SSP 57135-A0-1-2
Baseline

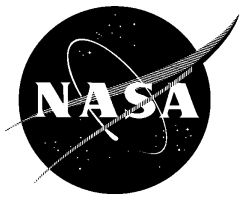
Addendum to the Payload Integration Agreement For The Middeck Active Control Experiment - II

International Space Station Program

Baseline

September 2000

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas



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INTERNATIONAL SPACE STATION PROGRAM

ADDENDUM
TO
SSP 57135
FOR INCREMENTS 0, 1, AND 2

PREFACE

ADDENDUM
TO
SSP 57135
FOR INCREMENTS 0, 1, AND 2

This Increment-Unique Addendum is the agreement between the Department of Defense (DoD) Shuttle/International Space Station (ISS) Payload Integration Office and the ISS Program on the increment-specific responsibilities and tasks which relate directly to integration of the Payload into the ISS. Signature on this Addendum constitutes technical agreement on the tasks to be performed.

All commitments and services to be furnished by the ISS Program to the DoD Shuttle/ISS Payload Integration Office under this Payload Integration Agreement (PIA) shall be furnished using its best efforts.

This Addendum, when baselined, becomes the controlling document for payload resources for an Increment, superseding any previously agreed-to payload Mission Evaluation Request.

The flight dates shown in this PIA are for planning purposes only.

The abbreviations and acronyms list is found in Appendix A. The glossary of the terms requiring definition is found in Appendix B. Open items which have not been determined are designated as To Be Determined (TBD) and are found in Appendix C. Items which need to be resolved will be designated as To Be Resolved (TBR) and are also found in Appendix C.

INTERNATIONAL SPACE STATION PROGRAM

ADDENDUM
TO
SSP 57135
FOR INCREMENTS 0, 1, AND 2

CONCURRENCE

SEPTEMBER 2000

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INTERNATIONAL SPACE STATION PROGRAM

ADDENDUM
TO
SSP 57135
FOR INCREMENTS 0, 1, AND 2

CONCURRENCE

SEPTEMBER 2000

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	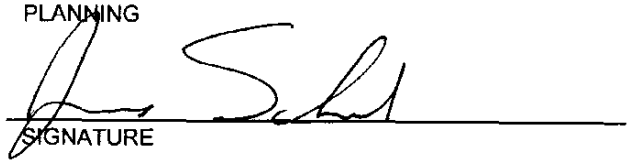 SIGNATURE	9-7-00 DATE
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INTERNATIONAL SPACE STATION PROGRAM

ADDENDUM
TO
SSP 57135
FOR INCREMENTS 0, 1, AND 2

CONCURRENCE

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1.0 INTRODUCTION

This section contains the top-level requirements unique to the Middeck Active Control Experiment - II (MACE-II) for Increments 0, 1, and 2, and for Flight(s) 2A.2b and return on 5A.1. This Addendum will contain all of the relevant data to document the International Space Station (ISS) Program and Payload Developer (PD) requirements and commitments for that increment. The Addendum is not a detailed collection of integration and operations requirements and data; such detailed information will reside in the payload data sets. All sections of SSP 57135, Payload Integration Agreement for the Middeck Active Control Experiment - II, are applicable during this increment except as modified by this Addendum.

A. The Payload Developer shall enter the appropriate information into each of the tables in the Addendum. If the requested information in the table is Not Applicable (N/A), N/A should be entered.

B. Section 1 of this Addendum describes the overall payload configuration and any changes that may occur during the increment. The PD shall document the purpose/objectives, a payload description, the payload category, the microgravity (µg) operating sensitivity, and the services required by the payload.

1.1 PAYLOAD PURPOSE/OBJECTIVES

This section documents the increment-specific purposes and objectives of the payload.

1.1.1 PAYLOAD PURPOSE/OBJECTIVES STATEMENT

The objectives of this payload are to validate advanced modeling and control designs for adaptive neural net control and multi-body dynamics and control in a micro-gravity environment. The MACE-II technology will be used develop algorithms which will provide stable platforms that are required for the transmission and linking high data rates across the country and the world via satellite.

1.2 PAYLOAD DESCRIPTION

This section contains an increment-specific description of the payload, indicates what type of payload hardware will be flown, and the operation requirements for operating the payload during this increment. If the payload description or operation is expected to change during the course of the increment, the operational scenarios will be described. The PD shall provide in the subsequent tables: the increment-specific payload description, the science or technology category of the payload, and the microgravity sensitivity level of the payload during this increment.

1.2.1 INCREMENT-SPECIFIC PAYLOAD DESCRIPTION

The MACE-II payload provides a test bed for studying the interaction of automatic control systems with dynamic space structures in ways which are not feasible in the Earth-bound 1 gravity (1g) environment. The focus of the MACE-II project will be to

examine the performance of controlled payloads performing pointing and tracking tasks on the multibody platform.

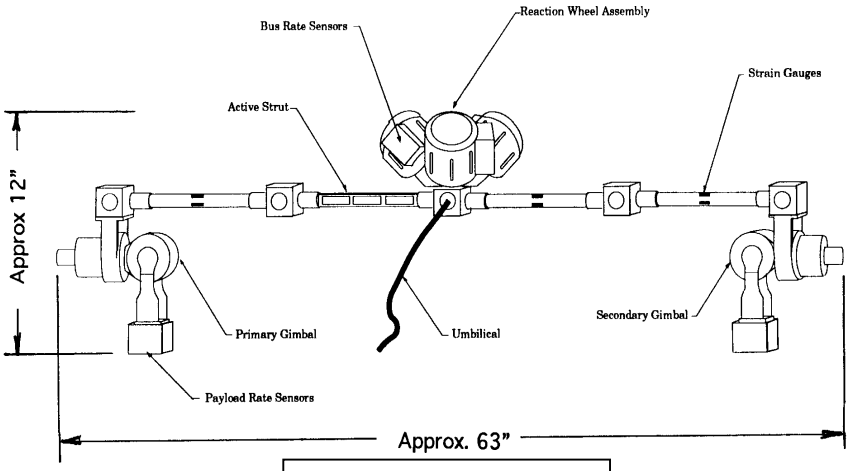
The MACE-II experiment consists of two types of hardware elements, the Experiment Support Module (ESM) and the Multibody Platform (MBP). The ESM contains the data storage, realtime control computer, actuator power amplifiers, signal conditioning and operator interface typical of a dynamics and control laboratory. The MBP is a sub-scale model of the multi-segment spacecraft with reaction wheels, gimbals, and associated actuators and sensors.

MACE-II will be stowed in 3 locker equivalents during launch and transfer on-orbit, with the ESM requiring one locker and the MBP and other associated hardware contained in the remaining 2 locker equivalents. The MACE-II hardware is passive stowage during ascent and entry and therefore can be stowed either in the middeck, Mini-Pressurized Logistics Module (MPLM) or in SpaceHab. Once on-orbit, the hardware will be transferred by the crew to the ISS. The ESM will require stowage on the ISS and will also require power during MACE-II payload operations. The ESM will be operated outside of the locker. The remaining stowage items can be transferred and stowed in any available ISS stowage volume.

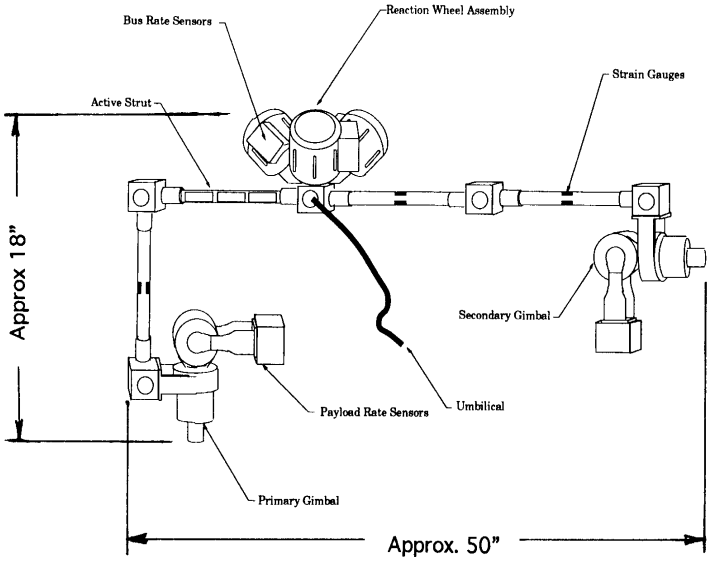
During payload operations, the crew will initially assemble the MBP and connect it to the ESM using a ten foot umbilical. The ESM can be operated outside of its stowage locker if necessary in order for the umbilical to reach the area where the MBP is being operated. The crew will then execute a warm-up procedure. This will prepare the hardware for testing and also allow the crew to familiarize themselves with the hardware. During test operations on-orbit, the MBP will be free floated or lightly tethered to prevent drifting and collision with other objects. The crew will operate the various science protocols in 1 to 4 hour increments while observing and documenting the results. These observations as well as data accumulated by the ESM (on Portable Computer Memory Card International Adapter (PCMCIA) cards) will be downlinked to the ground via the Orbital Communications Adapter (OCA) to allow the Principle Investigator (PI) an opportunity to modify the science protocol prior to the next scheduled MACE-II operations. After a minimum of 72 hours, the modified programs can be uplinked back to the crew for use during the next payload run.

1.2.2 INCREMENT-SPECIFIC PAYLOAD DRAWING

The PD shall provide a drawing which depicts the payload in its proposed on-orbit configuration in Figure 1.2.2-1, Increment-Specific Payload Drawing.



Primary Configuration



Secondary Configuration

FIGURE 1.2.2-1 INCREMENT-SPECIFIC PAYLOAD DRAWING

1.2.3 PAYLOAD CATEGORY TYPE SELECTION

The PD shall provide the following information in Table 1.2.3-1, Payload Category Type Selection/Specification.

A. Payload Type – The payload science discipline or technology that best characterizes the payload. The PD shall indicate the category of the payload by placing an X in the appropriate cell in the right column. If the payload type is "Other", a brief description will be provided by the PD.

TABLE 1.2.3-1 PAYLOAD CATEGORY TYPE SELECTION/SPECIFICATION

Payload Type	Category
Biomedical Science	
Biotechnology	
Combustion Science	
Commercialization	
Earth Science	
Fluid Physics	
Gravitational Biology	
Materials Research	
Space Science	
Space Systems Technology	
Other (describe)	

1.2.4 ISS OPERATING MODE SENSITIVITY

The PD shall provide the following information in Table 1.2.4-1, ISS Operating Mode Sensitivity for Payload.

A. Microgravity Type – Select the microgravity type by entering an X in the box to the right of the choice. Description of the ISS microgravity types follow:

1. Sensitive – The contents of this payload carrier are sensitive to disturbances in the ISS microgravity environment.
2. Sensitive/Disturber – The contents of this payload carrier may be sensitive to disturbances from the ISS and may also disturb the ISS microgravity environment during its various phases of operations.
3. Disturber – The contents of this payload carrier will create disturbances to the ISS microgravity environment.
4. Neither – This payload carrier is neither sensitive to disturbances in the ISS microgravity environment nor will they create disturbances in the ISS microgravity environment.

B. Level – Indicate the sensitivity and/or disturber level of the payload, if known, to the nearest order of magnitude in µg.

TABLE 1.2.4-1 ISS OPERATING MODE SENSITIVITY FOR PAYLOAD

Microgravity Type (check ONE only)		Level (µg)
Sensitive		
Sensitive/Disturber		
Disturber		
Neither	X	

1.3 SERVICES

This section documents the Space Shuttle Program (SSP) and ISS Program Non-Standard Services on a flight-by-flight basis, which are being requested by the PD. The SSP Services are further described in NSTS 07700, Program Definition and Requirements, Volume XIV, Space Shuttle System Payload Accommodations, Appendix 5, System Description and Design Data – Ground Operations. The ISS Program Non-Standard Services are further described in **<TBD A.1-1>**. In addition, the ISS Program Standard Services are described in **<TBD B-1>**.

The PD and the Payload Integration Manager (PIM) together will provide in the subsequent Table 1.3.1-1, SSP and ISS Program Non-Standard Services Requirements, by flight: identification of hardware requiring the service; the service required; additional information; and, a technical rationale for the service based on that specific hardware.

1.3.1 SSP AND ISS PROGRAM NON-STANDARD SERVICES REQUIREMENTS

The PD and the PIM shall provide the following information in Table 1.3.1-1.

A. Flight # - The requested flight identification (ID) number (e.g., 7A.1, UF-6.)

B. Location – Where the requested service is located.

C. Hardware – Identify the hardware that requires the service.

D. Services – Choose from the following list of ISS Program and SSP Non-Standard Services and enter data in table. (Reference Payload Integration Agreement (PIA) Section 7.0 for a description of these services.)

1. MPLM late access for installation of conditioned cargo
2. Middeck (MDK) late access for payload installation/servicing between Launch minus (L-)72 hours and L-24 hours
3. MDK late access for payload installation/servicing within L-24 hours

4. MDK late access for payload installation/servicing within a specific time between L-24 hours and L-18.5 hours (enter specific time in column for additional data)
5. MDK late access for payload installation/servicing within a specific time between L-18.5 hours and L-15.5 hours
6. Prelaunch Orbiter power/cooling/data monitoring for a MDK payload
7. Payload servicing for a 24-hour launch delay (MDK items only)
8. Payload servicing for a 48-hour launch delay (MDK items only)
9. Payload servicing for a greater than 48-hour launch delay but less or equal to a 30-day delay (MDK and MPLM) (enter specific time in column for additional data)
10. Payload-unique rollback requirements in case of a contingency vehicle rollback (enter specific requirements in column for additional data)
11. Post-landing Orbiter power/cooling/data monitoring for a MDK payload
12. Nominal End of Mission (EOM) middeck early access for payload runway removal from the Orbiter crew compartment prior to Orbiter tow (less than Landing plus (L+)6 hours)
13. Intact Abort Processing air transport to/from landing site
14. Early End of Mission (EEOM) middeck early access for payload runway removal from the Orbiter crew compartment prior to Orbiter tow (less than L+6 hours)
15. MPLM early access for removal of conditioned cargo
16. Other

E. Additional data - Enter any additional data necessary to describe the service required.

F. Technical Rationale – Provide a specific justification for the Service such as the specific potential research/science loss.

TABLE 1.3.1-1 SSP AND ISS PROGRAM NON-STANDARD SERVICES REQUIREMENTS

Flight #	Location	Hardware Item	Service	Additional Data	Technical Rationale
2A.2b	N/A	N/A	N/A	N/A	N/A
5A.1	N/A	N/A	N/A	N/A	N/A

2.0 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following documents include specifications, models, standards, guidelines, handbooks, and other special publications. The current issue of the following documents is identified in the Program Automated Library System (PALS) (issa-www.jsc.nasa.gov/cgi-bin/dsql+/ORAP?-h+palshome) or Payload Integrated Library System (PILS) (sspweb.jsc.nasa.gov/pils/payload.cfm). The documents listed in this paragraph are applicable to the extent specified herein. Inclusion of applicable documents herein does not in any way supersede the order of precedence identified in Paragraph 1.3 of this document.

SSP 57135	Payload Integration Agreement for the Middeck Active Control Experiment - II
NSTS 07700 Volume XIV Appendix 5	Program Definition and Requirements, Volume XIV, Space Shuttle System Payload Accommodations, Appendix 5, System Description and Design Data - Ground Operations
PTA-SH\MACE-II\ STS106	SpaceHab/MACE-II Payload Transfer Agreement

2.2 REFERENCE DOCUMENTS

The following documents contain supplemental information to guide the user in the application of this document. These reference documents may or may not be specifically cited within the text of this document.

3.0 PAYLOAD PLANNING REQUIREMENTS

This section documents the operations concept of the payload during each Increment. This data will be used to develop the projected allocations found in Addendum Sections 4, 5, and 6. The data collected in this section reflects the resources per Payload Operations Performance (POP) to implement the operations concept of the integrated rack. The data also addresses special considerations that should be taken into account during payload tactical planning and manifesting.

The PD will define in the subsequent sections the payload operation performance description, the basic on-orbit operating requirements, the on-orbit resource requirements, the on-orbit consumable, and the stowage requirements.

3.1 PAYLOAD OPERATION PERFORMANCE REQUIREMENTS

This section documents the top-level resource operations requirements for the payload. The top-level operations requirements for the payload are requested for each nominal POP type which is defined as follows:

POP type - A category of payload operations; a PD-defined sequence of payload activities expected to result in the completion of a major objective of the payload, such as the growth of a crystal or a major maintenance/calibration operation.

3.1.1 PAYLOAD OPERATION PERFORMANCE DESCRIPTION

The PD shall provide the following information in Table 3.1.1-1, Payload Operation Performance Description.

A. POP ID is a short title or id each type of payload operation.

B. Payload Operation Performance Description - Description of the payload operation performance. Describe the operation performance including critical performance requirements such as event dependence, continuous operation, or operation when resources are available.

TABLE 3.1.1-1 PAYLOAD OPERATION PERFORMANCE DESCRIPTION

POP ID	Description
Onboard training (OBT)	Unstow OBT disk and place in 760 series computer on board the ISS. Start lesson and learn how to assemble the MACE-II and execute protocols.
Reaction Wheel Spin Up	Unstow Center Node/Reaction Wheel Assembly, connect to ESM with umbilical and perform spin up protocol. Performed prior to MACE-II protocol execution. Performed when longer than 45 days have passed since last protocol execution.
Assembly	Unstow and setup video if required. Unstow MBP components and assemble. Perform assembly at mission start and as necessary prior to MACE-II protocol execution.
Protocol Execution	Unstow and setup video if required. Verify position of MBP, enter test protocol, monitor MBP performance.
Downlink	Insert MACE-II PCMCIA card in laptop and verify ground station go for downlink. Initiate transfer, verify completed, then stow PCMCIA disk. Data written from protocol runs will be downlinked and new, executable protocol files uplinked for subsequent operations.
Uplink	Insert MACE-II PCMCIA card in laptop and verify ground station go for uplink. Initiate transfer, verify completed, then stow PCMCIA disk. Data written from protocol runs will be downlinked and new, executable protocol files uplinked for subsequent operations.
Disassembly	Perform disassembly after protocol executions as required and at mission end. Stow or temperature stow MACE-II components.

3.1.2 ON-ORBIT OPERATING REQUIREMENTS

The PD shall provide the following basic on-orbit operating requirements in Table 3.1.2-1, Basic On-Orbit Operating Requirements.

A. POP ID - A short title or identifier for each type of payload operation.

B. Minimum Acceptable Number of Performances - The minimum number of payload operation performances required during the Increment.

C. Maximum Time Allowed to Complete Performances - The maximum number of months the ISS Program is allowed to complete the specified minimum acceptable number of performances.

D. Nominal Payload Operation Performance Time - The average duration of one nominal payload operation performance of the payload, in hours.

E. Minimum Time Required Between Performances - The minimum amount of time required between payload operating performances, in hours.

TABLE 3.1.2-1 BASIC ON-ORBIT OPERATING REQUIREMENTS

POP ID	Basic On-Orbit Operating Requirements	Amount
Onboard training	Minimum Acceptable Number of Performances	1
Onboard training	Maximum Time Allowed to Complete Performances (months)	1
Onboard training	Nominal Payload Operation Performance Time (hours/performance)	2
Onboard training	Minimum Time Required Between Performances (hours)	0.0
Reaction Wheel Spin Up	Minimum Acceptable Number of Performances	6
Reaction Wheel Spin Up	Maximum Time Allowed to Complete Performances (months)	6-12
Reaction Wheel Spin Up	Nominal Payload Operation Performance Time (hours/performance)	0.5
Reaction Wheel Spin Up	Minimum Time Required Between Performances (hours)	Note (1)
Assembly	Minimum Acceptable Number of Performances	Note (2)
Assembly	Maximum Time Allowed to Complete Performances (months)	6-12
Assembly	Nominal Payload Operation Performance Time (hours/performance)	1.33
Assembly	Minimum Time Required Between Performances (hours)	Note (2)
Protocol Execution	Minimum Acceptable Number of Performances	6
Protocol Execution	Maximum Time Allowed to Complete Performances (months)	6-12
Protocol Execution	Nominal Payload Operation Performance Time (hours/performance)	up to 1.5
Protocol Execution	Minimum Time Required Between Performances (hours)	72
Downlink	Minimum Acceptable Number of Performances	6
Downlink	Maximum Time Allowed to Complete Performances (months)	6-12
Downlink	Nominal Payload Operation Performance Time (hours/performance)	0.5
Downlink	Minimum Time Required Between Performances (hours)	72
Uplink	Minimum Acceptable Number of Performances	5
Uplink	Maximum Time Allowed to Complete Performances (months)	6-12
Uplink	Nominal Payload Operation Performance Time (hours/performance)	0.5
Uplink	Minimum Time Required Between Performances (hours)	72
Disassembly	Minimum Acceptable Number of Performances	Note (3)
Disassembly	Maximum Time Allowed to Complete Performances (months)	6-12
Disassembly	Nominal Payload Operation Performance Time (hours/performance)	0.5
Disassembly	Minimum Time Required Between Performances (hours)	Note (3)

NOTES:

1. The reaction wheel spin up should only be performed after the payload has gone without operation for more than 45 days. Reaction wheel spin up will be executed as a “protocol execution” POP ID.
2. The full assembly of the payload is only required once prior to initial payload operations and then only prior to subsequent payload operations where the payload has been fully disassembled.
3. The full disassembly of the payload is only required after final payload operations have been completed. During other times of payload idleness, partial disassembly, or temperature stow is preferred.

3.2 ON-ORBIT RESOURCE REQUIREMENTS

This section documents the peak (not transient) and off-peak resources required by the payload per POP ID. These requirements include electrical power, data uplink and downlink, video uplink and downlink, payload to payload communications, and crew support/subject.

Electrical power is power required to support payload operations, in kilowatts (kW).

Auxiliary power is the average amount of essential/auxiliary electrical power required by the payload in the event of loss of main power, in watts.

Vacuum exhaust is the average amount of time required on the ISS Vacuum Exhaust System (VES) during one nominal payload operation performance of the payload, in hours.

The thermal flow is the average amount of moderate and low temperature cooling required by the payload, in kilograms/hour.

Data uplink is the transmission rate of digital data from the ground to the ISS, in kilobits per second (kbps).

Data downlink is the transmission rate of digital data from the ISS to the ground, in megabits per second (Mbps).

Video uplink is the transmission rate of digital video from the ground to the ISS, in Mbps. Analog video signals generated by a payload are connected to a digital stream for downlink by the Video Baseband Signal Processor (VBSP). A correlation between analog video and the appropriate digital rate must be made.

Video downlink is the transmission rate of digital video from the ISS to the ground. Video downlink information is requested in Mbps or bit size and frame field/seconds (preferred).

The payload to payload Local Area Network (LAN) can provide users with the capability to transfer data from an International Standard Payload Rack (ISPR) to one or more ISPR locations, in Megabits.

Crew support is the number of ISS crew members required to simultaneously support payload operations. Crew subject is the number of ISS crew members required as life science subjects. It should be noted that the peak and off-peak requirements of the various resources do not necessarily coincide.

Data packet size refers to the length of the Consultative Committee for Space Data Systems (CCSDS) data packet. Data packet rate refers to the number of data packets to be downlinked to the ground. Data packet grouping refers to any special orbital periods when the data packets need or are expected to be transmitted to the ground.

3.3 ON-ORBIT CONSUMABLE REQUIREMENTS

The PD shall provide the following on-orbit consumable requirements in Table 3.3-1, On-Orbit Resource Requirements.

A. POP ID - A short title or identifier for each type of payload operation.

B. Peak Quantity - The peak amount of the resource required in the units specified.

C. Peak Duration - The duration for the associated peak quantity in the units specified.

D. Off-Peak Quantity - The average off-peak amount of the resource required in the units specified.

E. Off-Peak Duration - The duration for the associated off-peak quantity in the units specified.

F. Utility Interface Panel (UIP) Power - The power drawn at the UIP.

G. Auxiliary - The power drawn from the auxiliary power interface.

H. Utility Outlet Panel (UOP) Power - The power drawn from the UOP.

I. Vacuum Exhaust Rate - The rate and duration of vacuum vent.

J. Vacuum Exhaust Frequency - The frequency of vacuum vent for the POP.

K. Vacuum Resource Frequency - The duration and frequency of vacuum use as a resource in the rack.

L. Moderate Temperature Loop (MTL) Flowrate - The flowrate of fluid through the MTL in the rack and the duration of that flowrate.

M. MTL Heat Dissipation - The amount of heat dissipated into the MTL per unit of time.

N. Low Temperature Loop (LTL) Flowrate - The flowrate of fluid through the LTL in the rack and the duration of that flowrate.

O. LTL Heat Dissipation - The amount of heat dissipated into the LTL per unit of time.

P. Latent Cabin Air Heat Dissipation - Heat with moisture (humidity) dissipated into the cabin (e.g., life sciences payloads).

Q. Sensible Cabin Air Heat Dissipation - Heat without moisture dissipated into the cabin.

R. MTL Flow Control - The method of control for the flow of fluid through the MTL in the rack. Indicate whether the method of control is automatic or manual. Manual is defined as internal rack control.

S. MTL Flow Controlling Parameter - The parameter used to control the flow of fluid through the MTL in the rack. Indicate whether this parameter is the flowrate, exit temperature, or some other parameter.

T. Data Uplink - The rate and duration of data uplinked to ISS and routed to the rack via the ISS 1553B Payload Bus.

U. Low Rate Data Downlink Rate/Duration - The rate and duration of data transmitted from the rack to the ground via the ISS 1553B Payload Bus.

V. Medium Rate Data Downlink Rate/Duration - The rate and duration of data transmitted from the rack to the ground via the ISS Payload Ethernet Bus.

W. High Rate Data Downlink Rate/Duration - The rate and duration of data transmitted from the rack to the ground via the ISS high rate data link.

X. Video Uplink/Duration - The rate and duration of video uplinked to ISS and routed to the rack via the ISS video system.

Y. Video Downlink/Duration - The rate and duration of video transmitted from the rack to the ground via the ISS video system.

Z. Video Downlink Bit and Frame Field Data per second and Seconds.

AA. Video Transfer to Another Rack - The rate and duration of video transmitted to another ISS rack.

BB. Low Rate Data Transfer to Another Rack - The rate and duration of data transmitted to another rack via the ISS 1553B Payload Bus.

CC. Medium Rate Data Transfer to Another Rack - The rate and duration of data transmitted to another rack via the ISS Payload Ethernet Bus.

DD. High Rate Data Transfer to Another Rack - The rate and duration of data transmitted to another rack via the ISS high rate data link.

EE. Crew Support - The number of crew persons and duration required for the POP.

FF. Gaseous Nitrogen Consumption - The aggregate amount of gaseous nitrogen consumed for the POP.

GG. Argon Consumption - The aggregate amount of argon consumed for the POP.

HH. Helium Consumption - The aggregate amount of helium consumed for the POP.

II. Carbon Dioxide Consumption - The aggregate amount of carbon dioxide consumed for the POP.

JJ. Potable Water Consumption - The aggregate amount of potable water consumed for the POP.

KK. Support Equipment and Duration of Use - List Laboratory Support Equipment (LSE) or Station Support Equipment (SSE) to be used and the duration of use (minutes/hours/days). One item per line.

TABLE 3.3-1 ON-ORBIT RESOURCE REQUIREMENTS (PAGE 1 OF 6)

POP ID: Reaction Wheel Spin Up	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	.360	0.5
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	360	0.5
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	30
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Tether Restraints		N/A		30 minutes

TABLE 3.3-1 ON-ORBIT RESOURCE REQUIREMENTS (PAGE 2 OF 6)

POP ID: Assembly	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	N/A	N/A
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	80 minutes
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Digital Still Camera		N/A		30 minutes
Video Camera				80 minutes
Tether Restraints		N/A		80 minutes

TABLE 3.3-1 ON-ORBIT RESOURCE REQUIREMENTS (PAGE 3 OF 6)

POP ID: Protocol Execution	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	.86	< .0003	.517	-1.5
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	860	< .0003	517	up to 1.5
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	up to 90
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
ISS General Purpose Video Camera		N/A		up to 1.5
Video Tapes		N/A		up to 1.5
Tether Restraints		N/A		up to 1.5

TABLE 3.3-1 ON-ORBIT RESOURCE REQUIREMENTS (PAGE 4 OF 6)

POP ID: Downlink	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	N/A	N/A
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	NOTE	NOTE
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	**<TBD 2-1>**	**<TBD 2-1>**	**<TBD 2-1>**	**<TBD 2-1>**
Video Downlink Bit and Frame Field Data per second and Seconds Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	**<TBD 2-1>**	**<TBD 2-1>**	**<TBD 2-1>**	**<TBD 2-1>**
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	30
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Laptop Computer		N/A		30 minutes

NOTE: Data downlink and uplink will be via OCA.

TABLE 3.3-1 ON-ORBIT RESOURCE REQUIREMENTS (PAGE 5 OF 6)

POP ID: Uplink	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	N/A	N/A
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	NOTE	NOTE
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	30
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Laptop Computer		N/A		15 minutes

NOTE: Data uplink and downlink will be via OCA.

TABLE 3.3-1 ON-ORBIT RESOURCE REQUIREMENTS (PAGE 6 OF 6)

POP ID: Disassembly	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	N/A	N/A
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	30
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Tether Restraints		N/A		30 minutes
Video Camera				30 minutes

3.4 RESUPPLY/STOWAGE REQUIREMENTS

This section documents the on-orbit stowage requirements going to and from the ISS per POP ID. The stowage requirements in this table are for those items which will be accommodated outside the payload racks or lockers that contain payload hardware. The PD will define in the subsequent table, by POP ID: the payload carrier, the up mass and volume and the down mass and volume.

3.4.1 RESUPPLY/STOWAGE REQUIREMENTS

The PD shall provide the following requirements for each POP ID in Table 3.4.1-1, Re-supply/Stowage Requirements.

A. POP ID - A short title or identifier for each type of payload operation.

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS while on the ISS and during return. If the Hardware Item is not known, this cell should be left blank pending analysis to determine the appropriate Hardware Item.

C. Stowage Container - The container where the requested item will be stored while on-orbit. If the payload carrier is not known, this cell should be left blank pending analysis to determine the appropriate payload container. Below is a list of the stowage containers and locations.

+4 °C Refrigerator	-20 °C Freezer	-80 °C Freezer	-183 °C Cryo Freezer
ASC	Soft Stowage	MDL	Stowage Drawers
Incubator	Hazardous Trash Containers	Nonhazardous Trash Containers	Other/No Requirements

D. Stowage Constraints/Orientation - Indicate stowage items that have constraints or specific orientation requirements when stowed.

E. Mass - Specify the up/down mass of the stowage for each container required for each POP ID.

F. Volume - Specify the up/down volume of the stowage for each container required for each POP ID.

TABLE 3.4.1-1 RESUPPLY/STOWAGE REQUIREMENTS

POP ID	Hardware Item	Stowage Container	Stowage Constraint/ Orientation	Up Mass Resupply		Down Mass Production	
				Mass (kg)	Volume (m^3)	Mass (kg)	Volume (m^3)
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

4.0 PRELAUNCH TO ASCENT REQUIREMENTS

This section documents the requirements for the transportation of the payload to the ISS. This section reflects a summary of the launch requirements in Addendum Section 3, Payload Planning Requirements.

The PD will identify in the subsequent tables per flight: the payload hardware, payload Launch Commit Criteria (LCC), maximum launch configuration, and the ascent to on-orbit requirements. Details of these requirements will be further documented in the various payload-specific data sets.

4.1 PAYLOAD HARDWARE INFORMATION

This section documents the payload hardware transportation scenario to the ISS. It also contains a brief description of the payload hardware.

4.1.1 PRELAUNCH PROCESSING AND PAYLOAD TRANSPORTATION TO ISS ACTIVITIES

The PD shall provide the following information in Table 4.1.1-1, Scenario of Prelaunch Processing and Payload Transportation to ISS Activities.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Prelaunch to On-Orbit Activities - Define the scenario describing the prelaunch processing and the transportation of the payload hardware to the ISS by flight. It will include a summary or brief description of the prelaunch to on-orbit activities (including reactivation of time sensitive hardware).

TABLE 4.1.1-1 SCENARIO OF PRELAUNCH PROCESSING AND PAYLOAD TRANSPORTATION TO ISS ACTIVITIES

Flight #	Prelaunch to On-Orbit Activities
2A.2b	The MACE-II hardware will be stowed in the SpaceHab at KSC (See Note.) approximately 2 months prior to launch. The hardware will be transported by the space shuttle to the ISS and transferred to the ISS. The MACE-II hardware will be transferred to the ISS where it will be stowed until payload ops.

NOTE: MACE-II Payload prelaunch processing, integration, transport requirements, and agreements with SpaceHab are documented in PTA - SH/MACE-II/STS106, SpaceHab/MACE-II Payload Transfer Agreement.

4.1.2 PAYLOAD HARDWARE DESCRIPTION

The PD shall provide the following information in Table 4.1.2-1, Payload Hardware Description.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS while on the ISS and during return. If the hardware item is not known, this cell should be left blank pending analysis to determine the appropriate payload carrier.

C. Hardware Item Location - The location of the payload carrier (e.g., MDK, MPLM, ISPR, etc.).

ISPR	EXPRESS Rack	Transportation Rack	
Powered Single MDL	Powered Double MDL	Unpowered Single MDL	Unpowered Double MDL
4-Panel Unit ISIS Drawer	8-Panel Unit ISIS Drawer	12-Panel Unit ISIS Drawer	Stowage Tray
+4 °C Refrigerator	-20 °C Freezer	-80 °C Freezer	-183 °C Cryo Freezer
ASC/Softpack	Undefined/Loose Items	Other	

D. Volume - The volume of the payload carrier inclusive of the payload hardware. If the hardware item is an ISPR, Transportation Rack, Middeck Locker (MDL), or an International Subrack Interface Standard (ISIS) drawer, this cell is to be left blank.

E. Mass - The mass of the hardware item inclusive of the payload hardware listed in the table.

F. Additional Information - Information such as unique shapes and sizes, hazardous materials, etc., which might be pertinent to the ISS Program.

G. Total Mass/Flight - The total mass of the hardware item(s) inclusive of the payload hardware, by flight.

TABLE 4.1.2-1 PAYLOAD HARDWARE DESCRIPTION

Flight #	Hardware Item	Hardware Item Location (MDK, MPLM, etc.)	Volume (m^3)	Mass (kg)	Additional Information
2A.2b	CTB #1 (ESM)	SpaceHab	.06	27.2	
2A.2b	CTB #2	SpaceHab	.06	30.5	
2A.2b	CTB #3	SpaceHab	.06	30.5	
			Total Mass/Flight:	88.2	

Table 4.1.2-2 details those items included in the payload hardware list.

TABLE 4.1.2-2 PAYLOAD HARDWARE LIST

Hardware Item	Part Number	Additional Information
Experiment Support Module (ESM)	MACE-1-930	
Hand-Held Serial Terminal (HST) with umbilical	MACE-1-929	
Intermediate Node (Primary)	MACE-1-913-P	
Intermediate Node (Secondary)	MACE-1-913-S	
Corner Node	MACE-1-924	
Outer Strut (Primary)	MACE-1-925-PO	
Inner Strut (Secondary)	MACE-1-925-S1	
Outer Strut (Secondary)	MACE-1-925-SO	
Active Strut	MACE-1-926	
Inertia Wheel Assembly	MACE-1-915	
Primary Gimbal	MACE-1-920-P	
Secondary Gimbal	MACE-1-920-S	
Flexible Appendage, Primary Inner	MACE-2-923-PI	
Flexible Appendage, Primary Outer	MACE-2-923-O	
Flexible Appendage, Secondary Inner	MACE-2-923-SI	
Flexible Appendage, Secondary Outer	MACE-2-923-SO	Quantity 13
MACE-II PCMCIA Hard Disks	MACE-2-999	
Tether Pouch	MACE-1-940	
Laser Pointer	MACE-1-927-3	
AAA Battery	528-41350-2	Quantity 4
Ku-Band Power Supply (Modified)	SEG46116711-302	Quantity 3
UOP to Power Supplies Power Cable	MACE-1-ISS-NC	
MACE-II Power Cable	MACE-1-ISS-CESM	

4.2 PROGRAM-FURNISHED EQUIPMENT

This section of the PIA Addendum documents the flight-by-flight PD requirements for Program-Furnished Equipment (PFE) for payload ground and flight hardware for each flight within Increment 0. The ISS Program will review, provide, approve, and fabricate all decals.

4.2.1 GROUND REQUIREMENTS

The PD shall provide the following information in Table 4.2.1-1, Program-Furnished Equipment Ground Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Location - The location where the PFE is to be provided (e.g., Kennedy Space Center (KSC), PD site, etc.).

C. Equipment - List the PFE ground hardware required by the PD for his use (e.g., Rack Handling Adapter, Rack Shipping Container, Suitcase Test Environment for Payloads, Payload Rack Checkout Unit, etc.). Hardware to be listed in this table includes ISS Fleet Resources and other ISS-provided hardware but does not include KSC-provided hardware and equipment to be used by the PD at KSC. KSC-provided hardware and equipment to be used at KSC shall be entered in the KSC Support Requirements Data Set.

D. Need Date - The date by which the equipment is needed (e.g., L-24 months to L-12 months).

E. Duration - The length of time from launch, the equipment is needed (e.g., L-24 months to L-12 months).

TABLE 4.2.1-1 PROGRAM-FURNISHED EQUIPMENT GROUND REQUIREMENTS

Flight #	Location	Equipment	Need Date	Duration
2A.2b	N/A	N/A	N/A	N/A

4.2.2 FLIGHT REQUIREMENTS

The PD shall provide the following information in Table 4.2.2-1, Program-Furnished Equipment Flight Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Location - The location where the PFE is to be provided (e.g., KSC, PD site, etc.).

C. Equipment - The PFE flight hardware to be used by the PD (e.g., ISPR, Active Rack Isolation System (ARIS) Avionics Air Assembly, etc.).

D. Need Date - The date by which the equipment is needed (e.g., L-24 months to L-12 months).

E. Duration - The length of time from launch that the equipment is needed (e.g., L-24 months to L-12 months).

TABLE 4.2.2-1 PROGRAM-FURNISHED EQUIPMENT FLIGHT REQUIREMENTS

Flight #	Location	Equipment	Need Date	Duration
2A.2b	N/A	N/A	N/A	N/A

4.3 PAYLOAD LAUNCH COMMIT CRITERIA

This section contains the payload LCC. Criteria for developing payload constraints for Shuttle launches are identified in NSTS 07700, Volume XIV, Appendix 5, Section 6.

4.3.1 LAUNCH COMMIT CRITERIA REQUIREMENTS

The PD shall provide the following LCC information in Table 4.3.1-1, Payload Launch Commit Criteria.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS while on the ISS and during return. If the hardware item is not known, this cell should be left blank pending analysis to determine the appropriate payload carrier.

C. Payload LCC - The requirements, negotiated by the ISS Program, the Launch Vehicle office, and the PD which could cause launch holds.

D. Technical Rationale - A justification for the need of the LCC.

TABLE 4.3.1-1 PAYLOAD LAUNCH COMMIT CRITERIA

Flight #	Hardware Item	Payload LCC	Technical Rationale
2A.2b	N/A	N/A	N/A

4.4 PAYLOAD MAXIMUM LAUNCH CONFIGURATION

The maximum launch configuration duration is the amount of time the payload can sustain its launch configuration without physical access. Conditioned cargo launch configuration duration is based on the completion of MPLM access at L-88 hours (MPLM) or L-44 hours (SpaceHab). All other MPLM or SpaceHab payloads besides conditioned cargo have a launch configuration duration based on completion of payload closeouts. In Table 4.4.1-1, Payload Maximum Launch Configuration Duration, provide both the technical rationale and the requirement for the maximum amount of days (or indicate indefinitely) from the completion of payload prelaunch operations until the payload requires access after an extended launch delay.

NOTE: Middeck payload and conditioned cargo scrub turnaround requirements less than or equal to 30 days (for example, 24 hours, 48 hours, 72 hours, 96 hours, and 120 hours) are to be negotiated, technically justified, and documented in Addendum Section 1.3.

4.4.1 PAYLOAD MAXIMUM LAUNCH CONFIGURATION DURATION

The PD shall provide the following LCC information in Table 4.4.1-1.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS while on the ISS and during return. If the hardware item is not known, this cell should be left blank pending analysis to determine the appropriate payload carrier.

C. Maximum Launch Configuration Duration - The maximum time the payload can sustain launch configuration without physical access.

D. Technical Rationale - A justification for the launch configuration limitation.

TABLE 4.4.1-1 PAYLOAD MAXIMUM LAUNCH CONFIGURATION DURATION

Flight #	Hardware Item	Maximum Launch Configuration Duration (Days) (See Note.)	Technical Rationale
2A.2b	ESM Locker	45 days from first launch attempt	Certain MACE-II components, including the ESM, will require functional check out after being inaccessible since approximately L-3 months.
2A.2b	Reaction Wheel Assembly	45 days from first launch attempt	Certain MACE-II components will require functional check out after being inaccessible since approximately L-3 months.
2A.2b	Primary Gimball	45 days from first launch attempt	Certain MACE-II components will require functional check out after being inaccessible since approximately L-3 months.
2A.2b	Secondary Gimball	45 days from first launch attempt	Certain MACE-II components will require functional check out after being inaccessible since approximately L-3 months.

NOTE: MACE-II Payload prelaunch processing, integration, transport requirements, and agreements with SpaceHab are documented in the SpaceHab/MACE-II Payload Transfer Agreement (PTA) - SH/MACE-II/STS106.

4.5 ASCENT TO ON-ORBIT PAYLOAD RESOURCE REQUIREMENTS

This section documents on a flight basis, the resource transportation, payload transport and transfer, and flight crew time requirements from pre-PLBD closure to the completion of payload assembly/installation. The PD will specify in the subsequent tables, by flight: the transport, payload transfer, and the flight crew time requirements.

4.5.1 ASCENT TO ON-ORBIT PAYLOAD RESOURCE TABLE

The PD shall provide the following information in Table 4.5.1-1, Resource Transportation Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS, while on the ISS, and during return. If the hardware item is not known, this cell should be left blank, pending analysis to determine the appropriate payload container.

C. Resource - The power (kW), command/data Mbps, telemetry (Mbps), and heat removal method (kW or kilogram (kg)/hour) needed to be provided by the carrier

vehicle to support the payload during each transportation phase to support payload operations.

D. Pre-Payload Bay Door (PLBD) Closure - The average and peak resource needed during period of time from payload insertion into the Orbiter Bay to PLBD closure for flight. The peak resource requirement will be identified in parentheses. In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

E. Post-PLBD Closure - The average and peak resource needed during period of time from PLBD closure for flight to Solid Rocket Booster (SRB) ignition. (Ascent software configuration loading +6 at Time prior to launch minus (T-)20.) In addition, for power, indicate the length of time, in minutes, that identified payloads can be unpowered by placing this value in brackets.

F. Ascent - The average and peak resource needed during period of time from SRB ignition through the establishment of a stable orbit (typically post-Orbital Maneuvering System (OMS) second burn). In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

G. Pre-assembly - The average and peak resource needed during period of time from just after the establishment of a stable orbit until the start of the Cargo Element (CE) deployment or assembly operations (i.e., docking). In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

H. Assembly - The average and peak resource needed during period of time from the start of the activity or assembly sequence until the completion of the CE assembly operations (i.e., docked operation, re-powering time sensitive hardware, etc.). In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

I. Interface Routing - Indicate the interface routing based on the resource type below.

Power	Command/Data	Telemetry	Heat Removal
Orbiter MDK Power	MPLM MDM to Payload	MPLM MDM to Payload	MDK Cabin Air
Cabin P/L Bus to PCS	PCS to MDK	PCS to MDK	MDK Rear Duct Air
Safing	Other	Other	MPLM to LTL
MPLM to Payload			Other
Other			

TABLE 4.5.1-1 RESOURCE TRANSPORTATION REQUIREMENTS

Flight #	Hardware Item	Resource	Pre-PLBD Closure	Post-PLBD Closure	Ascent	Pre-Assembly	During Assembly	Interface Routing
2A.2b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

4.5.2 TRANSPORT AND TRANSFER REQUIREMENTS

PD shall provide the following information in Table 4.5.2-1, Transport and Transfer Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS, while on the ISS, and during return. If the hardware item is not known, this cell should be left blank pending analysis to determine the appropriate payload container.

C. Description of Transport Requirements - A description of the special requirements, if any, for the transportation of the payload hardware to ISS (e.g., launch orientation, temperature, early on-orbit requirements, special handling, etc.).

D. Description of Transfer Requirements - A description of the special requirements, if any, for transferring the payload hardware from the Orbiter to the ISS.

TABLE 4.5.2-1 TRANSPORT AND TRANSFER REQUIREMENTS

Flight #	Hardware Item	Description of Transport Requirements	Description of Transfer Requirements
2A.2b	CTB #1	N/A	N/A
2A.2b	CTB #2	N/A	N/A
2A.2b	CTB #3	N/A	N/A

4.5.3 FLIGHT CREW TIME REQUIREMENTS

The PD shall provide the following information in Table 4.5.3-1, Flight Crew Time Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Total Time During Ascent and Early On-Orbit - The total amount of crew time needed to perform activities in support of payload operations during this mission phase. The total time needed should include overhead time, (e.g., to access, set up, and tear down support equipment).

C. Description of Flight Crew Requirements - A description of the crew activities being performed in support of payload operations during the mission phase.

TABLE 4.5.3-1 FLIGHT CREW TIME REQUIREMENTS

Flight #	Total Crew Time During Ascent and Early On-Orbit (Hours)	Description of Flight Crew Requirements
2A.2b	Standard transfer time for 3 MLEs	Transfer ESM Locker and MACE Kits 1-2 from orbiter to their on-orbit stowage location on the ISS.

5.0 ON-ORBIT ISS REQUIREMENTS

This section documents the on-orbit requirements for the payload for operation in the ISS for Increment 0 and 1. This section reflects a summary of the on-orbit requirements in Addendum Section 3, Payload Planning Requirements. The PD will identify in the subsequent tables: the payload rack definition and payload carrier placement criteria, payload stowage, and on-orbit POP requirements. Details of these requirements will be further documented in one or more of the data sets.

5.1 PAYLOAD DEFINITION AND PAYLOAD CARRIER PLACEMENT

This section describes payload hardware placement criteria, if any. Table 5.1.1-1, Payload Definition and Placement Criteria, provides further details on any payload operational microgravity sensitivities. The PD will specify in the subsequent table: the payload carrier and the payload placement criteria.

5.1.1 PAYLOAD DEFINITION AND PLACEMENT CRITERIA

The PD shall provide the following information in Table 5.1.1-1.

A. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS, while on the ISS, and during return. If the hardware item is not known, this cell should be left blank pending analysis to determine the appropriate payload container.

B. Payload Placement Criteria - Any criteria for the placement of the payload carrier, including any requested module, co-location requirements, special handling requirements, or operational sensitivities. Include the intended use of a temporary attachment to the payload that will extend into the aisle of the ISS lab (e.g., ergometer or glove box).

TABLE 5.1.1-1 PAYLOAD DEFINITION AND PLACEMENT CRITERIA

Hardware Item	Payload Placement Criteria
CTB #1	ESM Locker
CTB #2	Stow near ESM Locker location
CTB #3	Stow near ESM Locker location

NOTE: All hardware items should be located on-orbit within a 10 foot range of one another. This distance is limited by the 10 foot umbilical used to connect the ESM to the MBP.

5.2 PAYLOAD STOWAGE REQUIREMENTS

This section documents the on-orbit stowage requirements of the payload. This section will be completed once the analyses and negotiations of the data in Addendum Section 3, Payload Planning Requirements, are performed. Values are calculated based on a summation of the requirements defined by Section 3 of this Addendum. The stowage requirements in this table are for those items which will be accommodated outside the experiment rack(s) that contain the payload hardware.

The PD will define in the subsequent table, from flight to flight, if appropriate: the stowage location, the time when the stowage is needed, the volume, and a brief description of any special stowage requirements.

5.2.1 STOWAGE CONTAINER/ACCOMMODATION

The PD shall provide the following information in Table 5.2.1-1, Payload Stowage Requirements.

A. Stowage Container/Accommodation - The container or location where the requested item will be stored. Below is a list of the stowage containers and locations.

+4 ^{o}C Refrigerator	-20 ^{o}C Freezer	-80 ^{o}C Freezer	-183 ^{o}C Cryo Freezer
Incubator	MDL	ASC	Soft Stowage
Stowage Drawers	Nonhazardous Trash Container	Hazardous Trash Container	
Other/No Requirements			

B. From Flight # - The flight number in the increment which begins when the stowage is needed.

C. To Flight # - The flight number in the increment which ends when the stowage is needed.

D. Volume - The volume of the stowage being requested if the storage container is not specified. Dimensions are recorded in the Configuration Data Set.

E. Description of Special Stowage Requirements - Any special requirements for stowage (e.g., hazardous materials, environment, location, biomedical waste, etc.).

TABLE 5.2.1-1 PAYLOAD STOWAGE REQUIREMENTS

Stowage Container/ Accommodation	Stowage Duration		Stowage Container	Description of Special Stowage Requirements
	From Flight #	To Flight #	Volume (m^3)	
CTB #1	2A.2b	See Note 1.	.06	ESM locker (See Note 2.)
CTB #1 & 2	2A.2b	See Note 1.	.12	CTB #1-2 stowed near ESM locker

NOTES:

1. Length of time on-orbit is dependent upon return flight. MACE-II has requested an on-orbit duration of 6-12 months.
2. The ESM can be operated outside of its stowage locker if required to do so due to MBP operation location.

5.3 LAB/STATION SUPPORT EQUIPMENT AND ACCOMMODATIONS

The contents of this section list the LSE, SSE, and Accommodations which are available on the ISS to support the payload operation. The PD will select from the list of those items which are required.

5.3.1 LAB SUPPORT EQUIPMENT AND ACCOMMODATIONS FOR PAYLOAD OPERATION

The PD shall provide the following information in Table 5.3.1-1, Lab Support Equipment and Accommodations Requirements. The duration of use is captured in Table 3.3-1, by POP, and in Table 5.4.1-1, Increment On-Orbit Resource Requirements, as increment summation, for each item listed in Table 5.3.1-1.

A. LSE - Specify which of the LSE items listed below are required to support operations of the payload.

ISS General Purpose Video Camera	Microscope, Dissecting	Passive Dosimeter Reader/Annealer
Cleaning Equipment	Freezer, Cryogenic Storage	Mass Measuring Device, Micro
Compound Microscope	Freezer, Quick/Snap Cryogenic	Mass Measuring Device, Small
Digital Thermometer	Incubator	

B. Comments - Enter any notes pertaining to the use of the LSE item, especially if the item is required during a majority of the time the payload will be operating. Indicate the approximate length of time the item will be required (e.g., need the digital thermometer and the incubator at the same time).

TABLE 5.3.1-1 LAB SUPPORT EQUIPMENT AND ACCOMMODATIONS REQUIREMENTS

Lab Support and Accommodation Equipment Item	Comments
ISS General Purpose Video Camera	Used during MACE-II protocol executions to document results Should be dedicated to MACE-II during protocol executions (up to 1.5 hour increments)
Video Tapes	Up to 2 tapes per session, with a minimum of 12 tapes

5.3.2 ISS SUPPORT EQUIPMENT AND ACCOMMODATIONS FOR PAYLOAD OPERATION

The PD shall provide the following information in Table 5.3.2-1, ISS Support Equipment and Accommodations Requirements. The duration of use is captured in Table 3.3-1, by POP, and in Table 5.4.1-1, as increment summation, for each item listed in Table 5.3.2-1.

A. SSE - Specify which of the SSE items listed below are required to support operations of the payload.

General Purpose IVA Tools	Portable Utility Light
Digital Still Camera	Utility Outlet Panel
Still Camera	Crew Refrigerated Freezer
Restraints and Mobility Aids	Fluid System Servicer
Digital Recording Oscilloscope, Digital Multimeter, pH meter and Digital Thermometer (combined)	Bar Code Reader
Battery Charger	Maintenance Work Area
DC Power Supply	Function/Sweep Generator

B. Comments - Enter any notes pertaining to the use of the SSE item, especially if the item is required during a majority of the time the payload will be operating. Indicate the approximate length of time the item will be required (e.g., need the digital thermometer and the incubator at the same time).

TABLE 5.3.2-1 ISS SUPPORT EQUIPMENT AND ACCOMMODATIONS REQUIREMENTS

Station Support and Accommodation Equipment Item	Comments
Digital Still Camera	Used for documentary purposes only to record set up and operations Required for less than 1 hour during assembly
Restraints	MACE-II will require the use of restraints during protocol execution Restraints will be dedicated to MACE-II during protocol executions (approx. 1.5 hour increments) Restraints should allow tethering of MBP to rack seat tracks

5.4 ON-ORBIT RESOURCE REQUIREMENTS

This section summarizes the on-orbit resources of the payload for Increment 0 and 1. Values are calculated based on a summation of the requirements defined by Section 2 of this Addendum. These requirements include electrical power, auxiliary power, data uplink and downlink, video and crew support.

Electrical energy is energy required to support payload operations, in kilowatt hours (kWh). Auxiliary power is backup to the electrical power, in kWh. Data uplink is the total transmission of digital data from the ground to the ISS, in Megabits (Mb). Data downlink is the total transmission of digital data from the ISS to the ground, in Gigabytes (GB). Video is the total transmission of analog video from the ISS to the ground, in GB. Crew support is the total number of ISS crew hours required to support payload operations.

5.4.1 INCREMENT ON-ORBIT RESOURCE REQUIREMENTS

The PD shall provide the following information in Table 5.4.1-1. This section provides a summary of the ISS consumable resources required to support payload operations during the increment based on a summation of requirements in Section 2 of this Addendum. Note that potable water must be transported to the payload by a crew member.

A. POP ID - A short title or identifier for each type of payload operation.

B. Peak Quantity - The peak amount of the resource required in the units specified.

C. Peak Duration - The duration for the associated Peak Quantity in the units specified.

D. Off-Peak Quantity - The average off-peak amount of the resource required in the units specified.

E. Off-Peak Duration - The duration for the associated Off-Peak Quantity in the units specified.

F. UIP Power - The power drawn at the Utility Interface Panel.

G. Auxiliary - The power drawn from the auxiliary power interface.

H. UOP Power - The power drawn from the Utility Outlet Panel.

I. Vacuum Exhaust Rate - The rate and duration of vacuum vent.

J. Vacuum Exhaust Frequency - The frequency of vacuum vent for the POP.

K. Vacuum Resource Frequency - The duration and frequency of vacuum use as a resource in the rack.

L. MTL Flowrate - The flowrate of fluid through the MTL in the rack and the duration of that flowrate.

M. MTL Heat Dissipation - The amount of heat dissipated into the MTL per unit of time.

N. LTL Flowrate - The flowrate of fluid through the LTL in the rack and the duration of that flowrate.

O. LTL Heat Dissipation - The amount of heat dissipated into the LTL per unit of time.

P. Latent Cabin Air Heat Dissipation - Heat with moisture (humidity) dissipated into the cabin (e.g., life sciences payloads).

Q. Sensible Cabin Air Heat Dissipation - Heat without moisture dissipated into the cabin.

R. MTL Flow Control - The method of control for the flow of fluid through the MTL in the rack. Indicate whether the method of control is automatic or manual. Manual is defined as internal rack control.

S. MTL Flow Controlling Parameter - The parameter used to control the flow of fluid through the MTL in the rack. Indicate whether this parameter is the flowrate, exit temperature, or some other parameter.

T. Data Uplink - The rate and duration of data uplinked to ISS and routed to the rack via the ISS 1553B Payload Bus.

U. Low Rate Data Downlink Rate/Duration - The rate and duration of data transmitted from the rack to the ground via the ISS 1553B Payload Bus.

V. Medium Rate Data Downlink Rate/Duration - The rate and duration of data transmitted from the rack to the ground via the ISS Payload Ethernet Bus.

W. High Rate Data Downlink Rate/Duration - The rate and duration of data transmitted from the rack to the ground via the ISS High Rate Data Link.

X. Video Uplink/Duration - The rate and duration of video uplinked to ISS and routed to the rack via the ISS video system.

Y. Video Downlink/Duration - The rate and duration of video transmitted from the rack to the ground via the ISS video system.

Z. Video Downlink Bit and Frame Field Data per second and Seconds.

AA. Video Transfer to Another Rack - The rate and duration of video transmitted to another ISS rack.

BB. Low Rate Data Transfer to Another Rack - The rate and duration of data transmitted to Another rack via the ISS 1553B Payload Bus.

CC. Medium Rate Data Transfer to Another Rack - The rate and duration of data transmitted to another rack via the ISS Payload Ethernet Bus.

DD. High Rate Data Transfer to Another Rack - The rate and duration of data transmitted to another rack via the ISS high rate data link.

EE. Crew Support - The number of crew persons and duration required for the POP.

FF. Gaseous Nitrogen Consumption - The aggregate amount of gaseous nitrogen consumed for the POP.

GG. Argon Consumption - The aggregate amount of argon consumed for the POP.

HH. Helium Consumption - The aggregate amount of helium consumed for the POP.

II. Carbon Dioxide Consumption - The aggregate amount of carbon dioxide consumed for the POP.

JJ. Potable Water Consumption - The aggregate amount of potable water consumed for the POP.

KK. Support Equipment and Duration of Use - List LSE or SSE to be used and the duration of use (minutes/hours/days). One item per line.

TABLE 5.4.1-1 INCREMENT ON-ORBIT RESOURCE REQUIREMENTS (PAGE 1 OF 6)

POP ID: Reaction Wheel Spin Up	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	2.230	0.25-1.5
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	2230	0.25-1.5
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds. Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	15-90
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Tether Restraints		N/A		0.25-1.5 hours

TABLE 5.4.1-1 INCREMENT ON-ORBIT RESOURCE REQUIREMENTS (PAGE 2 OF 6)

POP ID: Assembly	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	N/A	N/A
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds. Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	80-480
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Digital Still Camera		N/A		30-180 minutes
Video Camera		N/A		30-480 minutes
Tether Restraints		N/A		40-480 minutes

TABLE 5.4.1-1 INCREMENT ON-ORBIT RESOURCE REQUIREMENTS (PAGE 3 OF 6)

POP ID: Protocol Execution	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	.86	< 0.002	.517	6-24
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	860	< 0.002	517	6-24
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds. Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	60-1440
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
ISS General Purpose Video Camera		N/A		1-6 hours
Video Tapes		N/A		1-6 hours
Tether Restraints		N/A		1-6 hours
Digital Still Camera		N/A		1-6 hours

TABLE 5.4.1-1 INCREMENT ON-ORBIT RESOURCE REQUIREMENTS (PAGE 4 OF 6)

POP ID: Downlink	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	N/A	N/A
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A		
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	NOTE	NOTE
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	**<TBD 4-1>**	**<TBD 4-1>**	**<TBD 4-1>**	**<TBD 4-1>**
Video Downlink Bit and Frame Field Data per second and Seconds. Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	**<TBD 4-1>**	**<TBD 4-1>**	**<TBD 4-1>**	**<TBD 4-1>**
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	180
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Laptop Computer		N/A		60 minutes

NOTE: Data uplink and downlink will be via OCA.

TABLE 5.4.1-1 INCREMENT ON-ORBIT RESOURCE REQUIREMENTS (PAGE 5 OF 6)

POP ID: Uplink	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	.086	.083
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	86	.083
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	NOTE	NOTE
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds. Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	180
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Laptop Computer		N/A		75 minutes

NOTE: Data downlink and uplink will be via OCA.

TABLE 5.4.1-1 INCREMENT ON-ORBIT RESOURCE REQUIREMENTS (PAGE 6 OF 6)

POP ID: Disassembly	Peak		Off-Peak	
	Quantity	Duration	Quantity	Duration
UIP Power (kW and hours)	N/A	N/A	N/A	N/A
Auxiliary (kW and hours)	N/A	N/A	N/A	N/A
UOP Power (kW and hours)	N/A	N/A	N/A	N/A
Vacuum Exhaust Rate (kg/minute and minutes)	N/A	N/A	N/A	N/A
Vacuum Exhaust Frequency (number of times per POP)	N/A		N/A	
Vacuum Resource Frequency (number of times per POP and minutes)	N/A	N/A	N/A	N/A
MTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
MTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
LTL Flowrate (kg/hour and hours)	N/A	N/A	N/A	N/A
LTL Heat Rejection (Watts and hours)	N/A	N/A	N/A	N/A
Latent Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
Sensible Cabin Air Heat Dissipation (Watts and hours)	N/A	N/A	N/A	N/A
MTL Flow Control (indicate whether automatic or manual)	N/A		N/A	
MTL Flow Controlling Parameter (indicate whether flowrate, exit temperature, or other)	N/A		N/A	
Data Uplink (kbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Downlink Rate/Duration (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Downlink Rate/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Uplink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink/Duration (Mbps and seconds)	N/A	N/A	N/A	N/A
Video Downlink Bit and Frame Field Data per second and Seconds. Select from the following: *6 bit, 30 full-frame fields/second/Seconds* *6 bit, 30 half-frame fields/second/Seconds* *6 bit, 15 half-frame fields/second/Seconds* *6 bit, 7.5 half-frame fields/second/Seconds* *6 bit, 1.875 half-frame fields/second/Seconds* *8 bit, 30 full-frame fields/second/Seconds* *8 bit, 30 half-frame fields/second/Seconds* *8 bit, 15 half-frame fields/second/Seconds* *8 bit, 7.5 half-frame fields/second/Seconds* *8 bit, 1.875 half-frame fields/second/Seconds*	N/A	N/A	N/A	N/A
Video Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Low Rate Data Transfer to Another Rack (kbps and seconds)	N/A	N/A	N/A	N/A
Medium Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
High Rate Data Transfer to Another Rack (Mbps and seconds)	N/A	N/A	N/A	N/A
Crew Support (number persons and minutes)	N/A	N/A	1	30-180
Gaseous Nitrogen Consumption (kg)	N/A		N/A	
Argon Consumption (kg)	N/A		N/A	
Helium Consumption (kg)	N/A		N/A	
Carbon Dioxide Consumption (kg)	N/A		N/A	
Potable Water Consumption (kg)	N/A		N/A	
Support Equipment and Duration of Use (minutes/hours/days)				
Tether Restraints		N/A		30-80 minutes

6.0 RETURN REQUIREMENTS

This section of the documents the late on-orbit, descent, and landing requirements associated with the transportation of the payloads from the ISS. This section reflects a summary of the return requirements in Addendum Section 2, Payload Planning Requirements. The PD will identify in the subsequent tables, per flight, the payload hardware and the return requirements. Details of these requirements will be further documented in the various payload-specific data sets.

6.1 PAYLOAD ACTIVITIES AND HARDWARE

This section provides a scenario describing the landing activities on a flight-by-flight basis during this increment and provides a brief description of the payload hardware being transported from ISS.

6.1.1 RETURN SCENARIO ACTIVITIES

The PD shall provide the following information in Table 6.1.1-1, Return Scenario Activities.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Description of Payload Return Activities - A scenario which describes deintegration processing and the transportation of the payload hardware from the ISS by flight. This will include a summary or brief description of the assembly, post-assembly, descent and post-flight activities.

TABLE 6.1.1-1 RETURN SCENARIO ACTIVITIES

Flight #	Description of Return Activities
5A.1 See Note.	MACE-II hardware will require crew transfer from its on-orbit stowage location to the orbiter, MPLM or SpaceHab module.

NOTE: MACE-II has requested to remain on-orbit for 6-12 months.

6.1.2 PAYLOAD HARDWARE DESCRIPTION

The PD shall provide the following information in Table 6.1.2-1, Payload Hardware Description.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item Location - The location of the hardware item (e.g., middeck, MPLM, SpaceHab, ISPR, etc.).

C. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS, while on the ISS, and during return. If the hardware item is not known, this cell should be left blank pending analysis to determine the appropriate payload container.

ISPR	EXPRESS Rack	Transportation Rack	
Powered Single MDL	Powered Double MDL	Unpowered Single MDL	Unpowered Double MDL
4-Panel Unit ISIS Drawer	8-Panel Unit ISIS Drawer	12-Panel Unit ISIS Drawer	Stowage Tray
+4 °C Refrigerator	-20 °C Freezer	-80 °C Freezer	-183 °C Cryo Freezer
ASC/Softpack	Undefined/Loose Items	Other	

D. Volume - The volume of the payload carrier inclusive of the payload hardware. If the hardware item is an ISPR, Transportation Rack, MDL, or a ISIS drawer, this cell is to be left blank.

E. Mass - The mass of the hardware item inclusive of the payload hardware listed in the table.

F. Additional Information - Information such as unique shapes and sizes, hazardous materials, etc., which might be pertinent to the ISS Program.

G. Total Mass/Flight - The total mass of the hardware item(s) inclusive of the payload hardware, by flight.

TABLE 6.1.2-1 PAYLOAD HARDWARE DESCRIPTION

Flight #	Hardware Item	Hardware Item Location (MDK, MPLM, etc.)	Volume (m^3)	Mass (kg)	Additional Information
5A.1 See Note.	ESM Locker CTB #1	MPLM	.06	27.2	Locker Insert
5A.1 See Note.	CTB #2	MPLM	.06	30.5	Fits into 1 MLE
5A.1 See Note.	CTB #3	MPLM	.06	30.5	Fits into 1 MLE
			Total Mass/Flight:	88.2	

NOTE: MACE-II has requested to remain on-orbit for 6 - 12 months.

6.2 ON-ORBIT TO RETURN PAYLOAD REQUIREMENTS

This section documents, on a flight-by-flight basis, the resource transportation, payload transport and transfer, and flight crew time requirements from payload de-assembly/installation to post-flight. The PD will specify in the subsequent tables, by flight: the transport, payload transfer, and the flight crew time requirements.

6.2.1 RESOURCE TRANSPORTATION REQUIREMENTS

The PD shall provide the following information in Table 6.2.1-1, Resource Transportation Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS, while on the ISS, and during return. If the hardware item is not known, this cell should be left blank pending analysis to determine the appropriate payload container.

C. Resource - The power, command/data, telemetry, and heat removal needed during each transportation phase to be provided by the carrier vehicle to support payload operations.

D. Assembly - The average and peak resource needed during the period of time from the start of the activity or assembly sequence until the completion of the payload assembly operations (i.e., undocked operations). The peak resource requirement will be identified in parentheses. In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

E. Post-assembly - The average and peak resource needed during period of time from the completion of the payload assembly operations (undocking) to start of preparation for entry. The peak resource requirement will be identified in parentheses. In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

F. Descent - The average and peak resource needed during period of time from start of preparation for entry through wheelstop. The peak resource requirement will be identified in parentheses. In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

G. Post-flight - The average and peak resource needed during period of time from wheelstop to the removal of a return complement. The peak resource requirement will be identified in parentheses. In addition, for power, indicate the length of time, in minutes, identified payloads can be unpowered by placing this value in brackets.

H. Interface Routing - Indicate the interface routing based on the resource type below:

Power	Command/Data	Telemetry	Heat Removal
Orbiter MDK Power	MPLM MDM to Payload	MPLM MDM to Payload	MDK Cabin Air
Cabin P/L Bus to PCS	PCS to MDK	PCS to MDK	MDK Rear Duct Air
Safing	Other	Other	MPLM to LTL
MPLM to Payload			Other
Other			

TABLE 6.2.1-1 RESOURCE TRANSPORTATION REQUIREMENTS

Flight #	Hardware Item	Resource	Assembly Average (Peak)	Post-Assembly Average (Peak)	Descent Average (Peak)	Post-Flight Average (Peak)	Interface Routing
2A.2b	N/A	N/A	N/A	N/A	N/A	N/A	N/A

6.2.2 TRANSPORT AND TRANSFER REQUIREMENTS

The PD shall provide the following information in Table 6.2.2-1, Transport and Transfer Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Hardware Item - The rack, locker, drawer, etc., which is used as a carrier for transporting the payload to the ISS, while on the ISS, and during return. If the hardware item is not known, this cell should be left blank, pending analysis to determine the appropriate payload container.

C. Description of Transport Requirements - A description of the special requirements, if any, for the transportation of the payload hardware from ISS to landing (e.g., landing orientation, temperature, late on-orbit requirements, special handling, whether the MDL cooling configuration is front or rear cooled, mounting, etc.).

D. Description of Transfer Requirements - A description of the special requirements, if any, for transferring the payload hardware from the ISS to the Orbiter.

TABLE 6.2.2-1 TRANSPORT AND TRANSFER REQUIREMENTS

Flight #	Hardware Item	Description of Transport Requirements	Description of Transfer Requirements
5A.1	CTB #1	N/A	N/A
5A.1	CTB #2	N/A	N/A
5A.1	CTB #3	N/A	N/A

6.2.3 FLIGHT CREW TIME REQUIREMENTS

The PD shall provide the following information in Table 6.2.3-1, Flight Crew Time Requirements.

A. Flight # - The requested flight identification number (e.g., UF-6, 7-PROG).

B. Total Crew Time During Descent - The total amount of crew time needed to perform activities in support of payload operations during descent.

C. Description of Flight Crew Requirements - A description of the crew activities to be performed in support of payload operations.

TABLE 6.2.3-1 FLIGHT CREW TIME REQUIREMENTS

Flight #	Total Crew Time During Descent (Hours)	Description of Flight Crew Requirements
5A.1 See Note.	Standard transfer time for 3 MLEs	Transfer the three CTBs from their on-orbit stowage location in the ISS to the orbiter, MPLM or SpaceHab.

NOTE: Length of orbit is dependent upon return flight. MACE-II has requested to remain on-orbit for 6-12 months

7.0 PAYLOAD DEVELOPER-PROVIDED GROUND SUPPORT PERSONNEL TRAINING REQUIREMENTS

This section describes the top-level training requirements for the Ground Support Personnel (GSP) involved with the payload. This section documents the training requirements that the PD will provide.

The PD will describe these training requirements in the subsequent tables and provide the flights affected, the trainees involved, and the training location. Detailed training requirements will be further documented in the Payload Training Data Set.

This section does not include requirements for training that will be provided to the PD by the Payload Operations Integrations Function (POIF). These requirements will be determined by the Training Strategy Team (TST).

7.1 GROUND SUPPORT PERSONNEL REQUIREMENTS

The PD shall provide the following information in Table 7.1-1, Payload Developer-Provided Ground Support Personnel Training Requirements.

A. Flight # - The first flight or the flight increments affected by the training requirement (e.g., UF-1, 7A).

B. Trainee Classification - The individual(s) requiring training in support of the payload operations, chosen from the following list:

   1. Launch/Landing Site GSP - loading/unloading operations; special ground processing

   2. Telescience Support Center (TSC) Personnel - ground control and monitoring of individual payload

   3. Crew Instructors - provide training to crew members

   4. Other - other ground support personnel

C. Training Hours - Estimate of number of hours required for this training.

D. Training Timeframe - The timeframe during which the training needs to occur. The following is a list of training dates for reference:

   1. Crew payload training begins at Increment minus (I-)18 months.

   2. Instructor training begins 3 months prior to crew training.

   3. GSP training begins at L-12 months.

E. Training Location - The location where the training is to occur.

TABLE 7.1-1 PAYLOAD DEVELOPER-PROVIDED GROUND SUPPORT PERSONNEL TRAINING REQUIREMENTS

Flight #	Trainee Classification	Training Hours	Training Timeframe	Training Location
5A.1	N/A	N/A	N/A	N/A

8.0 GROUND DATA SERVICES SUPPORT REQUIREMENTS DURING FLIGHT OPERATIONS

This section documents the ground data services support requirements. These include the ground support facilities and equipment, transportation, and services (e.g., ground synchronized control testing) which are not included in the integration of the payload into the ISS. Details of these ground support requirements will be documented in the Ground Data Services Data Set. The PD shall identify in the subsequent tables such ground requirements requested from the ISS Program.

8.1 GROUND DATA SERVICES REQUIREMENTS DURING FLIGHT OPERATIONS

This section lists the support for the ground data services requirements requested by the PD which are not directly associated with payload hardware. Significant pre-mission planning and coordination is necessary to define the facilities and equipment requirements for ground support. The PD will identify the ground support requirement, the quantity needed, the need dates, the location and provide a brief description of each requirement.

8.1.1 PAYLOAD DEVELOPER-REQUESTED GROUND DATA SERVICES REQUIREMENTS NOT ASSOCIATED WITH PAYLOAD HARDWARE DURING FLIGHT OPERATIONS

The PD shall provide the following information in Table 8.1.1-1, Ground Data Services Requirements During Flight Operations.

A. Ground Data Services Requirement - The facility, hardware, or service being requested by the PD (e.g., data handling and archiving, communication needs both for software and hardware, TSCs, and Mission Operation facilities).

B. Need Dates - The dates the support for the ground requirements are needed (e.g., UF1 L-24 months to UF1 Return plus (R+)12 months).

C. Location - Where the ground data services support requirement is needed.

D. Description - A brief description of the ground support requirement.

TABLE 8.1.1-1 GROUND DATA SERVICES REQUIREMENTS DURING FLIGHT OPERATIONS

Ground Support Requirement	Need Dates	Location	Description
Data Handling	While On-Orbit	JSC DoD POCC	Data transfer from the MACE-II on-orbit to the DoD Payload Operations and Control Center (POCC) and back to the MACE-II on-orbit via OCA

9.0 SCHEDULES

This section contains deviations from the Payload Integration Schedule, detailed in Section 9.0 of the PIA Main Volume. This includes any deviation of the payload delivery dates to the phased safety reviews deviations. Commitments and services agreed-to will be furnished using the best efforts of both the ISS Program and PD. Detailed payload specific schedules will be maintained in Appendix D of this Addendum. All identified deviations from the Payload Integration Schedule prior to the baselining of this Addendum will be recorded in Tables 9.1.1-1, Deviations from the Safety Review Schedule, and 9.2.1-1, Deviations from the Payload Integration Schedule. Subsequent deviations will be recorded and tracked in Appendix D of this Addendum.

9.1 SAFETY REVIEWS

This section documents the safety reviews which will require the support of the PD. The PD shall provide the payload data packs and represent the payload at the Safety Reviews. The PD shall document, in Table 9.1.1-1, Deviations from the Safety Review Schedule, any known deviation from their delivery dates indicated by the Payload Integration Schedule.

9.1.1 DEVIATIONS FROM THE SAFETY REVIEWS SCHEDULE

The PD shall provide the following information in Table 9.1.1-1.

A. Date for Payload/Flight Safety Review – The deviated date for the Payload/Flight Safety Review.

B. Date for Ground Safety Review (GSR) – The deviated date for the GSR.

TABLE 9.1.1-1 DEVIATIONS FROM THE SAFETY REVIEW SCHEDULE

Safety Reviews	Date for Payload/Flight Safety Review	Date for GSR
Phase 0/1 Safety Review	N/A	N/A
Phase 2 Safety Review	N/A	N/A
Phase 3 Safety Review	L-9	L-7.5

9.2 DEVIATIONS FROM THE PAYLOAD INTEGRATION SCHEDULE

This section lists the deliverable documents and the known deviation from their delivery dates indicated by the Payload Integration Schedule prior to the baselining of this Addendum.

9.2.1 DEVIATIONS FROM THE PAYLOAD INTEGRATION SCHEDULE

The PD PIM shall provide the following information in Table 9.2.1-1, Deviations From the Payload Integration Schedule.

A. Preliminary Date – The deviated date the PIM and the PD will have reviewed, negotiated, and updated the listed document.

B. Baselined Date – The deviated date the document will be baselined.

TABLE 9.2.1-1 DEVIATIONS FROM THE PAYLOAD INTEGRATION SCHEDULE

Increment Number _____0-2_____ Flight Name_____2A.2b _____

Document Title	Preliminary Date	Baselined Date
PIA	L-13 months	L-10 months
PIA Addendum	L-13 months	L-10 months
Data Sets (all)	L-12 months	L-10 months

NOTE: Subsequent schedule deviations post baselining of this Addendum will be recorded and tracked in Appendix D, Payload-Specific Schedule, which will be baselined prior to launch.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

APPENDIX A – ACRONYMS AND ABBREVIATIONS

1g	1 gravity
µg	Microgravity
ARIS	Active Rack Isolation System
ASC	Aisle Stowage Container
°C	degree celsius
CCSDS	Consultative Committee for Space Data Systems
CE	Cargo Element
Cryo	Cryogenic
CTB	Cargo Transfer Bag
DC	Direct Current
DoD	Department of Defense
DQA	Data Quality Assurance
EEOM	Early End of Mission
EOM	End of Mission
ESM	Experiment Support Module
GB	Gigabytes
GSP	Ground Support Personnel
GSR	Ground Safety Review
HST	Hand-Held Serial Terminal
I-	Increment minus
ID	Identification
ISIS	International Subrack Interface Standard
ISPR	International Standard Payload Rack
ISS	International Space Station
IVA	Intravehicular Activity
JSC	Johnson Space Center
kbps	kilobits per second
kg	kilogram
KSC	Kennedy Space Center
Ku-Band	15.250 to 17.250 Gigahertz
kW	Kilowatt
kWh	Kilowatt hours
L-	Launch minus
LAN	Local Area Network
LCC	Launch Commit Criteria
LSE	Laboratory Support Equipment

LTL	Low Temperature Loop
MACE-II	Middeck Active Control Experiment - II
Mb	Megabits
MBP	Multibody Platform
Mbps	megabits per second
MDK	Middeck
MDL	Middeck Locker
MDM	Multiplexer/Demultiplexer
MLE	Middeck Locker Equivalent
MPLM	Mini-Pressurized Logistics Module
MTL	Moderate Temperature Loop
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
OBT	Onboard Training
OCA	Orbital Communications Adapter
OMS	Orbital Maneuvering System
PCMCIA	Portable Computer Memory Card International Adapter
PD	Payload Developer
PFE	Program-Furnished Equipment
pH	measure of acidity
PI	Principle Investigator
PIA	Payload Integration Agreement
PIM	Payload Integration Manager
PLBD	Payload Bay Door
POCC	Payload Operations and Control Center
POIF	Payload Operations Integrations Function
POP	Payload Operations Performance
PROG	Progress
PTA	Payload Transfer Agreement
R+	Return plus
SRB	Solid Rocket Booster
SSE	Station Support Equipment
SSP	Space Shuttle Program
T-	Time prior to launch minus
TBD	To Be Determined
TBR	To Be Resolved
TSC	Telescience Support Center
TST	Training Strategy Team
UF	Utilization Flight
UIP	Utility Interface Panel

UOP	Utility Outlet Panel
VBSP	Video Baseband Signal Processor
VES	Vacuum Exhaust System

APPENDIX B

GLOSSARY OF TERMS
<RESERVED>

APPENDIX B - GLOSSARY OF TERMS
<RESERVED>

APPENDIX C

OPEN WORK

APPENDIX C - OPEN WORK

Table C-1 lists To Be Determined (TBD) items in this document. Each item is given a TBD number using the section of the document that contains the item as the first digit and a consecutive number for the second digit. The TBD number is listed along with the affected section and a description of the item. As each TBD item is resolved, the updated text is inserted in place of the TBD in the document and the entry is removed from this table.

TABLE C-1 TO BE DETERMINED ITEMS

Number	Description	Section	Assignee	Due Date	Status
2-1	To be provided.	Table 2.3-1			
4-1	To be provided.	Table 4.4.1-1			
A.1-1	ISS Program Non-Standard Services.	1.3	K. Watts	12/98	Open
B-1	ISS Program Standard Services.	1.3	K. Watts	12/98	Open

Table C-2 lists To Be Resolved (TBR) issues in this document. Each issue is given a TBR number using the section of the document that contains the item as the first digit and a consecutive number for the second digit. The TBR number is listed along with the affected section and a description of the item. As each TBR issue is resolved, the updated text is inserted in place of the TBR in the document and the entry is removed from this table.

TABLE C-2 TO BE RESOLVED ISSUES

Number	Description	Section	Assignee	Due Date	Status

APPENDIX D

PAYLOAD-SPECIFIC SCHEDULE
<RESERVED>

APPENDIX D - PAYLOAD-SPECIFIC SCHEDULE
<RESERVED>