JSC-14013
Revision C
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P80-1 Space Vehicle System

Payload Integration Plan

Revision C

August 1980

NASA
National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

DESCRIPTION OF CHANGES TO

PAYLOAD INTEGRATION PLAN

SPACE TRANSPORTATION SYSTEM

AND

P80-1 SPACE VEHICLE SYSTEM

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
--	Baseline Issue/AAV-00001	12/21/78	All
1	Correct typo; Earth Shield configuration verification; change scheduled orbit period; EMC design criteria change/ AAV-00002; -00004; -00007; P14013-1	04/10/79	3,7,9,13
2	Revise Payload Integration Schedule/P14013-12	04/30/79	23,24
3	Delete TBR 5; Delete TBR 2; change KU-Band constraint; P14013-6; -7; -10	05/21/79	9,12,15, 17,25,26
4	Change Launch Date Milestone/ P14013-13	06/01/79	23,26
5	Change to Launch Configuration/ P14013-9	08/20/79	6
6	(P14013-15 supersedes AAV-00006); Update RF Communications; Revise Summary Price Sheet/P14013-3; -15	09/04/79	8,21
7	(P14013-14 Supersedes AAV-00005); Update Optional Services provided USAF/SD at KSC/P14013-14	10/22/79	20
REV A	Change Cargo Bay Door Opening Time; Disposition of unique hardware; RCS separation/	11/21/79	All

	P14013-16;-20:-24		
1	Revise Interface Verification Reqmts; Change RF Comm constraints; Update PIM Burn constraints; P14013-21A; -22A; -26A	11/10/80	8,9,10,19, 23,26
REV B	Change to Word One format; Update Cryogen Rechill reqmts; Delete low Beta angle table; change Para. 9.3 TBD's; define launch constraints; delete Attachment 1; reflect new KSC organization/P14013-17; -18; -19; -23B; -33; -34	04/28/80	All
1	Provide better definition of operational control resp. and authority/P14013-30	05/05/80	17
2	Update return time maximum/ P14013-35	06/24/80	9
REV C	Provide contamination levels definition; payload schedule revision; editorial changes; RTS contact time/elevation; redundant camera reqmt; Ref. chg. to ICD A-14013/P14013-31D;-32C;-36;-37; -39;-41	08/13/80	All

PAYLOAD INTEGRATION PLAN

SPACE TRANSPORTATION SYSTEM

AND

P80-1 SPACE VEHICLE SYSTEM

AUGUST 13, 1980

APPROVED:

Signed by Glynn S. Lunney,
Manager, STS Operations
Program Office, December 1978
GLYNN S. LUNNEY, Manager
STS Operations Program Office
Lyndon B. Johnson Space Center

Signed by John S. Boyland,
Col. USAF, December 1978
JOHN S. BOYLAND, Colonel, USAF
Director of Payload Integration
and Mission Operations
Space Launch Systems Organization

REVISIONS

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Orig.	---	Baseline Issue	Dec. 78
---	1	By Authority of CR/D AAV-00002, AAV-00004, AAV-00007 and P14013-1	04/10/79
---	2	By Authority of CR/D P14013-12	04/30/79
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BASELINE DOCUMENT FOR P80-1 SPACE VEHICLE SYSTEM

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ii	Blank
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vi	Blank
vii	12/--/78
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xi	12/--/78
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13	04/10/79
14	12/--/78
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16	12/--/78
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18	12/--/78
19	12/--/78
20	12/--/78
21	12/--/78
22	12/--/78
23	04/30/79
24	04/30/79
*25	05/21/79
*26	DELETED
27	12/--/78
*Back Cover	05/21/79

*CURRENT CHANGE

CONTENTS

Section		Page
9.1	P80-1 Processing	19
9.1.1	Solid Propellant Storage Area	19
9.1.2	Battery Storage	19
9.1.3	Orbiter Processing Facility	19
9.2	VPF Operations	20
9.3	Pad Operations	20
9.4	Postflight Services and Disposition	21
9.5	Security Requirements	21
10.0	SAFETY	21
11.0	INTERFACE VERIFICATION	22
12.0	POSTFLIGHT DATA REQUIPEMENTS	23
13.0	SUMMARY OF OPTIONAL SERVICES	23
14.0	PIP ANNEXES	24
15.0	SCHEDULE	25
16.0	REFERENCE DOCUMENTS	25
APPENDIX A - TO BE RESOLVED ITEMS		A-1

1.0 INTRODUCTION

The National Aeronautics and Space Administration (NASA) and United States Air Force plan to launch the P80-1 Space Vehicle System (SVS) satellite with the Space Transportation System (STS). The P80-1 SVS includes the satellite deployed from the Orbiter and the Airborne Support Equipment (ASE) that is retained in the Orbiter.

For purposes of this Payload Integration Plan (PIP), the STS shall be represented by the NASA Lyndon B. Johnson Space Center (JSC) and NASA John F. Kennedy Space Center (KSC). The payload shall be represented by SD/YVO, SD/YLT, and 6555th ASTG.

This plan provides for the management roles and responsibilities, a definition of technical activities, interfaces, and a schedule required to accomplish the integration of the P80-1 SVS.

The requirements for implementation are contained in this PIP and its required documentation.

2.0 MANAGEMENT RESPONSIBILITIES

The responsibilities for assuring the definition, control, implementation, and accomplishment of the activities identified in this document for the STS are vested with the STS Operations Program Office at NASA JSC, and the Mission Control Program Office (SD/YVO) of the Space Launch Systems Organization at the SD.

Changes to this document and associated documentation, including the unique ICD, created by this plan shall be mutually agreed to and signed by the STS and SD/YVO.

2.1 Joint Responsibilities

STS and SD will support the necessary integration activities, both analytical and physical, as identified in this plan and according to the schedules contained herein. STS and SD will support the interface working groups which include management, structural/mechanical, avionics, thermal, flight operations, and ground operations working groups with the technical responsiblity for accomplishment of the integration task.

The individual working groups will be co-chaired by JSC and YVO representatives, except that the ground operations working group will be co-chaired by KSC and the 6555th ASTG. These working groups will meet jointly or individually as necessary to resolve integration items.

Each working group will support the integration activities by:

a. Providing inputs to the PIP, PIP annexes, and interface control documents

b. Resolving all technical interface problems associated with their respective discipline

c. Supporting the scheduled STS reviews (ref. Paragraph 2.5)

d. Preparing and distributing minutes documenting all agreements and open items

2.2 STS Responsibilities

The NASA KSC DOD STS Affairs Office (SP-DSA) is responsible for launch and landing support for agreed upon facilities and services required for integrated checkout and for ground integration of the P80-1 SVS and STS.

NASA JSC is responsible for the Shuttle vehicle/P80-1 analytical and physical integration, integrated flight design, integrated flight operations prior to deployment, and compatibility with other cargo elements which share the same flight.

NASA JSC will support the DOD safety review team.

2.3 SD Responsibilities

SD is responsible for the design, development and test of the P80-1 satellite, ASE and Ground Support Equipment (GSE).

SD is responsible for the procurement, manufacture, delivery to KSC, and checkout at KSC of the P80-1 SVS.

SD is responsible for all analytical and physical integration of the P80-1 satellite with its ASE and GSE. SD is responsible for all operations of the P80-1 SVS.

2.4 Documentation

The primary documentation to insure proper integration of the payload will consist of the PIP, the PIP annexes, and appropriate ICDs. These documents will be jointly approved by STS and SD.

NASA JSC will maintain configuration control of the above documentation, with the exception of the Launch Site Support Plan Annex which will be maintained by KSC.

Configuration control will be initiated upon signature approval and maintained in accordance with Change Control Requirements and Procedures Manual, JSC 13995.

2.5 Reviews

The following reviews will be implemented to assess the cargo implemention process as described in the Shuttle/Payload Integration Activities Plan, JSC 14363:

a. Cargo Integration Review (CIR)

b. Integration Hardware/Software Review (IH/SR)

c. Flight Operations Review (FOR)

d. Ground Operation Review (GOR)

e. Flight Readiness Review (FRR)

2.6 Security

SD shall be responsible for defining the P80-1 program security requirements.

NASA KSC will be responsible for the implementation of the security requirements as specified in Paragraph 9.5.

3.0 PAYLOAD DESCRIPTION

The P80-1 SVS is comprised of the P80-1 satellite (Figure 3-1) and the associated ASE. The vehicle is designed to be installed in the Orbiter cargo bay (Figure 3-2) after the Orbiter is in the vertical position. The payload will be deployed from the Orbiter using a self-contained mechanism, and separation is initiated by actuation of the electroexplosive devices on clamps at the cradle/satellite separation plane. Physical separation is accomplished by preloaded springs.

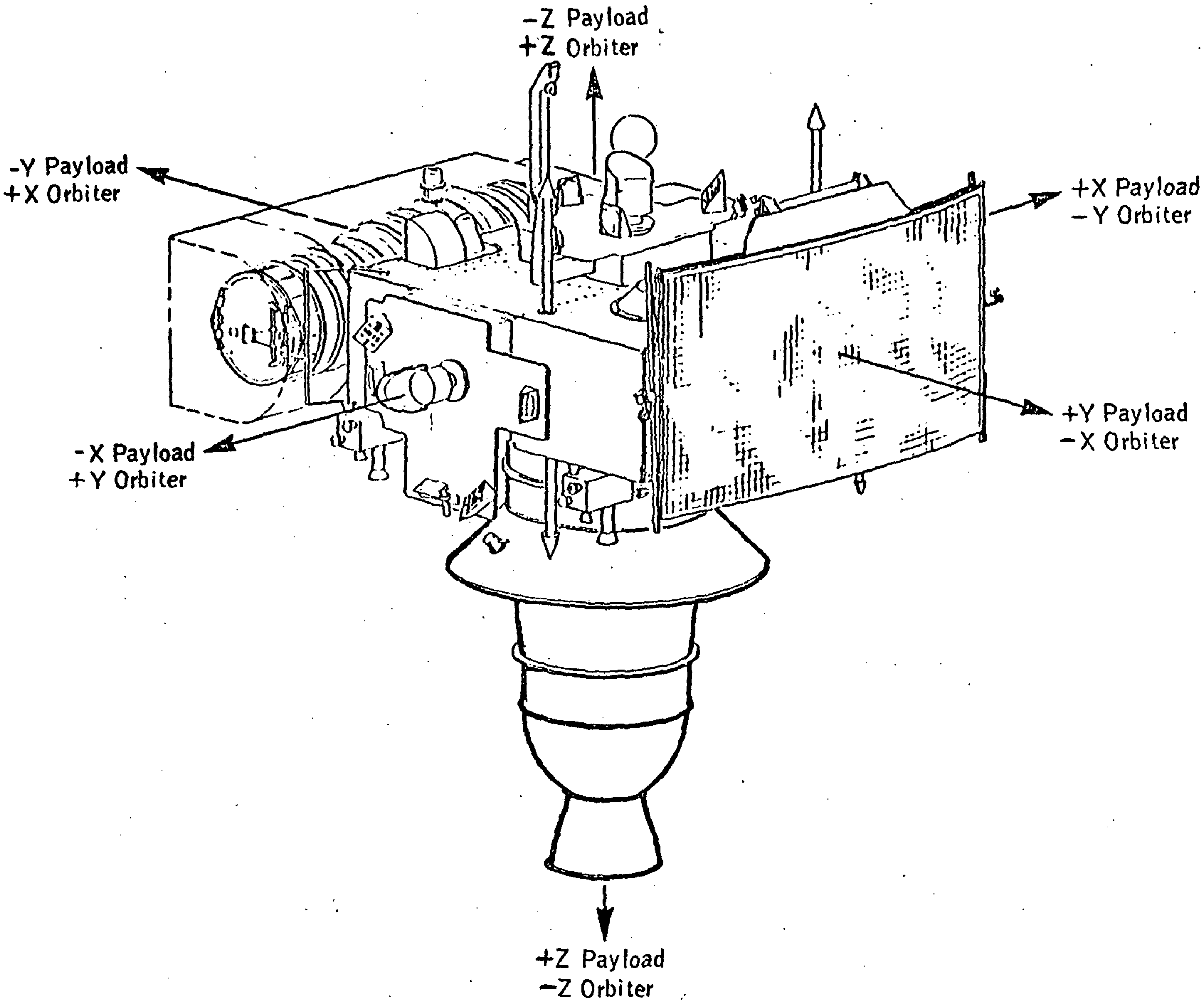
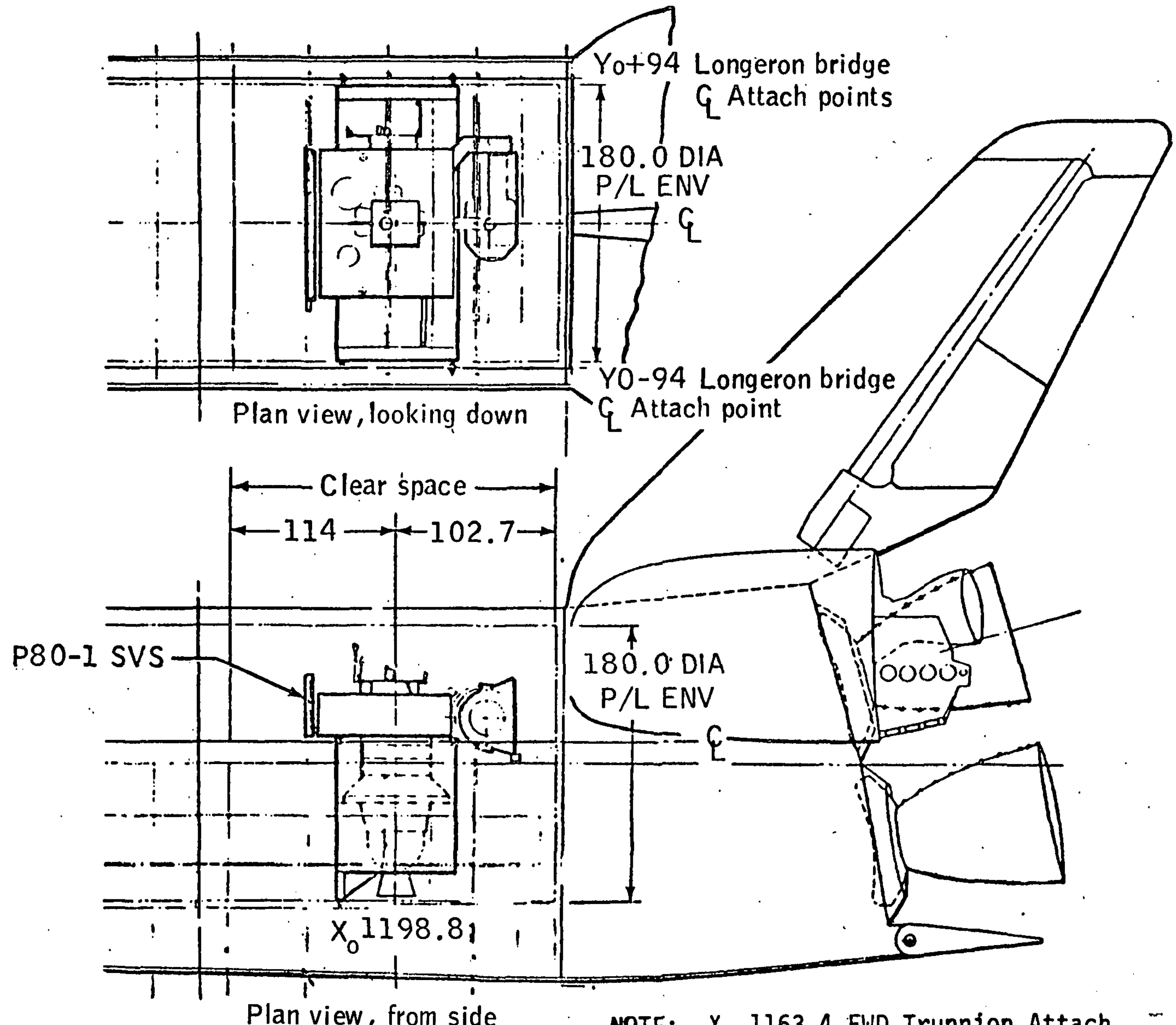


Figure 3-1.- P80-1 Satellite.



NOTE: X_o 1163.4 FWD Trunnion Attach
X_o 1234.2 Aft Trunnion Attach
X_o 1163.4 Keel Attach

Figure 3-2.- P80-1 Launch Configuration in Orbiter.

The P80-1 mission objective is to fly four space experiments: the Teal Ruby Experiment for assessment/verification of the multispectral mosaic focal plane telescopes; the Ion Auxiliary Propulsion System for assessment/verification of ion propulsion technology, design, and equipment; the Extreme Ultraviolet photometer for gathering scientific data from space sources; and the Lasercom Space Measurement Unit for proof of concept of space based laser communication receiver, as well as measurement of far-field laser beam homogenities.

In addition to the four experiments, the satellite consists of the following systems:

Orbit Injection System (OIS) -- Two solid rocket motors capable of producing a total impulse of 654,000 lb-sec/motor

Propulsion Subsystem -- A hydrazine system which provides three-axis control during the perigee and apogee injection maneuvers using N2H4 propellant

A cold gas (N2) system for attitude and orientation control during separation and deployment and orbit transfer

Attitude Control and Determination Subsystem -- Subsystem includes the following: IMU for attitude and rate information (star sensor for updating), and a computer for attitude control during coast, Perigee Injection Motor (PIM), and Apogee Injection Motor (AIM) burns

Telemetry Tracking and Command Subsystem -- Provides both stored and real-time commands, simultaneous Carrier 1 and 2 data transmission and recording, and antenna coverage that permits operations with Air Force Satellite Control Facility/Remote Tracking Station (AFSCF/RTS) facilities

Electrical Power Subsystem -- A solar array consisting of three panels are deployed upon reaching operational orbit. Energy storage both for transfer and operational activities is provided by nickel cadmium batteries

Thermal Control Subsystem -- Passive thermal control is used throughout. Cold biasing with heaters is used for critical temperature control cases

4.0 MISSION OPERATIONS

The mission operation summary requirements and constraints by mission phase are as delineated in subsequent paragraphs of this section.

4.1 Preliminary Operations Scenario

The P80-1 Space Vehicle System will be delivered to the Air Force Satellite Assembly Building (SAB) at the Cape Canaveral Air Force Station for off-line processing which will include Teal Ruby cryostat loading, integrated system tests, and AFSCF compatibility tests. After operations at the SAB, the P80-1 elements will be transported by the DOD to the Vertical Processing Facility (VPF) for final assembly, cargo integration and STS interface tests, and hydrazine and GN2 loading. After VPF operations, the P80-1 control panel (TBR No. 4) will be transferred to the Orbiter Processing Facility (OPF) for installation into the Orbiter and the P80-1 SVS will be transported to the Rotating Service Structure (RSS) for installation into the Orbiter payload bay.

Launch will be from the KSC, Florida. After reaching orbital altitude, the cargo bay doors will be opened and the Orbiter maintained to allow P80-1 communications with the AFSCF ground stations. The crew will power up the P80-1 for RF checkout and state vector update by the AFSCF. The crew will initiate deployment from the Aft Flight Deck (AFD) control panel.

Following separation from the Orbiter, the P80-1 flight will become the operational responsibility of the AFSCF. The events of the transfer to the flight orbit will be controlled and monitored by the AFSCF following acquisition of the satellite by the appropriate PTS's.

The P80-1 will use springs to provide the separation velocity specified in Paragraph 4.3.3.4. A ground checkout sequence by AFSCF will then follow prior to the perigee maneuver. Approximately one-half orbit later, the apogee maneuver is performed placing the spacecraft in a final orbit. The solar array will then deploy, and P80-1 will align itself to a favorable solar orientation.

4.2 Orbital Requirements and Payload Control Parameters

STS

Orbital altitude:	160 plus or minus TBD n mi
Inclination:	57 deg minimum

	P80-1	Unique integration hardware	Total
Weight (lb) to launch:	8,600	2,800*	11,400**

Weight (lb) to be ejected: 8,600

Weight (lb) to be landed: Normal 2,800; contingency 11,400**

AFD storage: 1-Control panel - weight TBD

*Cradle, panel, vent line, purge line
**Longeron and keel bridges and fittings not included

Cargo bay length of P80-1 SVS is 220 inches maximum (this includes a minimum of 3 inches clearance forward and aft of the payload).

The mass properties and configuration drawings will be defined in the Payload Data Package Annex of this PIP.

4.3 Operational Requirements and Constraints

The following P80-1 operational requirements and constraints will be considered during flight planning and implementation of the STS and P80-1 flight.

4.3.1 Prelaunch.- Cryogen chilling will be maintained as long as possible prior to payload bay door closure. After cryogen chilling disconnect, launch will be accomplished nominally within 50 hours or rechilling will be required. If the need for this rechilling is attributable to payload-incurred delays to the Orbiter processing time, the cost of this serial impact will be charged to the payload as an optional service (TBR No.3).

4.3.1.1 Launch Window: The P80-1 launch window requirements will be defined in terms of right ascension limits of the ascending node of the Earth parking orbit at the time of spacecraft deployment. These requirements will reflect:

a. A maximum allowable cumulative eclipse time in the spacecraft parking orbit

b. A maximum eclipse time per orbit in the parking orbit

c. A desired 72 hours in a fully sunlit Earth parking orbit after deployment (if manifesting requirements dictate, the 72 hours will be reevaluated)

The launch window data will be provided in the Flight Planning Annex.

4.3.2 Ascent.- No payload-unique requirements

4.3.3 On-Orbit.- The P80-1 must be deployed within 10 hours from lift-off due to battery life and orbital opportunities.

The cargo bay doors 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 5.0 hours maximum. The SD desires that the cargo bay doors be opened as soon as possible in order to maximize the number of RTS contacts. For abort, descent and landing, the payload shall be designed so that the resulting loads and thermal conditions present no hazard to the Orbiter or crew. Note: for contingency landing sites, no ground purge of the cargo bay will exist.

4.3.3.1 RF link to AFSCF stations: During P80-1 payload checkout, RTS contact to perform the P80-1 Deployment Readiness Test (DRT) is required for a ground GO/NO-GO deployment decision. The P80-1 DRT requires at least three RTS passes with a cumulative contact time of 17 minutes above 5 degrees elevation. Each of the three RTS passes must be greater than 4 minutes above 5 degrees elevation, and one pass must be within 2 hours of deployment. During these periods, no Orbiter noncritical or other payload RF operations which interfere with P80-1 communications will be permitted which exceed 25 dB microvolts/meter from 1.75 to 1.85 GHz, based on minimum receiver sensitivity, at the P80-1 location. During RTS coverage for P80-1 checkout, the P80-1 desires that the Orbiter maximize the RTS contact time by avoiding STS structural interference with the P80-1 antenna pattern. The P80-1 antenna patterns will be supplied in the Payload Data Package Annex.

4.3.3.2 Thermal Environment (TBR No. 1): The STS will normally be oriented with the cargo bay facing Earth (+ZLV) or Passive Thermal Control (PTC), which is defined as X-axis perpendicular to the solar vector and rolling about X-axis at a rate of 2 to 5 rph with multiple allowable excursions of solar viewing (+Z Solar), deep space viewing (+Z Space), Earth viewing (+ZLV) as shown in the table below. Also specified are the P80-1 recovery times for these excursions which allows repeat of the required attitudes.

BETA ANGLE GREATER THAN 60 DEG ATTITUDE REQUIREMENT

Attitude	Required time	Payload recovery time at PTC
+PTC	Continuous	N/A
+ZLV	6 hr (followed by 3 hr PTC)	TBD

+Z Solar	30 minutes	TBD
+Z Space	90 minutes	TBD
Payload worst solar angle	TBD	TBD

ASE remaining in the cargo bay after deployment of the satellite shall be compatible with the Orbiter attitude capability as defined in Paragraph 6.1.1.2. of ICD A-14013.

In the event of failure to deploy due to a P80-1 problem all P80-1 constraints will be considered, but STS attitudes will be inhibited only by safety constraints.

4.3.3.3 Contamination: The P80-1 contamination budget allows contamination contributions from Orbiter operations (paylaod bay door closeout through achievement of safe separation distance) of less than or equal to 0.65 mg/ft2 of nonvolatile residue (NVR) and particulate contamination that shall not degrade the P80-1 visibly clean level (750) (reference MIL-STD-1246A). The STS understands these levels to be a goal for surfaces above 25 deg C. To this end, the STS will:

a. Maintain cognizance of the allowable contamination levels of P80-1

b. Notify SD if any design mission plans, within other PIP and manifesting constraints, violate the goal to minimize P80-1 residence time in the cargo bay or prevent deployment prior to other payloads

c. Design a separation sequence which will attempt, within other mission constraints, to minimize contamination

d. Minimize operation of the Orbiter systems or other payloads which could result in contamination of P80-1

A comprehensive contamination analysis for CIR will be performed by SD using the available IECM data with defined deployment and separation timelines to determine contamination levels. If these contamination levels exceed 0.65 mg/ft2, as determined by NASA and SD, then a joint solution will be determined using design fixes and/or operational procedures. Separation sequence design and details of contamination avoidance procedures will be contained in the Flight Procedures which will be provided for SD review.

4.3.3.4 Separation (nominal): The Orbiter Z-axis must point along the velocity vector within 3 deg either retrograde or posigrade.

The Orbiter +Y-axis must be pointed as per specified attitude TBD deg plus or minus 3 deg of the nadir.

The P80-1 will provide at least 1 ft/sec separation velocity; details will be found in the Flight Planning Annex.

4.3.3.5 P80-1 Perigee Injection Motor Burn: The PIM burn will not be executed until at least 45 minutes after deployment of the P80-1 and until a safe separation distance is obtained. Ascending or descending node PIM burn is acceptable. The STS is responsible for attaining a safe separation distance within the contamination constraints identified in Paragraph 4.3.3.3.

Visual observation of the PIM burn is highly desirable.

4.3.3.6 Ku-Band Interference: The Orbiter Ku-band system shall remain off throughout the flight until the P80-1 satellite is TBD feet from the orbiter.

4.3.3.7 Teal Ruby Earth Shield: Visual verification by television is required prior to P80-1 deployment that the Teal Ruby earth shield is in a stowed configuration. This will require two aft bulkhead cameras to provide the necessary redundancy.

5.0 P80-1-TO-STS INTERFACES

The P80-1/STS interfaces consist of mechanical, electrical avionics, and environmental requirements, as defined in the Shuttle Orbiter/P80-1 Cargo Element Interfaces, ICD A-14013, with which the spacecraft must be compatible. An Interface Control Document (ICD) will be generated and maintained by the STS to define P80-1 unique interface requirements. The electrical and vent interfaces are physically located at the P80-1 ASF/STS interface plane which will be above the Zo 400 station. The following paragraphs provide a brief description of the interfaces required.

The standard STS services for P80-1 include one section of the standard cargo bay harness and one section of the standard AFD harness.

5.1 Structural/Mechanical Interfaces (TBR No. 4)

P80-1 installation is at the aft portion of the Orbiter bay and is retained at four longeron locations and one keel location. Standard Orbiter bridges and fittings are utilized. Cargo bay and aft flight deck envelope requirements will be specified in P80-1/STS ICD A-14013. P80-1 unique umibilicals, purge, and vent provisions interface with the STS as specified in P80-1/STS ICD A-14013. The P80-1 supplied display and control panel will be installed in the AFD station, and its electrical connector will interface with the Shuttle standard AFD harness. NASA JSC will prepare all required cargo-to-Orbiter installation documentation.

5.2 Electrical Power Interfaces

During flight operations, power will be supplied by the P80-1. For ground operations, the P80-1 power will be supplied by GSE which will be provided by the User. Electrical power interface requirements are as follows:

Electrical power source interface	Prelaunch	Launch	Attached (Orbiter)
a. Hardwire through T-0	X	N/A	N/A
b. Carry on cable	X	N/A	N/A

The above interfaces are physically located (except for the carry on cable) as specified in the P80-1/STS ICD A-14013.

The specific power profile will be defined in the Flight Planning Annex.

5.3 Command Interfaces

Commands will be required to support the following P80-1 functions:

The command and response interfaces are as follows: Specific requirements will be defined in the P80-1/STS ICD A-14013.

Commands interface/ source	Prelaunch	Launch	On-orbit attached	On-orbit detached
a. Payload hardwire to T-0 umbilical EGSE (Serial) to LCC (KSC)	X	N/A	N/A	N/A

b.	RF - AFSCF (Direct)	X**	N/A	X*	X
c.	Hardwire - AFD to P80-1	X	N/A	X	N/A

*Cargo bay doors open
**Cargo bay doors open - During prelaunch operations, the RF link is via antenna hats and FSS antenna to SAB.

All hardwire interfaces are located at the P80-1 ASE/STS interface and identified in the ICD A-14013. No STS-generated commands are required to support the P80-1 flight.

Arrangement and nomenclature of the switch panel functions are to be defined in the Orbiter Crew Compartment Annex to the PIP.

5.4 Telemetry and Data Interfaces

The telemetry and data interfaces are as follows: Specific requirements will be defined in the P80-1/STS ICD A-14013.

Telemetry interface/ route		Prelaunch	Launch	On-orbit attached	On-orbit detached
a.	Hardwire to T-O	X	N/A	N/A	N/A
b.	RF direct to AFSCF	X**	N/A	X*	X
c.	Hardwire - P80-1 to P80-1 AFD panel	X	N/A	X	N/A

*Cargo bay doors open
**Cargo bay doors open - During prelaunch operations, the RF link is via antenna hats and FSS antenna to SAB.

All hardwire interfaces are located at the P80-1 ASE/STS. No telemetry via the STS telemetry links is required to support the P80-1 flight. Telemetry will be direct from P80-1 to RTS terminals.

5.5 Purge and Vent Interfaces

Purge characteristics using the Orbiter spigot system are specified in ICD A-14013 and will be controlled (inlet gas temperature) within 60-70 deg F. Location of P80-1 local duct will be specified in P80-1/STS ICD A-14013. Contingency venting for methane will be provided through the Orbiter overboard vent and the location will be specified in P80-1/STS ICD A-14013.

Contingency venting for neon will be into the Orbiter cargo bay and implementation will be compatible with the safety requirements.

6.0 ENVIRONMENTAL ANALYSES AND INTERFACES

Environmental interface analyses will be conducted to determine physical and functional interface compatibility and to minimize impacts to the P80-1 and STS. The specific analyses are described below.

The schedules and responsibility for accomplishment of these activities are included in Figure 15-1.

6.1 Structural Loads

The payload preliminary design shall be based upon load factors provided in ICD A-14013. Subsequent design shall be based upon coupled dynamic and quasi-static analyses performed using updated payload and Shuttle models. The SD project is responsible for assuring that the payload is designed to be compatible with the Shuttle environments resulting from these analyses and any subsequent updates. The payload is also responsible for assuring that the interface forces and deflections (including thermal effects) do not exceed the allowables in ICD A-14013. The schedule for anticipated shuttle model updates will be provided to the payload. The SD is responsible for applying appropriate conservatism to the loads to account for anticipated model updates. The STS will advise the SD regarding appropriate conservatism for Shuttle loads; however, the responsibility for payload compatibility with the final flight loads remains with the SD. The SD will define the degree of conservatism used in the design to the STS.

For the P80-1 SVS, two design support load cycle analyses will be performed by the STS as an optional service (TBR No. 3) and documented in P80-1/STS loads reports to be provided by the STS. These results will be discussed by the joint working group and the latest report will be referenced in P80-1/STS ICD A-14013. The STS will subsequently perform a verification loads cycle as a standard service. The model deliveries and analyses will be in accordance with the Section 15 schedule. All models and analyses will be per SD77-SH-0214.

The results of the verification loads cycle will be used by the STS to assure that the interface load conditions are within the Orbiter capability. The results will be provided to SD, who is responsible for verifying that the dynamic envelope (including thermal effects) does not exceed the allowable limit as specified in ICD A-14013.

6.2 Thermal Environments and Interface

Integration of the P80-1 into the STS will require engineering thermal analysis to support design and flight operations. STS will provide thermal math models to the P80-1 program. P80-1 thermal models and updates shall be furnished by the P80-1 program to STS. As a standard service, STS will then perform an integrated cargo thermal analysis consistent with Section 4.0 mission constraints to support the CIR. A second standard service integrated cargo thermal analysis will be performed by the STS to support the mission activity. The schedule for accomplishing the various P80-1 thermal analyses is contained in Figure 15-1.

6.3 Electromagnetic Interference/Electromagnetic Compatibility

The Shuttle induced environments are defined in ICD A-14013. P80-1 is responsible for assuring that the P80-1 SVS is compatible with the electromagnetic interference environments. P80-1 is responsible for defining the payload induced Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC) environment to the STS. The specific characteristics of the payload radiation sources will be defined in Payload Data Package Annex. The RF environment to which the P80-1 SVS will be exposed during KSC ground operations shall not exceed those specified in JSC 07700, Vol X.

The STS will perform an intentional radiators RF interference assessment for mutual compatibility as a standard service. The SD will be responsible for assuring that they are compatible with the environment.

Payload intentional transmitter radiation levels outside of the payload envelope incident on other cargo elements within the cargo bay shall be limited to those levels specified for S-band in ICD A-14013.

6.4 Contamination

The STS-induced environmental conditions are defined in ICD A-14013. The payload list of nonmetallic materials provided as part of the safety requirements is used to assess outgassing of the payload. Fluid dumps, if required, shall be designed to avoid deposition on other payloads or STS systems and should be manually controllable.

Ground contamination control will be implemented and, in addition, the use of the Orbiter cargo bay liner is required.

At the KSC ground facilities (VPF and RSS), input air will be nominal class 100, guaranteed class 5,000 as specified in FED-STD-209B.

Maintenance of a class 100,000 environment is expected to be achieved through operational controls. In addition, all surfaces shall be maintained visibly clean.

Any problems identified by the detailed analytical assessment or the materials list review will be mutually discussed and resolved.

6.5 Shock, Vibration, and Acoustic

The STS shock, vibration, and acoustic environment definition for P80-1 SVS design is contained in the Shuttle Orbiter/P80-1 Cargo Element Interfaces, ICD A-14013.

6.6 Ground Environmental Requirements

Loads factors for ground handling of the P80-1 SVS shall not exceed those specified in JSC 07700, Vol X.

7.0 INTEGRATION HARDWARE

The responsibilities for the integration hardware are defined in the following paragraphs. All flight integration hardware is payload weight chargeable.

7.1 STS-Provided Hardware

The STS will provide:

a. *Longeron and keel bridges, passive longeron attach fittings, and active keel fittings

b. *Standard cargo bay liner

c. Electrical cables from the P80-1 control panel interface in the AFD to the P80-1 ASE/STS interface in the cargo bay (standard mixed cargo harness and fixed Orbiter wiring)

d. Electrical umbilical cables from the P80-1 ASE/STS interface to the Orbiter T-0 umbilical panel (standard mixed cargo harness and fixed Orbiter wiring)

e. Local purge duct from the spigot system to the payload as an optional service (TBR No. 3)

f. Design and fabrication of a methane vent line from the cradle interface to an Orbiter overboard vent as an optional service (TBR No. 3)

g. TV cameras

*Not payload weight chargeable

7.2 SD-Provided Hardware

The SD will provide:

a. Ground power supply

b. AFD display and control panel (will mate with AFD standard harness connectors) (TBP No. 4)

c. Training display and control panel

d. Payload rotation device

8.0 FLIGHT OPERATIONS

This section defines the responsibility for flight design, flight activity planning, flight crew and flight controller training, and flight operations support activities required for P80-1 SVS/STS integration.

8.1 Flight Design

The STS will be responsible for performing integrated mission analysis from lift-off until Orbiter and P80-1 safe separation distance is obtained. The constraints for flight design are defined in Section 4. The SD will provide information to support the analysis in the Flight Planning Annex. The P80-1 program will be responsible for the detached P80-1 Orbital mission requirements.

8.2 Flight Activity Planning

The STS will be responsible for all flight crew activity plans and procedures, and will develop an integrated summary STS/P80-1 crew activity plan to support the mission. Included in the plan will be the sequence of events and crew timelines for nominal operations. The SD will provide the payload sequence of events as part of the Flight Planning Annex.

8.3 Training

The STS will be responsible for providing the crew training plans and crew training. Since no specific P80-1 training requirements have been identified, the scope of P80-1 involvement is to provide a crew briefing for payload familiarization, representative training hardware for the P80-1 display and control panel on the AFD, and configuration data to support the above training.

8.4 Flight Operations Control

The STS will be responsible for integration of all flight operations until the P80-1 is a safe distance from the Orbiter. At physical separation from the Orbiter, the P80-1 will become the operational responsibility of the AFSCF and SD. However, all commanding of the P80-1 prior to attaining a safe separation distance will be precoordinated with and approved by the JSC Mission Control Center (MCC) at Houston, Texas. STS flight control operations in support of the Orbiter will be conducted from the MCC. P80-1 flight control operations will be conducted from the AFSCF at Sunnyvale, California. The basic plan, timelines, and agreements for these operations, including necessary procedures, will be identified in the Flight Operations Support Annex.

8.5 Command and Control Support

The interface required between the JSC MCC and AFSCF is voice. The engineering agreement necessary to implement this interface will be defined in the POCC Annex, Vol 2.

9.0 LAUNCH AND LANDING SITE SUPPORT

The KSC P80-1 Launch Site Support Manager (LSSM) will be the single point of contact for KSC launch and landing support and will co-chair the P80-1 Ground Operations Working Group with the 6555th ASTG.

A KSC Launch Site Support Plan (LSSP) will be generated as an annex to the PIP to further develop and provide a detailed summary of the KSC launch and landing requirements. This plan will include P80-1 facility requirements, support services, and the detailed test/checkout requirements. The 6555th ASTG will interface directly with the KSC LSSM for coordination and implementation of all launch and landing site support.

9.1 P80-1 Processing

The P80-1 payload will be processed through the Air Force SAB located at Cape Canaveral Air Force Station (CCAFS). The P80-1 GSE located at the SAB will communicate with the payload via RF and hardline while the payload flows through the STS off-line and on-line facilities.

9.1.1 Solid Propellant Storage Area (SPSA).- The P80-1 OIS solid motors will be received, inspected, and stored at the CCAFS SPSA until P80-1 SVS assembly at the VPF.

9.1.2 Battery Storage.- P80-1 silver-zinc batteries will be stored in the SRB battery storage area until P80-1 SVS assembly at the VPF. The SRB battery activation facilities will be utilized to activate the P80-1 silver-zinc batteries.

9.1.3 Orbiter Processing Facility.- The P80-1 display and control panel and the NASA-provided vent and purge lines will be installed in the Orbiter in the OPF. Following a normal flight, the P80-1 ASE cradle, the display and control panel, and the vent and purge lines will be removed in the OPF.

9.2 VPF Operations

The P80-1 payload will be transported to the VPF for final assembly, Cargo Integration Test Equipment (CITE) tests, and for installation into the payload canister. The operations to be performed at the VPF consist of stacking of the OIS solid motors, mating the OIS to the cradle, and mating the spacecraft to the OIS motors. After assembly, the P80-1 SVS will be rotated utilizing a SD supplied rotating device, mated to the Vertical Payload Handling Device (VPHD), and installed into CITE for cargo integration and interface tests. The P80-1 GSE supplied cryostat chilling, the EUV purge, and battery cooling will be maintained to the maximum extent practical during this period.

After the CITE test is completed, the hydrazine and GN2 systems will be loaded and pressurized to flight pressure. The total integrated cargo will be installed into the payload canister at the VPF for transportation to the pad.

It should be noted that use of the VPF for final assembly and hydrazine and GN2 loading is the baseline, but contingent upon the ability to schedule them on a noninterference basis with processing activities for other Shuttle flights. As the flight assignment baseline (FAB) is iterated, use of the VPF for final assembly and hydrazine and GN2 loading will be reexamined.

9.3 Pad Operations

The payload canister will be transported to the RSS, hoisted into position, and the cargo extracted by the Payload Ground Handling Mechanism (PGHM) and retracted into the RSS. Some RSS time will be available in the rollback position for payload systems test prior to or during Orbiter-to-pad transfer operations. The P80-1 operations to be performed in the RSS are:

a. Resume Teal Ruby cryostat chilling with LHe

b. Resume EUV purge with GN2

c. Resume battery conditioning with P80-1 GSE through T-O umbilical

d. Conduct preinstallation checks

e. Install electroexplosive devices

After the Mobile Launcher Platform (MLP) is hard-down on the pad, the FSS will swing into position and the total integrated cargo will be inserted into the Orbiter cargo bay. Payload installation will take approximately TBD hours with subsequent payload-to-Orbiter interface verification test and closeout procedures taking approximately 10 hours. Subsequently, a launch readiness test of a 4-hour duration will be conducted in the cargo bay with P80-1 GSE located at the SAB. Orbiter cargo bay door closing at launch minus 26 hours (nominal) will be the last time the P80-1 payload may be physically accessed prior to lift-off. After cryogen chilling disconnect, launch will be accomplished nominally within 50 hours or rechilling will be required. If the need for this rechilling is attributal to payload-incurred delays to the Orbiter processing time, the cost of this serial impact will be charged to the SD as an optional service (TBR No. 3).

9.4 Postflight Services and Disposition

KSC will be responsible for removing the P80-1 cradle with associated local purge duct, methane vent line connection hardware, and the aft flight deck panel with associated payload cables. The P80-1 unique hardware will be returned to the P80-1 program as stated in the LSSP.

9.5 Security Requirements

The physical security requirements for P80-1 during KSC ground processing are:

a. Each facility (VPF, RSS and launch pad) utilized for processing P80-1 SVS shall be maintained at a security level of SECRET at all times the P80-1 SVS is present. Access shall be limited to those personnel cleared to that level or must be escorted by personnel with that clearance and must have a valid "need to know". Physical access to COMSEC equipment shall be limited to those personnel cleared to the level of SECRET-CRYPTO.

b. Each facility at which the P80-1 AGE vans containing the P80-1 SVS checkout equipment are utilized shall provide a parking area for the vans. The vans shall be maintained at a level of SECRET-CRYPTO at all times. Access shall be limited to those personnel cleared to that level or must be escorted by personnel with that clearance and must have a valid "need to know".

10.0 SAFETY

The P80-1 shall be designed to comply with the requirements contained in Section 5.1, "Technical Requirements," of the NASA

Office of Space Flight document "Safety Policy and Requirements for Payloads Using the Space Transportation System."

Safety certification of the P80-1 design shall be as defined in the "DCD/NASA Agreement for Safety Certification of DOD Payloads," dated July 26, 1977.

The safety responsibilities for the Space Test Program (STP) Flight P80-1 are as follows:

a. SD/YVA-1

(1) Assure the P80-1 complies with the above-stated NASA safety requirements

(2) Conduct safety reviews

(3) Prepare accident risk assessment report

(4) Provide to NASA certification of payload design safety

b. NASA JSC

(1) Conduct interface safety assessment between cargo and Orbiter

(2) Provide membership support to DOD Safety Review Team

c. NASA KSC

(1) NASA KSC is responsible for approving ground operations safety and GSF to be used at KSC and in KSC facilities located on CCAFS.

d. Joint NASA JSC and SD/YVA-1

(1) Conduct safety assessment of interface/interaction between P80-1 and other payloads in cargo bay as part of the CIR

(2) Provide joint certification of the cargo

11.0 INTERFACE VERIFICATION

The non-safety associated verification requirements and planning will be negotiated and concurred in by the STS Operations Program Office and SD in the Payload Interface Verification Summary Annex. It is anticipated that this interface verification will be accomplished within the scope of normal test, checkout, and integration flow of the P80-1 cargo element. SD is responsible for assuring compatibility with the interfaces and environments as specified in this PIP and applicable ICD's. The interface verification requirements are specified in Payload Interface Verification Requirements document, JSC 14046 (TBR No. 7), SD will submit the interface verification data in the Payload Interface Verification Summary Annex in accordance with Figure 15-1. NASA and SD will certify that their respective P80-1 interface verification tests and analyses conducted were successfully completed.

12.0 POSTFLIGHT DATA REQUIREMENTS

Not applicable

13.0 SUMMARY OF OPTIONAL SERVICES (TBR No. 3)

Planning and budget estimates of reimbursements for the payload transportation requirements and the following optional services are displayed in the STS Preliminary Price Summary, Figure 13-1. These estimates are intended to provide preliminary information on the assumed level of cost to be borne by the User and will change through more detailed definition and joint negotiations. The estimates are stated in current year dollars and the use of these estimates for planning purposes should be adjusted for inflation.

The final estimates for Standard Shuttle Services and Optional Flight System Services will be jointly negotiated between NASA Headquarters and the User in the Launch Services Agreement. Immediately prior to the initiation of the individual optional service, the performing NASA organization and the User will jointly define the tasks and negotiate the final firm cost on a firm cost sheet according to the Section 15 schedule for the optional service.

The optional services to be provided and priced to SD for P80-1 integration are as follows:

JSC

1. The STS will conduct two coupled loads analysis cycles in support of the P80-1 design efforts using P80-1 models supplied by SD (Reference Paragraph 6.1).

2. Local purge duct from the spigot system to the payload (Reference Paragraph 7.1 (e)).

3. The STS will design and fabricate a methane vent line from the cradle to an Orbiter overboard vent (Reference Paragraph 7.1 (f)).

KSC

4. VPF usage for stacking and spacecraft final assembly (Reference Paragraph 9.2).

5. Supplies and Services:

   a. Propellant support at VPF (Reference Paragraph 9.2).

   b. Wide band communication lines and operational communications (Reference Paragraph 9.1).

   c. Fluid sampling and analysis (Reference Paragraph 9.2).

   d. Support for cryogen chilldown at the VPF and at pad (Reference Paragraph 9.2 and 9.3).

   e. SCAPE support for P80-1 hydrazine cart and payload operation (Reference Paragraph 9.2).

   f. Battery storage and delivery (Reference Paragraph 9.1.2).

   g. Installation of the AFD control panel in the Orbiter while in the OPF (Reference Paragraph 9.1.3).

   h. Installation and cleaning of Orbiter bay liner (Reference Paragraph 6.4).

6. RSS serial time (Reference Paragraph 9.3a, b, c, d, e) (Est. 24 hr).

7. Pad serial time (Reference Paragraph 4.3.1 and 9.3) (Est. 12 hr).

14.0 PIP ANNEXES

As identified in other sections of the document, the following annexes are required:

Annex 1 - Payload Data Package

Annex 2 - Flight Planning

Annex 3 - Flight Operations Support

Annex 5 - Payload Operations Control Center, Vol. 2

Annex 6 - Orbiter Crew Compartment

Annex 8 - Launch Site Support Plan

Annex 9 - Payload Interface Verification Summary

15.0 SCHEDULE

The attached schedule, Figure 15-1, provides a summary of the various technical areas requiring data exchange and/or products in support of the P80-1 SVS/STS integration activities. Changes to this schedule will be mutually agreed to by the STS Operations Program Office and SD through the P80-1 management working group.

16.0 REFERENCE DOCUMENTS

a. NASA OSF "Safety Policy and Requirements for Payloads Using the Space Transportation System," dated June 1976 and Implementation Guide

b. KSC STP P80-1 SVS Launch Site Support Plan

c. Shuttle Orbiter/P80-1 Cargo Element Interfaces, ICD A-14013

d. Shuttle Orbiter/P80-1 Cargo Standard Interfaces, ICD 2-19001

e. Change Control Requirements and Procedures Manual, JSC 13995, dated May 18, 1978

f. Shuttle/Payload Integration Activities Plan, JSC 14363

g. Math Model Requirements, SD77-SH-0214

h. DOD/NASA Agreement for Safety Certification of DOD Payloads, dated July 26, 1977

i. Space Shuttle Flight and Ground System Specification, JSC 07700, Vol X

STS PRELIMINARY PRICE SUMMARY
PRICE PER LAUNCH -- CURRENT YEAR DOLLAR ESTIMATES*

DATE PREPARED: 05/24/79

PAYLOAD IDENTIFICATION: SD P80-1

	ESTIMATE*	USE FEE
STANDARD SHUTTLE PRICE ($M):	6.937	
OPTIONAL FLIGHT SYSTEM PRICE ($M):	0.0	
OPTIONAL SERVICE PRICE ($M):	1.231	
TOTAL ESTIMATED PRICE ($M):	8.168	

STANDARD SHUTTLE CHARGE INFORMATION

PAYLOAD CHARGEABLE WEIGHT (LB): 11,400, LENGTH (IN.): 220

INCLINATION: 57 degrees, CHARGE FACTOR: 0.407

EARNEST MONEY DATE: 04/78, INITIAL LAUNCH CAPABILITY (ILC): 05/83

NUMBER OF FLIGHTS IN SERIES: 1

B.L.S. INDEX FACTOR*: 1.397 AS OF: 01/01/79

STANDARD: $6.937 (75$M) PLUS USE FEES $0.0

OPTIONAL FLIGHT SYSTEM INFORMATION

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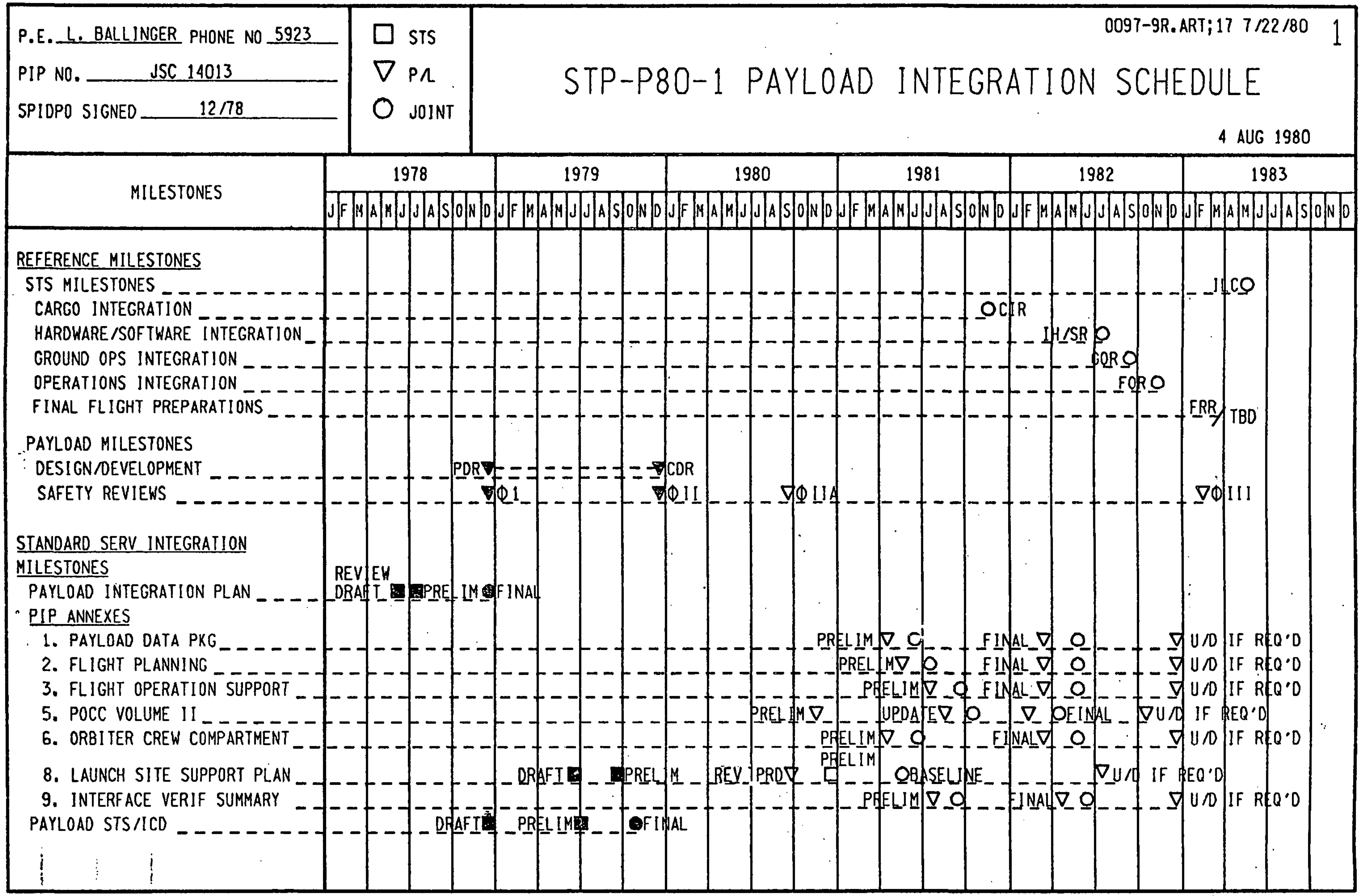
*ESTIMATES SUBJECT TO ESCALATION ACCORDING TO THE BUREAU OF LABOR STATISTICS (B.L.S.) INDEX AS DEFINED IN THE NASA REIMBURSEMENT POLICIES NMI 8610.8 AND NMI 8610.9; USE FEES ARE NOT SUBJECT TO ESCALATION.
!!!NOTICE!!! THESE ESTIMATES ARE IN CURRENT YEAR DOLLARS. THE BILLINGS WILL BE IN FUTURE VALUE DOLLARS!!

Figure 13-1

PAYLCAD RELATED OPTIONAL SERVICE INFORMATION

OPTICN DESCRIPTION	ESTIMATF ($M)
1. Two Coupled Loads Analyses	.179
2. Des & Fab Purge Duct spigot to P/L	.125
3. Des & Fab Methane Vent Line	.125
4. KSC VPF Usage	.034
5. KSC Supplies & Services	.057
6. KSC RSS Serial Time (Est. 24 hr)	.474
7. KSC Pad Serial Time (Est. 12 hr)	.237
Optional Service Subtotal	--------

Figure 13-1 (Concluded)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SPIDPO SIGNED 12/78
STS
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0097-9R.ART;17 7/22/80
1
STP-P80-1 PAYLOAD INTEGRATION SCHEDULE
4 AUG 1980
MILESTONES
1978
1979
1980
1981
1982
1983
J F M A M J J A S O N D
REFERENCE MILESTONES
STS MILESTONES
CARGO INTEGRATION
HARDWARE/SOFTWARE INTEGRATION
GROUND OPS INTEGRATION
OPERATIONS INTEGRATION
FINAL FLIGHT PREPARATIONS
PAYLOAD MILESTONES
DESIGN/DEVELOPMENT
SAFETY REVIEWS
STANDARD SERV INTEGRATION MILESTONES
PAYLOAD INTEGRATION PLAN
PIP ANNEXES
1. PAYLOAD DATA PKG
2. FLIGHT PLANNING
3. FLIGHT OPERATION SUPPORT
5. POCC VOLUME II
6. ORBITER CREW COMPARTMENT
8. LAUNCH SITE SUPPORT PLAN
9. INTERFACE VERIF SUMMARY
PAYLOAD STS/ICD
JLC
CIR
IH/SR
GOR
FOR
FRR/TBD
PDR
CDR
I
II
IIA
III
REVIEW DRAFT
PRELIM
FINAL
U/D IF REQ'D
UPDATE
DRAFT
REV
PRD
BASELINE

Figure 15-1

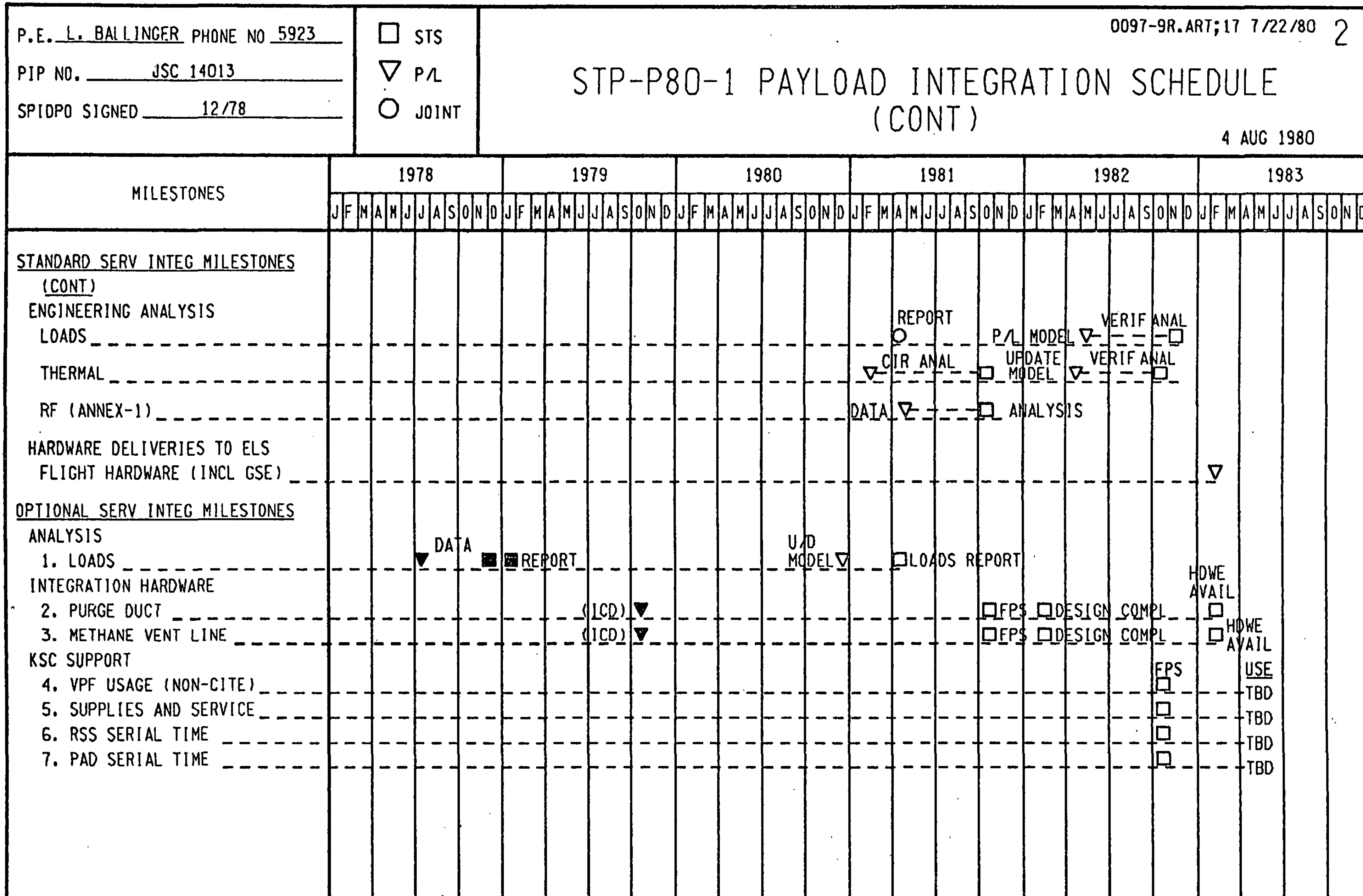

Figure 15-1 (concluded)

APPENDIX A

TO BE RESOLVED ITEMS

TBR No. 1 Subject: Thermal Environment (Reference Paragraph 4.3.3.2)

It was agreed that the thermal table would be included into the PIP. However, SD feels there may be some payload incompatibilities with the constraints in the table. Analysis will be required to verify the compatibility of P80-1 with the constraints.

Further negotiations may be required if analysis indicates a P80-1 problem.

TBR No. 2 Subject: Deleted

TBR No. 3 Subject: Optional Services (Reference Preface, page iii, and Paragraphs 4.3.1, 6.1, 7.1, 9.3, and 13.0)

SD Position - The following qualifying statements should be incorporated in Section 13.0.

"The following is a list of STS-provided services which have been identified by NASA as optional services. Final agreement between NASA and DOD as to whether these are standard or optional services is TBD."

NASA Position - The items listed are unique to P80-1 payload. If supplied, they must be identified as such and funded.

TBR No. 4 Subject: AFT Flight Deck Panel (Reference Paragraphs 4.1, 5.1, and 7.2)

SD Position - The standard NASA panel will not satisfy the P80-1 functional requirements. P80-1 will supply a unique display and control panel.

NASA Position - The standard panel may well satisfy all P80-1 requirements and should be utilized to reduce integration complexity. NASA will supply the standard panel for the Orbiter, checkout, and training requirements if the standard is used. If a unique panel is used, the payload will be required to furnish one training and two flight panels. In order for CITE checkout not to interfere with Orbiter panel installation and flow, NASA feels that one panel should be available for CITE and one panel for Orbiter installation.

TBR No. 5 Subject: Deleted

TBR No. 6 Subject: Deleted

TBR No. 7 Subject: Payload Interface Verification Requirements Document (JSC 14046) (Reference Paragraph 11.0)

SD Position - JSC 14046 has not been baselined. Until the Air Force comments on the proposed JSC 14046 have been negotiated, committment to incorporation must be conditional.

NASA Position - The Payload Interface Verification Summary Annex must be submitted by the SD; therefore, the incorporation into the PIP is a requirement.

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