Standard Orbiter Crew Compartment Interface Control Annex

Space Shuttle Program Office

June 1999

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

DESCRIPTION OF CHANGES TO

STANDARD ORBITER CREW COMPARTMENT
INTERFACE CONTROL ANNEX

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
--	Basic issue/B21000-ICA-001	09/11/95	All
REV A	General revision/B21000-ICA-003	06/24/99	All

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

NSTS 21000-ICA
Revision A

ORBITER CREW COMPARTMENT
INTERFACE CONTROL ANNEX

(PAYLOAD NAME)

(DATE)

D. J. FITTS
CREW COMPARTMENT
CREW STATION MANAGER

C. M. JONES
INTERFACE CONTROL MANAGER

(NAME)
PAYLOAD MANAGER

REPOSITORY: FLIGHT CREW SUPPORT DIVISION
CREW STATION BRANCH
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

FOREWORD

This document will be used to develop a payload specific Orbiter Crew Compartment Interface Control Annex (ICA) for middeck type payloads - ISS and standard/sortie. The format and content of the requirements needed for proper integration of a middeck payload into the Space Shuttle Program's (SSP) Orbiter Crew Compartment are contained in this annex.

The customer should submit the data required per schedules defined in the customer's Payload Integration Plan (PIP) or Mission Integration Plan (MIP). The submitted data will be reviewed and compiled into a basic release document. The basic release will be submitted for signature by both the Space Shuttle Program designated parties and the customer. Upon final signature, the annex will be published.

Changes may be negotiated by submitting data for review to the Payload Integration Manager (PIM) and the Crew Compartment Engineer (CCE).

At any time during payload development, contact the appropriate Crew Compartment Engineer for any assistance required.

Signed by R. Dittemore

R. DITTEMORE

PREFACE

This document is issued as an interface control annex to the Payload Integration Plan (PIP) or Mission Integration Plan (MIP) for the (PAYLOAD NAME) payload. This ICA describes all (PAYLOAD NAME) equipment stowed or installed in the Orbiter crew compartment and the pertinent requirements affecting interfaces, stowage, installation, or flight crew use.

In case of any variation between this ICA and the PIP/MIP, the PIP/MIP shall take precedence. Any requirements submitted in this document that are not within the scope of the PIP/MIP will not be considered binding on the National Aeronautics and Space Administration (NASA) for implementation.

By signing this document, the customer is accepting and agreeing to abide by the requirements defined in the following documents unless otherwise specified and/or agreed to in this document.

NSTS-21000-IDD-MDK	Shuttle/Payload Interface Definition Document for Middeck Accommodations
NSTS-21000-ICA	Orbiter Crew Compartment Interface Control Annex Blank Book

The location of equipment defined in this ICA is subject to change by NASA without prior agreement as long as the basic requirements of the payload and integrating hardware are satisfied. Official stowage/installation locations for a given flight will be defined in the appropriate Crew Compartment Configuration Drawing (CCCD).

Any stowage time requirements listed in this ICA are used to assure installation/removal feasibility. Final stowage timelines are the responsibility of the NASA John F. Kennedy Space Center (KSC).

Corrections and updates to this ICA will be made as necessary.

Comments or questions relative to this ICA should be directed to the following:

Space Shuttle Program Representative:

NASA, Lyndon B. Johnson Space Center (JSC)
SF6/Crew Compartment Engineer, (NAME)
Telephone 281-483-XXXX, Fax 281-483-XXXX.

Customer Technical Representative:

(COMPANY NAME)
(CUSTOMER NAME)
Telephone (XXX-XXX-XXXX), Fax (XXX-XXX-XXXX).

[Any instructional information contained in this Standard Interface Control Annex (ICA) is italicized and enclosed in brackets [], or appears in a footnote. Information to be supplied is enclosed in parentheses (). All instructional information will be removed for the flight-specific ICA.]

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TABLES

FIGURES

1. MIDDECK IDD REQUIREMENTS

The payload will meet all requirements as defined in the Shuttle/Payload Interface Definition Document for Middeck Accommodations, NSTS-21000-IDD-MDK. The customer will be responsible for the following sections of the NSTS-21000-IDD-MDK:

1.0 1.1 1.1.1 1.2		2.0 2.1 2.1.1 2.1.2 2.2 2.3 2.4		3.0 3.1 3.1.1 3.2 3.3 3.3.1 3.4 3.4.1 3.4.1.1 3.4.1.2 3.4.2 3.4.2.1 3.4.2.2 3.4.2.3 3.4.2.4 3.4.2.5 3.5 3.6 3.7 3.8 3.9		4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.7.1 4.7.2 4.7.3 4.8 4.8.1 4.8.2 4.8.2.1 4.8.2.2 4.8.2.3 4.9		5.0 5.1 5.2 5.3 5.4

6.0 6.1 6.1.1 6.2 6.2.1 6.2.1.1 6.2.1.2 6.2.1.3 6.2.2		7.0 7.1 7.1.1 7.2 7.2.1 7.2.1.1 7.2.1.2 7.2.1.3 7.2.1.4 7.2.2 7.3 7.3.1 7.3.1.1 7.3.1.2 7.3.1.3 7.4 7.4.1 7.4.2 7.4.3 7.5 7.5.1		8.0 8.1 8.2 8.2.1 8.2.2 8.3 8.3.1 8.3.2 8.4 8.4.1 8.4.1.1 8.4.1.2 8.4.1.2.1 8.4.1.2.1.1 8.4.1.2.1.2 8.4.1.2.1.3 8.4.1.2.2 8.4.1.2.3 8.4.1.2.3.1 8.4.2 8.5 8.5.1 8.5.2 8.5.3 8.5.4		9.0 9.1 9.1.1 9.1.2 9.2		10.0 10.1 10.2 10.2.1 10.2.2 10.3 10.3.1 10.3.1.1 10.3.1.2 10.3.2

2. PAYLOAD UNIQUE EXCEEDANCES, WAIVERS, DEVIATIONS TO MIDDECK IDD

The payload will meet all requirements as defined in Section 1 above for the Shuttle/Payload Interface Definition Document for Middeck Accommodations, NSTS-21000-IDD-MDK. To support payload review and acceptance, the customer will be required to submit test data for *[list those that are appropriate: Electromagnetic Compatibility (EMC), Thermal, Acoustic, and Structures]*. The Thermal and Structures test data will be available to JSC for review no later than Launch minus 4 (L-4) months. The EMC and Acoustic test data will be available to JSC for review no later than L-2.5 months. For payload hardware requiring stowage into a locker, the payload is willing to accept the loads transmitted to the hardware by the Orbiter through isolating foam material inside the stowage locker. (Reference NSTS-21000-IDD-MDK, Section 4.*) [Any of the last four sentences of this paragraph may be omitted depending on the payload.]*

The following are approved exceedances to the Middeck Interface Definition Document (IDD). Justification of the exceedances is located in Appendix A.

a. Payload exceedance has been approved per Change Request (CR) Axxxxx-ICA-xxx.

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3. POWER REQUIREMENTS

Payload power interface characteristics at the Space Shuttle Program (SSP)/payload interface are per Section 7 of the Shuttle/Payload Interface Definition Document for Middeck Accommodations, NSTS-21000-IDD-MDK.

Table 3-1.- PAYLOAD POWER INTERFACE REQUIREMENTS

Orbiter service by flight	IDD ref. par.	Voltage range	Power watts		Time limit on peak power	Payload character-istics
			Max. cont.	Peak		
Prelaunch Ascent On-orbit Descent Postflight						

4. PAYLOAD INSTALLATION STOWAGE/CREW REQUIREMENTS

4.1 PAYLOAD INSTALLATION/STOWAGE/CREW INTERFACE REQUIREMENTS

a.

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4.2 PAYLOAD STOWAGE/INSTALLATION HARDWARE DEFINITION

NOMENCLATURE AND P/N	QTY[1]	DIMENSIONS (in.)	WEIGHT (lb)
A. SSP-provided			
1.			
.			
.			
.			
B. Payload-provided			
1.			
.			
.			
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[1] [*See Instructions in Section 4.2 of Appendix A for guidance in providing quantity data for ISS-type and standard/sortie payloads.*]

4.3 PAYLOAD ELEMENT STOWAGE/INSTALLATION DESCRIPTION

a. To support stowage design and analysis, the Payload Customer, at time of manifesting, will submit to the Crew Compartment Engineer, engineering drawings of all hardware defined in this annex as Payload-provided. Access to the hardware may also be required to support the stowage design.

b. To support final stowage for flight and the Flight Crew Bench Review, the Payload Customer will provide the flight hardware to Lyndon B. Johnson Space Center (JSC) no later than 6 weeks prior to launch.

c. To support proper installation and stowage assessments, the customer will be required to supply center of gravity (c.g.) data for all hardware being installed in place of a locker or hardware being stowed exceeding 30 lb in weight.

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RESERVED

Figure X.- The (payload name) configuration.

APPENDIX A

JUSTIFICATION OF EXCEEDANCES

a. The (Payload Name) exceedance has been approved per CR Axxxxx-ICA-xxx (Reference NSTS-21000-IDD-MDK, Section xxxx).

   Requirements:

   Exceedance:

   Rationale:

   Effectivity: STS-xxx only

b. The (payload name) exceedance has been approved per CR Axxxxx-ICA-xxx for STS-xxx only. (Reference NSTS-21000-IDD-MDK, Section xxxx).

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APPENDIX B

ACRONYMS AND ABBREVIATIONS

c.g.	center of gravity
CCCD	Crew Compartment Configuration Drawing
CCE	Crew Compartment Engineer
Cont.	Continuous
CR	Change Request
EMC	Electromagnetic Compatibility
ICA	Interface Control Annex
IDD	Interface Definition Document
in.	inch
ISS	International Space Station
JE	Johnson Engineering
JSC	Lyndon B. Johnson Space Center
KSC	John F. Kennedy Space Center
L-	Launch minus
lb	Pounds
Max	Maximum
MDK	Middeck
MIP	Mission Integration Plan
N/A	Not Applicable
N/R	Not Required
NASA	National Aeronautics and Space Administration
No.	Number
NSTS	National Space Transportation System
Par	Paragraph

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APPENDIX C

INSTRUCTIONS

The following explains each section of the Standard Orbiter Crew Compartment ICA and the sections into which the customer needs to provide input.

SECTION 1:

Section 1 lists the paragraphs of the Shuttle/Payload Unique Interface Control Document, NSTS-21000-IDD-MDK (Middeck IDD), that apply to the payload as a whole. If a paragraph is not applicable, then it will be removed from this list. The Crew Compartment Engineer (CCE) responsible for the annex will determine which paragraphs are applicable. If there is an exceedance to a paragraph of the Middeck IDD, it will be documented in section 2.

This section will be applicable to all hardware configurations or experiments if the payload consists of multiple hardware configurations or experiments.

SECTION 2:

Section 2 defines the approved exceedances for the payload. Each exceedance description will reference the appropriate paragraph (structures, thermal, etc.) from the Middeck IDD. The justification and explanation of the exceedance will be referenced by the Change Request (CR) and will be included, along with any other applicable support data, into one of the appendices to this document. In this section, four sentences are considered optional statements. The inclusion of these depends on the payload type and its requirements. The CCE responsible for the annex will determine if the sentences are appropriate.

SECTION 3:

Section 3 describes the power requirements for all payload elements. All of the following values must be provided for each phase of flight (prelaunch, ascent, etc.). If no value can be entered into a particular space on the chart, enter N/A for not applicable.

Required Value	Description
Voltage Range:	This is the voltage range at which the payload will function normally.
Power, Max. Cont.:	This is the maximum continuous power (in watts) of the payload.
Power, Peak:	This value is the maximum power (in watts) of the payload at any given time.
Time Limit, Peak:	This is the amount of time (in seconds or milliseconds) that the payload is at peak power.
Payload Characteristics:	Filled in with the term “Constant” or “Resistive”. Constant power is achieved when the current increases with a decrease in voltage (current ↑ when voltage ↓). Resistive power is achieved when the current decreases with a decrease in voltage (current ↓ when voltage ↓).

SECTION 4.1:

Section 4.1 describes any interface requirements for the payload, such as:

Number of lockers required for stowage, special mounting to wire trays, computer interfaces, video interfaces, thermal requirements, late stowage, early removal, turnaround time, photography requirements, and systems or hardware being used on a shared basis.

Any requirement identified by the customer to have an impact to the stowage, installation, or manifesting of a payload into the Orbiter Crew Compartment should be defined in this section, and these items are to be explained by the customer.

There will be separate sections added for multiple hardware configurations or multiple experiments for a payload.

Note: This section is not for procedures. Only items, which are required or desired for proper installation or crew interface, should be listed.

SECTION 4.2:

Section 4.2 describes in detail each item dedicated to a payload that will be required for stowage. This section is divided into two sections.

Section	Description
SSP-provided:	These items are supplied by the SSP. These items will be counted towards the payload's stowage total.
Payload-provided:	The following item information must be supplied by the customer: description of the item (engineering drawing name), part number, applicable quantity (QTY) needed for ascent (UP), sortie (UP/DN) and descent (DN), dimensions in inches, and unit weight in pounds.

Dimensions provided in these sections are to be the maximum three-axes dimensions required to describe the object. These dimensions should include all protrusions beyond the basic object (i.e., switches, connectors, etc.) The weights provided are to be actual weights of the objects. When an actual weight is not available, an analytical weight may be provided to temporarily fill the weight section until which time the actual weight is available.

For ISS-type payloads: Three columns are provided for quantity data. These are UP, UP/DN and DN. An UP quantity should be provided for items that will be launched and then transferred to ISS (these items are not returning on the same Shuttle flight). An UP/DN quantity should be provided for sortie items which will be launched and returned on the same Shuttle flight. A DN quantity should be provided for items which are to be transferred from ISS and returned on a Shuttle flight that is different from the flight which ferried them to ISS.

For standard/sortie payloads: Only one column is needed for quantity data of these items which will be launched and returned on the same Shuttle flight.

SECTION 4.3:

Section 4.3 describes any special requirements for the items listed in section 4.2.

Special requirements may include special stowage for film, floppy disks, etc., items to be pre-assembled; and cable pre-routing references.

These items are usually defined by the Crew Compartment Engineer unless specified by the customer.

Notes:

Any figures, including the Standard Switch Panels (SSP's), that need to be referenced in this document will be placed after the appropriate PAYLOAD ELEMENT STOWAGE/INSTALLATION DESCRIPTION section. A figure (or figures) describing the overall configuration of the hardware should be included. For items with Display and Control (D&C) panels, a figure clearly depicting the D&Cs should be included.

If the payloads are comprised of multiple hardware configurations or experiments (as is the case for ISS flights), and require multiple tables for sections 4.1, 4.2, and 4.3, then new sections or subsections will be added and the numbering of all sections will be adjusted accordingly.

Appendix A:

Appendix A contains the justification of any payload exceedances. The CCE responsible for the annex will provide the appropriate information for this appendix.

Appendix B:

Appendix B lists and defines the acronyms and abbreviations used throughout the ICA.

APPENDIX D

EXAMPLE PAYLOAD

The following pages illustrate an Orbiter Crew Compartment Interface Control Annex for an ISS-type payload (one that is transferred to/from ISS). It can be used as a reference when preparing customer inputs for any type of middeck payload.

An electronic copy of this annex can be obtained on the Internet from the Payload Integration Library System (PILS) at the following address:

http://sspweb.jsc.nasa.gov/ntdata/ssp/pils/payload/sip/ica.doc

Orbiter Crew Compartment Interface Control Annex

Example Payload

Basic
August 1998

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

DESCRIPTION OF CHANGES TO

ORBITER CREW COMPARTMENT
INTERFACE CONTROL ANNEX

EXAMPLE PAYLOAD

CHANGE NO.	DESCRIPTION/AUTHORITY	DATE	PAGES AFFECTED
--	Basic issue/AXXXXX-A06-001	08/21/98	All

ORBITER CREW COMPARTMENT
INTERFACE CONTROL ANNEX

EXAMPLE PAYLOAD

AUGUST 21, 1998

D. J. FITTS
CREW COMPARTMENT
CREW STATION MANAGER

C. M. JONES
INTERFACE CONTROL MANAGER

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LAUNCH PACKAGE MANAGER
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

PREFACE

This document is issued as an Interface Control Annex (ICA) to the Mission Integration Plan (MIP) for the Example Payload. This ICA describes all Example Payload equipment stowed or installed in the Orbiter crew compartment and the pertinent requirements affecting interfaces, stowage, installation, or flight crew use.

In case of any variation between this ICA and the MIP, the MIP shall take precedence. Any requirements submitted in this document that are not within the scope of the MIP will not be considered binding on the National Aeronautics and Space Administration (NASA) for implementation.

By signing this document the customer is accepting and agreeing to abide by the requirements defined in the following documents unless otherwise specified and/or agreed to in this document.

NSTS-21000-IDD-MDK	Shuttle/Payload Interface Definition Document for Middeck Accommodations
NSTS-21000-ICA	Orbiter Crew Compartment Interface Control Annex Blank Book

The location of equipment defined in this ICA is subject to change by NASA without prior agreement as long as the basic requirements of the payload and integrating hardware are satisfied. Official stowage/installation locations for a given flight will be defined in the appropriate Crew Compartment Configuration Drawing (CCCD).

Any stowage time requirements listed in this ICA are used to assure installation/removal feasibility. Final stowage timelines are the responsibility of the NASA John F. Kennedy Space Center (KSC).

Corrections and updates to this ICA will be made as necessary.

Comments or questions relative to this ICA should be directed to the following:

Space Shuttle Program Representative:

NASA, Lyndon B. Johnson Space Center (JSC)
SF6/JE/Kenneth Kruse
Telephone 281-483-XXXX, FAX 281-483-XXXX

Customer Technical Representative:

United Space Alliance
OM/Steven Eakin
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CONTENTS

TABLES

FIGURES

1. MIDDECK IDD REQUIREMENTS

The payload will meet all requirements as defined in the Shuttle/Payload Interface Definition Document for Middeck Accommodations, NSTS-21000-IDD-MDK. The customer will be responsible for the following sections of the NSTS-21000-IDD-MDK:

1.0 1.1 1.1.1 1.2		2.0 2.1 2.1.1 2.1.2 2.2 2.3 2.4		3.0 3.1 3.1.1 3.2 3.3 3.3.1 3.4 3.4.1 3.4.1.1 3.4.2 3.4.2.3 3.4.2.4 3.4.2.5 3.5 3.6 3.7 3.8		4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.7.1 4.7.2 4.7.3 4.8 4.8.1 4.8.2 4.8.2.3		5.0 5.1 5.2 5.3 5.4

6.0 6.1 6.1.1 6.2 6.2.1 6.2.1.1 6.2.1.2 6.2.1.3 6.2.2		7.0 7.1 7.1.1 7.2 7.2.1 7.2.1.1 7.2.1.3 7.2.1.4 7.2.2 7.3 7.3.1 7.3.1.1 7.3.1.2 7.3.1.3 7.4 7.4.1 7.4.2 7.4.3 7.5 7.5.1		8.0 8.1 8.2 8.2.1 8.2.2 8.3 8.3.1 8.3.2 8.4 8.4.1 8.4.1.1 8.4.1.2 8.4.1.2.1 8.4.1.2.1.1 8.4.1.2.1.3 8.4.1.2.3 8.4.1.2.3.1 8.4.2 8.5 8.5.1 8.5.2 8.5.3 8.5.4		9.0 9.1 9.1.1 9.1.2 9.2		

2. PAYLOAD UNIQUE EXCEEDANCES, WAIVERS, DEVIATIONS TO MIDDECK IDD

The payload will meet all requirements as defined in Section 1 above for the Shuttle/Payload Interface Definition Document for Middeck Accommodations, NSTS-21000-IDD-MDK. To support payload review and acceptance, the customer will submit test data for Electromagnetic Compatibility (EMC), Thermal, Acoustic, and Structures. The Thermal and Structures test data will be available to Lyndon B. Johnson Space Center (JSC) for review no later than Launch minus 4 (L-4) months. The EMC and Acoustic test data will be available to JSC for review no later than L-2.5 months. For payload hardware requiring stowage into a locker, the payload is willing to accept the loads transmitted to the hardware by the Orbiter through isolating foam material inside the stowage locker. (Reference NSTS-21000-IDD-MDK, Section 4.)

The following are approved exceedances to the middeck Interface Definition Document (IDD). Justification of the exceedances is located in Appendix A.

a. Payload-generated conducted emissions exceedance has been approved per Change Request (CR) Axxxxx-ICA-xxx. (Reference NSTS-21000-IDD-MDK, Section 8.3.1)

b. Payload-produced radiated emissions exceedance has been approved CR Axxxxx-ICA-xxx for STS-xxx only. (Reference NSTS-21000-IDD-MDK, Section 8.3.2)

c. Payload bonding exceedance has been approved per CR Axxxxx-ICA-xxx. (Reference NSTS-21000-IDD-MDK, Sections 8.4.1.1.2 and 8.4.1.2.1.1)

3. POWER REQUIREMENTS

Payload power interface characteristics at the Space Shuttle Program (SSP)/payload interface are per Section 7 of the Shuttle/Payload Interface Definition Document for Middeck Accommodations, NSTS-21000-IDD-MDK.

Table 3-1.- PAYLOAD POWER INTERFACE REQUIREMENTS

Orbiter service by flight	IDD ref. par.	Voltage range	Power watts		Time limit on peak power	Payload character-istics
			max. cont.	peak		
Prelaunch						
CR/IM	7.2.1	24-32 V	126 W	126 W	N/A	Note 1
Ascent						
CR/IM	7.2.1	24-32 V	126 W	126 W	N/A	Note 1
On-orbit						
CR/IM	7.2.1	24-32 V	126 W	126 W	N/A	Note 1
Powerbook	7.3.1	110–120 V	15 VA	15 VA	N/A	N/A
EPCS (Laptop)	7.2.1	24–32 V	35 W	50 W Note 2	TBD	Constant
EPCS (Laptop)	7.2.1	24-32 V	35 W	50 W Note 2	TBD	Constant
Descent CR/IM	7.2.1	24-32 V	126 W	126 W	N/A	Note 1
Postflight						
CR/IM	7.2.1	24-32 V	126 W	126 W	N/A	Note 1

Notes: (1) The power characteristics are such that the Commercial Refrigerator/Incubator Module (CR/IM) thermoelectric cooler draws a constant current which is dependent on the CR/IM temperature differential (delta T). A lower temperature differential or a lower interface voltage results in lower power consumption.

(2) Each Early Portable Computer System (EPCS) draws 280 W at 28 V for 90 milliseconds (msec) when turned on.

4. CR/IM PAYLOAD INSTALLATION STOWAGE/CREW REQUIREMENTS

4.1 CR/IM PAYLOAD INSTALLATION/STOWAGE/CREW INTERFACE REQUIREMENTS

a. One CR/IM will be installed in the middeck replacing the volume of a single middeck locker. The CR/IM will be mounted utilizing a single Payload Mounting Panel (PMP).

b. Additional stowage space utilizing a middeck locker and stowage tray is required to support miscellaneous hardware. The payload is allocated the equivalent stowage space in middeck lockers totaling one middeck locker.

c. The CR/IM requires late installation into the Orbiter middeck.

d. The CR/IM requires early removal from the middeck after landing.

e. There are no thermal constraints, required by the payload, which would impact the installation location of the payload.

f. A payload-provided Macintosh Powerbook computer will be provided for additional crew interface in controlling the experiment. This computer will be temporarily mounted, during on-orbit phases of the mission only, near the CR/IM using velcro.

4.2 CR/IM PAYLOAD STOWAGE/INSTALLATION HARDWARE DEFINITION

NOMENCLATURE AND P/N	UP QTY	UP/DN QTY[2]	DN QTY	DIMENSIONS (in.)	WEIGHT (lb)
A. SSP-provided					
1. DC Power Cable P/N 10108-10082		1		See section 9, item b	N/R
2. PMP P/N 10108-10077-01		1		18.125 x 10.75 x 0.50	3.50
3. Bolt, Hex Head P/N NAS1954C-7H		4		N/R	N/R

[2] *When preparing an ICA for a standard/sortie payload, only this UP/DN QTY column is required.*

4.2 CR/IM PAYLOAD STOWAGE/INSTALLATION HARDWARE DEFINITION (Concluded)

NOMENCLATURE AND P/N	UP QTY	UP/DN QTY[2]	DN QTY	DIMENSIONS (in.)	WEIGHT (lb)
4. Washer P/N NAS1587-4C		4		N/R	N/R
B. Payload-provided					
1. CR/IM w/contents P/N PCG-F10013-1		1		20.381 x 18.12 x 10.67	65.50
2. Cable, A/D Converter Data P/N PCG-F50010-1		2		18.00 x 0.40 diam	0.70 ea
3. A/D Converter Assembly P/N PCG-F10010-1		2		13.75 x 6.125 x 3.50	6.10 ea
4. Power Adapter Assy, MPC P/N SED33104021-301		1		3.38 x 6.00 x 2.38	1.20
5. Cable, MPC AC Power P/N SED33104024-301		2		159.00 x 0.50 diam (1 x 4 x 4.3 stowed)	1.00 ea
6. Cable, MPC DC Power P/N SED33104024-307		2		72.00 x 0.50 diam (7 x 4 x 4.3 stowed)	0.30 ea
7. MPC Powerbook 170 Assy P/N SED39123144-301		2		11.25 x 10.50 x 2.50	9.00 ea
8. Battery Pack Assembly P/N SED39123148-703		1		4.60 x 4.20 x 1.13	0.90
9. Disk, Powerbook P/N PCG-F50015-1		10		3.50 x 3.63 x 0.13	0.10 ea

[2] *When preparing an ICA for a standard/sortie payload, only this UP/DN QTY column is required.*

4.3 CR/IM PAYLOAD ELEMENT STOWAGE/INSTALLATION DESCRIPTION

a. To support stowage design and analysis, the Payload Customer, at time of manifesting, will submit to the Crew Compartment Engineer, engineering drawings of all hardware defined in this annex as payload provided. Access to the hardware may be required to support the stowage design.

b. To support final stowage for flight and the Flight Crew Bench Review, the Payload Customer will provide the flight hardware to JSC no later than 6 weeks prior to launch.

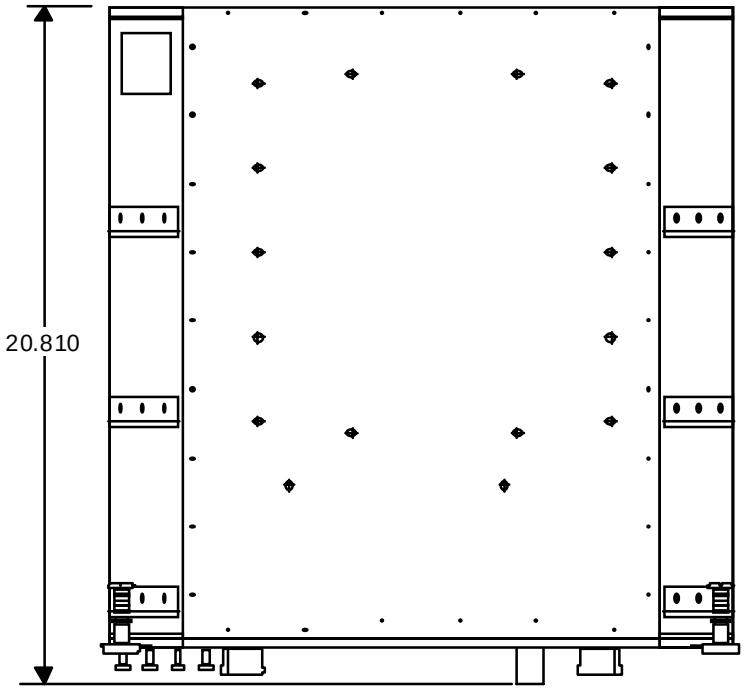
c. To support proper installation and stowage assessments the customer will be required to supply center of gravity (c.g.) data for all hardware being installed in place of a locker or hardware being stowed exceeding 30 lb in weight.

   CR/IM c.g. (measured from geometric y-z center of CR/IM at the payload/Orbiter interface)

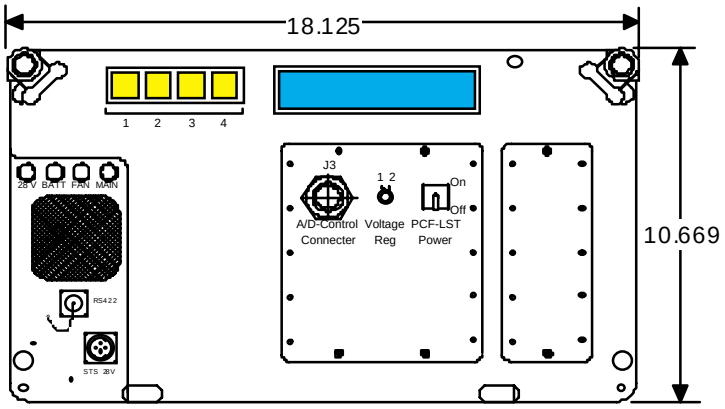
   x = 9.81 in.
   y = 0.00 in.
   z = +0.34 in.

d. The configuration of the CR/IM will be similar to the configurations shown in figures 4-1 and 4-2.

e. Exact installation configuration of the CR/IM will be defined by the Crew Compartment Configuration Drawing (CCCD).



Top View



Front View

Figure 4-1.- EP CR/IM configuration.

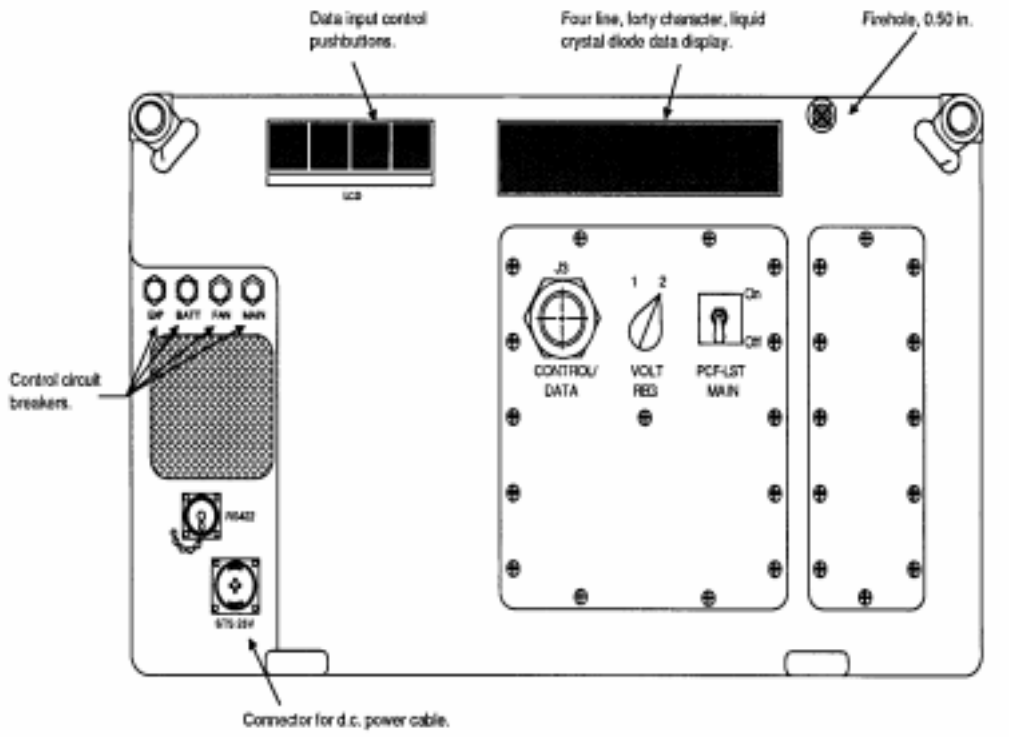


Figure 4-2.- EP CR/IM D&Cs.

5. EPCS PAYLOAD INSTALLATION STOWAGE/CREW REQUIREMENTS

5.1 EPCS PAYLOAD INSTALLATION/STOWAGE/CREW INTERFACE REQUIREMENTS

The stowage items listed in Section 5.2 have no special requirements that impact stowage, installation, or manifesting such as thermal requirements, late stowage, early removal, turnaround time, or photography requirements.

5.2 EPCS PAYLOAD STOWAGE/INSTALLATION HARDWARE DEFINITION

NOMENCLATURE AND P/N	UP QTY	UP/DN QTY	DN QTY	DIMENSIONS (in.)	WEIGHT (lb)
A. Payload-provided					
1. EPCS P/N SDG39129270-301	2		0	8.30 x 11.70 x 2.34	7.94 ea
2. Orb DC Pwr Cable, 6’ P/N SEG39129264-301		1		72.00 x 0.82 diam	0.36
3. Orb DC Pwr Cable 10’ P/N SEG39129264-303		1		120.00 x 0.82 diam	0.41
4. DC Pwr Supply Adapter Cable, 10’ P/N SEG39129263-301	4		2	120.00 x 1.19 diam	0.36 ea
5. DC Pwr Supply (28 V) P/N SED39126010-301	2		1	5.65 x 3.15 x 2.34	1.42 ea
6. Orb 1553 Data Cable, 8’ P/N SEG39129282-301		2		96.00 x 11.00 x 1.00	0.57 ea
7. PC Hard Card P/N SED33105832-304		1		3.25 x 2.13 x 0.13	0.10
8. RF Card P/N SDZ39139739-303	1		0	3.00 x 12.00 x 4.00	0.01

5.2 EPCS PAYLOAD STOWAGE/INSTALLATION HARDWARE DEFINITION (Concluded)

NOMENCLATURE AND P/N	UP QTY	UP/DN QTY	DN QTY	DIMENSIONS (in.)	WEIGHT (lb)
9. 1553 Card Cable w/Adapter Cable P/N SDG39129273-301	2		0	13.00 x 11.00 x 1.00	0.27 ea
10. Floppy Drive P/N SJG39129288-301	1		0	13.00 x 11.00 x 1.00	0.51

5.3 EPCS PAYLOAD ELEMENT STOWAGE/INSTALLATION DESCRIPTION

a. To support stowage design and analysis, the Payload Customer, at time of manifesting, will submit to the Crew Compartment Engineer, engineering drawings of all hardware defined in this annex as payload provided. Access to the hardware may also be required to support the stowage design.

b. To support final stowage for flight and the Flight Crew Bench Review, the Payload Customer will provide the flight hardware to JSC no later than 6 weeks prior to launch.

c. To support proper installation and stowage assessments the customer will be required to supply c.g. data for all hardware being installed in place of a locker or hardware being stowed exceeding 30 lb in weight.

d. Exact installation configuration of the payload hardware will be defined by the CCCD.

6. MISCELLANEOUS PAYLOAD INSTALLATION STOWAGE/CREW REQUIREMENTS

6.1 MISCELLANEOUS PAYLOAD INSTALLATION/STOWAGE/CREW INTERFACE REQUIREMENTS

a. The stowage items listed in Section 6.2, along with the Contingency Maintenance equipment, Extravehicular Mobility Unit (EMU) Extravehicular Activity (EVA) Support Equipment List (ESEL-EMU) middeck items, and Tools EVA ESEL (ESEL-Tools) middeck items, have no special requirements that impact stowage, installation, or manifesting such as thermal requirements, late stowage, early removal, turnaround time, or photography requirements.

b. The Contingency Maintenance equipment requires three middeck locker equivalents for both ascent and descent.

c. Refer to EMU ESEL, CR No. XXXXX, latest revision, for the listing of ESEL-EMU items to be stowed in the middeck.

d. Refer to Tools ESEL, CR No. X-XXXX, latest revision, for the listing of ESEL-Tools items to be stowed in the middeck.

6.2 MISCELLANEOUS PAYLOAD STOWAGE/INSTALLATION HARDWARE DEFINITION

NOMENCLATURE AND P/N	UP QTY	UP/DN QTY	DN QTY	DIMENSIONS (in.)	WEIGHT (lb)
A. Payload-provided					
1. Systems Operational Data File (SODF) P/N SODF-XX	1		1	9.50 x 10.00 x 17.00	26.00

6.3 MISCELLANEOUS PAYLOAD ELEMENT STOWAGE/INSTALLATION DESCRIPTION

a. To support stowage design and analysis, the Payload Customer, at time of manifesting, will submit to the Crew Compartment Engineer, engineering drawings of all hardware defined in this annex as payload provided. Access to the hardware may also be required to support the stowage design.

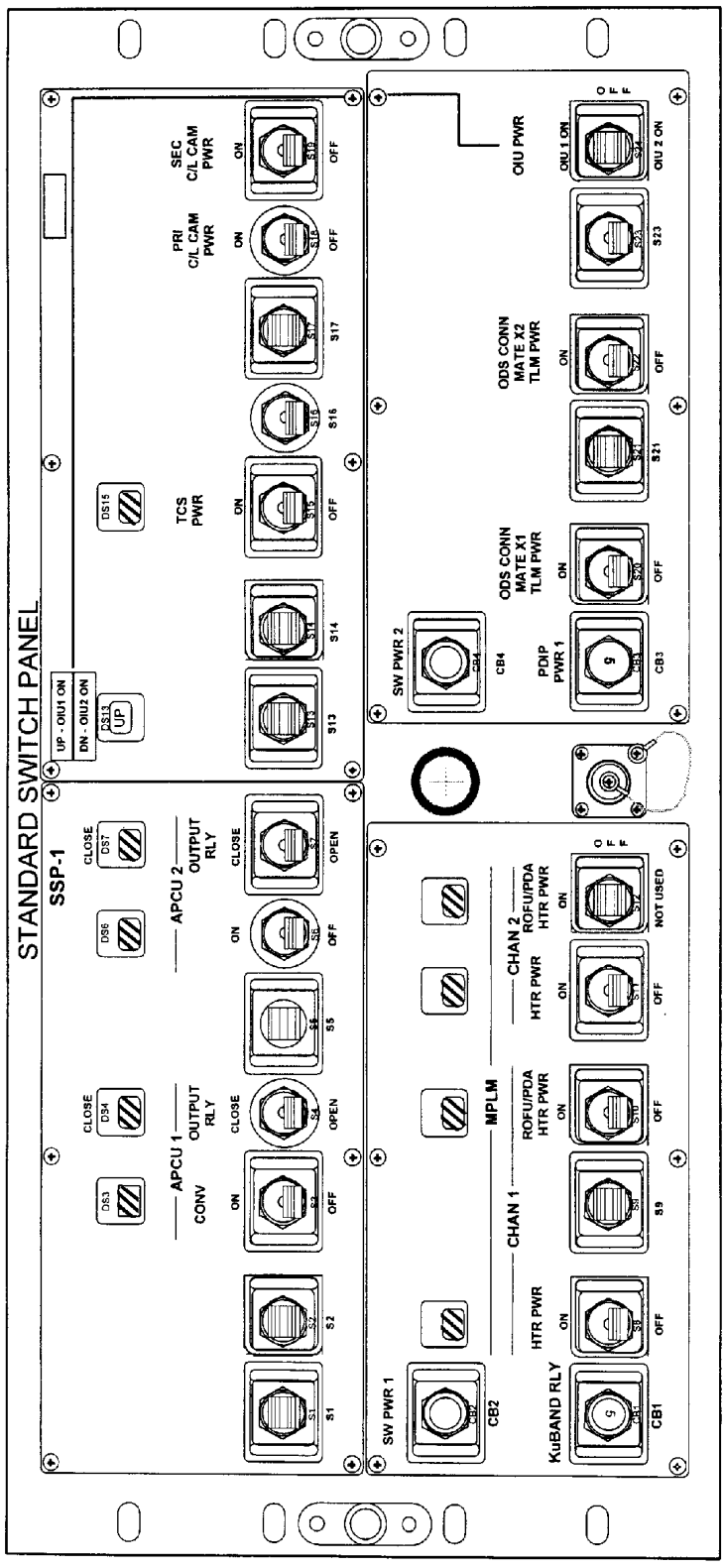
6.3 MISCELLANEOUS PAYLOAD ELEMENT STOWAGE/INSTALLATION DESCRIPTION (Concluded)

b. To support final stowage for flight and the Flight Crew Bench Review, the Payload Customer will provide the flight hardware to JSC no later than 6 weeks prior to launch.

c. To support proper installation and stowage assessments the customer will be required to supply c.g. data for all hardware being installed in place of a locker or hardware being stowed exceeding 30 lb in weight.

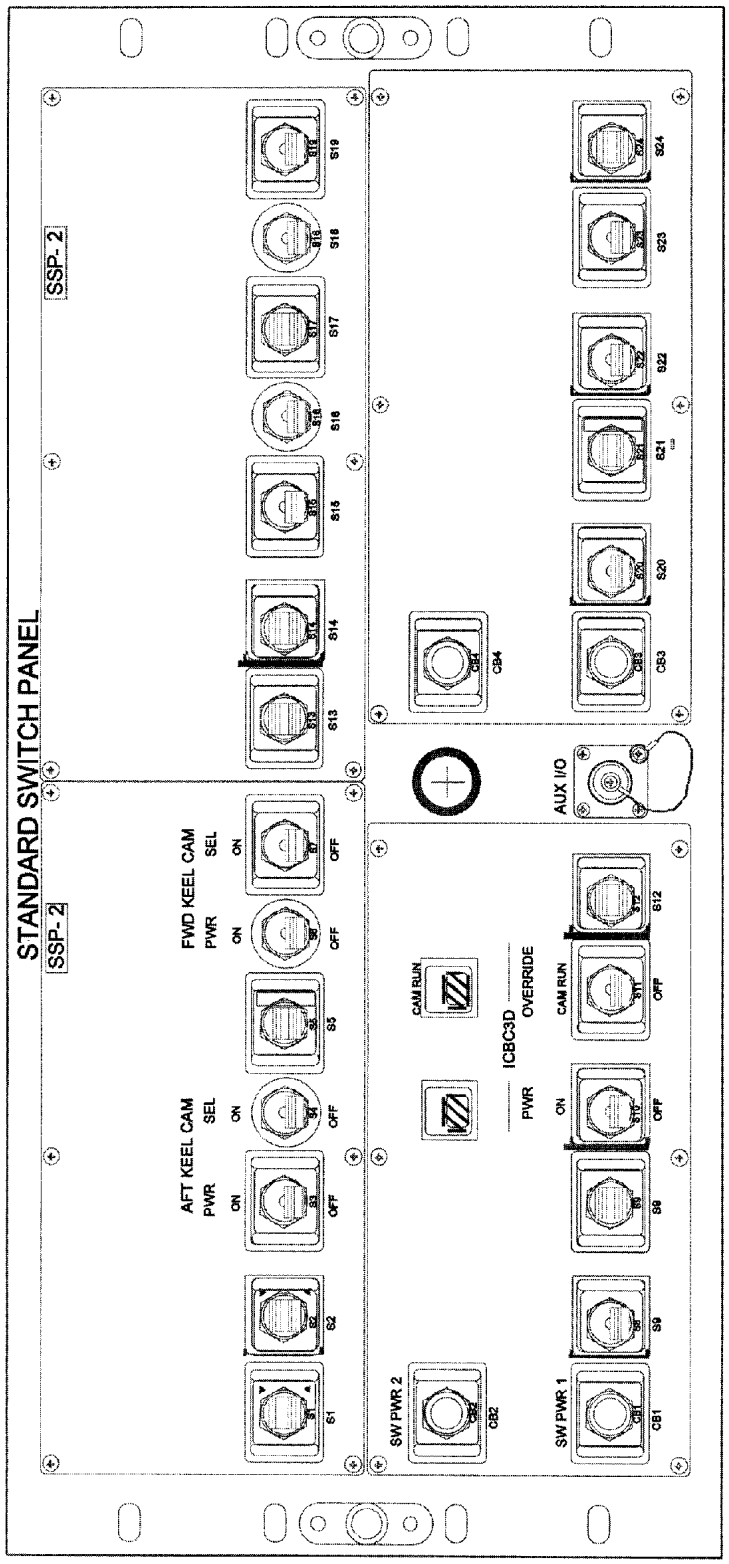
d. Exact installation configuration of the payload hardware will be defined by the CCCD.

e. The Standard Switch Panel (SSP) overlays are as shown in figures 6-1 and 6-2.



Note: Component designators (e.g. S3, S4) are shown for reference only and only those for unused switches and circuit breakers will appear on the actual panel overlay. Unused displays will be covered and obscured from view.

Figure 6-1.- Example Standard Switch Panel 1.



Note: Component designators (e.g. S1, S2) are shown for reference only and only those for unused switches and circuit breakers will appear on the actual pane l overlay. Unused displays will be covered and obscured from view.

Figure 6-2.- Example Standard Switch Panel 2.

APPENDIX A

JUSTIFICATION OF EXCEEDANCES

a. The CR/IM payload-generated conducted emissions exceedance has been approved per CR Axxxxx-ICA-xxx (Reference NSTS-21000-IDD-MDK, Section 8.3.1).

Requirements: The payload generated conducted emissions, applicable to all DC power interfaces, shall not exceed the levels defined in figure 8.3.1-1 of NSTS 21000-IDD-MDK and the steady state ripple voltage shall be less than or equal to 0.9 V peak-to-peak.

Exceedance: as much as 5.5 dB overlimit from 0.67 MHz to 1.69 MHz peak at 1.69 MHz (37.3 dBμA)

as much as 10 dB overlimit from 2.15 MHz to 19.22 MHz peak at 5.69 MHz (40 dBμA)

Rationale: Conducted emission overlimits are at least 33 dB below the susceptibility threshold levels of Orbiter avionics. Required safety margin is 6 dB.

Effectivity: STS-99 only

b. The CR/IM payload produced radiated emissions exceedance has been approved per CR Axxxxx-ICA-xxx for STS-xxx only. (Reference NSTS-21000-IDD-MDK, Section 8.3.2).

Requirements: The payload produced radiated electric fields (Broadband) shall not exceed the levels defined in figure 8.3.2-1 of NSTS 21000-IDD-MDK.

Exceedance: Broadband Emissions

as much as 20 dB overlimit from 5.6 MHz to 19.1 MHz peak at 19.1 MHz (95.4 dBμV/m/MHz)

as much as 5 dB overlimit from 129.8 MHz to 190.7 MHz peak at 179.5 MHz (70.5 dBμ V/m/MHz)

Rationale: Broadband radiated emission overlimits impose no interference threat to Orbiter receivers. None of the overlimits lie within the Orbiter receivers' pass bands.

Effectivity: STS-99 only

c. The CR/IM Orbiter-powered payload bonding exceedance has been approved per CR Axxxxx-ICA-xxx (Reference NSTS-21000-IDD-MDK, Sections 8.4.1.1.2 and 8.4.1.2.1.1).

Requirements: All Orbiter powered payloads require a class C type of bond. The payload structure to Orbiter structure bond continuity shall be less than or equal to 150 milliohms for payloads interfacing with 10 amperes Orbiter utility outlets.

The primary payload connector bond shall have less than or equal to 0.25 milliohms at each junction of the fault bond interface.

Excellence: as much as 0.4 milliohms measured at each junction.

Rationale: The high resistance measurements are contributed by long AWG#16 28VDC cable and power cable. The payload is protected by 7 amp fuse and there is no safety threat to the Orbiter.

Effectivity: All flights

APPENDIX B

ACRONYMS and ABBREVIATIONS

A/D	Analog to Digital
AC	Alternating Current
Assy	Assembly
c.g.	center of gravity
CCCD	Crew Compartment Configuration Drawing
CCE	Crew Compartment Engineer
Cont.	Continuous
CR	Change Request
CR/IM	Commercial Incubator/Refrigerator Module
D&C	Display and Control
DC	Direct Current
diam	diameter
DN	down
ea	each
EMC	Electromagnetic Compatibility
EMU	Extravehicular Mobility Unit
EPCS	Early Portable Computer System
ESEL	EVA Support Equipment List
EVA	Extravehicular Activity
ICA	Interface Control Annex
IDD	Interface Definition Document
in.	inch
ISS	International Space Station
JE	Johnson Engineering
JSC	Lyndon B. Johnson Space Center
KSC	John F. Kennedy Space Center
L-	Launch minus
lb	Pounds
Max	Maximum
MDK	Middeck
Min	Minutes
MIP	Mission Integration Plan
msec	milliseconds

N/A	Not Applicable
N/R	Not Required
NASA	National Aeronautics and Space Administration
No.	Number
NSTS	National Space Transportation System
P/N	Part Number
Par	Paragraph
PC	Personal Computer
PILS	Payload Integration Library System
PIM	Payload Integration Manager
PIP	Payload Integration Plan
PLBD	Payload Bay Door
PMP	Payload Mounting Panel
Pwr	Power
QTY	Quantity
Ref	Reference
Rev	Revision
RF	Radio Frequency
SODF	Systems Operational Data File
SSP	Space Shuttle Program or Standard Switch Panel
T	Temperature
TBD	To Be Determined
US	United States
V	Volts or Voltage
VA	Voltage Alternating Current
V dc	voltage direct current
W	watts
w/	with