraft is deployed. This profile shall predict the RAAN history of the payload from the date the profile is delivered until 90 days after the preliminary launch date.

b. [Use for active rendezvous payloads only: Updated Rendezvous Target - The SSP shall provide the customer with an updated prediction of the launch date and time, the Orbiter's argument of latitude at control box start-time, and an updated RAAN from the RAAN profile described above (Preliminary Rendezvous Target). These updates shall be provided at least 30 days prior to the updated launch date. The payload shall have the capability to adjust its phasing 360 degrees to accommodate the argument of latitude target.]

c. [Use for active rendezvous payloads only: Final Rendezvous Target - After the rendezvous launch, the customer will be provided with the following information:

1. A GO for descent

   The GO for descent will normally be provided 5 hours after launch.

2. Final targets

   At GO for descent, the SSP will specify a final target plane defined by inclination and RAAN, the Orbiter's semi-major axis at control box start-time, and the Orbiter's argument of latitude at control box start-time. The final target plane will incorporate two adjustments to the previous estimate. The first will be a RAAN adjustment, based on the nodal regression rate of the payload orbit at Space Shuttle launch. The second will be an adjustment to the target orbital plane of no more than 0.1 degree. The specified semi-major axis will include an adjustment of no more than one n. mi. to the requirement defined by the designated control box. The specified argument of latitude will be within 5 degrees of the previous estimate.

3. A control box start-time

   At GO for descent, a control box start-time will be provided in G.m.t. The control box start-time itself will be at least 40 hours after the GO for descent.]

4.2.4.2 Rendezvous Navigation: Navigation accuracy to support rendezvous and revisit operations requires Orbiter and target tracking data. As part of the rendezvous and retrieval services, the SSP will schedule C-band, S-band, RTS and/or TDRSS tracking, as appropriate, to satisfy the SSP tracking requirements for the Orbiter and target.

Target tracking begins 48 hours prior to launch if a launch targeting vector is required. No target maneuvering is permitted during this prelaunch tracking phase.

Critical target tracking begins 6 hours prior to an Orbiter rendezvous maneuver. No target maneuvering is permitted during this tracking phase.

Target tracking during noncritical phases is required for orbital maintenance and for evaluation of the target's ACS and drag characteristics.

An initial target state vector is required 2 hours prior to the time of the first tracking pass to initialize the orbit determination processor. [For active-rendezvous payloads, add the following: This vector shall be propagated to the control box start-time.] The customer provides the initial vector, as defined in the POCC Capabilities Description: MCC, JSC POCC, Remote POCC Interface, NSTS 21063-POC-CAP, for all other targets.

4.2.4.3 Rendezvous Operations: The payload will be tracked by Orbiter onboard navigation sensors. The payload will be compatible with the rendezvous radar passive mode, the Star Tracker, and the Crew Optical Alignment Sight (COAS).

a. Rendezvous radar - The payload must provide an effective radar cross section of 1.0 m to enable passive mode (skin track). Since the rendezvous radar operates at Ku-band frequency, the payload must be compatible with section 4.2.8.

b. Star Tracker (STRK) - The payload must provide visibility to the STRK in reflected sunlight (equivalent brightness of a third magnitude star) for a minimum of 30 minutes per orbit revolution out to a range of 250 n. mi.

c. Reflectors - The customer will install SSP-provided Stimsonite reflectors. The Stimsonite pattern and locations will be documented in the Shuttle Orbiter/(payload) ICD (no.).

d. Payload tracking - [For payload tracking by the customer, select paragraph 1 or 2 as appropriate:

    1. For active payloads - The customer is responsible for any payload tracking necessary for the phase adjustments to attain the orbital position required before Space Shuttle launch. The customer is also responsible for tracking to ensure its payload reaches the specified control box at the specified control box start-time.

    2. For passive payloads - The customer shall supply periodic updates of the payload state vector in either the Aries Mean-of-50 or the True-of-date rotating coordinate system, both defined in Coordinate Systems for the Space Shuttle Program, NASA TM-X-58153. From deployment until 2 months before a retrieval launch, the customer shall provide monthly updates. From 2 months before launch until 48 hours before launch, the customer shall provide weekly updates.]

4.2.4.4 Payload Configuration for RMS Retrieval:

a. Payload configuration for Orbiter approach and stationkeeping - The payload shall be in an attitude hold configuration when the Orbiter arrives on the +V bar.

The planned capture attitude shall align the payload approach axis with the +V bar and align the grapple fixture with the +H bar. The expected payload attitude at capture, relative to the Orbiter LVLH reference frame, shall be

(no.) degrees pitch
(no.) degrees yaw
(no.) degrees roll

If the actual attitude differs from this expected value by more than a total of 20 degrees (relative to the same reference frame), the payload may not be retrievable.

The payload shall be in the planned capture attitude when the Orbiter arrives on the +V bar. The payload shall remain in this capture attitude (no.) hours (must be at least 90 minutes) after the Orbiter arrives on the +V bar.

The payload must stow all appendages that would prohibit the Orbiter from establishing a stationkeeping position on the +V bar for capture.

The payload must be insensitive to contamination or structural damage due to Orbiter control jet plumes. The SSP shall attempt to minimize plume impingement on the payload to the extent compatible with the maneuvering requirements of capture.

b. Payload capture configuration - The expected payload rotational rate at capture, relative to an inertial or LVLH reference frame, will be (no.) degrees/second per axis. If the actual rotational rate is greater than plus or minus 0.1 degrees/second per axis, the payload may not be retrievable.

Payload ACSs will be operated within limits defined in NSTS 1700.7.

[Include any other general payload requirements affecting retrieval operations.]

4.2.4.5 Aborted Nominal Rendezvous: If a nominal revisit flight is aborted, the payload shall be able to survive at least 9 months after the previously planned revisit date.

4.2.5 Service Requirements.-

4.2.5.1 After Berthing: [Specify any payload-unique operations and constraints.]

4.2.6 Redeploy Requirements.- Same as 4.2.3.3, 4.2.3.4, 4.2.3.5 deployment requirements.

4.2.7 Photographic Coverage.- Photographic and/or Television (TV) coverage of the payload (deployment, retrieval, service, or redeploy) will be initiated by the SSP.

[Specify any unique photographic or TV coverage requirements.]

[If the payload is scheduled for repair or service, add the following statement: A complete set of payload photographs are required to be taken by the customer during payload assembly and buildup. This engineering photography should show all areas of the payload where repair or service may be required and shall include photography of EVA interface/tools.]

[If the payload is not designed for repair or service, add the following statement: A complete set of external photographs are required to be taken by the customer to adequately record the payload external configuration. These photographs should be retained by the customer and made available to JSC in the event of future contingency operations.]

4.2.8 Ku-band Control.- The payload can tolerate a maximum of (no.) volt per meter (V/m) at Ku-band.

For retrieval, the Ku-band system will operate in the radar mode. This mode has three radiation power levels which are selected as a function of distance from the Ku-band antenna to the payload. The payload (at a distance of 1 m) could be exposed to 350 V/m in the high power mode, 90 V/m in the medium power mode, and 22 V/m in the low power mode.

If the Ku-band system is operating in the comm mode, the radiation level is nearly the same as the radar high power mode. The payload could be exposed to 350 V/m, 350 V/m, and 4 V/m at 1 m, 10 m, and 100 m, respectively.

Payloads could also be exposed to radiation levels as high as 20 V/m from other payloads in the payload bay after berthing. Therefore, payloads which require retrieval must be able to sustain at least 20 V/m of Ku-band radiation during normal operations. A failure of the Ku-band radar system could expose a berthed payload to 285 V/m.

In all cases, the SSP reserves the right to operate the Ku-band system as required to obtain critical data for Space Shuttle anomaly resolution. Every attempt will be made to minimize the radiation power levels on the payload.

4.2.9 Extravehicular Activity Requirements.- [If payload EVA requirements exist, include the following information as appropriate.

(Number) 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].

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].

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 Annex, Annex 11.]

4.2.10 Orbital Debris.- The payload customer is responsible for implementing the requirements of NASA Policy Directive (NPD) 8710.3, NASA Policy for Limiting Orbital Debris Generation to limit and manage orbital debris. The SSP will provide support to the customer in response to NPD 8710.3 in those areas where integrated Shuttle/payload planning and/or operations could result in orbital debris.

4.2.11 Other Constraints.- [Include other required payload constraints.]

4.2.12 Operational Safety Constraints.-

4.2.12.1 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 1700.7, with contingency safing power as defined in section 5.4.

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

4.2.12.3 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.

4.2.12.4 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.

4.2.13 Associated Non-SSP Program Launch Vehicles.- When non-SSP vehicles are launched in conjunction with any of the payload/experiment tasks (cooperative launches), the payload must take responsibility to protect against collision. If the payload is aware of potential for placing a non-SSP launch vehicle in orbital conjunction (in the orbital path) with the Space Shuttle or International Space Station (ISS) orbiting vehicles, the payload organization must inform the SSP of these details. It is the payload organization’s responsibility to identify and initiate points of contact so that state vectors can be discussed between the SSP and/or International Space Station Program (ISSP) and the non-SSP vehicle’s launch site. The launch site is required to identify tentative launch schedule parameters and agree to not launch directly into the path of the oncoming Space Shuttle or the ISS.

[Add if required:
4.2.14 Lasers Pointed to Space

All payloads that shine lasers into space shall, as part of the integration process, obtain approval for operation from the SSP. The customer will provide the lasers physical properties for assessment.]

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 Shuttle Orbiter/(payload or carrier) ICD (no.). (Mission Phase Definitions included as Appendix D.)

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 Shuttle Orbiter/(payload or carrier name) ICD (no.).

5.2 Cable Interfaces

The payload will use one section of the standard Aft Flight Deck (AFD) and cargo harnesses in accordance with the mixed user allocations section of NSTS 07700, Volume XIV and ICD 2-19001.

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

5.3 Display and Control Interfaces

Display and Control (D&C) functions are accomplished using [select from 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 Payload and General Support Computer (PGSC) is used, add the following: The SSP will provide, if requested, the use of a PGSC to support in-flight payload operations.

The SSP will also provide a Computer Interface Panel (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 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-inch 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.]

Assignment of functions and nomenclature for the switch panel are to be defined in the 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 2-19001. 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 PLBD closure Pre	Prelaunch PLBD closure Post	Ascent	Payload (deployment/retrieval) Pre	Payload (deployment/retrieval) During	Payload (deployment/retrieval) Post	Descent	Post-flight
a.	Orbiter bus	(cont)W (peak)W	(cont)W (cont)W	(cont)W (peak)W	(cont)W (peak)W	(cont)W (peak)W	(cont)W (peak)W	(cont)W (peak)W	N/A
b.	Hardwire through T-0 umbilical*	(cont)W (peak)W	(cont)W (peak)W	N/A	N/A	N/A	N/A	N/A	N/A
c.	Safing**	N/A	N/A	N/A	(cont)W (peak)W	(cont)W (peak)W	(cont)W (peak)W	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.)

*From 30 minutes before launch until launch, the amount of current being transferred through the 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-760XD.]

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 nominal total energy shall not exceed TBD Kilowatt Hours (kWh)/day (worst case TBD kWh/day). Survival power for two contingency weather wave-off days shall not exceed TBD kWh.

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	Payload (deployment/retrieval)			Descent	Post-flight*
	Pre**	Post		Pre	During	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 (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 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 IVT or End-To-End Test

(Note: The following acronyms appear in the table:

BTU - Bus Terminal Unit
GPC - General Purpose Computer
I/F - Interface
MDM - Multiplexer/Demultiplexer
PF-1 - Payload Forward
PI - Payload Interrogator
PSP - Payload Signal Processor
RF - Radio Frequency)

Payload commanding will be constrained as follows:

a. Prelaunch - 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.

   Before PLBD closure for flight, all payload RF transmitters will be turned off.

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

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

Engineering characteristics of the above interfaces are defined in Shuttle Orbiter/(payload or carrier) ICD (no.). 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 NSTS 21063-POC-CAP. 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 NSTS 21063-POC-CAP.

5.6 Telemetry and Data Interfaces

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

Table 5-3.- TELEMETRY AND DATA INTERFACES

Power source	Prelaunch PLBD closure		Ascent	Payload (deployment/ retrieval)			Descent	Post-flight*
	Pre**	Post		Pre	During	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 (kbps) 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*

Table 5-3.- TELEMETRY AND DATA INTERFACES (Continued)

Power source	Prelaunch PLBD closure		Ascent	Payload (deployment/ retrieval)			Descent	Post-flight*
	Pre**	Post		Pre	During	Post		
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 ground		N/A	N/A		N/A		N/A	N/A
i. PGSC via CIP (RS422A)		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.

(Note: The following acronyms appear in the table:
BTU - Bus Terminal Unit
GPC - General Purpose Computer
MDM - Multiplexer/Demultiplexer
PDI - Payload Data Interleaver
PF-1 - Payload Forward
PI - Payload Interrogator
PLBD - Payload Bay Door
RF - Radio Frequency)

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 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.

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. For all hardware to be carried inside the crew cabin, the customer is responsible for verifying compatibility with the Orbiter as 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 Models and Forcing Functions 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 thermal, pressure, misalignment and manufacturing effects) do not exceed the constraints in ICD 2-19001 or the Shuttle Orbiter/payload ICD (no.).

All payload bay structural math model deliveries, analyses, and documentation content will be in accordance with Structural Integration Analyses Responsibility Definition for Space Shuttle Vehicle and Cargo Element Developers, NSTS 37329 and with the schedule in Appendix E.

The schedule for anticipated SSV Structural Math Model and Forcing Function updates will be provided to the customer. The SSP will provide upon request to the customer a package of one set of SSV structural design math models and forcing functions as a standard service. The customer is responsible for applying appropriate conservatism to the structural analysis results to account for anticipated payload and SSV structural math model 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 for payloads manifested on this mission 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 payload structural 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
Payload Preliminary Design Review (PDR)	Conceptual approach to verification a. Structural verification tests b. Math model verification
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 nonlinearities or nonstandard damping)
Two months prior to start of testing	Detailed Verification Testing Plans a. Strength structural testing b. Dynamic structural testing
Prior to 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-inch cargo bay thermal and dynamic envelope, whose dynamic or static deflection could be within 3 inches of the envelope, or are within 3 inches of any Orbiter protrusions into the envelope must be clearly identified in the Shuttle Orbiter/(payload) ICD (no.). 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 Payload Design Loads Report which will be provided to the SSP. The SSP can perform a design loads analysis in support of the customer’s design activity. 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 Shuttle Orbiter/payload ICD (no.). This loads report is required to support the SSP Cargo Compatibility Review (CCR), CIR, and Pre-Verification Loads Review (PVLR).

The SSP will perform a VLA as a standard service for the final flight manifest using final, test-verified math models provided by the customer. The PVLR will be conducted approximately 3 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 liftoff; 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 7.5 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 5.5 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 4.5 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 Shuttle Orbiter/(payload) ICD (no.).

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 landing configurations (including nominal, abort, and contingency) 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 constraints 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) will be documented in an SSP/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 Appendix E.

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 (EMI) environment and that the entire payload complies with the radiation requirements defined in ICD 2-19001. The specific characteristics of the payload 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 the SPP for review and evaluation. The RF Systems Data, the EMC Test Data, and Thermal Blanket Data shall be required 90 days, 60 days, and 60 days, respectively, prior to the CIR. The required data submittal dates shall be defined in the schedule in Appendix E. 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 outside the payload envelope incident on other cargo elements within the payload bay shall be limited to those levels specified in ICD 2-19001. These specified levels apply outside the control length limits.

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/.1 m2/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.

A payload bay liner will be installed and 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 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 dedicated sensitive payloads, use the following:

The payload is sensitive to contamination and requires cleaning of the payload bay. 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 integrated processing flow, accessible payload bay surfaces will be visually inspected from 2-4 feet with a minimum incident light level of 50 ft-c and cleaned as required.]

[For dedicated highly-sensitive payloads, use the following:

The payload is highly sensitive to contamination and requires cleaning of the payload bay. 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 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 mutually agreed upon 3 months prior to payload 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 the 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 Appendix E) 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 items' 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. The [specify type(s): Flight Releasable Grapple Fixture (FRGF), Rigidize Sensing Grapple Fixture (RSGF), Electrical Flight Grapple Fixture (EFGF), or other] shall be (leased/purchased) from the SSP by the customer for the payload handling, deployment, and/or retrieval.]

e. If applicable, PGSC, CIP, and power and data cables

[If the payload is RMS deployed, add the following: All grapple fixtures are designed to be EVA releasable. Because of the criticality classification of the grapple fixtures, unauthorized operation of the EVA release bolts is strictly forbidden. Preflight inspection of grapple fixture configuration will be performed by the SSP, and any indication of EVA release bolt operation will result in loss of flight certification.]

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 items' use. Examples are listed below:

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

b. One power supply (ground)

c. Star Tracker 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 (until the payload reaches a safe separation distance or, for retrieved payloads, through landing). Constraints for flight design are defined in section 4.0. The customer will provide flight design information in Annex 2. The customer will be responsible for the detached payload orbital flight requirements.

8.1.1 Deployment/Redeployment Design.- When the payload ASE or payload is designed to impart a separation velocity, the customer shall conduct an analysis of deployment dynamics, including worst-case dispersions, of payload separation from the Orbiter. The SSP will provide the Orbiter initial conditions. When the Orbiter provides separation velocity (as in a PDRS deployment), the analysis is performed by the SSP as a standard service.

8.1.2 Retrieval Design.- When the Orbiter retrieves the payload, the analysis for rendezvous, proximity operations, and retrieval operations are performed by the SSP as part of the payload retrieval package.

The Shuttle Engineering Simulator (SES) will be used to develop and verify generic procedures for rendezvous, proximity operations, and RMS operations. The customer shall provide the data necessary to develop SES payload models.

8.2 Flight Activity Planning and Flight Operations Integration

8.2.1 Flight Plan.- The SSP 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
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 Data and Malfunction Procedures
In-flight Maintenance (IFM) procedures	L-12 months	Payload Systems and Data Malfunction Procedures

Table 8-1.- DATA SUBMITTAL REQUIREMENTS (Continued)

Payload data	Submittal deadline	Flight document containing data
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 DO6	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

The customer is also required to provide schematics/diagrams to support the following processes. Specific diagram/schematic requirements and delivery dates will be defined in the PIP and/or Annex 1.

a. Cargo Systems Manuals

b. Flightcrew Procedures Development

8.2.3 MCC/JSC POCC/Customer Support Room Support Facility Requirements.- [Identify any requirement for telemetry, command, JSC POCC Workstations, or voice loops in the MCC, JSC POCC, or MCC Customer Support Room (CSR). Detailed support requirements for the JSC MCC, JSC POCC, 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. Annex 5 submittal will be provided by the customer per the schedule documented in Appendix E.]

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.] [If an Annex 7 is not required, so state.]

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 flightcrew 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 payload customer is responsible for providing payload-specific training for the payload support personnel residing in the JSC POCC or the payload remote POCC. The payload customer is also responsible for conducting intercenter exercises that would not involve JSC participation.

The customer is required to provide schematics/diagrams to support simulator model development (as applicable) and crew and flight controller training. Specific diagram/schematic requirements and delivery dates will be defined in the PIP and/or Annex 1.

For customer-required training, the SSP will provide, as a standard service, the travel costs associated with sending the flightcrew and support personnel to the customer training facility for up to two trips of 2 days per trip.

[If the customer plans to supply a PS(s) for the flight, add the following statement: The MOD will provide training for the payload prime and backup PSs. 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.- [For payloads which do not require Annex 7, or for payloads which will have Annex 7, but the annex will be developed on a shortened, or late template, add the following words: 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 Joint Integrated Simulation 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 exercising in 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 SMS will model payload 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.

If any payload telemetry data is required to be simulated to meet flightcrew or flight controller training objectives, then the payload customer will provide the necessary information to MOD. MOD will define the information required from the payload customer. The payload customer will provide moments and products of inertia of any object deployed. MOD will determine what mathematical simplifications of this data may be acceptable for simulation purposes.

[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. MOD will define the information that is required from the customer to successfully develop an SMS model of 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 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). Training for rendezvous/proximity operations or RMS retrieval will be provided by the SSP.]

[If the customer 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 (NBL) for development of EVA techniques/procedures and flightcrew training will be provided by the (customer/SSP). Mockup high fidelity is required only in the EVA crewmember worksite(s). All payload-related EVA crew training will be provided by the SSP.]

[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 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.]

8.4 Flight Operations Control

8.4.1 Responsibility.- The SSP will be responsible for integration of flight operations when the Orbiter is in the payload hazard envelope.

The customer is responsible for all payload operations when the Orbiter is out of the payload hazard envelope.

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, deployment/retrieval, etc.)

b. Options on launch window expansion

c. Alternate mission plans

d. Priorities of payload operations

e. In-flight 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 NASA 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 (JOIPs).

8.5 Ground Command and Control - Mission Control Center and Remote 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) and the payload acronym is (assigned by JSC). 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.

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 Payload Control Center (PCC) and MCC data, voice, TV 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 Joint Operations Interface Procedure (JOIP) document.

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

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 Appendix E.

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. Specific payload requirements will be documented in Annex 8, the Time Critical Ground Handling Requirements (TGHR) table, or the OMRSD. 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 to the Launch Site Support

Engineer (LSSE) member of the (MPT) for KSC review/approval. Guidelines for procedure delivery dates are specified in the LSSP. The customer will include the negotiated procedure delivery dates as Part of the Phase III Ground Safety Review Package.

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 in-flight contingencies. These 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 are included 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 are in Annex 8.

9.1 Customer Processing

9.1.1 Payload Processing Facility.- Upon arrival at the launch site, the payload hardware is delivered to a preassigned Payload Processing Facility (PPF) (which will be identified in Annex 8) for postshipment customer inspection, final assembly, functional checkout, and preparation for simulated Orbiter interface testing. Typically, the customer is responsible for these preintegration activities and utilizes customer-provided GSE. An GSE station may be established to monitor and conduct checkout via hardlines and RF as the payload is processed through the rest of the launch site operations.

9.1.2 Hazardous Processing Facility.- Once the PPF operations have been completed, the payload will be transported in customer-provided GSE to a Hazardous Processing Facility (HPF) if specific hazardous operations are required. If those hazardous operations are not required, the payload will go directly to the VPF for payload integration operations.

Typically, operations such as pressurization, leak-testing, propellant loading, Solid Rocket Motor (SRM) installation, and spin-balancing are performed in an HPF. Specific HPF assignment will be identified in Annex 8.

Once HPF operations have been completed, the payload is moved in customer-provided GSE to the VPF.

9.2 Payload Integration

Payload integration begins in the VPF. Once this activity begins, all operations and testing are scheduled and controlled by L&L personnel.

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 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.

Once in the VPF airlock, the exterior of the payload transporter is cleaned before entering the high bay area. The payload is then hoisted into the appropriate position in the workstand beginning with the aft-most payload and working forward (according to the manifest). Spacecraft-to-upper-stage integration that cannot be accomplished in the HPF is performed in the VPF. Simulated Orbiter interface verification testing is then conducted. The customer supports the verification process as defined in Annex 8.

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 tape 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 for a POCC with a command uplink via the Space Shuttle.

Agreed-upon customer-funded services to be performed in the VPF for this payload: [List as required.]

When all testing has been completed, the integrated payloads are transferred into the payload canister for vertical transport to the PCR at the launch pad.

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.

Prior to the Orbiter's arrival at the launch pad, the canister is hoisted into position and the payload(s) is extracted from the canister by the Payload Ground Handling Mechanism (PGHM) in the PCR. With the PGHM in the rollback position, the payload may be available for systems test before Orbiter arrival at the pad. 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 IVTs and closeout procedures will be accomplished. 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 interface verification and closeout requirements will be documented in the OMRSD.

9.4 Late Installation 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 [for pad-installed payloads, insert 26 days; for OPF-installed payloads, insert 47 days], as specified in NSTS 07700, Volume XIV, Appendix 5 for requirements associated with contingencies such as launch delay, scrub turnaround, and launch termination. The details of these requirements will be documented in the OMRSD.

9.5 Postlanding

9.5.1 Landing Processing.- A conditioned GSE purge is provided to the Orbiter payload bay by right and left upper aft safety assessment completion plus thirty minutes after landing occurs at the KSC SLF or at EAFB. If the landing occurs at an abort site, an emergency site, or the White Sands Space Harbor (WSSH), the 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. 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 when coordinated with the LSSM and in accordance with the schedule indicated in Appendix E.]

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 2-19001. Payload-unique rollback requirements shall be specified by the customer in Annex 8 and the OMRSD.

10.0 SAFETY

The customer is responsible for ensuring that the payload and its GSE are safe. Flight and ground Phase III Safety Reviews must be completed 30 days prior to payload and GSE delivery to KSC. All customer-provided hardware and GSE shall be designed and operated to comply with the requirements of NSTS 1700.7B, Safety Policy and Requirements for Payloads Using the Space Transportation System and KHB 1700.7/45 SPW HB S-100, Space Shuttle Payload Ground Safety Handbook. Safety reviews will be conducted in accordance with NSTS/ISS 13830, Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Transportation System and International Space Station.

10.1 Initial Contact Briefing

Prior to customer initiation into Payload Safety Review Panel (PSRP) activity, the SSP may provide an initial contact safety briefing to the customer. This request should be coordinated between the PSRP Executive Secretary and appropriate Payload Integration Manager.

[If applicable, use the following:

10.2 Hazardous Materials Summary Table

To preclude hazardous operations, the customer will disclose the contents, flammability, Hydrogen-Ion concentration (pH) and toxicity of all substances (including proprietary material) used in or produced by the payload or experiment. The customer will submit a materials list to the JSC Toxicologist and the PSRP Executive Secretary in accordance with JSC 27472 and NSTS/ISS 13830. The customer will verify that (1) materials planned to be loaded are listed on the HMST, and (2) the materials are on the approved loading list. After final HMST approval, only deletions and/or reductions in concentration of the hazardous materials are allowed. The payload must also comply with the toxic labeling standards defined in System Description and Design Data – Intravehicular Activities, NSTS 07700, Volume XIV, Appendix 9.]

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 Appendix E and the requirements specified in NSTS 14046. Those 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. IVTs 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 customer 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 will be noted in table 8-1 telemetry, if required.]

[Mark as appropriate]

	Reqd	N/R	Remarks
a. Closed Circuit Television (CCTV)	______	_______	
b. Photography	______	_______	
c. On-orbit Post Flight 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 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 customer-funded services.

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

Prior to initiation of individual customer-funded 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 customer-funded service(s) until customer approval of a PIP Change Request (CR) and funding 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.

Annex 1 - Payload Data Package

Annex 2 - Flight Planning

Interface Control Annex (ICA)

Annex 4 - Orbiter Command and Data

Annex 5 - Payload Operations Control Center (POCC)

Annex 7 - Training

Annex 8 - Launch Site Support Plan

OMRSD - Operations and Maintenance Requirements and Specifications Document, File II, Volume 2

Annex 11 - Extravehicular Activity (EVA)

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. NASA TM-X-58153, Coordinate Systems for the Space Shuttle Program, October 1974

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

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

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

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

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

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

v. NSTS 16007, Shuttle Launch Commit Criteria*

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

x. NSTS 13830, Implementation Procedure for NSTS Payloads System Safety Requirements*

y. NSTS 14046, Payload Verification Requirements*

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

aa. NSTS 18798, Interpretations of NSTS Payload Safety Requirements*

bb. Item deleted

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

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

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

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

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

hh. NSTS 37329, Structural Integration Analyses Responsibility Definition for Space Shuttle Vehicle and Cargo Element Developers, current issue*

ii. SFOC FL2121, Payload Familiarization Briefing Guidelines*

jj. 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 ISSUES

TBR No. 1 Subject: (reference section XX)

[Text of issue explaining SSP and customer positions and any course of action identified to resolve.]

TBR No. 2

TBR No. 3

APPENDIX B

TO-BE-DETERMINED ITEMS

TBD No. 1 Subject: (Reference section XX)

TBD No. 2 Subject:

TBD No. 3 Subject:

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	Crew 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
E	East
EAFB	Edwards Air Force Base
EFGF	Electrical Flight Grapple Fixture
EMC	Electromagnetic Compatibility
EOM	End of Mission
EVA	Extravehicular Activity
F	Fahrenheit
FCS	Flight Control System
FDF	Flight Data File
FES	Flash Evaporator System
FOIG	Flight Operations Integration Group
FOR	Flight Operations Review
FRGF	Flight Releasable Grapple Fixture
FRR	Flight Readiness Review
ft-c	foot-candles
ft/sec	feet per second
G.m.t.	Greenwich mean time
GHz	Gigahertz
GLS	Ground Launch Sequencer
GN&C	Guidance, Navigation & Control

GOR	Ground Operations Review
GPC	General Purpose Computer
GSE	Ground Support Equipment
HEPA	High Efficiency Particle Air
HMST	Hazardous Materials Summary Table
HPF	Hazardous Processing Facility
Hz	Hertz
I/F	Interface
ICA	Interface Control Annex
ICD	Interface Control Document
IFM	In-flight 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
JSC	Lyndon B. Johnson Space Center
kbps	kilobits per second
kg	kilogram(s)
km	kilometer(s)
KSC	John F. Kennedy Space Center
Ku-band	15.250 to 17.250 GHz
kWh/day	Kilowatt Hours
L&L	Launch and Landing
L-	Launch minus
lb/sec	pounds per second
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
MDM	Multiplexer/Demultiplexer
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	Space Shuttle/Payload 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
PCR	Payload Checkout Room
PDCR	Payload Director’s Countdown Review
PDI	Payload Data Interleaver
PDR	Preliminary Design Review
PDRS	Payload Deployment and Retrieval System
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 Processing Facility
ppm	parts per million
PPS	Payload Prelaunch Simulation
PRCS	Primary Reaction Control 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
RAAN	Right Ascension of Ascending Node
RCS	Reaction Control System
rev/hr	revolutions per hour
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
SSV	Space Shuttle Vehicle
STRK	Star Tracker
SWG	Structure Working Group
TBD	To Be Defined
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
VAB	Vehicle Assembly Building
VADAR	Verification Analysis Data Acceptance Review
VAR	Verification Acceptance Review
VLA	Verification Loads Analysis
V/m	Volts per meter
VPF	Vertical Processing Facility
VRCS	Vernier Reaction Control System
W	West, Watt
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.

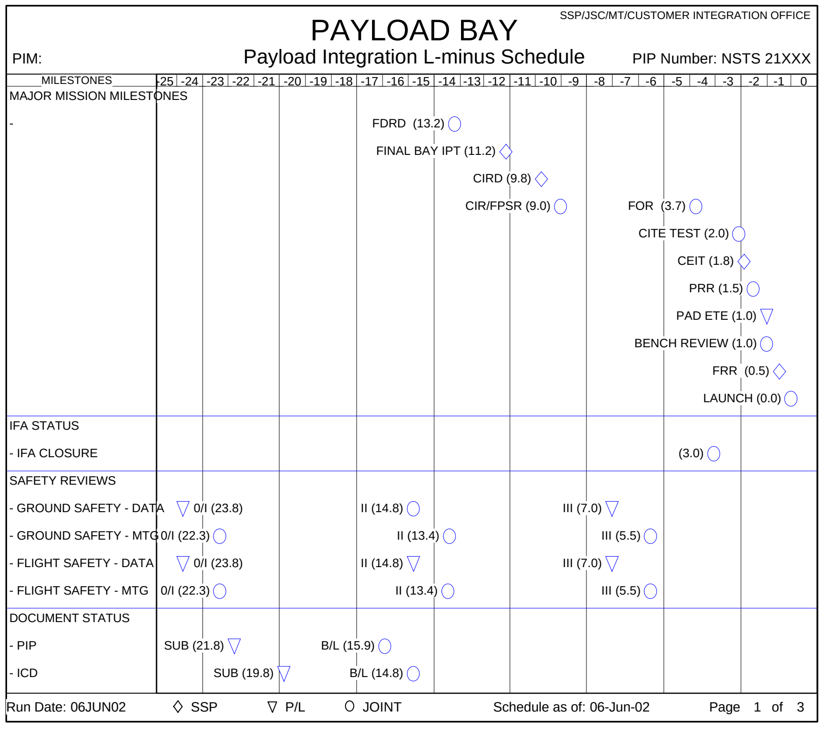
f. Payload postoperation - The period of time from the completion of the postoperation reconfiguration to start of preparation for entry.

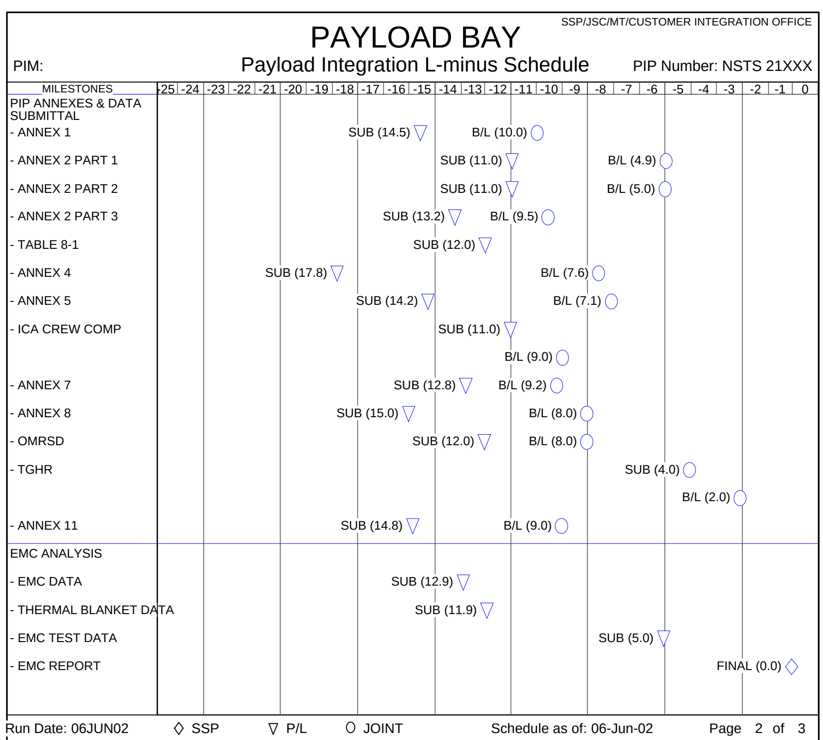
g. Descent - The period of time from start of preparation for entry through wheel stop.

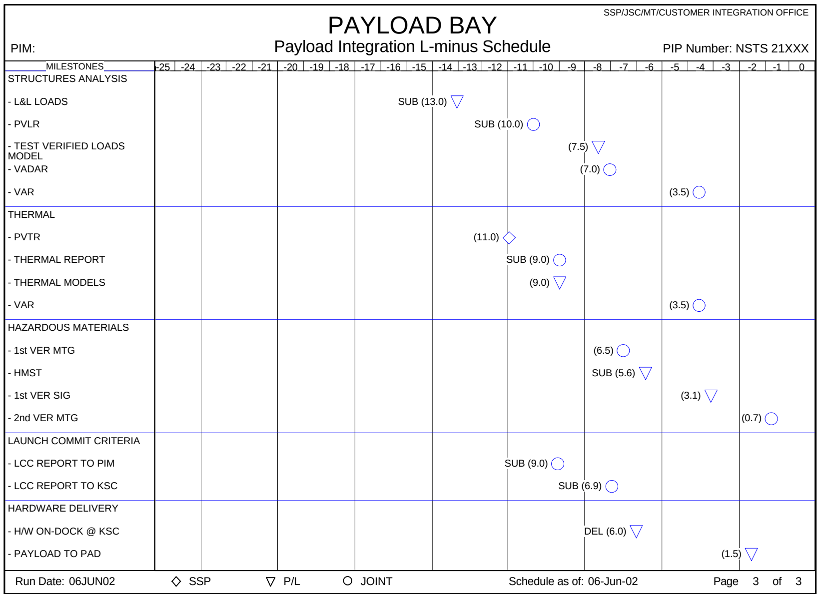
h. Postflight - The period of time from wheel stop to the removal of the payload from the Orbiter.

APPENDIX E

SCHEDULES






SSP/JSC/MT/CUSTOMER INTEGRATION OFFICE
PAYLOAD BAY
Payload Integration L-minus Schedule
PIM:
PIP Number: NSTS 21XXX
MILESTONES
-25 -24 -23 -22 -21 -20 -19 -18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0
STRUCTURES ANALYSIS
- L&L LOADS
SUB (13.0)
- PVLR
SUB (10.0)
- TEST VERIFIED LOADS MODEL
(7.5)
- VADAR
(7.0)
- VAR
(3.5)
THERMAL
- PVTR
(11.0)
- THERMAL REPORT
SUB (9.0)
- THERMAL MODELS
(9.0)
- VAR
(3.5)
HAZARDOUS MATERIALS
- 1st VER MTG
(6.5)
- HMST
SUB (5.6)
- 1st VER SIG
(3.1)
- 2nd VER MTG
(0.7)
LAUNCH COMMIT CRITERIA
- LCC REPORT TO PIM
SUB (9.0)
- LCC REPORT TO KSC
SUB (6.9)
HARDWARE DELIVERY
- H/W ON-DOCK @ KSC
DEL (6.0)
- PAYLOAD TO PAD
(1.5)
Run Date: 06JUN02
◇ SSP
▽ P/L
○ JOINT
Schedule as of: 06-Jun-02
Page 3 of 3