

Alpha Magnetic Spectrometer-02 (AMS-02) Hardware Interface Control Document (ICD)

International Space Station Program

Baseline

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REVISION AND HISTORY PAGE

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INTERNATIONAL SPACE STATION PROGRAM

ALPHA MAGNETIC SPECTROMETER-02 (AMS-02)
HARDWARE INTERFACE CONTROL DOCUMENT (ICD)

JUNE 2003

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PREFACE

This Hardware Interface Control Document (ICD) represents the interface agreement and design interface verification activities between the International Space Station (ISS) and the Alpha Magnetic Spectrometer-02 (AMS-02). It serves to define and control the AMS-02 interfaces and describes the design verification activities necessary to ensure compatibility with the ISS. Information addressed includes physical, functional, mechanical interfaces, and verification activities to satisfy requirements contained in SSP 57003, Attached Payload Interface Requirements Document (IRD). This document is under the control of the ISS Payloads Control Board (PCB), the ISS Program Payloads Office Manager, and the AMS-02 Mission Manager.

APPROVAL

JUNE 2003

Approved by: James R. Bates
AMS-02 Mission Manager

Date

Approved By: Lesa B. Roe
ISS Program Payloads Office Manager

Date

INTERNATIONAL SPACE STATION PROGRAM

ALPHA MAGNETIC SPECTROMETER-02 (AMS-02)
HARDWARE INTERFACE CONTROL DOCUMENT (ICD)

CONCURRENCE

JUNE 2003

Prepared by: Robert R. Miley/IPIC/USA
Payload Integration Manager

Date

Concurred by: John D. Selmarten/IPIC/USA
Payload Integration Management

Date

Concurred by: Wade C. Geiger/Boeing
Payload Engineering & Integration

Date

Approved by: Gene Cook/NASA
Hardware Engineering Integration

Date

Concurred by: Sophia Chubick/Boeing
Document Quality Assurance

Date

INTERNATIONAL SPACE STATION PROGRAM

ALPHA MAGNETIC SPECTROMETER-02 (AMS-02)
HARDWARE INTERFACE CONTROL DOCUMENT (ICD)

LIST OF CHANGES

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

| PCB | Entry Date | Change | Paragraph(s) |
|------------|-------------------|---------------|---------------------|
|------------|-------------------|---------------|---------------------|

TABLE(S)

FIGURE(S)

TABLE OF CONTENTS

| PARAGRAPH | PAGE |
|--|--------|
| 1.0 INTRODUCTION | 1-1 |
| 1.1 PURPOSE | 1-1 |
| 1.2 SCOPE | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 1.2.1 APPROVAL AUTHORITY | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 1.2.2 CONFIGURATION MANAGEMENT | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 1.3 PRECEDENCE | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 2.0 DOCUMENTS | 2-1 |
| 2.1 APPLICABLE DOCUMENTS | 2-1 |
| 2.2 REFERENCE DOCUMENTS | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.0 PAYLOAD INFORMATION | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.1 PAYLOAD OBJECTIVES/DESCRIPTION | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.1.1 PAYLOAD/OBJECTIVES STATEMENT | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.1.2 PAYLOAD DESCRIPTION STATEMENT | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.1.3 FLIGHT-SPECIFIC PAYLOAD DRAWINGS | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.2 ISS PAYLOAD/CARGO CARRIER COMPATIBILITY | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.2.1 ISS ATTACHED PAYLOAD CARGO CARRIER COMPATIBILITY | ERROR! |
| BOOKMARK NOT DEFINED. | |
| 3.2.2 ISS ATTACHED PAYLOAD INTERFACES | ERROR! |
| BOOKMARK NOT DEFINED. | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|---------|---|---------------|
| 3.2.2.1 | ISS ATTACH SITES/PAYLOAD COMPATIBILITY | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.2.3 | PAYLOAD CATEGORY TYPE SELECTION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.3 | PAYLOAD MICROGRAVITY CHARACTERISTICS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.4 | VIEWING REQUIREMENTS/LOCATION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.5 | PAYLOAD ATTITUDE AND POINTING REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.6 | ISS LAPTOP COMPUTERS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.7 | PAYLOAD-PROVIDED LAPTOP COMPUTER REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.8 | PAYLOAD PHOTO/TELEVISION BOOK REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.9 | PAYLOAD-UNIQUE ENVIRONMENTAL ELEMENT REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.9.1 | PAYLOAD-UNIQUE ENVIRONMENTAL ELEMENTS OF COMPATIBILITY REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.9.2 | PAYLOAD-UNIQUE ENVIRONMENTAL ELEMENTS COMPATIBILITY DESCRIPTION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.10 | SSP SERVICES AND ISS PROGRAM-FUNDED SSP SERVICES | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.11 | PAYLOAD OPTIONAL SERVICES..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.11.1 | EXTRAVEHICULAR ROBOTICS EQUIPMENT REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.11.2 | FLIGHT EQUIPMENT - PROCURED OR PROGRAM FURNISHED | ERROR! |
| | BOOKMARK NOT DEFINED. | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|----------|--|---------------|
| 3.11.2.1 | PROCURED EQUIPMENT - UMBILICAL MECHANISM ASSEMBLY | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.11.2.2 | PROGRAM FURNISHED EQUIPMENT - FLIGHT REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.11.2.3 | PAYLOAD FLIGHT EQUIPMENT REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.0 | PAYLOAD PRELAUNCH TO DOCKED REQUIREMENTS..... | 4-1 |
| 4.1 | PAYLOAD HARDWARE..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.1.1 | PRELAUNCH PROCESSING AND PAYLOAD TRANSPORTATION TO ISS ACTIVITIES | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.1.2 | PAYLOAD HARDWARE DESCRIPTION FOR ASCENT | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.2 | PROGRAM-FURNISHED EQUIPMENT - GROUND REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.3 | LAUNCH COMMIT CRITERIA | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.4 | PAYLOAD MAXIMUM LAUNCH CONFIGURATION..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.4.1 | PAYLOAD MAXIMUM LAUNCH CONFIGURATION DURATION..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.5 | PRELAUNCH TO DOCKED PAYLOAD RESOURCE REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.5.1 | PRELAUNCH TO DOCKED PAYLOAD RESOURCE TABLE..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.6 | PRELAUNCH TO DOCKED CONTINGENCY REQUIREMENTS FOR PAYLOAD OPERATIONS OR FLIGHT CREW TIME | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.0 | TRANSFER AND INTEGRATION ONTO ISS REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.1 | SHUTTLE REMOTE MANIPULATOR SYSTEM HANDOFF AND TRANSFER REQUIREMENTS FROM THE ORBITER TO THE ISS | ERROR! |
| | BOOKMARK NOT DEFINED. | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|---------|--|---------------|
| 5.2 | SPACE STATION REMOTE MANIPULATOR SYSTEM HANDOFF AND TRANSFER REQUIREMENTS FOR PLACEMENT ON THE ISS ATTACH SITE | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3 | EXTRAVEHICULAR ACTIVITY REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.1 | STANDARD EXTRAVEHICULAR ACTIVITY TOOLS AND CREW AIDS - DEPLOYMENT | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.2 | UNIQUE EXTRAVEHICULAR ACTIVITY TOOLS AND CREW AIDS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.3 | EXTRAVEHICULAR ACTIVITY INTERFACES | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.3.1 | EXTRAVEHICULAR ACTIVITY AIDS LOCATIONS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.3.2 | EXTRAVEHICULAR ACTIVITY TRANSLATION PATHS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.3.3 | EXTRAVEHICULAR ACTIVITY DANGER AND WARNING LABEL LOCATIONS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.4 | EXTRAVEHICULAR ACTIVITY TASK HAZARDS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.4.1 | UNIQUE EXTRAVEHICULAR ACTIVITY TASK HAZARDS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.4 | EXTRAVEHICULAR ROBOTICS REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.5 | COMMON ATTACH SYSTEM EXTERNAL BERTHING CAMERA SYSTEM OPERATIONS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.6 | TRANSFER FROM ORBITER AND INTEGRATION ONTO ISS RESOURCE REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.6.1 | TRANSFER AND INTEGRATION ONTO ISS RESOURCE TABLE | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.7 | TRANSFER AND INTEGRATION ONTO ISS CONTINGENCY REQUIREMENTS FOR PAYLOAD OPERATIONS OR FLIGHT CREW TIME | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|---------|--|---------------|
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.0 | ON-ORBIT RESOURCE REQUIREMENTS | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.1 | ON-ORBIT OPERATING REQUIREMENTS..... | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.2 | ON-ORBIT RESOURCE REQUIREMENTS | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.2.1 | ON-ORBIT OPERATIONS ISS RESOURCE TABLE | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.2.2 | ON-ORBIT INTRAVEHICULAR ACTIVITY PAYLOAD OPERATIONS AND PERFORMANCE REQUIREMENTS | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.2.2.1 | INTRAVEHICULAR ACTIVITY PAYLOAD OPERATION PERFORMANCE DESCRIPTION | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.3 | ON-ORBIT STOWAGE..... | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.4 | ON-ORBIT ISS PRESSURIZED VOLUME STATION SUPPORT EQUIPMENT/LABORATORY SUPPORT EQUIPMENT AND ACCOMMODATIONS FOR PAYLOAD OPERATION..... | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.4.1 | ON-ORBIT ISS PRESSURIZED VOLUME STATION SUPPORT EQUIPMENT AND ACCOMMODATIONS ITEMS REQUIREMENTS | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.4.2 | ON-ORBIT ISS PRESSURIZED VOLUME LABORATORY SUPPORT EQUIPMENT AND ACCOMMODATIONS ITEMS REQUIREMENTS | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.5 | PRESSURIZED ACCOMMODATIONS - OTHER..... | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.6 | ON-ORBIT CONTINGENCY REQUIREMENTS FOR PAYLOAD OPERATIONS OR FLIGHT CREW TIME | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.0 | ISS DEINTEGRATION AND POST-LANDING REQUIREMENTS | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|---------|---|---------------|
| 7.1 | SPACE STATION REMOTE MANIPULATOR SYSTEM CAPTURE AND TRANSFER REQUIREMENTS FOR REMOVAL FROM THE ISS ATTACH SITE | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.2 | SHUTTLE REMOTE MANIPULATOR SYSTEM HAND-OFF AND TRANSFER REQUIREMENTS TO THE SHUTTLE REMOTE MANIPULATOR SYSTEM TO THE ORBITER..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3 | EXTRAVEHICULAR ACTIVITY REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.1 | STANDARD EXTRAVEHICULAR ACTIVITY TOOLS AND CREW AIDS - RETRIEVAL..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.2 | UNIQUE EXTRAVEHICULAR ACTIVITY TOOLS AND CREW AIDS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.3 | EXTRAVEHICULAR ACTIVITY INTERFACES..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.3.1 | EXTRAVEHICULAR ACTIVITY AIDS LOCATIONS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.3.2 | EXTRAVEHICULAR ACTIVITY TRANSLATION PATHS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.3.3 | EXTRAVEHICULAR ACTIVITY DANGER AND WARNING LABEL LOCATIONS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.4 | EXTRAVEHICULAR ACTIVITY TASK HAZARDS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.4.1 | UNIQUE EXTRAVEHICULAR ACTIVITY TASK HAZARDS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.4 | EXTRAVEHICULAR ROBOTICS REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.5 | COMMON ATTACH SYSTEM EXTERNAL BERTHING CAMERA SYSTEM OPERATIONS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6 | RETURN REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.1 | HARDWARE RETURN READINESS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|--------|--|---------------|
| 7.6.2 | PAYLOAD HARDWARE DESCRIPTION FOR DESCENT..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.7 | RETURN RESOURCE REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.7.1 | ISS DEINTEGRATION AND RETURN OPERATIONS RESOURCE TABLE..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.8 | RETURN CONTINGENCY REQUIREMENTS FOR PAYLOAD OPERATIONS OR FLIGHT CREW TIME..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 8.0 | FERRY FLIGHT REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 9.0 | PAYLOAD DEVELOPER-PROVIDED CREW TRAINING, GROUND SUPPORT TRAINING, AND TRAINER MOCKUP REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 9.1 | CREW AND GROUND SUPPORT PERSONNEL TRAINING REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 9.1.1 | TRAINING CLASSIFICATION AND LOCATION REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 9.2 | TRAINER/SIMULATOR REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 9.2.1 | TRAINING FACILITY AND EQUIPMENT REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 10.0 | GROUND DATA SERVICES REQUIREMENTS - FLIGHT OPERATIONS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 10.1 | GROUND DATA SERVICES OPERATIONAL REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 10.1.1 | GROUND DATA SERVICES REQUIREMENTS SUPPORTING FLIGHT OPERATIONS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 10.1.2 | ADDITIONAL REQUIREMENTS/SERVICES SUPPORTING FLIGHT OPERATIONS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |

APPENDIX

| | | |
|---|---------------------------------|-----|
| A | ACRONYMS AND ABBREVIATIONS..... | A-1 |
| B | GLOSSARY OF TERMS..... | B-1 |

SSP 57213
Baseline (Draft – June 2003)

C OPEN WORK C-1

TABLE

| | | |
|------------|--|---------------|
| 3.2.1-1 | ISS PAYLOAD CARGO CARRIERS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.2.2.1-1 | ISS PAYLOAD ATTACH SITES..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.2.3-1 | PAYLOAD CATEGORY TYPE SELECTION/SPECIFICATION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.3-1 | PAYLOAD OPERATING MODE MICROGRAVITY CHARACTERISTICS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.4-1 | ISS VIEWING LOCATIONS FOR ATTACHED PAYLOADS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.5-1 | PAYLOAD ATTITUDE AND POINTING REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.8-1 | PAYLOAD TELEVISION/PHOTO BOOK REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.9.2-1 | ENVIRONMENTAL COMPATIBILITY DESCRIPTION | 3-21 |
| 3.11.2.3-1 | PAYLOAD FLIGHT EQUIPMENT REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.1.1-1 | SCENARIO OF PRELAUNCH PROCESSING AND PAYLOAD TRANSPORTATION TO DOCKED ACTIVITIES..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.1.2-1 | PAYLOAD HARDWARE DESCRIPTION FOR ASCENT | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.4.1-1 | PAYLOAD MAXIMUM LAUNCH CONFIGURATION DURATION..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.5.1-1 | PRELAUNCH TO DOCKED PAYLOAD RESOURCE TABLE..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.1-1 | EXTRAVEHICULAR ACTIVITY STANDARD TOOLS AND CREW AIDS REQUIREMENTS - DEPLOYMENT | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.4.1-1 | UNIQUE EXTRAVEHICULAR ACTIVITY TOOLS AND CREW AIDS REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|-----------|--|---------------|
| 5.6.1-1 | TRANSFER AND INTEGRATION ONTO ISS RESOURCE TABLE | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.1-1 | ON-ORBIT OPERATING REQUIREMENTS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.2.1-1 | ON-ORBIT OPERATIONS ISS RESOURCE TABLE | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.2.2.1-1 | PAYLOAD OPERATION PERFORMANCE DESCRIPTION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 6.4.1-1 | ON-ORBIT ISS PRESSURIZED VOLUME STATION SUPPORT EQUIPMENT PARTS TABLE | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.1-1 | EXTRAVEHICULAR ACTIVITY STANDARD TOOLS AND CREW AIDS REQUIREMENTS - RETRIEVAL | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.4.1-1 | UNIQUE EXTRAVEHICULAR ACTIVITY TASK HAZARDS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.1-1 | SCENARIO FOR PAYLOAD RETURN READINESS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.2-1 | PAYLOAD HARDWARE DESCRIPTION FOR DESCENT..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.7.1-1 | ISS DEINTEGRATION AND RETURN OPERATIONS RESOURCE TABLE | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 9.1.1-1 | PAYLOAD DEVELOPER-PROVIDED TRAINING CLASSIFICATION AND LOCATION REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 9.2.1-1 | TRAINING FACILITY AND EQUIPMENT REQUIREMENTS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 10.1.1-1 | GROUND DATA SERVICES REQUIREMENTS SUPPORT FLIGHT OPERATIONS | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 10.1.2-1 | ADDITIONAL REQUIREMENTS/SERVICES SUPPORTING FLIGHT OPERATIONS..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| C-1 | TO BE DETERMINED ITEMS | C-2 |
| C-2 | TO BE RESOLVED ISSUES..... | C-2 |

SSP 57213
Baseline (Draft – June 2003)

FIGURE

| | | |
|-----------|--|---------------|
| 3.1.3-1 | MISSE PEC PREDEPLOYED CONFIGURATION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.1.3-2 | GENERIC MISSE PEC DEPLOYED CONFIGURATION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.1.3-3 | MISSE INNER BAG CONFIGURATION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.1.3-4 | MISSE PEC #1 AND PEC #3 DEPLOYED CONFIGURATION..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.1.3-5 | MISSE PEC #1 CLAMP/POINTER CONFIGURATION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.1.3-6 | MISSE PEC #2 AND PEC #4 DEPLOYED CONFIGURATION..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 3.1.3-7 | MISSE PEC #2 CLAMP/POINTER CONFIGURATION | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.1.2-1 | MISSE PAYLOAD HARDWARE CENTER OF GRAVITY LOCATION FOR ASCENT - MISSE PEC #4 WITHOUT INNER BAG (MISSE PEC #3 CG WITHOUT INNER BAG - IDENTICAL)..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 4.1.2-2 | PAYLOAD HARDWARE CENTER OF GRAVITY LOCATION FOR MISSE PEC CLAMP/POINTER ASSEMBLY #2 INSTALLED ON-ORBIT (IDENTICAL CG FOR MISSE PEC CLAMP/POINTER ASSEMBLY #1 INSTALLED ON-ORBIT) | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.3.1-1 | EXTRAVEHICULAR ACTIVITY AIDS LOCATIONS, ASCENT - MISSE PEC | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 5.3.3.1-2 | EXTRAVEHICULAR ACTIVITY AIDS LOCATIONS, ASCENT - MISSE CLAMP/POINTER | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.3.1-1 | EXTRAVEHICULAR ACTIVITY AIDS LOCATIONS, DESCENT - MISSE PEC..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.3.3.1-2 | EXTRAVEHICULAR ACTIVITY AIDS LOCATIONS, DESCENT - MISSE CLAMP/POINTER | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.2-1 | PAYLOAD HARDWARE CENTER OF GRAVITY LOCATIONS FOR DESCENT - MISSE PEC #1 WITHOUT INNER BAG..... | |

SSP 57213
Baseline (Draft – June 2003)

| | | |
|---------|--|---------------|
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.2-2 | PAYLOAD HARDWARE CENTER OF GRAVITY LOCATIONS FOR DESCENT - MISSE PEC #2 WITHOUT INNER BAG..... | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.2-3 | PAYLOAD HARDWARE CENTER OF GRAVITY LOCATIONS FOR DESCENT - MISSE PEC #3 WITHOUT INNER BAG..... | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.2-4 | PAYLOAD HARDWARE CENTER OF GRAVITY LOCATIONS FOR DESCENT - MISSE PEC #4 WITHOUT INNER BAG..... | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |
| 7.6.2-5 | PAYLOAD HARDWARE CENTER OF GRAVITY LOCATIONS FOR DESCENT - MISSE PEC CLAMP/POINTER ASSEMBLY #1 AND #2 | |
|  | ..... | ERROR! |
| | BOOKMARK NOT DEFINED. | |

1.0 INTRODUCTION

As a research platform in near-earth orbit, the International Space Station (ISS) provides installation and operational support of science and technology experiments and their associated support equipment at four external attach sites on the Integrated Truss Segment (ITS) S3 and two external attach sites on the ITS P3. The Alpha Magnetic Spectrometer-02 (AMS-02) payload will utilize the ITS S3 zenith inboard Payload Attach System (PAS) site for completing its 3-years on-orbit mission life.

1.1 PURPOSE

This Interface Control Document (ICD) is the primary source of design implementation control and verification activities of the AMS-02 specific interfaces in accordance with SSP 57003, Attached Payloads Interface Requirements Document (IRD). This ICD controls the ISS and AMS-02 interfaces for integration onto the ISS and encompasses the set of verification requirements that address the AMS-02 interface compatibility during on-orbit integration and operations. The physical, functional, and environmental design implementation associated with the AMS-02 interface compatibility is included herein. The ICD controls the hardware interfaces between the AMS-02 payload hardware and the ITS S3 PAS, ITS P3 Unpressurized Cargo Carrier Attach System (UCCAS), and Mobile Base System Common Attach System (MCAS) included herein. The AMS-02 primary attach location is the S3 zenith inboard PAS site. All other standard external attach sites are for contingency only.

1.2 SCOPE

The interfaces defined in this document apply to the ISS on-orbit phases of the payload mission cycle when the AMS-02 external hardware is utilized for science collection. The reader is referred to NSTS 21000-IDD-ISS, International Space Station Interface Definition Document.

That portion of the AMS-02 payload, the AMS Crew Operations Post (ACOP), which resides within the pressurized volume of an ISS module for data storage, monitoring and linkage to the ISS systems for command and downlink will be delivered to the ISS by the Space Shuttle and installed into an Express Rack. The ACOP pressurized ICD and ACOP Payload Verification Plan (PVP) will be controlled under Express Rack documentation. The reader is referred to SSP 50467, ISS Cargo Stowage Technical Manual: Pressurized Volume, for requirements related to ISS stowage. The ACOP is to be delivered and checked out before the arrival of the external AMS-02 unpressurized payload.

1.3 USE

Section 3 of this document contains design implementation and module specific interface information while Section 4 has an applicability matrix that provides traceability back to the IRD requirements and corresponding verification requirements contained in the IRD. Section 5 contains a table that AMS-02 will utilize to document exceptions to requirements in SSP 57003 or interfaces defined in this document.

1.4 PAYLOAD DESCRIPTION

1.4.1 OVERVIEW

The AMS-02 is a state-of-the-art particle physics detector containing a large, cryogenic superfluid helium superconducting magnet that will be designed, constructed, tested and operated by an international team organized under United States Department of Energy (DOE) sponsorship. AMS-02 will use the unique environment of space to advance knowledge of the universe and potentially lead to a clearer understanding of the universe's origin. Specifically, the science objectives of the AMS-02 are to search for cosmic sources of antimatter (i.e., anti-helium or heavier elements) and dark matter.

1.4.2 TRANSPORTATION

For transport to/from the ISS, the selected ISS Program carrier for AMS-02 is a direct interface in the Orbiter's payload bay utilizing a AMS-02 Unique Support Structure-02 (USS-02). The USS-02 attaches directly to the Orbiter via four longeron trunnions and one keel trunnion, and is also used to support the vacuum case assembly, the cryomagnet, the payload detectors, and the interface to the ISS S3 PAS site.

The selection of a return flight carrier will occur at the appropriate time.

1.4.3 HARDWARE

The USS-02 is employed to support the AMS-02 cryomagnet, detectors, and provides the interface for the entire AMS-02 with the Orbiter and the ISS. The cryogenic superconducting magnet (Cryomagnet) system consists of a superconducting magnet and a Superfluid Helium (SFHe) dewar with a capacity of about 2500 liters enclosed in a vacuum case. The vacuum case serves a dual purpose as a primary structural support to the USS-02 and as a vacuum vessel for the cryosystem and magnet. In addition, the USS-02 is comprised of the following subassemblies: Upper USS-02 Assembly, Vacuum Case Assembly, Lower USS-02 Assembly, Keel Assembly, and the Payload Attach System (PAS)/Umbilical Mechanism Assembly (UMA) Assemblies. The USS-02 primary members consist of layered tubing with aluminum walls fastened with rivets and bolts. Several AMS-02 components are mounted to the USS-02.

1.4.4 ON-ORBIT OPERATIONS

1.4.4.1 ON-ORBIT SCIENCE OPERATIONS

The AMS-02 is an unpressurized, full truss mounted payload that will utilize a Cryomag with planes of detectors above, inside and below the magnet. Electrically charged particles that pass through the magnetic field will curve. Charged particles made of matter will curve one way, and those of anti-matter will curve the opposite way. The positions of the charged particles will be electronically recorded. Physicists will be able to study the trajectory of curvature and determine the charge of the particles from the direction of curvature. They will also be able to establish the mass of the particles from the amount of curvature. The physicists will then be able to decide whether it was matter or anti-matter.

1.4.4.2 ON-ORBIT ROBOTIC INSTALLATION

The AMS-02 is a robotic-deployable payload, requiring scheduled Extravehicular Robotics (EVR) operations for payload deployment and installation. Payload design incorporates two grapple fixtures, a Flight Releasable Grapple Fixture (FRGF) and a Power Video Grapple Fixture (PVGF), and the required External Berthing Camera System avionics package for installation on the payload's USS-02 allowing for dual robotic arm operations for attachment of AMS-02 to the designated ITS S3 PAS site.

The FRGF, which is located on the Orbiter forward-port side of the AMS-02, is used for unberth and handoff operations and the PVGF on the Orbiter port-aft side is used for handoff and installation operations. The Shuttle Remote Manipulator System (SRMS) grapples the Orbiter forward-port FRGF on the AMS-02, unberths the payload from the Orbiter payload bay and brings the AMS-02 to the handoff position. The Space Station Remote Manipulator System (SSRMS), based on the Mobile Remote Servicer (MRS) Base System (MBS) Power Data Grapple Fixture (PDGF) #1, with the Mobile Transporter (MT) at truss segment S1-Bay 6, accepts the handoff using the Orbiter aft-port PVGF and then moves the AMS-02 station starboard toward the S3 ITS. The AMS-02 is then robotically installed by the SSRMS to the S3 zenith inboard PAS site.

Since the AMS-02 violates the Payload Attach System On-Orbit Operational Envelope, as defined in SSP 57003, the clearance from the AMS-02 to another truss-attached elements is less than 24-inches. This issue has been presented to the ISS Program End-to-End Berthing and Integration Team (EBIT). The EBIT decision was to mandate the use of the S3 aft camera to view AMS-02 berthing if another element is present on the adjoining S3 zenith outboard PAS. Also, if another payload is being installed on the adjoining PAS, and the AMS-02 is present, the S3 aft camera must be used for viewing robotic operations.

1.4.4.3 ON-ORBIT RETRIEVAL OPERATIONS

Retrieval of the AMS-02 requires scheduled EVR operations for payload release and retrieval after completing its 3-years on-orbit mission life. The AMS-02 will be transferred from the ISS to a Space Shuttle flight for return of the payload to the KSC landing site for de-integration and return of the AMS-02 flight hardware to the AMS-02 Program.

At the appropriate time the AMS-02 Mission Manager will submit a new change request to the ISS Program Payloads Office to retrieve the on-orbit AMS-02.

Figure 1.4.1-1 provides an isometric view of the integrated AMS-02 installed on the ITS S3 zenith inboard PAS.

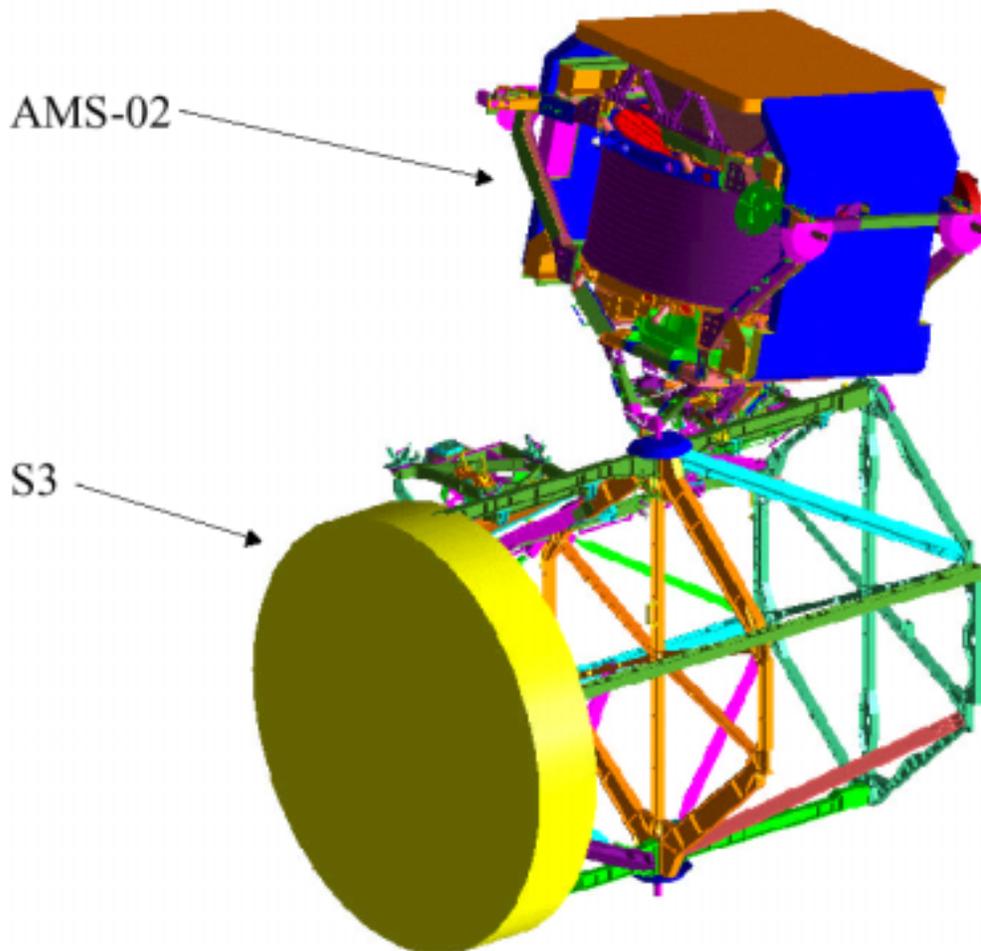


FIGURE 1.4.1-1 AMS-02 ON S3 PAS LOOKING ISS ZENITH-STARBOARD

2.0 DOCUMENTATION

The following documents include specifications, models, standards, guidelines, handbooks, and other special publications. Specific date and revision number of documents under control of the Space Station Control Board can be found in SSP 50257, Program Control Document Index, or SSP 50258, Prime Control Document Index. The documents in this section are inclusive to those specified herein. They form a part of this ICD to the extent specified herein. In event of a conflict between the documents referenced and the contents of this ICD shall be considered a superseding requirement.

2.1 APPLICABLE DOCUMENTS

| | |
|------------------|---|
| 98H0749 | ISS S3 Segment Thermal Math Model Report |
| ANSI Y14.5 | Dimensioning and Tolerancing |
| D684–10058–03–01 | Integrated ISS Thermal Math Models, Volume 3, Book 1 |
| DOD–STD–100 | Military Standard, Engineering Drawing Practices |
| LMSMSS 31039 | Safety & Health Plan Science, Engineering, Analyses and Test Contract |
| MIL–STD–1553 | Digital Time Division Command/Response Multiplex Data Bus |
| SSP 30245 | Space Station Electrical Bonding Requirements |
| SSP 30263–002 | Remote Power Controller Module (RPCM) ICD |
| SSP 42131 | Space Station Program Integrated Truss Segment P3 and S3 To Attached Payloads and Unpressurized Cargo Carriers (UCC) Standard Interface Control Document |
| SSP 50184 | Physical Media, Physical Signaling & Link- Level Protocol Specifications for Ensuring Interoperability of High Rate Data Link Stations on the International Space Station |
| SSP 50257 | Program Control Document Index |
| SSP 50258 | Prime Control Document Index |
| SSP 50467 | ISS Stowage Accommodations Handbook: Pressurized Volume |
| SSP 57000 | Pressurized Payloads Interface Requirements Document |
| SSP 57003 | Attached Payload Interface Requirements Document |

SSP 57213
Baseline (Draft – June 2003)

| | |
|-----------|---|
| SSP 57061 | Standard Payload Integration Agreement for Unpressurized Payloads |
| SSQ 21637 | Connectors and Accessories, Electrical, Umbilical Interface, Environmental Space Quality, General Specification |
| SSQ 21654 | Cable, Single Fiber, Multimode, Space Quality, General Specification Document |
| SSQ 21655 | Cable, Electrical, MIL–STD–1553 Data Bus, Space Quality, General Specification |

2.2 REFERENCE DOCUMENTS

| | |
|---------------|--|
| SEG33106347 | Top Mounted Handrail Assembly Drawing |
| SP–M–229 | Addendum Specification to Prime Item Development Specification for Integrated Truss Element P3 for Integrated Truss Segment (ITS) S3 |
| SP–M–235 | Specification to Prime Item Development Specification for Integrated Truss Element P3 |
| SP–M–600 | Configuration Item Specification for the Capture Latch Assembly |
| SP–M–601 | Configuration Item Specification for the Umbilical Mechanism Assembly |
| SP–M–602 | Configuration Item Specification for the Payload Attach System |
| SP–M–603 | Configuration Item Specification for the Unpressurized Cargo Carrier Attach System |
| SSP 30263–002 | Remote Power Controller Module (RPCM) ICD |
| SSP 30233 | Space Station Requirements for Materials and Processes |
| SSP 30425 | Space Station Program Natural Environment Definition for Design |
| SSP 30426 | Space Station External Contamination Control Requirements |
| SSP 30512 | Space Station Ionizing Radiation Design Environment |
| SSP 30575 | Space Station Interior and Exterior Operational Location Coding System |

SSP 57213
Baseline (Draft – June 2003)

| | |
|------------|--|
| | System |
| SSP 52005B | Payload Flight Equipment Requirements and Guidelines for Safety-Critical Structures |
| SSP 57004 | Attached Payload Hardware Interface Control Document Template |
| SSP 57062 | Payload Integration Agreement Increment Addendum Blank Book for Unpressurized Payloads |

2.3 UNIQUE ICD APPLICABLE DOCUMENTS

AMS-02 will be developing their hardware to the current version of SSP 57000 and SSP 57003 and the IRD applicable documents that correspond to requirements marked as applicable in the Section 4, Applicability Matrix of this ICD. This matrix provides the traceability back to the applicable IRD and hence the corresponding verification requirement. AMS-02 will be responsible for impacting any changes processed by the ISS Payloads Office Payload Interface Revision Notice (PIRNs) to these applicable documents and report to the ISS Program Payloads Office as to whether the changes impact them. Changes that impact hardware development will be handled with either a waiver or design change that is approved by the ISS Program Payloads Control Board.

| | |
|-----------|---|
| SSP 57113 | Payload Integration Agreement for Alpha Magnetic Spectrometer-02 (AMS-02) |
|-----------|---|

3.0 ATTACHED PAYLOAD INTERFACES

3.1 STRUCTURAL/MECHANICAL INTERFACES

3.1.1 INTERFACE WITH THE MOBILE SERVICING SYSTEM

There are no scheduled or planned operations for berthing the AMS-02 to the Mobile Servicing System (MSS); but for contingency reasons, AMS-02 does provide for an interface to the MSS.

The AMS-02 Passive Payload Attach System (PPAS) to MSS interface provides structural support for the AMS-02 while attached to the MRS Base System Common Attach System (MCAS). See Figure 3.1.1-1. The MCAS also provides access to power and data resources from the ISS via an UMA while the MSS is parked and utilizing a truss utility port. The mechanical interface between the AMS-02 and the MCAS is physically similar to the interface with the PAS sites. The PVGF, which is a SSRMS compatible grapple fixture, on the AMS-02 provides an additional structural/mechanical interface with the MSS allowing the SSRMS or the Payload/Orbiter Replacement Unit (ORU) Accommodation (POA) to grapple the payload.

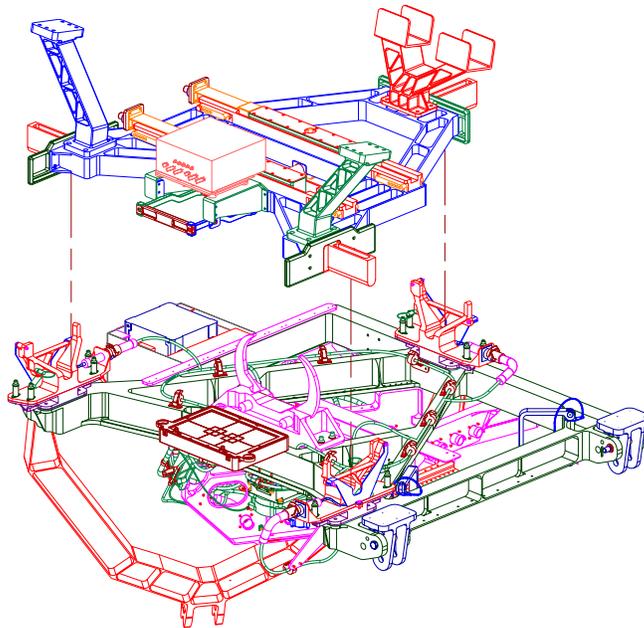


FIGURE 3.1.1-1 MSS INTERFACE TO AMS PPAS INTERFACE

3.1.2 INTERFACE WITH ISS TRUSS

The physical interface between the ISS and AMS-02 occurs at the PAS site located on the ITS S3 zenith inboard. Figure 3.1.2-1 illustrates the location of PAS No. 3 where the AMS-02 will be installed. The AMS-02 payload assembly installed on the ITS S3 zenith inboard PAS site is illustrated in Figure 3.1.2-2.

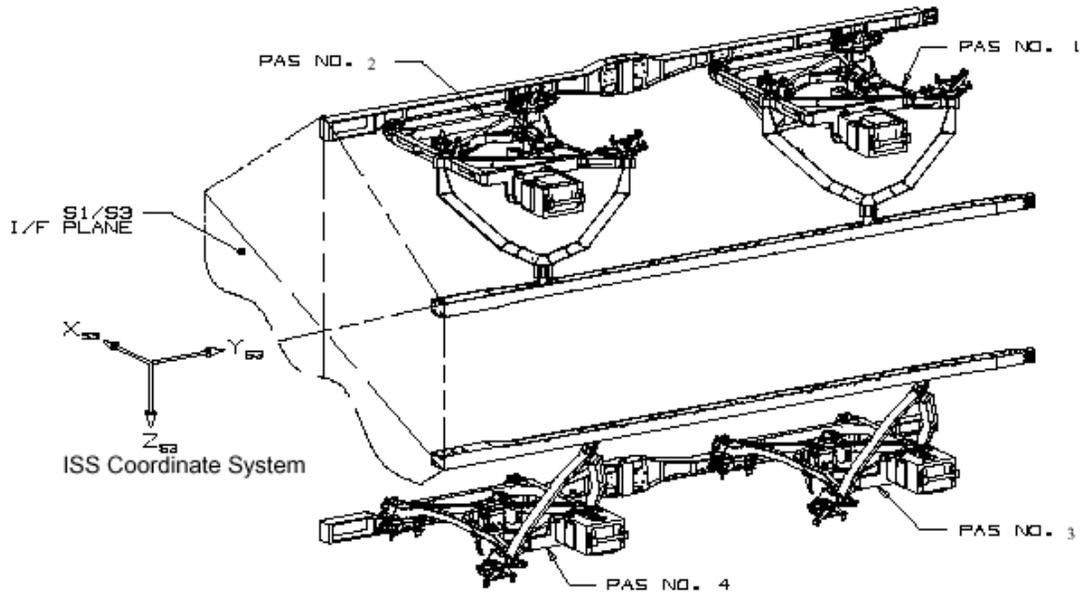
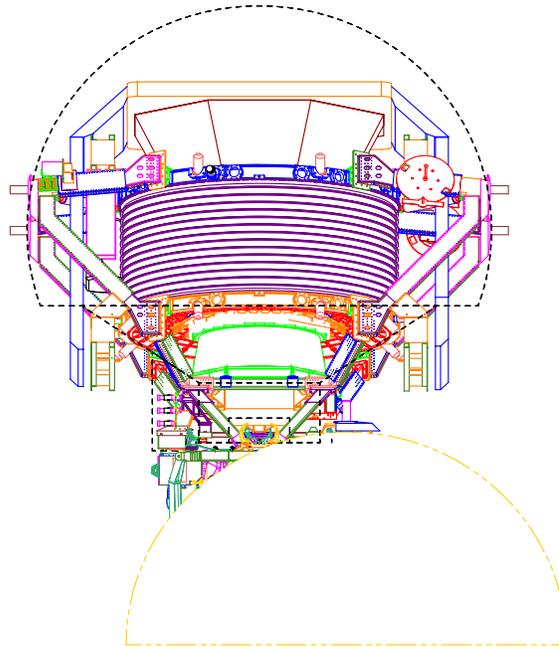


FIGURE 3.1.2-1 ITS PAS SITES

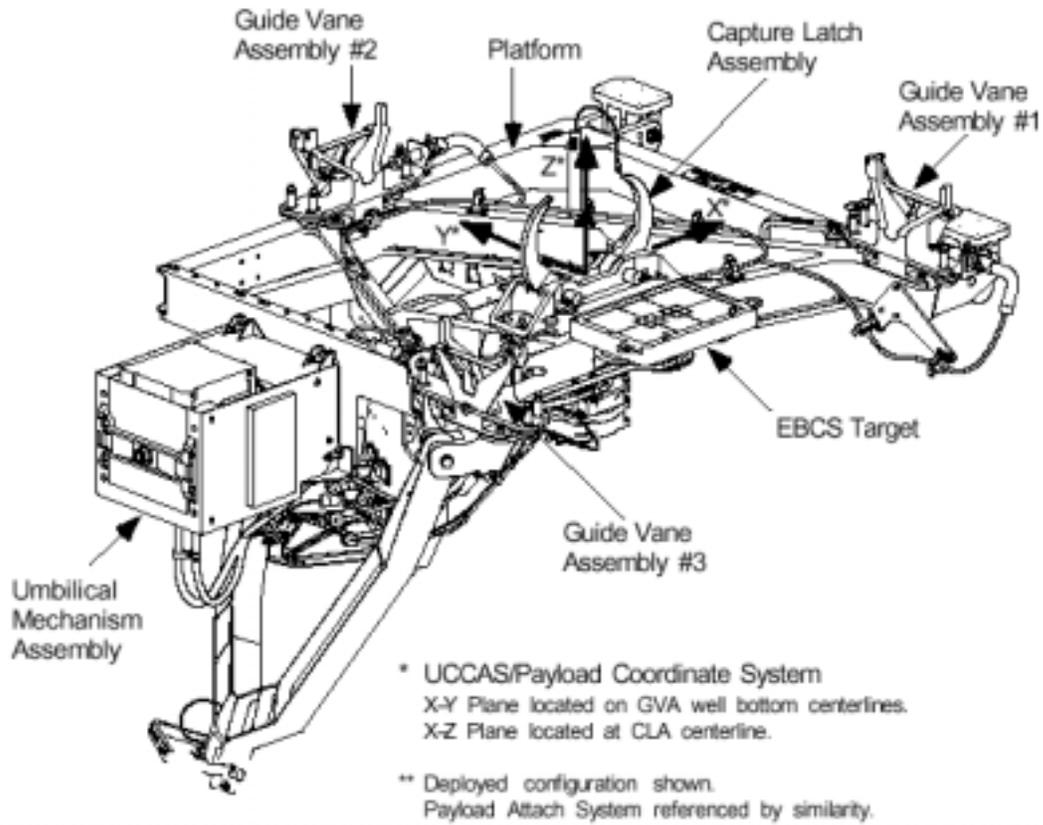


3.1.2-2 AMS-02 INSTALLED ON ITS S3 PAS SITE

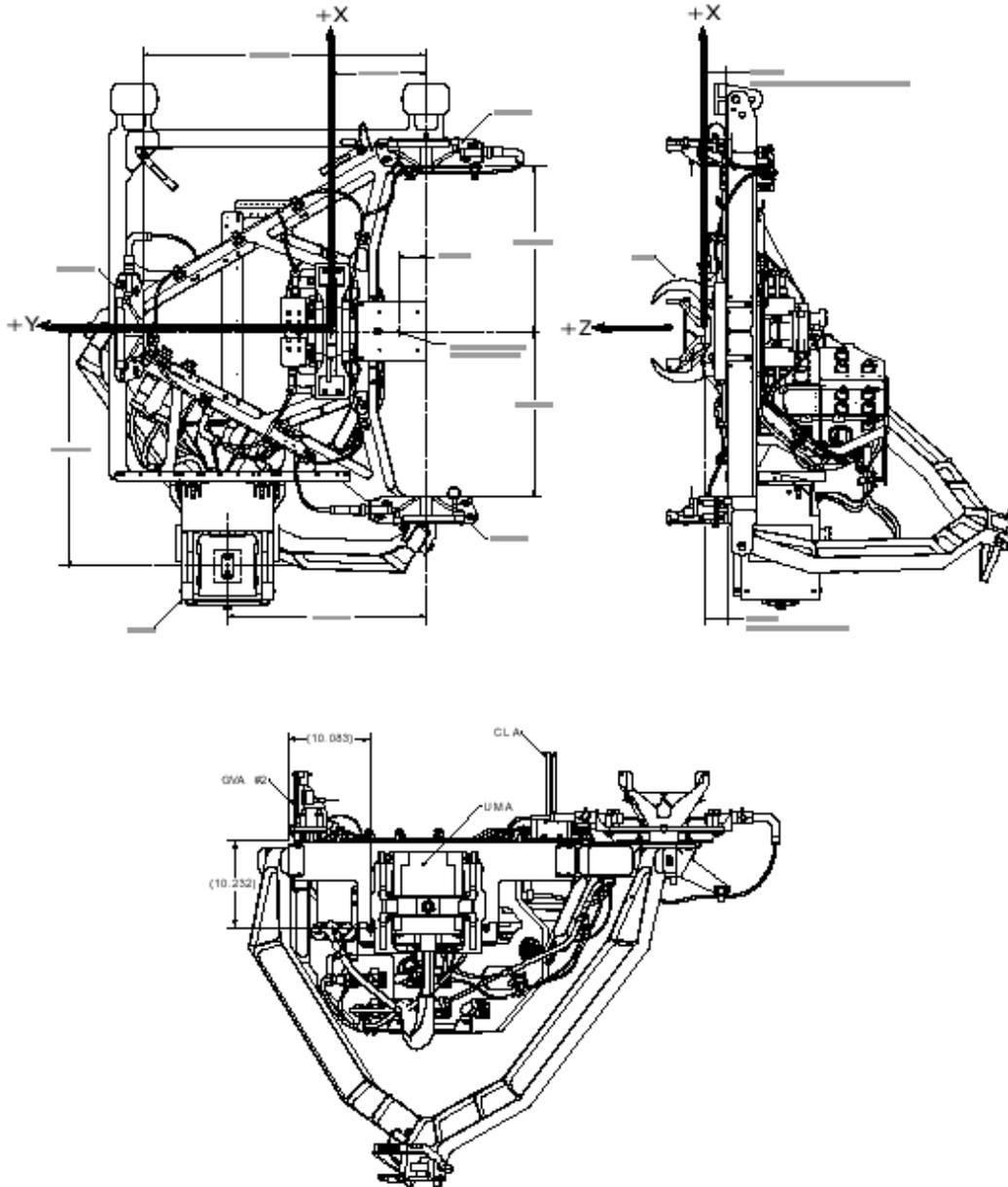
3.1.2.1 ACTIVE PAYLOAD ATTACH SYSTEM

The PAS is that portion of ITS S3 that has direct physical contact with the AMS-02. SP-M-602, Configuration Item Specification for the Payload Attach System, controls the active PAS design. The primary components of the active PAS interface are: An active Umbilical Mechanism Assembly (UMA), a Capture Latch Assembly (CLA), and three guide vanes to support the robotic AMS-02 installation and berthing. Figure 3.1.2.1-1 illustrates the active PAS and Figure 3.1.2.1-2 shows the active ITS PAS interface dimensions and defines the location of the local coordinate system origin for the PAS.

The UCCAS is that portion of ITS P3 that has direct physical contact with the Attached Payloads, including AMS-02. A UCCAS unit is similar to the PAS and can be represented by the same figures as the PAS since the interface to the payload is identical. The only functional difference between the S3/PAS and P3/UCCAS is that the P3/UCCAS is designed with redundant Integrated Motor Control Assemblies (IMCAs) in both its CLA and UMA.



3.1.2.1-1 ITS ACTIVE PAS



3.1.2.1-2 ITS PAS STRUCTURAL DIAGRAM

3.1.2.2 AMS-02 PASSIVE PAS

AMS-02 interfaces directly to the PAS and for the purpose of this ICD, the AMS-02 portion of the interface will be termed the passive PAS (PPAS). The AMS-02 PPAS includes an Extravehicular Activity (EVA) releasable capture bar assembly interfacing to the CLA, three guide pins interfacing to the three guide vanes, and a passive UMA mounting bracket to maintain the proper component positioning and to react transfer loads to the active PAS. The AMS-02 PPAS size, surface finish, and location of the

SSP 57213
Baseline (Draft – June 2003)

capture bar, guide pins, and passive UMA mounting bracket are defined in Figure 3.1.2.2-1. Access to ISS power and data systems will require the provision of a passive UMA mounted to its mounting bracket. Figure 3.1.2.2-2 shows the EBCS location in relationship to the EVA capture bar release mechanism. The AMS-02 interface geometry is fully defined in Figure 3.1.2.2-3.

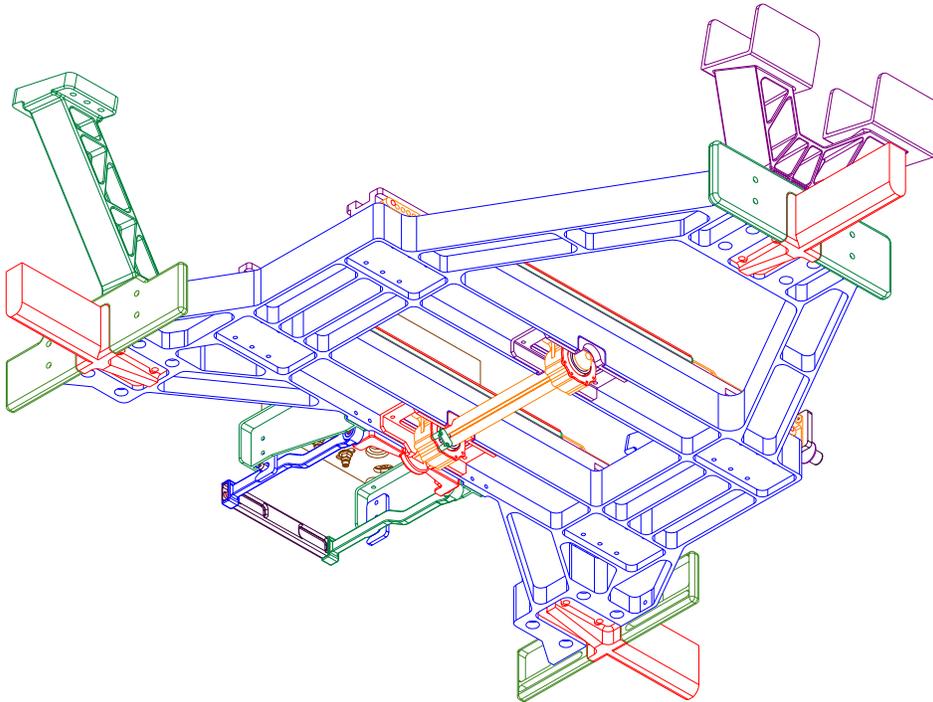


FIGURE 3.1.2.2-1 AMS PASSIVE PAS GEOMETRY (1 OF 3)

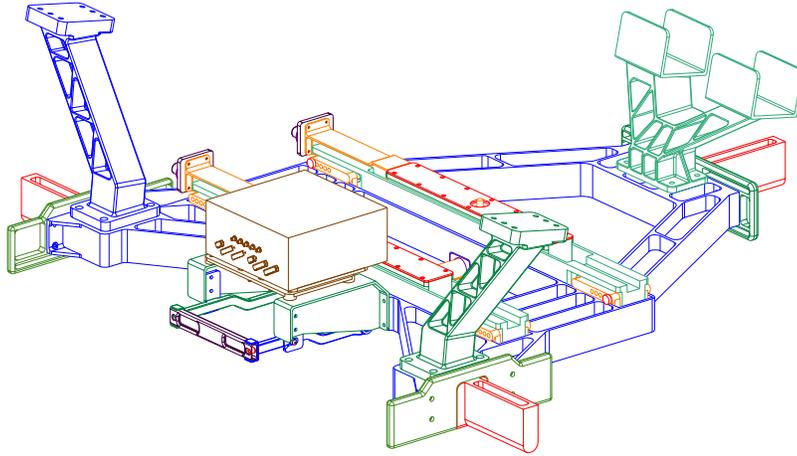


FIGURE 3.1.2.2-2 AMS PASSIVE PAS GEOMETRY (2 OF 3)

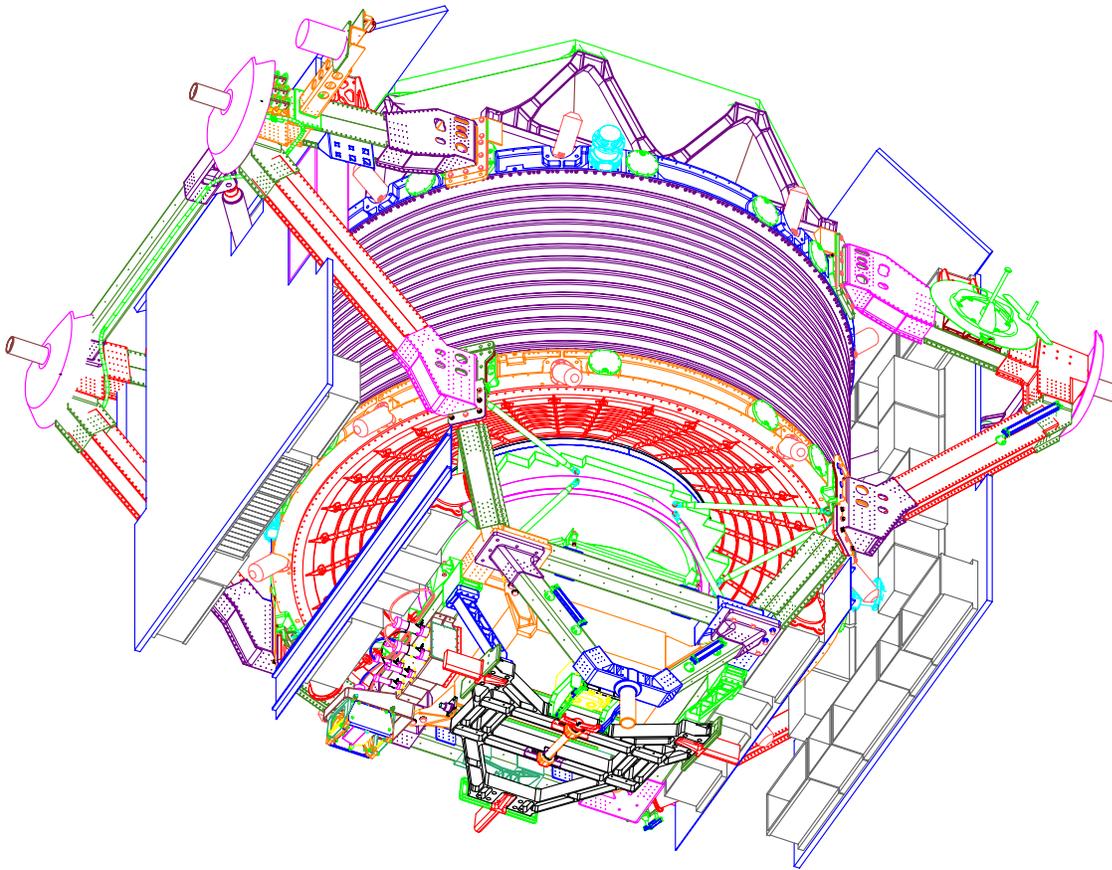


FIGURE 3.1.2.2-3 AMS PASSIVE PAS GEOMETRY (3 OF 3)

3.1.2.3 CAPTURE LATCH ASSEMBLY

Each active PAS/UCCAS includes one CLA. SP-M-600, Configuration Item Specification for the Capture Latch Assembly, controls the design of the CLA. The CLA is a remotely actuated mechanism supporting capture, berthing and structural integration of AMS-02 Payload to the PAS. Each CLA consists of a pair of latch jaws that are driven open and closed by a standard DC IMCA. The CLA operates in conjunction with the three guide vanes located on the PAS. The guide vanes maintain proper alignment of the guide pins as the AMS-02 are drawn into final position. The PAS is capable of capturing the AMS-02 when the releasable capture bar is positioned within the CLA capture envelope defined in Figure 3.1.2.3-1. This combined figure also provides the AMS-02 capture bar and guide pin interface dimensions.

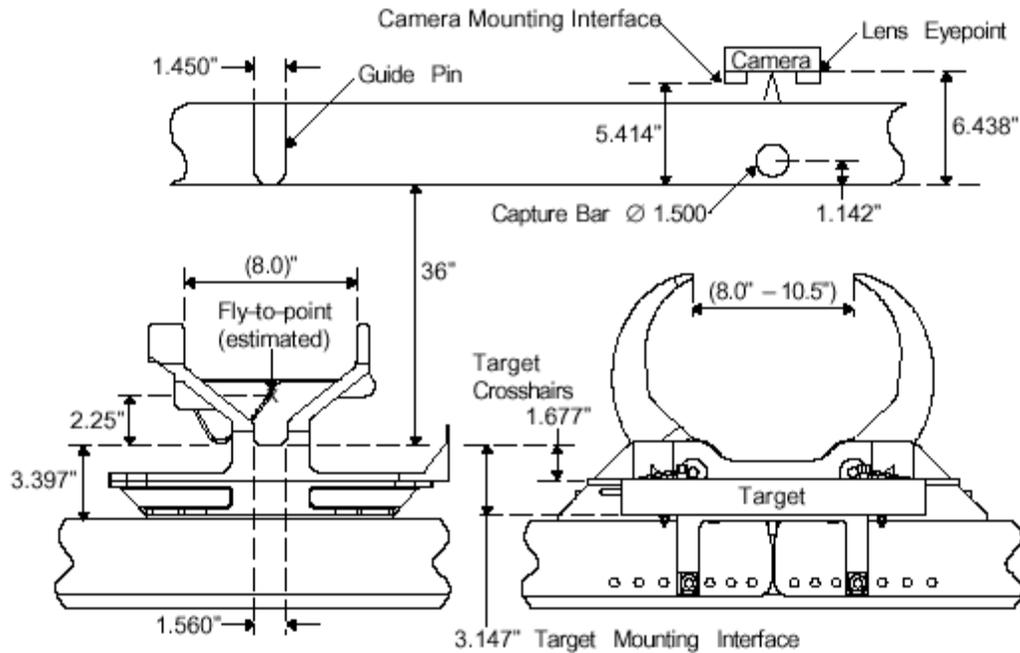


FIGURE 3.1.2.3-1 CLA CAPTURE ENVELOPE

3.1.2.4

The AMS-02 design includes an EVA unloadable/releasable capture bar to interface with the PAS/UCCAS CLA. The EVA unloadable/releasable capture bar design and location are in accordance with SSP 50005, ISSA Flight Crew Integration Standard. Reference Figure 3.1.2.2–1 for capture bar for dimensions and tolerances. The AMS-02 EVA releasable capture bar is shown in Figure 3.1.2.4–1.

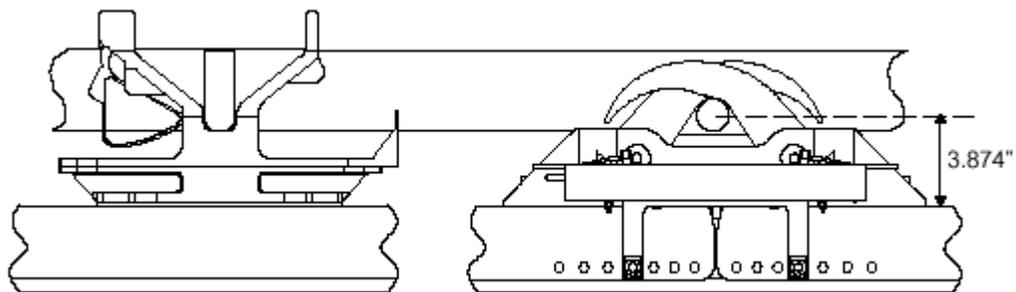


FIGURE 3.1.2.4-1 AMS CAPTURE BAR FULLY LOADED IN CLA

3.1.2.5 GUIDE VANES

The active PAS/UCCAS has three guide vanes that interface with the three guide pins on the AMS-02 passive PAS. SP-M-602 controls the design of the guide vanes. The guide vanes and pins are capable of passive guidance and fine alignment for an AMS-02 being drawn into final position by the CLA. The guide vanes include Ready-To-Latch (RTL) indicators providing positive feedback to SSRMS operators that the AMS-02 is properly positioned within the CLA capture envelope prior to CLA activation. Figure 3.1.2.5-1 shows the guide vane design.

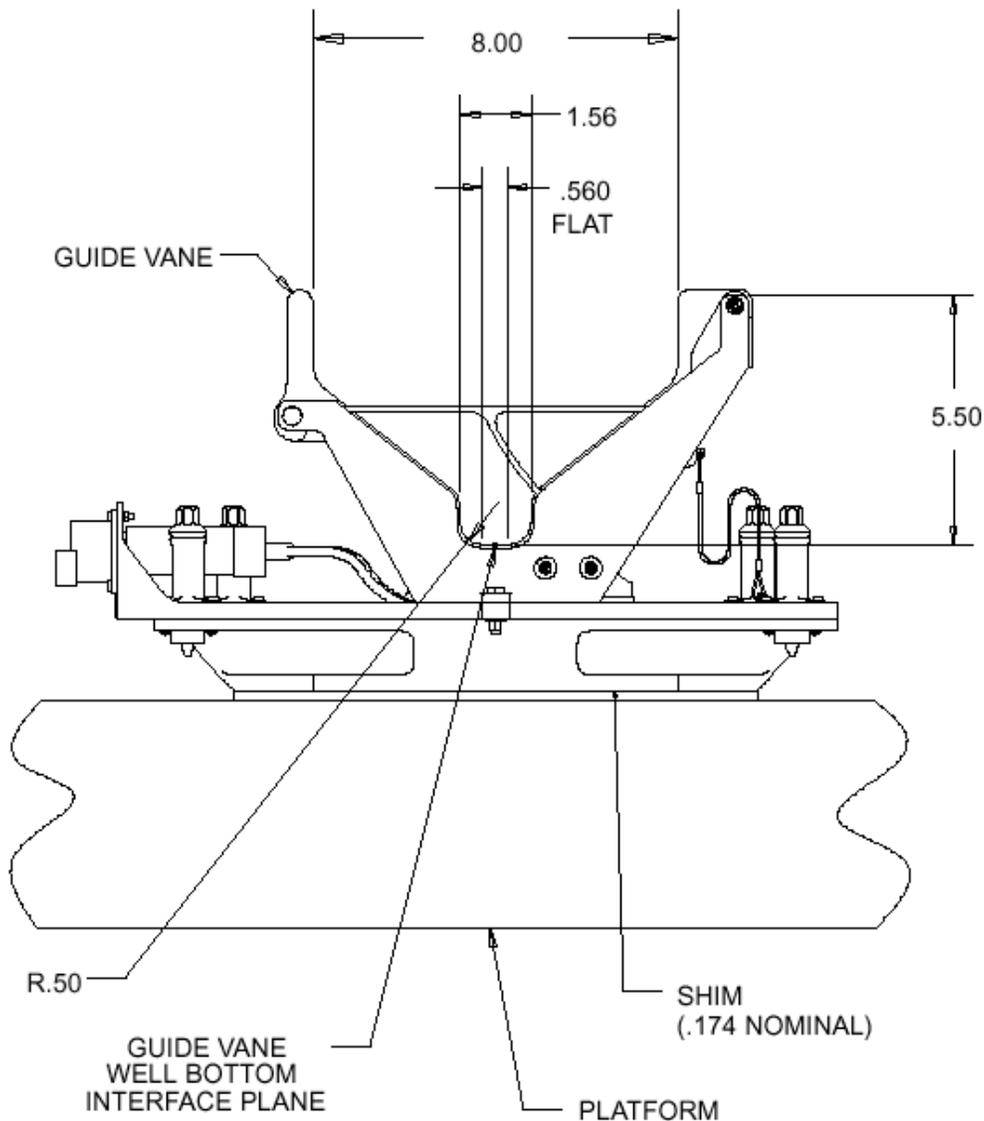


FIGURE 3.1.2.5-1 GUIDE VANES

Mechanism Assembly, controls the design of the active UMA. The active UMA design is shown in Figure 3.1.2.7–1.

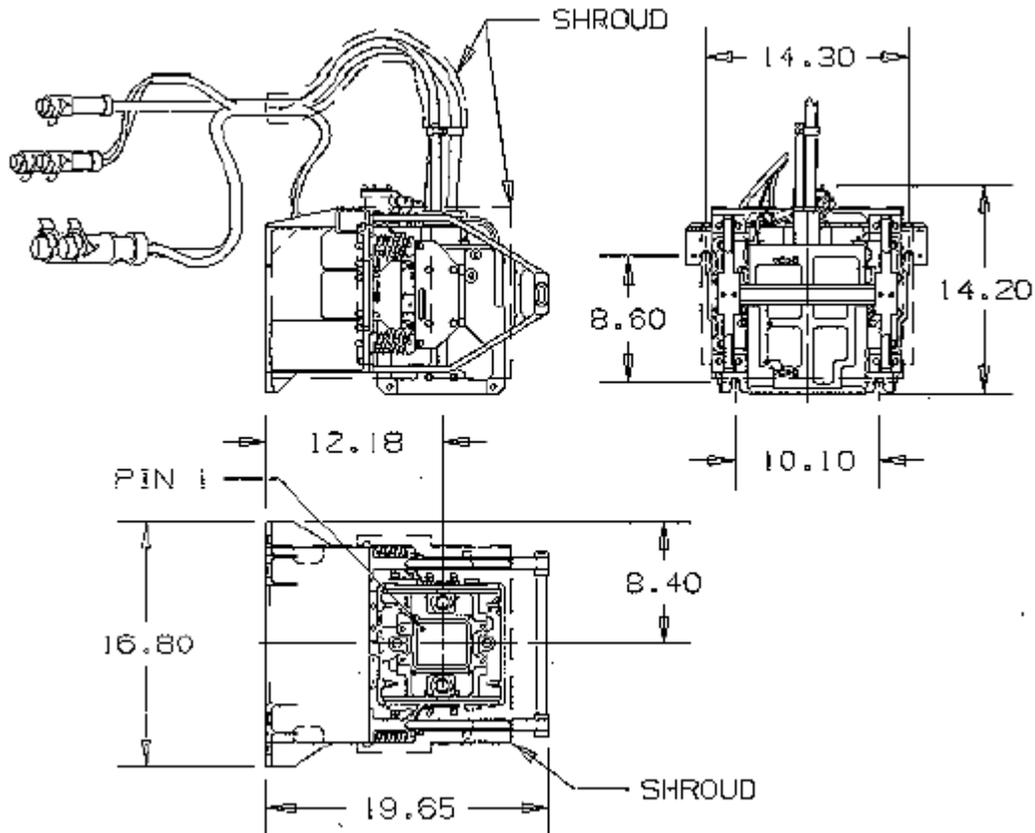


FIGURE 3.1.2.7-1 ACTIVE UMA DESIGN

3.1.2.8 PASSIVE UMA

The passive UMA, Part Number (P/N) 1F70162–1, is designed and manufactured by the Boeing Company for the NASA. The UMA passive half, and associated cables and connectors will be furnished to AMS-02 as NASA/Government Furnished Equipment (GFE), at no cost to the AMS-02, and will be certified by NASA.

The passive UMA is an Orbital Replacement Unit (ORU) that contains the female connector, debris shield, and an interlocking system that reacts loads with the active UMA, see SSQ 21637, Connectors and Accessories, Electrical, Umbilical Interface, Environmental Space Quality, General Specification. The passive UMA provides an interface for the payload power and data connection and meets the requirements of SSQ 21637. The passive UMA provides 385 inches \pm 24 inches of cable for connection to the AMS. In addition, the passive UMA is capable of achieving berthing

SSP 57213
Baseline (Draft – June 2003)

with the contact conditions and misalignments defined in SSP 42131, Space Station Program Integrated Truss Segment P3 and S3 to Attached Payloads and Unpressurized Cargo Carriers (UCC) Standard Interface Control Document. The passive UMA is accessible for manual EVA backup operation in accordance with SSP 50005, paragraph 12.3. A representation of a passive UMA is shown in Figure 3.1.2.8–1, for illustrative purposes only. A representation of the active and passive UMAs prior to engagement is shown in Figure 3.1.2.8–2, for illustrative purposes only.

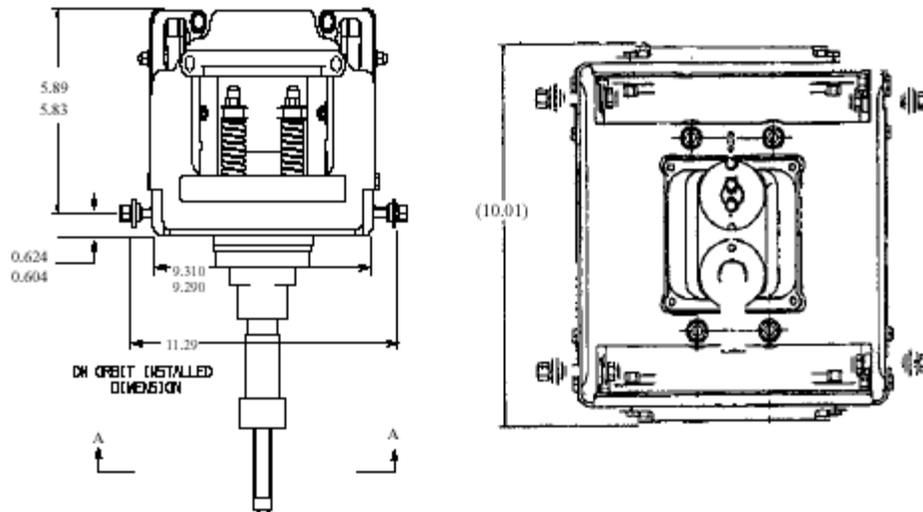


FIGURE 3.1.2.8-1 PASSIVE UMA DESIGN

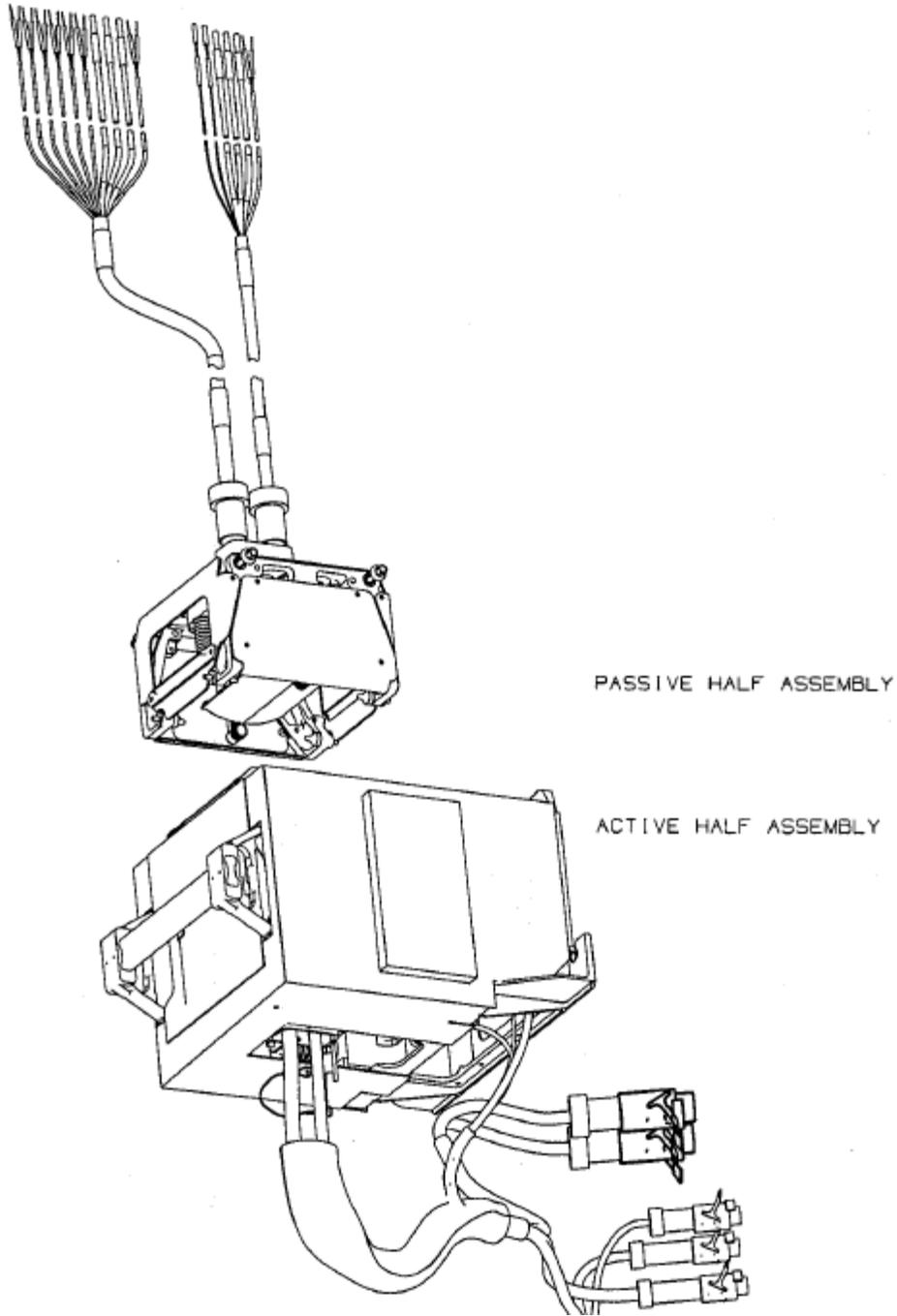


FIGURE 3.1.2.8-2 UMBILICAL MECHANISM ASSEMBLY

3.1.3 PHYSICAL ENVELOPE

3.1.3.1 INSTALLATION AND TRANSLATION ENVELOPE

The AMS-02 and associated equipment does exceed the maximum allowable installation envelope. A waiver will be requested for the exceedances. The installation envelope is defined by the extreme physical envelope of the AMS-02 while being transported by the SRMS, SSRMS, and Mobile Servicing System (MSS) and while being robotically installed on the S3 PAS. Figures 3.1.3.1-1 and 3.1.3.1-2 show that SSRMS transfer operations of the AMS-02 does exceed S3 and P3 installation envelope.

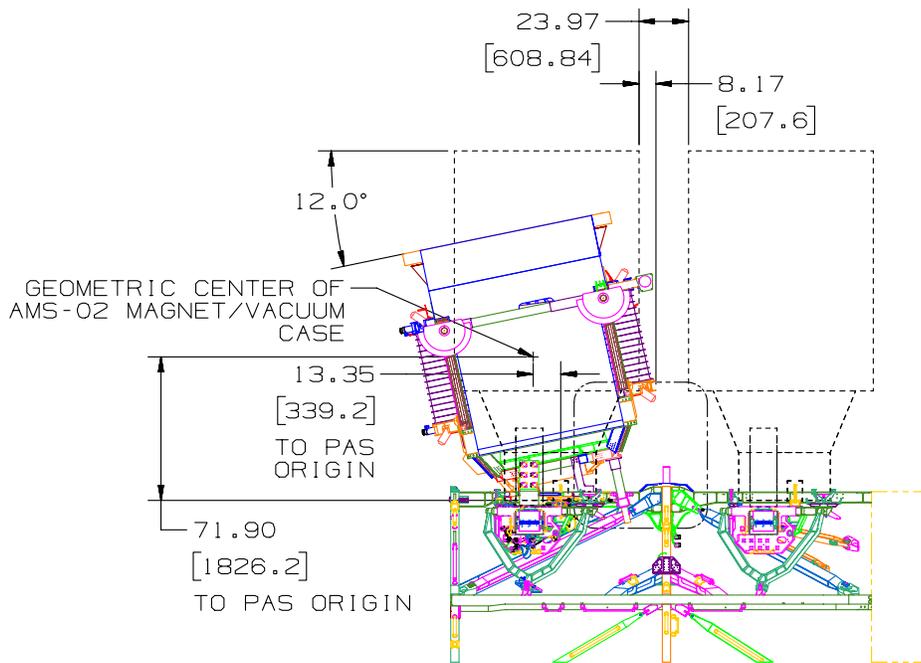


FIGURE 3.1.3.1-1 AMS-02 INSTALLATION AND TRANSLATION ENVELOPE (1 OF 2)

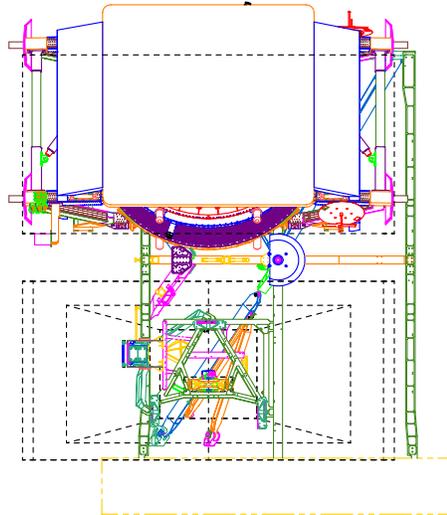


FIGURE 3.1.3.1-2 AMS-02 INSTALLATION AND TRANSLATION ENVELOPE (2 OF 2)

3.1.3.2 INTERFACE PLANE

The AMS-02 payload and associated equipment other than the keel trunnion do not protrude past the PAS interface plane as shown in Figure 3.1.3.2–1.

< insert Figure 3.1.3.2–1 >

3.1.3.3 AMS-02 ON-ORBIT OPERATIONAL ENVELOPE <TBR 3-2>

The AMS–02 on–orbit operational envelope does exceed the maximum allowable operational envelope. The on-orbit operational envelope is shown in Figure 3.1.3.1-1 and Figure 3.1.3.1-2. A waiver will be processed for this exceedance.

MASS PROPERTIES AND CENTER OF GRAVITY

3.1.3.4 AMS-02 HARDWARE DESCRIPTION

The AMS-02 hardware detail described in Table 3.1.4.1-1, Payload Hardware Description for Ascent supports transportation of the payload to orbit and onto the ITS S3 PAS site.

TABLE 3.1.4.1-1 PAYLOAD HARDWARE DESCRIPTION FOR ASCENT

| Payload Item | Payload Item Location | Volume ft ³ (m ³) | Mass lbm (kg) | Additional Information - Drawing Number | Physical External Dimension in (cm) | Center of Gravity ⁽¹⁾ | | |
|-----------------|----------------------------------|--|----------------|---|--|----------------------------------|-----------------|------------------|
| | | | | | | CGx in (cm) | CGy in (cm) | CGz in (cm) |
| AMS-02 Assembly | Orbiter Payload Bay/ISS PAS Site | 1400 (39.6) | 14,809 (6,717) | SEG39135720 | 152.24 (386.8) H 193.00 (490.2) W 126.55 (321.4) L | 2.7 ± 1 (6.9) | 12.5 ± 1 (31.8) | 67.5 ± 1 (171.5) |

Note: Center of gravity is relative to the ITS Active PAS local coordinate system defined in Figure 3.1.2.12-2.

3.1.3.5 ATTACHED PAYLOAD COORDINATE SYSTEM

The AMS-02 uses the coordinate system as defined in SSP 30219, Space Station Reference Coordinate System to meet the requirements of the ITS S3 zenith inboard PAS site for payload installation. Table 3.1.4.2-1 describes the PAS/UCCAS local coordinate system. Figure 3.1.4.2-1 depicts the AMS-02 installation with respect to the ISS coordinate system.

TABLE 3.1.4.2-1 PAS AND UCCAS LOCAL COORDINATE SYSTEM ORIGIN LOCATION

| LOCATIONS | LOCAL COORDINATE (in.) | | |
|-------------|----------------------------|-----------------------------|----------------------------|
| S3, PAS 1 | X _{S0} = -33.7013 | Y _{S0} = 967.6696 | Z _{S0} = -80.9270 |
| S3, PAS 2 | X _{S0} = -33.7013 | Y _{S0} = 953.9664 | Z _{S0} = -80.9270 |
| S3, PAS 3 | X _{S0} = -33.7013 | Y _{S0} = 854.2996 | Z _{S0} = -80.9270 |
| S3, PAS 4 | X _{S0} = -33.7013 | Y _{S0} = 838.6094 | Z _{S0} = -80.9270 |
| P3, UCCAS 1 | X _{S0} = -33.7013 | Y _{S0} = -967.6696 | Z _{S0} = -80.9270 |
| P3, UCCAS 2 | X _{S0} = -33.7013 | Y _{S0} = -953.9664 | Z _{S0} = -80.9270 |

Note: The X, Y and Z values define the location of the Attached Payload origin point for the PAS and UCCAS as shown in Figures 3.1.2.1-1 and 3.1.2.1-2 with respect to the ISS Coordinate System origin.

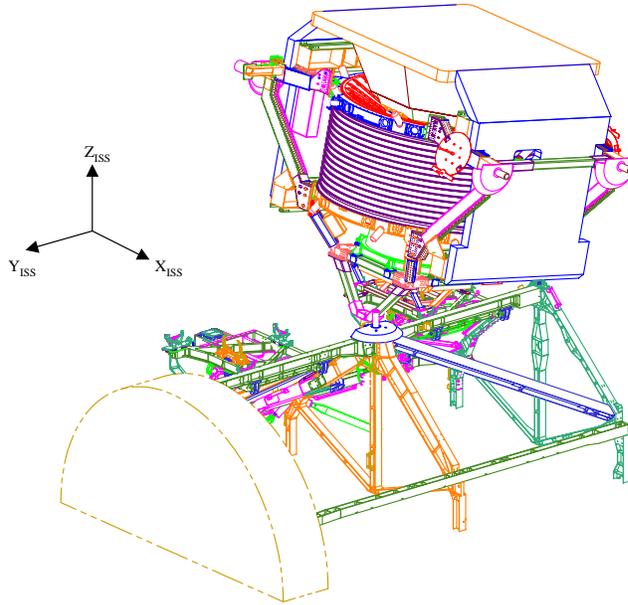


FIGURE 3.1.4.2-1 ISS COORDINATE SYSTEM WITH AMS-02 INSTALLED

3.1.3.6 CONTROL WEIGHT

The AMS-02 total on-orbit control weight, including facility carrier and payload experiments is provided in Table 3.1.4.2-1.

TABLE 3.1.4.2-1 CONTROL WEIGHT

| Attached Payload | Weight (lbs.) |
|------------------|---------------|
| AMS-02 | 14,809 |

3.1.3.7 CONTROL CENTER OF GRAVITY

The AMS-02 payload hardware Center of Gravity (CG) locations for ascent are identified in Table 3.1.4-1, Payload Hardware Description For Ascent in this document. The following figures depict the AMS-02 CG locations: Figure 3.1.4.4-1 and Figure 3.1.4.4-2. The center of gravity accounts for variations, locations and articulating (dynamic) effects of payloads on the AMS-02.

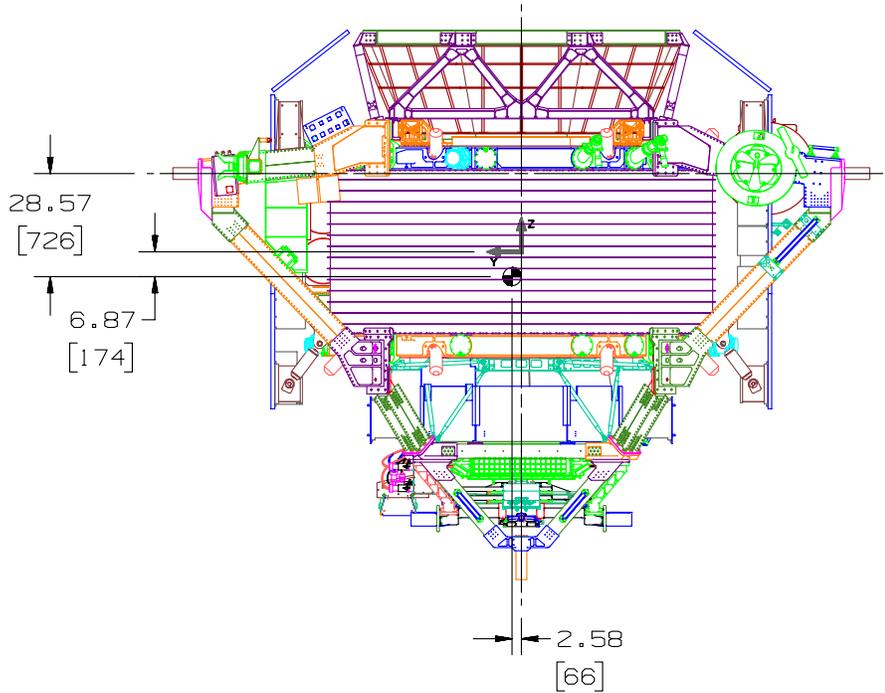


FIGURE 3.1.4.4-1 AMS-02 CENTER OF GRAVITY

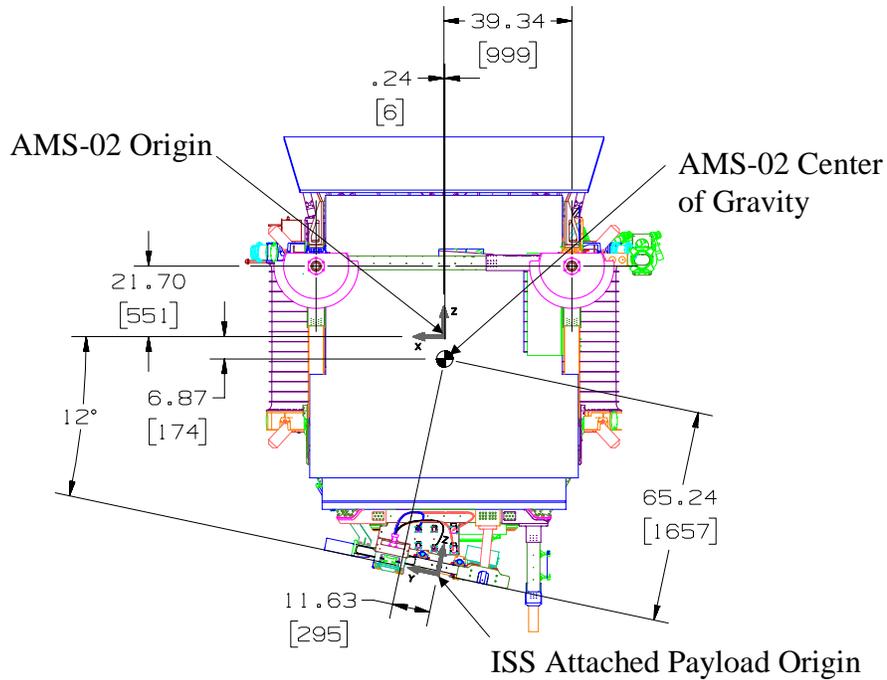


FIGURE 3.1.4.4-2 AMS-02 CENTER OF GRAVITY

3.1.3.8 PAYLOAD HARDWARE DESCRIPTION FOR DESCENT

Table 3.1.4.5-1 provides a description of the AMS-02 payload hardware options available for descent/return of the payload equipment. The hardware description in Table 3.1.4.5-1 supports payload return as an external cargo element in Orbiter's payload bay or the ACOP as a cargo element in a pressurized environment.

TABLE 3.1.4.5-1 PAYLOAD HARDWARE DESCRIPTION FOR DESCENT <TBR 3-4>

| Payload Item | Payload Item Location | Volume ft ³ (m ³) | Mass lbm (kg) | Additional Information - Drawing Number | Physical External Dimension in or ft (cm) | Center of Gravity ⁽¹⁾ | | |
|-----------------|--|--|----------------|---|---|----------------------------------|-----------------|------------------|
| | | | | | | CGx in (cm) | CGy in (cm) | CGz in (cm) |
| AMS-02 Assembly | Orbiter Payload Bay/ISS PAS Site | 1400 (39.6) | 14,809 (6,717) | zzzzzzzz | 15 ft dia x 10.? ft (yy.yy x zz.zz) | 2.7 ± 1 (6.9) | 12.5 ± 1 (31.8) | 67.5 ± 1 (171.5) |
| ACOP | Stowed in a pressurized environment for return | | | | | | | |

Note: Center of gravity is relative to the ITS Active PAS local coordinate system defined in Figure 3.1.2.12-2.

3.1.4 UNIQUE INTERFACES

There are no unique interfaces currently required for the AMS-02 payload.

3.1.4.1 INTERFACE LOADS

There are no unique interfaces currently required for the AMS-02 payload fundamental frequency.

3.1.4.2 ACCELERATION ENVIRONMENT <TBR 3-5>

The AMS-02 and its subsystems shall be designed to withstand an on-orbit acceleration environment including reboost having peak transient accelerations of up to 0.25 g's, a vector quantity acting in any direction. Table 3.1.5.3 provides the functional interface compatibility of the AMS-02 payload with the station from induced loads.

TABLE 3.1.5.3-1 ENVIRONMENTAL COMPATIBILITY DESCRIPTION

| Payload Environmental Characteristic | Induced Environment Description/Measurement |
|---|---|
| Shuttle plume-induced loads on ISS attachment structure | Maximum force in any direction: x.x lb, acting xx.x inches above the PAS site interface. Maximum moment applied to handrail: xx.x in-lb. |

3.2 ELECTRICAL POWER INTERFACES

The UMA interface supports the transfer of electrical power to the AMS-02 at a maximum of 25A between 113 and 126 Volts Direct Current (VDC). The MCAS interface supports the transfer of electrical power to the AMS-02 at a maximum of 12A

between 112.5 and 126 Volts Direct Current (VDC). The UMA interface is capable of providing power across either of two circuits depending upon operational constraints.

ITS S3 PAS keep-alive power of 500-Watts minimum is available when full station power is unavailable. However, this available keep-alive power is dependent on the total power load on the station at the time it may be required. Potentially the load shed required for station operations may lower the available keep-alive power to payloads.

3.2.1 AMS-02 CONNECTORS AND PIN ASSIGNMENTS

ISS electrical and Command and Data Handling (C&DH) interfaces terminate in the active UMA connector, NUP1-005, as defined in SSQ 21637. The AMS-02 utilizes the passive UMA connector, NUR1-005, as defined in SSQ 21637. The active UMA connectors and pin assignments are defined in Table 3.2.1-1 to mate with the AMS-02 passive UMA connectors and pin assignments shown in the last two columns of Table 3.2.1-1.

The UMA pin designations are shown in Figure 3.2.1-1.

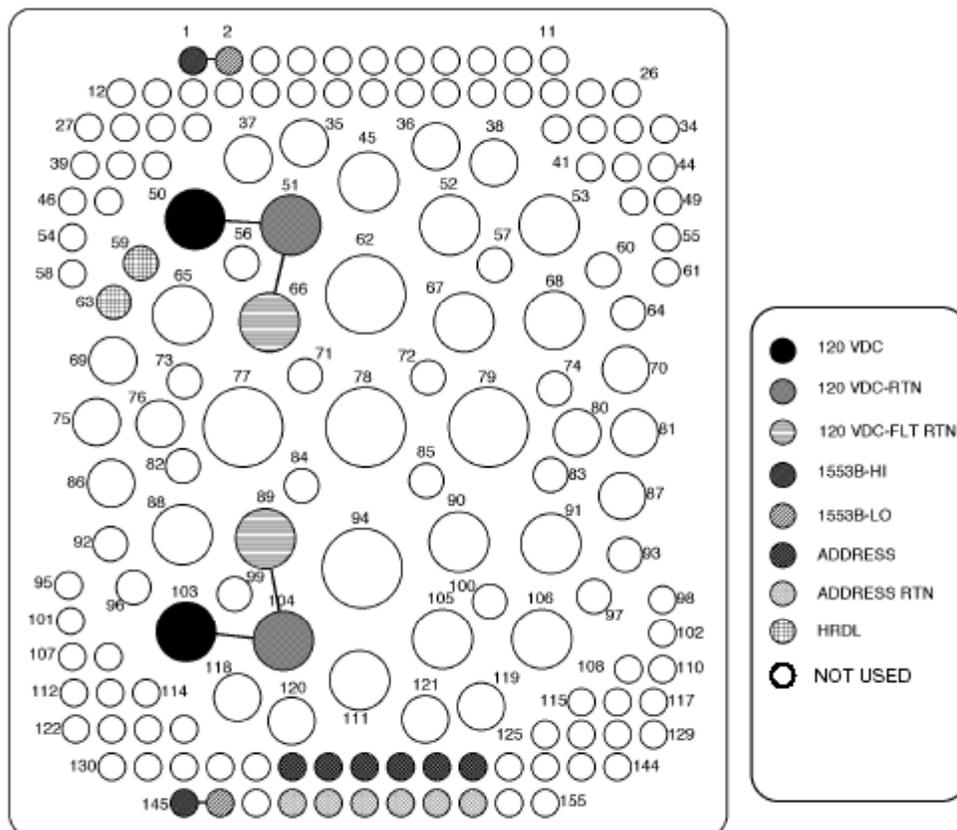


FIGURE 3.2.1-1 UMA PIN DESIGNATIONS

SSP 57213
Baseline (Draft – June 2003)

3.2.1.1.1.1 TABLE 3.2.1–1 AMS-02 CONNECTORS AND PIN ASSIGNMENTS

| UMA PINOUT DEFINITIONS | | | | | | |
|-----------------------------|--------|-----------------------------|--------|-------|-----------------------------|-----------------------------|
| ACTIVE | | | | | PASSIVE | |
| CONNECTOR PART NO. NUP1-005 | | | | | CONNECTOR PART NO. NUR1-005 | |
| PIN | SYSTEM | DESCRIPTION | SIGNAL | WIRE* | SIGNAL | DESCRIPTION |
| 1 | C&DH | 1553 BUS A HI | RFH | 22 | RFH | 1553 BUS A HI |
| 2 | C&DH | 1553 BUS A LO | RFL | 22 | RFL | 1553 BUS A LO |
| 145 | C&DH | 1553 BUS B HI | RFH | 22 | RFH | 1553 BUS B HI |
| 146 | C&DH | 1553 BUS B LO | RFL | 22 | RFL | 1553 BUS B LO |
| 66 | POWER | PASSTHRU-1 FAULT RTN | GND | 8 | GND | PASSTHRU-1 FAULT RTN |
| 50 | POWER | PASSTHRU-1(4B) PWR | PWR | 8 | PWR | PASSTHRU-1(4B) PWR |
| 51 | POWER | PASSTHRU-1(4B) RTN | RTN | 8 | RTN | PASSTHRU-1(4B) RTN |
| 89 | POWER | PASSTHRU-2 FAULT RTN | GND | 8 | GND | PASSTHRU-2 FAULT RTN |
| 106 | POWER | PASSTHRU-2(3A) PWR | PWR | 8 | PWR | PASSTHRU-2(3A) PWR |
| 104 | POWER | PASSTHRU-2(3A) RTN | RTN | 8 | RTN | PASSTHRU-2(3A) RTN |
| 63 | HRDL | HRDL-IN (Receive from APS) | FO | 16 | FO | HRDL-IN (Receive from APS) |
| 59 | HRDL | HRDL-OUT (Transmit to APS) | FO | 16 | FO | HRDL-OUT (Transmit to APS) |
| 135 | C&DH | PAYLOAD ADDRESS BIT 0 | ML | 22 | ML | PAYLOAD ADDRESS BIT 0 |
| 148 | C&DH | PAYLOAD ADDRESS BIT 0 RTN | ML | 22 | ML | PAYLOAD ADDRESS BIT 0 RTN |
| 136 | C&DH** | PAYLOAD ADDRESS BIT 1 | ML | 22 | ML | PAYLOAD ADDRESS BIT 1 |
| 149 | C&DH** | PAYLOAD ADDRESS BIT 1 RTN | ML | 22 | ML | PAYLOAD ADDRESS BIT 1 RTN |
| 137 | C&DH | PAYLOAD ADDRESS BIT 2 | ML | 22 | ML | PAYLOAD ADDRESS BIT 2 |
| 150 | C&DH | PAYLOAD ADDRESS BIT 2 RTN | ML | 22 | ML | PAYLOAD ADDRESS BIT 2 RTN |
| 138 | C&DH | PAYLOAD ADDRESS BIT 3 | ML | 22 | ML | PAYLOAD ADDRESS BIT 3 |
| 151 | C&DH | PAYLOAD ADDRESS BIT 3 RTN | ML | 22 | ML | PAYLOAD ADDRESS BIT 3 RTN |
| 139 | C&DH | PAYLOAD ADDRESS BIT 4 | ML | 22 | ML | PAYLOAD ADDRESS BIT 4 |
| 152 | C&DH | PAYLOAD ADDRESS BIT 4 RTN | ML | 22 | ML | PAYLOAD ADDRESS BIT 4 RTN |
| 140 | C&DH | PAYLOAD ADDRESS PAR BIT | ML | 22 | ML | PAYLOAD ADDRESS PAR BIT |
| 153 | C&DH | PAYLOAD ADDRESS PAR BIT RTN | ML | 22 | ML | PAYLOAD ADDRESS PAR BIT RTN |

* For EM classification, wire type, and shield grounding see SSP 30242, Table 3.2.1.1–1.

** Not available on UCCAS.

3.2.2 ELECTRICAL BONDING

Electrical bonding resistance of the AMS-02 fully seated on the V-guide interfaces is equal to or less than Class S bond in accordance with the requirement of SSP 30245, Electrical Bonding Requirements. Electrical bonding resistance of the AMS-02 connected to Interface C across the UMA interface connector is, at the conclusion of UMA mating, equal to or less than Class R bond in accordance with the requirements of SSP 30245. The surface treatment for the guide pins to provide at least Class S bonding when AMS-02 is berthed to the PAS is <TBR 3-6>.

Note: Refer to Figure 3.1.2.5-1 that depicts the V-guide well bottoms flattened to facilitate electrical resistance Class S bonding at the bottom of the V-guide interface in accordance with the requirements of SSP 30245.

3.2.3 POWER HANDLING CAPABILITY

Specific Electrical Power System (EPS) characteristics of PAS/UCCAS/MCAS sites are shown in Table 3.2.3–1.

TABLE 3.2.3-1 EPS CHARACTERISTICS AT ATTACHED PAYLOAD LOCATIONS

| LOCATION | MAIN (kW) | MAIN RPC CURRENT RATING (Amps) | AUXILIARY RPC CURRENT RATING (Amps) | RPC TYPE main/aux. |
|----------------|-----------|--------------------------------|-------------------------------------|--------------------|
| ITS S3 PAS-1 | 3 | 25 | 25 | II/II |
| PAS-2 | 3 | 25 | 25 | II/II |
| PAS-3 | 3 | 25 | 25 | II/II |
| PAS-4 | 3 | 25 | 25 | II/II |
| ITS P3 UCCAS-1 | 3 | 25 | 25 | II/II |
| UCCAS-2 | 3 | 25 | 25 | II/II |
| MCAS | 1.35 | 12 | 12 | I/I |

3.2.4 IMPEDANCE LIMITS

3.2.4.1 SOURCE IMPEDANCE LIMITS

The source impedance at Attached Payload Power Interface (APPI) locations meets the limits as shown in Figure 3.2.4.1–1 and Figure 3.2.4.1–2. The source impedance at MCAS power interface locations meets the limits as shown in Figure 3.2.4.1–3 and Figure 3.2.4.1–4.

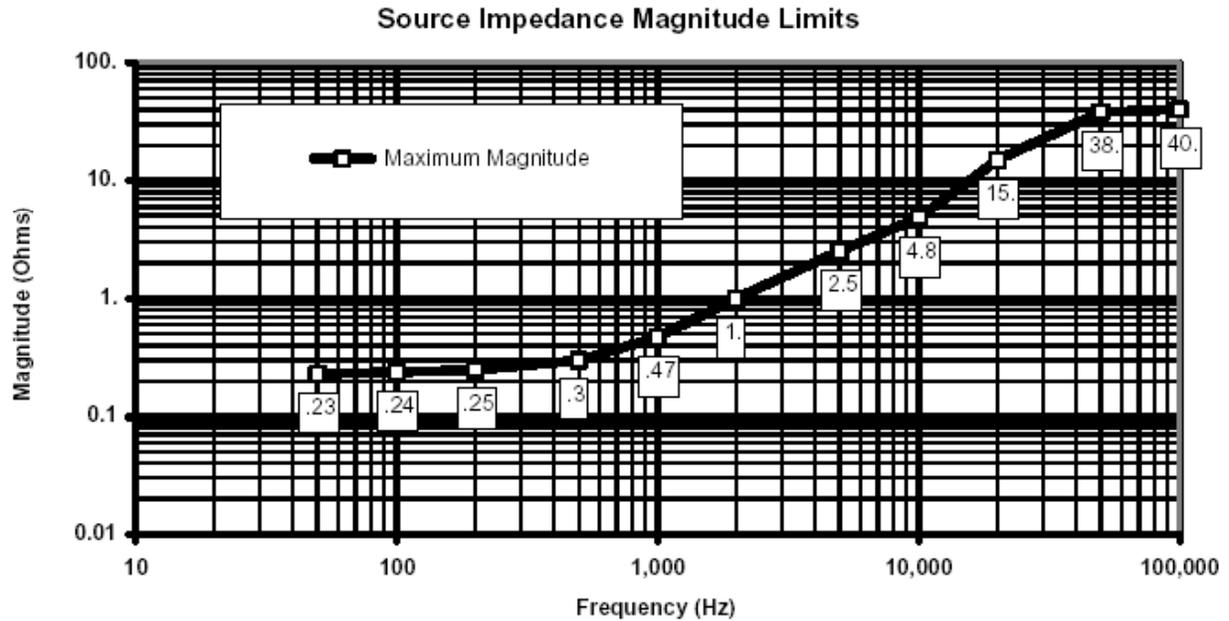


FIGURE 3.2.4.1-1 APPI SOURCE IMPEDANCE MAGNITUDE LIMITS

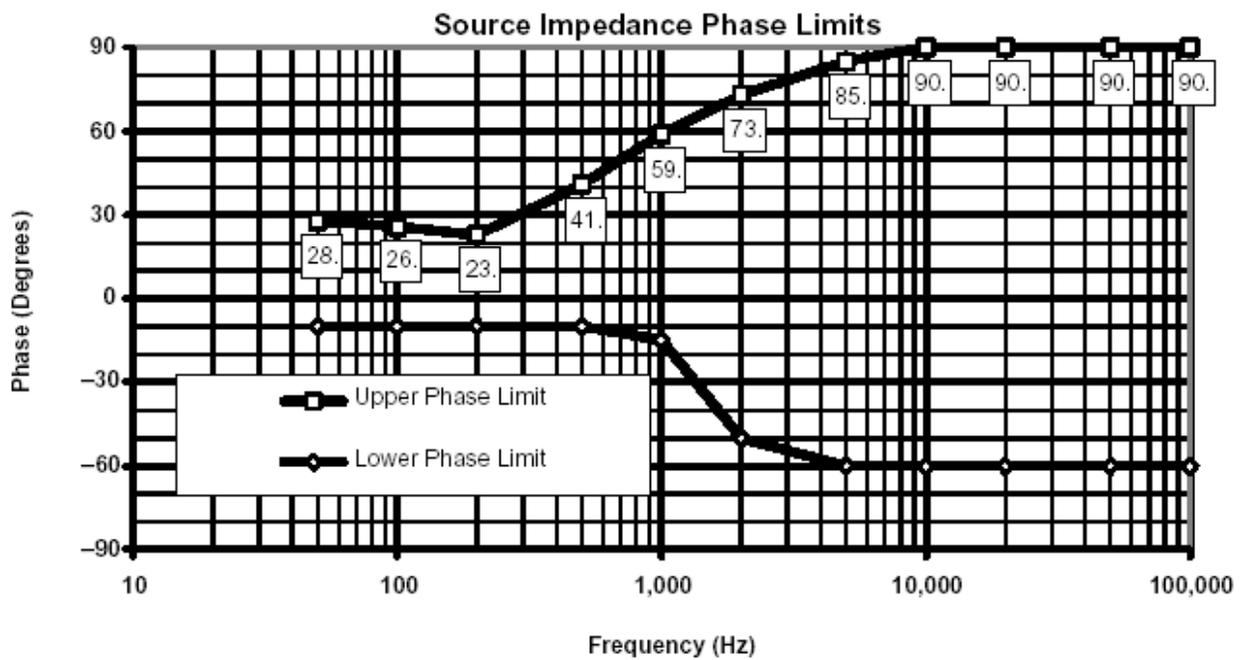
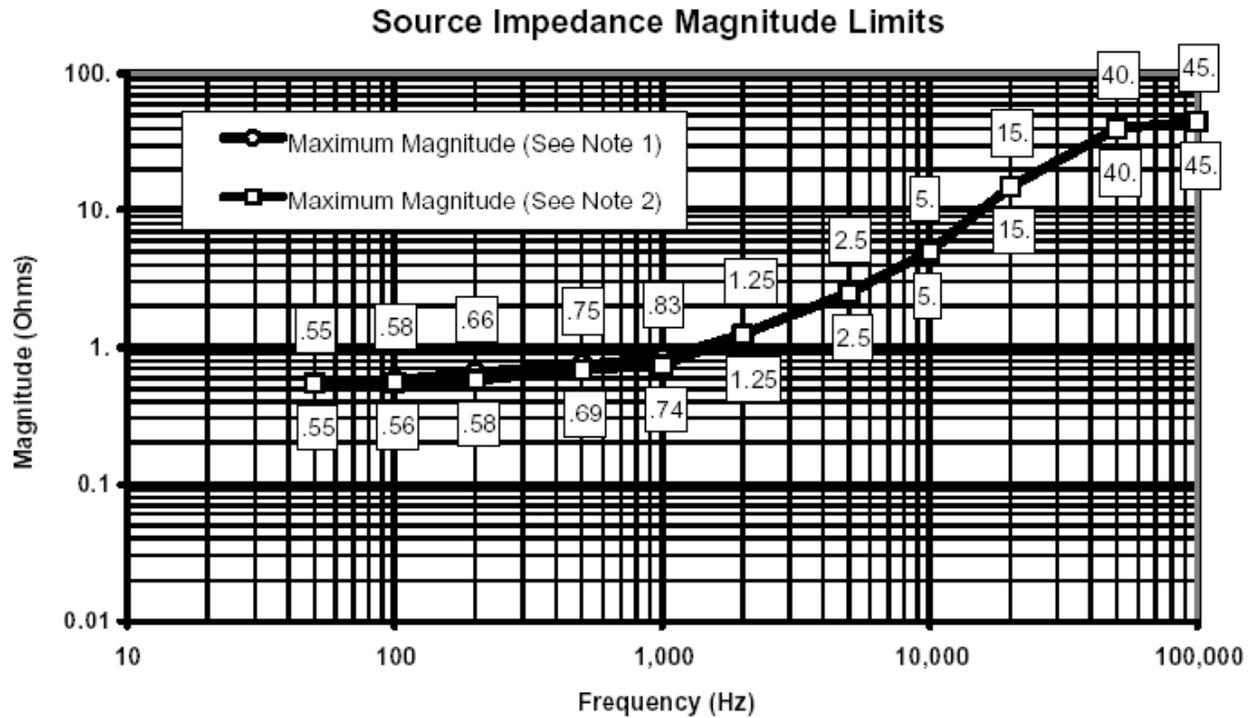


FIGURE 3.2.4.1-2 APPI SOURCE IMPEDANCE PHASE LIMITS



3.2.4.1-3 MCAS SOURCE IMPEDANCE MAGNITUDE LIMITS

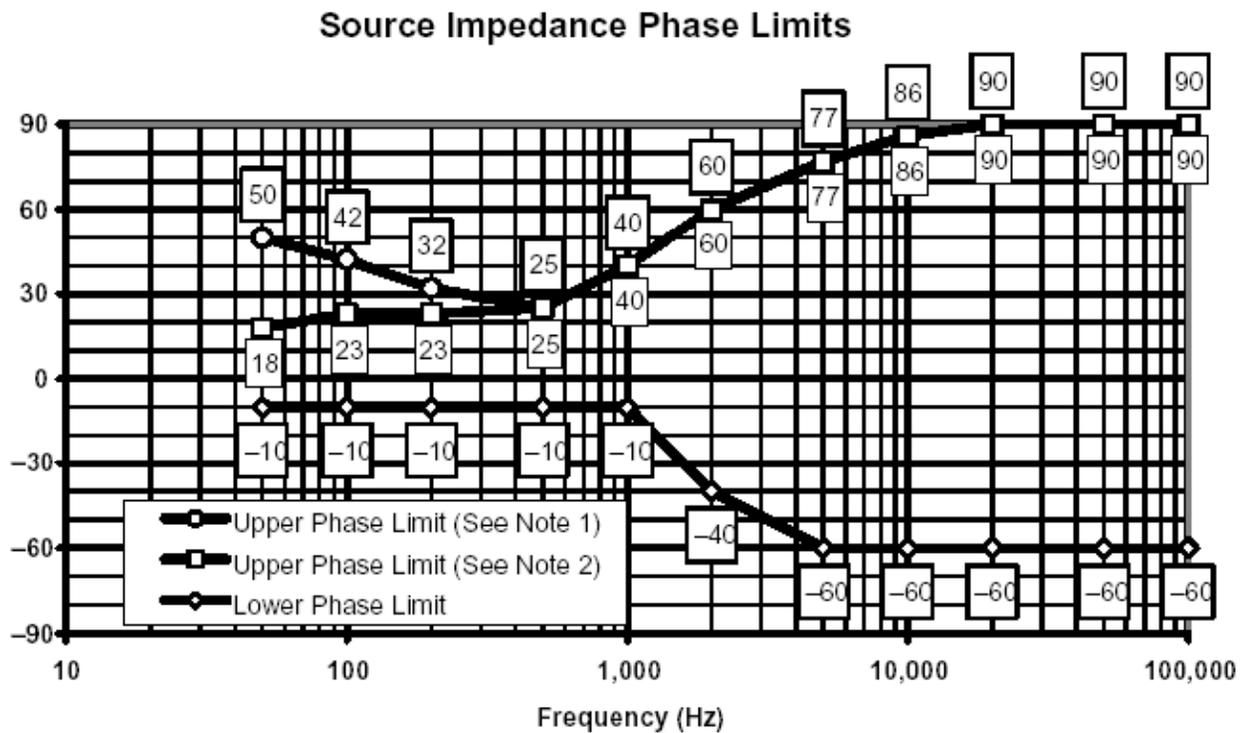


FIGURE 3.2.4.1-4 MCAS SOURCE IMPEDANCE PHASE LIMITS

3.2.4.2 LOAD IMPEDANCE LIMITS

The AMS–02 load impedance magnitude and phase values at the APPI are shown in Figure 3.2.4.2–1 and Figure 3.2.4.2–2.

<TBR 3-7>

FIGURE 3.2.4.2-1 AMS-02 APPI LOAD IMPEDANCE MAGNITUDE

<TBR 3-8>

FIGURE 3.2.4.2-2 AMS-02 APPI LOAD IMPEDANCE PHASE

3.2.5 REMOTE POWER CONTROLLER OVERLOAD LIMIT

The ISS power source will provide protection to the APPI for overload conditions by means of a remote power controller. The overload limitation characteristics of the power feeders are defined in Table 3.2.5-1 and Figure 3.2.5-1. Current limiting protection devices start to limit the current when the current reaches the limiting threshold. The shaded regions in the figures show the current limit regions from the time the protection devices start to control the current within the specified range to the maximum time where the protection device trips and interrupts the current flow. Nominal current ratings are 25 amperes. The current will be controlled to within the limiting level of 27.5 to 30 amperes within 1 millisecond. The current at the MCAS power interface will be controlled to within the limiting level of 13.2 to 14.4 amperes within 1 millisecond. The Remote Power Controller (RPC) will trip if the current remains in the limiting region up to the decision time of 34.5 ± 3.5 milliseconds. The AMS-02 overload protection characteristics are defined in Figure 3.2.5-2.

TABLE 3.2.5-1 DETAILED UPSTREAM PROTECTION CHARACTERISTICS

| POWER INTERFACE | MAIN PWR FEEDER | | | AUX PWR FEEDER ⁽¹⁾ | |
|--------------------|--|------------------------------|--------------------------------------|--|--------------------------------------|
| | LOWEST CURRENT LIMITATION LEVEL | MINIMUM TRIP THRESHOLD | MINIMUM* TRIP DECISION TIME | LOWEST CURRENT LIMITATION LEVEL | MINIMUM* TRIP DECISION TIME |
| S3 PAS | 27.5A | 27.5A | 31ms | 27.5A | 31ms |
| P3 UCCAS | 27.5A | 27.5A | 31ms | 27.5A | 31ms |
| MCAS | 13.2A | 13.2A | 31ms | 13.2A | 31ms |

Note (1): Trip decision time at or above limiting/trip threshold (27.5A to 30.0A)

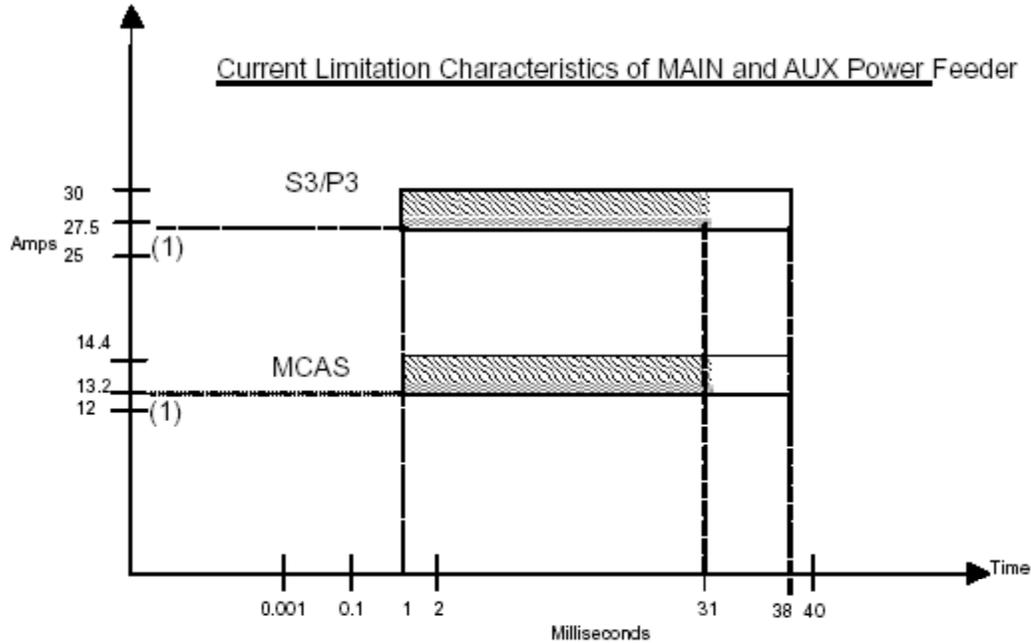


FIGURE 3.2.5-1 ITS S3 OVERLOAD PROTECTION CHARACTERISTICS

<TBR 3-9>

FIGURE 3.2.5-2 OVERLOAD PROTECTION CHARACTERISTICS OF AMS-02
 DOWNSTREAM CIRCUITS

3.2.6 ELECTRICAL POWER CONSUMING EQUIPMENT (EPCE) INTERFACE WITH THE APPI

The AMS-02 power consumption and current draw is defined in Table 3.2.6-1. The AMS-02 surge current is illustrated in Figure 3.2.6-1 and the electrical schematics are provided in Figure 3.2.6-2.

TABLE 3.2.6-1 AMS-02 POWER CONSUMPTION

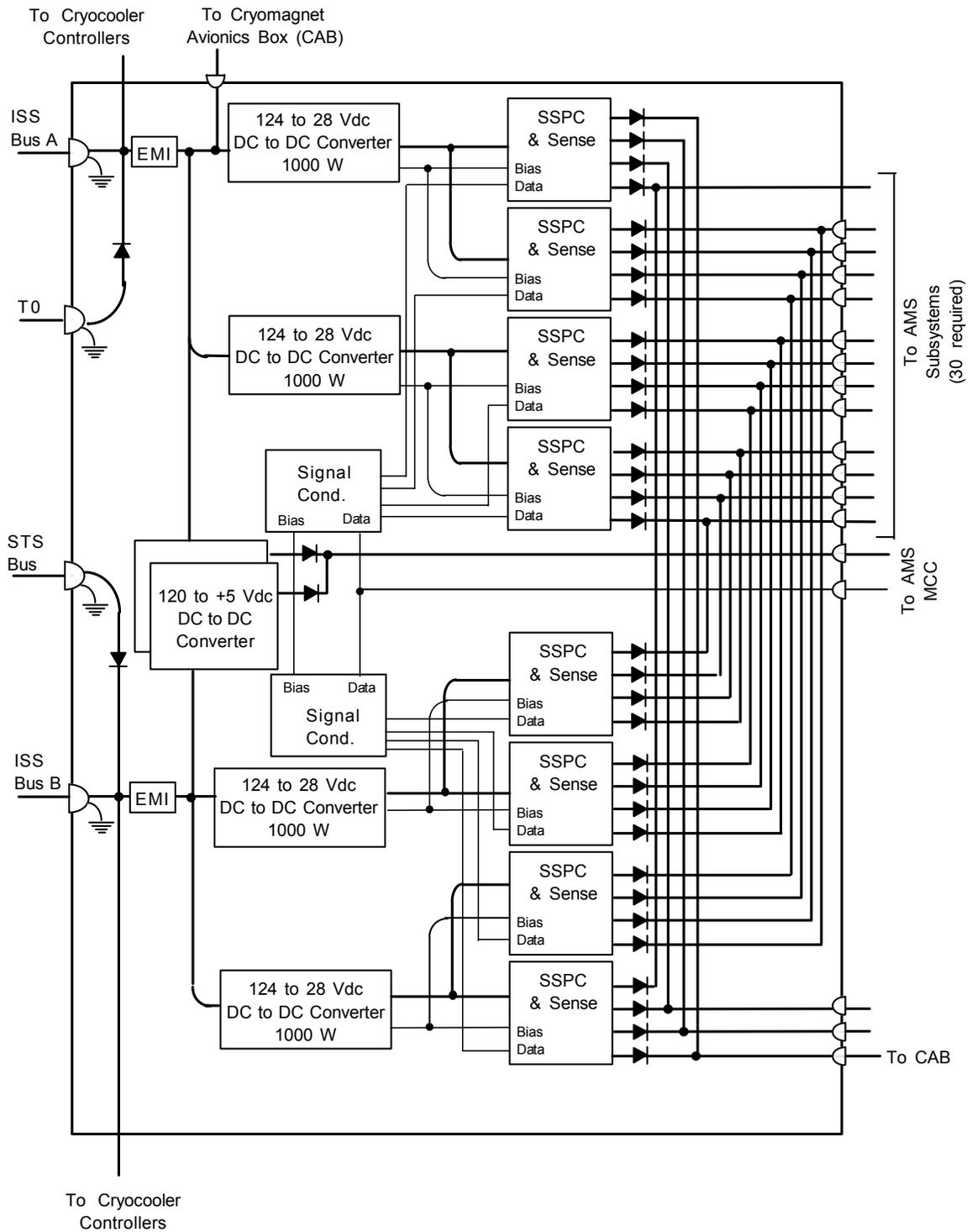
| On-Orbit Interfaces | POWER (WATTS) MAIN FEED | | | POWER (WATTS) AUXILIARY FEED | | |
|---------------------|-------------------------|----------|------------|------------------------------|----------|------------|
| | Peak | Max Cont | Keep Alive | Peak | Max Cont | Keep Alive |
| SRMS | 0 | 0 | 0 | 0 | 0 | 0 |
| SSRMS | 0 | 0 | 0 | 0 | 0 | 0 |
| MCAS | N/A | N/A | N/A | N/A | N/A | N/A |
| S3 PAS | 2300 | 2000 | 1500 | 2300* | 2000* | 1500* |
| P3 UCCAS | N/A | N/A | N/A | N/A | N/A | N/A |

Notes:

1. Peak power is defined as the highest power requirement lasting greater than 50 milliseconds.
2. Max Continuous power is defined as the steady state power condition
3. Keep Alive power is defined as the lowest uninterrupted power requirement to the attached payload without damage to the attached payload.
4. The above Power Consumption figures do not include power necessary to run heaters on External Berthing Camera System (EBCS)
5. **AMS-02 IS DESIGNED TO OPERATE FROM EITHER PRIMARY BUS OR AUXILIARY BUS, OR BOTH, AS REQUIRED BY ATTACHED PAYLOAD** IRD, SSP-57003.
6. Nominally AMS-02 will be attached to the S3 zenith inboard PAS; requirements for contingency stow on any other site (including P3) will be the same.

<TBR 3-10>

FIGURE 3.2.6-1 AMS-02 SURGE CURRENT



Power Distribution Box

FIGURE 3.2.6-2 AMS-02 ELECTRICAL SCHEMATIC (1 OF 2)

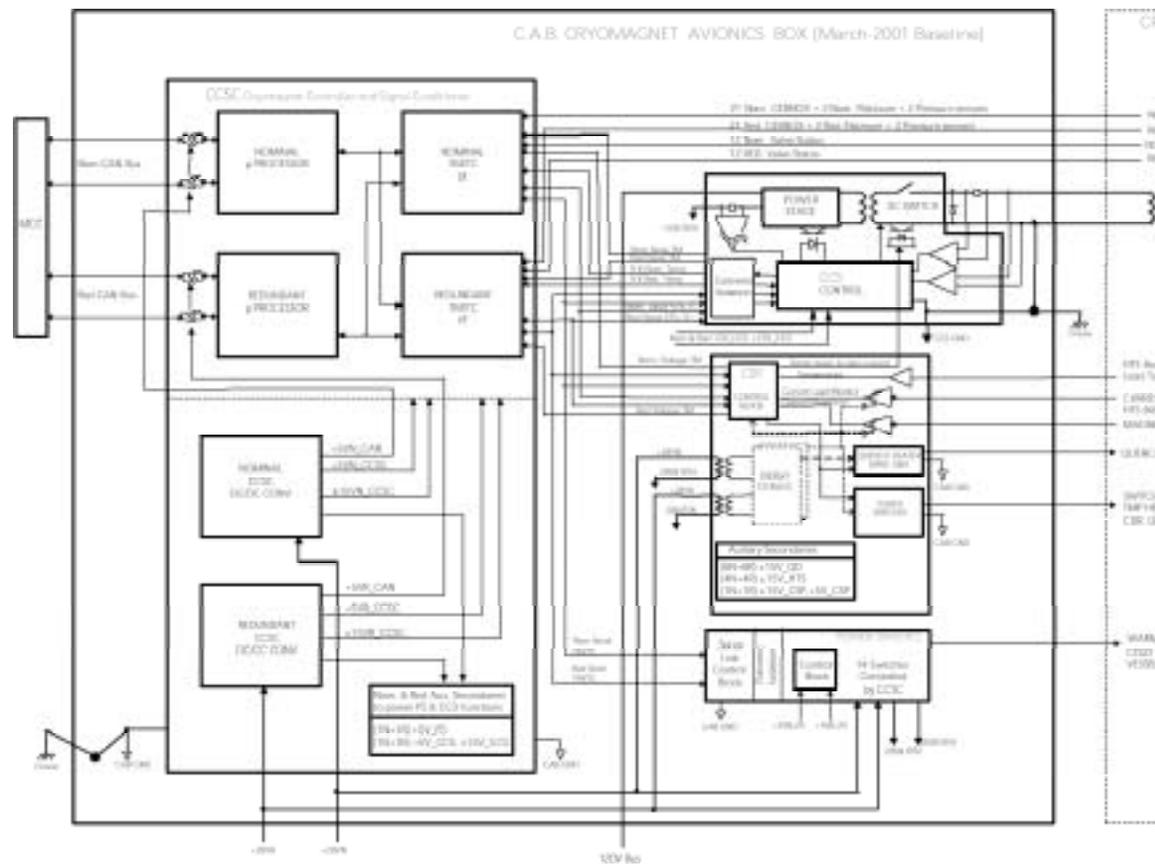


FIGURE 3.6.2-2 AMS-02 ELECTRICAL SCHEMATIC (2 OF 2)

3.3 COMMAND AND DATA HANDLING INTERFACES

Each PAS site provides connections to the ISS MIL-STD-1553, Digital Time Division Command/Response Multiplex Data Bus, and High Rate Data Link (HRDL) systems through the UMA. The AMS-02 receives command and control signals via the active UMA. Each UMA has a single redundant MIL-STD-1553 data bus (two channels where only one channel is active at a time), and two HRDL fiber optic channels (transmit and receive).

3.3.1 MIL-STD-1553 LOW DATA RATE LINK

PAS/UCCAS provides a MIL-STD-1553 transmit and receive data interface at the UMA interface to support low rate telemetry, and health and status data communications for Attached Payloads. The Attached Payload represents a single Remote Terminal (RT) to the ISS MIL-STD-1553 Bus.

3.3.1.1 MIL-STD-1553 LRDL CONNECTOR/PIN ASSIGNMENTS

The AMS-02 interfacing with MIL-STD-1553 Bus to transmit data and/or receive commands utilizes the connector and pin assignments for the UMA in accordance with Table 3.2.1-1.

3.3.1.2 LRDL CABLING

The AMS-02 MIL-STD-1553 internal wiring characteristics are in accordance with SSQ 21655, Cable, Electrical, MIL-STD-1553 Data Bus, Space Quality, General Specification Document for 75 Ohm or equivalent. The AMS-02 MIL-STD-1553 internal wiring characteristics are summarized in Table 3.3.1.2-1.

TABLE 3.3.1.2-1 MIL-STD-1553 CABLE CHARACTERISTICS

| Type | Recommended Payload Twisted Shielded Pair | Attached Payload Twisted Shielded Pair |
|----------------------------------|--|---|
| Characteristic Impedance | 75 ± 5 ohms | 70 ~ 85 ohms |
| Wire Size | 22 AWG or 24 AWG | 22 AWG or 24 AWG |
| Nominal Wire to Wire Capacitance | 66 pf/m | 52.49 pf/m |
| Internal Wiring Stub Length | ≤ 10 feet | ≤ 10 feet |

3.3.2 HIGH DATA RATE LINK

PAS/UCCAS provides two HRDL channels, one for transmitting data and one for receiving data at each PAS UMA interface to support high rate data communications to and from the AMS-02.

3.3.2.1 HRDL CONNECTOR/PIN ASSIGNMENTS

The AMS-02 interfacing with the HRDL utilizes the same passive UMA connector, NUR1-005, as defined in SSQ 21637. The active and passive UMA connectors and pin assignments are shown in Table 3.2.1-1.

3.3.2.2 HRDL CABLING

The AMS-02 HRDL fiber optic cable characteristics are in accordance with SSQ 21654, Cable Single Fiber, Multitude, Space Quality General Specification Characteristics. HRDL input and output characteristics are in accordance with SSP 50184 Appendix C, High Rate Data Link Physical Media, Physical Signaling and Protocol Specifications.

3.4 PASSIVE THERMAL CONTROL INTERFACES

The ITS S3/P3 passive thermal control interfaces are based on thermal analysis using The Boeing Company generated thermal math model provided to NASA in D684-10058-03-01, ISS Thermal Math Model, Volume 3, Book 1. The AMS-02 Payload passive thermal control design will be analyzed using the S3 thermal math model in D684-10058-03-01.

3.4.1 ITS S3 PAS/P3 UCCAS THERMAL INTERFACES

AMS-02 to the PAS/UCCAS interfaces meet all specified requirements when the structural interface temperature is within –120°F and +200°F. The structural interface temperatures between the AMS-02 and the PAS are shown in Table 3.4.1-1.

TABLE 3.4.1-1 AMS-02 AND PAS/UCCAS INTERFACE TEMPERATURES

| Attached Payload PAS/UCCAS | Cold | Hot |
|----------------------------|------------|------------|
| AMS-02 | <TBR 3-11> | <TBR 3-12> |

3.4.2 THERMAL SHADOWING ENVELOPE

ITS S3/P3 reserves an envelope to ensure that thermal shadowing associated with the AMS-02 does not exceed ISS requirements. The operational envelope defines shadowing boundaries. Refer to Figure 3.1.3.1-1.

3.4.3 EXTERNAL SURFACE OPTICAL PROPERTIES

The AMS-02 external optical surface properties are shown in Figure 3.4.3-1 and are contained in Table 3.4.3-1.

<TBR 3-13>

FIGURE 3.4.3-1 AMS-02 EXTERNAL SURFACE OPTICAL PROPERTIES

TABLE 3.4.3-1 AMS-02 EXTERNAL SURFACE OPTICAL PROPERTIES

| Node | Absorptivity (α) BOL | Emissivity (α) BOL | Absorptivity (α) EOL | Emissivity (α) EOL |
|------|----------------------------------|--------------------------------|----------------------------------|--------------------------------|
| | | | | |
| | | <TBR 3-14> | | |
| | | | | |

Legend: BOL = Beginning of Life; EOL = End of Life

3.5 EXTRAVEHICULAR ROBOTICS INTERFACES

3.5.1 GRAPPLE FIXTURE LOCATIONS

The AMS-02 grapple fixtures are located in accordance with Figure 3.5.1–1. The AMS-02 includes two grapple fixtures to facilitate the robotic transfer from the Orbiter to ISS. The FRGF and PVGF will be used to implement the dual arm robotic transfer.

Current operations scenarios call for the SRMS to lift AMS-02 out of the Orbiter’s payload bay using the FRGF. The SRMS will hand off AMS-02 to the SSRMS. The SSRMS will use the PVGF to grapple the AMS-02. Without moving the MT, the SSRMS will place the AMS-02 on the S3 zenith inboard PAS.

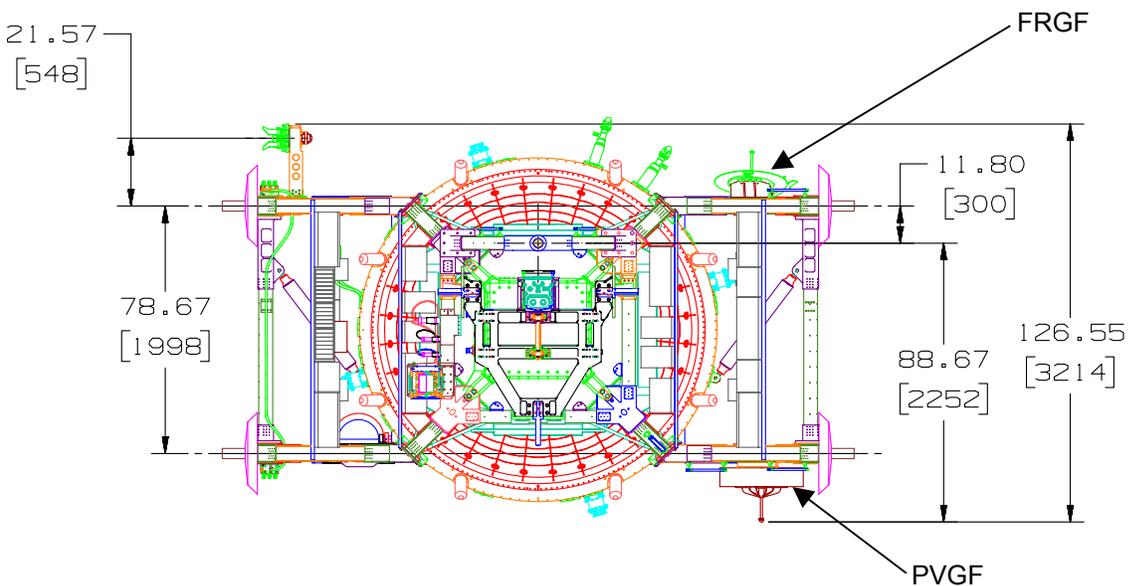


FIGURE 3.5.1-1 AMS-02 GRAPPLE FIXTURE LOCATIONS

3.5.2 SPECIAL DEXTEROUS GRASP FIXTURE LOCATIONS

Not applicable. No Special Dexterous Grasp Fixture(s) (SDGF) are located on AMS-2.

3.6 EXTRAVEHICULAR ACTIVITY INTERFACES

The Attached Payload is designed such that all operations are performed via Extravehicular Robotics (EVR), with contingency EVA capability. While EVR is primary for attached payload installation, the AMS-02 will provide the hardware, translation paths, and appropriate labeling to affect EVA access to AMS-02 hardware in accordance with SSP 50005 and SSP 30256.

3.6.1 EVA AIDS LOCATIONS

The ISS Program and NASA EVA Tool Panel approved and provided certified flight EVA handrails and EVA aids required by the payload in accordance with SSP 57003 and SSP 57061-Revision A. Table 3.6.1-1-1 details the EVA fabricated hardware to support the AMS-02 payload.

TABLE 3.6.3-1 PAYLOAD EVA TOOL AND AIDS

| EVA Flight Equipment | Procured or Program Furnished | Location | Need Date | Duration |
|---|-------------------------------|----------|-----------------------|----------|
| EVA handrail numbers/sizes are: Part Number: SEG33106347-xxx -809 Quantity: 3 (8.47-inches) -811 Quantity: 4 (15.29-inches) -843 Quantity: 2 (25.46-inches) | Procured | PD Site | L-8 months or earlier | N/A |
| The Side-mounted Worksite Interface (WIF) Part Number: SEG33106860-301 Quantity: 1 | Procured | PD Site | L-8 months or earlier | N/A |
| Flight labels, decals, or placards | Program Furnished | PD Site | L-8 months or earlier | N/A |

3.6.2 PAYLOAD EVA AIDS LOCATIONS

EVA aids for AMS-02 contingency operations are shown in Figure 3.6.2-1.

<TBR 3-15>

FIGURE 3.6.2-1 AMS-02 EVA AIDS AND LABEL LOCATIONS

3.6.3 EVA TRANSLATION PATHS

The AMS-02 installation operation was assessed, and violations of the Remote Manipulator System (RMS) Grapple Fixture (GF) approach envelopes and EVA Contingency Release envelopes were found. Violations of the SSRMS 24-inch requirement during AMS-02 installation were also identified.

These violations are severe enough to be brought to the End-to-End Berthing Integration Team (EBIT) for review. The Mission Operations Directorate (MOD) Robotics Section (DX22) and EVA Section (DX3) must also be consulted, and waivers must be granted for all 24-inch violations.

The AMS-02 EVA translation paths with gaps of 24 inches are shown to connect to existing ISS translation paths in Figure 3.6.3-1.

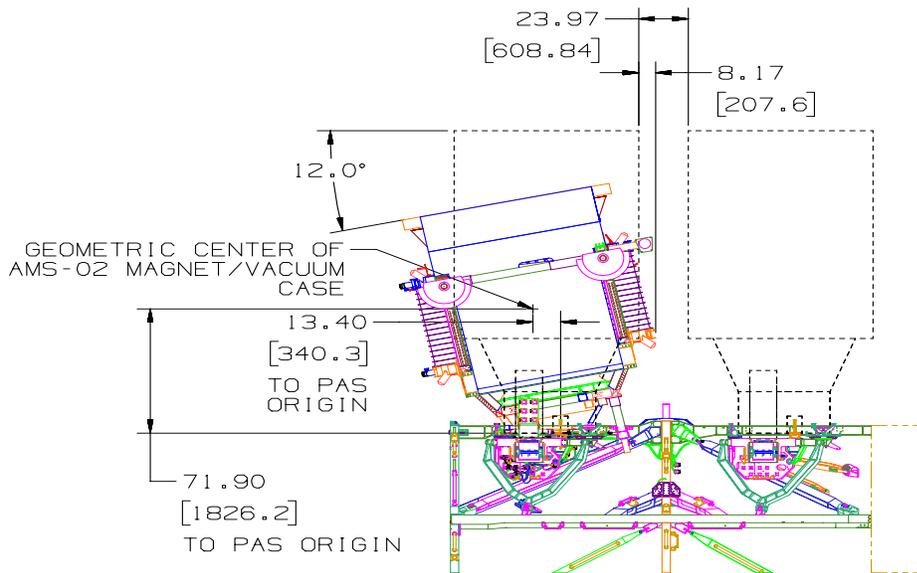


FIGURE 3.6.3-1 AMS-02 EVA TRANSLATION PATHS

3.6.4 DANGER AND WARNING LOCATIONS

The AMS-02 translation and mobility handholds located within three feet of the AMS-02 equipment that poses a critical or catastrophic hazard to the crewmember or to the equipment are identified as shown in Figure 3.6.4-1.

<TBR 3-16)

FIGURE 3.6.4-1 AMS-02 DANGER AND WARNING LOCATIONS

3.7 EXTERNAL BERTHING CAMERA SYSTEM INTERFACES

3.7.1 EBCS AVIONICS PACKAGE MECHANICAL INTERFACE

The EBCS avionics package mounting interface, dimensions and locking insert type are shown in Figure 3.7.1-1.

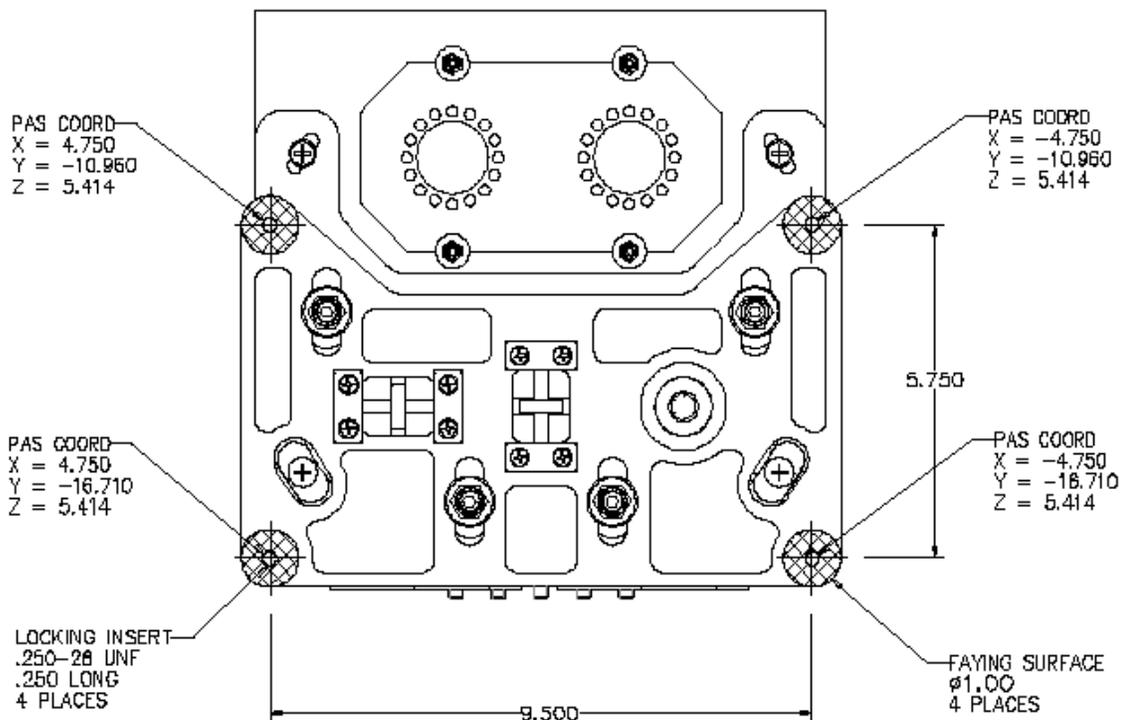
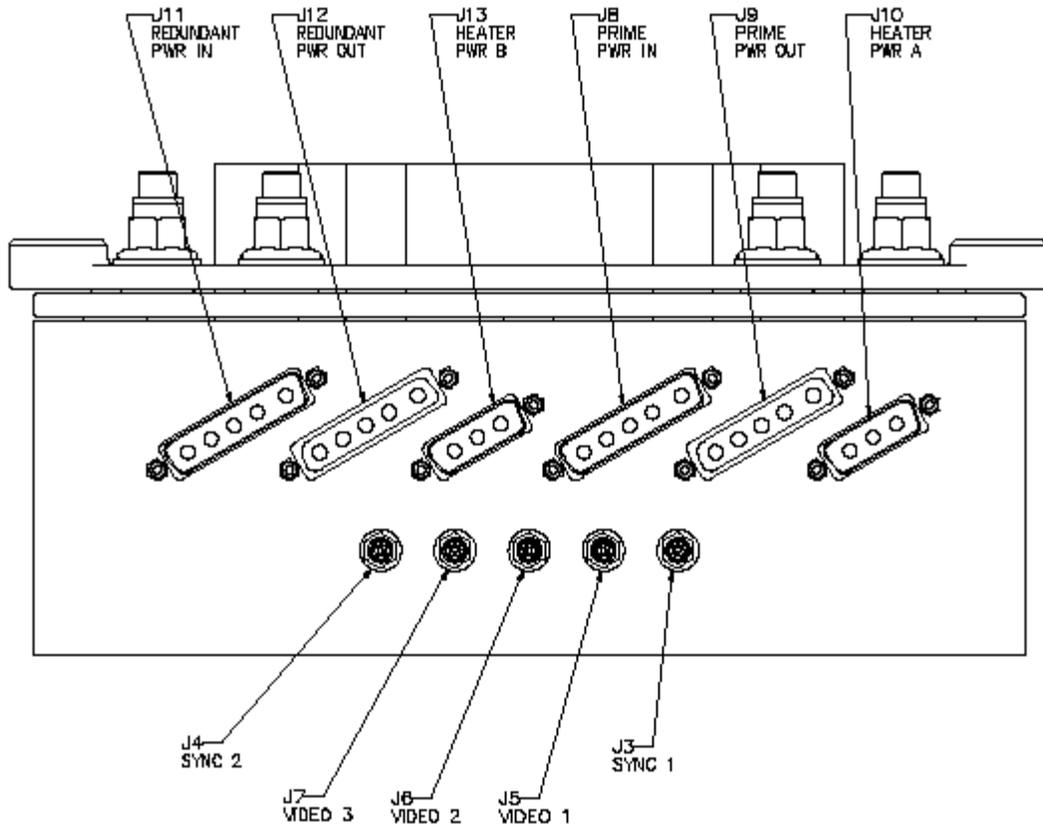


FIGURE 3.7.1-1 EBCS AVIONICS PACKAGE MOUNTING INTERFACE DIMENSIONS

3.7.2 EBCS CONNECTOR INTERFACES

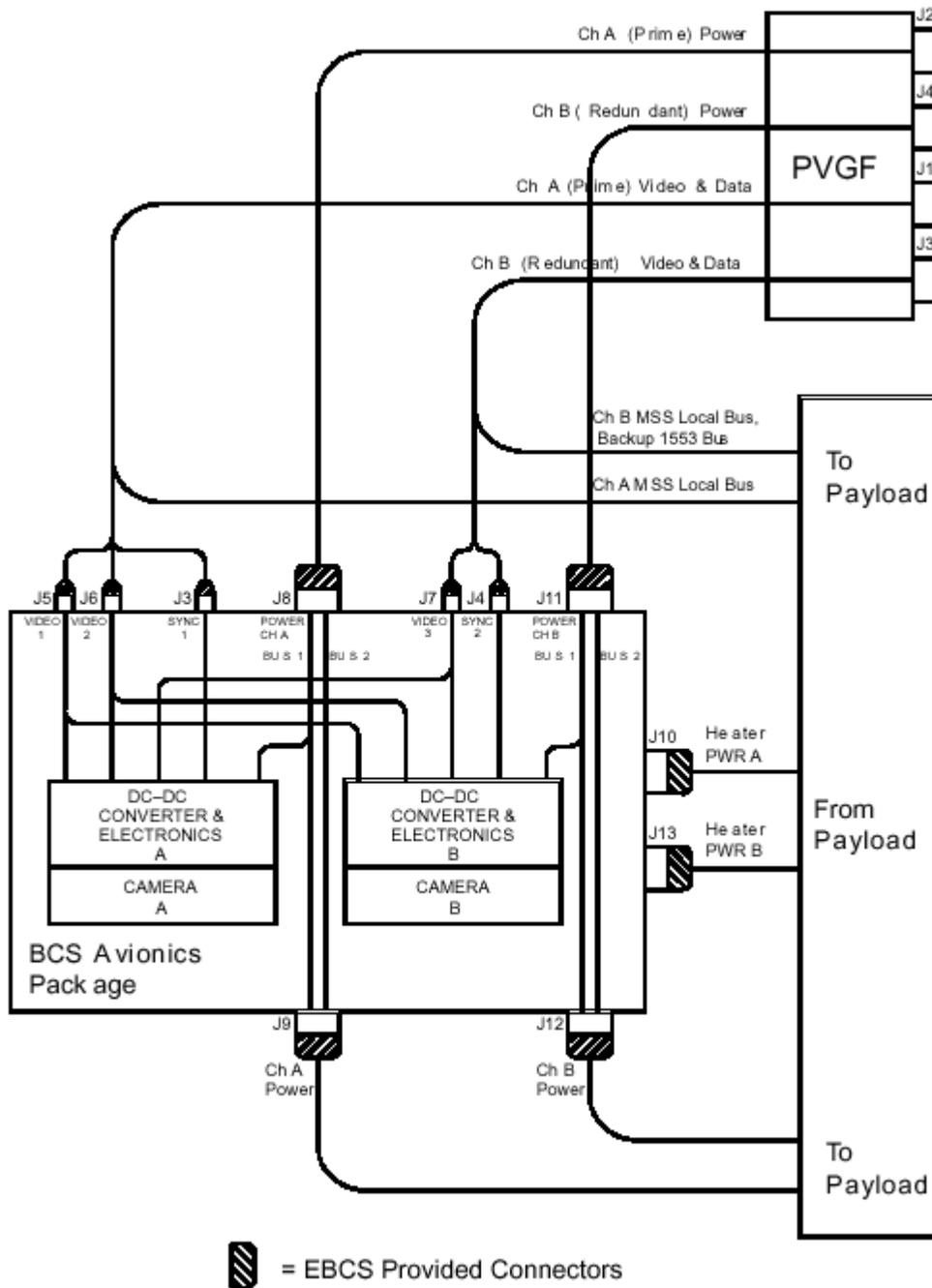
Figure 3.7.2-1 illustrates the primary power channel A, redundant power channel B, heater power A, heater power B, payload power A, payload power B, video 1, video 2, video 3, sync 1 and sync 2 connector locations on the avionics package chassis with respect to the PAS coordinate system. Figure 3.7.2-2 is a functional block diagram of the EBCS.

SSP 57213
Baseline (Draft – June 2003)



| DESIG | DESCRIPTION | X CORD | Y CORD | Z CORD |
|-------|---------------------|--------|---------|--------|
| J11 | Redundant Power In | -2.948 | -17.070 | -5.965 |
| J12 | Redundant Power Out | -1.618 | -17.070 | -5.965 |
| J13 | Heater Power B | -0.664 | -17.070 | -6.182 |
| J8 | Prime Power In | 1.042 | -17.070 | -5.965 |
| J9 | Prime Power Out | 2.372 | -17.070 | -5.965 |
| J10 | Heater Power A | 3.326 | -17.070 | -6.182 |
| J4 | Sync 2 | -1.500 | -17.070 | -7.225 |
| J7 | Video 3 | -0.750 | -17.070 | -7.225 |
| J6 | Video 2 | 0.000 | -17.070 | -7.225 |
| J5 | Video 1 | 0.750 | -17.070 | -7.225 |
| J3 | Sync 1 | 1.500 | -17.070 | -7.225 |

FIGURE 3.7.2-1 EBCS AVIONICS PACKAGE CONNECTOR LOCATIONS



Note: The AMS-02 PVGF pigtail length = 30-feet (does not include connectors at the payload end).

FIGURE 3.7.2-2 EBCS FUNCTIONAL BLOCK DIAGRAM

SSP 57213
Baseline (Draft – June 2003)

Table 3.7.2-1 lists the connector designation and part number, the mating connector part numbers and connector pin outs for primary power channel A, redundant power channel B, heater power A, heater power B, payload power A, payload power B. The table also lists voltage, impedance and connector pin outs for video 1, video 2, video 3, sync 1 and sync 2.

TABLE 3.7.2-1 EBCS CONNECTOR SPECIFICATIONS

| Designation | Manufacturer | Part Number | Pin Pin | Signal Level | Impedance | Mating Connector Pin | Socket Pin | Blockout |
|-------------|---------------------------------|---------------|------------|--------------|-----------|----------------------|------------|------------|
| 21 | Test Pin - Not Assembled | | | | | | | |
| 22 | Test Pin - Not Assembled | | | | | | | |
| 23 | Modulated Video IN Prime | 142-0301-801* | Center | 2V p-p | 80 | AMP P/N 22500-2 | Center | |
| 24 | Modulated Video IN Back-up | 142-0301-801* | Center | 2V p-p | 80 | AMP P/N 22500-2 | Center | |
| 25 | FM output 1 | 142-0301-801* | Center | 2V p-p | 80 | AMP P/N 22500-2 | Center | |
| 26 | FM output 2 | 142-0301-801* | Center | 2V p-p | 80 | AMP P/N 22500-2 | Center | |
| 27 | FM output 3 | 142-0301-801* | Center | 2V p-p | 80 | AMP P/N 22500-2 | Center | |
| 36-1 | Prime Payload Power Bus 1 | AMP 212491-6 | 449176-1 | +120 VDC | | AMP P/N 213095-2 | 213006-1 | 201345-1** |
| 36-2 | Prime Payload Power Bus 1 RIN | | 449176-1 | 120 VDC RIN | | | 213006-1 | |
| 36-3 | SSRMS GND | | 449176-1 | GND | | | 213006-1 | |
| 36-4 | Prime Payload Power Bus 2 | | 449176-1 | +120 VDC | | | 213006-1 | |
| 36-5 | Prime Payload Power Bus 2 RIN | | 449176-1 | 120 VDC RIN | | | 213006-1 | |
| 39-1 | Prime Payload Power Bus 1 | AMP 212059-2 | 445798-1 | +120 VDC | | AMP P/N 212491-6 | 213007-1 | 201345-1** |
| 39-2 | Prime Payload Power Bus 1 RIN | | 445798-1 | 120 VDC RIN | | | 213007-1 | |
| 39-3 | SSRMS GND | | 445798-1 | GND | | | 213007-1 | |
| 39-4 | Prime Payload Power Bus 2 | | 445798-1 | +120 VDC | | | 213007-1 | |
| 39-5 | Prime Payload Power Bus 2 RIN | | 445798-1 | 120 VDC RIN | | | 213007-1 | |
| 39-6 | Prime 120 V Heater Power | AMP 207251-2 | 1-212563-0 | +120 VDC | | AMP P/N 207251-2 | 206793-1 | 201344-1** |
| 39-7 | Prime 120 V Heater Power RIN | | 1-212563-0 | 120 VDC RIN | | | 206793-1 | |
| 39-8 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 39-9 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 39-10 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 39-11 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 39-12 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 39-13 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 39-14 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 39-15 | Prime Channel GND | | 1-212563-0 | Channel GND | | | 206793-1 | |
| 411-1 | Back-up Payload Power Bus 1 | AMP 212491-6 | 449176-1 | +120 VDC | | AMP P/N 213095-2 | 213006-1 | 201345-1** |
| 411-2 | Back-up Payload Power Bus 1 RIN | | 449176-1 | 120 VDC RIN | | | 213006-1 | |
| 411-3 | SSRMS GND | | 449176-1 | GND | | | 213006-1 | |
| 411-4 | Back-up Payload Power Bus 2 | | 449176-1 | +120 VDC | | | 213006-1 | |
| 411-5 | Back-up Payload Power Bus 2 RIN | | 449176-1 | 120 VDC RIN | | | 213006-1 | |
| 412-1 | Back-up Payload Power Bus 1 | AMP 212059-2 | 445798-1 | +120 VDC | | AMP P/N 212491-6 | 213007-1 | 201345-1** |
| 412-2 | Back-up Payload Power Bus 1 RIN | | 445798-1 | 120 VDC RIN | | | 213007-1 | |
| 412-3 | SSRMS GND | | 445798-1 | GND | | | 213007-1 | |
| 412-4 | Back-up Payload Power Bus 2 | | 445798-1 | +120 VDC | | | 213007-1 | |
| 412-5 | Back-up Payload Power Bus 2 RIN | | 445798-1 | 120 VDC RIN | | | 213007-1 | |
| 413-1 | Back-up 120 V Heater Power | AMP 207251-2 | 1-212563-0 | +120 VDC | | AMP P/N 207251-2 | 206793-1 | 201344-1** |
| 413-2 | Back-up 120 V Heater Power RIN | | 1-212563-0 | 120 VDC RIN | | | 206793-1 | |
| 413-3 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 413-4 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 413-5 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 413-6 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 413-7 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 413-8 | No Contact | | 1-212563-0 | | | | 206793-1 | |
| 413-9 | Back-up Channel GND | | 1-212563-0 | Channel GND | | | 206793-1 | |

*Johnson Components
 **Position, modified by MDR

4.0 APPLICABILITY MATRIX

4.1 PURPOSE

The purpose of the Applicability Matrix is to define and control the design of interfaces and verification requirements between the ISS and the AMS-02 Payload. The attached payload interfaces are defined by direct reference to the corresponding sections and subsections of SSP 57003, Attached Payload IRD. The AMS-02 Mission Manager and the ISS Payloads Office must mutually disposition each IRD paragraph and record that disposition in an applicability matrix contained in Section 4.2 of this document. The documented applicability matrix for the unique payload also serves as the verification requirements matrix for this payload.

4.2 ORGANIZATION – UNPRESSURIZED INTERFACE REQUIREMENTS

In Table 4.2–1, Applicability Matrix, the numbers and headings are directly referenced to the sections and subsections of the SSP 57003. The entries in Table 4.2-1 that are shaded are titles that are included for reference only and are not required to be dispositioned. Figure 4.2-1 defines the information that is addressed by each column in Table 4.2-1.

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Sub-pallet Payload Changeout Verification | Comments |
|---------------|-----------------|-----------------------|---------|-------------------------|----------------|---|----------|
| Block A | Block B | Block C | Block D | Block E | Block F | Block G | Block H |

FIGURE 4.2-1 EXAMPLE APPLICABILITY/VERIFICATION MATRIX

Block A - Contains the SSP 57003, IRD Section 3 and Section 4 requirement numbers.

Block B - Contains the SSP 57003, IRD Section 3 requirement title.

Block C - Each paragraph of the SSP 57003, IRD shall be dispositioned in the “Payload Applicability” column with one of the following:

SSP 57213

Baseline

- A Applicable to this ICD, indicating that the referenced interface is utilized by the integrated payload hardware item.
- N/A Not Applicable to this ICD, indicating that the integrated payload hardware item does not utilize the referenced interface.
- E-## Exception with the exception identifier (reference) number ## as listed in the “Exceptions” table.

Block D - Contains the SSP 57003, IRD Section 4 verification method.

- Note: Requirements with “Safety” in the method column are satisfied by the submittal of a Certificate of Compliance (COC) letter documenting the closure of all applicable hazard reports.

Block E - Contains the data submittal that is required by OZ3/Payload Engineering & Integration (PEI).

Block F - Contains the date the submittal data is required by OZ3/PEI (In Launch minus month format.).

Block G - Identifies the verification method used to address the requirement when a sub-pallet payload is changed out within a pallet that remains on-orbit.

- Note: Block G is not applicable (N/A) to the AMS-02 payload which is an integrated standalone payload with no sub-pallet type payloads. Therefore, Block G is deleted from Table 4.2.1-1.

Block H - Used for any relevant comments that need to be added.

Legend - Table 4.2.1-1 Notes:

T – Test

A – Analysis

I – Inspection

D – Demonstration

E – Exception

SSP 57213
Baseline

4.2.1 CROSS-REFERENCE MATRIX – UNPRESSURIZED SSP 57003

This section contains the Applicability Matrix, Table 4.2.1-1, for SSP 57260 and Verification Data Sheet (VDS) Traceability Matrix.

TABLE 4.2.1-1 APPLICABILITY MATRIX

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|---|-----------------------|--------|--|----------------|-------------------------------|
| 3.0/ 4.3.0 | INTERFACE REQUIREMENTS | | TITLE | N/A | N/A | |
| 3.1/ 4.3.1 | Structural/Mechanical and Microgravity Interface Requirements | | NVR | NVR | | |
| 3.1.1/ 4.3.1.1 | General Design Requirements | A | I | Certificate of Compliance | L-3.5 | |
| 3.1.1.1/ 4.3.1.1.1 | SAFETY CRITICAL STRUCTURES | | TITLE | N/A | N/A | |
| 3.1.1.1.1/ 4.3.1.1.1.1 | Fail-Safe, Safe-Life, or Low-Risk Fracture Parts | A | A | Data Certificate providing a fracture control summary | L-7.5 | Stress Analysis |
| 3.1.1.1.2/ 4.3.1.1.1.2 | Fracture Control | A | I | Data Certificate providing a fracture control summary | L-7.5 | Stress Analysis |
| 3.1.1.1.3/ 4.3.1.1.1.3 | Meteoroid and Orbital Debris Protection Requirement for External Payloads | A | A&T | Certificate of Compliance | L-3.5 | Analysis Report & Test Report |
| 3.1.1.2/ 4.3.1.1.2 | INTERFACE LOADS | | NVR | NVR | | |
| 3.1.1.2.1/ 4.3.1.1.2.1 | Margins of Safety | A | I | Data Certificate providing a summary listing all operational modes analyzed and showing positive margins of safety | L-7.5 | Inspection Report |
| 3.1.1.2.2/ 4.3.1.1.2.2 | Factor(s) of Safety | A | I | Data Certificate providing a summary of safety for | 1. 7-5 | Inspection Report |

**SSP 57213
Baseline**

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|------------------------------------|-----------------------|--------|--|----------------------|--|
| | | | | <p>all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available.</p> <p>2. Data Certificate providing a summary of safety for all SCS) identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results.</p> | 2. L-5 | |
| 3.1.1.2.3-A/ 4.3.1.1.2.3-A | Design Loads – External to Payload | A | A or T | <p>Data Certificate providing a summary of safety for all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available.</p> <p>2. Data Certificate providing a summary of safety for all SCS) identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results.</p> | 1. 7-5 2. L-5 | Structural Analysis of Interface Loads & Test Report |
| 3.1.1.2.3-B/ 4.3.1.1.2.3-B | Design Loads – Internal to Payload | A | A or T | Data Certificate providing a summary of safety for | 1. 7-5 | Structural Analysis of Interface Loads & Test |

**SSP 57213
Baseline**

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|--------------------------|-----------------------|--------|---|----------------------|--|
| | | | | <p>all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available.</p> <p>2. Data Certificate providing a summary of safety for all SCS) identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results.</p> | 2. L-5 | Report |
| 3.1.1.2.4/ 4.3.1.1.2.4 | PAYLOAD BERTHING | | TITLE | N/A | N/A | |
| 3.1.1.2.4.1/ 4.3.1.1.2.4.1 | Guide Pin Contact Forces | A | A | <p>Data Certificate providing a summary of safety for all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available.</p> <p>2. Data Certificate providing a summary of safety for all SCS identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results.</p> | 1. 7-5 2. L-5 | Structural Analysis of Interface Loads |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|----------------------------|-----------------------|--------|--|-----------------------------|--|
| 3.1.1.2.4.2/ 4.3.1.1.2.4.2 | Capture Bar Contact Forces | A | A | <p>Data Certificate providing a summary of safety for all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available.</p> <p>2. Data Certificate providing a summary of safety for all SCS) identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results.</p> | <p>1. 7-5</p> <p>2. L-5</p> | Structural Analysis of Interface Loads |
| 3.1.1.2.5/ 4.3.1.1.2.5 | Thermal effects | A | A | <p>Data Certificate providing a summary of safety for all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available.</p> <p>2. Data Certificate providing a summary of safety for all SCS) identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results.</p> | <p>1. 7-5</p> <p>2. L-5</p> | Structural Analysis of Interface Loads |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|----------------------------|---|-----------------------|--------|---|----------------|--|
| 3.1.1.2.6/ 4.3.1.1.2.6 | Extravehicular Activity On-Orbit Induced Loads | A | A | Certificate of Compliance | L-7.5 | Analysis of induced loads approved by PSRP & EVA AIT |
| 3.1.1.3/ 4.3.1.1.3 | Design Service Life | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.1.1.4/ 4.3.1.1.4 | Operational Lifetime | | NVR | NVR | | |
| 3.1.1.5/ 4.3.1.1.5 | Interchangeability | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.1.1.6/ 4.3.1.1.6 | Attached Payload Interface Durability | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.1.1.7-A/ 4.3.1.1.7-A | Structural Materials Criteria and Selection – Mechanical Properties | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.1.1.7-B/ 4.3.1.1.7-BA | Structural Materials Criteria and Selection – Material Selection | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.1.1.8/ 4.3.1.1.8 | Structural Degradation from Material Erosion | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.1..2 4.3.1.2 | Structural/Mechanical Interface with the Mobile Servicing System | | NVR | NVR | | |
| 3.1.2.1/ 4.3.1.2.1 | Structural Design Interface | A | A | 1. Preliminary Data Certificate based on static analysis using approved Finite Element Model (FEM) (or Design Coupled Loads (DCL) analysis results), providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified. | 1. L-7.5 | Analysis Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|--|-----------------------|--------|--|----------------|---|
| | | | | 2. Final Data Certificate providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified. (Attachment force can be obtained from the results of the Verification Coupled Loads (VCL.)). | 2. L-5 | |
| 3.1.2.2/ 4.3.1.2.2 | Mechanical Design Interface | A | I&T | Certificate of Compliance | L-3.5 | Inspection & Test with ACAS Simulator & IVT 3/11/03 |
| 3.1.2.3-A/ 4.3.1.2.3-A | Mass and Envelope Dimensions – Total Mass | A | T | Certificate of Compliance | L-3.5 | Weight Test @ KSC On-line Ground Operations Payload Processing |
| 3.1.2.3-B/ 4.3.1.2.3-B | Mass and Envelope Dimensions – Envelope | A | E-1 | Certificate of Compliance | L-3.5 | Weight & CG Test @ KSC On-line Ground Operations Payload Processing |
| 3.1.3/ 4.3.1.3 | Structural/Mechanical Interface with the Integrated Truss Segment S3 Payload Attach System and Integrated Truss Segment P3 Unpressurized Cargo Carrier Attach System | | NVR | NVR | | |
| 3.1.3.1/ 4.3.1.3.1 | STRUCTURAL/MECHANICAL | | TITLE | N/A | N/A | |
| 3.1.3.1.1/ 4.3.1.3.1.1 | PHYSICAL ENVELOPE REQUIREMENTS | | TITLE | N/A | N/A | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.1.3.1.1.1/ 4.3.1.3.1.1.1 | Payload Attach System/ Unpressurized Logistics Carrier Attach System On- Orbit Operational Envelope | A | E-2 | Certificate of Compliance | L-3.5 | Inspection @ KSC On- line Ground Operations Payload Processing |
| 3.1.3.1.1.2/ 4.3.1.3.1.1.2 | Interface Plane Protrusion | A | E-3 | Certificate of Compliance | L-3.5 | Inspection @ KSC On- line Ground Operations Payload Processing |
| 3.1.3.1.1.3-A/ 4.3.1.3.1.1.3-A | Extravehicular Activity/Robotics Operational Envelope – EVA | A | E-4 | Certificate of Compliance | L-3.5 | MAGIK Analysis & Inspection @ KSC On- line Ground Operations Payload Processing |
| 3.1.3.1.1.3-B/ 4.3.1.3.1.1.3-B | Extravehicular Activity/Robotics Operational Envelope – Robotics | A | E-5 | Certificate of Compliance | L-3.5 | End-to-End Berthing AIT (EBIT) Analysis & Inspection @ KSC On- line Ground Operations Payload Processing |
| 3.1.3.1.2/ 4.3.1.3.1.2 | MASS PROPERTIES AND CENTER OF GRAVITY | | TITLE | N/A | N/A | |
| 3.1.3.1.2.1/ 4.3.1.3.1.2.1 | Payload Attach System Coordinate System Origin Location | A | I | Certificate of Compliance | L-3.5 | Analysis Report & Inspection |
| 3.1.3.1.2.2/ 4.3.1.3.1.2.2 | Mass and Center of Gravity | A | I | Certificate of Compliance | L-3.5 | Weight & CG Test @ KSC On-line Ground Operations Payload Processing |
| 3.1.3.1.3/ 4.3.1.3.1.3 | Attached Payload Fundamental Frequency | A | A or T | Certificate of Compliance | L-7.5 | Certificate based on static analysis using approved Finite Element Model (FEM) |
| 3.1.3.1.3.1/ 4.3.1.3.1.3.1 | Interface Preload | A | A&T | Certificate of Compliance | L-3.5 | Analysis & Test & IVT 3/11/03 |
| 3.1.3.1.3.2/ 4.3.1.3.1.3.2 | Interface Stiffness | A | T | Certificate of Compliance | L-3.5 | Test & IVT 3/11/03 |
| 3.1.3.2/ 4.3.1.3.2 | Mechanical Interface | | NVR | NVR | | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|--|------------------------|---|
| 3.1.3.2.1-A/ 4.3.1.3.2.1-A | Extravehicular Activity Releasable Capture Bar | A | I | Certificate of Compliance | L-3.5 | Inspection & IVT 3/11/03 & NBL Demonstration |
| 3.1.3.2.1-B/ 4.3.1.3.2.1-B | Extravehicular Activity Releasable Capture Bar – Design | A | A | Certificate of Compliance | L-3.5 | Inspection & IVT 3/11/03 & NBL Demonstration |
| 3.1.3.2.1-C/ 4.3.1.3.2.1-C | Extravehicular Activity Releasable Capture Bar – Preload | A | T | Certificate of Compliance | L-3.5 | ACAS Simulator & IVT 3/11/03 |
| 3.1.3.2.2-A/ 4.3.1.3.2.2-A | Guide Pins | A | A | Certificate of Compliance | L-3.5 | ACAS Simulator & IVT 3/11/03 |
| 3.1.3.2.2-B/ 4.3.1.3.2.2-B | Guide Pins – Design | A | T | Certificate of Compliance | L-3.5 | ACAS Simulator & IVT 3/11/03 |
| 3.1.3.2.3-A/ 4.3.1.3.2.3-A | Passive Umbilical Mechanism Assembly – Part Selection | A | A&I | Certificate of Compliance | L-3.5 | Procured GEF from NASA & NASA Certified |
| 3.1.3.2.3-B/ 4.3.1.3.2.3-B | Passive Umbilical Mechanism Assembly – EVA Access | A | A&I | Certificate of Compliance | L-3.5 | Analysis & Inspection & IVT 3/11/03 & NBL Demonstration |
| 3.1.3.2.3.1-A/ 4.3.1.3.2.3.1-A | Passive UMA Mounting – Location | A | A | 1. Preliminary Data Certificate based on static analysis using approved Finite Element Model (FEM) (or Design Coupled Loads (DCL) analysis results), providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified. 2. Final Data Certificate providing the interface attach point forces and | 1. L-3.5 2. L-5 | Analysis Report |

**SSP 57213
Baseline**

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|----------------------------------|-----------------------|--------|---|----------------------|-----------------|
| | | | | margins of safety calculations based on the allowable limits as specified. (Attachment force can be obtained from the results of the Verification Coupled Loads (VCL.)). | | |
| 3.1.3.2.3.1-B/ 4.3.1.3.2.3.1-B | Passive UMA Mounting – Loads | A | A | Data Certificate providing a summary of safety for all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available. 2. Data Certificate providing a summary of safety for all SCS) identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results. | 1. 7-5 2. L-5 | Analysis Report |
| 3.1.3.2.3.1-C/ 4.3.1.3.2.3.1-C | Passive UMA Mounting – Stiffness | A | A | Data Certificate providing a summary of safety for all safety critical structures (SCS) identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results re not available. | 1. 7-5 | Analysis Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------------|---|-----------------------|--------|--|----------------|---|
| | | | | 2. Data Certificate providing a summary of safety for all SCS) identified in accordance with SSP 52005 using loads validated by the Verification Loads Analysis (VLA) results. | 2. L-5 | |
| 3.1.3.2.3.1-D/ 4.3.1.3.2.3.1-D | Passive UMA Mounting – Temperature | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.1.3.2.4-A/ 4.3.1.3.2.4-A | Mechanical Stop Design – Strength | N/A | N/A | N/A | N/A | No gimbaled or other mechanical actuating devices |
| 3.1.3.2.4-B/ 4.3.1.3.2.4-B | Mechanical Stop Design – Duty Cycles | N/A | N/A | N/A | N/A | No gimbaled or other mechanical actuating devices |
| 3.1.3.2.5/ 4.3.1.3.2.5 | Safety Interlocks | N/A | N/A | N/A | N/A | No gimbaled or other mechanical actuating devices |
| 3.1.3.2.6/ 4.3.1.3.2.6 | MICROGRAVITY | | NVR | NVR | | |
| 3.1.3.2.6.1/ 4.3.1.3.2.6.1 | Limit Quasi-Steady Accelerations | N/A | N/A | N/A | N/A | Not applicable to ITS attached payloads |
| 3.1.3.2.6.2/ 4.3.1.3.2.6.2 | Limit Vibratory and Transient Accelerations | | TITLE | N/A | N/A | |
| 3.1.3.2.6.2.1/ 4.3.1.3.2.6.2.1 | Vibratory Requirements | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.1.3.2.6.2.2A/ 4.3.1.3.2.6.2.2A | Transient Requirements – Force Limit | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.1.3.2.6.2.2B/ 4.3.1.3.2.6.2.2B | Transient Requirements – Peak Force Limit | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.1.3.2.6.3/ 4.3.1.3.2.6.3 | Angular Momentum Limits | | NVR | NVR | N | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|---|-----------------------|--------|---------------------------|----------------|---|
| 3.1.3.2.6.3.1/ 4.3.1.3.2.6.3.1 | Limit Disturbance Induced ISS Attitude Rate | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.1.3.2.6.3.2/ 4.3.1.3.2.6.3.2 | Limit Disturbance Induced CMG Momentum Usage | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.1.3.2.7/ 4.3.1.3.2.7 | Contact Surfaces | A | I | Certificate of Compliance | L-3.5 | Inspection @ KSC |
| | INTERFACE WITH SPACE STATION EXTRAVEHICULAR ROBOTICS | | TITLE | N/A | N/A | |
| 3.1.4.1/ 4.3.1.4.1 | Interface with NSTS Remote Manipulator System and Space Station Remote Manipulator System | A | A | Certificate of Compliance | L-7.5 | MAGIK Analysis & EBIT Analysis |
| 3.1.4.1.1/ 4.3.1.4.1.1 | Grapple Fixture Locations | A | A&I | Certificate of Compliance | L-3.5 | Inspection @ KSC & MAGIK Analysis & EBIT Analysis |
| 3.1.4.1.2/ 4.3.1.4.1.2 | Grapple Fixture Structural Support | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.1.4.2/ 4.3.1.4.2 | Interface with Special Purpose Dexterous Manipulator | N/A | N/A | N/A | N/A | No SPDM Interface |
| 3.1.4.2.1-A/ 4.3.1.4.2.1-A | Special Purpose Dexterous Manipulator Fixture Locations – Stabilization Aids | N/A | N/A | N/A | N/A | No SPDM Interface |
| 3.1.4.2.1-B/ 4.3.1.4.2.1-B | Special Purpose Dexterous Manipulator Fixture Locations –Loads | N/A | N/A | N/A | N/A | No SPDM Interface |
| 3.1.4.2.2/ 4.3.1.4.2.2 | Special Purpose Dexterous Manipulator Fixture Structural Support | N/A | N/A | N/A | N/A | No SPDM Interface |
| 3.2/ 4.3.2 | ELECTRICAL INTERFACE REQUIREMENTS | | TITLE | N/A | N/A | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.2.1/ 4.3.2.1 | Electrical Interface with Mobile Servicing System MCAS | | NVR | NVR | | |
| 3.2.2/ 4.3.2.2 | Electrical Power Interface with the Integrated Truss Segment S3 Payload Attach System and P3 Unpressurized Cargo Carrier Attach System | | NVR | NVR | | |
| 3.2.2.1/ 4.3.2.2.1 | Electrical Power Characteristics | | NVR | NVR | | |
| 3.2.2.1.1/ 4.3.2.2.1.1 | Steady-State Voltage Characteristics | A | T | Certificate of Compliance | L-3.5 | PRCU Test Report |
| 3.2.2.1.2/ 4.3.2.2.1.2 | RIPPLE VOLTAGE CHARACTERISTICS | | TITLE | N/A | N/A | |
| 3.2.2.1.2.1/ 4.3.2.2.1.2.1 | Ripple Voltage and Noise | A | T | Certificate of Compliance | L-3.5 | PRCU Test Report with plot of input voltage versus frequency |
| 3.2.2.1.2.2/ 4.3.2.2.1.2.2 | Ripple Voltage Spectrum | A | T | Certificate of Compliance | L-3.5 | PRCU Test Report |
| 3.2.2.1.3/ 4.3.2.2.1.3 | TRANSIENT VOLTAGES | | TITLE | N/A | N/A | |
| 3.2.2.1.3.1/ 4.3.2.2.1.3.1 | Normal Transient Voltages | A | A or T | Certificate of Compliance | L-3.5 | Test Report |
| 3.2.2.1.3.2/ 4.3.2.2.1.3.2 | Fault Clearing and Protection | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.2.2.1.3.3-A/ 4.3.2.2.1.3.3-A | Interface C Non-Normal Voltage Range – Overvoltage | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.2.2.1.3.3-B/ 4.3.2.2.1.3.3-B | Interface C Non-Normal Voltage Range – Undervoltage | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.2.2.2/ 4.3.2.2.2 | ELECTRICAL POWER INTERFACE | | TITLE | N/A | N/A | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|---|-----------------------|--------------|---------------------------|----------------|--|
| 3.2.2.2.1-A/ 4.3.2.2.2.1-A | Attached Payload Connectors and Pin Assignments – Connector | A | I&D | Certificate of Compliance | L-3.5 | Inspection & Demonstration |
| 3.2.2.2.1-B/ 4.3.2.2.2.1-B | Attached Payload Connectors and Pin Assignments – Pin Assignments | A | I&D | Certificate of Compliance | L-3.5 | Inspection & Demonstration |
| 3.2.2.2.2-A/ 4.3.2.2.2.2-A | Power Bus Isolation – Independent Feeds | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.2.2.2.2-B/ 4.3.2.2.2.2-B | Power Bus Isolation – Diodes | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.2.2.2.3/ 4.3.2.2.2.3 | Compatibility with Soft Start/Stop Remote Power Controller | A | T | Certificate of Compliance | L-3.5 | PRCU Test Report |
| 3.2.2.2.4-A/ 4.3.2.2.2.4-A | Surge Current – Amplitude | A | A&T | Certificate of Compliance | L-7.5 | PRCU Test Report or Equivalent |
| 3.2.2.2.4-B/ 4.3.2.2.2.4-B | Surge Current – Rate of Change | A | A&T | Certificate of Compliance | L-7.5 | PRCU Test Report or Equivalent |
| 3.2.2.2.5/ 4.3.2.2.2.5 | Reverse Energy/Current | A | A | Certificate of Compliance | L-7.5 | Analysis Report comparing worst-case reverse current case condition to SSP 57003, Table 3.2.2.2.5-1 allowables |
| 3.2.2.2.6/ 4.3.2.2.2.6 | CIRCUIT PROTECTION DEVICES | | TITLE | N/A | N/A | |
| 3.2.2.2.6.1-A/ 4.3.2.2.2.6.1-A | ISS EPS Circuit Protection Characteristics – RPC | A | T | Certificate of Compliance | L-3.5 | Test Report |
| 3.2.2.2.6.1-B/ 4.3.2.2.2.6.1-B | ISS EPS Circuit Protection Characteristics – Overcurrent Protection | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.2.2.2.6.2/ 4.3.2.2.2.6.2 | Attached Payload Trip Ratings | A | T&D | Certificate of Compliance | L-3.5 | Test Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.2.2.2.7/ 4.3.2.2.2.7 | Interface C Attached Payload Complex Load Impedances | A | T | Certificate of Compliance | L-7.5 | Test Report |
| 3.2.2.2.8/ 4.3.2.2.2.8 | Large Signal Stability | A | A&T | Certificate of Compliance | L-7.5 | Test Report |
| 3.2.2.3/ 4.3.2.2.3 | ELECTRICAL POWER CONSUMER CONSTRAINTS | | TITLE | N/A | N/A | |
| 3.2.2.3.1/ 4.3.2.2.3.1 | Wire Derating | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.2.2.3.2/ 4.3.2.2.3.2 | Exclusive Power Feeds | A | D&I | Certificate of Compliance | L-3.5 | Demonstration & Inspection @ KSC |
| 3.2.2.3.3/ 4.3.2.2.3.3 | Loss of Power | A | PSRP | Certificate of Compliance | L-3.5 | PSPR Approval of all applicable Hazard Reports |
| 3.2.2.4/ 4.3.2.2.4 | Electromagnetic Compatibility | A | T&A | Certificate of Compliance | L-7.5 | Test Report (Results must be provided for each configuration in the worst-case operational modes. The report should include the test configuration/layout (including cables), photographs of the test configuration, and a description of testing equipment.). |
| 3.2.2.4.1/ 4.3.2.2.4.1 | Electrical Grounding | A | T&A | Certificate of Compliance | L-7.5 | Test report and analysis report showing (A) compliance of actual grounding (based on end item qualification test data) versus grounding design philosophy (in Design Analysis Report), and |

**SSP 57213
Baseline**

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|--|-----------------------|------------------|---------------------------|--|---|
| | | | | | | (B) the compliance with SSP 30242. |
| 3.2.2.4.2/ 4.3.2.2.4.2 | Electrical Bonding | A | T, A&I | Certificate of Compliance | 1. L-7.5 2. L-7.5 3. L-3.5 | 1. Test report showing compliance with SSP 30245 and NSTS 1700.7B/ ISS, 213 and 220. 2. Analysis report showing compliance with SSP 30245, NSTS 1700.7B/ ISS, 213 and 220, and the Unique Payload Hardware ICD. 3. Certificate of Compliance for inspection |
| 3.2.2.4.3/ 4.3.2.2.4.3 | Cable/Wire Design and Control Requirements | A | A&T Or A&I | Certificate of Compliance | L-7.5 | Analysis Report showing (A) compliance of actual grounding (based on end item qualification test data) versus grounding design philosophy (in Design Analysis Report), and (B) the compliance with SSP 30242. |
| 3.2.2.4.4/ 4.3.2.2.4.4 | Electromagnetic Interference | A | A&T | Certificate of Compliance | L-7.5 | Test Report (Results must be provided for each configuration in the worst-case operational modes. The report should include |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|-------------------------------------|-----------------------|--------|---|----------------|---|
| | | | | | | the test configuration/layout (including cables), photographs of the test configuration, and a description of testing equipment.) |
| 3.2.2.4.5-A/ 4.3.2.2.4.5-A | Electrostatic Discharge – Warning | | NVR | NVR | | |
| 3.2.2.4.5-B/ 4.3.2.2.4.5-B | Electrostatic Discharge – Labeling | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.2.2.4.6/ 4.3.2.2.4.6 | Alternating Current Magnetic Fields | A | T | Certificate of Compliance | L-7.5 | Test Report (emissions greater than 20 dB below specified limits will be recorded in the EMI test report. In cases where the noise floor and ambient are not 20dB below specified level, only those emissions above the noise floor/ambient are required to be recorded.) |
| 3.2.2.4.7/ 4.3.2.2.4.7 | Direct Current Magnetic Fields | E-6 | T or A | Certificate of Compliance | L-7.5 | Test Report (a tabular listing of each magnetic field measurement, distance from the Experiment Under Test (EUT), and mode of EUT operation.) |
| 3.2.2.4.8/ 4.3.2.2.4.8 | Corona | A | T | 1. A report on test results and an analysis showing compliance during functional testing. | L-7.5 | Test Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|---|-----------------------|--------|--|----------------|--|
| | | | | 2. Test Report and detailed analysis for items requiring more detailed corona test (if any). | L-7.5 | |
| 3.2.2.4.9/ 4.3.2.2.4.9 | Electromagnetic Interferences Susceptibility for Safety Critical Circuits | N/A | N/A | N/A | N/A | No payload safety critical circuits |
| 3.2.2.5/ 4.3.2.2.5 | SAFETY REQUIREMENTS | | TITLE | N/A | N/A | |
| 3.2.2.5.1/ 4.3.2.2.5.1 | Payload Electrical Safety | A | PSRP | Certificate of Compliance | L-3.5 | PSPR Approval of all applicable Hazard Reports |
| 3.2.2.5.1.1/ 4.3.2.2.5.1.1 | Mating/Demating of Powered Connectors | N/A | N/A | N/A | N/A | No mating/demating power connectors to power Interface C |
| 3.2.2.5.1.2/ 4.3.2.2.5.1.2 | Safety-Critical Circuits Redundancy | N/A | N/A | N/A | N/A | No payload safety critical circuits |
| 3.2.2.5.2-A/ 4.3.2.2.5.2-A | Power Switches/Controls – Open | N/A | N/A | N/A | N/A | No crew interface |
| 3.2.2.5.2-B/ 4.3.2.2.5.2-B | Power Switches/Controls – Markings | N/A | N/A | N/A | N/A | No crew interface |
| 3.2.2.5.2-C/ 4.3.2.2.5.2-C | Power Switches/Controls – Nomenclature | N/A | N/A | N/A | N/A | No crew interface |
| 3.3/ 4.3.3 | Command and Data Handling Interface Requirements | | NVR | NVR | | |
| 3.3.1/ 4.3.3.1 | Command and Data Handling Interface with Mobile Servicing System | N/A | N/A | N/A | N/A | No MCAS data interface |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------------------|---|-----------------------|--------|---------------------------|----------------|---------------------------------------|
| 3.3.2/ 4.3.3.2 | Command and Data Handling Interface with the Integrated Truss Segment S3 Payload Attach System and P3 Unpressurized Cargo Carrier Attach System | | NVR | NVR | | |
| 3.3.2.1/ 4.3.3.2.1 | Word/Byte Notations, Types, and Data Transmissions | | NVR | NVR | | |
| 3.3.2.1.1/ 4.3.3.2.1.1 | Word/Byte Notations | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.1.2/ 4.3.3.2.1.2 | Data Types | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.1.3-A/ 4.3.3.2.1.3-A | Data Transmissions - LRDL | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.1.3-B/ 4.3.3.2.1.3-B | Data Transmissions - HRDL | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.2/ 4.3.3.2.2 | Consultative Committee for Space Data Systems | | NVR | NVR | | |
| 3.3.2.2.1-A/ 4.3.3.2.2.1-A | Consultative Committee for Space Data Systems – Ku Band | A | A or T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.2.1-B/ 4.3.3.2.2.1-B | Consultative Committee for Space Data Systems – Data | A | A or T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.2.1.1/ 4.3.3.2.2.1.1 | Consultative Committee for Space Data Systems Data Packets | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.2.1.1.1/ 4.3.3.2.2.1.1.1 | Consultative Committee for Space Data Systems Primary Header | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.2.1.1.2-A/ 4.3.3.2.2.1.1.2-A | Consultative Committee for Space Data Systems Secondary Header – Location | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------------------|--|-----------------------|--------|---------------------------|----------------|---------------------------------------|
| 3.3.2.2.1.1.2-B/ 4.3.3.2.2.1.1.2-B | Consultative Committee for Space Data Systems Secondary Header – SSP 52050 | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.2.1.2/ 4.3.3.2.2.1.2 | Consultative Committee for Space Data Systems Data Field | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.2.1.3/ 4.3.3.2.2.1.3 | Consultative Committee for Space Data Systems Application Process Identification Field | | NVR | NVR | | |
| 3.3.2.2.2/ 4.3.3.2.2.2 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS TIME CODES | | TITLE | N/A | N/A | |
| 3.3.2.2.2.1/ 4.3.3.2.2.2.1 | Consultative Committee for Space Data Systems Unsegmented Time | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.2.2.2/ 4.3.3.2.2.2.2 | Consultative Committee for Space Data Systems Segmented Time | | NVR | NVR | | |
| 3.3.2.3-A/ 4.3.3.2.3-A | MIL-STD-1553 Low Rate Data Link – Single RT | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.3-B/ 4.3.3.2.3-B | MIL-STD-1553 Low Rate Data Link – Address | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.3.1/ 4.3.3.2.3.1 | MIL-STD-1553 Protocol | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.3.1.1-A/ 4.3.3.2.3.1.1-A | Standard Messages | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.3.1.1-B/ 4.3.3.2.3.1.1-B | Standard Messages – Subaddresses | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.3.1.2-A/ 4.3.3.2.3.1.2-A | Commanding | A | I&T | Certificate of Compliance | L-7.5 | Test Report STEP or Equivalent |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---|---|-----------------------|--------|---------------------------|----------------|---------------------------------------|
| 3.3.2.3.1.2-B/ 4.3.3.2.3.1.2-B | Commanding – Subaddresses | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.3.1.3-A/ 4.3.3.2.3.1.3-A | Health and Status Data | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.3.2.3.1.3-B/ 4.3.3.2.3.1.3-B | Health and Status Data – Format | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.3.1.3-C/ 4.3.3.2.3.1.3-C | Health and Status Data – Response | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU, STEP, or Equivalent |
| 3.3.2.3.1.4-A/ 4.3.3.2.3.1.4-A | Safety Data | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.1.4-B/ 4.3.3.2.3.1.4-B | Safety Data – Standard Words | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.1.4.1/ 4.3.3.2.3.1.4.1 | Caution and Warning | | NVR | NVR | | |
| 3.3.2.3.1.4.1.1/ 4.3.3.2.3.1.4.1.1 | Class 1 – Emergency | | NVR | NVR | | |
| 3.3.2.3.1.4.1.2-A/ 4.3.3.2.3.1.4.1.2-A | Class 2 – Warning – Precursor Event | N/A | N/A | N/A | N/A | No crew interface |
| 3.3.2.3.1.4.1.2-B/ 4.3.3.2.3.1.4.1.2-B | Class 2 – Warning – Loss of Hazard Control | N/A | N/A | N/A | N/A | No crew interface |
| 3.3.2.3.1.4.1.3-A/ 4.3.3.2.3.1.4.1.3-A | Class 3 – Caution – Precursor Event | N/A | N/A | N/A | N/A | No crew interface |
| 3.3.2.3.1.4.1.3-B/ 4.3.3.2.3.1.4.1.3-B | Class 3 – Caution – Loss of Hazard Control | N/A | N/A | N/A | N/A | No crew interface |
| 3.3.2.3.1.4.1.4-A/ 4.3.3.2.3.1.4.1.4-A | Class 4 – Advisory – Ground Monitoring | N/A | N/A | N/A | N/A | No crew interface |
| 3.3.2.3.1.4.1.4-B/ 4.3.3.2.3.1.4.1.4-B | Class 4 – Advisory – Time Tagging and Logging | N/A | N/A | N/A | N/A | No crew interface |
| 3.3.2.3.1.5/ 4.3.3.2.3.1.5 | Service Requests | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.1.6/ 4.3.3.2.3.1.6 | Ancillary Data | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|---------------------------|----------------|--------------------------------|
| 3.3.2.3.1.7/ 4.3.3.2.3.1.7 | File Transfer | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.1.8/ 4.3.3.2.3.1.8 | Low Rate Telemetry | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.1.9/ 4.3.3.2.3.1.9 | Defined Code Modes | | NVR | NVR | | |
| 3.3.2.3.1.10/ 4.3.3.2.3.1.10 | Implemented Mode Codes | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.1.11/ 4.3.3.2.3.1.11 | Illegal Commands | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.2/ 4.3.3.2.3.2 | MIL-STD-1553 LRDL INTERFACE CHARACTERISTICS | | TITLE | N/A | N/A | |
| 3.3.2.3.2.1/ 4.3.3.2.3.2.1 | LRDL Connector/Pin Assignments | A | I&T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.2.2-A/ 4.3.3.2.3.2.2-A | LRDL Signal Characteristics | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.2.2-B/ 4.3.3.2.3.2.2-B | LRDL Signal Characteristics – Terminal | A | T | Certificate of Compliance | L-3.5 | Test Report PRCU or Equivalent |
| 3.3.2.3.2.3-A/ 4.3.3.2.3.2.3-A | LRDL Cabling – Characteristics | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.3.2.3-B/ 4.3.3.2.3.2.3-B | LRDL Cabling – Stub Length | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.4/ 4.3.3.2.4 | HIGH RATE DATA LINK | | TITLE | N/A | N/A | |
| 3.3.2.4.1/ 4.3.3.2.4.1 | Payload to High Rate Frame Multiplexer Protocols | A | I&T | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.4.2/ 4.3.3.2.4.2 | HIGH RATE DATA LINK INTERFACE CHARACTERISTICS | | TITLE | N/A | N/A | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|--|-----------------------|--------|---------------------------|----------------|---|
| 3.3.2.4.2.1/ 4.3.3.2.4.2.1 | Physical Signaling | A | T&A | Certificate of Compliance | L-3.5 | Data Certificate providing rates, signal coding, and control signals. |
| 3.3.2.4.2.2/ 4.3.3.2.4.2.2 | Encoding | A | I&T | Certificate of Compliance | L-3.5 | PRUC Test Report |
| 3.3.2.4.2.3/ 4.3.3.2.4.2.3 | Symbols Used in Testing | A | T | Certificate of Compliance | L-3.5 | Test Report |
| 3.3.2.4.3/ 4.3.3.2.4.3 | HIGH RATE DATA LINK OPTICAL POWER | | TITLE | N/A | N/A | |
| 3.3.2.4.3.1/ 4.3.3.2.4.3.1 | High Rate Data Link Transmitted Optical Power | A | T | Certificate of Compliance | L-3.5 | Test Report |
| 3.3.2.4.3.2/ 4.3.3.2.4.3.2 | High Rate Data Link Received Optical Power | A | T | Certificate of Compliance | L-3.5 | Test Report |
| 3.3.2.4.4/ 4.3.3.2.4.4 | High Rate Data Link Fiber Optic Cable | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.4.5/ 4.3.3.2.4.5 | High Rate Data Link Fiber Optic Cable Bend Radius | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.4.6/ 4.3.3.2.4.6 | High Rate Data Link Connectors | A | I&D | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.4.7/ 4.3.3.2.4.7 | High Rate Data Link Connector/Pin Assignments | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.3.2.5/ 4.3.3.2.5 | Portable Computer System | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.4/ 4.3.4 | PASSIVE THERMAL CONTROL INTERFACE REQUIREMENTS | | TITLE | N/A | N/A | |
| 3.4.1/ 4.3.4.1 | PASSIVE THERMAL CONTROL INTERFACE WITH THE ITS S3 PAYLOAD ATTACH SYSTEM AND P3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM | | TITLE | N/A | N/A | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|--------------------------------|---|-----------------------|---------------|---------------------------|----------------|--|
| 3.4.1.1/ 4.3.4.1.1 | Passive Thermal Control Design Requirements for Payload on the ITS S3 PAS and P3 UCCAS | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.4.1.1.1/ 4.3.4.1.1.1 | Temperature Requirement | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.4.1.1.5-A/ 4.3.4.1.1.5-A | Thermal Radiation Models | A | Thermal Model | Certificate of Compliance | L-7.5 | Certificate of Compliance stating that the thermal model was submitted as part of the PDR data package |
| 3.4.1.1.5-B/ 4.3.4.1.1.5-B | Thermal Radiation Models – Specular Surfaces | A | A or T | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.4.1.1.6-A / 4.3.4.1.1.6-A | Thermal Exchange Between Payloads – Active Radiation Surfaces | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.4.1.1.6-B/ 4.3.4.1.1.6-B | Thermal Exchange Between Payloads – Specularity | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.5/ 4.3.5 | ENVIRONMENT INTERFACE REQUIREMENTS | | TITLE | N/A | N/A | |
| 3.5.1/ 4.3.5.1 | ENVIRONMENTAL CONTROL INTERFACE WITH THE INTEGRATED TRUSS SEGMENT S3 PAYLOAD ATTACH SYSTEM AND P3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM | | TITLE | N/A | N/A | |
| 3.5.1.1/ 4.3.5.1.1 | Pressure | | NVR | NVR | | |
| 3.5.1.2/ 4.3.5.1.2 | Thermal Environment | | NVR | NVR | | |
| 3.5.1.3/ 4.3.5.1.3 | Humidity | | NVR | NVR | | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------|--|-----------------------|--------|---|--------------------------|-----------------------------|
| 3.5.1.4/ 4.3.5.1.4 | Atomic Oxygen | | NVR | NVR | | |
| 3.5.1.5/ 4.3.5.1.5 | External Contamination Requirements | | NVR | NVR | | |
| 3.5.1.5.1/ 4.3.5.1.5.1 | Molecular Column Density from Venting, Leakage and Outgassing | A | A | 1. Data Certificate providing the required outgassing characteristics including materials, locations, surface area, outgassing rate, and temperature. 2. Data Certificate providing the required venting characteristics including mass flow rate, composition (effluents), blowdown curves, temperature, plume model and pressure | 1. L-7.5 2. L-7.5 | Contamination Certification |
| 3.5.1.5.2A/ 4.3.5.1.5.2A | Molecular Deposition from Materials Outgassing and Venting – Other Attached Payloads | A | T&A | 1. Data Certificate providing the required outgassing characteristics including materials, locations, surface area, outgassing rate, and temperature. 2. Data Certificate providing the required venting characteristics including mass flow rate, composition | 1. L-7.5 2. L-7.5 | Contamination Test Report |

**SSP 57213
Baseline**

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|--|-----------------------|------------|--|--------------------------|--|
| | | | | (effluents), blow down curves, temperature, plume model and pressure | | |
| 3.5.1.5.2-B/ 4.3.5.1.5.2-B | Molecular Deposition from Materials Outgassing and Venting – ISS | A | T&A | 1. Data Certificate providing the required outgassing characteristics including materials, locations, surface area, outgassing rate, and temperature. 2. Data Certificate providing the required venting characteristics including mass flow rate, composition (effluents), blow down curves, temperature, plume model and pressure | 1. L-7.5 2. L-7.5 | Contamination Test Report |
| 3.5.1.5.3/ 4.3.5.1.5.3 | Particulates | A | A and/or I | Certificate of Compliance | L-3.5 | Contamination Test Report |
| 3.5.1.6/ 4.3.5.1.6 | Electromagnetic Radiation | | NVR | NVR | | |
| 3.5.1.7/ 4.3.5.1.7 | Plasma | | NVR | NVR | | |
| 3.5.1.8/ 4.3.5.1.8 | IONIZING RADIATION | | TITLE | N/A | | |
| 3.5.1.8.1/ 4.3.5.1.8.1 | Attached Payload Contained or Generated Ionizing Radiation | A | PSRP | Certificate of Compliance | L-3.5 | PSPR Approval of all applicable Hazard Reports |
| 3.5.1.8.2/ 4.3.5.1.8.2 | Ionizing Radiation Dose | A | A | Certificate of Compliance | L-7.5 | Analysis Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------|---|-----------------------|--------|---|------------------------|---------------------|
| 3.5.1.8.3/ 4.3.5.1.8.3 | Nominal Single Event Effects Ionizing Radiation | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.5.1.8.4/ 4.3.5.1.8.4 | Extreme Single Event Effects | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.5.1.9/ 4.3.5.1.9 | Solar Ultraviolet Radiation | | NVR | N/A | | |
| 3.5.1.10/ 4.3.5.1.10 | Plume Impingement | | NVR | N/A | | |
| 3.5.1.11/ 4.3.5.1.11 | Meteoroids and Orbital Debris | | NVR | N/A | | |
| 3.5.1.12-A/ 4.3.5.1.12-A | Acceleration Environment – Reboost | A | A | 1. Data Certificate that provides a summary of the margins of safety for all SCS identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results are not available. 2. Data Certificate that provides a summary of the margins of safety for all SCS identified in accordance with SSP 52005 using loads validated by the verification loads analysis (VLA) results. | 1. L-7.5 2. L-5 | Structural Analysis |
| 3.5.1.12-B/ 4.3.5.1.12-B | Acceleration Environment – Berthing | A | A | 1. Data Certificate that provides a summary of the margins of safety for all SCS identified in accordance with SSP | 1. L-7.5 | Structural Analysis |

**SSP 57213
Baseline**

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------|--|-----------------------|--------|--|------------------------|---------------------|
| | | | | <p>52005 using design loads if the Design Loads Analysis (DLA) results are not available.</p> <p>2. Data Certificate that provides a summary of the margins of safety for all SCS identified in accordance with SSP 52005 using loads validated by the verification loads analysis (VLA) results.</p> | 2. L-5 | |
| 3.5.1.13/ 4.3.5.1.13 | Vibration Environment – Linear Peak Loads | A | A | <p>1. Data Certificate that provides a summary of the margins of safety for all SCS identified in accordance with SSP 52005 using design loads if the Design Loads Analysis (DLA) results are not available.</p> <p>2. Data Certificate that provides a summary of the margins of safety for all SCS identified in accordance with SSP 52005 using loads validated by the verification loads analysis (VLA) results.</p> | 1. L-7.5 2. L-5 | Structural Analysis |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.6/ 4.3.6 | MATERIALS AND PARTS INTERFACE REQUIREMENTS | | TITLE | N/A | N/A | |
| 3.6.1/ 4.3.6.1 | Materials and Parts Use Selection | A | A&I | Certificate of Compliance | L-3.5 | Materials Certification |
| 3.6.1.1/ 4.3.6.1.1 | Thermal Vacuum Stability | A | I | Certificate of Compliance | L-7.5 | Inspection Report providing all of the surface materials and thermal vacuum stability data to the Materials Working Group for approval, and additional updates as required |
| 3.6.2/ 4.3.6.2 | Commercial Parts | A | PSRP | Certificate of Compliance | L-3.5 | PSRP FSR Phase III approval |
| 3.6.3/ 4.3.6.3 | Cleanliness | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.6.4/ 4.3.6.4 | Atomic Oxygen Interaction | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7/ 4.3.7 | EXTRAVEHICULAR ROBOTICS REQUIREMENTS | | TITLE | N/A | N/A | |
| 3.7.1-A/ 4.3.7.1-A | Equipment Requiring Shuttle Robotic Support – Impulse | | NVR | NVR | | |
| 3.7.1-B/ 4.3.7.1-B | Equipment Requiring Shuttle Robotic Support – Clearance Zone | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.1-C/ 4.3.7.1-C | Equipment Requiring Shuttle Robotic Support – Grapple Fixture (GF) | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.1-D/ 4.3.7.1-D | Equipment Requiring Shuttle Robotic Support – GF Location | A | I | Certificate of Compliance | L-3.5 | Inspection Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------|---|-----------------------|--------|---|----------------|--|
| 3.7.1-E/ 4.3.7.1-E | Equipment Requiring Shuttle Robotic Support – Mass | A | A | Certificate of Compliance | L-7 | Analysis Report providing weight and CG summary for on-orbit configuration |
| 3.7.1-F/ 4.3.7.1-F | Equipment Requiring Shuttle Robotic Support – Loads | | NVR | NVR | | |
| 3.7.1-G/ 4.3.7.1-G | Equipment Requiring Shuttle Robotic Support – Vibration Frequency | A | A | Verified Finite Element Model or Data Cert. | L-7.5 | Verified Finite Element Model |
| 3.7.1-H/ 4.3.7.1-H | Equipment Requiring Shuttle Robotic Support – Grounding | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.1-I/ 4.3.7.1-I | Equipment Requiring Shuttle Robotic Support – Thermal Isolation | A | I | Analysis Report | L-7.5 | Analysis Report |
| 3.7.1-J/ 4.3.7.1-J | Equipment Requiring Shuttle Robotic Support – Scuff Plates | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.1-K/ 4.3.7.1-K | Equipment Requiring Shuttle Robotic Support – Shielding | A | A | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.1-L/ 4.3.7.1-L | Equipment Requiring Shuttle Robotic Support – Contact Velocity | | NVR | NVR | | |
| 3.7.1-M/ 4.3.7.1-M | Equipment Requiring Shuttle Robotic Support – Capture Envelope | A | A | Data Certificate providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified. (Attachment force can be obtained from the result of the Verification Coupled Loads (VCL)). | L-7.5 | Analysis Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------|--|-----------------------|--------|---------------------------|----------------|-------------------------------|
| 3.7.1-N/ 4.3.7.1-N | Equipment Requiring Shuttle Robotic Support – Ready to Latch Indication | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report & IVT 3/11/03 |
| 3.7.2/ 4.3.7.2 | External Equipment Requiring Robotic Hand-Off | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3-A/ 4.3.7.3-A | External Equipment Requiring Space Station Remote Manipulator System (RMS) Support – LEE | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3-B/ 4.3.7.3-B | External Equipment Requiring Space Station RMS Support – Properties | A | I | Certificate of Compliance | L-7.5 | Verified Finite Element Model |
| 3.7.3-C/ 4.3.7.3-C | External Equipment Requiring Space Station RMS Support – Contact Conditions | | NVR | NVR | | |
| 3.7.3-D/ 4.3.7.3-D | External Equipment Requiring Space Station RMS Support – Backdrive | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.7.3-E/ 4.3.7.3-E | External Equipment Requiring Space Station RMS Support – Ready to Latch | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.7.3-F/ 4.3.7.3-F | External Equipment Requiring Space Station RMS Support – Scuff Plates | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3-G/ 4.3.7.3-G | External Equipment Requiring Space Station RMS Support – Shielding | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.7.3-H/ 4.3.7.3-H | External Equipment Requiring Space Station RMS Support – Contact with Equipment | | NVR | NVR | | |
| 3.7.3-I/ 4.3.7.3-I | External Equipment Requiring Space Station RMS Support – SSRMS Limits | A | A | Certificate of Compliance | L-3.5 | Analysis Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|---|-----------------------|--------|---|----------------|-------------------|
| 3.7.3-J/ 4.3.7.3-J | External Equipment Requiring Space Station RMS Support – Capture Envelope | A | A | Data Certificate providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified. (Attachment force can be obtained from the result of the Verification Coupled Loads (VCL)). | L-5 | Analysis Report |
| 3.7.3-K/ 4.3.7.3-K | External Equipment Requiring Space Station RMS Support – Grapple Fixture | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.1-A/ 4.3.7.3.1-A | Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture – Clearance Envelope | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.1-B/ 4.3.7.3.1-B | Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture – Grapple Fixture | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.1-C/ 4.3.7.3.1-C | Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture – Tip Loads | | NVR | NVR | | |
| 3.7.3.1-D/ 4.3.7.3.1-D | Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture – Impulse | | NVR | NVR | | |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|---|-----------------------|--------|---------------------------|----------------|-------------------------------|
| 3.7.3.1-E/ 4.3.7.3.1-E | Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture – Vibration Frequency | A | I | Certificate of Compliance | L-7.5 | Verified Finite Element Model |
| 3.7.3.1-F/ 4.3.7.3.1-F | Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture – Thermal Isolation | A | I | Certificate of Compliance | L-7.5 | Inspection Report |
| 3.7.3.1-G/ 4.3.7.3.1-G | Equipment Requiring SSRMS Support Using a National Space Transportation System Grapple Fixture – Electrical Interface | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.2-A/ 4.3.7.3.2-A | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture (PDGF) – Clearance Envelope | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.2-B/ 4.3.7.3.2-B | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – Structural and Mechanical Interface | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.2-C/ 4.3.7.3.2-C | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – Electrical Interface with the PDGF | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.2-D/ 4.3.7.3.2-D | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – Power Quality | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.2-E/ 4.3.7.3.2-E | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – Data Interface with the PDGF | N/A | N/A | N/A | N/A | No PDGF Interface |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|--|-----------------------|--------|---|----------------|-------------------------------------|
| 3.7.3.2-F/ 4.3.7.3.2-F | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – Video Interface | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.2-G/ 4.3.7.3.2-G | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – Harness and Connectors | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.2-H/ 4.3.7.3.2-H | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – Thermal Conductance | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.2-I/ 4.3.7.3.2-I | Equipment Requiring SSRMS Support Using a Power Data Grapple Fixture – EME Effects | N/A | N/A | N/A | N/A | No PDGF Interface |
| 3.7.3.3-A/ 4.3.7.3.3-A | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Clearance Envelope | E-7 | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.3-B/ 4.3.7.3.3-B | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Structural and Mechanical Interface | A | I&A | Data Certificate providing the interface attach point forces and margins of safety calculations based on the allowable limits as specified. (Attachment force can be obtained from the result of the Verification Coupled Loads (VCL)). | L-5 | Analysis Report & Inspection Report |
| 3.7.3.3-C/ 4.3.7.3.3-C | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Electrical Power Interface | A | I | Certificate of Compliance | L-3.5 | Inspection Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.7.3.3-D/ 4.3.7.3.3-D | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Electrical Power Operation | A | A | Certificate of Compliance | L-7.5 | Analysis Report providing plot of input voltage versus frequency |
| 3.7.3.3-E/ 4.3.7.3.3-E | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Data Interface | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.3-F/ 4.3.7.3.3-F | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Video Interface | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.3-G/ 4.3.7.3.3-G | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Electrical Harness and Connectors | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.3.3-H/ 4.3.7.3.3-H | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Thermal Conductance | A | A | Certificate of Compliance | L-7.5 | Analysis Report |
| 3.7.3.3-I/ 4.3.7.3.3-I | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGF) – Electromagnetic Effects | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.7.4-A/ 4.3.7.4-A | External Equipment Requiring Dexterous Robotic Support – Interface | N/A | N/A | N/A | N/A | No Standard Dexterous Grasp Fixture (SDGF) Interface |
| 3.7.4-B/ 4.3.7.4-B | External Equipment Requiring Dexterous Robotic Support – Structural Limits | N/A | N/A | N/A | N/A | No Standard Dexterous Grasp Fixture (SDGF) Interface |
| 3.7.4-C/ 4.3.7.4-C | External Equipment Requiring Dexterous Robotic Support – Operating Limits | N/A | N/A | N/A | N/A | No Standard Dexterous Grasp Fixture (SDGF) Interface |
| 3.7.4-D/ 4.3.7.4-D | External Equipment Requiring Dexterous Robotic Support – | N/A | N/A | N/A | N/A | No Standard Dexterous Grasp Fixture (SDGF) Interface |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|---|-----------------------|--------|---------------------------|----------------|--|
| 4.3.7.4-D | Dexterous Robotic Support – Worksites | | | | | Grasp Fixture (SDGF) Interface |
| 3.7.4-E/ 4.3.7.4-E | External Equipment Requiring Dexterous Robotic Support – Temporary Storage | N/A | N/A | N/A | N/A | No Standard Dexterous Grasp Fixture (SDGF) Interface |
| 3.7.5-A/ 4.3.7.5-A | Equipment Requiring Robotic Translation – Structural Limits | N/A | N/A | N/A | N/A | No Payload/ORU Accommodation (POA) Interface |
| 3.7.5-B/ 4.3.7.5-B | Equipment Requiring Robotic Translation – SSRMS AND POA | N/A | N/A | N/A | N/A | No Payload/ORU Accommodation (POA) Interface |
| 3.7.5-C/ 4.3.7.5-C | Equipment Requiring Robotic Translation – No Power, Data, Video | N/A | N/A | N/A | N/A | No Payload/ORU Accommodation (POA) Interface |
| 3.7.5-D/ 4.3.7.5-D | Equipment Requiring Robotic Translation – Translation Corridor | N/A | N/A | N/A | N/A | No Payload/ORU Accommodation (POA) Interface |
| 3.7.6/ 4.3.7.6 | EBCS Avionics Package | | NVR | NVR | | |
| 3.7.6.1-A/ 4.3.7.6.1-A | EBCS Avionics Package Envelope and Mounting – Operational Envelope, Roll Adjustments, and Optical Keep-Out Zone | A | I | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.6.1-B/ 4.3.7.6.1-B | EBCS Avionics Package Envelope and Mounting – Location | A | I&A | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.6.1-C/ 4.3.7.6.1-C | EBCS Avionics Package Envelope and Mounting – Vibration, Impact Loads, and Thermal Environment | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.7.6.2-A/ 4.3.7.6.2-A | EBCS Avionics Package Power – Cable Routing and Connections | A | I&D | Certificate of Compliance | L-3.5 | Inspection Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|---|-----------------------|-----------|---------------------------|----------------|---|
| 3.7.6.2-B/ 4.3.7.6.2-B | EBCS Avionics Package Power – Keep-Alive Heater Power | A | I&D | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.6.3-A/ 4.3.7.6.3-A | EBCS Thermal Requirements – Non-Operational On-Orbit | TBD | TBD | TBD | TBD | |
| 3.7.6.3-B/ 4.3.7.6.3-B | EBCS Thermal Requirements – Operational On-Orbit | TBD | TBD | TBD | TBD | |
| 3.7.6.4/ 4.3.7.6.4 | EBCS Vibration Requirements | A | I&D | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.7.6.5/ 4.3.7.6.5 | EBCS Avionics Package Video | A | I&D | Certificate of Compliance | L-3.5 | Inspection Report |
| 3.8-A/ 4.3.8-A | Extravehicular Activity – Contingency EVA | A | A & D & I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, VITT Inspection |
| 3.8-B/ 4.3.8-B | Extravehicular Activity – Sharp Edge, Protrusion, Glove Temperature | A | A&I | Certificate of Compliance | L-3.5 | Analysis, Crew Evaluation, VITT Inspection |
| 3.8.1-A/ 4.3.8.1A | Extravehicular Activity as a Backup for Robotics Activities – EVA Aids | A | A | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, VITT Inspection |
| 3.8.1-B/ 4.3.8.1B | Extravehicular Activity as a Backup for Robotics Activities – Attachment Points or Restraints | A | A | Certificate of Compliance | L-3.5 | Analysis, Crew Evaluation, VITT Inspection |
| 3.8.1-C/ 4.3.8.1C | Extravehicular Activity as a Backup for Robotics Activities – Force Reaction | A | A | Certificate of Compliance | L-3.5 | Analysis, NBL Training, Crew Evaluation |
| 3.8.2/ 4.3.8.2 | Extravehicular Activity Translation | A | A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation |
| 3.8.2.1/ 4.3.8.2.1 | Payload Attach System/Unpressurized Cargo Carrier Attach System Interface Clearances | E-8 | A | Certificate of Compliance | L-3.5 | Inspection Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|---|-----------------------|--------|---------------------------|----------------|--|
| 3.8.2.2/ 4.3.8.2.2 | Extravehicular Activity Translation Corridor Protrusion | A | A&I | Certificate of Compliance | L-3.5 | Analysis, NBL Training, Crew Evaluation |
| 3.8.3/ 4.3.8.3 | HUMAN ENGINEERING DESIGN | | TITLE | N/A | N/A | |
| 3.8.3.1/ 4.3.8.3.1 | Crew Access Dimensions | A | D | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation |
| 3.8.3.1.1/ 4.3.8.3.1.1 | Body Envelope and Reach Accessibility | A | D | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation |
| 3.8.3.1.1.1-A/ 4.3.8.3.1.1.1-A | Centering – Left or Right | A | A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation |
| 3.8.3.1.1.1-B/ 4.3.8.3.1.1.1-B | Centering – Above or Below | A | A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation |
| 3.8.3.1.1.2/ 4.3.8.3.1.1.2 | Extravehicular Activity Crewmember Field of View | A | A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation |
| 3.8.3.1.1.3/ 4.3.8.3.1.1.3 | External Task Location Requirements | A | D | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation |
| 3.8.3.2/ 4.3.8.3.2 | STRENGTH REQUIREMENTS | | TITLE | N/A | N/A | |
| 3.8.3.2.1/ 4.3.8.3.2.1 | External Limit Loads | A | T | Certificate of Compliance | L-7.5 | Test Report providing a summary listing of all operational modes analyzed and showing positive margins of safety |
| 3.8.3.2.2/ 4.3.8.3.2.2 | Extravehicular Activity Actuated Controls | A | I | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, IVT 3/11/03, Inspection, VITT |
| 3.8.3.3/ 4.3.8.3.3 | Mobility Aids and Restraints | A | I | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1/ 4.3.8.3.3.1 | Provide Extravehicular Activity Handles | N/A | N/A | N/A | N/A | No portable payload units |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|---|-----------------------|--------|---------------------------|----------------|---|
| 3.8.3.3.1.1-A/ 4.3.8.3.3.1.1-A | Extravehicular Activity Handholds/Handrails – Design | A | A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.1-B/ 4.3.8.3.3.1.1-B | Extravehicular Activity Handholds/Handrails – Orientation | A | A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.2/ 4.3.8.3.3.1.2 | Dimensions | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report, GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.3-A/ 4.3.8.3.3.1.3-A | Mounted Clearance –Handrail to Surface | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report, GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.3-B/ 4.3.8.3.3.1.3-B | Mounted Clearance – Grasp Areas | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report, GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.3-C/ 4.3.8.3.3.1.3-C | Mounted Clearance – Clearances | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report, GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.4-A/ 4.3.8.3.3.1.4-A | Positioning/Location – Positioning | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report, GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.4-B/ 4.3.8.3.3.1.4-B | Positioning/Location – Removal Direction | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report, GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.4-C/ 4.3.8.3.3.1.4-C | Positioning/Location – Hazard Color Coding | A | A or D | Certificate of Compliance | L-3.5 | Analysis Report, GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|---|-----------------------|--------|---------------------------|----------------|--|
| 3.8.3.3.1.5-A/ 4.3.8.3.3.1.5-A | Non-Fixed Handles Design – Stop Position | N/A | N/A | N/A | N/A | No hinged, foldout, or attachable EVA handles |
| 3.8.3.3.1.5-B/ 4.3.8.3.3.1.5-B | Non-Fixed Handles Design – Use Position | N/A | N/A | N/A | N/A | No hinged, foldout, or attachable EVA handles |
| 3.8.3.3.1.5-C/ 4.3.8.3.3.1.5-C | Non-Fixed Handles Design – Locked/Unlocked Status | N/A | N/A | N/A | N/A | No hinged, foldout, or attachable EVA handles |
| 3.8.3.3.1.6/ 4.3.8.3.3.1.6 | Handrail/Handhold Tether Attachment | A | I | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.7/ 4.3.8.3.3.1.7 | Danger Warnings | A | I&A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.1.8/ 4.3.8.3.3.1.8 | Color | A | I | Certificate of Compliance | L-3.5 | GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.3.2/ 4.3.8.3.3.2 | Extravehicular Activity Safety Tethers and Safety Hooks | N/A | N/A | N/A | N/A | No AMS-02 tether attachment points |
| 3.8.3.3.2.1-A/ 4.3.8.3.3.2.1-A | Tether Attach Points – Standard Hook | N/A | N/A | N/A | N/A | No AMS-02 tether attachment points |
| 3.8.3.3.2.1-B/ 4.3.8.3.3.2.1-B | Tether Attach Points – Item Securing | N/A | N/A | N/A | N/A | No AMS-02 tether attachment points |
| 3.8.3.3.2.1-C/ 4.3.8.3.3.2.1-C | Tether Attach Points – Design | N/A | N/A | N/A | N/A | No AMS-02 tether attachment points |
| 3.8.3.4/ 4.3.8.3.4 | GLOVED OPERATION | | TITLE | N/A | N/A | |
| 3.8.3.4.1/ 4.3.8.3.4.1 | Extravehicular Activity Glove Hand Access | A | A or D | Certificate of Compliance | L-3.5 | GFE Procured, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.3.5/ 4.3.8.3.5 | Location Coding | A | A | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------------------|---|-----------------------|--------|---------------------------|----------------|--|
| 3.8.4/ 4.3.8.4 | HUMAN ENGINEERING SAFETY | | TITLE | N/A | N/A | |
| 3.8.4.1/ 4.3.8.4.1 | EXTERNAL TOUCH TEMPERATURE | | TITLE | N/A | N/A | |
| 3.8.4.1.1/ 4.3.8.4.1.1 | Incidental Contact | A | A | Certificate of Compliance | L-3.5 | Thermal Analysis |
| 3.8.4.1.2/ 4.3.8.4.1.2 | Unlimited Contact | A | A | Certificate of Compliance | L-3.5 | Thermal Analysis |
| 3.8.4.2/ 4.3.8.4.2 | Equipment Clearance for Entrapment Hazards | A | A & D | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.4.2.1/ 4.3.8.4.2.1 | EXTERNAL CORNER AND EDGE PROTECTION | | TITLE | N/A | N/A | |
| 3.8.4.2.1.1/ 4.3.8.4.2.1.1 | Sharp Edges | A | A & I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.1.1.1-A/ 4.3.8.4.2.1.1.1-A | Exposed Edge Requirements – .25 Inches + | A | A & I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.1.1.1-B/ 4.3.8.4.2.1.1.1-B | Exposed Edge Requirements – .12 to .25 Inches | A | A & I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.1.1.1-C/ 4.3.8.4.2.1.1.1-C | Exposed Edge Requirements – .02 to .12 Inches | A | A & I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.1.1.1-D/ 4.3.8.4.2.1.1.1-D | Exposed Edge Requirements – .02 Inches - | A | A & I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.1.1.2-A/ 4.3.8.4.2.1.1.2-A | Exposed Corner Requirements – 1.0 Inches - | A | A & I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.1.1.2-B/ 4.3.8.4.2.1.1.2-B | Exposed Corner Requirements – 1.0 Inches + | A | A & I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.1.2/ 4.3.8.4.2.1.2 | Thin Materials | A | A & I | Certificate of Compliance | L-3.5 | Analysis, Inspection, VITT |
| 3.8.4.2.2/ 4.3.8.4.2.2 | Burrs | A | A & I | Certificate of Compliance | L-3.5 | Analysis, Inspection, VITT |
| 3.8.4.2.3/ 4.3.8.4.2.3 | Holes | A | I | Certificate of Compliance | L-3.5 | Inspection, VITT |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.8.4.2.3.1/ 4.3.8.4.2.3.1 | Handrails/Holds | A | I | Certificate of Compliance | L-3.5 | Inspection, VITT |
| 3.8.4.2.4/ 4.3.8.4.2.4 | Pinch Points | A | A & I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.4.2.5/ 4.3.8.4.2.5 | Protective Covers for Portable Equipment | N/A | N/A | N/A | N/A | No protective covers |
| 3.8.4.2.6/ 4.3.8.4.2.6 | LATCHES | | TITLE | N/A | N/A | |
| 3.8.4.2.6.1-A/ 4.3.8.4.2.6.1-A | Design – Entrapment | N/A | N/A | N/A | N/A | No latches |
| 3.8.4.2.6.1-B/ 4.3.8.4.2.6.1-B | Design – Gap | N/A | N/A | N/A | N/A | No latches |
| 3.8.4.2.6.1-C/ 4.3.8.4.2.6.1-C | Design – Over Center Latches | N/A | N/A | N/A | N/A | No latches |
| 3.8.4.2.6.1-D/ 4.3.8.4.2.6.1-D | Design – Catches | N/A | N/A | N/A | N/A | No latches |
| 3.8.4.2.6.1-E/ 4.3.8.4.2.6.1-E | Design – Handle | N/A | N/A | N/A | N/A | No latches |
| 3.8.4.2.6.2/ 4.3.8.4.2.6.2 | Protective Covers or Guards | A | A & I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.4.2.7/ 4.3.8.4.2.7 | Captive Parts | A | D | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.4.2.7.1/ 4.3.8.4.2.7.1 | Screws and Bolts | A | A | Certificate of Compliance | L-3.5 | Analysis Report, Crew Evaluation, Inspection, VITT |
| 3.8.4.2.7.2/ 4.3.8.4.2.7.2 | Securing Pins | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.8.4.2.7.3/ 4.3.8.4.2.7.3 | Locking Wires | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.8.4.2.8/ 4.3.8.4.2.8 | Safety Critical Fasteners | A | T | Certificate of Compliance | L-3.5 | Test Report |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-------------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.8.4.2.9/ 4.3.8.4.2.9 | Levers, Cranks, Hooks and Controls | A | A & I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.8.4.3/ 4.3.8.4.3 | Moving or Rotating Equipment | A | A | Certificate of Compliance | L-3.5 | Analysis Report |
| 3.8.4.4/ 4.3.8.4.4 | Power Sources | N/A | N/A | N/A | N/A | No nuclear or radioisotopic power source |
| 3.8.4.5/ 4.3.8.4.5 | Transmitters | N/A | N/A | N/A | N/A | No electromagnetic wave transmitter |
| 3.9/ 4.3.9 | MAINTAINABILITY AND MAINTENANCE | | TITLE | N/A | N/A | |
| 3.9.1/ 4.3.9.1 | Qualitative Maintainability Design | | NVR | NVR | | |
| 3.9.1.1/ 4.3.9.1.1 | FAILURE DETECTION, ISOLATION AND RECOVERY | | TITLE | N/A | N/A | |
| 3.9.1.1.1-A/ 4.3.9.1.1.1-A | Manual Failure Detection, Isolation and Recovery – Human/Equipment Interfaces | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.1.1-B/ 4.3.9.1.1.1-B | Manual Failure Detection, Isolation and Recovery – Lighting | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.1.1-C/ 4.3.9.1.1.1-C | Manual Failure Detection, Isolation and Recovery – Audible Caution and Warning Devices | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.1.1-D/ 4.3.9.1.1.1-D | Manual Failure Detection, Isolation and Recovery – No Data | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.1.1-E/ 4.3.9.1.1.1-E | Manual Failure Detection, Isolation and Recovery – One Time Use | N/A | N/A | N/A | N/A | External payload truss site payload |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.9.1.2/ 4.3.9.1.2 | RESERVED | | NVR | NVR | | |
| 3.9.1.3-A/ 4.3.9.1.3-A | Access – Geometry | A | A&I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection, VITT |
| 3.9.1.3-B/ 4.3.9.1.3-B | Access – ORU Removal | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.3-C/ 4.3.9.1.3-C | Access – SSP 50005 | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.3-D/ 4.3.9.1.3-D | Access – Rear | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.4-A/ 4.3.9.1.4-A | Nonpressurized Area Equipment Maintenance Time – Less Than 3 Hours | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.4-B/ 4.3.9.1.4-B | Nonpressurized Area Equipment Maintenance Time – More Than 3 Hours | N/A | N/A | N/A | N/A | External payload truss site payload |
| 3.9.1.5/ 4.3.9.1.5 | Access Item Retainment | A | A&I | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.9.1.5.1/ 4.3.9.1.5.1 | Captive Parts | A | D&I | Certificate of Compliance | L-3.5 | NBL Training & Crew Evaluation, Inspection, VITT |
| 3.9.1.6/ 4.3.9.1.6 | INSTALLATION/REMOVAL | | TITLE | N/A | N/A | |
| 3.9.1.6.1/ 4.3.9.1.6.1 | Method | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.2/ 4.3.9.1.6.2 | Equipment Item Interconnection Devices | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.3/ 4.3.9.1.6.3 | Incorrect Equipment Installation | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.4/ 4.3.9.1.6.4 | Lockwiring and Staking | N/A | N/A | N/A | N/A | No replaceable ORUs |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|-------------------------|----------------|---------------------|
| 3.9.1.6.5-A/ 4.3.9.1.6.5-A | Restraining and Handling Devices for Temporary Storage – EVA Crew | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.5-B/ 4.3.9.1.6.5-B | Restraining and Handling Devices for Temporary Storage – Robotics | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.6/ 4.3.9.1.6.6 | Installation/Removal Force | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.6.1/ 4.3.9.1.6.6.1 | Direction of Removal | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.6.2/ 4.3.9.1.6.6.2 | Visibility | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.6.3-A/ 4.3.9.1.6.6.3-A | Mounting Alignment – Design, Label, Marking | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.6.3-B/ 4.3.9.1.6.6.3-B | Mounting Alignment – Alignment Marks | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.6.3-C/ 4.3.9.1.6.6.3-C | Mounting Alignment – Connectors | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.7/ 4.3.9.1.6.7 | ORBITAL REPLACEMENT UNIT | | TITLE | N/A | N/A | |
| 3.9.1.6.7.1/ 4.3.9.1.6.7.1 | Capture Latch Assembly and Umbilical Mechanical Assembly EVA Override | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.7.2/ 4.3.9.1.6.7.2 | Payload Attach System and Unpressurized Cargo Carrier Attach System Orbital Replacement Unit Extravehicular Activity Maintenance | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.6.7.3/ 4.3.9.1.6.7.3 | Attached Payload Remove/Replace Items | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.7-A/ 4.3.9.1.7-A | Standard EVA/EVR Interfaces –EVA | N/A | N/A | N/A | N/A | No replaceable ORUs |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.9.1.7-B/ 4.3.9.1.7-B | Standard EVA/EVR Interfaces – EVR | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.7.1/ 4.3.9.1.7.1 | Extravehicular Activity Tools | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.7.1.1-A/ 4.3.9.1.7.1.1-A | Tool Clearance – 90 Degree Throw | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.7.1.1-B/ 4.3.9.1.7.1.1-B | Tool Clearance – 3 Inch Clearance | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.7.1.1-C/ 4.3.9.1.7.1.1-C | Tool Clearance – Head Clearance | N/A | N/A | N/A | N/A | No replaceable ORUs |
| 3.9.1.7.2-A/ 4.3.9.1.7.2-A | Payload Hardware and Equipment Mounting – Design, Label, Marks | A | D&I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.2-B/ 4.3.9.1.7.2-B | Payload Hardware and Equipment Mounting – Alignment Marks | A | D&I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3/ 4.3.9.1.7.3 | Connectors | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.1-A/ 4.3.9.1.7.3.1-A | One Handed Operation – Mate/Demate | A & D | D | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.1-B/ 4.3.9.1.7.3.1-B | One Handed Operation – Right/Left Hand | A & D | D | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.2-A/ 4.3.9.1.7.3.2-A | Mate/Demate – One Connector | A | A | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.2-B/ 4.3.9.1.7.3.2-B | Mate/Demate – No Damage | A | A | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.3-A/ 4.3.9.1.7.3.3-A | Connector Arrangement – Spacing | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|---------------------------------------|------------------------------------|-----------------------|--------|---------------------------|----------------|--|
| 3.9.1.7.3.3-B/ 4.3.9.1.7.3.3-B | Connector Arrangement -- Clearance | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.3.1/ 4.3.9.1.7.3.3.1 | Status | A | D | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.4/ 4.3.9.1.7.3.4 | Connector Protection | A | A | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.4.1/ 4.3.9.1.7.3.4.1 | Protecting Caps | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.5-A/ 4.3.9.1.7.3.5-A | Coding -- Code or Identifier | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.5-B/ 4.3.9.1.7.3.5-B | Coding -- Location | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.6/ 4.3.9.1.7.3.6 | Pin Identification | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.7/ 4.3.9.1.7.3.7 | Orientation | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.3.7.1-A/ 4.3.9.1.7.3.7.1-A | Spacing -- SSP 50005 | N/A | N/A | N/A | N/A | No external cable bundles |
| 3.9.1.7.3.7.1-B/ 4.3.9.1.7.3.7.1-B | Spacing -- Wing Connectors | N/A | N/A | N/A | N/A | No external cable bundles |
| 3.9.1.7.4-A/ 4.3.9.1.7.4-A | Cable Restraints -- Loose Ends | N/A | N/A | N/A | N/A | No external cable bundles |
| 3.9.1.7.4-B/ 4.3.9.1.7.4-B | Cable Restraints -- EVA Clamps | N/A | N/A | N/A | N/A | No external cable bundles |
| 3.9.1.7.4-C/ 4.3.9.1.7.4-C | Cable Restraints -- Clamps | N/A | N/A | N/A | N/A | No external cable bundles |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|-------------------------|----------------|----------------------------|
| 3.9.1.7.4-D/ 4.3.9.1.7.4-D | Cable Restraints – Bundled | N/A | N/A | N/A | N/A | No external cable bundles |
| 3.9.1.7.5-A/ 4.3.9.1.7.5-A | Covers – Access | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.5-B/ 4.3.9.1.7.5-B | Covers – Removable | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.5-C/ 4.3.9.1.7.5-C | Covers – Lock Indicator | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.5-D/ 4.3.9.1.7.5-D | Covers – EVA Loads | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.5-E/ 4.3.9.1.7.5-E | Covers – Opening Interference | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.5-F/ 4.3.9.1.7.5-F | Covers – Self-Supporting | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.5-G/ 4.3.9.1.7.5-G | Covers – Housings | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.5-H/ 4.3.9.1.7.5-H | Covers – Sealing Areas | N/A | N/A | N/A | N/A | No removable EVA covers |
| 3.9.1.7.6/ 4.3.9.1.7.6 | Fasteners | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.1-A/ 4.3.9.1.7.6.1-A | Engagement Status Indication – Visually Accessible | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.1-B/ 4.3.9.1.7.6.1-B | Engagement Status Indication – Engagement Status | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.2/ 4.3.9.1.7.6.2 | One-Handed Actuation | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.3-A/ 4.3.9.1.7.6.3-A | Fastener Clearances – 3 Inches | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.3-B/ 4.3.9.1.7.6.3-B | Fastener Clearances – Separation | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.3-C/ 4.3.9.1.7.6.3-C | Fastener Clearances – Recessed | N/A | N/A | N/A | N/A | No removable EVA fasteners |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|--|-----------------------|--------|---------------------------|----------------|--|
| 3.9.1.7.6.4/ 4.3.9.1.7.6.4 | Fastener Access Holes | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.5-A/ 4.3.9.1.7.6.5-A | Captive Fasteners – External | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.5-B/ 4.3.9.1.7.6.5-B | Captive Fasteners – No Temporary | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.6-A/ 4.3.9.1.7.6.6-A | Quick Release Fasteners – One Turn | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.6-B/ 4.3.9.1.7.6.6-B | Quick Release Fasteners – Positive Lock | N/A | N/A | N/A | N/A | No removable EVA fasteners |
| 3.9.1.7.6.7-A/ 4.3.9.1.7.6.7-A | Over Center Latches – Realignment | N/A | N/A | N/A | N/A | No over center latches |
| 3.9.1.7.6.7-B/ 4.3.9.1.7.6.7-B | Over Center Latches – Catches | N/A | N/A | N/A | N/A | No over center latches |
| 3.9.1.7.6.7-C/ 4.3.9.1.7.6.7-C | Over Center Latches – Handle | N/A | N/A | N/A | N/A | No over center latches |
| 3.9.1.7.6.8-A/ 4.3.9.1.7.6.8-A | Fastener Heads and Knobs – Diameters | N/A | N/A | N/A | N/A | No over center latches |
| 3.9.1.7.6.8-B/ 4.3.9.1.7.6.8-B | Fastener Heads and Knobs – Head Height | N/A | N/A | N/A | N/A | No over center latches |
| 3.9.1.7.6.9-A/ 4.3.9.1.7.6.9-A | Contingency Override – Hexagonal | N/A | N/A | N/A | N/A | No over center latches |
| 3.9.1.7.6.9-B/ 4.3.9.1.7.6.9-B | Contingency Override – No Cotter Keys | N/A | N/A | N/A | N/A | No over center latches |
| 3.9.1.7.7/ 4.3.9.1.7.7 | CONTROLS AND DISPLAYS | | TITLE | N/A | N/A | |
| 3.9.1.7.7.1-A/ 4.3.9.1.7.7.1-A | Contingency EVA Controls – Position | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.7.1-B/ 4.3.9.1.7.7.1-B | Contingency EVA Controls – Inadvertent Operation | A | I | Certificate of Compliance | L-3.5 | Analysis & Inspection |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------------------|---|-----------------------|--------|---------------------------|----------------|--|
| 3.9.1.7.7.2-A/ 4.3.9.1.7.7.2-A | Displays – SSP 50005 | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.7.2-B/ 4.3.9.1.7.7.2-B | Displays – Field of View | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.1.7.7.3/ 4.3.9.1.7.7.3 | Labeling | A | I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.9.2/ 4.3.9.2 | MAINTENANCE | | TITLE | N/A | N/A | |
| 3.9.2.1/ 4.3.9.2.1 | Planned Maintenance and Storage | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2-A/ 4.3.9.2.2-A | On-Orbit Maintenance – Mobility Aids and Restraints | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2-B/ 4.3.9.2.2-B | On-Orbit Maintenance – EVA Tools | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.1/ 4.3.9.2.2.1 | Corrective Maintenance | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.2/ 4.3.9.2.2.2 | In Situ Maintenance | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.3/ 4.3.9.2.2.3 | ORU Intermediate Maintenance | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.4/ 4.3.9.2.2.4 | Preventive Maintenance | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.5/ 4.3.9.2.2.5 | On-Orbit Maintenance Back-Up | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.6/ 4.3.9.2.2.6 | Access for On-Orbit Maintenance | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.6.1/ 4.3.9.2.2.6.1 | EVA Access to Fasteners | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |
| 3.9.2.2.7/ 4.3.9.2.2.7 | Standard On-Orbit Diagnostic Equipment | N/A | N/A | N/A | N/A | No On-Orbit Maintenance |

SSP 57213
Baseline

| IRD Paragraph | IRD Requirement | Payload Applicability | Method | Required Submittal Data | Submittal Date | Comments |
|-----------------------|---|-----------------------|--------|--|----------------|--|
| 3.9.2.3/ 4.3.9.2.3 | Ground Maintenance | N/A | N/A | N/A | N/A | Non-standard PAS payload - No Maintenance |
| 3.10-A/ 4.3.10-A | Nameplates and Product Marking | A | A&I | Certificate of Compliance showing Form 732 approval. | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |
| 3.10-B/ 4.3.10-B | Nameplates and Product Marking – Structural Integrity | A | A&I | Certificate of Compliance | L-3.5 | Analysis, NBL Training & Crew Evaluation, Inspection |

5.0 EXCEPTIONS TABLE

5.1 EXCEPTIONS TABLE

The AMS-02 Payload ICD contains a table of Exceptions per Table 5.1-1.

TABLE 5.1-1 EXCEPTIONS TABLE

| IRD/ICD PARAGRAPH NUMBER. | CLASSIFICATION | IDENTIFIER (REFERENCE NUMBER) | DESCRIPTION | STATUS |
|--|-----------------------|--|--|---------------|
| 3.1.2.3-B/ 4.3.1.2.3-B | Exceedance | E-1 | Interface Loads | |
| 3.1.3.1.1.1/ 4.3.1.3.1.1.1 | Exceedance | E-2 | Payload Attach System/ Unpressurized Logistics Carrier Attach System On-Orbit Operational Envelope | |
| 3.1.3.1.1.2/ 4.3.1.3.1.1.2 | Exceedance | E-3 | Interface Plane Protrusion | |
| 3.1.3.1.1.3-A/ 4.3.1.3.1.1.3-A | Exceedance | E-4 | Extravehicular Activity/Robotics Operational Envelope – EVA | |
| 3.1.3.1.1.3-B/ 4.3.1.3.1.1.3-B | Exceedance | E-5 | Extravehicular Activity/Robotics Operational Envelope – Robotics | |
| 3.2.2.4.7/ 4.3.2.2.4.7 | Exceedance | E-6 | Direct Current Magnetic Fields | |
| 3.7.3.3-A/ 4.3.7.3.3-A | Exceedance | E-7 | Equipment Requiring SSRMS Support Using a Power Video Grapple (PVGf) – Clearance Envelope | |
| 3.8.2.1/ 4.3.8.2.1 | Exceedance | E-8 | Payload Attach System/Unpressurized Cargo Carrier Attach System Interface Clearances | |

APPENDIX A
ACRONYMS AND ABBREVIATIONS

APPENDIX A - ACRONYMS AND ABBREVIATIONS

| | |
|-----------------|---|
| μg | Microgravity |
| +X | +X axis direction |
| +X _A | +X axis direction |
| +Y | +Y axis direction |
| +Z | +Z axis direction |
| ASS'Y | Assembly |
| CG | Center of Gravity |
| CGx | Center of Gravity +X axis direction |
| CGy | Center of Gravity +Y axis direction |
| CGz | Center of Gravity +Z axis direction |
| cm | centimeter |
| DoD | Department of Defense |
| EAR | Export Administration Regulations |
| EVA | Extravehicular Activity |
| EVR | Extravehicular Robotics |
| EXPRESS | Expedite the Processing of Experiments to the Space Station |
| ft ³ | cubic foot |
| GFE | Government Furnished Equipment |
| Hz | Hertz |
| ICD | Interface Control Document |
| IDD | Interface Definition Document |
| in | inch |
| in-lb | inch-pound |
| IPLAT | ISS Payload Label Approval Team |
| ITA | Integrated Truss Assembly |
| ITS | Integrated Truss Segment |
| IVA | Intravehicular Activity |
| JSC | Johnson Space Center |
| kbps | kilobits-per-second |
| kg | kilogram |
| KSC | Kennedy Space Center |
| L- | Launch minus |
| lb | pound |
| lbm | pounds mass |
| LI | Lower Inboard |

SSP 57213
Baseline

| | |
|----------------|---|
| LO | Lower Outboard |
| m ³ | cubic meter |
| Mbps | Megabits-per-second |
| MBS | MRS Base System |
| MCAS | MBS Common Attach System |
| min | minute |
| MOD | Mission Operations Directorate |
| MRS | Mobile Remote Servicer |
| MSS | Mobile Servicing System |
| N/A | Not Applicable |
| NASA | National Aeronautics and Space Administration |
| NBL | Neutral Buoyancy Laboratory |
| OPS | Operations |
| OZ | ISS Program Payloads Office |
| P | Port |
| PAS | Payload Attach System |
| PCB | Payloads Control Board |
| PD | Payload Developer |
| PIA | Payload Integration Agreement |
| PIM | Payload Integration Manager |
| S | Starboard |
| sec | second |
| SPPF | SpaceHab Payload Processing Facility |
| SRMS | Shuttle Remote Manipulator System |
| SSP | Space Shuttle Program |
| SSPF | Space Station Processing Facility |
| SSRMS | Space Station Remote Manipulator System |
| STS | Space Transportation System |
| TBD | To Be Determined |
| TBR | To Be Resolved |
| TEA | Torque Equilibrium Attitude |
| UCCAS | Unpressurized Cargo Carrier Attach System |
| UI | Upper Inboard |
| ULC | Unpressurized Logistics Carrier |
| UO | Upper Outboard |
| U.S. | United States |
| W | Watt |

APPENDIX B
GLOSSARY OF TERMS

APPENDIX B - GLOSSARY OF TERMS

ACCOMMODATIONS

Applies to Shuttle or ISS physical locations where utilization or system items are stowed or installed.

ADDENDUM

ISS to payload integration details are documented in SSP 57062.

ASCENT

The period of time from Space Shuttle Solid Rocket Booster (SRB) ignition through the establishment of a stable orbit (typically post-Orbital Maneuvering System (OMS) second burn).

CARRIER

An item that delivers to orbit and returns from orbit launch package/cargo items in an MPLM or in an unpressurized atmospheric environment on an Unpressurized Logistics Carrier (ULC), Spacelab Logistics Pallet.

DATA SETS

Data sets contain the engineering, integration, and operational details required and agreed upon by the implementing organizations. Data sets define, on an increment and flight-specific basis, the engineering, integration, and operational details of the requirements in the Addendum. Data sets will be updated as agreed to by the implementing organizations to meet increment and flight-specific needs.

DESCENT

The period of time from start of crew preparation for entry through wheels stop at the landing site.

EARLY ON-ORBIT

The time from ascent complete (stable orbit) to Space Shuttle Orbiter dock/mate to the ISS.

ENTRY

The time from Space Shuttle deorbit burn to wheels stop at the landing site.

EXPRESS PALLET

A pallet system assembly of up to six payload adapters for payloads plus an EXPedite the PProcessing of Experiments to the Space Station (EXPRESS) Pallet Controller Assembly. For the purposes of this document, the EXPRESS Pallet is considered as one payload when integrating and operating on ISS.

EXPRESS PALLET PAYLOAD ADAPTER

The EXPRESS Pallet Adapter accommodates up to 500 pounds of payload equipment with volumetric constraints of 34.00 inches x 46.00 inches x 49.00 inches during launch/landing

SSP 57213
Baseline

and ground handling. EXPRESS Pallet Adapters may be installed on ISS as part of a pallet complement or on an individual pallet adapter basis.

FLIGHT

The time phase and the sequence of events that take place between liftoff and entry/landing of an Earth-to-Orbit Vehicle.

FLIGHT SUPPORT EQUIPMENT

That equipment, both hardware and associated software, that is used to provide support to flight hardware from the time of flight hardware insertion into the launch vehicle (e.g., Space Shuttle Orbiter cargo bay) until removal for on-orbit installation or assembly.

FLIGHT-TO-FLIGHT

On-orbit configuration of the ISS after each flight that adds a major capability to the ISS through assembly complete. An assembly element is a Station configuration change, whereas flying up a logistics carrier is not a major ISS capability change.

GOVERNMENT FURNISHED EQUIPMENT

Equipment acquired by the Government and delivered or otherwise made available to a non-Government organization.

GROUND SUPPORT EQUIPMENT

Deliverable equipment, both hardware and associated software, that is used on the ground to provide some means of support to flight systems or equipment. Ground Support Equipment includes test and checkout equipment, handling and transporting equipment, access equipment, and servicing equipment.

INCREMENT

A specific time period into which various assembly, discipline research, testing, logistics, maintenance, and other ISS system operations and utilization activities are grouped. Increment boundaries are established to coincide with, and are defined by, crew rotations.

ISS PROGRAM-FUNDED SSP SERVICES

Those services or tasks outside the scope of the standard SSP services but that NASA performs for a customer. These services are commonly performed for individual payloads to accomplish complex or unique mission requirements. Funding sources/costs of these services are to be negotiated by the ISS Program, agreed to by the SSP, and documented as required in the flight-unique MIP.

ISS PROGRAM NON-STANDARD SERVICES

All ISS Program non-standard services are negotiated outside the Payload Integration Agreement on a payload-unique basis with the ISS Payloads Office/Code OZ.

SSP 57213
Baseline

JOINT OPERATIONS

The time from Space Shuttle Orbiter dock/mate to Station to Orbiter undock from the Station.

LAUNCH VEHICLE

The term “launch vehicle” means an object (or any part thereof) intended for launch, launched from Earth, or returning to Earth that carries payloads, persons, or both.

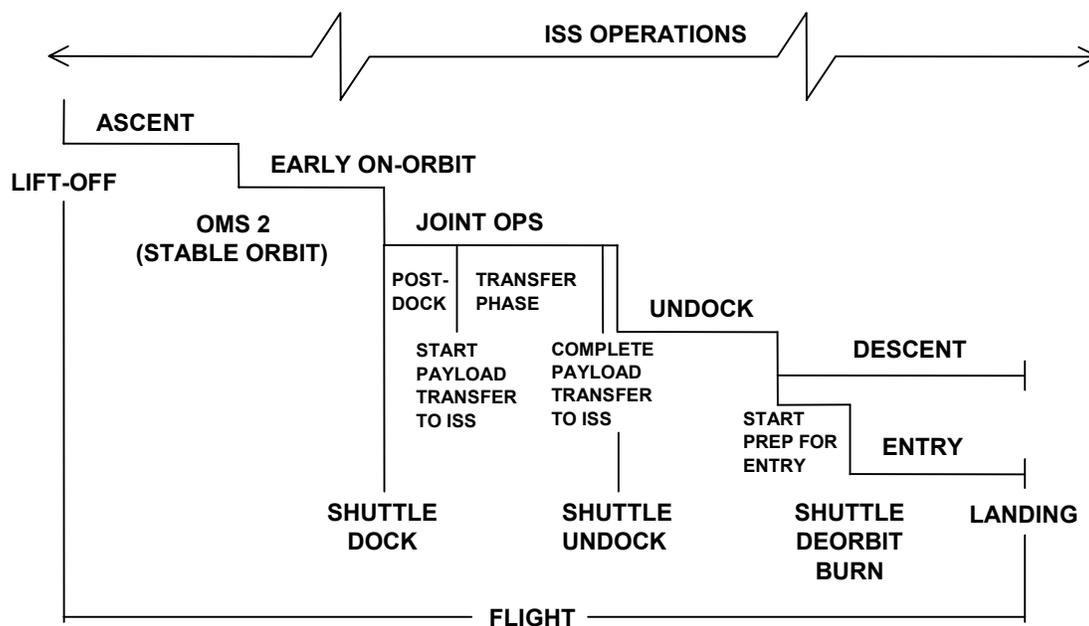
MAY

The word “may” is used for expressing purpose or an expectation to be fulfilled by the PD of a non-mandatory requirement.

MISSION

The performance of a coherent set of investigations or operations in space to achieve ISS Program goals.

MISSION PHASE DEFINITION



MULTI-PURPOSE LOGISTICS MODULE

MPLM is a pressurized carrier for transfer of cargo/payload elements to the Station that is launched in the Shuttle’s payload bay. The Shuttle is the only means for returning items in the MPLM from ISS. The MPLM provides structural, mechanical, electrical, data, and robotic interfaces between it and Station facilities. Payload equipment may be transported on an MPLM resupply stowage element or in an International Standard Payload Rack in the MPLM.

SSP 57213
Baseline

ON-ORBIT CONFIGURATION

The hardware/software configuration that occurs during assembly operations, including stage configuration.

ORBITAL TRANSPORT VEHICLE

A space vehicle that docks and departs from the ISS (e.g., Space Shuttle Orbiter, Progress, Soyuz, Autonomous Transfer Vehicle, and others).

PAYLOAD DEVELOPER

The engineering team/principal investigator or organization responsible for the development and management of the payload.

PAYLOAD SUPPORT EQUIPMENT

Payload Support Equipment (PSE) is equipment that is to be used for a specific payload. It is provided by the specific payload and is not available for multi-use.

POST-DOCK

The time from Space Shuttle Orbiter dock/mate to Station and until the start of payload transfer onto the ISS.

RESOURCES

This is the term used to identify a particular subset of ISS on-orbit capabilities used in support of system and payload operations. Resources include, but are not limited to, power, crew time, etc.

SHALL

Statements containing the word “shall” are mandatory requirements that the PD shall meet. In addition, “shall” statements are verifiable requirements in which the PD will be responsible for providing proof, as defined in the generic payload verification plan, that the requirements have been satisfied or addressed in the appropriate manner.

SHOULD

Statements containing the word “should” are used for goals that the PD should try to meet, but are not mandatory requirements.

SSP SERVICES

Those services provided to all customers for transportation of payloads to and from ISS.

STATION SUPPORT EQUIPMENT

Station Support Equipment (SSE) are devices/equipment, that are owned by the Station. Payloads may request use of devices/equipment prior to launch of the payload. The use of the SSE will be negotiated through the Laboratory Support Equipment (LSE) Payload Integration Manager (PIM).

SSP 57213**Baseline****TRANSFER PHASE**

The time from Space Shuttle Orbiter post-dock through completion of payload transfer onto ISS.

UNPRESSURIZED LOGISTICS CARRIER

An unpressurized carrier for transfer of cargo/payload elements to the ISS launched on the Shuttle. The Shuttle is the Earth-to-Orbit return vehicle for the ULC. The ULC provides structural and mechanical interfaces for cargo/payloads. Required robotic interface (e.g., grapple fixtures) to the Station are to be provided by the cargo/payload elements.

VERIFICATION

Ensures that facilities, system and payload hardware/software products, and operational procedures comply with the specification requirements imposed on them.

WILL

The word "will" is used for stating facts, information, and/or capability that are important to the PD.

APPENDIX C
OPEN WORK

APPENDIX C - OPEN WORK

Table C-1 lists the specific To Be Determined (TBD) items in the document that are not yet known. The TBD is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBD item is numbered based on the section where the first occurrence of the item is located as the first digit and a consecutive number as the second digit (i.e., <TBD 4-1> is the first undetermined item assigned in Section 4 of the document). As each TBD is solved, the updated text is inserted in each place that the TBD appears in the document and the item is removed from this table. As new TBD items are assigned, they will be added to this list in accordance with the above-described numbering scheme. Original TBDs will not be renumbered.

TABLE C-1 TO BE DETERMINED ITEMS

| TBD | Section | Description |
|-----|---------|-------------|
| | | |

Table C-2 lists the specific To Be Resolved (TBR) issues in the document that are not yet known. The TBR is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBR issue is numbered based on the section where the first occurrence of the issue is located as the first digit and a consecutive number as the second digit (i.e., <TBR 4-1> is the first unresolved issue assigned in Section 4 of the document). As each TBR is resolved, the updated text is inserted in each place that the TBR appears in the document and the issue is removed from this table. As new TBR issues are assigned, they will be added to this list in accordance with the above-described numbering scheme. Original TBRs will not be renumbered.

TABLE C-2 TO BE RESOLVED ISSUES

| TBR | Section | Description |
|------|---------|--|
| 3-1 | 3.1.3.2 | Interface plane - A waiver will be processed for this exceedance |
| 3-2 | 3.1.3.3 | AMS-02 on-orbit operational envelope - A waiver will be processed for this exceedance |
| 3-3 | 3.1.4.1 | Table 3.1.4.1-1 - Payload hardware description for ascent |
| 3-4 | 3.1.4.5 | Table 3.1.4.5-1 - Payload hardware description for descent |
| 3-5 | 3.1.5.2 | Acceleration environment requirements |
| 3--6 | 3.2.2 | The surface treatment for the guide pins to provide at least Class S bonding when AMS-02 is berthed to the PAS is <TBR 3.2.2-1>. |
| 3-7 | 3.2.4.2 | Figure 3.2.4.2-1 - AMS-02 APPI Load Impedance Magnitude |
| 3-8 | 3.2.4.2 | Figure 3.2.4.2-2 - AMS-02 APPI Load Impedance Phase |
| 3-9 | 3.2.5 | Figure 3.2.5-2 - Overload Protection Characteristics of AMS-02 Downstream Circuits |
| 3-10 | 3.2.6 | Figure 3.2.6-1 - AMS-02 Surge Current |
| 3-11 | 3.4.1 | Table 3.4.1-1 Attached Payload PAS/UCCAS – Cold Case |
| 3-12 | 3.4.1 | Table 3.4.1-1 Attached Payload PAS/UCCAS – Hot Case |
| 3-13 | 3.4.3 | Figure 3.4.3-1 - AMS-02 External Surface Optical Properties |

SSP 57213**Baseline**

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|------|-------|--|
| 3-14 | 3.4.3 | Table 3.4.3-1 – AMS-02 External Surface Optical Properties |
| 3-15 | 3.6 | Figure 3.6.2-1 - AMS-02 EVA Aids And Label Locations |
| 3-16 | 3.6 | Figure 3.6.4-1 - AMS-02 Danger And Warning Locations |