NSTS 21000-SIP-NDD
Revision B

Standard Integration Plan for the Nonstandard Development Test Objective/Detailed Supplementary Objective or Risk Mitigation Experiment

Space Shuttle Program Office

February 1998

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

DESCRIPTION OF CHANGES TO

NONSTANDARD
DTO/DSO/RME INTEGRATION PLAN

SPACE SHUTTLE PROGRAM

AND

DEVELOPMENT TEST OBJECTIVE/DETAILED SUPPLEMENTARY OBJECTIVE
DTO/DSO NAME

OR RISK MITIGATION EXPERIMENT

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
--	Basic issue/B21000-SIP-NDD-001	08/08/95	All
1	Update sections 2.6.1 and 2.6.2 and correct cover/ B21000-SIP-NDD-002	09/08/95	cover,4
2	Update section 9.1 and correct cover/B21000-SIP-NDD-0003	11/07/95	cover,23,23A
3	Update sections 2.1.1 and 16.0/B21000-SIP-NDD-0005	01/19/96	2,29
4	Update table of contents; sections 5.3 and 16.0/B21000-SIP-NDD-0006	04/30/96	vi,11,11A,30
5	Section 4.2.3.8 has been added/B21000-SIP-NDD-0007	06/28/96	9,9A
6	Update table of contents, sections 2.6.2, 4.2.3.1, 5.3, 5.5, 8.2, 8.2.2, 8.4.2, 16.0, figure 15-1, and appendix A; add new section 8.2.4 and new table 8-C/B21000-SIP-NDD-0009;-0010	09/03/96	vii,viii,4, 8,11A,12,13, 19,19A,19B, 21,30,32,A-3
REV A	General revision/B21000-SIP-NDD-0011	11/26/96	All

DESCRIPTION OF CHANGES (CONCLUDED)

DEVELOPMENT TEST OBJECTIVE/DETAILED SUPPLEMENTARY OBJECTIVE
DTO/DSO NAME

OR RISK MITIGATION EXPERIMENT

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
1	Update table of contents and section 8.3/B21000-SIP-NDD-0012	12/17/96	vii,20,20A, 20B
2	Update sections 4.1.2 and 5.3/B21000-SIP-NDD-0013	09/09/97	5,10
REV B	Pagination revision to include updates to table of contents, sections 4.2.3.1, 5.0, 5.3, 6.3, 6.7, 9.5.1, 9.5.2, 9.5.3, 10.0, 15.0, appendix A; add sections 4.2.3.1.2, 4.2.3.1.3, and 4.2.3.1.4, appendix B; and delete section 8.2.3/B21000-SIP-NDD-0014A	02/03/98	All
1	Update figure 15-1/B21000-SIP-NDD-0016	10/17/00	34,35

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

NSTS 21000-SIP-NDD

STANDARD INTEGRATION PLAN

SPACE SHUTTLE PROGRAM

AND

DEVELOPMENT TEST OBJECTIVE/DETAILED SUPPLEMENTARY OBJECTIVE OR RISK MITIGATION EXPERIMENT

FEBRUARY 3, 1998

FOREWORD

This Standard Integration Plan (SIP) is intended to be one of two primary agreements for management and technical activities required for integrated flight and ground operations of a nonstandard Development Test Objective, Detailed Supplementary Objective or Risk Mitigation Experiment (DTO, DSO, or RME) as defined in the Flight Test Supplementary Objective Document (FTSOD), NSTS 16725, with the Space Shuttle Program (SSP). Use of this standard format will provide a consistent definition of the required integration agreements for the DTO, DSO, or RME organization and the SSP implementation. The other primary agreements document is the Integration Plan (IP). That document defines the specific and unique requirements associated with the particular DTO, DSO, or RME.

Signed by Richard M. Swalin
Manager,
Space Shuttle Program,
Customer and Flight
Integration Office

PREFACE

This Standard Integration Plan (SIP) represents the DTO, DSO, or RME-to-Space Shuttle Program (SSP) agreement on the responsibilities and tasks directly related to integration of the DTO, DSO, or RME into the Space Shuttle.

CONTENTS

1.0 INTRODUCTION

The National Aeronautics and Space Administration (NASA) plans to launch and operate in orbit the [Development Test Objective (DTO), Detailed Supplementary Objective (DSO), or Risk Mitigation Experiment (RME)], using the Space Shuttle.

The DTO, DSO, or RME is sponsored by the organization specified in the Integration Plan (IP) and developed by the organization specified in the IP.

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 DTO, DSO, or RME shall be represented by the organization specified in the IP.

This plan provides the management roles and responsibilities and a definition of the technical activities, interfaces, and generic schedule requirements to accomplish the integration, launch, flight operations, and postlanding operations of the DTO, DSO, or RME with the Space Shuttle.

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 DTO, DSO, or RME with the organization specified in the IP. Hereafter in this SIP the organization specified in the IP will be referred to as the sponsor.

2.1 Joint Responsibilities

The SSP and the sponsor will support the necessary integration activities, both analytical and physical, identified in this plan. The SSP and the sponsor 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 DTO, DSO, or RME integration into the Orbiter consists of the SIP, IP, IP annexes, data submittals, and appropriate Interface Control Documents (ICDs).

The SIP, IP, IP annexes, data submittals, DTO, DSO, or RME-unique ICD (or ICD addendum), and associated changes will be jointly approved by the SSP and the sponsor. When the sponsor is authorized to provide or specify requirements in an IP annex or an ICD, these requirements are subject to SSP approval. The IP annexes will be specified in the DTO, DSO, or RME IP. 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-Book 1, Appendix H, Space Shuttle Configuration Management Requirements.

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

a. Safety documents specified in section 10

b. Standard Integration Plan and Integration Plan

c. Interface Control Documents referenced in the Integration Plan

d. Annexes/data submittals to the Integration Plan

e. Applicable documents of the Integration Plan other than a above

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

a. Payload Safety Review Panel (if required)

b. Cargo Integration Review (CIR)

c. Flight Operations Review (FOR)

d. Ground Operations Review (GOR)

e. Integrated Product Team (IPT)

f. Flight Readiness Review (FRR)

2.2 Space Shuttle Program Responsibilities

The SSP at JSC is responsible for integration of the DTO, DSO, or RME into the Space Shuttle, including analytical integration, integrated flight design, integrated flight operations and compatibility with other cargo elements that share the same flight. The SSP is also responsible for assuring that any other SSP activities required to support the flight are accomplished. The SSP is responsible for specifying to the sponsor 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 and integrated checkout, ground integration of the DTO, DSO, or RME and Space Shuttle, and postlanding activities.

All SSP organizations or elements are responsible for supporting the integration activities of DTO, DSO, or RME without additional funding unless specifically identified in the IP.

2.3 Sponsor Responsibilities

The sponsor is responsible for the design, development, test, performance, and safety of the DTO, DSO, or RME, Airborne Support Equipment (ASE), and Ground Support Equipment (GSE), as well as for providing support to the SSP analytical and physical integration activities identified in this SIP. The sponsor is also responsible for the pre-integration preparation of the DTO, DSO, or RME and is responsible for responding in the appropriate timeframe to SSP requirements set forth in this document. The sponsor is responsible for identifying to the SSP all DTO, DSO, or RME problems which may affect SSP milestones, and shall discuss with the SSP a plan to resolve the problem(s).

The sponsor will support the Certification of Flight Readiness (COFR) process as described in NSTS 07700, Volume XIV. The sponsor will also support the safety certification process as described in section 10.0.

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 Reserved

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

2.6.2 Cargo Management Team.- The sponsor'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 sponsor management representatives who have the authority and technical knowledge to make final programmatic recommendations to the MMT on issues which affect the DTO, DSO, or RME. CMT membership, responsibilities, and functions are DTO, DSO, or RME specific and are addressed further in the Payload Operations Workbook, JSC-27508.

3.0 DESCRIPTION AND MISSION OVERVIEW

3.1 Description and Objectives

A brief description of the DTO, DSO, or RME and the flight objectives will be included in the IP.

3.2 Mission Overview

3.2.1 Integrated Ground Operations.- A brief description of the ground operations will be included in the IP.

3.2.2 Flight Operations.- A description of the mission operations will be included in the IP.

3.2.3 Postlanding.- A brief description of the postlanding operations will be included in the IP.

4.0 MISSION OPERATIONS

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

4.1 Orbital Requirements and Control Parameters

4.1.1 Orbital Requirements.- The DTO, DSO, or RME will be compatible with all Orbiter altitudes and inclinations.

4.1.2 Control Parameters.- The control weight and control length define maximum weight and length of the DTO, DSO, or RME for SSP mission planning purposes. The DTO, DSO, or RME may not exceed its control weight or control length without SSP approval. These parameters will be listed in the IP.

If an Annex 1 is required the sponsor shall provide the configuration drawings and sequenced mass properties of DTO, DSO, or RME as part of DTO, DSO, or RME Data Package, Annex 1.

If an Annex 1 is not required, the sponsor shall provide the status weights and lengths to the SSP at no later than launch minus 7 months.

For each item stowed in a middeck locker, the sponsor shall provide weight and configuration drawings to the Interface Control Annex (ICA). The sponsor will provide engineering drawings, and flight equipment or dimensionally correct mockups to JSC no later than 90 days before flight. The sponsor will provide flight equipment to JSC no later than 6 weeks prior to launch to support the final Flight Crew Bench Review.

The sponsor shall exclude from the DTO, DSO, or RME mass property data all SSP integration hardware and Orbiter Mission Kits noted in section 7.0 except where the hardware is incorporated into the DTO, DSO, or RME.

The sponsor shall perform a weight and center of gravity (c.g.) measurement of the DTO, DSO, or RME prior to delivery to the KSC integration facility. A Weight Log shall be maintained and verified by the sponsors Quality Assurance organization subsequent to the weight measurement. The Weight Log shall note all elements/assemblies added or removed through final configuration for flight. Exceptions to this requirement will be negotiated with the SSP or delineated within the annex if required.

If Annex 1 is required, then the required updates of the annex data shall be made as described in the annex and shall be submitted to the Annex 1 book manager according to the schedule in section 15.0 of the IP.

4.2 Operational Requirements and Constraints

The following DTO, DSO, or RME operational requirements and constraints will be used in flight planning and implementation of the Space Shuttle and the DTO, DSO, or RME mission.

4.2.1 Launch Readiness.-

4.2.1.1 Prelaunch Constraints: The DTO, DSO, or RME in the payload bay will be in final liftoff configuration at Payload Bay Door (PLBD) closure for flight. At this time, the DTO, DSO, or RME will be capable of indefinitely sustaining this configuration without physical access in the event of weather/equipment holds and launch scrubs. Exceptions to this must be negotiated with the SSP and documented in section 9.4 of the IP.

4.2.1.2 Launch Commit Criteria: None allowed

4.2.2 Ascent.- Any DTO, DSO, or RME-unique constraints during ascent should be specified in the IP.

4.2.3 On-orbit.- General DTO, DSO, or RME constraints and requirements affecting on-orbit operations will be specified in the IP.

4.2.3.1 Thermal Environment: The DTO, DSO, or RME design and operation shall be as a minimum, compatible with the following attitude conditions and shall not constrain Shuttle operations or the accomplishment of payload objectives.

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.

4.2.3.1.1 SSP-Required Attitude Capability for Beta Angles Less Than or Equal to 60°: The SSP required attitudes and durations are shown in table 4-1 for beta angles less than or equal to 60°. The Orbiter will normally be oriented with the payload bay facing Earth (+ZLV). All cargo elements will be designed to allow deep-space excursions that include a 35-minute Inertial Measurement Unit (IMU) alignment occurring approximately every 12 hours.

If applicable, the DTO, DSO, or RME recovery times for the following attitude excursions, so that repeat of the required attitudes can be planned, will be specified in the IP.

Table 4-1.- SSP-REQUIRED ATTITUDE CAPABILITY (BETA ANGLES LESS THAN OR EQUAL TO 60°)

Attitude	Duration
+ZLV (SSP preferred)	Continuous
+Z Space	35 minutes every 12 hours
+X Solar Inertial (EOM)	3 hours
PTC (EOM)	12 hours
±XLV/±ZVV (Rendezvous)(1)	7 hours

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

4.2.3.1.2 SSP-Required Attitude Capability For Beta Angles Greater Than 60°: The SSP-required attitudes and durations are shown in table 4-2 for beta angles greater than 60°. The Orbiter may be nominally oriented in a Passive Thermal Control (PTC) attitude. PTC is defined as the Orbiter X-axis perpendicular to the solar vector and rolling about the X-axis at a rate of 2 to 5 revolutions/hour. All cargo elements will be designed to allow deep-space excursions that include a 35-minute IMU alignment occurring approximately every 12 hours.

Table 4-2.- SSP-REQUIRED ATTITUDE CAPABILITY
(BETA ANGLES GREATER THAN 60°)

Attitude	Duration
PTC (SSP preferred)	Continuous
+Z Local Vertical	Continuous
+Z Space	35 minutes every 12 hours
+X Solar Inertial (EOM)	3 hours
±XLV/±ZVV (Rendezvous)[(1)]	7 hours

(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 4-3 unique attitudes and durations that are required to accomplish the payload/cargo element mission objectives. Payload attitudes that are constrained by beta angle should be specified here.

Table 4-3.- PAYLOAD ATTITUDE REQUIREMENTS

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

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

4.2.3.1.4 Payload Attitude Operational Capability: In order to ensure SSP operations will not violate payload constraints, the payload shall define their operational capability for the +Z solar inertial (+ZSI), +Z deep-space viewing (+Z space), and rendezvous (±XLV/±ZVV) attitudes as specified in table 4-4. 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 4-4.- PAYLOAD ATTITUDE OPERATIONAL CAPABILITY

Attitude	Beta angle less than or equal to 60°		Beta angle greater than 60°	
	Allowable time	Recovery time to repeat attitude	Allowable time	Recovery time 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 4-1 to the extent possible. In the event these constraints must be violated, the DTO, DSO, or RME safety constraints will be observed. The sponsor 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 or designated representative.

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

4.2.3.2 Ground Communications: For on-orbit attached RF checkout the amount of time required for real-time telemetry coverage will be specified in the IP. The IP will also specify the type of coverage needed and the antenna attitude and pointing requirements.

4.2.3.3 Remote Manipulator System Operations: If applicable, the DTO, DSO, or RME must comply with the Remote Manipulator System (RMS) requirements documented in System Description and Design Data - Payload Deployment and Retrieval System, NSTS 07700, Volume XIV, Appendix 8. Unique RMS operational requirements will be specified in the IP.

4.2.3.4 Photographic Coverage: Photographic and/or Television (TV) coverage of the DTO, DSO, or RME operations from the Orbiter will be initiated by the SSP. Unique photographic or TV coverage requirements will be in the IP. Shared usage of the Orbiter standard photographic equipment shall be identified in the IP.

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

4.2.3.6 Extravehicular Activity Requirements: If applicable, the Extravehicular Activity (EVA) requirements will be specified in the IP.

The DTO, DSO, or RME must comply with 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.

4.2.3.7 Primary Reaction Control System Compatibility: The DTO, DSO, or RME will be compatible with a Primary Reaction Control System (PRCS) mode of control for all required operations. Any PRCS constraints or requirements will be specified in the IP.

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

4.2.4 Operational Safety Constraints.-

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

4.2.4.2 Floodlights: The DTO, DSO, or RME must be designed to be safe with any payload bay floodlight failed on. (Reference ICD 2-19001 for floodlight characteristics.) Any floodlight constraints or requirements will be specified in the IP.

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

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

5.0 DTO, DSO, OR RME-TO-SPACE SHUTTLE INTERFACES

The DTO, DSO, or RME must be compatible with the Space Shuttle mechanical, electrical, avionics, and environmental interfaces as defined in Shuttle Interface Definition Document for Standard Accommodations, NSTS 21000-IDD-STD and Middeck Interface Definition Document, NSTS 21000-IDD-MDK. The Space Shuttle-to-DTO, DSO, or RME (and carrier if appropriate) standard and unique interfaces are specified in the unique ICD. The Space Shuttle-to-DTO, DSO, or RME standard and unique Aft Flight Deck (AFD) interfaces are specified in the unique ICA.

5.1 Structural/Mechanical Interfaces

The structural/mechanical interface between the DTO, DSO, or RME and the Space Shuttle will be defined in the IP and the ICD. All hardware to be carried in the crew compartment shall comply with the standard interface requirements specified in NSTS 21000-IDD-MDK.

5.2 Cable Interfaces

The cable interfaces and the cables will be listed in the IP.

The specific pin assignments will be in the applicable ICD.

5.3 Display and Control Interfaces

Display and Control (D&C) functions are accomplished using the crew-controlled equipment listed in the IP.

[If the Payload and General Support Computer (PGSC) is used, add the following: The SSP will provide the use of a PGSC to support in-flight operations. 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. Success of PGSC software is considered the responsibility of the sponsor. If the sponsor requires the use of SSP facilities for the testing of PGSC software, it must be negotiated with the SSP and documented in the IP. All software will be developed and provided by the sponsor. In no case will PGSC software be verified in the Orbiter itself. If sponsors will be using 3.5-inch diskettes, the sponsor is responsible for providing diskettes to support his DTO, DSO, or RME. Diskette information can be located in Shuttle/Payload Interface Definition Document for Payload and General Support Computer (PGSC), NSTS 21000-IDD-486.]

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

5.4 Electrical Power Interfaces

Before installation in the Orbiter, power will be supplied to the DTO, DSO, or RME using sponsor-provided or SSP-provided GSE as negotiated in Annex 8. If required, after installation in the Orbiter, Orbiter bus power will be supplied by the SSP; T-0 umbilical power will be supplied by the DTO, DSO, or RME GSE when required.

The DTO, DSO, or RME shall provide means for its power activation/deactivation via crew control.

The specific flight power profile will be defined by the sponsor in Annex 2. The total energy requirement will be specified in the IP.

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

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

5.5 Command Interfaces

Command interfaces will be listed in the IP.

DTO, DSO, or RME commanding will be constrained as follows:

a. Prelaunch - All DTO, DSO, or RME 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. DTO, DSO, or RME 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 or designated representative; 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 DTO, DSO, or RME commanding be permitted after the start of the T-9 minute hold which nominally is 10 minutes in duration.

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

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

Engineering characteristics of the above interfaces are defined in the applicable ICD. The commands are defined by the sponsor 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 or designated representative.

5.6 Telemetry and Data Interfaces

Telemetry and data interfaces will be listed in the IP.

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

5.7 Fluid Interfaces

Any special spigot, vent, Aft Flight Deck (AFD) equipment cooling, etc., interface requirements will be listed in the IP.

5.8 Orbiter General Purpose Computer Software Services

The General Purpose Computer (GPC) software support for commands from the ground to the DTO, DSO, or RME and data from the DTO, DSO, or RME to the ground will be provided for the applicable interfaces and defined in the IP.

Detailed DTO, DSO, or RME requirements will be specified in Annex 4.

6.0 ENVIRONMENTAL ANALYSES AND INTERFACES

Standard Space Shuttle natural and induced environmental interfaces, including structural loads, thermal, contamination, shock, vibration, and acoustics, are contained in NSTS 21000-IDD-STD.

Environmental interface analyses will be conducted to determine physical and functional interface compatibility of the DTO, DSO, or RME and the Space Shuttle. Specific analyses are described in the following paragraphs.

6.1 Structural Loads and Deflections

For all hardware to be carried inside the crew cabin, the sponsor is responsible for verifying compatibility with the Orbiter loads as defined in NSTS 21000-IDD-MDK. The sponsor will ensure compliance of the DTO, DSO, or RME hardware by providing a test report, if required, including structural test data and analysis.

For payload bay installed hardware, preliminary design guidelines for the DTO, DSO, or RME are provided in NSTS 21000-IDD-STD. These guidelines correspond to the Space Shuttle loading environments and are recommended as the minimum conditions to which the sponsor should develop its preliminary payload design. The sponsor is responsible for applying appropriate conservatism to the loads analysis results to account for changes to the DTO, DSO, or RME hardware and Space Shuttle model and forcing functions. The sponsor is responsible for assuring that the DTO, DSO, or RME hardware is designed to be compatible with the Space Shuttle environments resulting from these analyses and any subsequent SSP math models and forcing function updates. The sponsor is also responsible for assuring that the DTO, DSO, or RME-hardware/Shuttle Orbiter interface forces and deflections (including thermal affects) do not exceed the constraints in NSTS 21000-IDD-STD. The SSP will advise the sponsor regarding the status of Space Shuttle activities that could affect DTO, DSO, or RME hardware loads; however, the responsibility for DTO, DSO, or RME hardware compatibility with the final flight verification loads remains with the sponsor.

All structural models, analyses and reports will be performed in accordance with National Space Transportation System Models and Loads Analysis Configuration Management/Control, SD77-SH-0214. The model deliveries, analyses, and reports will be performed in accordance with the section 15.0 schedule of the IP.

The Space Shuttle/Payloads Structures Working Group will review and approve the approach to structural verification per the guidelines defined in Payload Verification Requirements, NSTS 14046. A written structural verification test plan will be provided prior to launch. The delivery date for that test plan will be identified in the IP. Test plans shall be submitted to the Space Shuttle/Payloads Structures Working Group at least 1 month prior to the start of testing to allow the Working Group sufficient time to review and comment on the plans and the sponsor time to incorporate recommended changes.

A Payload Design Loads Report is required to be provided by the sponsor to the SSP at least 15 months prior to launch in order to support the Cargo Compatibility Review and the CIR.

The SSP will perform a Verification Loads Analysis (VLA) for the final flight manifest, as a standard service, using a DTO, DSO, or RME hardware structural math model to be provided by the sponsor. Frequencies of payload bay mounted hardware must be above 35 hertz. All structural changes to the DTO, DSO, or RME hardware, however, must be coordinated with the SSP to ensure that the no math model verification testing and model uncertainty factor decisions are still appropriate. A list of all changes will be maintained during the VLA and will contain the VLA math model mass properties and the actual flight hardware mass properties, as the project develops. The model changes will be presented at the Verification Acceptance Review (VAR) in a statement of "is" and "was" with a description of the impact of these changes on the VLA loads. The VLA results will be documented by the SSP in a VLA report that will be published approximately 5.5 months prior to launch.

The VAR will be conducted approximately 4 months prior to launch to discuss and approve the results of the VLA. The sponsor will certify during this review that all margins of safety for the DTO, DSO, or RME hardware are positive and that the DTO, DSO, or RME hardware is safe for flight including all applicable uncertainty factors. The sponsor assessment shall cover loads from all sources (e.g., VLA results, thermal, pressure, random vibration, acoustics and friction). The sponsor is also responsible for verifying that the dynamic envelope (including thermal effects) does not exceed the constraints as specified in NSTS 21000-IDD-STD. The SSP will use the VLA results to assure that the interface loads and relative deflections are within the Orbiter constraints.

6.2 Thermal Environments and Interfaces

The sponsor is responsible for the design and analysis of the DTO, DSO, or RME to assure compliance with the thermal and attitude requirements defined in section 4.0 and the IP. The SSP will furnish Orbiter thermal models to the sponsor. Results of supporting design analyses accomplished by the SSP will be documented in a Space Shuttle thermal report to be provided to the sponsor. 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 sponsor to the SSP and in accordance with Criteria/ Guidelines for payload Thermal Math Models for Integration Analysis, JSC 14686. The specific schedule for furnishing the various payload thermal models and results of the integrated analyses are contained in section 15.0 of the IP.

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 sponsor is responsible for verifying DTO, DSO, or RME compatibility with this environment.

6.3 Electromagnetic Interference/Electromagnetic Compatibility

The sponsor is responsible for assuring that the DTO, DSO, or RME interfaces meet the induced electromagnetic interference environment and that the entire DTO, DSO, or RME complies with the radiation requirements defined in NSTS 21000-IDD-STD. The specific characteristics of the Payload Radio Frequency (RF) Systems Data, Electromagnetic Compatibility (EMC) Test Data, and Thermal Blanket Data as defined in NSTS 21288 shall be delivered to Payload Integration Engineering for review and evaluation. The RF Systems Data, EMC Test Data, and Thermal Blanket Data shall be furnished by the sponsor to the SSP. The required data submittal dates shall be defined in the schedule in section 15.0 of the IP. The SSP will perform an integrated radiated RF interference assessment for mutual compatibility; however, the sponsor is responsible for assuring that the DTO, DSO, or RME operates properly in the specified environment. Intentional transmitter radiated levels outside the specified envelope incident on other cargo elements within the payload bay shall be limited to those levels specified in NSTS 21000-IDD-STD. These specified levels apply outside the control length limits.

6.4 Contamination Control

The sponsor is responsible for assuring that the DTO, DSO, or RME is compatible with the induced contamination environment and complies with outgassing requirements defined in NSTS 21000-IDD-STD. In addition, certain materials and equipment requirements apply during ground operations in (or close proximity of) the Orbiter. The sponsor 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 sponsor shall assure that the presence of any allowed material, chemical, or gas will have no adverse effect on the DTO, DSO, or RME.

The facility input air at the Orbiter Processing Facility (OPF) and the Payload Changeout Room (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-SML-209E, and will contain less than 15 ppm hydrocarbons based on methane equivalent. Nonvolatile Residue (NVR) levels of less than 1 mg/0.1 meter squared/month will be maintained. Other KSC facilities have different levels of cleanliness and these operational requirements and capabilities are contained in KSC Payload Facility Contamination Control Requirements/Plan, K-STSM-14.2.1; Shuttle Facility/Orbiter Contamination Control Plan, KVT-PL-0025; and Payload Facility Contamination Control Implementation Plan, KCI-HB-5340.1.

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

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

The sponsor is responsible for cleaning the DTO, DSO, or RME 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 sponsor and the SSP. When a launch site facility or the payload bay is shared, unique contamination control measures may be required. Implementation of these measures will be agreed upon and documented by KSC at least 3 months prior to hardware delivery to KSC.

6.5 Shock, Vibration, and Acoustic Environments

The sponsor is responsible for compatibility with the Space Shuttle-induced shock, vibration, and acoustic environments defined in NSTS 21000-IDD-STD.

6.6 Ground Environmental Requirements

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

At the pad, purge temperatures at the payload bay inlet can be provided between 45° to 100° F but, in the OPF and Vehicle Assembly Building (VAB), the inlet temperature is only selectable throughout the range of 65° to 85° F controllable to ± 5° F. However, at all locations the payload bay purge inlet temperature nominal setpoint is 65° F controllable to ± 5° F. Deviations from this setpoint must be negotiated with the SSP based on the total flight configuration requirements. If the DTO, DSO, or RME has any unique payload bay purge inlet temperature requirements, it will be specified in the IP. Payload bay purge outages and variations will be stated in Annex 9.

Ground handling loads are always less than flight loads.

6.7 Orbiter Flight Control System Compatibility Analysis

The DTO, DSO, or RME nominal fundamental vibration frequency is specified in the IP. 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 to assess the interaction between the DTO, DSO, or RME 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

Unique hardware will be provided by the SSP and listed in the IP.

7.2 Sponsor-provided Hardware

Unique hardware will be provided by the sponsor and listed in the IP.

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 integration.

8.1 Flight Design

The SSP will be responsible for performing integrated flight design from liftoff through DTO, DSO, or RME operation. Constraints for flight design are defined in the IP. The sponsor will provide flight design information in Annex 2.

8.2 Flight Activity Planning and Flight Operations Integration

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

8.2.2 Data Submittal Requirements for Flight Operations Integration.- The sponsor 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 or designated representative 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.

[Flight-specific deletions or modifications should be made to this table for the flight-specific PIP as applicable.]

Table 8-1.- DATA SUBMITTAL REQUIREMENTS

Payload data	Submittal deadline	Flight document containing data
DTO/DSO/RME Flight Control Team & Launch OPS Team	L-6 months	JOIP
Formal letter specifying MCC/JSC POCC/CSR support facility requirements signed by sponsor	L-6 months	N/A
Keyset/loop requirements	L-6 months	JOIP
Flight rules & payload facility LCC	L-6 months	Flight Rules Annex
JOIP procedures	L-6 months	JOIP
Operations support timeline	L-6 months	OST
Nominal, backup, and contingency procedures	L-6 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-6 months	a. Ascent Switchlist b. Payload Operations Checklist
Malfunction procedures	L-6 months	Payload Systems and Data Malfunction Procedures
IFM procedures	L-6 months	Payload Systems and Data Malfunction Procedures
Hazardous, MOC, Prelaunch commands	L-6 months	a. JOIP b. OST c. Hazardous Command List in PL Hazard Report
Formal letter listing all operational hazard controls jointly signed between sponsor and DO6	L-6 months	a. Payload Operations Checklist b. Remote Manipulator Assisted Checklist c. Flight Rules Annex
Unique payload data collection requirements	L-6 months	a. Flight Plan b. Flight Rules Annex
PGSC/microcomputer requirements & user’s guide	L-6 months	N/A

8.2.3 Mission Control Center/JSC Payload Operations Control Center/Customer Support Room Support Facility Requirements.- [Identify any requirement for telemetry, command, JSC Payload Operations Control Center (POCC) Workstations (WSs), or voice loops in the Mission Control Center (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 or designated representative per the schedule in table 8-1. Instructions for providing these requirements are contained in the Payload Operations Workbook, JSC-27508.]

8.3 Training

The SSP is responsible for assessing the training requirements for the flightcrew and flight controllers to support the flight. Conduct of payload-unique training will require SSP and customer resources as defined below.

The customer will provide a payload familiarization briefing at JSC to the flightcrew members, SSP flight controllers, and SSP instructor personnel. This briefing will precede other required payload training, and be conducted according to guidelines documented in Payload Familiarization Briefing Guidelines, JSC 25716.

To ensure that the flightcrew training schedule can adequately accommodate payload training requirements, the customer will submit the following initial estimates of payload training requirements when the PIP is baselined or earlier to the Mission Operations Directorate Spaceflight Training and Facilities Operations (SFT&FO) branch. This data will, at a minimum, include the following:

a. A customer point of contact for payload training

b. Estimates for the amount of time necessary for flightcrew payload training at JSC and, if required, the customer’s facility

c. Tentative L-dates for such training

d. Estimates of crew travel requirements to non-JSC area facilities

[If a Training Annex is required, use the following:

Payload training requirements will be further documented in Training Annex, Annex 7.]

[If a Training Annex is not required, use the following:

A Training Annex, Annex 7, is not required for this payload. Within 2 weeks after the decision to manifest the payload has been confirmed, the customer will further define their training requirements by providing a training plan encompassing, as a minimum, the following payload training details for each planned training session:

a. A short title

b. The proposed location of the training

c. A proposed comprehensive timeframe in Launch minus (preferably weeks) format

d. Which crewmembers are required to participate

e. Planned hours for each crewmember

f. A summary of the training objectives

The SSP will review the customer's training plan proposals and reserves the right to negotiate alterations or amendments to the customer's training plan which will be in accordance with mutually acceptable customer training goals and objectives.]

The customer will coordinate with the MOD SFT&FO branch flightcrew scheduler for selecting specific payload training dates and times and agrees to abide by established and customary scheduling protocols.

Unverified payload procedures will not be used for training. Additionally, crew training sessions are not to be used for the purpose of verifying payload operating procedures.

Required training dedicated to the payload must be planned and scheduled for completion by L-13 weeks except for any required proficiency and update training. [Any exceptions must be negotiated with the SSP and documented in the PIP.]

[If the customer requires the use of JSC facilities such as the Crew Compartment or Full Fuselage Trainer, add a statement specifying the facility and purpose.]

The customer will provide opportunities for the flightcrew to train with the flight payload hardware. The flight hardware or equivalent will be submitted to JSC for utilization in the Full Fuselage Trainer, Crew Compartment Trainer, or Shuttle Mission Simulator during secondary payload crew training.

If the SSP recommends integrated training among the manifested secondary payloads, the customer should support such integrated training by providing flight or equivalent payload hardware and customer personnel. Integrated training is defined as the exercising of the procedures of two or more payloads and Orbiter activities during a given time segment of the crew Flight Plan.

To enhance mission success, the customer should prepare a brief, concise videotape that reviews payload hardware and operating procedures. This tape should clearly show payload hardware, control panels, Cathode-Ray Tube (CRT) displays, and should summarize key points required for mission success. The customer should make this videotape accessible for crew reviewing by L-1 month.

8.4 Flight Operations Control

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

8.4.2 Mission Decision Planning.- The sponsor 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 sponsor will identify alternate plans or courses of action which include the following:

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

b. Alternate mission plans

c. Priorities of DTO, DSO, or RME operations

d. In-flight management of DTO, DSO, or RME systems for off-nominal conditions

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

8.4.3 Operations Support.- The SSP flight control operations will be conducted from the NASA Mission Control Center-Houston (MCC-H) using the Space Network (SN). The sponsor flight control operations and control will be specified in the IP.

A DTO, DSO, or RME representative 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) for flight phases leading up to and during key mission events. It is required that this representative be identified no later than the CIR and that the sponsor representative support the CIR, FOR rules reviews, LCC reviews, and Joint Integrated Simulations (JISs).

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

During the mission, the DTO, DSO, or RME may be controlled from a POCC located at a remote site or the JSC MCC. If this capability is utilized, the requirements for the POCC facility configuration are listed in the IP.

9.0 LAUNCH AND LANDING SITE OVERVIEW

DTO, DSO, or RME-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 sponsor-requested ground support (both nominal and contingency) are documented in Annex 8, by the Launch Site Integration Manager (LSIM), according to the schedule in section 15.0 of the IP.

In support of Annex 8 development, the sponsor participates in ground operations working group meetings that further define the DTO, DSO, or RME L&L requirements and plan for the DTO, DSO, or RME implementation. All sponsor Technical Operating Procedures (TOPs) will be submitted to the LSIM for KSC review/approval. Specific DTO, DSO, or RME requirements will be documented in Annex 8. The sponsor also makes input to and supports the review schedule for SSP development of L&L operational procedures. Input could include a preliminary sponsor procedure 5-6 months prior to use for complicated test sequences or servicing activities.

During the launch site processing of the DTO, DSO, or RME, the SSP will conduct an inspection of the DTO, DSO, or RME 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 sponsor and corrective actions will be taken by the sponsor or sponsor's representatives. Hazards not correctable will be identified and documented.

The SSP will take required photographs of the DTO, DSO, or RME before and after installation in the Orbiter, including closeout photographs to support ground operations, Flight Data File (FDF) development, flightcrew, and flight controller training, and for possible in-flight contingencies. Photographic activities will be scheduled and coordinated with the sponsor.

Training or certification of training will be required for sponsor personnel performing certain 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, fueling, use of specified KSC systems, and deployment to non-Continental United States (CONUS) landing sites. Details are included in Annex 8.

The sponsor'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 provided in Annex 8.

9.1 Sponsor Processing

Upon arrival at the launch site, DTO, DSO, or RME hardware is delivered to an assigned area for postshipment sponsor inspection, functional checkout, and preparation for the next phase of integration. Typically the sponsor is responsible for the preintegration activities and utilizes DTO, DSO, or RME-provided GSE.

“[For DTO, DSO, or RME hardware containing gas, fluid, or solid media which, under multiple failures, could escape containment or become vaporized into the habitable atmosphere, insert the following paragraph:

The sponsor is responsible for labeling of hardware with any required toxic substance hazard decals prior to turnover to KSC or final stowage, as applicable. JSC will deliver the decals in sufficient time for affixing the decals prior to final payload stowage and closeout. Submittal of hazardous material listings will be provided per Reference Requirements for Submission of Test Sample-Materials Data for Shuttle Payload Safety Evaluations, JSC 27472. Based on the results of the toxicological assessment, the sponsor will provide to the JSC Payload Integration Manager a listing of all decals needed. This listing will include size, color, label material, and quantity. A second decal is also required to be affixed to each piece of hardware containing a hazardous decal and must contain a unique identifier code. The sponsor will also provide the complete addresses where the flight qualified labels are to be shipped. Sponsors will label their hardware prior to final stowage or turnover to KSC. Decals will be shipped to the sponsor per a schedule to be defined in the Integration Plan.]”

After these activities are completed, the DTO, DSO, or RME is transferred to KSC control to begin the ground integration process.

9.2 Facility Integration

DTO, DSO, or RME integration begins in the facility specified in Annex 8. Once this activity begins, all operations and testing are scheduled, performed, and controlled by L&L personnel and supported by the sponsor.

The sponsor is responsible for providing a second set of DTO, DSO, or RME-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 DTO, DSO, or RME integration and Orbiter integration. For example, one set might be installed in the simulated Orbiter test equipment in a DTO, DSO, or RME integration facility; while the other set is installed in the Orbiter at the OPF for flight.

Any DTO, DSO, or RME 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 sponsor'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 IP.

If SSP-provided DTO, DSO, or RME carrier is used, preparation of SSP-provided DTO, DSO, or RME carrier is begun by L&L personnel prior to the completion of preintegration activities. The ground integration process begins with the integration of the DTO, DSO, or RME with the DTO, DSO, or RME carrier. Throughout the DTO, DSO, or RME integration process, newly mated or re-established interfaces are verified. As agreed in Annex 8, space will be provided for the sponsor to monitor DTO, DSO, or RME parameters using DTO, DSO, or RME-provided GSE.

9.3 Orbiter Integration

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

If the DTO, DSO, or RME is installed in the OPF, the DTO, DSO, or RME arrives at the OPF and is installed into the Orbiter. Before the PLBDs are closed, the DTO, DSO, or RME-to-Orbiter Interface Verification Tests (IVTs) and closeout procedures will be accomplished. Agreed-upon servicing can be scheduled on a noninterference basis up until PLBD closure for OPF rollout, the last time that DTO, DSO, or RME access is expected before liftoff.

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

9.4 Late Operations

Reference NSTS 07700, Volume XIV, Appendix 5, for requirements associated with contingencies such as launch delay, scrub turnaround, and launch termination.

9.5 Postlanding

9.5.1 Landing Processing.- A conditioned GSE purge is provided to the payload bay by right and left upper aft safety assessment completion plus 30 minutes after landing occurs at the KSC Shuttle Landing Facility (SLF) or at the Edwards Air Force Base

(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 Vertical Processing Facility (VPF)/Operations and Checkout (O&C) is normally completed 7 days after the Orbiter arrives at the OPF. If the Orbiter lands at the Shuttle Landing Facility (SLF), it is towed to the OPF within 8 hours of landing. If the Orbiter lands at EAFB, it will undergo approximately 6 days of ferry flight preparation followed by a ferry flight from EAFB to KSC (1 to 10 days, weather dependent) on top of the Shuttle Carrier Aircraft (SCA). If the Orbiter lands at an abort site, an emergency site, or the WSSH, the ferry flight preparation will take approximately 6 to 8 weeks.

9.5.3 Ferry Flight Operations.- The payload shall be compatible with ferry operations.

9.6 Reserved

9.7 Contingency Shuttle Rollback

The DTO, DSO, or RME shall comply with the contingency rollback from the pad to the VAB requirements of NSTS 07700, Volume XIV, Appendix 5. Specific requirements and interfaces are in ICD-19001. Unique rollback requirements shall be specified by the sponsor in Annex 8 and DTO, DSO, or RME Verification Requirements Annex, Annex 9.

10.0 FLIGHT AND GROUND SAFETY REQUIREMENTS

The design, operation, and vehicle integration of the DTO, DSO, or RME shall comply with the following flight and ground safety requirements:

a. The DTO, DSO, or RME flight safety program shall meet NSTS 1700.7B or JSC 21096 (for XA/EVA Project Office EVA DTOs only) and NSTS 13830. The specific safety requirements shall be specified in the DTO, DSO, or RME end item Program Requirements Document (PRD).

b. The DTO, DSO, or RME ground safety program shall meet the requirements of KHB 1700.7 and NSTS 13830.

For all DTOs, DSOs, or RMEs, except EVA DTOs sponsored by XA for the initial flight of the hardware, the sponsor shall submit a flight Safety Analysis Report (SAR) in accordance with Appendix D of NSTS 13830 to the SSP, Payload Safety Review Panel, DTO, DSO, or RME Coordinator mail code NS2 no later than 60 days prior to flight. The sponsor shall also submit with the SAR, a Certificate of NSTS Payload Safety Compliance (JSC Form 1114A) and the Flight/Payload Standardized Hazard Control Report (JSC Form 1230) signed by the sponsor. The approved flight safety data package will be part of the flight certification paperwork sent by the sponsor to the Payload Government Furnished Equipment (GFE) Configuration Control Board (CCB), mail code MV5. The sponsor will certify the DTO, DSO, or RME for flight readiness through the Payload GFE CCB under the authority of NSTS 07700, Volume IV. If any changes are made to the DTO, DSO, or RME hardware after the initial flight, another flight safety analysis report shall be submitted by the sponsor. For a reflight of the same hardware, the sponsor shall follow NSTS 13830, section 8. Note: The hardware may be certified for multiple flights; however, the safety certification is for one flight only.

For EVA DTOs sponsored by XA, the sponsor shall submit a flight safety data package which has been signed by the sponsor and the JSC/GFE Safety and Mission Assurance Branch, mail code NS2, consisting of the DTO, DSO, or RME description, HAW, Hazard Verification/Flight Documentation and supporting documentation to the EVA CCB, mail code XA, no later than 30 days prior to the delivery of the hardware to KSC for installation into the Orbiter. The sponsor will certify the hardware for flight readiness through the EVA and FCE GFE CCB under the authority of NSTS 07700, Volume IV. If any changes are made to the hardware after the flight certification for the initial flight, another flight safety data package shall be submitted by the sponsor.

The sponsor shall submit a ground safety data package consisting of a description of the DTO, DSO, or RME, a description of the GSE, and a safety analysis of the hazards and controls for ground processing operations and a "Certification of STS Payload Safety Compliance" to the Chairman, Payload Ground Safety Review Panel, mail code RT-SOE, no later than 60 days prior to delivery of the hardware and GSE to KSC for installation in the Orbiter. Upon completion of the KSC safety package review, an approval to process the letter shall be issued by KSC Safety to the sponsor. This approval letter is required prior to the arrival of the DTO, DSO, or RME, hardware at KSC for installation in the Orbiter.

The sponsor is responsible for certifying that controls of hazardous material is consistent with the methods/designs approved by the Payload Safety Review Panel (PSRP). The JSC Toxicologist will develop and manage the Hazardous Materials Summary Table (HMST) from the sponsor-supplied list as required for the PSRP review. The sponsor will verify that (1) materials that are planned to be loaded are listed on the HMST, and (2) the materials loaded are on the approved planned loading list. Following the Flight Safety Phase III Review, the JSC Toxicologist will provide the sponsor with the preliminary HMST. The sponsor will return the HMST with the signed Verification 1 form which represents the final loading plan. Following SSP approval, corrections will be incorporated into the Final HMST at L-2 months and provided to the sponsor. Since loading will occur at various times, the sponsor will return Verification 2 forms and the As-loaded HMST when hazardous material loading actually occurs. Review and concurrence of the As-loaded list by the JSC Toxicologist will constitute the As-loaded list of Hazardous Materials for use by the flight team. Between Verification 1 and Verification 2, the SSP policy is to limit changes to the HMST to only allow deletions and/or reductions of concentration of the hazardous materials.

11.0 INTERFACE VERIFICATION AND TESTING

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

All DTO, DSO, or RME-to-Orbiter interface verification requirements are to be identified and submitted by the sponsor in Annex 9 in accordance with the schedule in section 15.0 of the IP and the requirements specified in NSTS 14046. Interfaces that cannot be verified prior to flight shall also be documented in Annex 9 with supporting rationale.

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 DTO, DSO, or RME objectives, SSP will supply the Space Shuttle data as available to the sponsor for evaluation.

In the event of a DTO, DSO, or RME anomaly, Space Shuttle data may be required for evaluation of the problem.

13.0 SUMMARY OF OPTIONAL SERVICES

Not applicable

14.0 IP ANNEXES

Required annexes will be specified in the IP.

In case of any conflict between the IP and the IP annexes, the IP shall take precedence. Any requirements submitted in the annexes/data submittals that are not within scope of the IP will not be considered binding on the SSP for implementation.

15.0 SCHEDULE

The attached generic schedule, figure 15-1, provides a summary of various technical areas requiring data exchange and/or products in support of Space Shuttle/integration activities.

16.0 APPLICABLE DOCUMENTS

The following documents are applicable to the extent stated herein:

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

b. JSC 21096, Space Shuttle Program DTO/DSO Noncritical Hardware Program Requirements Document

c. NSTS 07700, Program Definition and Requirements, Volume IV-Book 1, Appendix H, Space Shuttle Configuration Management Requirements, current issue*

d. SD77-SH-0214, National Space Transportation System Models and Load Analysis Configuration Management/Control, current issue*

e. K-STSM-14.1, Launch Site Accommodations Handbook for Payloads, current issue*

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

g. JSC 14686, Criteria/Guidelines for Payload Thermal Math Models for Integration Analysis, current issue*

h. NSTS 14046, Payload Verification Requirements, current issue*

i. K-STSM-14.2.1, KSC Payload Facility Contamination Control Requirements/Plan, current issue*

j. KVT-PL-0025, Shuttle Facility/Orbiter Contamination Control Plan, current issue*

k. KCI-HB-5340.1, Payload Facility Contamination Control Implementation Plan, current issue*

l. 45 SPW HB S-100/KHB 1700.7, Space Transportation System Payload Ground Safety Handbook, current issue*

m. NSTS 21000-IDD-STD, Shuttle/Payload Interface Definition Document for Standard Accommodations, current issue*

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

o. 14 CFR 1214.7, The Authority of the Space Shuttle Commander

p. NSTS 07700, Volume VIII, Space Shuttle Operations, current issue*

q. JSC 09958, Crew Procedures Management Plan, Appendix F, Space Shuttle Flight Data File Preparation Standards, current issue*

r. NSTS 16725, Flight Test Supplementary Objectives Document, current issue*

s. NSTS 13830 Implementation Procedure for NSTS Payloads System Safety Requirements, current issue*

t. NSTS 21288, Required Data/Guidelines for Payload/Shuttle Electromagnetic Compatibility Analysis, current issue*

u. NSTS 21000-IDD-486, Shuttle/Payload Interface Definition Document for Payload and General Support Computer (PGSC), current issue*

v. JSC 27508, Payload Operations Workbook

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

x. NSTS 21000-IDD-MDK, Middeck Interface Definition Document, current issue*

*Current issue includes all future changes and revisions.

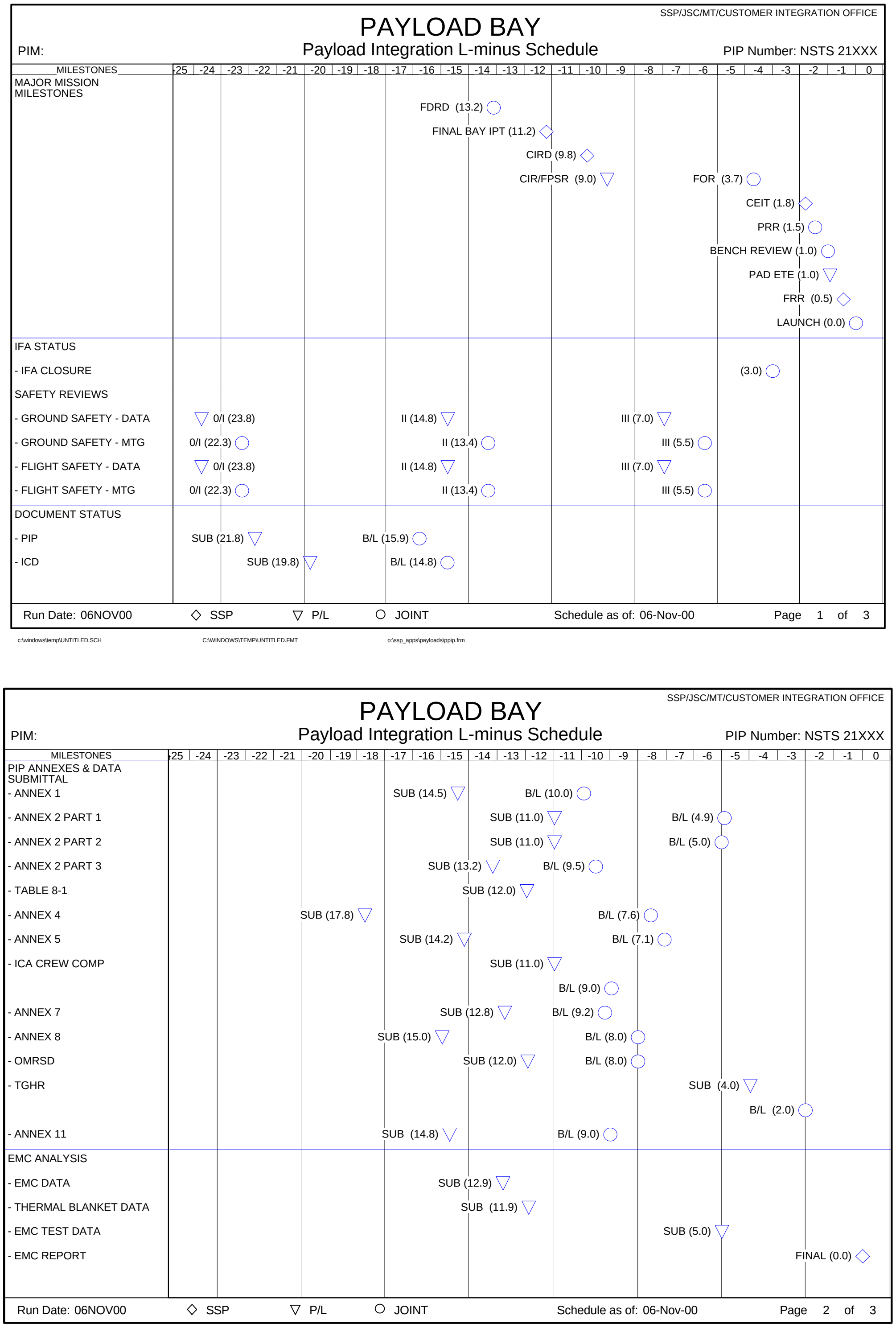

Figure 15-1.- Payload integration schedule (sheet 1 of 4).

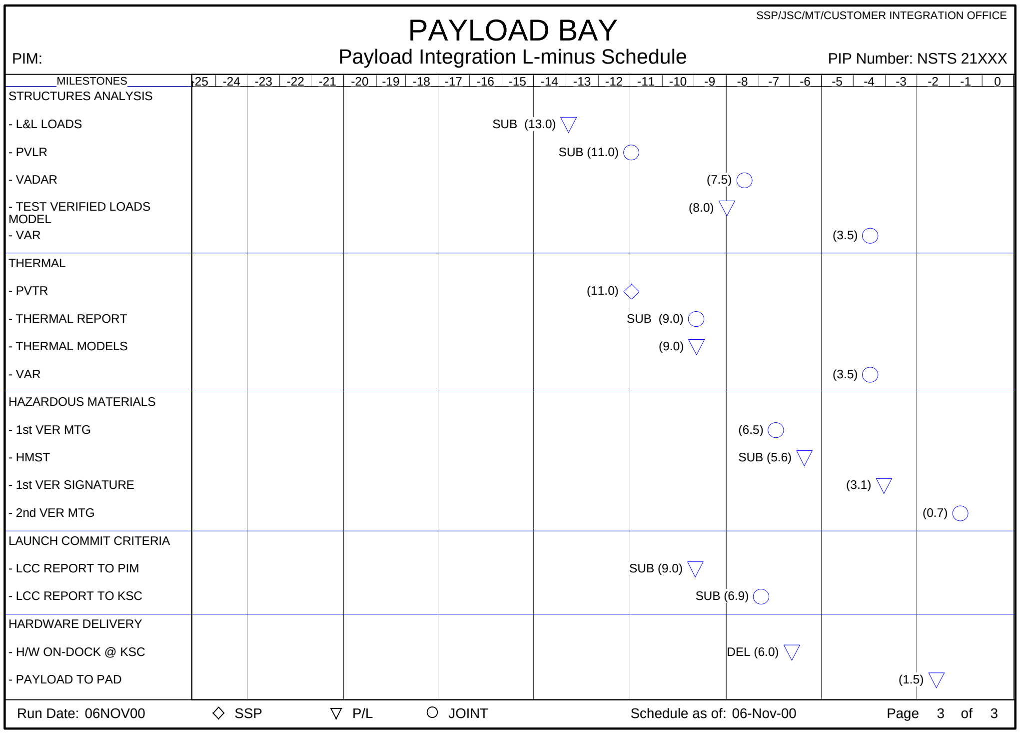

Figure 15-1.- Payload integration schedule (sheet 2 of 4).

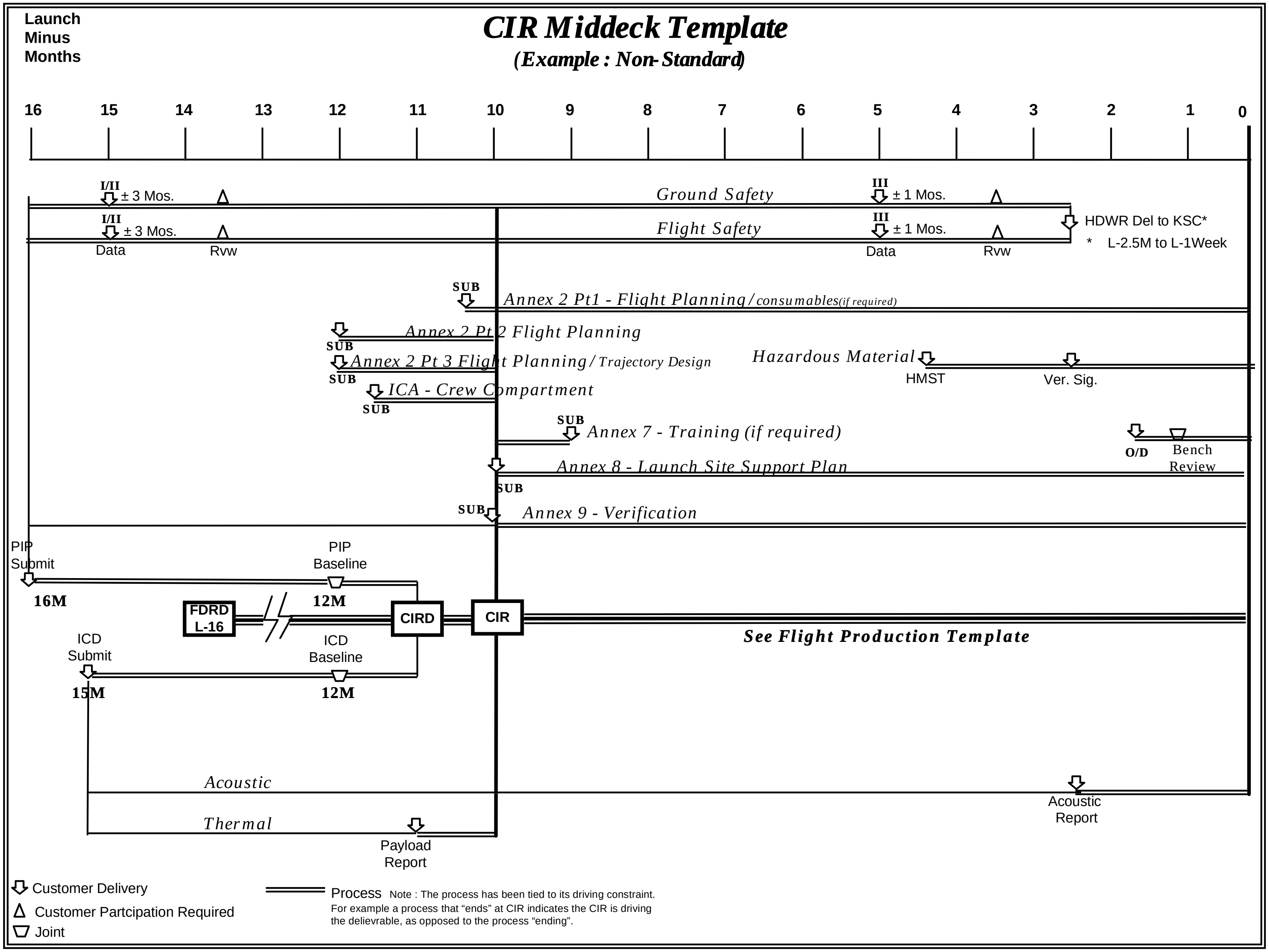

Figure 15-1. - Payload integration schedule (sheet 3 of 4).

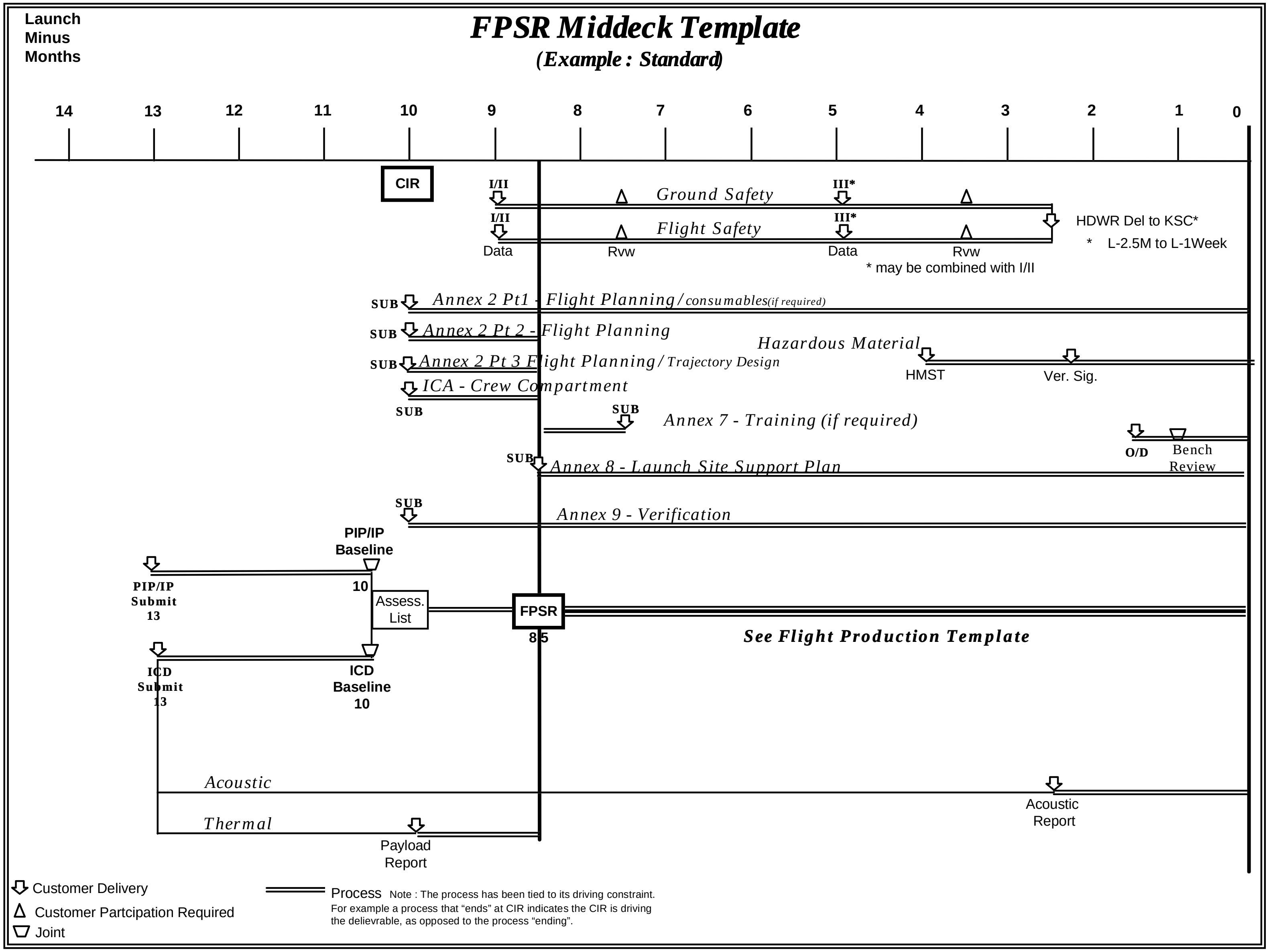

Figure 15-1.- Payload integration schedule (sheet 4 of 4).

APPENDIX A

ACRONYMS AND ABBREVIATIONS

AFD	Aft Flight Deck
ASE	Airborne Support Equipment
c.g.	center of gravity
CCB	Configuration Control Board
CIR	Cargo Integration Review
CMT	Cargo Management Team
COFR	Certification of Flight Readiness
CONUS	Continental United States
CRT	Cathode-Ray Tube
CSR	Customer Support Room
D&C	Display and Control
DSO	Detailed Supplementary Objective
DTO	Development Test Objective
EAFB	Edwards Air Force Base
EMC	Electromagnetic Compatibility
EOM	End of Mission
EVA	Extravehicular Activity
FCS	Flight Control System
FDF	Flight Data File
FOR	Flight Operations Review
FRR	Flight Readiness Review
FTSOD	Flight Test Supplementary Objective Document
ft-c	foot-candles
GFE	Government Furnished Equipment
GHz	Gigahertz
GOR	Ground Operations Review
GPC	General Purpose Computer
GSE	Ground Support Equipment
HEPA	High Efficiency Particle Air
Hz	Hertz (cycles per second)
ICD	Interface Control Document
IFM	In-flight Maintenance
IMU	Inertial Measurement Unit
IP	Integration Plan
IPT	Integrated Product Team
IVT	Interface Verification Test

JIS	Joint Integrated Simulations
JSC	Lyndon B. Johnson Space Center
KSC	John F. Kennedy Space Center
L&L	Launch and Landing
LCC	Launch Commit Criteria
LSIM	Launch Site Integration Manager
MCC	Mission Control Center
MCC-H	Mission Control Center-Houston
mg	milligram
MMT	Mission Management Team
MOC	Mission Operations Computer
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NVR	Nonvolatile Residue
OMS	Orbital Maneuvering System
OPF	Orbiter Processing Facility
OPS	Operations
OST	Operations Support Timeline
PCR	Payload Changeout Room
PGSC	Payload and General Support Computer
PLBD	Payload Bay Door
POCC	Payload Operations Control Center
ppm	parts per million
PRCS	Primary Reaction Control System
PRD	Program Requirements Document
psia	pounds per square inch absolute
PTC	Passive Thermal Control
rev/hr	revolutions per hour
RF	Radio Frequency
RME	Risk Mitigation Experiment
RMS	Remote Manipulator System
SAR	Safety Analysis Report
SCA	Shuttle Carrier Aircraft
SIP	Standard Integration Plan
SLF	Shuttle Landing Facility
SMS	Shuttle Mission Simulator
SN	Space Network
SRB	Solid Rocket Booster
SSP	Space Shuttle Program
STDN	Spaceflight Tracking and Data Network

T-	Time Prior to Launch
TOP	Technical Operating Procedures
TV	Television
V/m	Volts per meter
VAB	Vehicle Assembly Building
VAR	Verification Acceptance Review
VLA	Verification Loads Analysis
W	Watt
WS	Workstation
WSSH	White Sands Space Harbor
+ZLV	Z Local Vertical (Payload Bay Toward Earth)

APPENDIX B

DEFINITIONS

a. Pre-Payload Bay Door (PLBD) closure - Period of time from Detailed Test Objectives (DTO), Detailed Supplementary Objectives (DSO), or Risk Mitigation Experiment (RME) 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. DTO, DSO, or RME preoperation - The period of time from just after the establishment of a stable orbit until the start of DTO, DSO, or RME operation sequence.

e. DTO, DSO, or RME operation - The period of time from the start of the operation sequence until the completion of the postoperation reconfiguration.

f. DTO, DSO, or RME 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 DTO, DSO, or RME from the Orbiter.