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Produced by the NASA Center for Aerospace Information (CASI)
ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS)
SPACELAB PAYLOAD DEFINITION STUDY
FINAL REPORT

VOLUME III
BOOK 2 - AMPS EQUIPMENT TO SPACELAB ICD

Document No.
27615-6007-RU-02
DR-SE-02A

November 1976

Approved by: W.F. Rector, III
W.F. Rector, III
Project Manager, AMPS

Prepared for
National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Contract No. NAS8-31690

TRW
DEFENSE AND SPACE SYSTEMS GROUP
ONE SPACE PARK • REDONDO BEACH, CALIFORNIA 90278
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1. SCOPE

This document describes the interfaces between AMPS Payload No. (TBD) and Spacelab. The characteristics specified herein are based on the definition of Spacelab equipment and interfaces as of the date of issue of this document or date of latest revision. This document will be revised as necessary to maintain it current with the Spacelab configuration. The interfaces specified herein cover the AMPS physical, electrical, and thermal interfaces that are established to prescribe the standard Spacelab configuration required to perform the mission of overriding document 2.1.(b). If the configuration definition covered by this document changes due to change of Spacelab equipment model or serial numbers, then reidentification of the Labcraft payload by way of revision of this document may be required.

2. APPLICABLE DOCUMENTS

2.1 OVERRIDING DOCUMENTS

The current issues of the following documents are involved to the extent necessary to specify AMPS equipment and Spacelab interfaces:

(a) ESTEC/MSFC SLP-2104 Spacelab Payload Accommodations Handbook
(b) GSFC XXX.XXXX Mission Support Requirements Document - AMPS Flight TBD.
(c) GSFC XXX.XXXX AMPS/Orbiter Interface Control Document.

In the event of conflict among these documents, 2.1(a) shall have precedence regarding Spacelab interfaces. Document 2.1(c) shall have precedence regarding Orbiter interfaces.

2.2 REFERENCE DOCUMENTS

2.2.1 Program level documents. TBD.
2.2.2 Labcraft system requirements. TBD.

3. INTERFACES

3.1 PHYSICAL INTERFACES

3.1.1 Total payload interfaces. The Spacelab/AMPS payloads physical characteristics are given on Figure 3.1.1-1.

Sheet 1 - shows total payload (Spacelab plus AMPS equipment) installed in the Orbiter payload bay; shows location of units, Orbiter hardpoints used, the center-of-gravity location for the total payload, the location of utility bridges, and other key features of the total payload.
Figure 3.1.1-1
Figure 3.1.1-1 (Continued)
<table>
<thead>
<tr>
<th>CABLE (ID)</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR ROUTING</th>
<th>PHYSICAL ROUTING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL-01</td>
<td>20.16M</td>
<td>JM-1</td>
<td>FROM X₁Y₁Z₁</td>
<td>2' INTERVALS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP-1</td>
<td>TO X₂ Y₂Z₂</td>
<td>90° AT X₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TIEDOWN</td>
<td>NONE</td>
</tr>
</tbody>
</table>

Figure 3.1.1-1 (Continued)
Sheet 2 - a summary flight manifest identifying major payload components, their weight, and their center-of-gravity locations.

Sheet 3 - a listing of mission expendable and selected mass properties.

Sheet 4 - a listing of optional Orbiter equipment plus weight and center-of-gravity locations.

Sheet 5 - a listing of the top drawings defining the configured payload — should have the same headings as sheet 2.

Sheet 6 - a description of the physical routing of all cables used to interconnect the major payload components. Some method of tabulating this routing may be preferable to a drawing and that is the technique suggested. The idea is to define every end point and the routing of lines and cables by means of a coordinate system. Tie-downs and thermal shielding or other cable protection would be indicated on the table.

3.1.2 Pallet interfaces.

3.1.2.1 Pallet segment No. 1 interfaces. The physical interfaces between the forward pallet segment, pallet segment No. 1, and the AMPS equipment to be mounted are described on Figure 3.1.2-1.

Sheet 1 - a drawing showing the preparation/staging of the pallet including hole patterns to be drilled, MDE equipment installation, and hardpoints to be used.

Sheet 2 - a manifest of all equipment installed on the pallet plus the pallet itself.

Sheet 3 - a description of the physical routing of cables and utility lines on the pallet plus appropriate notations.

3.1.2.2 Pallet segment No. 2 interfaces. The physical interfaces between forward pallet segment, pallet segment No. 2, and the AMPS equipment to be mounted are described in Figure (180) (similar to Figure 3.1.2-1).

Sheet 1 - a drawing showing the preparation/staging of the pallet including hole patterns to be drilled, MDE equipment installation, and hardpoints to be used.

Sheet 2 - a manifest of all equipment installed on the pallet plus the pallet itself.
Figure 3.1.2-1

Pallet No.
MDE Location and Equipment Mounting Provisions

Pallet Coordinates
A

MDE Location (Typ)

Cold Plate No. 5

Hole Pattern in Honeycomb Panels (Typ)

Hardpoint and ID

Port Side

Hardpoint Usage

<table>
<thead>
<tr>
<th>Hardpoint ID</th>
<th>Equipment Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>5p5x6p6s</td>
<td>Electron Accelerator</td>
</tr>
</tbody>
</table>

Starboard Side

Pallet Floor

Figure 3.1.2-1
<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>DESCRIPTION</th>
<th>MODEL NUMBER</th>
<th>SERIAL NUMBER</th>
<th>WEIGHT (KG)</th>
<th>C.G. LOCATION</th>
<th>X₀</th>
<th>Y₀</th>
<th>Z₀</th>
</tr>
</thead>
<tbody>
<tr>
<td>PALLET</td>
<td>FLIGHT MANIFEST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PALLETT</td>
<td>CABLE AND UTILITY LINE ROUTING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABLE ID</td>
<td>CONNECTOR ROUTING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYSICAL ROUTING</td>
<td>FROM</td>
<td>TO</td>
<td>FROM</td>
<td>TO</td>
<td>BENDS</td>
<td>TIEDOWN</td>
<td>THERMAL COVERING</td>
<td>REMARKS</td>
</tr>
<tr>
<td>SHEET 2 OF 3</td>
<td>SIZE</td>
<td>CODE IDENT NO.</td>
<td>ICD – XXX</td>
<td>REV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCALE</td>
<td>DATE</td>
<td>DRAWN BY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.1.2-1 (Continued)
3.1.2.3 Pallet segment No. 3 interfaces. The physical interfaces between forward pallet segment, pallet segment No. 3, and the AMPS equipment to be mounted are described in Figure (TBD) (similar to Figure 3.1.2-1).

Sheet 1 - a drawing showing the preparation/staging of the pallet including hole patterns to be drilled, MDE equipment installation, and hardpoints to be used.

Sheet 2 - a manifest of all equipment installed on the pallet plus the pallet itself.

Sheet 3 - a description of the physical routing of cables and utility lines on the pallet plus appropriate notations.

3.1.3 Module layout. The interfaces between the Spacelab module and the AMPS payload are given on Figure 3.1.3-1.

Sheet 1 - drawings of the panel layouts plus planned usage of other module volume. Also may include a layout of a more detailed description of the aft feedthrough connector.

Sheet 2 - a manifest of the equipment in the module, including identification of the model and serial number of key items (e.g., the module itself).

Sheet 3 - a description of the physical routing of cabling and utility lines within the module plus appropriate notes describing the characteristics, handling, installation, or treatment of lines and cables.

Sheet 4 - Drawings and/or descriptions of any special or nonstandard installations of equipment in or on the Spacelab module.
Figure 3.1.3-1

PORT SIDE

STARBOARD SIDE

OVERHEAD RACK USAGE

WORKBENCH STOWAGE USAGE

FEEDTHROUGH CONFIGURATION

SIZE

CODE IDENT NO.

ICD – XXX

REV

SCALE

DATE

DRAWN BY

SHEET 1 OF 4
Figure 3.1.3-1 (Continued)
IDENT. ROUTING FROM ALONG TIEDOWNS

CL-08 - Pi - Pq RACINO. 3

1 FRAME 34 2-INTERVALS

NOTES (TYP):
1. ALL WATER LINES ARE TBD DIAMETER STEEL WITH TBD FITTINGS AND RATED FOR TBD PSIA SERVICE.
2. CABLE HARNESS TO BE PREFORMED UNLESS OTHERWISE NOTED

Figure 3.1.3-1 (Continued)
3.2 ELECTRICAL INTERFACES

3.2.1 Payload schematics.

3.2.1.1 Electric power schematic. The electrical power interface schematic for this payload is given on Figure 3.2.1-1.

3.2.1.2 Communication and data handling schematic. The communication and data handling interface schematic for this payload is given on Figure 3.2.1-2.

3.2.1.3 Caution and warning schematic. The caution and warning interface schematic for this payload is given on Figure 3.2.1-3.

3.2.2 Payload power/mode requirements. The AMPS payload shall require power from the Spacelab EPDS in accordance with the data on Table III.II.II-1.

3.2.3 Cable identification and wire lists. All cables and their associated wire lists for the AMPS payload that interface with Spacelab are identified on Table III.II.III-1.

3.3 THERMAL INTERFACES

3.3.1 Insulation blankets. The AMPS payload requires the installation of multilayer insulation blankets on the Spacelab module and on all pallets as illustrated in Figure 3.3.1-1 through 3.3.1-4.

3.3.2 Cold plates. Figure 3.3.1-5 shows the location and interconnection of all Spacelab TCS coldplates, the maximum average load and peak temperature imposed on each cold plate plus a table showing several representative flight modes and the resulting thermal load.

3.3.3 Heater power. Table III.III.III-1 identifies active heating elements required to maintain payload thermal control and shows those elements that may require power during ascent or prior to Spacelab activation.

3.4 SOFTWARE. Payload and Spacelab software will be compiled on a certified flight tape which will include the following:

(a) Spacelab subsystem operating software
(b) Experiment-CDMS operating software
(c) Experiment application programs
(d) Other (TBD)

The flight tape will be installed in the Spacelab CDMS mass memory during level III/II integration and will be used in all subsequent checkout operations. Two spare copies of the certified flight tape will be delivered and stored aboard Spacelab for possible use during the flight.
TYPICAL FORMAT
TYPICAL FORMAT
Table III.II.II-1. AMPS Payload No. Flight Power/Mode Analysis

<table>
<thead>
<tr>
<th>MODE 1</th>
<th>MODE 2</th>
<th>MODE 3</th>
<th>MODE N</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPDB</td>
<td>PAYLOAD STANDBY</td>
<td>PAYLOAD SYSTEM CHECKOUT</td>
<td>EXPERIMENT NO. 1</td>
</tr>
<tr>
<td>NUMBER LOCATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE DEFINITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODE NO.</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Table III.II.III-1. AMPS/Spacelab Interface Cable Wire List

<table>
<thead>
<tr>
<th>CABLE IDENTIFICATION NO.</th>
<th>TYPE:</th>
<th>SUPPLIER:</th>
</tr>
</thead>
</table>

A. CONNECTOR NO. | MFGR OR TYPE: | LOCATION: | MATING CONNECTOR NO. |
|-----------------|--------------|-----------|----------------------|

<table>
<thead>
<tr>
<th>PIN NO.</th>
<th>FUNCTION CODE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. CONNECTOR NO. | MFGR OR TYPE: | LOCATION: | MATING CONNECTOR NO. |
|-----------------|--------------|-----------|----------------------|

<table>
<thead>
<tr>
<th>PIN NO.</th>
<th>FUNCTION CODE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table III.11.11.1-1. AMPS/Spacelab Interface Cable Wire List
(Continued)

Wire Function Codes

### A. POWER

<table>
<thead>
<tr>
<th>FUNCTION CODE</th>
<th>WIRE SIZE</th>
<th>WIRE TYPE</th>
<th>VOLTAGE AC/DC</th>
<th>MAX POWER</th>
<th>FWD IMPEDANCE (RESISTANCE)</th>
<th>BACK IMPEDANCE (RESISTANCE)</th>
</tr>
</thead>
</table>

### B. SIGNAL AND CONTROL

#### B.1 DIGITAL

<table>
<thead>
<tr>
<th>FUNCTION CODE</th>
<th>WIRE SIZE</th>
<th>WIRE TYPE</th>
<th>VOLTAGE &quot;ON&quot;</th>
<th>VOLTAGE &quot;OFF&quot;</th>
<th>RATE STATE CODE</th>
<th>FWD IMPEDANCE</th>
<th>BACK IMPEDANCE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>FUNCTION CODE</th>
<th>WIRE SIZE</th>
<th>WIRE TYPE</th>
<th>VOLTS</th>
<th>FWD IMPEDANCE</th>
<th>BACK IMPEDANCE</th>
<th>BANDWIDTH</th>
</tr>
</thead>
</table>
Figure 3.3.1-1. Module Thermal Blanket Installation

Figure 3.3.1-2. Pallet No. 1 Thermal Blanket Installation

Figure 3.3.1-3. Pallet No. 2 Thermal Blanket Installation

Figure 3.3.1-4. Pallet No. 3 Thermal Blanket Installation

Table III.III.III-1. Active Thermal Elements

<table>
<thead>
<tr>
<th>ELEMENT DESCRIPTION</th>
<th>POWER CONSUMPTION (Watts)</th>
<th>ACTIVATION TEMPERATURE (°K)</th>
<th>DUTY CYCLE (%)</th>
<th>ACTIVE ON ASCENT?</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
</tbody>
</table>

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