

Expedite the Processing of Experiments to Space Station (EXPRESS) Rack Interface Control Document for Alpha Magnetic Spectrometer (AMS-02) Crew Operations Post (ACOP)

International Space Station Program

Draft

September 2005

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**National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas NAS9-02099 (DR PA16)**



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INTERNATIONAL SPACE STATION PROGRAM

**EXPEDITE THE PROCESSING OF EXPERIMENTS TO SPACE STATION (EXPRESS) RACK
INTERFACE CONTROL DOCUMENT
FOR ALPHA MAGNETIC SPECTROMETER (AMS-02) CREW OPERATIONS POST (ACOP)**

SEPTEMBER 2005

PREFACE

This Interface Control Document (ICD) is the exclusive document used jointly by the National Aeronautics and Space Administration (NASA) and the EXpedite the PRocessing of Experiments to Space Station (EXPRESS) Rack Office (ERO) to identify and establish the pressurize payload physical/functional interfaces and to control the designs of the Alpha Magnetic Spectrometer (AMS-02) Crew Operations Post (ACOP) payload. This document contains the design implementation of the interface requirements found in SSP 52000-IDD-ERP, EXPRESS Rack Interface Definition Document. Both sides of the interface are described and include mechanical, structural, electrical, avionics, and functional interfaces. The interfaces identified in this document are mandatory and may not be violated unless the Payloads Control Board (PCB) approves the specific exceptions. This document is under the control of the PCB, but approval authority has been delegated to the Chairman, Payload Engineering Control Panel (PECP).

APPROVED BY:

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Date

**INTERNATIONAL SPACE STATION PROGRAM
EXPEDITE THE PROCESSING OF EXPERIMENTS TO SPACE STATION (EXPRESS) RACK
INTERFACE CONTROL DOCUMENT
FOR ALPHA MAGNETIC SPECTROMETER (AMS-02) CREW OPERATIONS POST (ACOP)**

CONCURRENCE

SEPTEMBER 2005

PAYLOAD ACRONYM: ACOP

PAYLOAD NAME: ALPHA MAGNETIC SPECTROMETER (AMS-02) CREW
OPERATIONS POST

PAYLOAD DEVELOPER: ??

Approved by: THOMAS M. DANFORD NASA/MSFC/SW10
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SIGNATURE DATE

INTERNATIONAL SPACE STATION PROGRAM

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INTERNATIONAL SPACE STATION PROGRAM
EXPEDITE THE PROCESSING OF EXPERIMENTS TO SPACE STATION (EXPRESS) RACK
INTERFACE CONTROL DOCUMENT
FOR ALPHA MAGNETIC SPECTROMETER (AMS-02) CREW OPERATIONS POST

LIST OF CHANGES

SEPTEMBER 2005

All changes to paragraphs, tables, and figures in this document are shown below.

SSCBD	ENTRY DATE	CHANGE	PARAGRAPH(S)
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TABLE(S)

FIGURE(S)

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1.0 INTRODUCTION

1.1 PURPOSE

This ICD defines and controls the design of interfaces between the EXPRESS Rack and the Alpha Magnetic Spectrometer (AMS-02) Crew Operations Post (ACOP) payload (payload interfaces to the Orbiter are included). The interfaces are defined by direct reference to the corresponding sections and subsections of the EXPRESS Rack Payload Interface Definition Document, SSP 52000-IDD-ERP. This ICD has been written based on Revision E, plus the associated approved Preliminary Proposed Interface Revision Notices (PIRNs) 52000-IDD 0008A, 0009, 0010A, 0011B, 0012, 0013A, 0014A, 0015, 0016, 0017, 0018, 0019A, 0020, 0021, 0022, and 0023A of the EXPRESS Interface Definition Document (IDD). In the event of conflict between the IDD and this ICD, this ICD will take precedence.

1.2 PAYLOAD DESCRIPTION

The payload hardware items covered by this ICD are itemized in Table 1.2-1, Payload Hardware Identification. Payload configuration data is documented in this ICD to record a complete and accurate accounting of the hardware to be flown on the International Space Station (ISS). Payload Data Library (PDL) Data Sets are established for the Payload Developer (PD) to provide the detail data necessary for the ISS elements to configure flight and ground systems and implement other integration functions. The PD must ensure that requirements verification data submitted to close SSP 52000-ERP-IDD requirements are traceable to the hardware as defined in this section. Table 1.2-1 contains critical hardware identification and hardware characteristics needed to ensure that only compliant payload hardware is flown on the ISS. Table 1.2-2, Payload Hardware Center of Gravity (CG) Data, denotes ACOP hardware Center of Gravity data, and a Center of Gravity drawing is provided in Figure 1.2-1. ACOP-Rack Resource Interfaces for the ACOP core unit are depicted in Figure 1.2-2. Figure 1.2-3 shows the ACOP Core unit hardware configuration during the transport and on-orbit phases, and the stowage bag configuration is shown in Figure 1.2-4. The ACOP High Rate Data Link (HRDL) cable is shown in Figure 1.2-5.

ACOP consists of a reliable special purpose computer to be launched to the International Space Station (ISS) to assist the operations of large science experiment projects. ACOP provides the following functions: On-orbit recording mechanism for large volumes of data at high rates, play back for downlink of the recorded data at high rates, a crew interface for complex experiments, general computing facilities, and alternate bi-directional commanding path via the HRDL interface. ACOP will initially support a state-of-the-art particle physics detector experiment Alpha Magnetic Spectrometer (AMS-02), which uses the unique environment of space to study the properties and origin of cosmic particles and nuclei, including antimatter and dark matter, to study the actual origin of the universe and potentially to discover antimatter stars and galaxies. In addition to the ACOP system, there will be a stowage bag sent to ISS that will contain additional hard drives that can be exchanged with the hard drives in ACOP. From time to time, the astronauts will perform this exchange enabling ACOP to record all of AMS-02's data onto fresh hard drives. Once recorded, data will not be overwritten; rather they will be transported to ground as a permanent archive.

After the AMS-02 experiment, ACOP will stay permanently in the US LAB module as the only computer for large science experiment projects on the International Space Station for astronaut crew's use for recording and management of science data, monitoring and control of experiments, and improving the data communication between the Earth and the ISS.

Operationally, ACOP is principally a ground-operated payload. It will be powered and active whenever AMS-02 is active, with only short (<8 hrs) power outages. ACOP will maintain an active bi-directional data connection via the HRDL interface to AMS-02 at all times, and provides a mechanism for the crew to monitor and control AMS-02, supporting both front panel and EXPRESS Rack Laptop (ERL) crew interfaces. As Ku-band access is available, ACOP will be commanded to use its additional transmitting (TX) connection to downlink data, with the ability to burst the transmission at approximately 20 Mbits/sec. All data is additionally recorded onto ACOP's hard drives. Once ACOP has acknowledged that the data has been recorded, AMS-02 will release that data from its buffers. ACOP's four hard drives provide approximately 20 days of recording, and require periodic replacement by the crew. Sufficient spare blank hard drives are supplied by Shuttle to provide a minimum of 120 days recording capacity, and the used hard drives are returned to Earth as the master copies.

TABLE 1.2-2 ACOP HARDWARE CENTER OF GRAVITY (CG) DATA

ASSEMBLY (NOTE 1)	PART NUMBER	CG (X,Y,Z) (NOTE 2)
TBD 2		

NOTES:

1. Installed assemblies only (including locker inserts).
2. Define payload CG origin on payload assembly CG drawing.

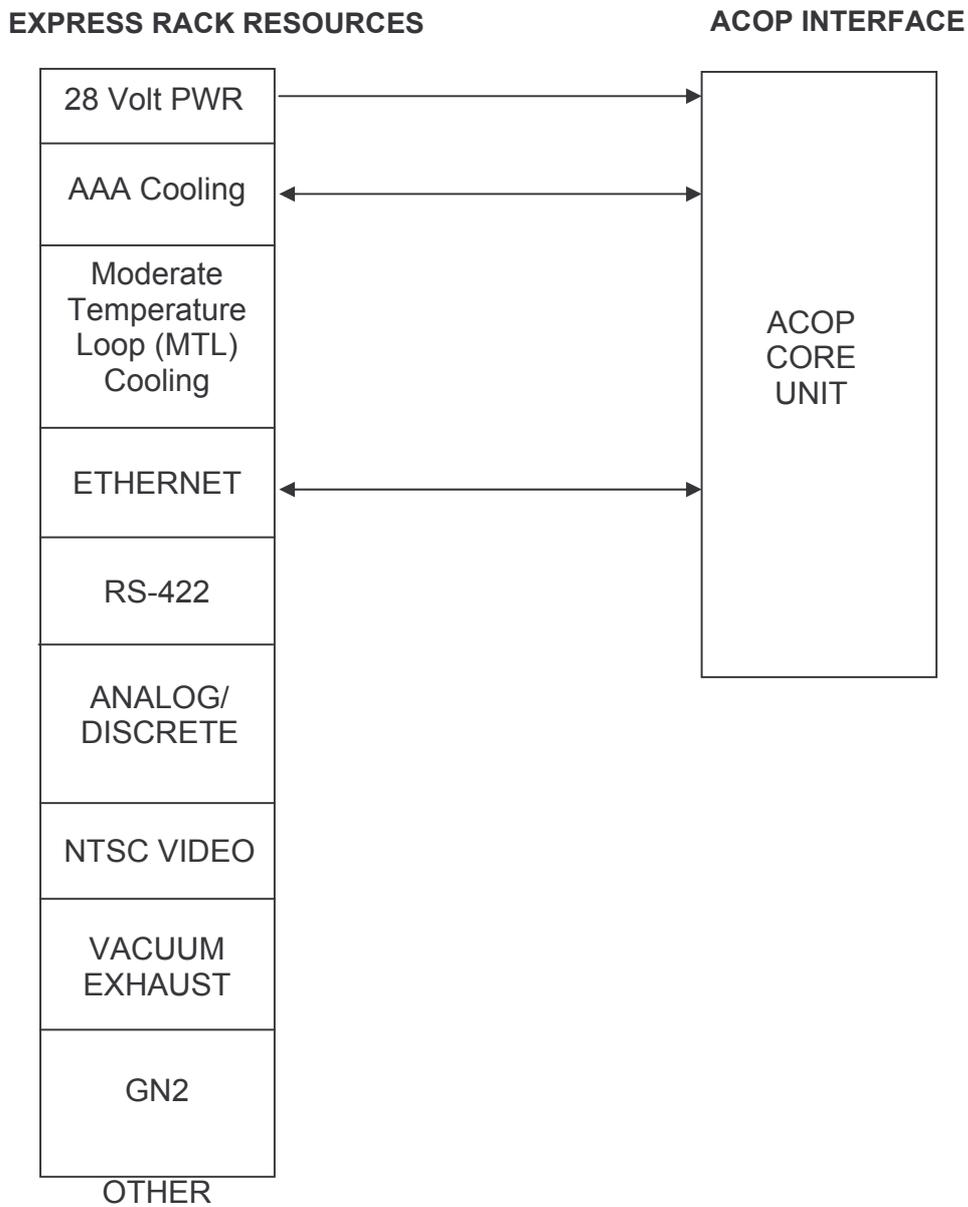


FIGURE 1.2-2 ACOP-RACK RESOURCE INTERFACE SCHEMATIC

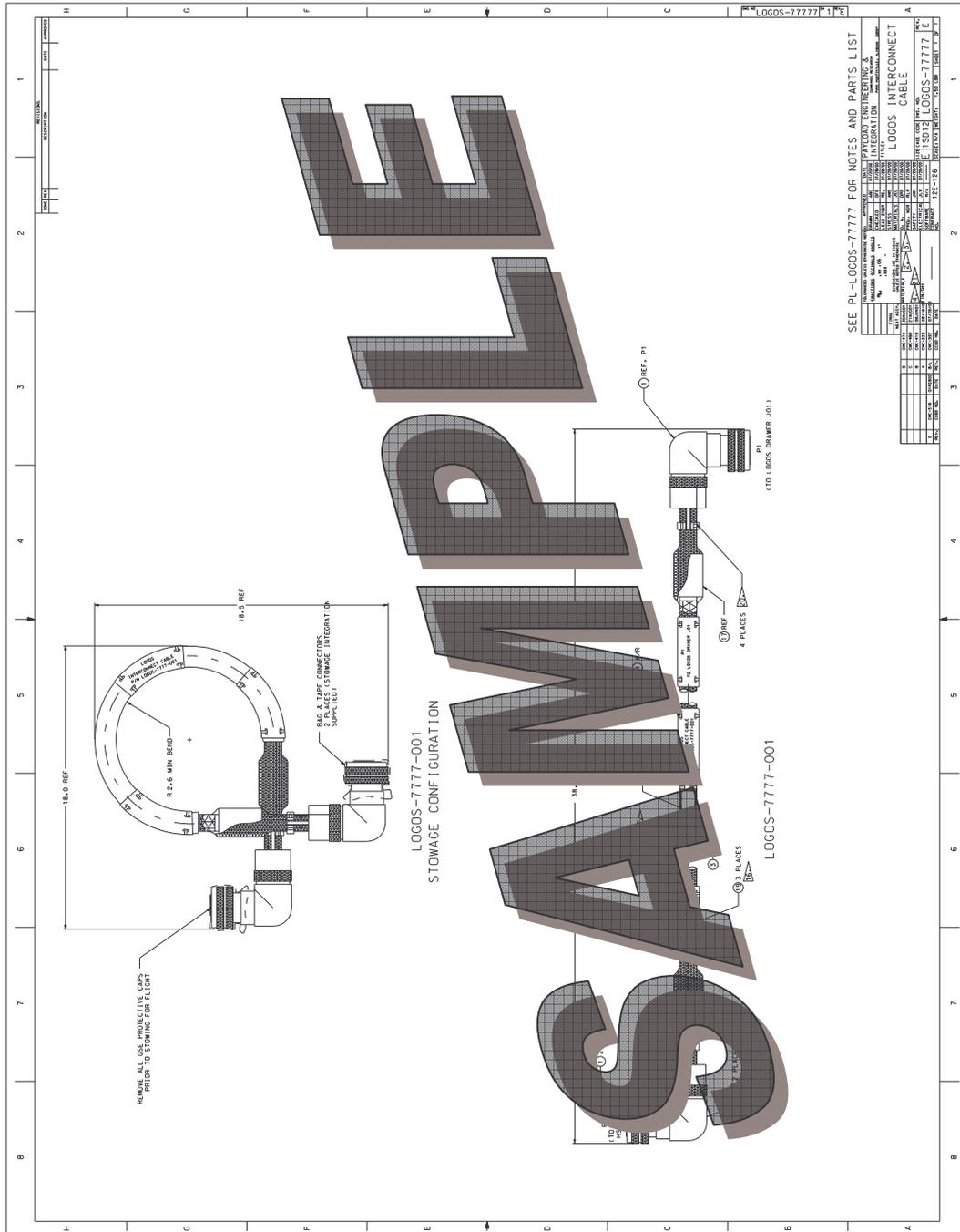


FIGURE 1.2-5 ACOP HIGH RATE DATA LINK CABLE (TBD 6)

1.2.1 ACOP SYSTEM ARCHITECTURE

1.2.1.1 ISS AVIONICS ARCHITECTURE

The ACOP System main element is the ACOP Core (simply ACOP in the following parts of this document), which is the box including all the ACOP specific elements with the corresponding interfaces. ACOP will be accommodated in a MDL/ISS locker inside a standard 8/2 EXPRESS Rack. (TBD 7)

During the transport phase from ground to the ISS, ACOP will be soft stowed (TBD 8) and will be un-powered and without any active electrical connections. ACOP hardware is not planned to be launched in the Shuttle Middeck (TBD 9). Once installed on orbit, ACOP will be interfaced with the standard elements present in the EXPRESS Rack for payload management and in particular with the ER Laptop Computer, which will be used for controlling all the ACOP functions by means of dedicated ER Laptop Software.

Figure 1.2.1.1-1 shows the ACOP Command & Data Handling (C&DH) interfaces with the EXPRESS Rack, the US Lab, and AMS-02.

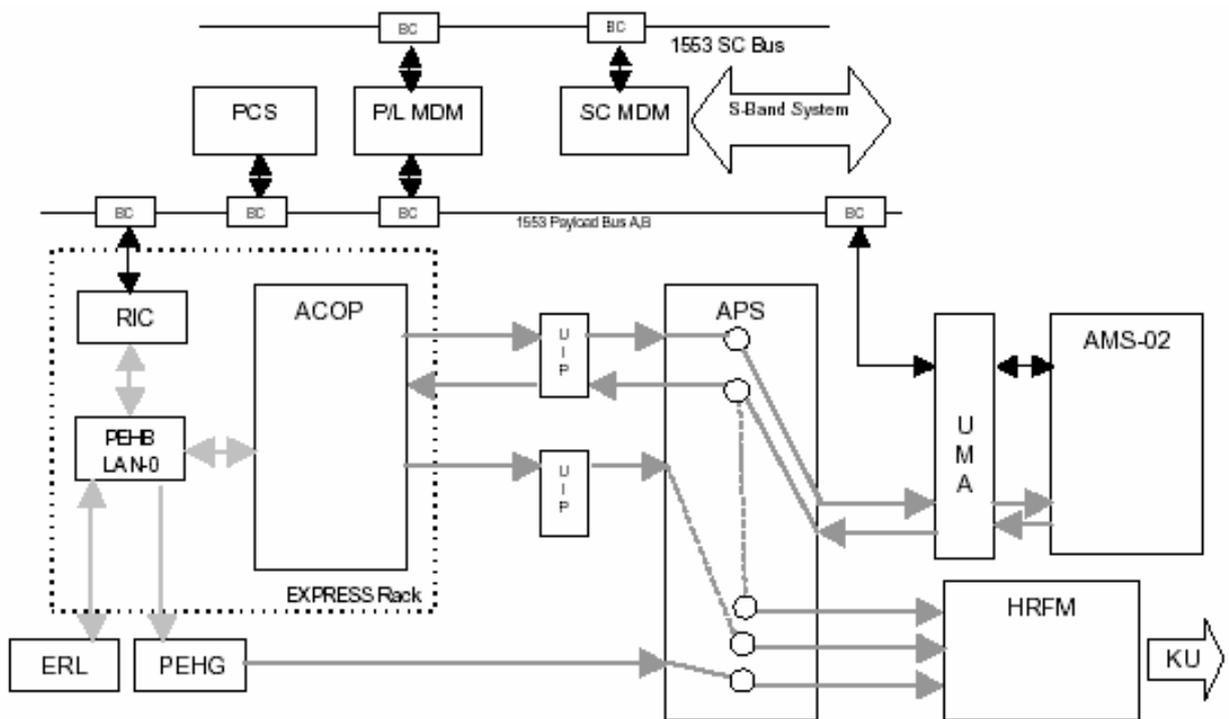


FIGURE 1.2.1.1-1 ACOP C&DH INTERFACES WITH EXPRESS RACK, US LAB, AND AMS-02

Commanding and housekeeping data for ACOP is handled via the EXPRESS Rack Interface Controller (RIC). ACOP communicates with the RIC software on an Ethernet connection via the Payload Ethernet Hub Bridge (PEHB) using the Transmission Control Protocol/Internet Protocol

(TCP/IP). All ISS HRDL fibers are connected to the Automated Payload Switch (APS). This device provides cross bar switching among the fiber systems of ISS. ACOP has two prime targets for HRDL transfers. The first is the High Rate Frame Multiplexer (HRFM - via the High-Rate Communications Outage Recorder (HCOR)). The HRFM interleaves data to the KU-Band transmission system for downlink. The second target is the AMS-02 payload. The APS can be configured to tee data transmitted by AMS-02 to both the HRFM and ACOP. ACOP maintains an active bi-directional connection via the HRDL interface to AMS-02 at all times. As KU access is available, ACOP will be commanded to use its additional TX connection to down link data. ACOP will have the ability to burst this transmission (~20Mbits/sec). All data transmitted by AMS-02 is recorded onto ACOP's hard drives as a master copy of the AMS-02 science data. When ACOP has acknowledged that the data is recorded, AMS-02 can release that data from its buffers.

1.2.1.2 ACOP AVIONICS ARCHITECTURE

The ACOP System is based on CompactPCI systems (cPCI). It contains a single board computer and several interface boards (including HRDL fiber interfaces, Ethernet interfaces, two USB interfaces to upgrade the operating system and programs and digital input-output and video interfaces). ACOP will also contain four exchangeable hard disks used to archive the data and the necessary interfaces. Other parts of ACOP are a LCD screen and a simple push button interface, connected via peripheral cards. In the main chassis and front panel there are electrical parts which include a set of digital computer hardware and software. The ACOP Chassis includes the modules listed in Table 1.2.1.2-1. The functional block diagram of ACOP electrical parts is shown in Figure 1.2.1.2-1.

TABLE 1.2.1.2-1 ACOP CHASSIS MODULES

Part Identifier	Description
ACOP-SBC	Single board computer, based on the IBM PPC 750, which provides 400Mhz speed as well as standard CompactPCI (cPCI) bus interfaces and acts as cPCI system slot.
ACOP-T101	Provides 2 fiber optic TX and 1 fiber optic RX interfaces
ACOP-T102	Provides video output interface, 2 USB 1.1 interfaces and a DIO interface.
ACOP-T103	Provides 2 Ethernet ports and 4 SATA ports
Spare Slot	Future expansion capability
ACOP-PS	Double height power supply
HDD	4 hot swappable HDD (Hard Disk Drive)

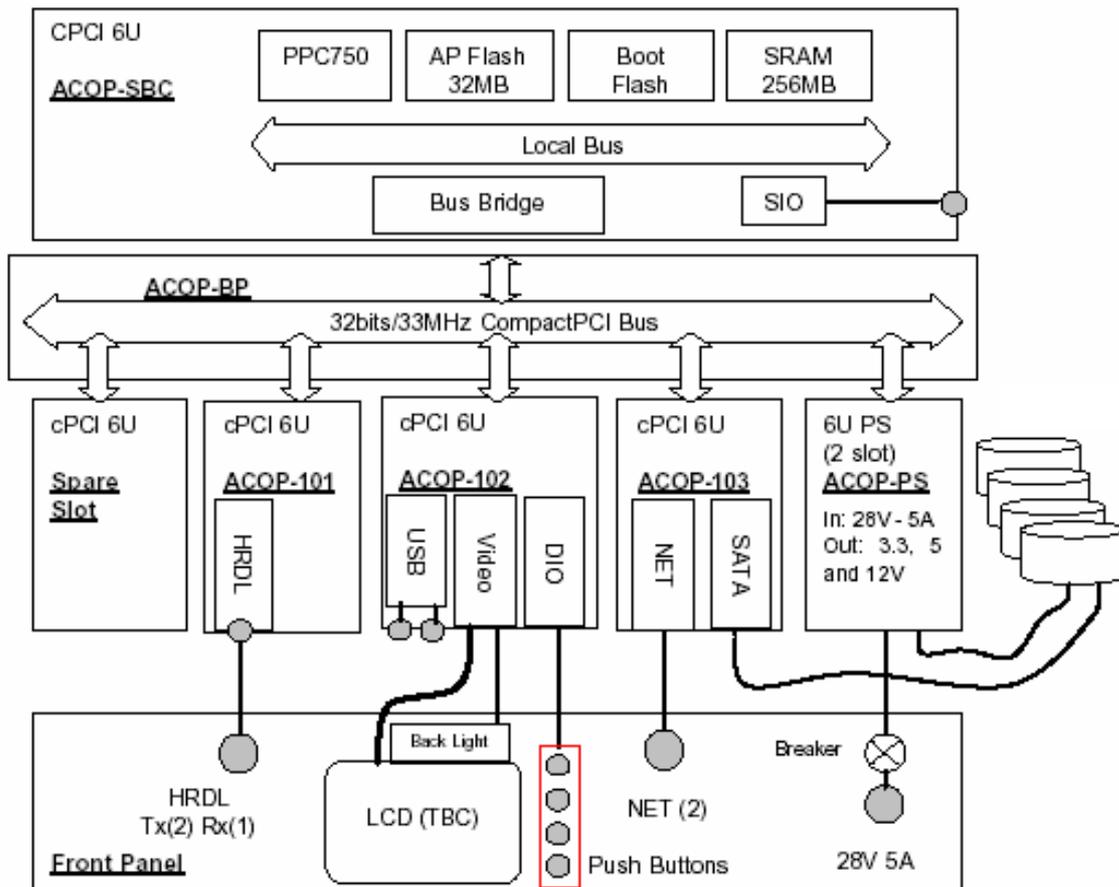


FIGURE 1.2.1.2-1 ACOP ELECTRICAL BLOCK DIAGRAM

The ACOP front panel will be equipped as shown in Figure 1.2.1.2-2, with four momentary push buttons, a circuit breaker with On/Off Switch (TBD 10), one HRDL connector, one Power Connector, one MRDL Connector with 10/100 base Ethernet, and one LCD screen with backlight. Figure 1.2.1.2-3 shows the ACOP front panel with the movable part of the front panel (access door) open.

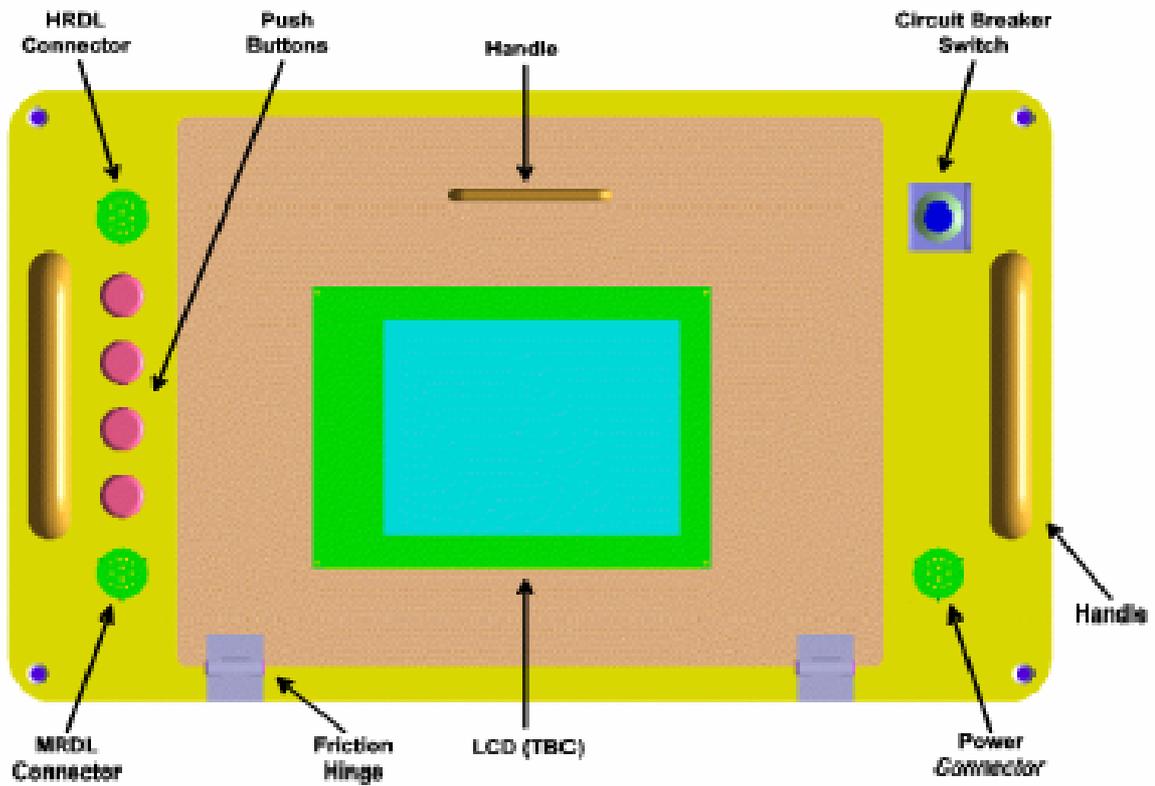


FIGURE 1.2.1.2-2 ACOP FRONT PANEL (TBD 11)



FIGURE 1.2.1.3-3 ACOP FRONT PANEL, ACCESS DOOR OPEN (TBD 12)

1.2.2 INTERFACE DEFINITION AND REQUIREMENTS

1.2.2.1 MECHANICAL INTERFACE

ACOP will be accommodated inside a standard 8/2 EXPRESS Rack as a standard ISS locker replacement. The ACOP locker is mounted to the EXPRESS Rack via four sleeve bolts at the corners of the back plate of the unit.

1.2.2.2 THERMAL INTERFACE

ACOP waste heat is dissipated by airflow to/from the Avionics Air Assembly (AAA). The EXPRESS Rack provides ACOP with cooling air through ducted ports on the ACOP back plate. The ports are outfitted with screens to filter the cooling air, and an inlet fan assists with directing airflow. There is no interface to the water cooling system.

1.2.2.3 ELECTRICAL INTERFACE

The ACOP electrical connector is located on the ACOP front panel. ACOP uses standard 28 Vdc power provided by the EXPRESS Rack, connected via the power connector on the front panel and the available upper or lower EXPRESS Rack connector panel. The maximum power allocated for ACOP is 200 Watts.

1.2.2.4 COMMAND AND DATA HANDLING

The ACOP Ethernet link is used for the communications of ACOP with the Rack Interface Controller (RIC) and the EXPRESS Rack Laptop (ERL), via the Payload Ethernet Hub Bridge (PEHB). Also the Ethernet connection is provided by a standard connector on the ACOP front panel and connectors available on the upper or lower EXPRESS Rack connector panel. Information transmitted on Ethernet includes ACOP and AMS-02 Housekeeping, Health and Status Data, AMS science data packets, and tele-commands for ACOP and AMS-02.

The ACOP fiber-optic HRDL interfaces allow all communications (commands, housekeeping, health and status, and science data) between ACOP and AMS-02. Two transmitting and one receiving channel are used. The HRDL connection is not a standard EXPRESS Rack provision, so a dedicated connector on the ACOP front panel is used.

A serial RS-422 link is available for ground testing and debugging. This interface is not planned for use under nominal on-orbit conditions for communications between the ACOP and the ERL. The RS-422 interface connector is not located on the ACOP front panel, but is accessible when the access door on the ACOP front panel is open.

A USB 1.1 interface is available for allowing quick ACOP software upgrades without using the standard ISS resources, and is not planned for use under nominal on-orbit conditions. The USB interface connector is not located on the ACOP front panel, but is accessible when the access door on the ACOP front panel is open.

1.3 RELATIONSHIP TO STANDARD PAYLOAD INTEGRATION AGREEMENT

The Standard Payload Integration Agreement (SPIA) and payload-unique Payload Integration Agreement (PIA) establish the minimum requirements of the management structure and the execution of the roles and responsibilities for services and resources that will be used/provided by ISS Program (ISSP) participants for an EXPRESS Rack Payload. The SPIA documents the primary management and technical requirements between the PD or Appropriate Office and the ISSP. This ICD provides specific design data and defines the engineering analyses applicable to the EXPRESS Rack/payload interfaces and optional/special services identified in the SPIA and payload-unique PIA.

2.0 DOCUMENTATION

2.1 DOCUMENTATION HIERARCHY

EXPRESS RACK/PAYLOAD-UNIQUE INTERFACE CONTROL DOCUMENT

The unique ICD shall be used for the following functions:

- A. Defines and controls all interfaces which shall be provided by the ISS and EXPRESS Rack for use by payloads.
- B. Defines and controls all constraints which shall be observed by all members of the payload community in using the interfaces so defined.
- C. Establishes commonality with respect to analytical approaches, analytical models, technical data and definitions for integrated analysis by all interfacing parties.

Note: Interfaces to the Orbiter (i.e., Shuttle Middeck) are covered here also.

ORGANIZATION OF EXPRESS RACK/ PAYLOAD-UNIQUE INTERFACE CONTROL DOCUMENTS

The unique ICD has the same section and subsection paragraph numbers and headings as the EXPRESS Rack Payload IDD, except for Sections 1 and 2, which are unique. Each paragraph of the unique ICD (following Section 2) is dispositioned with one of the following:

NAR Not a Requirement (e.g., section heading, no shall statement)

A Applicable to this ICD.

N/A Not applicable to this ICD. (Provide rationale in "Comments" column)

A-N Applicable with note.

E An exception is taken to the EXPRESS Rack payload IDD paragraph. Section 15 of the ICD shall be approved by special consideration or analysis and by a PCB Directive.

2.2 APPLICABLE DOCUMENTS

Applicable documents contained in SSP 52000-IDD-ERP as well as the following documents, form a part of this unique ICD to the extent specified herein. In the event of conflict between this unique ICD and any other documents involved herein, the contents of this ICD shall govern.

SSP 52000-IDD-ERP, Rev. D
June 2003

Expedite the Processing of Experiments to Space
Station (EXPRESS) Rack Payloads Interface
Definition Document

NSTS/ISS 13830, Rev. C

Implementation Procedures for Payloads System

January 1996	Safety Requirements – For Payloads Using the STS & ISS
JSC 26493 February 1995	Guidelines for the preparation of payload flight safety data packages and hazard reports
SSP 50004 April 1994	Ground Support Equipment Design Requirements
SSP 52000-PDS, Rev. B March 1999	Payload Data Set Blank Book
SSP 52000-EIA-ERP, Rev. A February 2001	EXPRESS Rack Integration Agreement Blank Book for EXPRESS Rack Payload
GD-PL-CGS-001 March 1999	Product Assurance & RAMS Plan
SSP 52000-PAH-ERP November 1997	Payload Accommodation Handbook for EXPRESS Rack
SSP 50184, Rev. D February 1996	Physical Media, Physical Signaling & Link-level Protocol Specification for Ensuring Interoperability Of High Rate Data Link Stations on the International Space Program
SSP 52050, Rev. D June 2001	S/W Interface Control Document for ISPR **Only for HRDL, Section 3.4**
ECSS-E-40, Issue A, Rev. 13 April 1999	Software Engineering Standard
AMS-02-CAT-ICD-R04, Rev. 04 August 2003	AMS02 Command and Telemetry Interface Control Document, Section AMS-ACOP Interfaces
SSP-52000-PVP-ERP, Rev. D September 2002	Generic Payload Verification Plan Expedite the Processing of Experiments to Space Station (EXPRESS) Rack Payloads
NSTS 1700.7B, Rev. B Change Packet 8 August 2000	Safety Policy and Requirements for Payloads Using the STS
NSTS 1700.7B Addendum, Rev. B Change Packet 1 September 2000	Safety Policy and Requirements for Payloads Using the International Space Station

SSP 52005 December 1998	Payload Flight Equipment Requirements and Guidelines for Safety Critical Structures
NSTS 18798B, Change Packet 7 October 2000	Interpretation of NSTS Payload Safety Requirements
MSFC-HDBK-527, Rev. E November 1986	Materials Selection List for Space Hardware Systems Materials Selection List Data
GD-PL-CGS-002, Issue 1 February 1999	CADM Plan
GD-PL-CGS-004, Issue 2 April 2003	SW Product Assurance Plan
GD-PL-CGS-005, Issue 2 May 2003	SW CADM Plan

2.3 REFERENCE DOCUMENTS

SSP 57066	Standard Payload Integration Agreement for EXPRESS/WORF Rack Payloads
SSP 52000-IDD-ERP	EXPRESS Rack Payload Interface Definition Document
SSP 52000-PVP-ERP	Generic Payload Verification Plan for EXPRESS Rack Payloads
SSP 52000-PVP-ERP/IA	Generic Payload Verification Plan Instruction Annex for EXPRESS Rack Payloads
SSP 52000-PAH-ERP	Payload Accommodation Handbook for EXPRESS Rack Payloads
GPQ-MAN-02, Issue 1	Commercial, Aviation and Military (CAM) Equipment Evaluation Guidelines for ISS Payloads Use
BSSC (96)2	Guide to applying the ESA software engineering standards to small software products
GPQ-MAN-01, Issue 2	Documentation Standard for ESA Microgravity Projects

MS-ESA-RQ-108	Documentation Requirements for Small and Medium Sized MSM Projects
PSS-05	Software Engineering Standards
GPQ-010, Rev. A	Product Assurance Requirements for ESA Microgravity Payload, Including CN-01
GPQ-010-PSA-101	Safety and Material Requirements for ESA Microgravity Payloads
GPQ-010-PSA-102	Reliability and Maintainability for ESA Microgravity Facilities (ISSA), Including CN 01

The PD is responsible for keeping up with current approved changes to the EXPRESS Rack Payloads IDD. The PD will be expected to either meet the new requirements or give satisfactory explanation to the ISS that the current experiment design is acceptable.

2.4 INTERFACE CONTROL DOCUMENT (ICD) EXCEPTIONS

Unique ICD agreements with the payload are based on ISSP (including EXPRESS Rack) and Space Station Program (SSP) allowed payload services and provisions and are identified in this document. All Orbiter/SSP and ISSP/EXPRESS Rack design-to requirements for payloads are controlled at the Payloads Office PCB.

This unique payload ICD does not require SSP Orbiter Project or ISSP approval if it remains within the Orbiter vehicle and EXPRESS Rack interface design parameters.

Any exceptions to the EXPRESS Rack Payload IDD shall be documented in this Payload-Unique ICD, Section 15, and evaluated to assure the state condition is controlled in a manner to guarantee acceptable conditions to eliminate any added risk to the vehicle (Shuttle, ISS, EXPRESS Rack) or crew.

DEFINITIONS

EXCEPTION: The general term used to identify any payload-proposed departure from specified requirements or interfaces.

3.0 MECHANICAL INTERFACES

3.1 MECHANICAL INTERFACE REQUIREMENTS

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP paragraphs are dispositioned as indicated in Table 3.1-1, Interface Control Document Mechanical Interface Requirements. Payload installation torque requirements are depicted in Table 3.1-2, Payload Installation Torque Requirements.

TABLE 3.1-1 INTERFACE CONTROL DOCUMENT MECHANICAL INTERFACE REQUIREMENTS (PAGE 1 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
3.1	Geometric Relationships	NAR	
3.1.1	Crew Module (CM) Coordinate System	NAR	
3.1.2	International Standard Payload Rack (ISPR) Coordinate Systems (Limited Effectivity)	NAR	
3.1.3	Payload (PL) Coordinate System	NAR	
3.2	Dimensions and Tolerances	NAR	
3.3	Mechanical Interfaces	NAR	
3.3.1	Middeck Locations	NAR	
3.3.1.1	Avionics Bay Locations	NAR	
3.3.1.2	Middeck Payload Provisions	N/A	ACOP not transported in MDK (TBD 9)
3.3.2	ISS Locations	NAR	
3.3.2A	ISS Locations	NAR	
3.3.2B	ISS Locations	NAR	
3.3.2C	ISS Locations	NAR	
3.4	Mechanical Payload Provisions	NAR	
3.4.1	EXPRESS Mounting Plates	NAR	
3.4.1.1	8/2 EXPRESS Rack Mounting Plate	N/A	ACOP will be installed into an EXPRESS locker on-orbit
3.4.1.2	EXPRESS Transportation Rack Mounting Plate	N/A	ACOP not transported in MDK (TBD 9)
3.4.2	Standard Modular Locker	A	
3.4.2.1	Standard Stowage Trays	NAR	
3.4.2.2	Modified Locker Access Door	A	
3.4.2.3	Payload Zero-G Requirements	NAR	
3.4.2.3A	Payload Zero-G Requirements	A	
3.4.2.3B	Payload Zero-G Requirements	A	

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
3.4.2.3C	Payload Zero-G Requirements	A	

**TABLE 3.1-1 INTERFACE CONTROL DOCUMENT MECHANICAL INTERFACE
REQUIREMENTS (PAGE 2 OF 5)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
3.4.2.4	Isolation Material Properties	N/A	No ACOP provided isolation materials (TBD 13)
3.4.2.5	ISS-Supplied Lockers	A	
3.4.2.6	PD-Supplied Locker Requirements	NAR	
3.4.2.6A	PD-Supplied Locker Requirements/Latches	N/A	ACOP will be installed in an EXPRESS Rack on-orbit
3.4.2.6B	PD-Supplied Locker Requirements/Latches	NAR	
3.4.3	Mounting Panels	NAR	
3.4.3A	Mounting Panels	A	
3.4.3B	Mounting Panels	A	
3.4.3.1	Single Adapter Plate	NAR	
3.4.3.2	Double Adapter Plate	NAR	
3.4.3.3	Payload Mounting Panel	NAR	
3.4.3.4	Vented Payload Mounting Panel	A	Or PD provide N/A rationale
3.4.3.4.1	Orbiter Inlet/Outlet Locations for Ducted Air-Cooled Payloads	N/A	ACOP does not interface with MDK ducted cooling interface
3.4.3.4.1.1	Orbiter Inlet/Outlet Locations for Single Payload Accommodations	N/A	ACOP does not interface with MDK ducted cooling interface
3.4.3.4.1.2	Orbiter Inlet/Outlet Locations for Double Payload Accommodations	N/A	ACOP does not interface with MDK ducted cooling interface
3.4.3.5	Mounting Access	NAR	
3.4.3.5A	Mounting Access	A	
3.4.3.5B	Mounting Access	A	
3.4.3.5C	Mounting Access	A	
3.4.3.5D	Mounting Access	A	
3.4.3.5.1	DELETED		
3.4.3.5.1A	DELETED		
3.4.3.5.1B	DELETED		
3.4.3.5.1C	DELETED		

3.4.3.5.2	DELETED		
3.4.3.6	Payload Attachment Point Provisions	NAR	
3.4.3.6.1	Orbiter/Middeck	NAR	
3.4.3.6.1.1	Attachment Hardware – Payloads Without Planned On-Orbit Transfers	N/A	Planned on-orbit transfer to the EXPRESS Rack

**TABLE 3.1-1 INTERFACE CONTROL DOCUMENT MECHANICAL INTERFACE
REQUIREMENTS (PAGE 3 OF 5)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
3.4.3.6.1.2	Attachment Hardware – Payloads With Planned On-Orbit Transfers	N/A	ACOP launched soft stowed (TBD 8)
3.4.3.6.2	EXPRESS Rack Backplate	A	
3.4.3.6.2.1	Interface Attachment Capabilities	A	
3.4.3.6.2.2	DELETED		
3.4.3.6.3	Captive Fasteners	A	
3.4.3.6.4	On-Orbit Removal of Fasteners	A	
3.4.4	International Subrack Interface Standard (ISIS) Drawer Payload Provisions	NAR	
3.4.4.1	Stowage ISIS Drawers	N/A	ACOP does not use an ISIS drawer
3.4.4.1A	DELETED		
3.4.4.1B	DELETED		
3.4.4.1C	DELETED		
3.4.4.1D	DELETED		
3.4.4.1E	DELETED		
3.4.4.2	Powered ISIS Drawers	N/A	ACOP does not use an ISIS drawer
3.4.4.2A	DELETED		
3.4.4.2B	DELETED		
3.4.4.2C	DELETED		
3.4.4.2D	DELETED		
3.4.4.2E	DELETED		
3.4.4.2F	DELETED		
3.4.4.2G	DELETED		
3.4.4.3	ISIS Drawer Replacement	NAR	
3.4.5	Securing of Threaded Fasteners	N/A	No ACOP safety critical structures
3.4.5.1	Fracture-Critical Threaded Fasteners	A	
3.4.5.2	Redundant Threaded Fasteners Locking Requirements	NAR	
3.4.5.2A	Redundant Threaded Fasteners Locking Requirements	A	
3.4.5.2B	DELETED		
3.4.5.2C	DELETED		
3.4.5.2D	DELETED		
3.4.5.2E	DELETED		
3.4.5.2F	Redundant Threaded Fasteners Locking	N/A	ACOP hardware

	Requirements		will always be in a habitable ISS area
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**TABLE 3.1-1 INTERFACE CONTROL DOCUMENT MECHANICAL INTERFACE
REQUIREMENTS (PAGE 4 OF 5)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
3.5	Ground Support Equipment (GSE)	NAR	
3.5.1	Ground Handling	NAR	
3.5.2	MPLM Late/Early Access Requirements	N/A	ACOP has no late or early access requirements
3.5.2.1	MPLM Late Access Envelope (Kennedy Space Flight Center (KSC))	NAR	
3.5.2.1A	MPLM Late Access Envelope (Kennedy Space Flight Center (KSC))	N/A	ACOP has no late or early access requirements
3.5.2.1B	MPLM Late Access Envelope (Kennedy Space Flight Center (KSC))	N/A	ACOP has no late or early access requirements
3.5.2.1C	MPLM Late Access Envelope (Kennedy Space Flight Center (KSC))	N/A	ACOP has no late or early access requirements
3.5.2.2	MPLM Early Access Envelopes (KSC and Dryden Flight Research Center (DFRC))	NAR	
3.5.2.2A	MPLM Early Access Envelopes KSC and Dryden Flight Research Center (DFRC))	N/A	ACOP has no late or early access requirements
3.5.2.2B	MPLM Early Access Envelopes KSC and Dryden Flight Research Center (DFRC))	N/A	ACOP has no late or early access requirements
3.6	Envelope Requirements	NAR	
3.6.1	Payload Static Envelopes	NAR	
3.6.1A	Payload Static Envelopes	N/A	ACOP does not use an ISIS drawer
3.6.1B	Payload Static Envelopes	A	
3.6.1C	Payload Static Envelopes	A	
3.6.2	On-Orbit Payload Protrusions	NAR	
3.6.2A	On-Orbit Payload Protrusions	E	53101-NA-0001 (TBD 14)
3.6.2B	On-Orbit Payload Protrusions	A	
3.6.2.1	Front Face Protrusions (Permanent)	N/A	ACOP has no permanent protrusions
3.6.2.2	On-Orbit Semi-Permanent Protrusions	NAR	
3.6.2.2A	On-Orbit Semi-Permanent Protrusions	A	

TABLE 3.1-1 INTERFACE CONTROL DOCUMENT MECHANICAL INTERFACE REQUIREMENTS (PAGE 5 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
3.6.2.2B	On-Orbit Semi-Permanent Protrusions	A	
3.6.2.3	On-Orbit Temporary Protrusions	NAR	
3.6.2.3A	On-Orbit Temporary Protrusions	N/A	ACOP has no temporary protrusions
3.6.2.3B	On-Orbit Temporary Protrusions	N/A	ACOP has no temporary protrusions
3.6.2.4	On-Orbit Momentary Protrusions	A	
3.6.2.5	On-Orbit Protrusions for Keep-Alive Payloads	N/A	ACOP has no keep alive protrusions
3.6.3	Sharp Edges and Corners	A	
3.6.3.1	Protective Covers/Shields	A	
3.6.3.2	Holes	A	
3.6.3.3	Screws/Bolts Ends	A	
3.6.3.4	Burrs	A	
3.6.3.5	Latches	A	
3.6.3.6	Levers, Cranks, Hooks, and Controls	A	
3.6.3.7	Safety/Lockwire	A	
3.6.3.8	Securing Pins	A	
3.6.4	Pressure Relief Device Location	A	
3.7	Mechanical Interfaces for Crew Restraints and Mobility Aids	NAR	
3.7.1	Hardware Definition	NAR	
3.7.2	Interface Compatibility	A	
3.8	Intravehicular Activity (IVA) Transfer Pathway	A	
3.9	Orbiter Overhead Window Interface Requirements	N/A	No interface to the orbiter overhead window

NAR = Not a requirement.

TABLE 3.1-2 ACOP INSTALLATION TORQUE REQUIREMENTS

ASSEMBLY	FASTENER TYPE (A286, etc.)	NUMBER REQUIRED	INSTALLATION LOCATION (Middeck, ETR, etc.)	REQUIRED TORQUE VALUE (INCLUDE TOLERANCE) (Note 1)	REMARKS (ABOVE RUNNING TORQUE, etc.)	CONSTRAINTS (TORQUE CYCLE LIMITATION, POSTIVE LOCKING FEATURES)
ACOP Core	A286	4	EXPRESS Rack	TBD 15	TBD 15	TBD 15

NOTE:

1. If the PD requires a fastener installation sequence, this information will be provided on the Payload Ascent/Descent Configuration drawing.

4.0 STRUCTURAL INTERFACES**4.1 STRUCTURAL INTERFACE REQUIREMENTS**

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 4.1-1, Interface Control Document Structural Interface Requirements.

TABLE 4.1-1 INTERFACE CONTROL DOCUMENT STRUCTURAL INTERFACE REQUIREMENTS (PAGE 1 OF 4)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
4.1	Operational Loads	NAR	
4.1.1	Component Frequency	NAR	
4.1.1.1	EXPRESS Payload Frequency Compatibility	N/A	ACOP launched soft-stowed (TBD 8)
4.1.1.2	Middeck Payload Frequency Compatibility	N/A	ACOP launched soft-stowed (TBD 8)
4.1.1.3	SPACEHAB Payload Frequency Compatibility	N/A	ACOP launched soft-stowed (TBD 8)
4.1.2	Payload Low Frequency Launch and Landing Loads	NAR	
4.1.2.1	EXPRESS Rack Low Frequency Launch and Landing Loads	A-N	With PSRP concurrence that ACOP has no SCS, no verification required.
4.1.2.2	Middeck Low Frequency Launch and Landing Loads	N/A	ACOP not transported in MDK (TBD 9)
4.1.2.3	SPACEHAB Low Frequency Loads	N/A	Not transported in Spacehab
4.1.2.4	Middeck Low Frequency On-Orbit Loads	N/A	ACOP not transported in MDK (TBD 9)
4.1.3	Factors of Safety for Structural Design	NAR	
4.1.3.1	EXPRESS Rack Factors of Safety	A	
4.1.3.2	Middeck Factors of Safety	N/A	ACOP not transported in MDK (TBD 9)
4.1.3.3	SPACEHAB Factors of Safety	N/A	Not transported in Spacehab
4.2	Emergency Landing Loads	NAR	
4.2.1	Middeck Emergency Landing Load Factors	N/A	ACOP not transported in MDK (TBD 9)
4.2.2	EXPRESS Rack Emergency Landing Load Factors	NAR	
4.2.3	SPACEHAB Emergency Landing Load Factors	N/A	Not transported in Spacehab

**TABLE 4.1-1 INTERFACE CONTROL DOCUMENT STRUCTURAL INTERFACE
REQUIREMENTS (PAGE 2 OF 4)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
4.3	Random Vibration Loads	NAR	
4.3.1	EXPRESS Rack Random Vibration Loads	N/A	ACOP launched soft-stowed (TBD 8)
4.3.2	Middeck Random Vibration Loads	N/A	ACOP not transported in MDK (TBD 9)
4.3.3	SPACEHAB Random Vibration Loads	N/A	Not transported in Spacehab
4.4	Payload Mass Properties Limits	NAR	
4.4.1	Single Middeck Locker (MDL) Location Mass Properties Limits	A	
4.4.2	Double MDL Location Mass Properties Limits	N/A	ACOP not in double locker configuration
4.4.3	Quad MDL Location Mass Properties Limits	N/A	ACOP not in quad locker configuration
4.4.4	SPACEHAB Locker Contents Mass Properties Limits	N/A	Not transported in Spacehab
4.5	On-Orbit Loads	NAR	
4.5.1	Crew-Induced Loading	A	
4.5.2	On-Orbit Low Frequency Loads	A	
4.6	EXPRESS Rack Payload Structural Design	NAR	
4.6.1	Structural Design	A	
4.6.2	Fracture Control	A	
4.7	Acoustics	NAR	
4.7.1	DELETED		
4.7.2	Payload-Generated Acoustic Noise	NAR	
4.7.2.1	Acoustic Noise Definitions	NAR	
4.7.2.1.1	Significant Noise Source	NAR	
4.7.2.1.2	Continuous Noise Source	NAR	
4.7.2.1.3	Intermittent Noise Source	NAR	
4.7.2.1.4	Acoustic Reference	NAR	
4.7.2.2	Acoustic Noise Limits	A	
4.7.2.2.1	Continuous Noise Limits	A	
4.7.2.2.2	Intermittent Noise Limits	N/A	ACOP is a continuous noise source
4.7.2.2.3	Continuous Noise Sources with Intermittent Noise Features	A	

**TABLE 4.1-1 INTERFACE CONTROL DOCUMENT STRUCTURAL INTERFACE
REQUIREMENTS (PAGE 3 OF 4)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
4.7.2.2.3A	Continuous Noise Sources with Intermittent Noise Features	NAR	
4.7.2.2.3B	Continuous Noise Sources with Intermittent Noise Features	NAR	
4.7.2.2.3C	Continuous Noise Sources with Intermittent Noise Features	NAR	
4.7.2.3	DELETED		
4.7.2.4	DELETED		
4.8	Depressurization/ Repressurization Requirements	NAR	
4.8.1	USL, APM, CAM, and JEM Maximum Depressurization/ Repressurization Rates	A	
4.8.2	MPLM Maximum Depressurization/ Repressurization Rate	A	
4.8.3	Middeck Maximum Depressurization/ Repressurization Rates	NAR	
4.8.3A	Middeck Maximum Depressurization/ Repressurization Rates	N/A	ACOP not transported in MDK (TBD 9)
4.8.3B	Middeck Maximum Depressurization/ Repressurization Rates	N/A	ACOP not transported in MDK (TBD 9)
4.8.4	Portable Fire Extinguisher (PFE) Discharge Rate	A	
4.9	Ground Handling Environments	NAR	
4.9.1	Ground Handling Load Factors	A	
4.9.2	Ground Handling Shock Criteria	A	
4.10	Microgravity Disturbances	NAR	
4.10.1	Quiescent Period Payload-Induced Quasi-Steady Accelerations	A	
4.10.2	Quiescent Period Payload-Induced Transient Accelerations	NAR	
4.10.2A	Quiescent Period Payload-Induced Transient Accelerations	A	
4.10.2B	Quiescent Period Payload-Induced Transient Accelerations	A	
4.10.3	Quiescent Period Payload-Induced On-Orbit Vibration	NAR	
4.10.3A	Quiescent Period Payload-Induced On-Orbit Vibration	A	
4.10.3B	Quiescent Period Payload-Induced On-Orbit Vibration	N/A	Not installed in an ARIS rack

**TABLE 4.1-1 INTERFACE CONTROL DOCUMENT STRUCTURAL INTERFACE
REQUIREMENTS (PAGE 4 OF 4)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
4.10.4	Angular Momentum Limits	NAR	
4.10.4A	Angular Momentum Limits	NAR	
4.10.4B	Angular Momentum Limits	NAR	
4.10.4C	Angular Momentum Limits	NAR	
4.10.4D	Angular Momentum Limits	NAR	
4.10.4E	Angular Momentum Limits	NAR	
4.10.4F	Angular Momentum Limits	NAR	
4.10.4G	Angular Momentum Limits	NAR	
4.10.4.1	Limit Disturbance Induced ISS Attitude Rate	A	
4.10.4.2	Limit Disturbance Induced Control Moment Gyroscope (CMG) Momentum Usage	A	
4.11	Constraints for Active Rack Isolation System (ARIS) EXPRESS Rack Activity	N/A	Not installed in an ARIS rack

NAR = Not a requirement.

5.0 THERMAL/FLUIDS INTERFACES

5.1 THERMAL INTERFACE REQUIREMENTS

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 5.1-1, Interface Control Document Thermal Interface Requirements. Payload thermal interfaces are depicted in Table 5.1-2, Payload Thermal Interfaces.

TABLE 5.1-1 INTERFACE CONTROL DOCUMENT THERMAL INTERFACE REQUIREMENTS (PAGE 1 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
5.1	General Requirements	NAR	
5.1.1	External Surface Touch Temperature	A	
5.1.1A	DELETED	NAR	
5.1.1B	DELETED	NAR	
5.1.1C	DELETED	NAR	
5.1.2	DELETED	NAR	
5.1.2.1	Condensation Prevention	N/A	No cold sources
5.1.3	Loss of Cooling	A	
5.1.4	Pressure Relief/Vent Valve Sizing	N/A	No sealed or semi-sealed enclosures
5.1.5	Pressurized Gas Systems	N/A	No pressurized gas systems
5.2	ISS Laboratory (Cabin) Environmental Conditions	A	
5.3	Payload Element Cooling	NAR	
5.3.1	Payload Heat Dissipation	NAR	
5.3.1.1	Passive Cooling	NAR	
5.3.1.1.1	Payload Front Surface Temperature	A	
5.3.1.1.2	Cabin Air Heat Leak	NAR	
5.3.1.1.2A	Cabin Air Heat Leak	A	
5.3.1.1.2B	Cabin Air Heat Leak	N/A	Not powered for launch
5.3.1.1.3	Convective Heat Transfer Coefficient	NAR	
5.3.1.2	Active Cabin Air Cooling/Heating Interface	N/A	Interfaces with rack AAA cooling system
5.3.1.2.1	Particulate(s) and Filters/Debris Traps	A	
5.3.1.3	Avionics Air Cooling	NAR	
5.3.1.3.1	Physical Interface	NAR	
5.3.1.3.1.1	MDLs	NAR	

**TABLE 5.1-1 INTERFACE CONTROL DOCUMENT THERMAL INTERFACE
REQUIREMENTS (PAGE 2 OF 5)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
5.3.1.3.1.2	ISIS Drawers	NAR	
5.3.1.3.1.3	Fans	NAR	
5.3.1.3.1.4	DELETED	NAR	
5.3.1.3.1.5	DELETED	NAR	
5.3.1.3.2	Air Supply Temperature	NAR	
5.3.1.3.3	Air Flow Rate	NAR	
5.3.1.3.3.1	MDLs	NAR	
5.3.1.3.3.2	ISIS Drawers	NAR	
5.3.1.3.4	Air Return Temperature	A	
5.3.1.3.5	Payload Inlet Debris Traps	NAR	
5.3.1.3.5A	Payload Inlet Debris Traps	A	
5.3.1.3.5B	Payload Inlet Debris Traps	A	
5.3.1.3.6	Maximum Allowable Heat Dissipation	NAR	
5.3.1.3.7	Payload Limitations on Heat Conducted to Structure	A	
5.3.1.4	Middeck Ducted Air Cooling	NAR	
5.3.1.4A	Middeck Ducted Air Cooling	N/A	Not powered in orbiter MDK
5.3.1.4B	Middeck Ducted Air Cooling	N/A	Not powered in orbiter MDK
5.3.1.4.1	Bay 1 Ducted Air Cooling Capability	N/A	Not powered in orbiter MDK
5.3.1.4.1.1	Bay 1 Standard Air Flow Capability	NAR	
5.3.1.4.1.2	Bay 2 Ducted Air Cooling Capability	N/A	Not powered in orbiter MDK
5.3.1.4.1.2.1	Bay 2 Standard Air Flow Capability	NAR	
5.3.1.4.2	Bay 3A Ducted Air Cooling Capability	N/A	Not powered in orbiter MDK
5.3.1.4.2.1	Bay 3A Standard Air Flow Capability	NAR	
5.3.1.4.3	Payload Limitations on Heat Conducted to Structure	N/A	Not powered in orbiter MDK
5.3.1.4.4	Payload Outlet Air Pressure Requirement	N/A	Not powered in orbiter MDK
5.3.1.4.5	Ducted Payload Air Cooling Requirement	NAR	

**TABLE 5.1-1 INTERFACE CONTROL DOCUMENT THERMAL INTERFACE
REQUIREMENTS (PAGE 3 OF 5)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
5.3.1.4.5.1	Single Size MDL Payload Air Cooling Interface	NAR	
5.3.1.4.5.2	Double Size MDL Payload Air Cooling Interface	NAR	
5.3.1.4.6	Cabin and Avionics Bay Air Mixing Limitations	N/A	Not powered in orbiter MDK
5.3.1.4.7	Ducted Payload Limitations on Heat Convected or Radiated to Cabin Air	N/A	Not powered in orbiter MDK
5.3.1.4.8	Maximum Air Leakage Across Payload Mounting Interface Requirement	N/A	Not powered in orbiter MDK
5.3.1.4.9	Payload Mounting Surface Physical Characteristic	N/A	Not powered in orbiter MDK
5.3.1.4.9A	DELETED	NAR	
5.3.1.4.9B	DELETED	NAR	
5.3.1.5	Water Cooling Interface Requirements	NAR	
5.3.1.5.1	Physical Interface	NAR	
5.3.1.5.2	Fluid Use	NAR	
5.3.1.5.2A	Fluid Use	N/A	No water cooling interface
5.3.1.5.2B	Fluid Use	N/A	No water cooling interface
5.3.1.5.2C	DELETED	NAR	
5.3.1.5.2D	Fluid Use	N/A	No water cooling interface
5.3.1.5.2E	Fluid Use	N/A	No water cooling interface
5.3.1.5.3	Water Quantity	N/A	No water cooling interface
5.3.1.5.4	Thermal Expansion	NAR	
5.3.1.5.4A	Thermal Expansion	N/A	No water cooling interface
5.3.1.5.4B(1)	Thermal Expansion	N/A	No water cooling interface
5.3.1.5.4B(2)	Thermal Expansion	N/A	No water cooling interface
5.3.1.5.4C	DELETED	NAR	
5.3.1.5.5	Water Loop Pressure Drop	N/A	No water cooling interface
5.3.1.5.6	Quick Disconnect (QD) Air Inclusion	N/A	No water cooling interface

5.3.1.5.7	Leak Rate	N/A	No water cooling interface
5.3.1.5.8	Water Coolant Flow Rate	N/A	No water cooling interface

**TABLE 5.1-1 INTERFACE CONTROL DOCUMENT THERMAL INTERFACE
REQUIREMENTS (SHEET 4 OF 5)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
5.3.1.5.9	Water Coolant Supply Temperature	NAR	
5.3.1.5.10	Water Coolant Return Temperature	N/A	No water cooling interface
5.3.1.5.11	Maximum Water Coolant System Pressure	N/A	No water cooling interface
5.3.2	DELETED	NAR	
5.4	Vacuum Exhaust System/Waste Gas System Interface Requirements (USL, APM, JEM)	NAR	
5.4.1	Physical Interface (USL, APM, JEM)	NAR	
5.4.2	Input Pressure Limit (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.3	Input Temperature Limit (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.4	Input Dewpoint Limit (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.5	Vacuum Exhaust System (VES)/Waste Gas System (WGS) MDP	N/A	No VES/WGS interface
5.4.6	Leak Rate (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.7	Acceptable Effluents (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.7.1	Acceptable Gases (USL, APM, JEM)	NAR	
5.4.7.1A	Acceptable Gases (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.7.1B	Acceptable Gases (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.7.1C	Acceptable Gases (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.7.1D	Acceptable Gases (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.7.2	External Contamination Control (USL, APM, JEM)	N/A	No VES/WGS interface
5.4.7.3	DELETED	NAR	
5.4.7.3A	DELETED	NAR	
5.4.7.3B	DELETED	NAR	

TABLE 5.1-1 INTERFACE CONTROL DOCUMENT THERMAL INTERFACE REQUIREMENTS (SHEET 5 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
5.4.8	Utility Control	NAR	
5.4.8A	Utility Control	N/A	No VES/WGS interface
5.4.8B	Utility Control	N/A	No VES/WGS interface
5.4.9	Vacuum Outgassing Requirements	N/A	No VES/WGS interface
5.5	Gaseous Nitrogen (GN ₂) Interface Requirements	NAR	
5.5.1	Physical Interface	NAR	
5.5.2	Utility Control	NAR	
5.5.2A	Utility Control	N/A	No GN ₂ interface
5.5.2B	Utility Control	N/A	No GN ₂ interface
5.5.3	GN ₂ System MDP	N/A	No GN ₂ interface
5.5.4	Interface Pressure (USL, APM)	N/A	No GN ₂ interface
5.5.5	Temperature	NAR	
5.5.6	Leak Rate	N/A	No GN ₂ interface
5.5.7	GN ₂ Characteristics	NAR	
5.5.7A	GN ₂ Characteristics	N/A	No GN ₂ interface
5.5.7B	GN ₂ Characteristics	N/A	No GN ₂ interface
5.5.7C	GN ₂ Characteristics	N/A	No GN ₂ interface

NAR = Not a requirement.

TABLE 5.1-2 ACOP THERMAL INTERFACES

HARDWARE ITEM (See Note 1)	INTERFACE TYPE	QUANTITY OF INTERFACES	CHARACTERISTICS	REMARKS (See Note 2)
	Moderate Temp Water Loop	NONE	Flow Rate: xxx lbm/hr Heat to Loop: xxxx.x W (max/min) Volume: xxx.xx liters	
	Vacuum Exhaust System Waste Gas System	NONE	Exhaust Gases and Quantities: Note 3 Venting Frequency: xx times per day/hr/min Venting Duration: xxxx minutes Isolation Methodology: _____	
	GN ₂	NONE	Flow Rate: xxx.xx lbm/hr Quantity: xxx.x lbm	
ACOP Core	Avionics Air (Interface to the EXPRESS Rack AAA)	1	Flow Rate: TBD 16 CFM (include Fan(s)) Heat to Loop: TBD 16 W (max/min)	
ACOP Core	Latent Cabin Air Heat	1	Heat Load: TBD 16 W (max/min) Duration Continuous	From Front Panel
	Sensible Cabin Air Heat	NONE	Heat Load: xxxx.x W (max/min) Duration xx.x hours	
	Middeck Rear Breather	NONE	Flow Rate: xxx.x CFM (include P/L Fan(s)) Heat to Loop: xxxx.x W (max/min)	
	Middeck Cabin Air	NONE	Heat Load: xxxx.x W (max/min)	

NOTES:

1. List part number, serial number.
2. Identify flight effectivity.
3. List each gas exhausted and the quantity in volume/pressure/temperature.

6.0 ELECTRICAL POWER INTERFACES

6.1 ELECTRICAL POWER INTERFACE REQUIREMENTS

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 6.1-1, Interface Control Document Electrical Power Interface Requirements. Payload electrical interfaces are depicted in Table 6.1-2, Payload Electrical Interfaces.

TABLE 6.1-1 INTERFACE CONTROL DOCUMENT ELECTRICAL POWER INTERFACE REQUIREMENTS (PAGE 1 OF 4)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
6.1	Electrical Power/Energy	NAR	
6.1.1	Baseline Power Allocation	NAR	
6.1.2	Shuttle/Middeck Power and Voltage	NAR	
6.2	EXPRESS Rack Direct Current (dc) Power Characteristics	NAR	
6.2.1	28 Vdc Power and Voltage	NAR	
6.2.1.1	Voltage Levels	A	
6.2.1.2	Output Impedance	NAR	
6.2.1.3	Reverse Current	A	
6.2.1.4	Reverse Energy	A	
6.2.1.5	Soft Start/Stop	NAR	
6.2.2	Overload Protection	NAR	
6.2.2.1	Overload Protection Device	A	
6.2.2.1.1	Device Accessibility	A	
6.2.2.1.2	Location	A	
6.2.2.1.3	Device Identification	A	
6.2.2.1.4	Extractor-Type Fuse Holder	A	
6.2.3	Current Limiting	NAR	
6.2.3A	Current Limiting	A	
6.2.3B	Current Limiting	A	
6.2.3C	Current Limiting	A	
6.2.3D	Current Limiting	A	
6.3	Ripple and Transient Spike (Repetitive) Limits - Shuttle/Middeck	NAR	
6.3.1	In-Flight dc Power Bus Ripple at the Interface - Shuttle/Middeck	NAR	

TABLE 6.1-1 INTERFACE CONTROL DOCUMENT ELECTRICAL POWER INTERFACE REQUIREMENTS (PAGE 2 OF 4)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
6.3.1A(1)	In-Flight dc Power Bus Ripple at the Interface - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.3.1A(2)	In-Flight dc Power Bus Ripple at the Interface - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.3.1B	In-Flight dc Power Bus Ripple at the Interface - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.3.2	In-Flight dc Power Transient Spikes (Repetitive) - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.3.3	Ground dc Power - Shuttle/Middeck	NAR	
6.3.3A	Ground dc Power - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.3.3B	Ground dc Power - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.3.3C	Ground dc Power - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.3.4	Alternating Current (ac) Power Characteristics - Shuttle/Middeck	N/A	Not powered in orbiter MDK.
6.4	Ripple and Transient Spikes (Repetitive) Limits - ISS	NAR	
6.4.1	Startup Condition Spikes	NAR	
6.4.2	Differential Mode Periodic and Random Deviation (PARD) (Noise/Ripple)	NAR	
6.5	Limitations on EXPRESS Rack Payload Utilization of Electrical Power	NAR	
6.5.1	On-Orbit Transfer	NAR	
6.5.2	EXPRESS Rack Payload Electrical Safety/Hazards	NAR	
6.5.2.1	Batteries	A	
6.5.2.2	Safety-Critical Circuits	NAR	
6.5.2.2A	Safety-Critical Circuits	N/A	No safety critical circuits
6.5.2.2B	Safety-Critical Circuits	N/A	No safety critical circuits
6.5.2.2C	Safety-Critical Circuits	N/A	No safety critical circuits

TABLE 6.1-1 INTERFACE CONTROL DOCUMENT ELECTRICAL POWER INTERFACE REQUIREMENTS (PAGE 3 OF 4)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
6.5.2.3	DELETED	NAR	
6.5.2.3A	DELETED	NAR	
6.5.2.3B	DELETED	NAR	
6.5.2.3C	DELETED	NAR	
6.5.2.3D	DELETED	NAR	
6.5.2.3E	DELETED	NAR	
6.5.3	Power Loss/Emergency Operational Modes	A	
6.5.3.1	Automatic Starting After Power Loss	A	
6.5.4	DELETED	NAR	
6.5.5	Payload Element Activation/Deactivation and Isolation	A	
6.6	Electrical Connectors	NAR	
6.6.1	Connector Pins/Sockets	A	
6.6.2	Electrical Connector Mating/Demating (Unpowered)	A	
6.6.3	Electrical Connector Mating/Demating (Powered)	N/A	Meets 6.6.2. Power removed prior to mating/demating connectors.
6.6.3A	Electrical Connector Mating/Demating (Powered)	N/A	Meets 6.6.2. Power removed prior to mating/demating connectors.
6.6.3B	Electrical Connector Mating/Demating (Powered)	N/A	Meets 6.6.2. Power removed prior to mating/demating connectors.
6.6.3B(1)	Electrical Connector Mating/Demating (Powered)	N/A	Meets 6.6.2. Power removed prior to mating/demating connectors.
6.6.3B(2)	Electrical Connector Mating/Demating (Powered)	N/A	Meets 6.6.2. Power removed prior to mating/demating connectors.
6.6.3B(3)	Electrical Connector Mating/Demating (Powered)	N/A	Meets 6.6.2. Power removed prior to mating/demating connectors.
6.6.3B(4)	Electrical Connector	N/A	Meets 6.6.2. Power removed prior to

	Mating/Demating (Powered)		mating/demating connectors.
6.6.4	Electrical Connector Mismatching Prevention	A	
6.6.4A	Electrical Connector Mismatching Prevention	A	
6.6.4B	Electrical Connector Mismatching Prevention	A	
6.6.4C	Electrical Connector Mismatching Prevention	A	

TABLE 6.1-1 INTERFACE CONTROL DOCUMENT ELECTRICAL POWER INTERFACE REQUIREMENTS (PAGE 4 OF 4)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
6.6.4D	Electrical Connector Mismatching Prevention	A	
6.6.5	Mechanical Protection	A	
6.6.6	DELETED	NAR	

NAR = Not a requirement.

TABLE 6.1-2 ACOP ELECTRICAL INTERFACES

ISS AND ORBITER SERVICE BY FLIGHT	HARDWARE ITEM (See Note 2)	QUANTITY OF INTERFACES	VOLTAGE RANGE (See Note 4)	SSPC SETTING (AMPS) (See Note 1)	POWER WATTS		TIME LIMIT ON PEAK POWER (Minutes/Frequency of Occurrence)	CONTINUOUS POWER (Yes/No)	PAYLOAD CHARACTERISTICS (See Note 5)	REMARKS (See Note 3)
					MAX. CONT.	PEAK				
Prelaunch:	N/A									
Ascent:	N/A									
On-orbit:	ACOP Core	1	25.5-29.5 Vdc	TBD 17	TBD 17	TBD 17	TBD 17	Yes	TBD 17	Launch: UF3
Descent:	N/A									
Post landing:	N/A									

NOTES:

1. SSPC Setting: Specify 5A, 10A, 15A, or 20A.
2. List part number, serial number.
3. Identify flight effectivity.
4. List Voltage Range – Middeck – 24 – 32 V/EXPRESS Rack 25.5 – 29.5.
5. Payload Characteristics: Specify whether payload is resistive, constant power, or both. If both, state the percentage of constant power.

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7.0 ELECTROMAGNETIC COMPATIBILITY (EMC)

7.1 ELECTROMAGNETIC COMPATABILITY INTERFACE REQUIREMENTS

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 7.1-1, Interface Control Document Electromagnetic Compatibility Interface Requirements.

TABLE 7.1-1 INTERFACE CONTROL DOCUMENT ELECTROMAGNETIC COMPATIBILITY INTERFACE REQUIREMENTS (PAGE 1 OF 4)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
7.1	Circuit EMC Classifications	NAR	
7.2	Shuttle-Produced Interference Environment	NAR	
7.2.1	Conducted Interference	N/A	Not powered in orbiter MDK
7.2.2	Radiated Interference - Shuttle/Middeck	NAR	
7.2.2A	Radiated Interference - Shuttle/Middeck	N/A	Not powered in orbiter MDK
7.2.2B	DELETED	NAR	
7.2.2C	DELETED	NAR	
7.2.2D	Radiated Interference - Shuttle/Middeck	N/A	Not powered in orbiter MDK
7.2.2E	Radiated Interference - Shuttle/Middeck	NAR	
7.2.2.1	Shuttle-Produced Wireless Crew Communication System (WCCS) Radiated Electric Fields	N/A	Not powered in orbiter MDK
7.3	Electromagnetic Compatibility	NAR	
7.3.1	Emission and Susceptibility Limits and Test Methods	A	
7.3.1.1	Compatibility	A	
7.3.1.2	Applicability	NAR	
7.3.1.3	Conducted Emissions	A	
7.3.1.3.1	CE01, Conducted Emissions	NAR	
7.3.1.3.2	CE01 Limits	A	
7.3.1.3.3	CE03, Conducted Emissions	NAR	
7.3.1.3.4	CE03 Limits	A	
7.3.1.3.5	CE07, Conducted Emissions	NAR	
7.3.1.3.6	CE07 Limits	A	
7.3.1.4	Conducted Susceptibility	NAR	

**TABLE 7.1-1 INTERFACE CONTROL DOCUMENT ELECTROMAGNETIC COMPATIBILITY
INTERFACE REQUIREMENTS (PAGE 2 OF 4)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
7.3.1.4.1	CS01, Conducted Susceptibility	NAR	
7.3.1.4.2	CS01 Limits	A	
7.3.1.4.3	CS02, Conducted Susceptibility	NAR	
7.3.1.4.4	CS02 Limits	A	
7.3.1.4.5	CS06, Conducted Susceptibility	NAR	
7.3.1.4.6	CS06 Limits	A	
7.3.1.4.6A	CS06 Limits	NAR	
7.3.1.4.6B	CS06 Limits	NAR	
7.3.1.5	Radiated Emissions	NAR	
7.3.1.5.1	RE02, Radiated Emissions	NAR	
7.3.1.5.2	Applicability	NAR	
7.3.1.5.3	RE02 Limits	A	
7.3.1.5.4	Narrowband Electric Field Emissions	A	
7.3.1.6	Radiated Susceptibility	NAR	
7.3.1.6.1	RS02, Radiated Susceptibility	NAR	
7.3.1.6.2	Applicability	NAR	
7.3.1.6.3	RS02 Limits	A	
7.3.1.6.3A	RS02 Limits	NAR	
7.3.1.6.3B	RS02 Limits	NAR	
7.3.1.7	RS03, Radiated Susceptibility	NAR	
7.3.1.7.1	Applicability	NAR	
7.3.1.7.2	RS03 Limits	A	
7.3.2	Electrostatic Discharge (ESD)	NAR	
7.3.2.1	ESD Compatibility	A	
7.3.2.2	ESD Labeling	A	
7.3.2.3	Corona	A	
7.3.2.4	Lightning	NAR	
7.4	Payload-Produced Interference Environment - Shuttle	NAR	
7.4.1	Payload-Produced Conducted Noise - Shuttle	NAR	
7.4.1A	Payload-Produced Conducted Noise - Shuttle	N/A	Not powered in orbiter MDK

**TABLE 7.1-1 INTERFACE CONTROL DOCUMENT ELECTROMAGNETIC COMPATIBILITY
INTERFACE REQUIREMENTS (PAGE 3 OF 4)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
7.4.1B	Payload-Produced Conducted Noise - Shuttle	N/A	Not powered in orbiter MDK
7.4.1C	Payload-Produced Conducted Noise - Shuttle	N/A	Not powered in orbiter MDK
7.4.2	Payload-Produced Radiated Fields - Shuttle	NAR	
7.4.2A	Payload-Produced Radiated Fields - Shuttle	N/A	Not powered in orbiter MDK
7.4.2B	Payload-Produced Radiated Fields - Shuttle	N/A	Not powered in orbiter MDK
7.4.2C	Payload-Produced Radiated Fields - Shuttle	N/A	Not powered in orbiter MDK
7.4.2D	Payload-Produced Radiated Fields - Shuttle	N/A	Not powered in orbiter MDK
7.4.3	Magnetic Fields for EXPRESS Rack Payloads in the ISS	NAR	
7.4.3.1	Alternating Current (ac) Magnetic Fields for EXPRESS Rack Payloads in the ISS	A	
7.4.3.2	Direct Current (dc) Magnetic Fields for EXPRESS Rack Payloads in the ISS	N/A	ACOP has no intentional magnetic fields
7.5	Avionics Electrical Compatibility - Shuttle and ISS	NAR	
7.5.1	Electrical Bonding	A	
7.5.1A	Fault Current Bond - Class C	A	
7.5.1B	Shock Hazard - Class H	A	
7.5.1C	Radio Frequency (RF) Bond - Class R	A	
7.5.1D	Static Bond - Class S	A	
7.5.1.1	Electrical Bonding of Payload Hardware	A	
7.5.1.1.1	Redundant Bond Paths	N/A	Power less than 32Vdc
7.5.1.2	Electrical Bonding of Payload Structures	NAR	
7.5.1.2.1	Payload-to-EXPRESS Rack Main Bond	NAR	
7.5.1.2.1.1	Primary Payload Power Connector Bond	A	

**TABLE 7.1-1 INTERFACE CONTROL DOCUMENT ELECTROMAGNETIC COMPATIBILITY
INTERFACE REQUIREMENTS (PAGE 4 OF 4)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
7.5.1.2.1.2	Payload-to-EXPRESS Rack Bond Strap	N/A	Mutually exclusive with 7.5.1.2.1.1
7.5.1.2.1.3	Payload-to-EXPRESS Rack Mated Surface Bond	N/A	Bond established through primary ACOP power connector
7.5.1.2.2	Payload-to-EXPRESS Rack and Fluid Line Bonding	NAR	
7.5.1.2.3	Payload-to-Orbiter and Fluid Line Bonding – Shuttle/Middeck	N/A	Not powered in orbiter MDK.
7.5.2	Circuit Reference Symbols	NAR	
7.6	Power Circuit Isolation and Grounding	NAR	
7.6.1	EXPRESS Rack 28 Vdc Primary Power Bus Isolation	A	
7.6.2	Dc Power Ground Reference	NAR	
7.6.3	Payload Secondary Power Isolation and Grounding	A	
7.6.4	GSE Isolation and Grounding	N/A	No GSE interfacing with ACOP
7.6.5	AC Power Ground Reference – Shuttle/Middeck	N/A	Not powered in orbiter MDK.
7.7	Signal Isolation and Grounding Requirements	NAR	
7.7.1	Ethernet	A	
7.7.2	RS-422	A	
7.7.3	Solid State Power Controller Module (SSPCM) Analog Grounding	N/A	No analog interface
7.7.4	SSPCM Discrete	N/A	No discrete interface
7.7.5	Video	N/A	No video interface to EXPRESS rack
7.7.6	Shield References	A	

NAR = Not a requirement.

8.0 ELECTRICAL WIRING INTERFACE**8.1 ELECTRICAL WIRING INTERFACE REQUIREMENTS**

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 8.1-1, Interface Control Document Electrical Wiring Interface Requirements.

TABLE 8.1-1 INTERFACE CONTROL DOCUMENT ELECTRICAL WIRING INTERFACE REQUIREMENTS

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
8.1	General	NAR	
8.1.1	Connector/Pin Interfaces	NAR	
8.1.1.1	MDLs/MDL Replacement	A	
8.1.1.1.1	Previously Flown (Shuttle) MDLs/MDL Replacement	N/A	Not previously flown
8.1.1.2	ISIS Drawers	N/A	Does not have ISIS drawer powered interfaces
8.1.2	Approved Connectors for EXPRESS Rack Payload Use	A	
8.2	Cable Schematics	NAR	

NAR = Not a requirement

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9.0 COMMAND AND DATA HANDLING (C&DH) INTERFACES

9.1 COMMAND AND DATA HANDLING (C&DH) INTERFACE REQUIREMENTS

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 9.1-1, Interface Control Document Command and Data Handling Interface Requirements. Payload data interfaces are depicted in Table 9.1-2, Payload Data Interfaces.

TABLE 9.1-1 INTERFACE CONTROL DOCUMENT COMMAND AND DATA HANDLING INTERFACE REQUIREMENTS (PAGE 1 OF 2)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
9.1	RS-422 Communications	NAR	
9.1.1	Signal Characteristics	A-N	No nominal use of RS-422 planned
9.1.2	Telemetry Format	A-N	No nominal use of RS-422 planned
9.1.3	Request/Command Format	A-N	No nominal use of RS-422 planned
9.1.4	Processing Requirements	A-N	No nominal use of RS-422 planned
9.1.5	Connector/Pin Interface	NAR	
9.1.5.1	MDLs/MDL Replacements	A-N	No nominal use of RS-422 planned
9.1.5.2	ISIS Drawers	N/A	Not an ISIS drawer payload
9.2	Ethernet Communications	NAR	
9.2.1	Signal Characteristics	A	
9.2.2	Communications Protocol	A	
9.2.3	Telemetry Format	A	
9.2.4	Request/Command Format	A	
9.2.5	Processing Requirements	A	
9.2.6	Connector/Pin Interface	NAR	
9.2.6.1	MDLs/MDL Replacements	A	
9.2.6.2	ISIS Drawers	N/A	Not an ISIS drawer payload
9.2.7	Communications to Laptop	NAR	
9.3	Analog Communications	NAR	
9.3.1	Signal Characteristics	N/A	No analog interface
9.3.2	Analog Driver Characteristics	N/A	No analog interface
9.3.3	Connector/Pin Interface	NAR	
9.3.3.1	MDLs/MDL Replacement	N/A	No analog interface
9.3.3.2	ISIS Drawers	N/A	Not an ISIS drawer payload
9.4	Discrete Communications	NAR	
9.4.1	Discrete Signal Characteristics	NAR	

**TABLE 9.1-1 INTERFACE CONTROL DOCUMENT COMMAND AND DATA HANDLING
INTERFACE REQUIREMENTS (PAGE 2 OF 2)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
9.4.1.1	Discrete Output Low Level	N/A	No discrete interface
9.4.1.2	Discrete Output High Level	N/A	No discrete interface
9.4.1.3	Discrete Output Maximum Fault Current	N/A	No discrete interface
9.4.1.4	Discrete Input Low Level	N/A	No discrete interface
9.4.1.5	Discrete Input High Level	N/A	No discrete interface
9.4.1.6	Discrete Input Maximum Fault Voltage	N/A	No discrete interface
9.4.2	Discrete Driver and Receiver Characteristics	N/A	No discrete interface
9.4.3	Connector/Pin Interface	NAR	
9.4.3.1	MDLs/MDL Replacement	N/A	No discrete interface
9.4.3.2	ISIS Drawers	N/A	Not an ISIS drawer payload
9.5	Continuity Discrete Jumper	N/A	Not powered ISIS drawer interface
9.6	Point-to-Point Communications Bus (PPCB)	N/A	No point-to-point communications interface
9.7	Video	N/A	No ACOP video interface
9.7.1	Payload Video Characteristics	NAR	
9.7.1.1	Input Impedance	N/A	No ACOP video interface
9.7.1.2	Sync Tip	N/A	No ACOP video interface
9.7.1.3	Blanking Level	N/A	No ACOP video interface
9.7.1.4	White Reference	N/A	No ACOP video interface
9.7.2	Deviations to Video Standard	NAR	
9.7.2A	Deviations to Video Standard	NAR	
9.7.2B	Deviations to Video Standard	NAR	
9.7.2C	Deviations to Video Standard	NAR	
9.7.2D	Deviations to Video Standard	NAR	
9.7.2E	Deviations to Video Standard	NAR	
9.7.3	Connector/Pin Interface	N/A	No ACOP video interface

NAR = Not a requirement.

TABLE 9.1-2 ACOP DATA INTERFACES

DATA INTERFACE	QUANTITY OF INTERFACES	DATA DOWNLINK	DOWNLINK RATE (Mb/Sec)	REMARKS
RS-422	1	N/A	N/A	For ground test, debugging only
ETHERNET (Note 1)	1	TBD 18	TBD 18	
Analog/Discrete	N/A			

Note: Include Identification and Duration of each major operational mode in Remarks

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10.0 ENVIRONMENTAL INTERFACES**10.1 ENVIRONMENTAL INTERFACE REQUIREMENTS**

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 10.1-1, Interface Control Document Environmental Conditions Interface Requirements.

TABLE 10.1-1 INTERFACE CONTROL DOCUMENT ENVIRONMENTAL CONDITIONS INTERFACE REQUIREMENTS

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
10.1	Payload Equipment Surface Cleanliness	NAR	
10.1A	Payload Equipment Surface Cleanliness	A	
10.1B	Payload Equipment Surface Cleanliness	A	
10.2	Illumination Requirements - Lighting Design	NAR	
10.2.1	Work Surface Specularity	A	
10.2.2	Supplemental Lighting	N/A	No fine or glovebox operations. Medium tasks performed in aisle.
10.2.3	Direct Light Sources	N/A	No ACOP light sources
10.2.4	Glovebox Lighting	N/A	Not a glovebox
10.2.5	DELETED		
10.3	Laser Requirements	NAR	
10.3.1	Laser Design and Operation in Compliance with ANSI Standard Z136.1-1993	N/A	No ACOP use of lasers.
10.3.2	Non-Ionizing Radiation	N/A	No ACOP use of lasers.
10.3.3	Safe Operation	N/A	No ACOP use of lasers.
10.3.4	Accidental Exposures	N/A	No ACOP use of lasers.
10.3.5	Laser and Optical Radiation Monitoring	N/A	No ACOP use of lasers.
10.3.6	Personnel Protection Devices	N/A	No ACOP use of lasers.
10.4	Radiation Requirements	NAR	
10.4.1	Payload Contained or Generated Ionizing Radiation	N/A	No ionizing radiation sources
10.4.2	Single Event Effect (SEE) Ionizing Radiation	A	

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
10.4.3	Radiation Dose Requirements	NAR	
10.5	Atmosphere Requirements	NAR	
10.5.1	Oxygen Consumption	N/A	No oxygen consumption
10.5.2	Chemical Releases	NAR	
10.5.2A	Chemical Releases	A	
10.5.2B	Chemical Releases	A	
10.5.2C	Chemical Releases	N/A	ACOP not launched in MDK (TBD9)
10.5.2D	Chemical Releases	N/A	ACOP not launched in MDK (TBD9)

NAR = Not a requirement.

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11.0 LAPTOP COMPUTERS AND SOFTWARE**11.1 COMPUTERS AND SOFTWARE INTERFACE REQUIREMENTS**

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 11.1-1, Interface Control Document Computers and Software Interface Requirements.

TABLE 11.1-1 INTERFACE CONTROL DOCUMENT COMPUTERS AND SOFTWARE INTERFACE REQUIREMENTS (PAGE 1 OF 3)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
11.1	Laptop Computers	NAR	
11.1.1	Payload and General Support Computer (PGSC)	NAR	
11.1.1.1	Payload and General Support Computer Electrical Power Characteristics	NAR	
11.1.1.1.1	Payload-Powered PGSC	NAR	
11.1.1.1.2	Orbiter-Powered PGSC	NAR	
11.1.1.2	PGSC Communication/Power Interfaces Cables	NAR	
11.1.1.2.1	RS-232 Communication Cables (Orbiter PGSC)	NAR	
11.1.1.2.2	RS-422 Communication Cables (Orbiter PGSC)	NAR	
11.1.1.2.3	Power Cables (Orbiter PGSC)	NAR	
11.1.1.3	Software (Orbiter PGSC)	N/A	No orbiter PGSC interface
11.1.2	EXPRESS Rack Laptop	NAR	
11.1.2A	Hardware Description	NAR	
11.1.2B	Hardware Description	NAR	
11.1.2C	Hardware Description	NAR	
11.1.2D	Hardware Description	NAR	
11.1.2E	Hardware Description	NAR	
11.1.2F	Hardware Description	NAR	
11.1.2G	Hardware Description	NAR	
11.1.2H	Hardware Description	NAR	
11.1.2I	Hardware Description	NAR	
11.1.3	ISS Portable Computer System (PCS)	N/A	No ISS PCS interface
11.2	EXPRESS Rack Software	NAR	
11.2.1	EXPRESS Rack PEHB Interface (Ethernet)	A	

**TABLE 11.1-1 INTERFACE CONTROL DOCUMENT COMPUTERS AND SOFTWARE
INTERFACE REQUIREMENTS (PAGE 2 OF 3)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
11.2.1A	ISS Payload Ethernet Hub/Gateway Interfaces	NAR	
11.2.1B	Laptop Ethernet Interface	NAR	
11.2.1B(1)	Laptop Ethernet Interface	NAR	
11.2.1B(2)	Laptop Ethernet Interface	NAR	
11.2.1C	Payload Ethernet Interface	NAR	
11.2.1C(1)	Payload Ethernet Interface	NAR	
11.2.1C(2)	Payload Ethernet Interface	NAR	
11.2.1C(3)	Payload Ethernet Interface	NAR	
11.2.2	EXPRESS Rack Interface Controller (RIC) Serial Interface (RS-422)	A-N	No nominal on-orbit use of RS-422 planned.
11.2.3	Payload Interface Data Elements	NAR	
11.2.3.1	EXPRESS Header	A	
11.2.3.2	Unique Identifier Numbers	NAR	
11.2.3.3	EXPRESS Telemetry Header	A	
11.2.3.4	Payload Telemetry Packet	A	
11.2.3.5	EXPRESS RIC Interface Requests and Responses	A	
11.2.3.5.1	Payload Executive Processor (PEP) Bundle Request	NAR	
11.2.3.5.2	PEP Procedure Execution Request	NAR	
11.2.3.5.3	Rack Time Request	NAR	
11.2.3.5.4	Ancillary Data Configuration Control	NAR	
11.2.3.5.5	File Transfer	A	
11.2.3.5.5.1	Payload File Transfer	NAR	
11.2.3.5.5.2	EMU File Transfer	NAR	
11.2.3.5.6	Payload Response	NAR	
11.2.3.6	Payload Health and Status Data	A	
11.2.3.7	EXPRESS Payload Commanding	A	
11.2.4	Laptop Computer Software Configuration Item (CSCI) Interfaces	A	

**TABLE 11.1-1 INTERFACE CONTROL DOCUMENT COMPUTERS AND SOFTWARE
INTERFACE REQUIREMENTS (PAGE 3 OF 3)**

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
11.2.4.1	Laptop Data Elements	NAR	
11.2.4.2	Payload-Provided Software/Peripherals	A	
11.2.4.3	EXPRESS Rack Laptop Display Requirements	A	
11.2.4.4	Payload Software Interfaces	NAR	
11.2.4.4A	Laptop Communications	A	
11.2.4.4B	Software Updating Process for Laptop	NAR	
11.2.4.4C	Payload Application to EXPRESS CSCI	A	
11.2.4.5	File Maintenance	A	
11.3	Software Safety Requirements for Payloads	A	

NAR = Not a requirement.

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12.0 HUMAN FACTORS INTERFACE REQUIREMENTS**12.1 HUMAN FACTORS INTERFACE REQUIREMENTS**

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 12.1-1, Interface Control Document Human Factors Interface Requirements.

TABLE 12.1-1 INTERFACE CONTROL DOCUMENT HUMAN FACTORS INTERFACE REQUIREMENTS (PAGE 1 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
12.1	Portable Item Handles/Grasp Areas/Temporary Stowage Restraints	NAR	
12.1.1	Provide Handles and Restraints	A	
12.1.2	Handle Location	A	
12.1.3	Handle Dimensions	A	
12.1.4	Handle Clearance	A	
12.1.5	Non-Fixed Handles Design Requirements	NAR	
12.1.5A	Non-Fixed Handles Design Requirements	N/A	No non-fixed handles
12.1.5B	Non-Fixed Handles Design Requirements	N/A	No non-fixed handles
12.1.5C	Non-Fixed Handles Design Requirements	N/A	No non-fixed handles
12.1.6	Tether Points	N/A	No tether points
12.1.7	Captive Parts	A	
12.1.8	Temporary Stowage/Placement	A	
12.2	Strength Requirements	NAR	
12.2A	Strength Requirements	NAR	
12.2A(1)	Grip Strength	A	
12.2A(2)	Linear Forces	A	
12.2A(3)	Torques	A	
12.2B	Strength Requirements	A	
12.3	Body Envelope and Reach Accessibility	NAR	
12.3.1	Operational Volume	A	
12.3.2	Accessibility	NAR	
12.3.2A	Accessibility	A	

TABLE 12.1-1 INTERFACE CONTROL DOCUMENT HUMAN FACTORS INTERFACE REQUIREMENTS (PAGE 2 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
12.3.2B	Accessibility	A	
12.3.3	Full Size Range Accommodation	A	
12.4	Payload Hardware Mounting	NAR	
12.4.1	Equipment Mounting	A	
12.4.2	Drawers and Hinged Panels	A	
12.4.3	Alignment	A	
12.4.4	Slide-Out Stops	N/A	No slide or pivot mounted hardware
12.4.5	Push-Pull Force	A	
12.4.6	Access	A	
12.4.6.1	Covers	NAR	
12.4.6.1A	Covers	A	
12.4.6.1B	Covers	A	
12.4.6.1C	Covers	A	
12.4.6.2	Self-Supporting Covers	A	
12.5	Identification Labeling	A	
12.5.1	Color	A	
12.5.2	Fluid Connector Pressure/Flow Indicators	N/A	No pressurized gas or liquid lines
12.5.3	DELETED		
12.5.3A	DELETED		
12.5.3B	DELETED		
12.5.4	Pin Identification	A	
12.6	Controls and Displays	NAR	
12.6.1	Controls Spacing Design Requirements	A	
12.6.2	Accidental Actuation	NAR	
12.6.2.1	Protective Methods	A	
12.6.2.1A	Protective Methods	NAR	
12.6.2.1B	Protective Methods	A-N	Single closure for 12.6.2.1
12.6.2.1C	Protective Methods	A-N	Single closure for 12.6.2.1
12.6.2.1D	Protective Methods	A-N	Single closure for 12.6.2.1
12.6.2.1E	Protective Methods	NAR	
12.6.2.1F	Protective Methods	NAR	

12.6.2.1G	Protective Methods	NAR	
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TABLE 12.1-1 INTERFACE CONTROL DOCUMENT HUMAN FACTORS INTERFACE REQUIREMENTS (PAGE 3 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
12.6.2.2	Noninterference	A	
12.6.2.3	DELETED		
12.6.2.4	Barrier Guards	A	
12.6.2.5	Recessed Switch Protection	N/A	No recessed switches
12.6.2.6	Position Indication	N/A	No switch protective cover used
12.6.2.7	Hidden Controls	N/A	No hidden controls
12.6.2.8	Hand Controllers	N/A	No hand controllers
12.6.3	Valve Controls	NAR	
12.6.3A	Valve Controls (Low-Torque Valves)	N/A	No valve controls
12.6.3B	Valve Controls (Intermediate-Torque Valves)	N/A	No valve controls
12.6.3C	Valve Controls (High-Torque Valves)	N/A	No valve controls
12.6.3D	Valve Controls (Handle Dimensions)	N/A	No valve controls
12.6.3E	Valve Controls (Rotary Valve Controls)	N/A	No valve controls
12.6.4	Toggle Switches	N/A	No toggle switches (TBD 10)
12.6.5	Stowage and Equipment Drawers/Trays	NAR	
12.6.5A	Stowage and Equipment Drawers/Trays	N/A	EXPRESS responsible for design of stowage drawers/trays
12.6.5B	Stowage and Equipment Drawers/Trays	N/A	EXPRESS responsible for design of stowage drawers/trays
12.6.6	Audio Devices (Displays)	NAR	
12.6.6A	Audio Devices (Displays)	N/A	No audio devices
12.6.6B	Audio Devices (Displays)	N/A	No audio devices
12.6.6C	Audio Devices (Displays)	N/A	No audio devices
12.7	Electrical Connector Design - General	NAR	
12.7.1	Mismatched	A	
12.7.2	Connector Protection	A	

12.7.3	DELETED		
12.7.4	Connector Arrangement	NAR	

TABLE 12.1-1 INTERFACE CONTROL DOCUMENT HUMAN FACTORS INTERFACE REQUIREMENTS (PAGE 4 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
12.7.4A	Connector Arrangement	A	
12.7.4B	Connector Arrangement	A	
12.7.5	One-Handed Operation	A	
12.7.6	Accessibility	NAR	
12.7.6A	Mate/Demate	NAR	
12.7.6A(1)	Mate/Demate - Nominal Operations	A	
12.7.6A(2)	Mate/Demate - Maintenance Operations	A	
12.7.6B	Accessibility Without Damage	A	
12.7.7	Ease of Disconnect	NAR	
12.7.7A	Ease of Disconnect	A	
12.7.7B	Ease of Disconnect	A	
12.7.8	Self-Locking	A	
12.7.9	Connector Shape	A	
12.7.10	Fluid and Gas Line Connectors	N/A	No fluid or gas lines
12.7.11	Fluid and Gas Line Connectors Mating	N/A	No fluid or gas lines
12.7.12	Alignment Marks or Guide Pins	A	
12.7.13	Orientation	A	
12.8	Hose/Cable Restraints	A	
12.9	Habitability/Housekeeping	NAR	
12.9.1	Closures or Covers	A	
12.9.2	Built-In Control	NAR	
12.9.2A	Built-In Control	N/A	No payload containers of liquids or particulates
12.9.2B	Built-In Control	N/A	No capture elements
12.9.3	One-Handed Operation	N/A	No unique cleaning supplies
12.10	DELETED		
12.11	Mechanical Energy Devices	N/A	No mechanical energy devices
12.12	Fasteners	NAR	
12.12.1	Non-Threaded Fasteners	A	
12.12.2	Mounting Bolt/Fastener Spacing	A	

TABLE 12.1-1 INTERFACE CONTROL DOCUMENT HUMAN FACTORS INTERFACE REQUIREMENTS (PAGE 5 OF 5)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
12.12.3	Multiple Fasteners	A	
12.12.4	Captive Fasteners	A	
12.12.5	Quick Release Fasteners	NAR	
12.12.5A	Quick Release Fasteners	A	
12.12.5B	Quick Release Fasteners	A	
12.12.6	Threaded Fasteners	A	
12.12.7	Over Center Latches	NAR	
12.12.7A	Over Center Latches	A	
12.12.7B	Over Center Latches	A	
12.12.7C	Over Center Latches	A	
12.12.8	Winghead Fasteners	N/A	No winghead fasteners
12.12.9	Fastener Head Type	NAR	
12.12.9A	Fastener Head Type	A	
12.12.9B	Fastener Head Type	A	
12.12.9C	Fastener Head Type	A	
12.12.10	One-Handed Actuation	A	
12.12.11	DELETED		
12.12.12	Access Holes	A	
12.13	Payload In-Flight Operations and Maintenance Tools	A	

NAR = Not a requirement.

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13.0 MATERIALS AND PARTS INTERFACE REQUIREMENTS**13.1 MATERIALS AND PARTS INTERFACE REQUIREMENTS**

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 13.1-1, Interface Control Document Materials and Parts Interface Requirements.

TABLE 13.1-1 INTERFACE CONTROL DOCUMENT MATERIALS AND PARTS INTERFACE REQUIREMENTS

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
13.1	Materials and Processes Use and Selection	A	
13.1.1	Acceptance Criteria for Stress Corrosion Cracking (SCC)	A	
13.1.2	Hazardous Materials and Compatibility	A	
13.1.3	Test and Acceptance Criteria for Flammability	A	
13.1.4	Test and Acceptance Criteria for Toxic Offgassing (Toxicity)	A	
13.2	Galvanic Corrosion	N/A	No aqueous fluid systems
13.3	Fungus-Resistant Material	A	
13.4	Materials and Parts Certification and Traceability	A	

NAR = Not a requirement.

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14.0 FIRE PROTECTION**14.1 FIRE PROTECTION INTERFACE REQUIREMENTS**

The EXPRESS Rack Payload IDD, SSP 52000-IDD-ERP, paragraphs are dispositioned as indicated in Table 14.1-1, Interface Control Document Fire Protection Interface Requirements.

TABLE 14.1-1 INTERFACE CONTROL DOCUMENT FIRE PROTECTION INTERFACE REQUIREMENTS (PAGE 1 OF 2)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
14.1	Fire Event Prevention Requirements	A	
14.1.1	Flammability Requirements	A	
14.1.2	Oxygen	NAR	
14.1.2A	Oxygen	N/A	ACOP does not use oxygen or strong oxidizers
14.1.2B	Oxygen	N/A	ACOP does not use oxygen or strong oxidizers
14.1.2C	Oxygen	N/A	ACOP does not use oxygen or strong oxidizers
14.1.3	Electrical Systems	NAR	
14.1.4	Payload Use of Battery Backup Power	A	
14.1.4A	Payload Use of Battery Backup Power	NAR	
14.1.4B	Payload Use of Battery Backup Power	NAR	
14.2	Payload Data Monitoring	A	
14.2A	Payload Data Monitoring	A	
14.2B	Payload Data Monitoring	A	
14.2C	Payload Data Monitoring	A	
14.2C(1)	Payload Data Monitoring	NAR	
14.2C(2)	Payload Data Monitoring	NAR	
14.2C(3)	Payload Data Monitoring	NAR	
14.2.1	Fire Event Location Indicator	NAR	
14.2.1A	Fire Event Location Indicator	NAR	
14.2.1B	Fire Event Location Indicator	NAR	
14.3	PFE Access Port Requirements	NAR	
14.3A	PFE Access Port Requirements	NAR	
14.3B	PFE Access Port	NAR	

	Requirements		
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TABLE 14.1-1 INTERFACE CONTROL DOCUMENT FIRE PROTECTION INTERFACE REQUIREMENTS (PAGE 2 OF 2)

IDD REQUIREMENT NO.	REQUIREMENT TITLE	DISPOSITION	COMMENTS
14.3C	PFE Access Port Requirements	N/A	Not powered in orbiter MDK
14.3D	PFE Access Port Requirements	N/A	ACOP interfaces with rack AAA cooling
14.3E	PFE Access Port Requirements	N/A	ACOP does not require a PFE port
14.3F	PFE Access Port Requirements	N/A	ACOP is not aisle mounted hardware
14.3G	PFE Access Port Requirements	N/A	ACOP does not require a PFE port
14.3H	PFE Access Port Requirements	N/A	ACOP does not require a PFE port
14.3.1	PFE Characteristics	A	
14.3.2	PFE Access Port Dimensions	N/A	ACOP does not require a PFE port
14.3.3	PFE Access	N/A	ACOP does not require a PFE port
14.3.4	PFE Quantity	N/A	ACOP does not require a PFE port
14.3.5	PFE Closeouts	N/A	ACOP does not require a PFE port
14.4	Fire Suppressant Distribution	N/A	ACOP does not require a PFE port

NAR = Not a requirement.

15.0 EXCEPTIONS

15.1 EXCEPTIONS, UNIQUE/NONSTANDARD INTERFACE REQUIREMENTS AND NOTES

Exceptions, unique/nonstandard interface requirements and notes from the ICD are listed in this section in Table 15.1-1, Interface Control Document Exceptions, Unique/Nonstandard Interface Requirements, and Notes. Any flight effectivity for these exceptions as well as the PCB directive are to be entered in the last column of this table.

TABLE 15.1-1 INTERFACE CONTROL DOCUMENT EXCEPTIONS, UNIQUE/NONSTANDARD INTERFACE REQUIREMENTS, AND NOTES

HARDWARE ITEM NOMENCLATURE	PART NUMBER	SERIAL NUMBER	IDD REQUIREMENT NO.	EXCEPTION OR UNIQUE INTERFACE DESCRIPTION OR NOTES
ACOP HRDL Fiber Optic Cable	TBD 14	TBD 14	3.6.2A	53101-NA-0001

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APPENDIX A
ABBREVIATIONS AND ACRONYMS

APPENDIX A**ABBREVIATIONS AND ACRONYMS**

A	Applicable
AAA	Avionics Air Assembly
ac	Alternating Current
ACOP	AMS-02 Crew Operation Post
AMS-02	Alpha Magnetic Spectrometer 02
APM	Attached Pressurized Module
APS	Automatic Payload Switch
ARIS	Active Rack Isolation System
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
ATV	Automated Transfer Vehicle
CAM	Centrifuge Accommodation Module
C&DH	Command and Data Handling
CE	Conducted Emissions
CFM	Cubic Feet per Minute
CG	Center of Gravity
CGS	Carlo Gavazzi Space
CM	Crew Module
CMG	Control Moment Gyroscope
COTS	Commercial Off the Shelf
cPCI	Compact Peripheral Component Interconnect
CSCI	Computer Software Configuration Item
CSIST	Chung Shan Institute of Science and Technology
dc	Direct Current
DFRC	Dryden Flight Research Center
DIO	Discrete Input/Output
E	Exceedance
EMC	Electromagnetic Compatibility
EMU	EXPRESS Memory Unit
ER	EXPRESS Rack
ERL	EXPRESS Rack Laptop
ERO	EXPRESS Rack Office
ESA	European Space Agency
ESD	Electrostatic Discharge
ETR	EXPRESS Transportation Rack
EXPRESS	EXPedite the PROcessing of Experiments to Space Station
GN ₂	Gaseous Nitrogen
GSE	Ground Support Equipment

HCOR	HRDL Communications Outage Recorder
HD	Hard Drive
HDD	Hard Disk Drive
hr	Hour
HRDL	High Rate Data Link
HRFM	High Rate Frame Multiplexer
HW	Hardware
ICD	Interface Control Document
IDD	Interface Definition Document
I/F	Interface
in	Inch
ISIS	International Subrack Interface Standard
ISPR	International Standard Payload Rack
ISS	International Space Station
ISSP	International Space Station Program
IVA	Intravehicular Activity
JEM	Japanese Experiment Module
JSC	Johnson Space Center
KSC	Kennedy Space Center
Ku-Band	High rate space to ground radio link
LAN	Local Area Network
lb	pounds
lbm	pound mass
LCD	Liquid Crystal Display
LRDL	Low Rate Data Link
max	maximum
Mb	megabyte
MDK	Middeck
MDL	Middeck Locker
MDP	
min	minimum
MPLM	Multi-Purpose Logistics Module
MRDL	Medium Rate Data Link
MSFC	Marshall Space Flight Center
N/A	Not Applicable
NAR	Not a Requirement
NASA	National Aeronautics and Space Administration
NSTS	National Space Transportation System

ORU	Orbital Replacement Unit
P/L	Payload
PARD	Periodic and Random Deviation
PCB	Payloads Control Board
PCI	Peripheral Component Interconnect
PCS	Portable Computer System
PD	Payload Developer
PDL	Payload Data Library
PECP	Payload Engineering Control Panel
PEHB	Payload Ethernet Hub Bridge
PEHG	Payload Ethernet Hub Gateway
PEP	Payload Executive Processor
PF	Portable Fire Extinguisher
PGSC	Payload and General Support Computer
PLMDM	Payload Multiplexer De-Multiplexer
PIA	Payload Integration Agreement
PIRN	Preliminary/Proposed Interface Revision Notice
PMC	PCI Mezzanine Card
PPCB	Point-to-Point Communications Bus
PROM	Programmable Read Only Memory
PS	Power Supply
RF	Radio Frequency
RIC	Rack Interface Controller
ROM	Read Only Memory
RS	Radiated Susceptibility
RX	Reception
SATA	Serial Advanced Transfer Architecture (disk interface)
S-band	Space to ground radio link
SBC	Single Board Computer
SCC	Stress Corrosion Cracking
SCMDM	Station Control Multiplexer De-Multiplexer
SDD	Solid-state Disk Drive
sec	second
SEE	Single Event Effect
SIO	Serial Input Output
SPIA	Standard Payload Integration Agreement
SPF	Single Point Failure
SSP	Space Shuttle Program
SSPCM	Solid State Power Controller Module
STS	Space Transportation System
SW	Software

TBD	To Be Determined
TCP/IP	Transmission Control Protocol/Internet Protocol
TM	Telemetry
TX	Transmission
UIP	Utility Interface Panel
UMA	Universal Mating Assembly
USB	Universal Serial Bus
USL	United States Laboratory
V	volts
Vdc	Volts, direct current
W	Watt
WCCS	Wireless Crew Communication System

APPENDIX B
GLOSSARY OF TERMS

APPENDIX B**GLOSSARY OF TERMS**

Access Port: Hole that allows penetration of the Portable Fire Extinguisher nozzle.

Active Air Exchange: Forced convection between two volumes. For example, forced convection between a subrack payload and the internal volume of an integrated rack, or forced convection between a subrack payload and the cabin air.

Deviation: Uniquely defined for Payloads Processes; refer to Section 5.1 of the payload appendices.

Exceedance: Uniquely defined for Payloads Processes; refer to Section 5.1 of the payload appendices.

Exception: Uniquely Payloads Processes; refer to Section 5.1 of the payload appendices.

Non-Normal: Pertaining to performance of the Electrical Power System outside the nominal design due to ISS system equipment failure, fault clearing, or overload conditions.

Operate: Perform intended design functions given specified conditions.

Safety Critical: Having the potential to be hazardous to the safety of hardware, software, and/or personnel.

Waiver: Uniquely defined for Payloads Processes; refer to Section 5.1 of the payload appendices.

APPENDIX C
OPEN ITEMS

APPENDIX C**OPEN ITEMS**

Table C.1.0-1, ANITA To Be Determined (TBD) Items, lists open items for the ACOP ICD and their due dates.

TABLE C.1.0-1 ACOP TBD ITEMS

TBD No.	Description	Document Section	Responsible	Due Date
1	Payload hardware Identification	Table 1.2-1	PD Rep	CDR- 1 mo.
2	Payload CG Data	Table 1.2-2	PD Rep	CDR- 1 mo.
3	Payload CG Drawing	Figure 1.2-1	PD Rep	CDR- 1 mo.
4	ACOP Core Configuration Drawing	Figure 1.2-3	PD Rep	CDR- 1 mo.
5	ACOP Stowage Bag Configuration Drawing	Figure 1.2-4	PD Rep	CDR- 1 mo.
6	ACOP HRDL Cable Drawing	Figure 1.2-5	PD Rep	CDR- 1 mo.
7	Identify locker insert or replacement	Para. 1.2.1	PD Rep	CDR- 1 mo.
8	Define launch configuration: soft-stow or hard mounted (assumed soft-stow)	Para. 1.2.1, Rqmts 3.4.3.6.1.2, 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.3.1	PD Rep	CDR- 1 mo.
9	Verify if planned for launch in MDK (assumed not)	Para. 1.2.1, Rqmts 3.3.1.2, 3.4.1.2, 4.1.2.2, 4.1.2.4, 4.1.3.2, 4.2.1, 4.3.2, 4.8.3 A/B, 10.5.2 C/D	PD Rep	CDR- 1 mo.
10	Identify type of switch used for circuit breaker on front panel	Para. 1.2.1.2, Rqmt 12.6.4	PD Rep	CDR- 1 mo.
11	ACOP Front panel photograph	Figure 1.2.1.2-2	PD Rep	CDR- 1 mo.
12	ACOP Front panel photograph with access door open	Figure 1.2.1.2-3	PD Rep	CDR- 1 mo.
13	Verify if PD provided isolation materials	Rqmt 3.4.2.4	PD Rep	CDR- 1 mo.
14	Protrusions exception number	Rqmt 3.6.2A	Boeing PEI/ICDE	CDR- 1 mo.
15	ACOP Installation torque requirements	Table 3.1-2	PD Rep	CDR- 1 mo.
16	ACOP Thermal Interface Data	Table 5.1-2	PD Rep	CDR- 1 mo.
17	ACOP Electrical Interface Data	Table 6.1-2	PD Rep	CDR- 1 mo.
18	ACOP Data Interface Data	Table 9.1-2	PD Rep	CDR- 1 mo.