

EVA Console Handbook

Volume 1 Standard Console Procedures



EVA, Robotics,
and Crew Operations Division

Basic, Rev. A, CPN-2
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EVA Console Handbook Standard Console Procedures

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REVISION LOG

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Prelim.		CR 03-0001: Standard Control Procedures (SCP) Change Process. CR 04-0001: Divide EVA CHB (Basic, Rev. C, PCN-1) into volumes. CR 04-0002: Update Appendix A: Flight Rules Index.	04/01/2004
Basic		Editorial updates; removed Appendix A, Flight Rules Index and Appendix B, Acronym List Note: The Acronym List for Volumes 1 to 4 of the EVA Console Handbook is in JSC-20597 Volume 5, TPS Inspection	12/01/06
A		Semiannual technical review. Also replaced Sections 3.6, 4.3, 4.6, 4.7, moved former Section 3.6 to 3.7, and added Sections 5.1 to 5.5	09/20/2007
	CPN-1	Updates to Sections 1.4, 2.2, 2.5, 3.3, 3.4, 3.6, 3.7, 3.9, and 4.6	05/20/2008
	CPN-2	Updates to Sections 2.5, 3.4, and 3.6, and added Appendix A	01/22/2010

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PREFACE

This document has been prepared by the Extravehicular Activity (EVA) Systems Group under the authority of the EVA and Crew Systems Operations Branch, EVA, Robotics, and Crew Systems Operations Division, Lyndon B. Johnson Space Center (JSC), National Aeronautics and Space Administration (NASA).

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Questions concerning the technical content of this document should be directed to Adele M. Luta, (281) 483-2507, DX35.

PURPOSE

The EVA Console Handbook provides a single authoritative source of primary information for use by EVA flight control personnel. For additional information, the reader should refer to training manuals and other documents referenced in this handbook.

SCOPE

Information in this handbook is not flight specific. It addresses systems and procedures used for EVA console operations.

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1.1 HANDBOOK CHANGE PROCESS

PURPOSE

The handbook change process is presented to control the content and change traffic to the EVA Console Handbook.

PROCEDURE

It is the responsibility of all EVA team members to ensure that all data in the Console Handbook are correct and up to date. Any EVA team member with knowledge of data or procedures that are used on console and are not documented in the Console Handbook will bring forward such information for use by all operators. Other disciplines may submit a change request to the book manager via this process for review. If discrepancies are found or data are missing, the following process must be followed to make the appropriate changes.

1. The change initiator notifies the EVA Console Handbook book manager of the need to change the document. This request can be submitted via any written means. At a minimum, the initiator supplies the submission date, a short descriptive title, a detailed description of the change, rationale for the change, and the initiator's organization/name. The initiator also has the option of filling out a Standard Console Procedure (SCP) change request shown in Figure 1.1-1. Specifics for filling out the change form are found in WI: DF-02 Standard Console Procedures (SCP) Change Process.
2. The initiator submits the Change Request (CR) form to the book manager.
3. The book manager has the appropriate group lead review the CR and determine whether to implement the change. The group lead assigns a technical author to draft the change; it may or may not be the initiator. The group lead also assigns a completion date and a reviewer for the change.
4. If the CR is approved, the book manager assigns a tracking number to it. The book manager maintains a file of the approved CRs and documents the CRs in an electronic log stored in S:\Divisions\DX\EVA\Joint\EVA Console Handbook.
5. The technical author makes the appropriate changes to the most current copy of the SCP and submits it to the reviewer.
6. The technical author incorporates the reviewer's changes into a final draft. If there are considerable changes, the SCP may need to be resubmitted to the reviewer.
7. The group lead examines the final draft. If no changes are required, the group lead has three options for directing the book manager on how to implement the CR.

- (a) Publish the CR in the next planned Page Change Notice (PCN). This option is intended for minor changes that do not affect technical content.
- (b) Publish the CR in the next planned PCN and post a read-only copy of the approved CR in S:\Divisions\DX\EVA\Joint\EVA Console Handbook. This allows EVA personnel to use the approved technical content as soon as possible.
- (c) Publish the CR in an unplanned PCN.

The book manager will submit the technical content of the CR to the editor for formatting and incorporation into the controlled copy of the document. At the group lead's direction, the book manager will also add the technical content to the EVA group shared drive.

- 8. At the desired publication date, the book manager incorporates the edited changes as a PCN. The PCN is submitted to the group lead and branch chief for signatures.
- 9. The book manager fills out JSC Form 31 for delivery of the PCN to the Printing Management Branch for printing of the document changes. The book manager also directs the editor to release the updated electronic copy for use. If necessary, the book manager removes the technical content from the EVA group shared drive once the PCN is published and distributed.
- 10. When the CR content has been implemented in the EVA Console Handbook as a PCN, the book manager indicates the CR is CLOSED in the tracking log.

The EVA Console Handbook is the only "goodie book" an EVA operator should require on console. If other data or information that are not flight specific in nature are required on console, that data or information must be covered by an approved CR to the Console Handbook.

REFERENCES

Mission Operations Directorate Systems Division Work Instruction DF-02

1.2 EVA TEAM CONSOLE POSITIONS

PURPOSE

This section defines the duties of the EVA team console positions.

DESCRIPTION

The EVA team consists of an EVA officer and up to three supporting positions: EVA TASK, EMU Systems, and A/L Systems (International Space Station (ISS) and Assembly only). The EVA team interfaces for ISS are shown in Figure 1.2-1. The EVA team interfaces for shuttle are shown in Figure 1.2-2.

A. EVA Officer

The EVA officer is responsible to the Flight Director (FD) for flight control support of all Extravehicular Mobility Unit (EMU) systems and EVA tasks and for coordinating EVA operational inputs with the Flight Control Team (FCT). The EVA officer responds to all EMU systems, A/L systems, and EVA task issues that may arise between the crew, Capsule Communicator (CAPCOM), or FD. The EVA officer is also responsible for crew and vehicle safety during any EVA-related operations. During shuttle flights, the EVA officer occupies the BOOSTER Flight Control Room (FCR) console during EVA planning, EVA, and EVA-related operations. The EVA officer shares the ISS console with the Visiting Vehicle Officer (VVO) and Russian Integration Officer (RIO). The console is coordinated with these three positions, according to the ISS phase. The official call sign for the EVA officer is EVA. The call loop for shuttle console is "EVA," while the call loop for the ISS console is "ISS EVA," as referenced in Section 3.3. For joint missions, the EVA officer starts in the White FCR (WFCR) until after docking and then migrates to the ISS FCR for the EVAs. The exact time of transfer is negotiated with the lead FD prior to launch.

The duties of the EVA officer include the following:

1. Establishes priorities for EVA team actions
2. Coordinates all EVA console activities
3. Leads the EVA team during all EVA/EMU/Airlock operations and is responsible for the safe and timely completion of all these operations
4. Advises the FD on the status of the EMU and EVA-related tasks
5. Interfaces with the FD and other front room console positions
6. Informs the FCT on the progress of EVA and associated timelines
7. Advises on impacts of EVA operations on other crew tasks and vehicle operations

8. Reports any EVA-related anomalies to the FD, identifies the impacts to EVA operations, and recommends appropriate action to the FD
9. Communicates any real-time changes involving EVA procedures (verbally or as a flight note) to the FD and CAPCOM for uplink to the crew
10. Ensures that all team members are informed of all operational, procedural, and system changes and updates
11. Assesses orbiter malfunctions and impacts to EVA/EMU operations
12. Maintains the console logs, data, and updates
13. Interfaces with external organizations (Customer Support Room (CSR) personnel, mission management team, Program Office personnel, Spacecraft Analysis/Mission Evaluation Room (SPAN/MER) personnel, etc.)
14. Reviews and approves all console products, flight notes, EVA timeline inputs, uplinks (execute package, daily summary, etc.)

B. EVA Task Support

The EVA task support officer is responsible to the EVA officer for flight control support of all EVA tasks and for coordinating EVA operational inputs with other Multipurpose Support Room (MPSR) positions. The EVA task support officer responds to all EVA task issues that may arise between the crew, CAPCOM, FD, or EVA. The EVA task support officer is also responsible for crew and vehicle safety during EVA task operations. EVA task support shares the EVA MPSR console with EMU systems support and A/L systems support (if required) during EVA planning and EVA-related operations. The official call sign for the EVA task support officer is EVA TASK, and the call sign used internal to the EVA group is TASK.

The duties of the EVA task support officer include the following:

1. Supports the EVA position for all task-related activities
2. Provides the task and timeline status updates to EVA
3. Reports on task anomalies, problems, and workarounds
4. Coordinates the timeline and task procedural updates
5. Interfaces with EVA, other MPSR positions, and JSC support facilities
6. Assesses impacts of orbiter operations and crew timelines on EVA task accomplishment
7. Monitors crew progress during EVA, assists crew, as required, and suggests alternate workarounds

8. Monitors EVA tool usage and keeps track of tool whereabouts and stowage
9. Interfaces with the payload experts and customers, as required
10. Maintains console logs, data, updates, and documentation
11. Provides expertise in the following task-related areas:
 - a. EVA planning
 - b. Planned and alternate EVA procedures and mission objectives
 - c. EVA task priorities and mission rules
 - d. EVA crewmember performance, capabilities, and limitations
 - e. EVA support hardware operational constraints and limitations
 - f. EVA contingency operations
 - g. EVA translation and restraint aids
 - h. EVA equipment stowage
 - i. Flight-specific payload contingency operations

C. EMU Systems Support

The EMU systems support officer is responsible to the EVA officer for coordinating EMU operational inputs with integrated flight operations. EMU systems support responds to all EMU technical issues that may arise between the crew, CAPCOM, FD, or EVA. EMU systems support is also responsible for crew, ISS, and orbiter safety during EMU-related operations. EMU systems support shares the EVA MPSR console with EVA task support and A/L systems support (if required) during EVA planning and EVA-related operations. The official call sign for the EMU systems support officer is EVA systems, and the call sign used internal to the EVA group is EMU.

The duties of the EMU systems support officer include the following:

1. Responsible for EMU system monitoring, configuration, and troubleshooting
2. Maintains console logs, data, updates, and documentation
3. Provides the EMU systems status and consumables management to EVA position
4. Assesses and evaluates EMU caution and warning malfunctions
5. Coordinates the timeline and EMU procedural updates
6. Interfaces with EVA, other MPSR positions, and JSC support facilities

7. Assesses orbiter malfunctions and impacts to EVA/EMU operations
8. Records and logs EMU performance data
9. Provides the anomaly log inputs and Mission Action Requests (CHITs), as required
10. Evaluates EMU anomalies and recommends workarounds and procedural changes
11. Generates EMU-related flight notes and inputs to execute package and/or daily summary
12. Provides expertise on the following:
 - a. Planned and alternate EMU-related procedures
 - b. EMU-related timeline requirements
 - c. EMU-related mission rules
 - d. EMU systems, performance, and limitations
 - e. EMU improvements and new technology
 - f. EMU equipment stowage
 - g. EMU ancillary equipment, operational constraints, and limitations
 - h. A/L, hatch, and associated EMU interfaces

D. Airlock Systems

The Airlock (A/L) systems support officer is a flight-specific console position for scheduled EVA operations utilizing ISS resources. Typically, the A/L systems position supports the Planning B and Execute shifts for time-critical EVA operations. (The Planning A shift is not supported by this position.) A/L systems support is responsible to the EVA officer for coordinating all A/L operational inputs and some EMU inputs, according to the level of support required by the team. This position supplements the EMU systems position during time-critical operations. A/L systems support responds to all A/L technical issues that may arise between the crew, CAPCOM, FD, or EVA. A/L systems support is also responsible for crew and vehicle safety during A/L-related operations. A/L systems support shares the EVA MPSR console with EMU systems support and EVA task support. The official call sign for the A/L systems support officer is A/L systems, and the call sign used internal to the EVA group is A/L.

The duties of the EVA timeline support include the following:

1. Responsible for A/L and some EMU system monitoring, configuration, and troubleshooting
2. Maintains the console logs, data, updates, and documentation
3. Helps with EMU systems status and consumables management to EVA position
4. Provides assistance on evaluating EMU caution and warning malfunctions
5. Coordinates timeline and Airlock/EMU procedural updates
6. Interfaces with EVA, other MPSR positions, and JSC support facilities
7. Assesses orbiter malfunctions and impacts to EVA/EMU/Airlock operations
8. Records and logs Airlock/EMU performance data
9. Provides anomaly log inputs and CHITS, as required
10. Evaluates Airlock/EMU anomalies and recommends workarounds and procedural changes
11. Generates Airlock/EMU-related flight notes and inputs to execute package and/or daily summary
12. Provides expertise on the following:
 - a. Planned and alternate Airlock/EMU-related procedures
 - b. Airlock/EMU-related timeline requirements
 - c. Airlock/EMU-related mission rules
 - d. Airlock/EMU systems, performance, and limitations
 - e. Airlock/EMU improvements and new technology
 - f. Airlock/EMU equipment stowage
 - g. Airlock/EMU equipment operational constraints and limitations
 - h. A/L, hatch, and associated EMU interfaces
13. Performs other functions at the discretion of the EVA officer

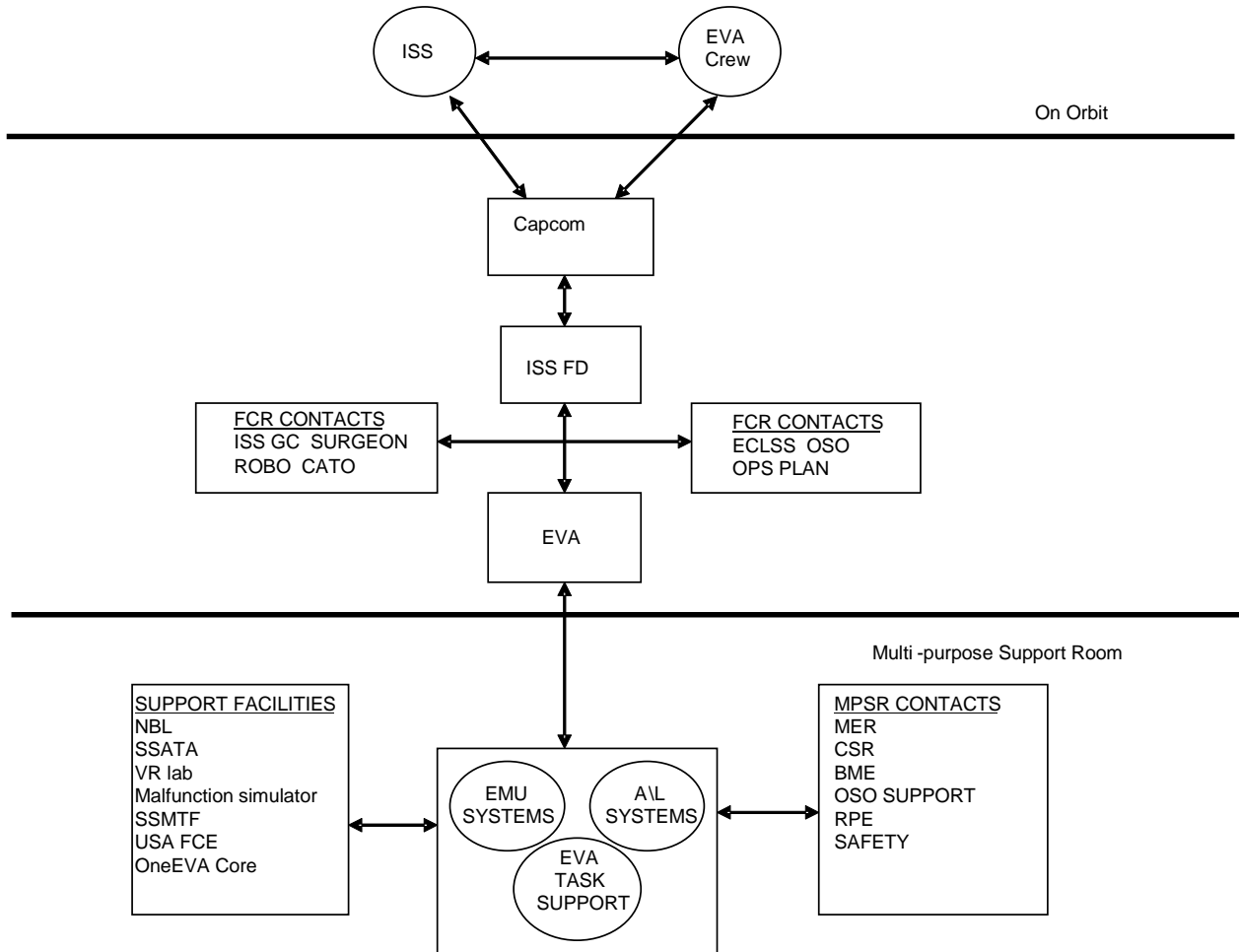


Figure 1.2-1. ISS EVA interfaces in the MCC

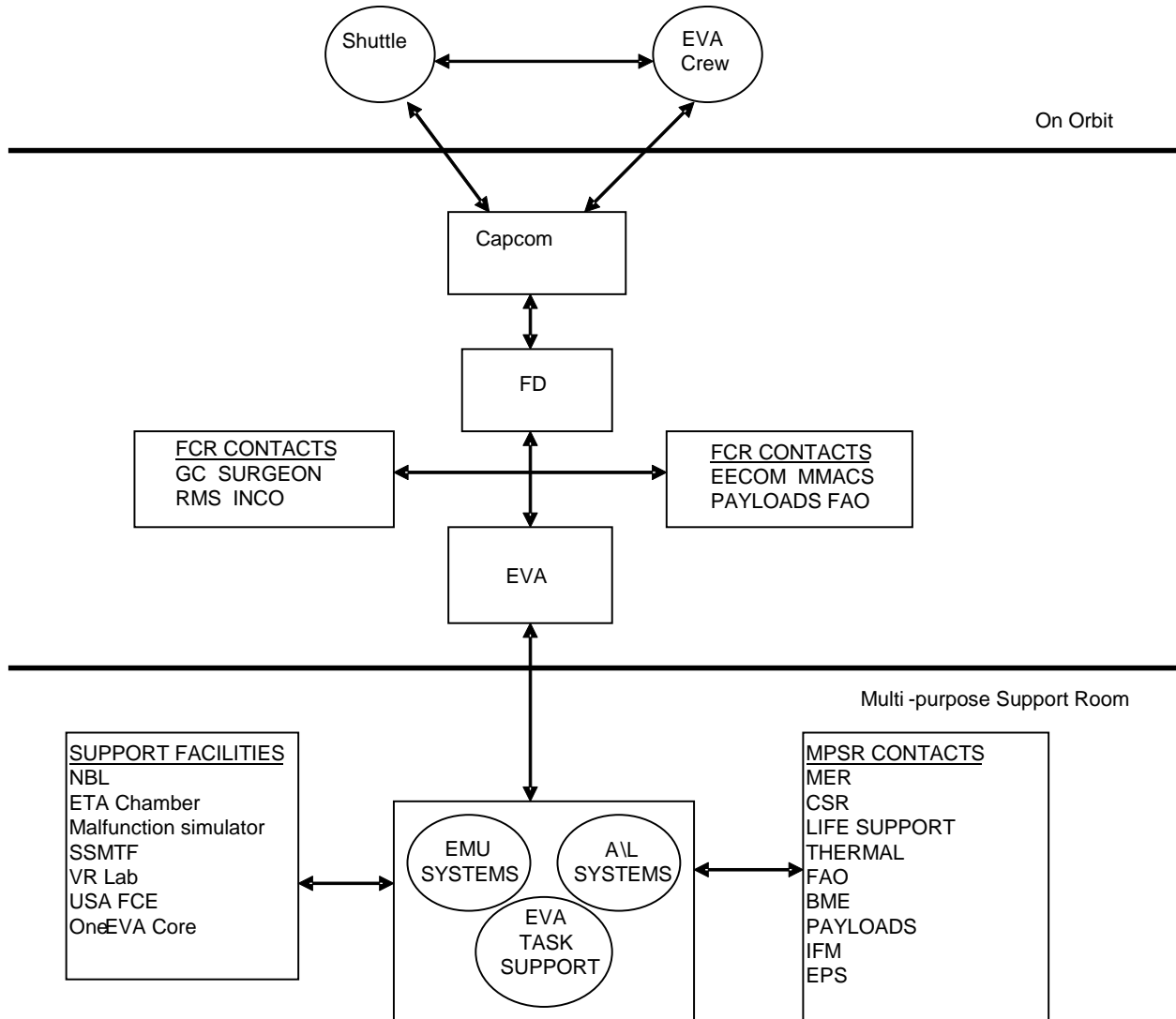


Figure 1.2-2. Shuttle EVA interfaces in the MCC

1.3 PRINCIPLES OF FLIGHT CONTROL

PURPOSE

The first section is adapted from the “Stone Tablets of Flight Control” and is provided to flight controllers as a guideline for conduct on console. The Stone Tablets of Flight Controller Operations can be found in Section 1.15 of the Shuttle Flight Control Operations Handbook (FCOH) and Section 1.2 of the Station FCOH. The second section is adapted from “The Autonomous Flight Controller” and is provided to flight controllers as generic principles of flight control. The principles fall into the following important categories to keep in mind:

- A. Mission Cognizance
- B. Systems Knowledge
- C. Problem Recognition and Resolution
- D. Console Management
- E. Communication
- F. Teamwork
- G. Attitude and Effort

PROCEDURE

STONE TABLETS OF FLIGHT CONTROL

1. Come prepared for your shift. Understand how your discipline fits into the activities planned for the day and be familiar with the corresponding Operations Data File (ODF)/Flight Data File (FDF).
2. Listen closely when the crew talks. If the information does not affect your discipline, you may resume your discussions, given that they are not on the flight loop.
3. Condition yourself to react to Air-to-Ground (A/G) discussions without being prompted by the FD.
4. When crew comments affect your discipline, immediately acknowledge their call on the flight loop. For example:

“We copy flight, stand by while we look at it.”

“Copy flight, it’s a transducer failure, no action.”

“We copy and concur flight.”

“Copy flight, have them work mal...”

5. Listen closely when your instructions are being read to the crew. Report on the flight loop that you copied the uplink. This lets the FD know the instructions were read as you intended and you are ready to observe the resulting actions. When the crew repeats uplinked instructions, particularly those with more than one step, acknowledge on the flight loop: “Good read back flight.”
6. Minimize your discussions on the flight loop when the crew is talking. Criticality of your need will dictate this. A good rule of thumb is to wait so CAPCOM can listen to the crew, if waiting is possible.
7. An ideal exchange between the crew and the Mission Control Center (MCC) is one where the FD talks the least. In this case, the FD can use quick vocal approvals on the flight loop to enhance the efficiency of the communication.
8. Minimize discussion over the airways. Use loops unless totally impractical to do so.
9. Be ahead of the crew in finding changes to procedures that are based on flight plan changes or previous failures. Look ahead.
10. Switch/circuit breaker actions should be called out with panel, row, and device nomenclature.
11. If you have time to write a flight note, write a flight note.
12. Flight note and/or vocal actions should include what you want done, by when, and why. When vocalizing this, the preferred order is to report what has happened, followed by the action required within some timeframe. For example:

“Flight, the ‘A’ heater on XYZ just failed, so I would like the crew to switch to the ‘B’ side within 10 minutes. The switch is on panel ...”

THE AUTONOMOUS FLIGHT CONTROLLER

1. Foundations of a Flight Controller
 - (a) Understand systems to the level that operational decisions can be made without consulting outside sources: MER, Program Office, vendor, etc.
 - (b) Understand MCC operations/data acquisition, including facility/console operations, console applications/requirements, FCOH, and offline computer tools and data archive systems.
 - (c) Understand integrated schematics, failure modes, test, and operations history.

- (d) Communicate to the team clearly, concisely, and in a timely manner.
- (e) Set priorities, then work through the stack.
- (f) Review EVA knowledge requirements and take course/self-study in related subjects to supplement training (i.e., electricity, mechanics, aerospace, mathematics, communications).
- (g) Take initiative and use resident experts, self-study, and group problem analysis.
- (h) Brilliant problem analysis is great for an accident investigation; however, flight controllers must solve the problems to prevent the accident.

2. How to Lead Your Leader

- (a) A flight director has management pressure, a headset, a flight plan, and a clock, but no data.
- (b) An FCR operator has flight director pressure, a headset, a flight plan, a clock, and some overview data.
- (c) An MPSR operator has all the data and FCR pressure.
- (d) Each level must transmit clear, concise reports and recommendations.
- (e) Encourage your leader, he/she will appreciate the support.

3. Console Management Techniques

- (a) Status dynamic events; do it often, and use a timer.
- (b) Retrace events: checkout data reliability, events, configuration, and malfunction procedures. Look for potential oversights.
- (c) Look for related failure-cause.
- (d) Implement flight rule.
- (e) Look ahead for potential impacts in upcoming activities and procedures.
- (f) Start work to resolve unknowns (in-house and SPAN/MER).
- (g) Communicate every step or change to the team.
- (h) Implement workarounds: change flight plan, procedures, and documents.

4. Communications
 - (a) Do not be afraid to say, "I don't know, but will find out."
 - (b) Loop discipline: learn to listen to the significant (crew reports, teammates reports), and do not respond to the extraneous.
 - (c) Give clear, concise, and timely verbal reports of all significant work and events to all team members.
 - (d) Write clear, concise, and timely reports of all significant work and events.
 - (e) Flight notes: write up flight decisions that have to be voiced to the crew, use exact nomenclature, and listen to the transmission of your message.
5. Documentation
 - (a) Be sure you have the correct ODF/FDF and console documentation.
 - (b) Be sure to pen and ink all real-time CRs and 482s.
 - (c) Be sure to pen and ink all instructions in powerdown procedures, malfunction procedures, etc.
6. Team and Self
 - (a) Respect your coworkers; it is a team effort. Do not press issues of team versus team.
 - (b) Fight for your position, but work the selected option after the decision is made. If all the data were not presented, try again.
 - (c) Be prepared to participate in press briefings with comprehensive summaries of major anomalies or events.
 - (d) Practice routine data and status scan habits that you will use in cool and hot conditions.
 - (e) Critique yourself in all aspects of the foundations and techniques of an EVA flight controller.
 - (f) Solicit often the critique of your team leader.
 - (g) Do not optimize the optimum. Better is the enemy of good.

REFERENCES

The Autonomous Flight Controller – Systems Division, Updated, 10/09/01 DF6/J. Spivey and 7/6/96 DA8/R. Castle, Original, 1981 by CF/D. Bourque.

JSC-26843 – FCOH for Shuttle Operations, Section 1.15, Stone Tablets of Flight Controller Operations, 3/01/05.

JSC-29229 – FCOH for Station Operations, Section 1.2, Stone Tablets of Flight Controller Operations, 4/12/07.

1.4 RESPONSIBILITY AGREEMENTS

1.4.1 MMACS/EVA/EECOM A/L and Hatch Responsibility Agreement

PURPOSE

The purpose of this SCP is to establish a Memorandum Of Understanding (MOU) between the Mechanical, Maintenance, Arm, and Crew Systems (MMACS), EVA, and Emergency, Environmental, and Consumables Management (EECOM) disciplines regarding Airlock (A/L) and hatch responsibilities. This agreement will cover both the internal and external configurations of the A/L.

The A/L and hatch functions overlap several disciplines requiring a joint level of understanding between them. This memo details the responsibility guidelines for Airlock/hatch-related procedures, drawings, hardware, flight protocol, the Airlock/hatch during flights/integrated simulations, simulation models, and crew training. This agreement will be incorporated and maintained in each discipline's console handbook as an SCP. Any changes to this agreement require concurrence of all three group leads and an updated release of the SCP.

DATE OF AGREEMENT

The date of agreement was February 5, 1997.

REFERENCES

- A. MECH JSC-26101, SCP TBD
- B. EVA JSC-20597, SCP 1.4
- C. ENVIRON JSC-19935, SCP 2.7

DETAILED AGREEMENT

A. Procedures

All procedural updates to FDF that overlap the MMACS, EVA, and EECOM systems are reviewed by all systems, as appropriate.

1. MMACS

MMACS maintains responsibility for all hatch/hinge-related malfunction procedures and cue cards, as detailed in Table 1.4-1. EVA is consulted for review and validation of any procedures changes.

2. EVA

EVA is the book manager for the EVA Checklist (C/L) and is responsible for the content of all other procedures in the EVA C/L. The EVA C/L book manager coordinates and validates all procedural changes (e.g., EMU

recharges/drains, EMU prebreathe, EVA prep) that affect the orbiter environment and/or EECOM systems.

3. EECOM

EECOM maintains responsibility for all malfunction, Ascent Pocket Checklist (APCL), Orbit Pocket Checklist (OPCL), and Entry Pocket Checklist (EPCL) procedures affecting orbiter atmosphere pressure integrity, as listed in Table 1.4-1. EECOM is responsible for the content of the 10.2 psi cabin procedures in the EVA C/L.

B. Space Shuttle Systems Handbook (SSSH)

The A/L schematics consist of a series of drawings:

1. Drawing 6.3-1 includes all A/L and Environmental Control and Life Support System (ECLSS) interfaces for the internal A/L. Publishing Drawing 6.3-1 requires two signatures (engineer and group lead) from each of the EVA and EECOM disciplines (total of four signatures).
2. Drawing 6.3-2 includes the A/L and EMU power supply and is the sole responsibility of EVA.
3. Drawing 6.14-1 is the external A/L version of Drawing 6.3-1. It includes all A/L and ECLSS interfaces for the International Space Station (ISS) configuration of the external A/L. Publishing Drawing 6.14-1 requires two signatures (engineer and group lead) from each of the EVA and EECOM disciplines (total of four signatures).
4. Drawing 6.14-2 includes all the external A/L Air Revitalization System (ARS) ductwork and booster fan interfaces. It is the sole responsibility of EECOM.
5. Drawing 6.14-3 includes all the internal and external A/L ECLSS interfaces for the Mir missions on OV-104. There are no EVA/EMU interfaces on this drawing. It is the sole responsibility of EECOM.
6. Drawing 6.14-4 includes all the ARS ductwork and booster fan and ECLSS interfaces associated with the tunnel adapter extension kit. This extension kit moves the ISS configuration of the external A/L aft in the payload bay. It is the sole responsibility of EECOM.
7. Drawing 15.5-1 is the side hatch. MMACS has the sole responsibility for this drawing.
8. Drawing 15.5-2 is the A/L/Spacelab. MMACS has the sole responsibility for this drawing.

C. Hardware

1. Primary Owner/User

The primary owner/user of a component has primary hardware responsibility as detailed in Table 1.4-1. This responsibility is defined, but not limited to, maintaining the following console handbook documentation:

- a. System operations descriptions
- b. Nominal and off-nominal performance characteristics
- c. Plumbing details and interface specifications
- d. Fluid types and flow characteristics
- e. Valve cutaway and mechanical connection views
- f. Telemetry requirements
- g. Talkback (tb) indications
- h. Failure history
- i. Turnaround process requirements

In addition, primary hardware responsibility includes being the prime console operator who manages nominal and off-nominal scenarios.

Furthermore, although the primary owner is the primary user and procedural caretaker of the component, this fact does not preclude another discipline from using the component in their procedures for their use.

2. Secondary Owner/User

A secondary owner/user is defined as a discipline that periodically uses the hardware owned by another discipline (reference Table 1.4-1). The primary owner/user maintains the console handbook documentation; however, it is highly desirable for the secondary owner/user to maintain appropriate console handbook documentation. The secondary user must also maintain reasonable console operator knowledge of the use and function of the equipment owned by the primary user. Any time the secondary user cites a component in his/her procedure, either for nominal or off-nominal procedures, concurrence and validation is required from the primary owner.

3. A/L Hatch, Prebreathe Equipment, and Liquid Cooling Garment (LCG) Water Line Procedural Exceptions

The A/L inner and outer/EVA hatches and their mechanisms are the primary responsibility of MMACS, except when being used by a suited crewmember for EVA operations. This includes both nominal and contingency procedures.

The sole exception to this is the inner hatch hinge mechanism for the internal A/L, which remains the primary responsibility of MMACS at all times. All hardware anomaly tracking and resolution will be the primary responsibility of MMACS, regardless of when the failure occurs. For example, MMACS will be responsible for tracking all hatch-related failures associated with an EVA crewmember's operation of the hatch once the EVA is terminated.

The prebreathe masks are primarily owned by MMACS, but during EVA activities are used by the EVA discipline. During post-fire cleanup and toxic spills, the prebreathe masks are used by EECOM. Thus, EVA and EECOM are secondary users of the prebreathe equipment.

The two LCG water loops and their pressure and temperature sensors associated with the external A/L are the primary responsibility of EECOM. However, when the Service and Cooling Umbilical (SCU) is connected to the EMU, the primary responsibility shifts to EVA. This is because there are EMU operational and failure modes that affect the pressure profile of the LCG pressure sensors and constrain the temperature limits.

D. Console Protocol

Table 1.4-1 describes the various MCC flight status calls that are made by the appropriate discipline. It is the responsibility of the indicated discipline to remain cognizant of all activities and orbiter parameters associated with that particular flight status call. Coordination and communication via the following voice loops are required when appropriate. In the event of a system failure potentially affecting another discipline, a call should be made to the affected discipline advising them of the failure and the potential impact.

In the event of a hardware failure involving both primary and secondary ownership (as described in the responsibility table), all CHITs and in-flight failure response will be coordinated by both parties prior to submittal.

Voice protocol procedures to be used on console during simulations and missions are as follows (reference FCOH 1.5):

1. MMACS

FCR operators contact MMACS for system discussions via the Mission Operations Control Room (MOCR) SYS 1/2 (2507/3507) Digital Voice Intercommunication Subsystem (DVIS) loops. Similarly, MPSR operators contact MECH via SSR 1/2 (2035/2036) DVIS loop.

Pertaining to EECOM and EVA-specific needs, MMACS is responsible for all hatch/hinge mechanisms and advises EECOM/EVA of any problems in these areas, as appropriate.

2. EVA

FCR operators contact EVA for system discussions via the EVA (2851) DVIS loop. Similarly, MPSR operators contact EMU systems support and EVA task support via EVA MPSR (2852).

The EMU systems support operator is responsible for the EMU A/L functions, and the EVA task support operator is responsible for the EVA tools, tasks, and duration.

Examples of when EVA can assist EECOM include EMU recharge/drain, preserving supply water tank C for EVA purposes, EVA duration. Similarly, EVA assists MMACS by advising MMACS of any A/L hatch/hinge problems.

3. EECOM

FCR operators contact EECOM for system discussions via the MOCR SYS 1/2 (2507/3507) DVIS loops. Similarly, MPSR operators contact the life support and thermal console operators for system discussions via the SSR 1/2 (2035/2036) DVIS loops.

Examples of when EECOM can assist EVA include A/L depresses/represses, EMU prebreathe initiate/terminate, and systems anomalies affecting EVA. Relating to EVAs needs, the life support operator is responsible for the wastewater system, A/L and cabin pressure management, and cabin temperature management. Similarly, the thermal operator is responsible for the supply water system, LCVG heat exchanger, and the H₂ separators.

The EECOM MPSR is in transition to a single position referred to as Life Support/Thermal (LST). The LST will be the sole source responsible for all the above mentioned systems.

In terms of MMACS needs, the life support operator is concerned about potentially leaking hatch seals. EECOM/LST advises EVA and/or MMACS of any problems/flight status of these aforementioned areas.

4. Console Protocol – Flight Status Call Philosophy

Table 1.4-1 delineates the agreed division of flight calls used in real time and during integrated simulations. The general philosophy is that a discipline retains control of its systems at all times, regardless of the flight phase. For example, EECOM is the primary owner/user of the A/L when no EVA activity is underway and retains that responsibility during the EVAs. EVA then becomes a customer of the EECOM during their use of the A/L. This approach is consistent with the arrangement in other systems. An example of similar arrangements with other systems is that Payload Deployment and Retrieval System (PDRS) retains control over the operation of the arm when the arm is required for various uses, such as water dump nozzle viewing, a platform for EVA crewmember translation, and payload manipulation tasks. In these

cases, EECOM, EVA, and Payloads have become PDRS customers and, therefore, secondary users of the RMS.

There are generally two kinds of flight calls, a GO/NO-GO or requirements call and system status calls. The GO/NO-GO or requirements call is used to define when an upcoming activity is ready to be performed. All safety and system requirements have been satisfied to proceed to the next activity. For example, a "GO for orbit operations" is given by the flight team after most postinsertion activities are nominally completed and no likely condition exists for a first-day Primary Landing Site (PLS).

The system status call reports the action or inaction of the crew or system event. For example, reporting the fact that the crew has initiated prebreathing prior to 10.2 depress is a system status call.

E. Flights/Integrated Simulations

During flights or integrated simulations, when the EVA team is not present, EECOM is responsible for the EVA A/L function and hardware. EECOM continues with that responsibility during the period when the EVA team supports their console responsibilities. Thus, EVA is an EECOM customer during EVA periods.

When the EVA team is not present during flights or integrated simulations, MMACS assumes responsibility for flight-specific EVA capability (EMU, EVA hardware, etc.) until EVA arrives. If an EVA is required or if EVA/EMU equipment problems arise, MMACS has the responsibility to notify EVA of the need to support console operations per EVA Console Handbook, Section 3, and MECH SCP TBD.

F. Simulation Models

The extent of EECOM involvement in generating future A/L-related models is to suggest enhancements, review requirements for completeness/correctness, and to ensure that model improvements do not inadvertently affect other ECLSS model functions. EVA leads the model requirements definition, Support Request (SR) generation, requirements implementation, and software checkout process. All A/L/hatch-related SRs require both EVA and EECOM review and concurrence signatures.

G. Crew Training

EVA performs all training of the crew associated with the A/L, prebreathe mask, EMU, and Liquid Cooling Ventilation Garment (LCVG).

**Table 1.4-1. MMACS/EVA/EECOM A/L
and hatch responsibilities**

	MMACS	EVA	EECOM
A. Procedures			
A.1 <u>MAL</u>			
SSR-8 small cabin leak			X
EXT A/L H2O LN T			X
EXT A/L STRUC T			X
FRP-3 contingency cabin O2 control			X
A.2 <u>MAL/APCL/OPCL/EPCL</u>			
Cab press leak			X
O2/N2 flow high/cab P low/dP/dT			X
Leaking Halon bottle discharge			X
A.3 <u>EVA C/L</u>			
Emergency A/L repress decal.....		1	2
All procedures except 10.2 psi cabin		X	
10.2 psi cabin procedures			X
Book manager		X	
A/L latch and hinge disconnect.....	2	1	
CO2 removal system act/deact			X
A.4 <u>IFM C/L</u>			
Hatch – Inner-jammed actuator/latch.....	X		
Hatch – Inner-jammed hinge	X		
Hatch – Side-jammed actuator	X		
A.5 <u>Postinsert/deorb prep</u>			
Airlock config.....			X
B. <u>Contingency EVA timelines</u>SSSH		X	
Airlock/ECLSS interfaces, Dwg. 6.3-1	1	X	X
Airlock/EMU power supply, Dwg. 6.3-2.....		X	
Ext A/L ECLS interfaces, Dwg. 6.14-1.....		X	X
Ext A/L ARS interfaces, Dwg. 6.14-2.....			X
Ext A/L Mir docking config, Dwg. 6.14-3.....	2		X
Ext A/L Tunnel adapter extension, Dwg. 6.14-4			X
Hatches (side), Dwg. 15.5-1	X		
Hatches (A/L and SL), Dwg. 15.5-2.....	X		

Responsibility legend: X = Sole/joint 1 = Primary 2 = Secondary * = Primary only during EVAs
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Table 1.4-1. MMACS/EVA/EECOM A/L and hatch responsibilities (continued)

	MMACS	EVA	EECOM
C. Hardware			
C.1 Hatch equipment			
A/L inner hatch	1	2*	
Internal A/L inner hinge	X		
A/L outer/EVA hatch and hinge	1	2*	
SL hatch and hinge.....	X		
Side hatch and hinge.....	X		
Inner hatch EQ vlvs and caps (2)		2	1
Outer/EVA hatch EQ vlvs and caps (2)		2	1
SL hatch EQ vlvs and caps (2)			X
Side hatch seal integrity test port.....	2		1
Inner hatch delta pressure gauge		2	1
Outer/EVA hatch delta pressure gauge		2	1
SL hatch delta pressure gauge.....			X
C.2 ARS equipment			
ARS air circulation ducts			X
SL tunnel fan			X
TA manual payload isolation valve			X
Booster fan			X
C.3 Airlock equipment			
Depress valve and vent cap		2	1
EMU 1, 2 water supply valves, tb, and TM		2	1
EMU 1, 2 SCU 1, 2 TP 144, 145 fittings		1	2
EMU 1, 2 water waste valves, tb, and TM		2	1
EMU 1, 2 SCU 1, 2 TP 146, 147 fittings		1	2
EMU 1, 2 O2 supply valves		2	1
EMU 1, 2 SCU 1, 2 O2 fittings/POS 1, 2 O2 QD		1	2
SCU 1, 2 and SCU H2O supply/waste reg 1, 2		1	2
LCVG HX.....		X	X
Supply press O2 and H2O A/L meter			X
Ext A/L LCG lines		2 ^a	1

Responsibility legend:
 X = Sole/joint
 1 = Primary
 2 = Secondary
 * = Primary only during EVAs
 a = Primary only when the SCU is hooked up to the EMU

Table 1.4-1. MMACS/EVA/EECOM A/L and hatch responsibilities (continued)

	MMACS	EVA	EECOM
C.3 <u>A/L equipment</u> (continued)			
A/L DIFF 1 press transducer (V64P0101A)			X
A/L DIFF 2 press transducer (V64P0102A)			X
A/L wall temp transducer – TA (V64T0130A)			X
A/L wall temp transducer – PLB (V64T0131A)			X
Ext A/L fluid line heaters			X
Ext A/L structural heaters			X
C.4 Middeck equipment			
EMU O2 ISOL vlv		2	1
AIRLK H2O S/O vlv	1	2	1
Cabin purge and purge isol vlvs			1
C.5 EVA equipment			
EMU and ancillary equipment		X	
Prebreathe mask	1	2*	2
LCVG H2O loop		X	
C.6 Docking base hardware			
Vestibule depress vlvs			1
Vestibule heaters	1		
Docking mechanism equipment	1		
D. Console protocol – Flight GO/NO-GO and status calls			
D.1 10.2/14.7 cabin depress/repress			
GO/NO-GO to initiate quick don mask (QDM)			
prebreathe		X	X
QDM prebreathe initiated			X
GO/NO-GO for cabin depress			
Cabin depress to 10.2 initiated		X	X
QDM prebreathe completed			X
Cabin depress to 10.2 completed			X
GO/NO-GO for cabin repress			
Cabin repress to 14.7 initiated		X	X
Cabin repress to 14.7 completed			X

Responsibility legend:
X = Sole/joint
1 = Primary
2 = Secondary
* = Primary only during EVAs
=

Table 1.4-1. MMACS/EVA/EECOM A/L and hatch responsibilities (continued)

	MMACS	EVA	EECOM
D.2 A/L depress			
GO/NO-GO for A/L depress to 5 psi.....		X	X
A/L depress to 5 psi initiated			X
A/L depress to 5 psi completed			X
5 psi suit leak check completed.....		X	
5 psi A/L leak check completed			X
GO/NO-GO to continue A/L depress from 5 psi.		X	X
A/L depress to 0 psi initiated			X
A/L at less than 0.2 psi			X
GO/NO-GO to open hatch	X	X	X
D.3 A/L repress			
GO/NO-GO to repress A/L to 5 psi.....		X	X
A/L repress to 5 psi initiated			X
A/L repress to 5 psi completed			X
5 psi A/L leak check completed			X
GO/NO-GO to continue A/L repress from 5 psi			X
A/L repress to 10.2/14.7 psi initiated			X
A/L repress to 10.2/14.7 psi completed			X
GO/NO-GO to initiate emergency A/L repress		X	
Emergency A/L repress initiated.....			X
Emergency A/L repress completed.....			X
D.4 EVA prep			
In-suit purge initiated			X
In-suit purge completed			X
			(report to EVA)
In-suit prebreathe initiated		X	
In-suit prebreathe completed.....		X	

Responsibility legend:
X = Sole/joint
1 = Primary
2 = Secondary
* = Primary only during EVAs

Table 1.4-1. MMACS/EVA/EECOM A/L and hatch responsibilities (concluded)

	MMACS	EVA	EECOM
E. Flights/integrated simulations			
EVA equipment	2	1	
EVA capability	2	1	
Hatches/hinges.....	1	2*	
A/L ECLSS equipment.....		2	1
A/L non-ECLSS equipment	2	1	
F. Simulation models			
Airlock/EMU SMS model		1	2
SSTF A/L model.....		1	2
SMS model enhancements		1	2
G. Crew training		X	

Responsibility legend: X = Sole/joint 1 = Primary 2 = Secondary * = Primary only during EVAs
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1.4.2 Memorandum of Agreement for Sharing the FCR-1, EVA/VVO, and TOPO/VVO Consoles

OVERVIEW

This Memorandum of Agreement (MOA) defines the priorities and console sharing plans among the EVA, TOPO, and VVO flight controllers for the FCR-1, EVA/VVO, and TOPO/VVO consoles and the TOPO MPSR console, to accommodate timeframes when both TOPO and VVO are required to be on console, and to accommodate VVO OJT time to train and certify new VVOs since they receive no simulations. As mission priorities and staffing requirements change in the future, this protocol may be amended.

REQUIREMENTS

EVA is required to be on console in FCR-1 for the following activities:

- A. EVA preparation activities, including EVA dry runs, EMU checkouts, and S/G conferences*
- B. ISS stage EVAs, from EVA - 2 days to EVA + 24 hours*
- C. Maintenance and/or troubleshooting for the EMU, U.S. Airlock, and tools, from Maintenance - 8 hours to Maintenance + 8 hours*
- D. Shuttle/ISS docked operations, from Docking + 8 hours to Final EVA + 8 hours*

For all other steady-state support, the EVA MPSR is available.

VVO is required to be on console in FCR-1 for the following activities:

- A. Arriving vehicle, from Launch - 1 week to Dock/Berth + 6 hours*
- B. Departing vehicle, from Undock/Release - 1 week to Undock/Release + 9 hours*
- C. Deorbiting vehicle (if not covered by Departing Vehicle above), from Deorbit - 1 day to Deorbit + 3 hours*
- D. Soyuz relocation, from Relocation - 1 week to Dock + 6 hours*

VVO console operations begin 1 week prior to launch/undock/release/relocation due to the complex plan review that begins with the preliminary OSTP generation at event - 6 days, and to support system checkouts requiring loop/telemetry/video monitoring such as Kurs tests, TORU tests, TORU training, Soyuz Motion Control System tests, and Ku-band video routing setup and testing; these checkouts always occur within a week of an event, but the actual schedule is often not known until 1 or 3 days prior based on release of the Russian ДПП. VVO does not have an assigned MPSR console; for docking day they acquire a TRAJ MPSR or POCC console for the VV Support and VV Track positions via a request to the DM MCC POC.

TOPO is required to be on console in FCR-1 for the following activities:

- A. Reboost, from Reboost - 8 hours to Reboost + 8 hours*
- B. Debris Avoidance Maneuver (DAM), from DAM - 8 hours to DAM + 8 hours*
- C. EVA (for planned and unplanned jettison), from Airlock/DC1 depress to hatch closure*
- D. Shuttle, from Launch to Undock*

TOPO has a console available in the TRAJ MPSR.

PROCEDURES

- 1. Approximately 1 week prior to VVO's first day on console, VVO will generate a preliminary console schedule. VVO (from JSC-VVO) will e-mail this schedule to JSC-DL-MCC-EVA and JSC-DL-TOPO. EVA will e-mail a response to VVO and TOPO, indicating any conflicts based on the required activities listed above and whether they need both seats or just the right seat.*
- 2. Console Allocation*
 - (a) For shifts where there are no conflicts between the EVA and VVO schedules, VVO will use the EVA/VVO console and TOPO will use the TOPO/VVO console.*

- (b) *For shifts where there is a conflict between the EVA and VVO schedules of 1 day or less and EVA requires only the right seat, VVO may opt to suspend OJT activities and use the left seat of the EVA/VVO console, in which case TOPO will use the TOPO/VVO console. If VVO does not opt to suspend OJT activities, see step (c).*

Note: For some non-EMU powered EVA operations (e.g., tool config, battery ops, etc.), the EVA officer may choose to operate from the EVA MPSR, leaving the right seat available.

- (c) *For shifts where there is a conflict between the EVA and VVO schedules of more than 1 day or EVA requires both seats, VVO and TOPO will use the TOPO/VVO FCR-1 and TOPO MPSR consoles as follows:*

(1) *If a VV is on orbit, VVO will use the TOPO/VVO console, and TOPO will use the TOPO MPSR console. (This is valid even if one of the TOPO events listed in the Requirements section is scheduled while a VV is on orbit.)*

(2) *If a VV is not on orbit and any of the TOPO events listed in the Requirements section are scheduled, TOPO will use the TOPO/VVO console, and VVO will use the TOPO MPSR console.*

(3) *If a VV is not on orbit and none of the TOPO events listed in the Requirements section are scheduled, then:*

- If a VVO OJT is scheduled, VVO uses the TOPO/VVO console, and TOPO uses the TOPO MPSR console (based on VVO event - 1 week requirements).*
- If a VVO OJT is not scheduled, VVO and TOPO share the TOPO/VVO console; VVO uses the left seat and TOPO uses the right seat.*

3. *Any time VVO or TOPO require the TOPO MPSR console, they have priority over all other TOPO MPSR console operations.*
4. *VVO console usage for additional docking/undocking preparation activities (e.g., Kurs tests) outside of the periods defined in the Requirements section will be coordinated via the notification process below.*

Note: "VV is on orbit" refers to the period when a VV is in freeflight (launch day through docking day and undock day through deorbit/landing day).

COMMUNICATION

It is imperative that affected parties communicate their level of support to each other at a working level. The sharing of console schedule changes (which develop after the

initial exchange in step 1 of the Procedures) will allow the affected disciplines to find alternate console locations as the situation warrants. Changes should be shared either in written form to the VVO, DL TOPO, and DL MCC EVA e-mail accounts or verbally with appropriate personnel identified in the ISS FCT Contact List. Two days advance notice should be the minimum.

Off-nominal visiting vehicle operations, off-nominal EVA operations, or off-nominal trajectory operations may require any of the three disciplines to retain a FCR-1 console for additional time. In these cases, all parties should be informed as soon as practical so that any conflicts can be identified and resolved. Any staffing conflict will be worked in advance between Lead Controllers. ISS Flight Director approval of the console support plan will only be required if mission priorities need to be clarified.

1.4.3 BME Support for Non-Medical Crew Conferences

PURPOSE

To define the proper coordination of nonmedical crew conference support, including requests for 30S/3302 Conference Room (CR) and/or 30S/3306 BME MPSR CR reservation and ISS BME support.

PARTICIPANTS

<u>MCC-H/POIC</u>	<u>MCC-M</u>	<u>CSA</u>	<u>COL-CC</u>	<u>ATV-CC</u>	<u>SSIPC</u>
*BME MCC-H FCT	None	None	None	None	None

GENERAL

- A. *A request for the use of 30S CRs other than the BME MPSR CR must be made by contacting the Action Center to schedule the CR. BME will not have the scheduling information in possession and will not be responsible for scheduling 30S CRs other than the BME MPSR CR.*
- B. *To reserve 30S/3306, the requestor may contact ISS BME on the ISS MEDOPS 1 Loop or if ISS BME is not on console, e-mail may be used. Send e-mails to "JSC-BME-ISS" (jsc-bmeiss@mail.nasa.gov).*
- C. *If possible, conferences that request ISS BME support should be made a week in advance to allow for proper resource management and OSTPV inputs and/or updates. However, all requests for ISS BME support of a crew conference must be given no later than 1 day in advance.*
 - 1. *Requests should indicate the number of people*
 - 2. *Requests should indicate the type of resource support needed (use of phone, video, etc).*

- D. Conference participants must provide their own headsets (if necessary).*
- E. Any changes or updates to the conference should be communicated to the affected parties as they are received.*

PROCEDURE

- A. Note the day and time of the crew conference.*
- B. Reserve conference rooms 3302 or 3306.*
 - 1. As soon as possible, call the Action Center at x35197 to reserve CR 3302 for the day and time reflected in OSTPV.*
 - 2. If CR 3306 is to be used, contact ISS BME via ISS MEDOPS 1 Loop or e-mail.*
- C. BME Support*
 - 1. BME should be informed of the conference type (audio from MCC, phone patch, video, etc.)*

If the conference requires a phone patch, the phone number should be given to GC and BME.
 - 2. The Ops Notes for the conference should contain video and audio set up per FCOH SOP 6.1.1.*

2.1 FLIGHT LEAD CHECKLIST

PURPOSE

This section provides a checklist of activities to be performed by the appropriate EVA FCR operator prior to the first execute shift.

DESCRIPTION

The following activities should be checked complete prior to the first EVA of the flight and placed in the console data log.

PRELAUNCH ACTIVITIES

- ___ 1. Log on to workstation – verify password (all shifts).
- ___ 2. Configure console log (if scheduled EVA flight).
- ___ 3. Verify that FDF errata package is available and incorporated.
- ___ 4. Verify that A/L and payload bay closeout photos are accessible (hard copy or Web site).
- ___ 5. Verify that FDF signoff list has been completed.
- ___ 6. Check office supplies in cabinet.
- ___ 7. Log on to PC – verify password and e-mail capability.
- ___ 8. Log off workstation and PC.

Completed by _____ Date _____

ITEMS TO BE TAKEN TO CONSOLE

- ___ 1. Console data book (i.e., CCCD, Boeing data book, EMU and tool ESEL, contacts sheet, flight-specific equipment information, SMACARs, CARDS, etc.)
- ___ 2. Office supplies
- ___ 3. Unique flight-specific hardware
- ___ 4. Flight-specific EVA Checklist

Completed by _____ Date _____

1st PLANNING SHIFT

- ___ 1. Log into primary and backup DVIS.
- ___ 2. Log on to workstation.
- ___ 3. Initialize EMU pages on workstation.
- ___ 4. Start ELOG and clear entries.
- ___ 5. Start RTPLOT.
- ___ 6. Start CRANS.
- ___ 7. Log on to PC.
- ___ 8. Start the electronic flight notes program.

Completed by _____ Date _____

2.2 TASK LEAD CHECKLIST

PURPOSE

This section provides a checklist of activities that should be performed by the appropriate EVA Task operator prior to the first execute shift.

DESCRIPTION

The following activities should be checked complete prior to *launch or ISS Stage* EVA.

PRELAUNCH/*PRE-EVA* ACTIVITIES

- ___ 1. *Create preliminary External EVA Transfer Cue Card (reference ISS FCOH SOP 8.12.4, ISS/Shuttle Center of Gravity Calculation).*
- ___ 2. *Coordinate with Increment team to perform Tool Pre-Gather and Tool Config (shuttle only).*
- ___ 3. Arrange for any desired EVA tools and EVA hardware to be delivered to the MPSR.
- ___ 4. Move key electronic files to V: drive *(or CD on console; e.g., FDF EVA Checklist).*
- ___ 5. *Verify that all hardware photos (bench review, payload and orbiter CEIT, general photos, as well as 1819 data, electronic copies of EVA checklist, ESELS, contact lists, and callup plan) are located on V: drive.*
- ___ 6. Log onto workstation – verify password (all shifts).
- ___ 7. *Log on to PC – verify password and e-mail capability.*
- ___ 8. Configure console log.
- ___ 9. Verify that FDF/SODF books and Flight Rules have been updated to current version, including Errata packages (shuttle only). *Place electronic copy of Errata package, or link to it, on V drive.*
- ___ 10. Make CHIT, AR, handover log/console log binders, and electronic copies.
- ___ 11. Check office supplies in cabinet, *supplies in food cabinet*, DOUG load, and DVR setup *(DVRs cleaned off, blank DVDs available).*

ITEMS TO BE TAKEN TO CONSOLE

- ___ 1. Console Data Book (photo *CD*, binders, tool ESEL, flight-specific equipment information, CARDS, etc.)
- ___ 2. *Flight-specific EVA checklist (establish a controlling copy that is left on console (shuttle only))*
- ___ 3. *Flight-specific flight plan (with highlighted activities that we care about (shuttle only))*
- ___ 4. *Unique flight-specific hardware (NBL tools and mockups)*
- ___ 5. Office supplies, *food cabinet supplies, and blank DVDs*

TO DO LIST FOR ALL SHIFTS

- ___ 1. Be on time.
- ___ 2. Log in to DVIS *and configure loops. Post a note with which page(s) are configured for all shifts to use.*
- ___ 3. Log on to PC.
- ___ 4. *Open electronic console log.*
- ___ 5. *Log onto MCC Gateway Web page: FNs, CHITs, ARs, OSTPV.*
- ___ 6. Open *Net-Meeting (typically only during EVAs).*
- ___ 7. Locate all V: drive folders (handover log, console log, hardware photos, ESELS, etc.).
- ___ 8. *Log on to workstation.*
- ___ 9. *Call up payload-specific workstation pages.*
- ___ 10. Open wall clock.
- ___ 11. Prepare DVRs for recording.
- ___ 12. Toward end of shift, complete handover log, print out all paperwork from that shift, and have it ready for the next shift; always inform next shift what information went up to the crew. *Plan to have MPSR handover complete for next shift to brief FCR ~30 min after handover start.*

2.3 EMU FLIGHT CHECKLIST

PURPOSE

This section provides a checklist of activities that should be performed by the appropriate EMU Systems flight controller before the first execute shift.

DESCRIPTION

The following activities should be checked complete prior to the first EVA of the flight and should be placed in the console data log.

PRELAUNCH ACTIVITIES

- ___ 1. Log on to workstation - verify password (flight controllers on all shifts).
- ___ 2. Initialize/verify EMU Data pages, ELOG, CRANS, and RTPLOT.
- ___ 3. Log on to primary and backup DVIS.
- ___ 4. Begin console log.
- ___ 5. Verify that FDF Errata package is available and incorporated.
- ___ 6. Verify that A/L closeout photos are accessible (hard copy or Web site).
- ___ 7. Verify that FDF signoff list has been completed.
- ___ 8. Check office supplies in cabinet.
- ___ 9. Check EVA forms in cabinet.
- ___ 10. Log on to PC - verify password, e-mail, and print capability.
- ___ 11. Start EMU consumable program and input Boeing data - save on desktop.
- ___ 12. Move all prior flight/Sim working notes from the U:/WORK/EVA directory to the historical working notes folder on the C: drive.
- ___ 13. Obtain the MER/Action Central support schedule from CTSD.
- ___ 14. Log off workstation, PC, and DVIS.

Completed by _____ Date _____

ITEMS TO BE TAKEN TO CONSOLE

- ___ 1. Console Data Book (CCCD, Boeing data book, astronaut info, EMU ESEL, flight-specific equipment info, DF42 shift/contact list, MER/Action Central support and numbers list, flight-specific hardware support, and numbers list, etc.)
- ___ 2. Office supplies
- ___ 3. Unique flight-specific hardware
- ___ 4. Flight-specific EVA Checklist

Completed by _____ Date _____

1st PLANNING SHIFT

- ___ 1. Log on to primary and backup DVIS.
- ___ 2. Log on to workstation.
- ___ 3. Initialize EMU pages on workstation.
- ___ 4. Start ELOG and clear entries.
- ___ 5. Start RTPLOT.
- ___ 6. Start Wall Clock display.
- ___ 7. Start CRANS.
- ___ 8. Log on to PC.
- ___ 9. Start the electronic flight notes program.

Completed by _____ Date _____

2.4 CONSOLE DOCUMENTATION CHECKLIST

PURPOSE

This section provides a procedure that describes how to update the EVA FCR and MPSR FDF and to verify that it is current and complete.

DESCRIPTION

The DX32 FDF coordinator is responsible for maintaining a complete list of all the FDF that DX32 maintains in the section library and at the MPSR and FCR locations. The coordinator also assigns, with the group lead's approval, section personnel to be responsible for updating individual books prior to simulations and flights. The following is a list of actions that must be performed prior to a flight to ensure that the console operator is making flight calls from the appropriate procedures:

1. The new FDF and PCNs are received by the branch secretary and placed in the FDF inbox.
2. The FDF coordinator periodically checks the inbox for new documents.
3. The coordinator immediately distributes the updates to the assigned section member for incorporation into the books.
4. The assigned section member incorporates the new book or PCN into the section library, the MPSR, and the FCR.
5. After updating the books, the assigned section member should write on the front cover of the book the PCN number that was just updated (if applicable), the date that he/she updated the PCN or book version, and his/her initials.
6. Two weeks prior to a flight, the coordinator downloads the FDF status sheet for that flight from the JSCFDF file server (JSCFDF/World:FDFInfo\SimStat\ STS-xx.doc). The procedure for finding the FDF status sheet is found on the JSC DO master list internet Web site (<http://stic.jsc.nasa.gov/dbase/iso9000/docs/DO/master.htm>) and is referred to as the Determining Flight Data File Version document (DO-CWI-01).
7. The coordinator mails a copy of the DX32 FDF assignment list and the FDF status list to each assignee and to the flight lead.
8. The coordinator also posts a copy of the flight-specific FDF signoff list (Figure 2.4-1) and the most current status list on the bulletin board outside the group lead's office.
9. It is the responsibility of the assignee to verify that the book has the latest PCN by comparing it to the FDF status list located on the bulletin board. The assignee should also check that the pages of the book are the correct version by comparing each page to the List Of Effective Pages (LOEP) at the front of the book. The

LOEP comparison should be done only for scheduled EVA flights; however, the FDF status list should be checked before all flights.

10. The assignee completes the verification within 1 week of the flight and signs and dates the signoff list posted on the bulletin board.

STS-87 FDF SIGNOFF

Assignee	Books	Signature/Date
Arne Aamodt	IFM Tool Catalog	
	Post Insertion C/L	
Anna Jarvis	FCOH (MCC/CCC)	
	Flight Rules Annex (Flight Sp)	
Michelle Hollinger	Orbit Pocket C/L	
	Reference Data	
Sean Dougherty	PDRS Ops C/L	
	Payload Ops C/L	
Gary Flynt	SSSH	
	EVA FMEA/CIL	
Peggy Berg	Flight Rules	
	Deorbit Prep C/L	
Kenny Vassigh	Med Ops C/L	
	IFM C/L	
Brian Peavey	Flight Plan	
	Rndz C/L	
Tracy Snow	EVA Console Handbook	
John Foss	Payload Sys Malf. C/L	
	Orbit Ops C/L	
Ed Tom	Malfunction Procedures	
	EVA C/L (EDP)	
George Guirgis	STS-TERROR Sim Pack	
	Photo TV C/L	
Daryl Hemingway	EVA Flight Procedures Rationale Handbook	
Dan Zell	Spacehab Ops C/L	
Roger Lottridge	EVA C/L Generic, FS, Cuff, Cue Cards	
Danny Miller	Mir/Shuttle Joint Ops	
	EVA C/L Student Copies (ECWS, COMM, Prep/Post)	
Paul Boehm	EMU S/AD	

Figure 2.4-1. Sample signoff list

2.5 POSTFLIGHT/EVA CHECKLIST

POST-EVA CONFIGURATION AND LOGISTICS DATA MANAGEMENT

PURPOSE

This section defines the actions required of the EVA MPSR following one or more EVAs to disseminate configuration and logistics data within and outside of the EVA Group.

DESCRIPTION

A. Following each EVA

TASK: Update and distribute the EVA Transfer Cue Card according to ISS FCOH SOP 8.12.4, ISS/SHUTTLE CENTER OF GRAVITY CALCULATION

B. Following completion of all planned EVAs

1. **TASK**

- a. E-mail a list of the final ISS external configuration, *list of EVA tasks accomplished, and EVA durations to the following groups* (all available via JSC Global). This should include the updated APFR and Safety tether charts, as well as any other items that were moved around outside, brought outside from inside, or vice versa.

(1) Dave Homan (*VR Lab*)

(2) JSC-DL-MOD-DX22 (*ROBO group*)

(3) JSC-DL-MOD-DX24 (*Robotics Analysis group*)

(4) JSC-DL-Pointing (*Pointing*)

(5) cammp-team@lists.nasa.gov (Configuration Analysis Modeling and Mass Properties (CAMMP) team)

(6) Your NBL flight lead

(7) *JSC-DL-MOD-DX3*

- b. Send a list of tool consumables used to XA Tools Logistics IPT Lead (e.g., wire ties, helmet light bulbs)

2. **TASK and SYSTEMS**

- a. Responsible for providing XA with postflight “as flown” ESEL updates. This captures any deltas resulting from real-time manifest changes.
- b. Archive the DVR video to DVD and then delete the video from the DVR hard drives.

- c. Clean the MPSR and throw out any left over food.
- d. Archive the flight data from the V: drive
- e. *Inform next stage/increment lead of any activities that were not completed and need rescheduling (e.g., ISS tool config. not finished when planned, or EVA photo not taken; hand these items over to next team). Inform CIO/ISO and/or Ops Plan of the forward plan to ensure they do not think the task was completed.*

C. Postflight/Stage EVA Series

1. **EVA FLIGHT LEAD:**

- a. *Send a Lessons Learned document to the Task and Systems groups via e-mail within 3 weeks of a flight or series of stage EVAs, and present the material at a group meeting as soon as possible thereafter. This document may be a draft of the Generic JOP or XA Lessons Learned presentation, but it can also be an internal document/presentation that has additional detailed information in it for the Task/Systems group members. This document should incorporate lessons learned by the Task and Systems lead instructors and any console operators that worked the flight/increment. The purpose of sending this soon after a group of EVAs (or after a standalone stage EVA) is to allow instructors to train upcoming crews with updated lessons learned and prepare console operators for the next EVAs.*
- b. *All ARs related to the flight/EVA series should be closed out before leaving console, if possible (or within 1 week).*

2. **TASK:** Within 2 weeks following flight or increment EVA series, redline the following items for anything that should be added, updated, or deleted based on your flight or increment EVAs and provide to document owner (see EVA Assignments list)

- a. Generic Notes/Cautions/Warnings
- b. Generic Inhibit Pad
- c. Generic & Maintenance Workarounds Cribsheets
- d. Place updated Toolbox, APFR and Safety Tether charts on the V drive:
V:\EVA\SS Tool Configuration

3. **TASK:** Within 3 weeks of final EVA, send a list of Limited Life items that were used on the EVAs to XA Tools Logistics IPT Lead

- a. Blank file is currently located at *S:\Divisions\DX\Eva\Joint\Limited Life tracking chart*, but XA is responsible for making any necessary updates.

- b. This list only includes EVA tools for which life limits depend on number of EVAs or hours EVA, which requires MOD input.
- c. Items that stayed in the airlock throughout the EVA are not counted as having gone EVA for the purpose of limited life, since they are relatively protected from AO and other environmental factors.

3.1 MCC WORKSTATION ACCESS

PURPOSE

To define procedures to be used by EVA flight controllers for accessing and maintaining access to MCC PCs and workstations both on site and remotely.

DESCRIPTION

The Automated Computer Access Request System (AutoCAR) is a Mission Operations Directorate (MOD)-developed, Web-based system that replaces JSC Form 237 Computer Access Request (CAR) form, and the MOD Access Request System (MARS).

This system manages access to over 120 MOD information systems, including the MCC, Integrated Planning System (IPS), MCC Automation System (MAS), various MOD mission awareness applications, and select MOD office systems. EVA flight controllers and instructors should keep their accounts up to date by using the AutoCAR system. EVA flight controllers use the AutoCAR system for MCC Operational Workstations (DEC Alpha or Control Center Complex Operations (CCC Ops)) and MCC Automation System (MAS) applications.

Accounts must be renewed annually. If the user account is scheduled to expire within 30 days, a red status bar appears on the MCC-H Gateway, indicating the number of days remaining. It is recommended that the account revalidation and/or password reset be completed prior to the expiration date for continuous access.

PROCEDURE

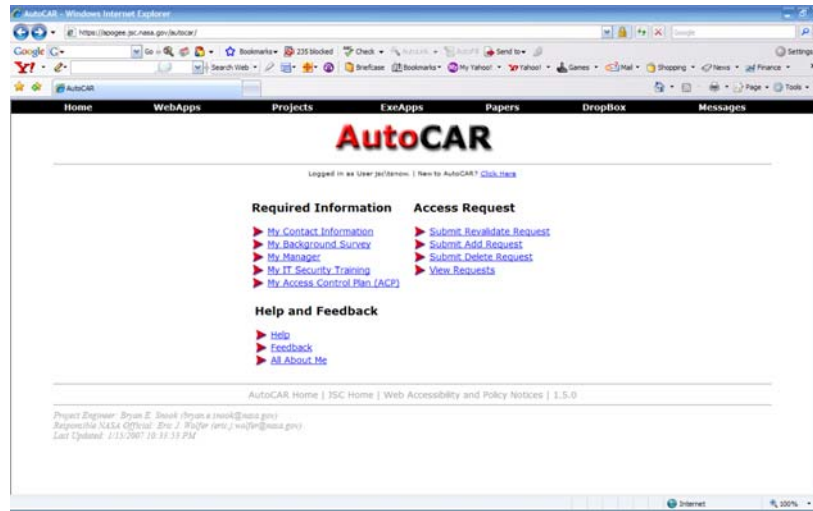
Log In

Log in to AutoCAR <https://apogee.jsc.nasa.gov/autocar> using your JSC, USATX, and/or other trusted account. If you have a JSC account, it is best to use your JSC account.



Where you see “JSC” in the User Name field, this is known as your **domain**. Where you see “jsmith,” that is known as your **account**. Make sure to preface your account name with your domain name. For example JSC\jsmith, USATX\jsmith, etc., as appropriate. Always separate your domain and account names with a backslash \ (above your ENTER key).

For most users, the following screen will appear once logged in:



In some cases, where users have multiple roles as managers, group administrators, or other roles, a “Multiple Roles” page may appear. If this is the case, select “User” as a role.

Submit and Verify Required Information

Looking under the “Required Information” heading, verify the following:

1. My Contact Information

Users should click “My Contact Information” and submit and/or verify that the information is correct.

2. My Background Survey

Users should click “My Background Survey” and submit and/or verify the information. The background survey is a series of questions to facilitate the proper export control, citizenship, and/or background verification processes required to grant access to MOD information systems.

3. My Manager

Users should click “My Manager” and submit and/or verify that the manager is correct. Civil servants should list their NASA group lead as their manager; USA and USA subcontractors should list the appropriate USA supervisor as their manager. Remote, offsite users, should list their remote site manager as their manager.

4. My IT Security Training Date

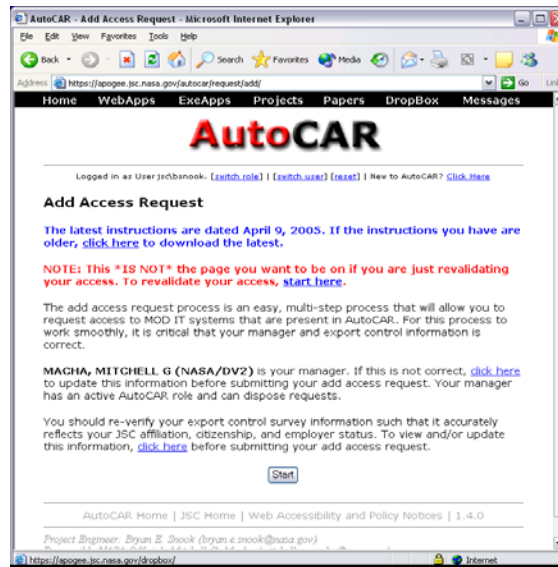
A valid IT security training date must be submitted. Those who do not have access to any of the NASA or contractor-managed IT security training systems may take their IT security training directly via AutoCAR. Mostly, this would include remote users such as the International Partners.

5. My Access Control Plan

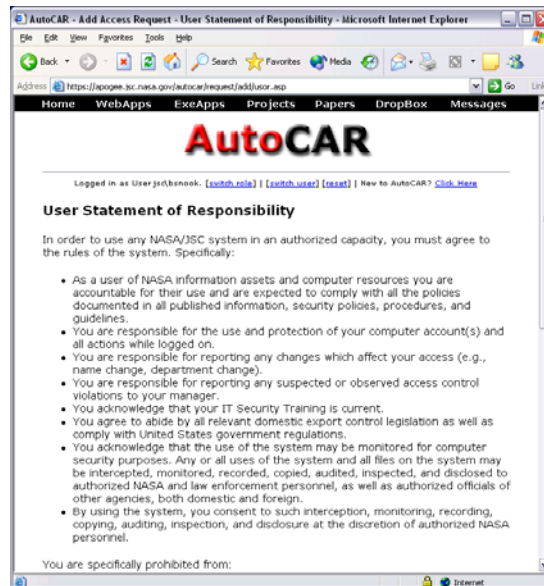
Users should click “My Access Control Plan (ACP)” and submit and/or verify the information. ACPs are not required for United States (U.S.) citizens; therefore, EVA flight controllers will likely select “I am not required to submit an ACP.”

Submit Add Request

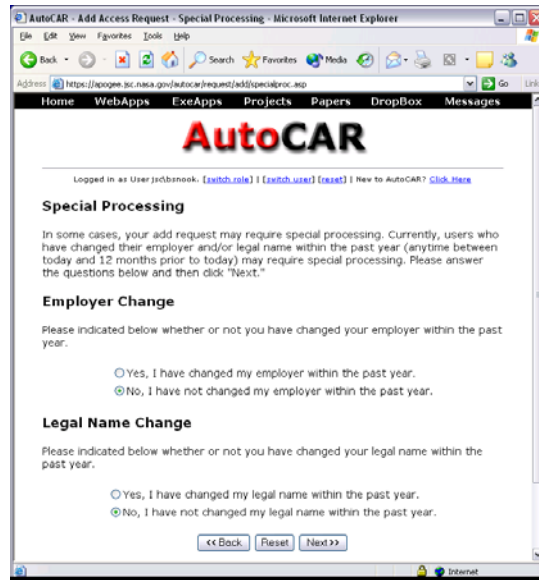
1. Once all required information is submitted and/or verified, users should click “Submit Add Request” on the AutoCAR main page. The following screen will appear:



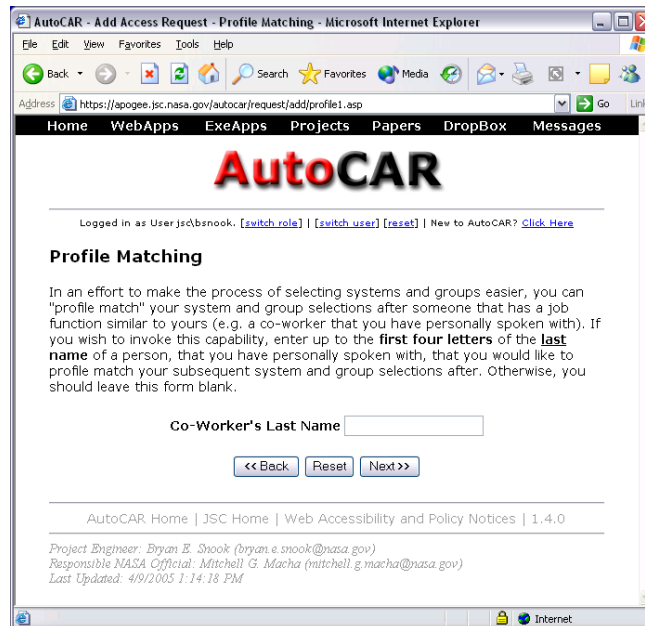
2. After clicking “Start,” the following screen will appear:



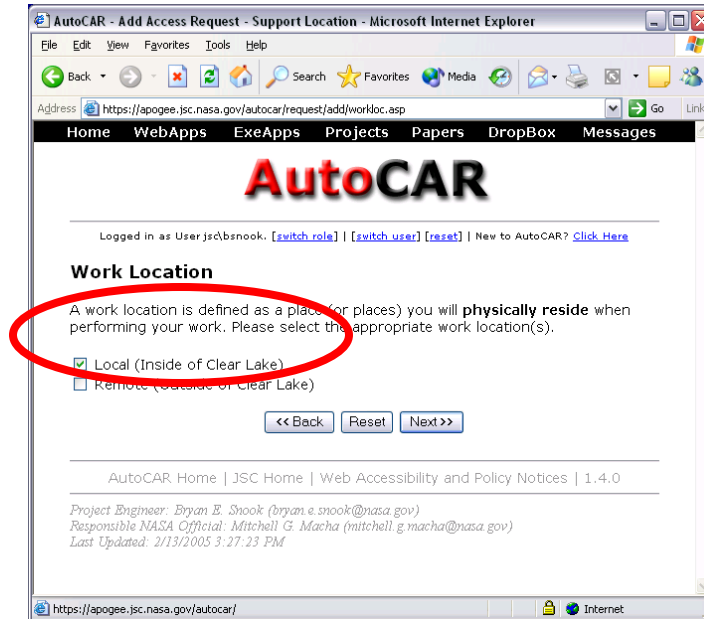
3. Scroll down to the bottom of the page, check to denote your electronic signature, and click "Next." The following screen will appear:



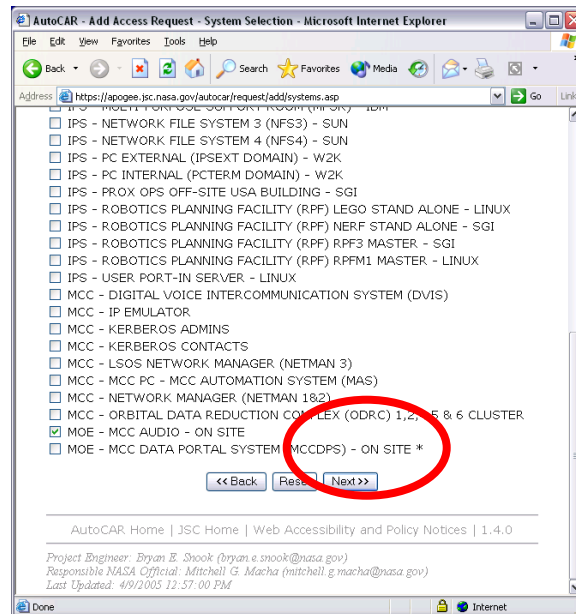
4. Indicate whether or not you have recently changed your employer or legal name. Click "Next," and the following page will appear:



5. If you are accessing AutoCAR for the first time and are uncertain of which computer systems to request, it is recommended that you select an experienced person in a similar position and use his/her system access as a guide. If you know exactly which system(s) you need, this is not necessary, simply click “Next.”



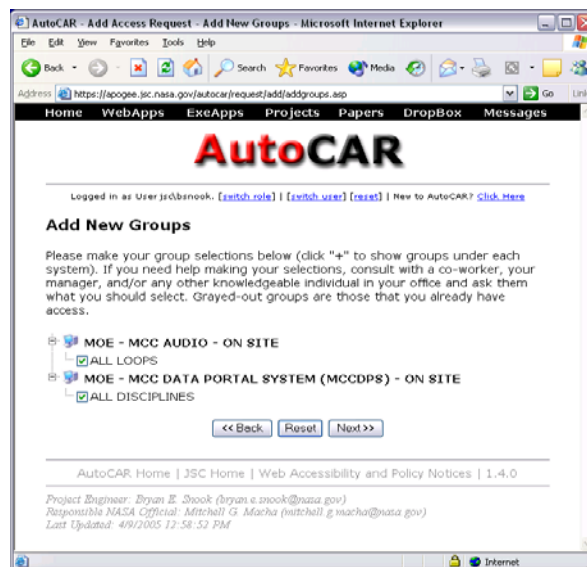
6. Select “Local,” and then click “Next.”



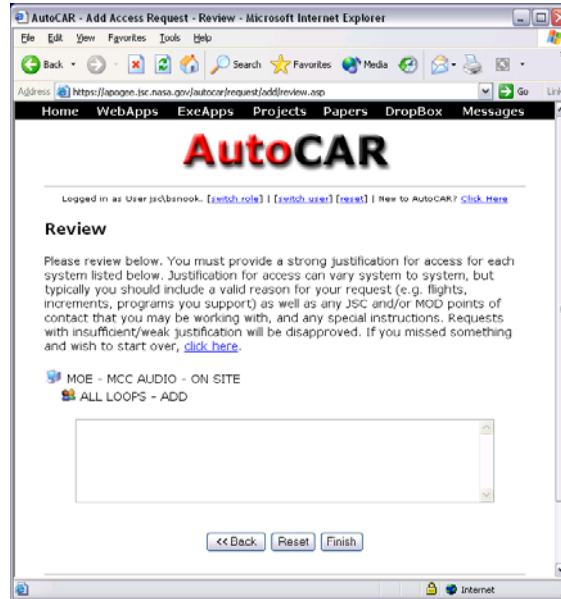
7. Use the following chart (**Chart 1**) to select the computer systems that EVA personnel typically need to access. If you need access to a system not listed, add it at this time as well. After selecting your system(s) to add, click “Next.”

Chart 1

System	Subsystem	Reason
MCC – MAS – MCC AUTOMATION SYSTEM – MCC PC	MCC-H – EVA	Allows access to MCC-H applications, such as IMS Search, JEDI, OSTPV, IPV, as well as the V: drive
MCC – DEC ALPHA AND LINUX – CONTROL CENTER COMPLEX OPERATIONS CCC-OPS	EVA	Allows you to access the console computers in the MCC
MOE – MCC AUDIO – ON SITE	GROUP 2 – MOD PERSONNEL ONLY – ALL LOOPS EXCEPT ISS MER MGR & EVA LOOPS GROUP 7 – EVA LOOPS – EVA; EVA PROCEED; EVA COORD; EVA MPSR	Provides MCC Audio (DVIS loops) access from your office PC
MOE – MCC DPS – MCC DATA PORTAL SYSTEM – ON SITE	ALL DISCIPLINES	Provides MCC DPS (run IAM, DOUG, MSK Displays, etc.) from your office PC

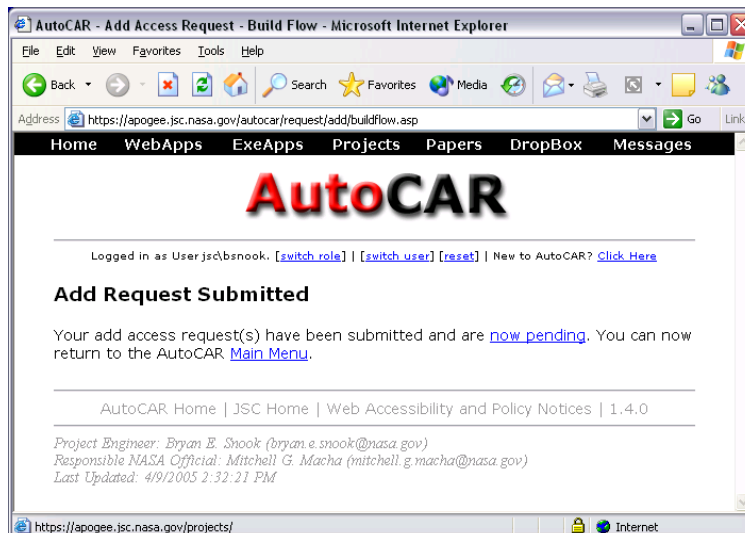


8. Select the appropriate subsystem for your selected computer system(s). EVA personnel should use **Chart 1** as a reference for the typical computer systems they need to access. If you added an additional computer system, you will need to know the appropriate subsystem.



9. For each system listed, **you must provide sufficient justification**. Justification is usually along the lines of, "Access required to perform my duties in DX3 EVA Operations as a flight controller and Crew instructor." Review and then click "Finish" to submit your add requests.

Note: A separate request will be sent for each system listed on the review page. After "Finish" is clicked, the following page will appear:



10. Users can verify that their requests were submitted, by clicking “now pending,” which will take them the following page. Users can expect to receive e-mails from each system with initial passwords and login instructions. The time for requests to be processed varies from system to system.



11. Finally, clicking either the AutoCAR logo at the top of the page, the “Main Menu” link in the sentence, or the “AutoCAR Home” link in the footer, users will be taken back the main AutoCAR home page.

PROBLEM RESOLUTION

Contact AutoCAR support via e-mail (jsc-autocar@mail.nasa.gov) for all questions and help regarding this system.

AutoCAR will automatically withdraw any and all pending requests that have not completed the approval process after 60 days of the request being submitted. Requests older than 60 days in age are considered to be irrelevant due to potential changes that may have occurred over an extended period of time (e.g., system and group names could have been added/changed/deleted during that time). If a request has been withdrawn for any reason, you must resubmit a new request.

REFERENCE

AutoCAR Web site: <https://apogee.jsc.nasa.gov/autocar/help/>; last updated January 14, 2007.

AutoCAR User Add System-Specific Instructions: MCC Audio & MCC DPS; last updated April 11, 2005.

3.2 CONSOLE LOGIN/INITIALIZATION AND LOGOUT

PURPOSE

Defines the standard procedure to be followed by the EVA flight controller for MCC PC system and workstation login/initialization and logout/shift change.

PROCEDURE

MCC PC SYSTEM LOGIN/INITIALIZATION AND LOGOUT

Desktop PCs are located in the EVA MPSR (two for EMU System and two for EVA Task) and the FCR. The PC systems include the following:

- A. Windows 95 Operating System
- B. DVD/CD

The PCs are used to log on to the JSC-MAS server, which is used for flight operations support. For security reasons, the PC is not accessible from outside the MCC; however, the JSC-MAS server and associated applications are accessible remotely, while logged on to the JSC network. A user Identification (ID) (typically, the same as your JSC login) is required, along with a password, to access the JSC-MAS server.

Note: The Team 4 PC is not a JSC-MAS computer.

Login

1. Turn on CPU unit and monitor
2. At the Government Warning dialog box, click "OK"

NOTE

<p>Only <u>JSC-MAS</u> server should be used by these PCs. The PC will not permit login to another server domain.</p>

3. At the server login window, enter
 - (a) USER NAME – This will be your JSC-MAS server ID, which is typically the same as your JSC server ID
 - (b) PASSWORD – For the JSC-MAS server
 - (c) LOG ON TO – JSC-MAS
 - (d) Click on "OK"

4. At the JSC ID? window
Click "Yes" if you have a JSC account
5. Enter your JSC domain password
6. The PC should then load and begin running Windows. The desktop will appear with the following task bar:

Mission Control Center Gateway, mission applications
7. Start Internet Explorer
8. If the MCC Gateway screen is not displayed, click the "home" button on the Internet Explorer window
9. Select Mission or Sim
 - (a) If supporting real-time Ops, under the Mission heading, select either ISS users or STS users, as appropriate for the current mission operations
 - (b) If supporting Sim Ops
Select Sim 1, Sim 2, Sim 3, or Sim 4, as appropriate
 - (1) Sim 1: ISS-only Generics or Dual/Joint Generics
 - (2) Sim 2: Dual/Joint Flight Specifics or ISS-only Flight Specifics
 - (3) Sim 3: STS-only (FS or Gen) or Alternate Flight Specifics
 - (4) Sim 4: Expedition Standalone Training
 - (c) Under the Sim selection heading box, select either ISS Users or STS Users, as appropriate for the current Sim operations

Logout

1. Close all programs
2. Under the *START Menu* button
 - (a) Choose "Log Off" or "Shut Down"
 - (b) Continue per normal Windows operating procedures
3. For JSC-MAS system assistance
 - (a) During standard hours: 2-6100

- (b) After hours account issue: 3-5665
- (c) On call pager: 281-467-0661

WORKSTATION FUNCTIONAL DESCRIPTION

The MCC workstations are Unix-based operating systems. Each workstation is identified with both a CPU name/number and a monitor number. The EVA positions are identified as follows:

White FCR

Position	Left monitor	Center monitor	Right monitor
EVA			

FCR 1

Position	Left monitor	Center monitor	Right monitor
EVA			

Red FCR

Position	Left monitor	Center monitor	Right monitor
EVA			

EVA MPSR

Position	Left monitor	Center monitor	Right monitor
EMU SYSTEMS	eva4 monitor 0	eva4 monitor 1	eva3 monitor 0
EVA TASK	eva1 monitor 0	eva1 monitor 1	eva2 monitor 0

These positional identifications are required when reporting and troubleshooting workstation anomalies.

<p>WARNING</p> <p>The EMU systems position, "eva1," shall be initialized first. Other workstations may log in, but may not initialize. This is required to ensure proper control of EMU data processing (starting the EMU Daemon). The first workstation to initialize is the controlling CPU for the EMU Daemon data processing. After the first workstation has initialized, other initializing workstations are connected to the host workstation, which is already running the EMU Daemon. If troubleshooting of the EMU data is required during a flight, the host workstation must be used by the EVA Group Administrator (GA). Therefore, the EMU systems position is initialized first so that it is the host and troubleshooting can be conducted in the MPSR.</p>
--

If FCR-only flight support is conducted, follow the procedure noted below, initializing from the FCR workstation. When nominal flight support is resumed, the FCR should log off, and the EMU systems workstation should be initialized. Any other workstations

already running will temporarily lose data until the EMU system workstation is initialized and running.

WORKSTATION LOGIN, INITIALIZATION, LOGOUT, AND SHIFT CHANGE

Login

1. At the “Welcome to the CCC: *cpu#*” dialog box, enter

Login: – XXXeva (where XXX are your initials; this is your user ID.)

Password: – Your password

Note: You have three opportunities to log in, after which you will be locked out of the system for security reasons. You must then contact MCC Access Control to reset your password. Your password expires after 12 weeks, is case sensitive, and must be 8 to 10 characters long. The system keeps a log of your last 10 passwords, which cannot be reused until they drop off the log. For help with workstation access contact

MCC Access Control support, building 30S, room 4312, x4-6294, or 4-6292

Password reset: Monday through Friday 7:30 a.m. to 4:00 p.m.

For after-hours support, contact OS Support Group at x3-9881.

If no response, contact FSM at x3-5665.

Additional contacts for Access Support are located under the plastic desktop of the console.

You may change your password once you have logged in by using the following procedure:

- (a) Move the cursor to the desktop background, and click on the right or left mouse button.
- (b) Choose *Applications*, then *DECterm*, which will bring up a DECterm window.
- (c) At the prompt EVA 1>, enter “passwd XXXeva” with a space between the command and your user ID.
- (d) Follow the displayed instructions.

Note: This function cannot be performed within 7 days of the last password change.

2. The “*Activity Selection*” dialog window will appear. In this window, you will see the **Current Activity** (not configured) that is selected for your workstation and your

Current Position (eva). The scroll box below indicates the activities that are available for selection by activity name and type (SIM = simulation, MIS = mission).

Select the proper activity by highlighting it and then click “OK.” A confirmation window will be displayed. Click “Confirm” if it is the activity you desire.

This determines what data are available to your workstation. Note that some activities are for facility checkouts only and have the same name but “No Data” listed as well. If this is selected, no data will be displayed on the workstation.

3. The “*Configure/Deconfigure Messages*” log will then be displayed as the workstation begins its login configuration script. The “*Console Log*” and “*Advisory Services*” logs are also displayed.
4. Minimize [ALT+F9] the *Configure/Deconfigure Messages*, *Advisory Services*, and *Console Log* windows. Do not close these windows. Message logging is lost if the window is closed, and it cannot be used by the EVA GA for troubleshooting.
5. Once the workstation configuration is completed, the “*EVA Display Navigation (DNAV) Menu*” bar shown below will be located at the top left of the screen.

Display Navigation Menu 1							
EVA	Initialize	Shuttle- SSPxxx	Station- ISSxxx	ISP Controls	Utilities	Print	Contacts

Initialization of EMU Daemon (to be performed by EMU MPSR)

1. Click on the “*Initialize* menu item” and on “*Initialize Servers.*” This will start the workstation initialization script.

The following applications are started, and the windows are displayed as part of the initialization script:

- (a) ISP Limit Manager Application
- (b) ISP Limit Manager Display (upper left of left monitor)
- (c) EMU Daemon Application
- (d) EVA Comps

Indication of a proper EMU Daemon startup can be verified by noting if the MET time for the *EMU Daemon* is updating on EMU Data Page 1.

Indication of a proper EVA Comps startup can be verified by noting if the ground computations (TIME EV, O2 TM LF, PWR TM LF, etc.) are displayed (nonblank) on EMU Data Page 1.

2. Any x-term windows that are displayed can be closed, if desired.
3. For “Limit Manager” (ISSEMU or SSPEMU) window(s)
 - (a) Verify ENABLE is selected
 - (b) Verify AUTOMATIC is selected
 - (c) Select EVA or CHECKOUT limits, as desired
 - (d) Minimize the “Limit Manager” window
4. For “ecws_emud::Station (Shuttle)” window(s)
 - (a) Select Setup, Configure
 - (b) Setup each channel on ISS window as follows:
 - (1) NAME: use crew name
 - (2) PRIMARY ID: primary radio ID
 - (3) BACKUP ID: alternate radio ID
 - (c) Set up each channel on the Shuttle window as follows:
 - (1) NAME: use crew name
 - (2) EMU ID: use last number of EMU ID
 - (3) EV ID: use crew EV no.
 - (d) Minimize “ecws emud::Station (Shuttle)” window(s)

Console Displays and Tools

5. Under the *EVA DNAV Menu*, the following displays can be selected, as required:
 - (a) Under the *Station-ISSxxx* menu
 - (1) EMU Displays
Data Page 1 through Data Page 3 (for both Ch 12 and Ch 34)
 - (2) Consumables, Control Panel
Start, Stop, or Recycle

- (3) Consumables, Displays
Summary 12, Details 12, Summary 34, Details 34, or Log Viewer
 - (4) Joint Airlock Displays
Joint Airlock Mega or Joint Airlock Mini
 - (5) RTPLOT
Data vs. MET, GMT, or EVA time
 - (6) ECWS Fault Stack
Fault Stack Ch 1 and Ch 2, or Fault Stack Ch 3 and Ch 4
 - (7) ELOG
 - (8) ISS EMU Log
 - (9) Limit Manager
 - (10) NH3 Bakeout Calculator
- (b) Under the *Shuttle-SSPxxx* menu
- (1) EMU Displays
 - SCU/Airlock Parameters
 - Data Page 1 through Data Page 3
 - EMU Utility
 - Fault Stack
 - (2) RTPLOT
SSP EVA or SSP MET
 - (3) ELOG
 - (4) CRANS
 - (5) Consumables, Control Panel
Start, Stop, or Recycle

- (6) Consumables, Displays
Summary, Details, or Log Viewer
- (7) SSP EMU Log
- (8) Limit Manager
- (9) NH3 Bakeout Calculator

(c) Change to the *Master DNAV Menu* (shown below) by clicking on *EVA* button.

Display Navigation Menu 1									
Master	Shuttle	Station	Global Apps	Windows	Tools	Print	Config	Help	

(d) Under the *Master DNAV Menu*, the following displays can be selected as required:

- (1) Under *Shuttle* menu
 - DPS, Displays from DPS Server, Onboard Fault Summary (OFS)
- (2) Under *Station* menu
 - Flight Director, CDDT Displays, Cur. Increment, Homepage
 - ODIN, ODIN Server displays, C&W Summary
- (3) Under Global Apps menu
 - Flt Dir Alert/Monitor
ISS Alert, ISS Monitor, SSP Alert, or SSP Monitor
 - MEWS/ODRC
 - Timers/Clocks
Wall Clock Display or Timer/Clock Control Panel

(4) Under *Tools* menu

- Calculator
- Calendar
- Clock (dxclock)
- Notepad

Logout

1. Move cursor to the desktop background, and click on right or left mouse button.
2. Choose *Logout*, then *Yes*.
3. On the logout countdown window
 - (a) Select LOGOUT NOW to bypass the 30-second countdown
 - (b) Select CANCEL to abort the logout

The workstation will begin the shutdown script. No further action is required.

Shift Change

1. Move cursor to the desktop background, and click on right or left mouse button.
2. Choose Shift Change.
3. In the xterm window that is displayed, follow the directions as listed.
 - (a) Input login ID of oncoming shift flight controller, and press enter.
 - (b) Input password for oncoming shift flight controller, and press enter.

The new user will log in but will not have to initialize the workstation. All data logging is retained.

3.3 EVA REQUIRED VOICE LOOPS

PURPOSE

To identify and describe the required DVIS keyset operation and the minimum required voice loops for EVA operations in the building 30S control center.

DESCRIPTION

The most important tool the EVA flight controller has at his/her disposal is the DVIS keyset. The DVIS keyset allows the controller to communicate with all disciplines (White Flight Control Room (WFCR), Flight Control Room 1 (FCR-1), and MPSR positions), any simulation support personnel, and KSC personnel, as required. International Space Station (ISS) FCOH SOP 1.2.2 identifies console locations and voice DVIS assignments in MCC-H. The following are the EVA console (WFCR, FCR-1, and MPSR) DVIS position identifications:

White FCR

<u>Position</u>	<u>Call Sign</u>	<u>DVIS</u>
EVA Officer	EVA	4243 (WFCR Left) 4244 (WFCR Right) - Prime DVIS 4741 (FCR-1 Left) 4290 (FCR-1 Right) - Prime DVIS 4190 (RFCR) 4191 (RFCR)

EVA MPSR

<u>Position</u>	<u>Call Sign</u>	<u>DVIS</u>
EMU Task Support	EVA TASK OJT	4372 4371 (Recordable to DVR)
EVA Systems	EMU SYSTEMS OJT	4830 4831 (Recordable to DVR)
Extra DVIS		4393

DVIS KEYSSET OPERATION

Refer to the Digital Voice Intercommunication Subsystem Keyset Operations Procedures, located in MCC Operations Handbook, Vol. III, SOP 1.4 for detailed instructions on the DVIS operation and reconfiguration. Refer to JSC-28883, DVIS Ground Rules Loop Directory, for a listing of all loops. To log in to DVIS, touch the screen, touch SIGN ON, and enter the four-digit position number plus 5 for real-time ops or 6 for simulations then ENTER. For real-time ops, use the prime loop, indicated by a 1 following the loop name. For simulations, the shuttle usually uses the prime loops, and station usually uses the alternate loops, indicated by a 2 following the loop name. Typically, for combined Sims, prime loops should be used for the shuttle loops, and alternate loops should be used for station since real-time ops are using the prime loops.

FREQUENTLY USED DVIS LOOPS

There is a full list of the MCC voice loops and call signs in SOP 1.4 of the FCOH and International Space Station (ISS) FCOH SOP 1.2.1 and ISS FCOH SOP 6.1.10. Table 3.3-1 identifies the primary voice loops of other disciplines with which shuttle EVA flight controllers typically interact. Table 3.3-12 identifies the primary voice loops of other disciplines with which station EVA flight controllers typically interact.

Table 3.3-1. Primary Shuttle voice loops on the MCC Partition

Voice loops	Function
Private Automatic Branch Exchange (PABX)	Provides access to commercial telephone lines. May be accessed by others or recorded
Dial Call (DIAL CALL)	Provides point-to-point communication between DVIS units by position number
Houston Voice (VOICE CONTROL)	Prime loop for all DVIS reconfigurations and for reporting DVIS and communications problems
WSS (WSS CALL)	Workstation support
Air to Ground (A/G 1 and A/G 2)	Used for communication between the orbiter flight crew and MCC, is also called the Big Loop when linked with S/G1. A/G 2 is typically used for payloads or for shuttle-only calls during docked ops
Air to Ground UHF (A/G UHF)	Used for communication between the orbiter flight crew and MCC through a UHF groundsite
Flight Director (FD)	This is the prime loop on which all flight controllers make inputs to the FD
Assistant Flight Director Conference (AFD CONF)	This is the FD backup loop. This loop is used to brief the oncoming FD during shift changes. It is also used for debriefing after simulations
Extravehicular Activities (EVA)	This loop is used by other Flight Control Room (FCR) disciplines to communicate with the EVA officer
EVA Procedures (EVA PROCED)	This loop is used as the primary loop for communication between the EVA FCR and EVA MPSR positions
EVA Multipurpose Support Room (EVA MPSR)	This loop is used by other disciplines to communicate with the EVA MPSR positions. The MER will also use this loop for communication to/from the MPSR

Table 3.3-1. Primary Shuttle voice loops on the MCC Partition (continued)

Voice loops	Function
EVA Coordination (EVA COORD)	Prime loop for coordination of EVA operations with the CSR. This loop is used by EVA MPSR to coordinate timeline, procedure, and task changes with customer representatives in the CSR
EVA Support (EVA SUPPORT)	This loop is used by EVA MER and EVA Safety
Internal EVA (INT EVA)	This is the internal EVA loop for the EVA FCR and EVA MPSR. This loop is established only on the DVISs used by EVA flight controllers, although it may be requested by any discipline
<i>Spacecraft Analysis Manager 2 (SPAN MANAGER 2)</i>	<i>After undocking, SPAN MANAGER 2 is used by the shuttle FCT to communicate with the SPAN Team. SPAN MANAGER loops serve as an MOD resource and interface with the MER. This loop is used to submit CHiTs and anomaly reports to the MER Manager.</i>
Mission Operations Control Room Systems (MOCR SYS)	This is the prime coordination loop for orbiter systems (EECOM, MMACS, and EGIL). This loop is used by EVA to call other FCR disciplines
Electrical, Environmental, Consumables Manager (EECOM)	This loop is used for coordination between EECOM FCR and MPSR support (Life Support and Thermal). This loop is used by EVA FCR to call EECOM concerning life support systems issues
Flight Activities Officer (FAO)	This loop is used for flight planning activities coordination between FAO and their MPSR. This loop is used by EVA FCR to call FAO concerning timeline changes, Execute package review, and flight note uplinks
Electrical Generation and Illumination Engineer (EGIL)	This loop is used for coordination between EGIL FCR and MPSR support (EPS) and by EVA FCR to call EGIL concerning electrical issues
Integrated Communications Officer (INCO)	This loop is used for coordination between INCO FCR and MPSR support (Instrumentation, RF Com, Data Com). This loop is used by EVA FCR to call INCO concerning communication and telemetry issues
Flight Surgeon (SURGEON)	This loop is used for coordination between SURGEON FCR and MPSR support (Aeromed - Biomedical Engineer (BME)). This loop is used by EVA FCR to call SURGEON concerning crew health, prebreathe, and radiation issues

Table 3.3-1. Primary Shuttle voice loops on the MCC Partition (continued)

Voice loops	Function
Maintenance, Mechanical, Arm, and Crew Systems (MMACS)	This loop is used for coordination between MMACS FCR and MPSR support (IFM, Mechanical, Crew Systems). This loop is used by EVA FCR to call MMACS concerning mechanical, IFM, and crew systems issues
Payloads (PAYLOADS)	This is the loop for coordination between the PAYLOAD FCR and MPSR. This loop is used by EVA FCR to call PAYLOADS concerning payload operations and issues
Prime Operations (PRIME OPS)	The prime loop for remote Payload Operations Control Center (POCC) communications with the JSC MCC FCR payload officer for command, crew operations, timeline, and procedures
Medical Operations (MED OPS)	This is the MPSR loop for SURGEON; it is used by the EVA MPSR to call the BME concerning crew health, EVA biomed, prebreathe, and radiation issues
Crew Operations (CREW OPS) or Timeline (REPLAN)	CREW OPS is used by FAO to coordinate the development of flight plans. This loop or REPLAN is used by the EVA MPSR to contact FAO MPSR position timeline concerning timeline issues
In-Flight Maintenance Coordination (IFM COORD)	This loop is used by MMACS to coordinate IFM and crew systems procedures. It is used by EVA MPSR to call MMACS MPSR positions (IFM, Crew Systems, Mechanical) concerning IFM and crew systems issues
Ground Controller Call (GC CALL)	This loop is used to coordinate ground facility and network issues with GC. The EVA MPSR uses this loop to coordinate with GC the display of wall clocks and facility anomaly reporting
RMS Support/Systems (RMS COORD)	This is a MPSR loop for PDRS. This loop is used by the EVA MPSR to call PDRS MPSR positions, RMS Support (timeline), and RMS Systems (hardware) concerning RMS issues
Staff Support Room Conference (SSR 1 CONF)	This is the prime loop for orbiter MPSR systems coordination. This loop is used by other MPSR positions (Life Support, Thermal, EPS, Mechanical) to call the EVA MPSR and vice versa

Table 3.3-1. Primary Shuttle voice loops on the MCC Partition (concluded)

Voice loops	Function
Instrumentation (INSTR COORD)	This is an INCO MPSR loop. It is used by the EVA MPSR to contact INCO MPSR positions (Instrumentation, Data Com) to coordinate airlock instrumentation and data issues
Comm Support (INCO SUPPORT)	This is an INCO MPSR loop. It is used by the EVA MPSR to contact INCO MPSR positions RF Com to coordinate airlock EVA Comm issues
Attitude/Pointing (A/P COORD)	This is an FAO MPSR loop. It is used by EVA MPSR during replanning to coordinate attitude and pointing issues

Table 3.3-2. Primary Station voice loops on the SSC Partition

Voice loops	Function
Space to Ground (S/G 1 and S/G 2)	Used for communication between the orbiter flight crew and MCC, is also called the Big Loop when linked with A/G1. S/G 2 is typically used for payloads or for station-only calls during docked ops
Flight Director (ISS FD)	This is the prime loop on which all flight controllers make inputs to the FD
Assistant Flight Director Conference (ISS AFD)	This is the FD backup loop. This loop is used to brief the oncoming FD during shift changes. It is also used for debriefing after simulations
Extravehicular Activities (EVA ISS)	This loop is used by other FCR disciplines to communicate with the EVA officer
EVA Procedures (EVA PROCED ISS)	This loop is used as the primary loop for communication between the EVA FCR and EVA MPSR positions
EVA Multipurpose Support Room (EVA MPSR ISS)	This loop is used by other disciplines to communicate with the EVA MPSR positions. The MER, Houston Support Group, and EVA Safety will also use this loop to contact the MPSR
EVA Coordination (EVA COORD ISS)	Prime loop for coordination of EVA operations with the IMC. This loop is used by EVA MPSR to coordinate timeline, procedure, and task changes with customer representatives in the CSR. This loop is also used by EVA Safety and EV/CS
EVA Support (EVA SUPPORT ISS)	This loop used by IMC, EVA MER, and EVA Safety

Table 3.3-2. Primary Station voice loops on the SSC Partition (continued)

Voice loops	Function
Internal EVA (INT EVA)	This is the internal EVA loop for the EVA FCR and EVA MPSR. This loop is established only on the DVISs used by EVA flight controllers, although it may be requested by any discipline
Operations Planning Officer (OPS PLAN)	This loop is used for operations planning activities coordination between OPS PLAN and their MPSR (RPE, OCA, LRP, ODF). This loop is used by EVA FCR to call OPS PLAN concerning timeline changes, Execute package review, and flight note uplinks
Flight Control Room Systems (FCR SYS)	This is the prime coordination loop for <i>ISS</i> systems (ATLAS, ECLSS, THOR, and PHALCON). This loop is used by EVA to call other FCR disciplines
<i>Spacecraft Analysis Manager 1 (SPAN MANAGER 1)</i>	Prime loop for coordination <i>with SPAN cadre for Stage Ops and the ISS FCT. For Stage Ops, this loop may be used by EVA to contact SPAN DX as well as SPAN Shuttle MPSR, SPAN ISS MPSR, and other DX monitored loops.</i> DX SPAN acts as a filter between flight controllers and MER. <i>SPAN serves as an MOD resource and interface with the MER.</i> This loop is used to submit CHiTs and anomaly reports to the MER Manager
Cargo and Integration Officer (CIO)	This loop is used for operations planning activities coordination between CIO and their MPSR (ISO, PLUTO, RISS). This loop is used by EVA FCR to call CIO concerning inventory, stowage, plug in plan, prepack, and Russian inventory
Environmental Control and Life Support System (ECLSS)	This loop is used for coordination between ECLSS FCR and MPSR (ACE). This loop is used by EVA FCR to call ECLSS concerning atmospheric, cooling, fire detection and suppression, and water storage issues
Thermal Operations and Resources Officer (THOR)	This loop is used for coordination between THOR FCR and MPSR support (TCON). This loop is used by EVA FCR to call THOR concerning thermal systems issues
Power, Heating, Articulation, Lighting Control (PHALCON)	This loop is used for coordination between PHALCON FCR and MPSR support (POWER) and by EVA FCR to call PHALCON concerning electrical power system, SARJ, and PVTCS issues
Communications and Tracking Officer (CATO)	This loop is used for coordination between CATO FCR and MPSR support (Starcom). This loop is used by EVA FCR to call CATO concerning RF, audio, video and recording issues

Table 3.3-2. Primary Station voice loops on the SSC Partition (continued)

Voice loops	Function
Flight Surgeon (SURGEON)	This loop is used for coordination between SURGEON FCR and MPSR support (Aeromed - Biomedical Engineer (BME) and Space Environment Officer (SEO) aka RADIATION). This loop is used by EVA FCR to call SURGEON concerning crew health, prebreathe, Crew Health Care systems, and radiation issues
Operations Support Officer (OSO)	This loop is used for coordination between OSO FCR and MPSR support (OSO support). This loop is used by EVA FCR to call MMACS concerning maintenance, structure, and mechanism issues
Robotics Officer (ROBO)	This loop is used for coordination between ROBO FCR and MPSR support (MSS Task and MSS Systems). This loop is used by EVA FCR to call ROBO concerning robotics issues
Assembly, Activation, and Checkout Officer (ACO)	This is the loop for coordination between the PAYLOAD FCR and MPSR (ACO Systems, Data, Transfer). This loop is used by EVA FCR to call ACO concerning payload operations and issues
ODIN	This loop is used for coordination between ODIN FCR and MPSR support (RAVEN). This loop is used by EVA FCR to call ODIN concerning data issues
LRP (IEPC) or RPE (OPS PLAN SUPPORT)	LRP and RPE are OPS Plan MPSR. IEPC is used to coordinate with LRP the modification to 1 week out OSTPV. OPS PLAN SUPPORT is used to contact RPE for modification to OSTPV within a week via PPCR and to contact OCA to coordinate uplink items
Operations Support Officer Support (OSO MPSR)	This is the OSO MPSR loop for EVA MPSR to coordinate maintenance (IFM) procedures, structural issues, and hatch issues
ISS Medical Operations (ISS MED OPS)	This is the MPSR loop for SURGEON; it is used by the EVA MPSR to call the BME concerning crew health, EVA biomed, prebreathe, and radiation issues
Space Environment Officer (RADIATION)	This is part of the SURGEON discipline that monitors crew radiation exposure

Table 3.3-2. Primary Station voice loops on the SSC Partition (concluded)

Voice loops	Function
Ground Controller Call (ISS GC CALL)	This loop is used to coordinate ground facility and network issues with GC. The EVA MPSR uses this loop to coordinate with GC the display of wall clocks and facility anomaly reporting
SSRMS Task/Systems (MSS Task/Systems)	This is a MPSR loop for ROBO. This loop is used by the EVA MPSR to call MSS Systems (hardware) or MSS Task (timeline) concerning SSRMS issues
Staff Support Room Conference (SYS COORD)	This is the prime loop for Station MPSR systems coordination. This loop is used by other MPSR positions (ACE, TCON, STARCOM, POWER, RAVEN, MSS Systems/Task) to call the EVA MPSR and vice versa
RAVEN	This is an ODIN MPSR loop. It is used by the EVA MPSR to coordinate airlock instrumentation issues
Starcom (CATO MPSR)	This is CATO MPSR loop. It is used by the EVA MPSR to coordinate station and airlock RF and audio communications issues
HAWKI (HAWKI COORD)	This is an ADCO MPSR loop. It is used by EVA MPSR for momentum, attitude, angular rate, kinetic energy, and moment of inertia information
Trajectory Profile Support (TPS)	This is the TOPO MPSR loop. It is used by EVA MPSR to coordinate trajectory of lost items
Telemetry Information Technology Attitude Navigation Officer (TITAN)	Orbit 1 and weekend ODIN, CATO, ADCO

Figure 3.3-1 shows a typical real-time shuttle DVIS page display. Ten pages are available to each DVIS. Typically, the first five contain shuttle loops, and the last five contain station loops. Reconfiguring them reconfigures for anyone signing in to that DVIS.

M P 1 A/G 1	M P 1 A/G 2	HM P FD 1	P SIGN ON/OFF	
M P FD 1	M P AFD CONF 1	TLM P INT EVA	PAGE 2	
TLM P EVA MPSR	TLM P EVA PROCED	TLM P EVA		
M P MOCR SYS	M P MOCR SPEC	TLM P SSR 1 CONF	RELEASE	
M P EECOM 1	TLM P FAO 1	M P EGIL 1	CONFIGURE	
TLM P MED OPS	TLM P CREW OPS 1	TLM P INCO 1	RING VOL 5	HOLD
TLM P IFM COORD 1	TLM P GC CALL 1	TLM P SPAN	MON VOL 5	RING
TLM P WSS CALL	IDLE P PABX 244- 6028	IDLE P DIAL CALL 4371		HEAD SET VOL 4

Where:

- TLM = Talk, Listen and Monitor
- M = Monitor
- HM = High Monitor

Figure 3.3-1. Typical DVIS page display

DVIS pages for EVA should be configured according to the standard in Figure 3.3-2.

HM P 1 A/G 1	HM P 1 A/G 2	HM P FD 1
M P 1 A/G 1	M P 1 A/G 2	M P FD 1
M P ISS FD 1	TLM P EVA	TLM P EVA MPSR
TLM P EVA PROCED	TLM P EVA SUPPORT	TLM P EVA COORD
USER CONFIG	USER CONFIG	USER CONFIG
USER CONFIG	USER CONFIG	USER CONFIG
USER CONFIG	USER CONFIG	USER CONFIG
TLM P INT EVA	IDLE P DIAL CALL 48XX	IDLE P PABX 244- XXXX
DVIS EVA PAGES 1-4 CONFIGURATION		

Figure 3.3-2. DVIS page configuration

EVA DVIS Loop Protocol

To establish efficient real-time communications within the EVA community, the following is the standard DVIS loop protocol for EVA missions. Refer to ISS FCOH SOP 1.2.1 and ISS FCOH SOP 6.1.1 for voice loop standards.

The following are defined guidelines and protocols for using voice loops:

- A. When talking on the loops, never talk while the shuttle FD, ISS FD, or crew is talking.
- B. If you are talking on a voice loop and the shuttle FD, ISS FD, or crew starts talking, stop and then resume your conversation when they are finished.
- C. It is okay to interrupt someone speaking to you and ask them to stand by if they do not follow these guidelines.
- D. Everyone needs to monitor the shuttle FD, ISS FD, Air-to-Ground (A/G), and Space-to-Ground (S/G) loops at all times, as well as their own designated call loop.
- E. Pay attention when attempting to call someone on their loop; if they are busy, or talking on the loop, wait until they are finished before attempting to call.
- F. Listen for your call sign. Keep your loop discussions concise, effective, and professional.
- G. When calling someone on their loop or another loop, state their call sign, state your call sign, and state on what loop you are calling.

Additional Voice Loop Guidelines

- A. Keep the off-loop discussion noise levels at a respectable level when you are around controllers supporting a mission. Loud discussions make it difficult for controllers to track the issues being discussed on the voice loops.
- B. If an issue under discussion is moved “offline” to splinter discussions and meetings, be sure to at least summarize the decisions from the splinter meetings on the voice loops. This will ensure that other controllers, who may be affected by the issue, will remain aware of the decisions.
- C. Be sure to make entries into the console log to document any formal decisions, directions, or issues that are communicated across the voice loops. The console logs are legal records. Issues that are identified or discussed on the voice loops that have a potential impact to mission objectives should be logged and tracked.

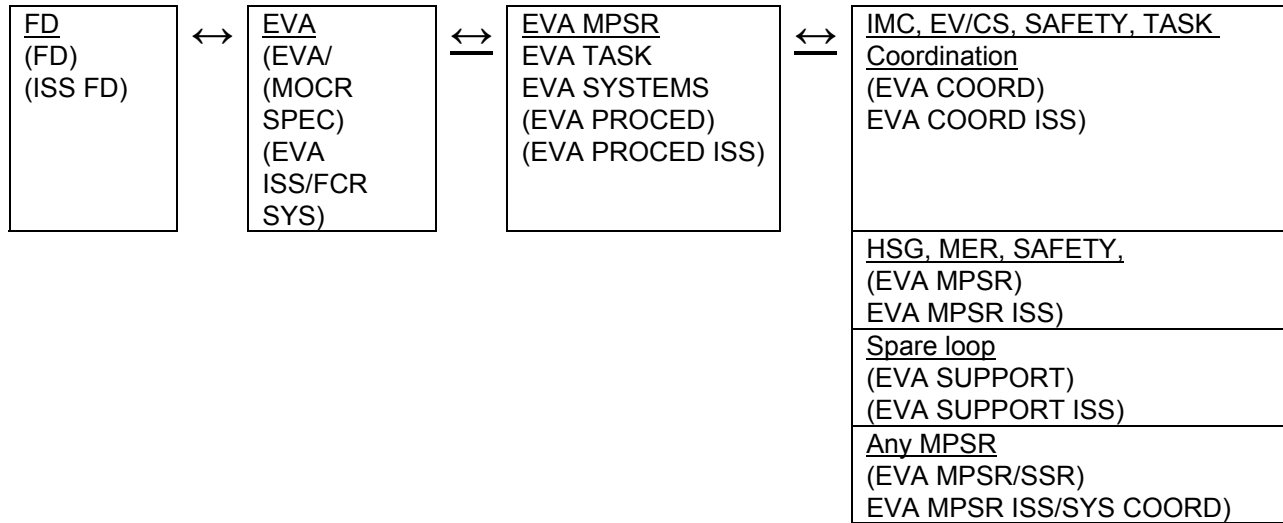


Figure 3.3-3. FCT communication with EVA

3.4 GENERIC WORKSTATION TOOLS FOR EVA

PURPOSE

Identifies the generic workstation application tools and how they can be used by the EVA flight controller. Details on how to use the application itself are found in the *MCC Workstation Applications User's Guide* binder located on console or in the online Help menu of the application. The binder is a collection of the individual application user guides.

DESCRIPTION

Once the workstation configuration is complete, the EVA Menu Display Navigation Menu (DNAV) bar shown below will be located at the top left of the screen.



Figure 3.4-1. EVA DNAV bar

REAL-TIME PLOT

Real-Time Plot (RTPLOT) is an application that will plot real-time data received during the mission. The data plotting begins when RTPLOT is started and is lost if RTPLOT is closed. RTPLOT is configured to plot both orbiter MSID data and EMU parameters after processing by the EMU Daemon. The plots may be viewed real time or reconfigured to view past history for as long as RTPLOT is started. See the RTPLOT DF42 User's Guide on console for further details on RTPLOT.

Located under the EVA → Shuttle-SSPXXX (or Station-ISS0XX) → RTPLOT.

A few guidelines

- A. *Your configuration (and the generic) is transposed independently of the activity (meaning if you configure in a SIM activity, these are also your real-time settings).*
- B. *For redundancy, LUTA also holds the generic settings.*
- C. *At this time, the Generic option is not locked out; please try to not configure this, but if you do, send A. Luta an e-mail.*
- D. *Directions to configure an RT Plot are as follows:*
 1. *Choose your name and the option (C/O, EVA Prep, or EVA).*
 2. *Make sure the option is highlighted gray.*
 3. *Set up the plots and the size of the window as you prefer.*

4. *Go to "SAVE CONFIG."*
5. *A window will pop up with the name of the file; look for your last name in the file name and click "yes."*

EVENT LOGGER

Event Logger (ELOG) is an application that monitors selected data parameters (only orbiter data) and compares them to preset limits/values. When a limit/value is reached, ELOG will display a one-line message indicating that the event has occurred, and keep a log by Greenwich Mean Time (GMT) of all events. For further information on ELOG, see the ELOG DF42 User's Guide on console.

Located under the EVA → *Shuttle-SSPXXX (or Station-ISS0XX)* → *ELOG*.

CONFIGURABLE REAL-TIME ANALYSIS SYSTEM

The Configurable Real-Time Analysis System (CRANS) is an application used to monitor and determine what orbiter capabilities are lost because of a dc or ac power bus or Multiplexer/Demultiplexer (MDM) data failure. Once the application has started, the controller can highlight the lost item, as defined by the FD or other disciplines. CRANS will identify all hardware/data capability that is lost with the associated item. CRANS should always be used in conjunction with the Malfunction Procedures Flight Data File book.

Located under the EVA → *Shuttle-SSPXXX (or Station-ISS0XX)* → *CRANS*.

ISP LIMIT MANAGER

The ISP Limit Manager application provides the capability to monitor data parameters (both orbiter data and EMU) on an EVA display, and change the parameter colors (red or yellow) when a preset limit is attained for that parameter. The limit manager is started upon initialization of the workstation. All EVA flight controllers are "tied" to the same configuration file and set of limits. If any EVA flight controller "disables" the limit manager function, all EVA flight controllers will be affected. To reestablish the function, any EVA flight controller must "enable" the limit manager. The limit manager is preset to monitor all EMU data and critical A/L parameters and will change limits (for EVA) automatically when the A/L is depressed below 10.0 psi. No interaction by the EVA flight controller is required for the use or configuration of limit manager because all values have been preset. Note that changing a value in the limit file will affect all EVA flight controllers. The values for EMU Checkout and EVA are shown in Table 3.4-1.

Located under the EVA → *Shuttle-SSPXXX (or Station-ISS0XX)* → *Limit Manager*.

Table 3.4-1. EMU ISP limit manager values

	ITEM Nomenclature	Logic	EMU C/O Values	EVA Values	Color	Description	Source
EMU PARAMETERS							
1	Analog Reference Voltage	<	3.94	3.94	Yellow	80% of 5.0 +/-0.06	HMS SVHS10105 pg 16
2		>	4.06	4.06	Yellow	80% of 5.0 +/-0.06	HMS SVHS10105 pg 16
3	Suit Pressure	<	4.05	4.05	Red	Suit P Low Msg	EVA Checklist
4		<	n/a	4.19	Yellow	Reg. lower limit	EVA Checklist
5		>	4.41	4.41	Yellow	Reg. upper limit	EVA Checklist
6		>	4.7	4.7	Red	PPRV cracking	PLSS S/AD pg 16
7	Battery Current	<	3	3	Yellow	Lower Ops Range	EVA Checklist
8		>	4	4	Yellow	Upper Ops Range	EVA Checklist
9		>	4.99	4.99	Red	Batt Amps High Msg	EVA Checklist
10	-13.5 Analog Voltage	<	-11.1	-11.1	Yellow		Mini-Data Book
11		>	-13.1	-13.1	Yellow		Mini-Data Book
12	+13.5 Analog Voltage	<	11.1	11.1	Yellow		Mini-Data Book
13		>	13.1	13.1	Yellow		Mini-Data Book
14	Motor Tach	<	n/a	13000	Red	Vent Flow Closed	ETA Chamber Run Data
15		<	n/a	19000	Yellow	Lower Ops Range	EVA Checklist
16		>	20000	20000	Yellow	Upper Ops Range	EVA Checklist
17		>	27000	27000	Red	Fan Breakup	FEMA/CIL pg 561
18	Battery Volts	<	15.7	15.7	Red	Batt Volts Low (Used Batt)	EVA Checklist
19		<	16.3	16.3	Yellow	Lower Ops Range	EVA Checklist
20		>	17	17	Yellow	Upper Ops Range	EVA Checklist
21		>	21.9	21.9	Red	EMU PLSS Damage	PLSS S/AD pg 34
22	CO2 Level	<	0.19	0.19	Yellow	Lower Ops Range	EVA Checklist
23		>	0.5	0.5	Yellow	Upper Ops Range	EVA Checklist
24		>	3	3	Red	Monitor CO2 Msg	EVA Checklist
25	Sublimator Pressure	<	n/a	2.05	Yellow	Lower Reg Range	PLSS S/AD pg 22
26		>	n/a	4.15	Yellow	Upper Reg Range	PLSS S/AD pg 22
27		>	n/a	4.6	Red	Max Oper P	PLSS S/AD pg 21
28		>	14.9	n/a	Red	Max Airlock Pressure	Nominal Airlock Pressure
29	Secondary O2 Pressure	<	5800	5800	Yellow	Lower Ops Range	EVA Checklist
30		>	6800	6800	Yellow	Upper Ops Range	EVA Checklist
31		>	7400	7400	Red	Max Oper P	SOP S/AD pg 4
32	Primary O2 Pressure	<	n/a	129	Red	30 min limit @1.7 use	EVA FLT RL A15.1.3-11
33		<	n/a	200	Yellow	O2 low FYI	Indicator Only
34		>	850	900	Yellow	Low C/O Rng / Upper Ops Range	EVA Checklist
35		>	950	1050	Red	Upper C/O Rng / Max Oper P	PLSS S/AD pg 2
36	H2O Gas Pressure	<	n/a	13.5	Red	Lower Reg + ducer error	PLSS S/AD pg 5
37		<	n/a	14.6	Yellow	Lower Reg Range	PLSS S/AD pg 5
38		>	30.4	15.7	Yellow	Upper Reg Range	PLSS S/AD pg 5
39		>	n/a	16	Red	High Mode Open	PLSS S/AD pg 7
40	H2O Water Pressure	<	n/a	12	Red	Resrv H2O On	EVA Checklist
41		<	n/a	14.6	Yellow	Lower Reg Range	PLSS S/AD pg 5
42		>	30.4	15.7	Yellow	Upper Reg Range	PLSS S/AD pg 5
43		>	n/a	18	Red	Fdwtr Relief Vlv Open	PLSS S/AD pg 61
44	H2O Temperature	<	32	32	Red	Sublimator Freeze	EVA Checklist
45		<	33.5	33.5	Yellow	32F + 1.5 ducer error	Indicator Only
46		>	75	75	Yellow	Upper Ops Range	EVA Checklist
47	SOP Rate	>	n/a	36	Red	SOP On Msg	EVA Checklist
AIRLOCK PARAMETERS							
1	SCU Voltage	>	21.9	21.9	Red	EMU PLSS Damage	PLSS S/AD pg 34
2	SCU Current	>	5	5	Red	Off-Scale High	Sensor Upper Limit
3	LCG1 Pressure	>	26.4	26.4	Red	SCU Max Oper P + ducer error	ECLSS FLT RL A18.1.2-11
4	LCG2 Pressure	>	26.4	26.4	Red	SCU Max Oper P + ducer error	ECLSS FLT RL A18.1.2-11
5	LCG2 Supply Temp ZN1	<	47	47	Red	ECLSS low limit/line freeze	ECLSS FLT RL A18.1.2-10
6	H2O Supply Temp ZN1	<	34	34	Red	ECLSS low limit/line freeze	ECLSS FLT RL A18.1.2-10
7	H2O Supply Temp ZN2	<	36	36	Red	ECLSS low limit/line freeze	ECLSS FLT RL A18.1.2-10
8	LCG2 Supply Temp ZN1	>	91	91	Yellow	EMU O2 Line Upper Limit	EMU /Airlock ICD
9	LCG2 Supply Temp ZN2	>	91	91	Yellow	EMU O2 Line Upper Limit	EMU /Airlock ICD
10	H2O Supply Temp ZN1	>	91	91	Yellow	EMU O2 Line Upper Limit	EMU /Airlock ICD
11	H2O Supply Temp ZN2	>	91	91	Yellow	EMU O2 Line Upper Limit	EMU /Airlock ICD

NOTE: All proper EMU parameters are default GREEN when EVA phase
EVA values used below A/L P < 10.0

NH3 BAKEOUT CALCULATOR

The NH3 Bakeout Calculator can be used during a contingency ammonia leak scenario to ensure that adequate time is spent at vacuum sublimating contamination off the EMU. Detailed instructions for operating the bakeout calculator are located in Section 3.6.2.3 of the EVA console handbook.

Located under the EVA → Shuttle-SSPXXX (or Station-ISS0XX) → NH3 Bakeout Calculator

MASTER DNAV ITEMS

Additional applications for EVA flight controller use are located under the Master DNAV Menu.



Figure 3.4-2. Master DNAV bar

WALL CLOCK

The wall clock will display the current MET, GMT, crew wakeup MET, orbiter burn MET, and any other high-profile event times. This is the same wall display that is in the FCR. The clock is controlled by the Ground Controller (GC).

Click on *Global Apps* menu item, then *Timers/Clocks*, then *Wall Clock Display*.

TIMER/CLOCKS CONTROL PANEL

The timer/clock control panel is used to create, delete, or modify event timers or countup/countdown timers. These timers are either Local (displayed only on an operator's workstation) or Global (displayed on any workstation or wall clock). The EMU systems controller will create Global timers for beginning of EMU C/O, EVA PREP, EMU Purge, Prebreathe, Depress, and EVA PET=0, which can be displayed by GC on the wall clock.

The purpose of this console SOP is to set up either a Local or Global clock on the DEC Alpha for tracking key event durations or time to events.

To access the application to create clocks, go to MASTER DNAV → Global Apps → Timers/Clocks → Timing Services Control Panel.



Figure 3.4-3. Timing Services Control Panel

1. Under Clock Types, select “Create Event Timer.”



Figure 3.4-4. Create Event Timer

- (a) Pulldown “A”

Pulldown options are

- (1) “SGMT Reference” - Simulator Greenwich Mean Time used for sims
- (2) “GMT Reference” - Used for shuttle, ISS operations
- (3) “MET Reference” - Mission Elapsed Time used for shuttle only
- (4) “MIR Reference” - Unknown

For flights or increment ops, select GMT Reference, which should automatically update and track with the current mission GMT. One can also use MET for shuttle operations.

(b) *Pulldown "B"*

- (1) *For a Local (EVA only) clock, select "Local Timer Label."*
- (2) *For a Global (MCC wall) clock, select "Global Timer Label."*
- (3) *Input a short, descriptive title.*

(c) *Pulldown "C"*

Select the appropriate time format for days, hours, minutes and seconds. Usually for EVA, one should use HH:MM:SS.

Note: Under Flight pulldown menu, "default" should list current activity and should not need to be changed.

(d) *Pulldown "D"*

Pulldown options are

- (1) *"Immediate Start" - Clock starts immediately upon creation.*
- (2) *"Start Target" - Typically used. Starts at designated GMT when clock is created.*
- (3) *"Past Start Duration" - Clock has start time earlier than current time.*
- (4) *"Future Start Duration" - Typically not used.*
- (5) *"Startup Paused" - Typically not used.*

Select an option and input the actual start GMT for the timer to use.

(e) *Pulldown "E"*

Pulldown options are

- (1) *Target Expiration (GMT) - GMT that clock expires.*
- (2) *Duration Expiration - Amount of time after which clock expires. Typically used for countdown timers.*
- (3) *Infinite Expiration - Does not expire. Continues to count down or up until clock is deleted. Typically used for countup clocks. If used for a countdown clock, after timer reaches zero, begins to count up.*

- (f) *Pulldown “F”*
 - (1) *“Count Down” or “Count Up” - Select as required*
 - (2) *“No Notification” or “DVIS 2 sec” or “DVIS Cont”*
 - (3) *“Auto Delete” or “User Delete” - “User Delete” recommend*
 - (4) *“Auto Display” or “Manual Display” - “Auto” (default) recommend*
 - (g) *Pushbuttons “G”*
 - (1) *“Create” - Generates the clock and displays it locally either as a new popup in an already existing popup window, Tdisplay0 (Figure 3.4-5)*
 - (2) *“Close” - Closes the “Create Event Timer” window without generating the clock*
 - (3) *“Help” - Opens a “Help” guide*
2. *Once you select “Create,” the following will be displayed on the W/S (Figure 3.4-5). Note the “(L)” indicates a local clock.*

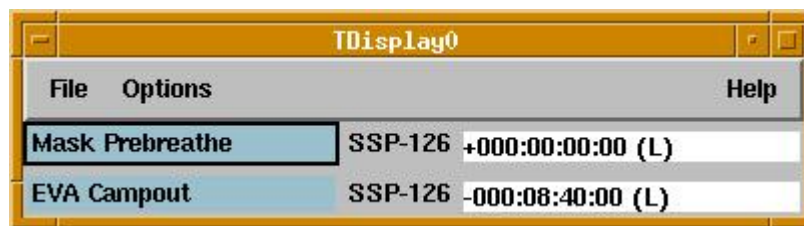


Figure 3.4-5. TDisplay0 window

- The above figure shows two local clocks. Mask Prebreathe is set up as an Infinite Expiration, countup clock. EVA Campout is set up as a Duration Expiration of 8H 40M countdown clock. Since neither event has started, the timer is not yet active. Both are created as Local clocks and are denoted as such with a “(L).” If created or changed to a Global clock, the display would show “(G).”*
3. *Once the clock is created and listed on TDisplay0, if you left-click on the title, you get a pulldown menu with the following options:*
- (a) *“Remove from Display” - Deletes the timer from TDisplay0*
 - (b) *“Modify” - Allows user to change existing timer*
 - (c) *“Copy”*
 - (d) *“Delete” - Deletes timer*

- (e) "Pause" - Pauses timer
 - (f) "Resume" - Resumes timer after it has been paused
 - (g) "Information"
 - (h) "Local to Global" - Changes a "Local" clock to a "Global" clock
4. If you select "Modify," the display below appears.

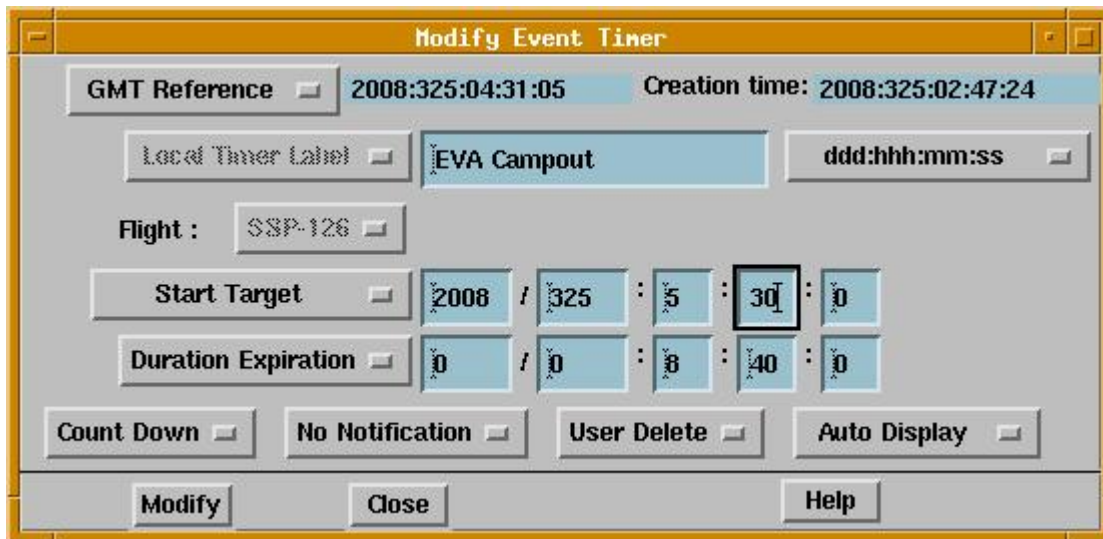


Figure 3.4-6. Modify Event Timer

5. To change a "Local" clock to "Global" for FCR wall clock, select "Local to Global." Then call GC on [ISS] GC Call 1 and request the clock be posted to the appropriate wall clock (ISS, shuttle, or both). Note that the workstation TDisplay0 timer then denotes the timer with "(G)."

USER'S NOTES

- A. Verify that the wall clocks are correct and working once GC puts them on the front board. Given the number of standard timers that EVA creates, it is possible for GC to mistakenly select an old or incorrect clock.
- B. If there are multiple EVAs within a stage or joint mission, use the same title for the same clock for each EVA. For example, if the title of a countdown clock is "Hygiene Break," use it consistently for each EVA to minimize confusion for the Flight Control Teams. Use of the same name, however, requires extra vigilance that the correct timer is used.

Located under Global Apps→Timer/Clock→Control Panel.

FLIGHT DIRECTOR STATUS (IMGO)

The FD IMGO application is used by the EVA FCR to provide a status to the FD during high-profile events. This application can also be monitored from the MPSR.

Located under Global Apps (for EVA FCR only).

Located under Shuttle, Flight Director, then Fd_Monitor (EVA MPSR).

MISSION EVALUATION WORKSTATION SYSTEM/ORIBTER DATA REDUCTION COMPLEX

The Mission Evaluation Workstation System (MEWS) Orbiter Data Reduction Complex (ODRC) system allows the EVA flight controller to access all orbiter data parameters for recall and plotting. Unlike RTPLOT, the ODRC data is permanently stored and can be retrieved at any time, for any flight, with greater resolution. The ODRC does not contain the EMU data parameters; it contains only the two biomed channel data parameters. See the MCC Workstation Application Users Guide binder for details on how to run MEWS/ODRC.

Located under *Global Apps*.

MIS QUERY

This application can be used to search orbiter data parameters by MSID or MDM source and channel. See the MCC Workstation Application Users Guide binder for details on how to run an MIS query (i.e., SCAP reports).

Located under *Global Apps, MIS, Query*.

CALCULATOR

Calculator application.

Located under *Tools, Calculator*.

CLOCK (dxclock)

Displays conventional analog/digital local time clock.

Located under *Tools, Clock (dxclock)*.

EVA CONSUMABLES COMPUTATION APPLICATION

The EVA Consumables Computation Application was designed to automate the process of estimating the amount of time remaining before running out of any of the consumables the suit can track: oxygen, CCC, and power. All equations used for estimating time are the same ones that were used manually (reference the EMU Calculation Worksheet, located on page 2.1-7 of Volume 4 of this handbook).

The EMU MPSR positions initialize this application, which allows other consoles to open and view the consumables details and summary pages () and (). There are two versions of this application, one that uses data downlinked from ISS and the other that uses data downlinked from shuttle. They are functionally similar, though differences in data input can result in some differences in estimated time left.

This section covers the following topics:

- A. Initialization of the Application
- B. Reset of Application to Account for an O2 Recharge

The current Consumables Application is version 2.4.1 (see Appendix A for the full guide). Changes to the application and/or guide should be submitted to the DTR for the EVA group. The consumables application is a guide to predicting EMU consumables during an EVA. This is only a tool and should not replace the authority of the EMU Systems flight controller in making critical calls. The consumables spreadsheet application is a redundant tool to aid in the consumables calculations during an EVA.

3.5 CONSOLE LOGS

PURPOSE

To define procedures to be used by EVA flight controllers for keeping logs of significant items occurring during any simulation or flight operation.

DESCRIPTION

The purpose of a console log is to provide a method of reconstructing the activities of a given console position for continuity between shifts, postflight analysis, and failure analysis.

PROCEDURE

The majority of the FCT uses an electronic console log as the primary tool for recording console events. This is a Microsoft Word (MS Word)-driven template. The console log is a single, continuous document for each console position to capture the events in chronological order and maintain mission cognizance over the entire support period. Refer to JSC-26843, FCOH for Shuttle Operations, and JSC-29229, FCOH for Station Operations, for details on content and format.

Note: The ISS FCT is currently using the electronic system. The shuttle FCT has not transitioned over yet and still uses the paper console log as referenced at the end of this section. EVA, as a specialist, uses the electronic system for both ISS and shuttle flights.

The following five subsections contain instructions detailing the management of console logs and support data.

CONSOLE LOG WORD TEMPLATE

The EVA console log uses two MS Word templates to set up the log, provide certain logging features, and export the log entries to the Console Log Database (CLDB). The CLDB is a Web-based database that allows for searching and viewing the exported logs. The CLDB and log MS Word template are maintained by DF81/B. Hall. The EVA Point of Contact (POC) is DX3/P. Boehm. The standard log template has been modified for use by EVA.

Current working EVA MS Word logs are kept on the V: drive. The log will also be automatically backed up to two locations, the local D: drive (in case the V: drive goes down) and to the S: drive S:\Divisions\DX\Eva\Joint\ConsoleLogBackup. This new logger can be used for logging mission and Sim/test activities.

DIRECTORY ORGANIZATION FOR CONSOLE LOGS

EVA console logs (MS Word file) should be organized in the following manner for ease of reference and standardization:

1. ISS expedition logs shall be kept in an increment-specific folder in
V:\EVA\Console Logs

V:\EVA\Console Logs\FLIGHT\Increment XX
 - (a) FCR
 - (b) Task
 - (c) Systems
 - (d) Airlock (if required)
2. Shuttle flight logs shall be kept in a flight-specific folder in V:\EVA\Console Logs
V:\EVA\Console Logs\FLIGHT\STS-XXX (XXA.X)
 - (a) FCR
 - (b) Task
 - (c) Systems
 - (d) Airlock (if required)

CONSOLE LOG USE AND DESCRIPTION

1. Go to: V:\EVA\Console Logs

The actual MS Word EVA Console Log template is located on the I:\EVA\Forms directory. Shortcuts on the V:\EVA\Console Logs drive will point to this location.

Note: This template should not be changed unless coordinated with DX3/P. Boehm or DF81/B. Hall.

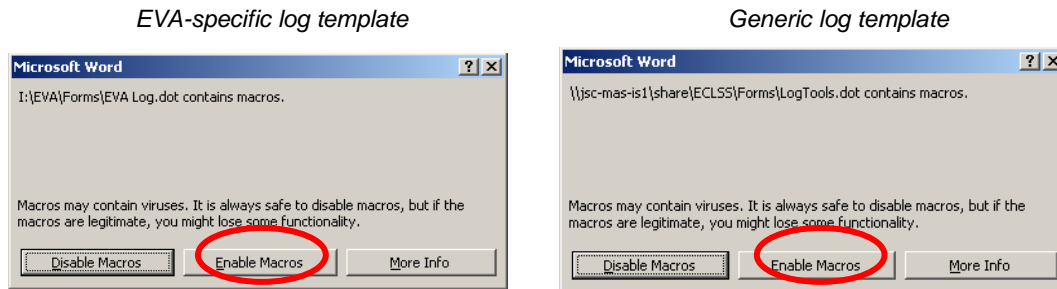
Starting a New Log

To start a new log, double-click on the "Create New Console Log" shortcut in the V:\EVA\Console Logs folder.

Continuing an Existing Log

To continue an existing log, double-click on one of the current existing log MS Word files in the V:\EVA\Console Logs directories.

- In the next two *MS Word* windows, click the “Enable Macros” buttons to enable both log templates. (If macros come up disabled, see the troubleshooting table at the end of this section.)

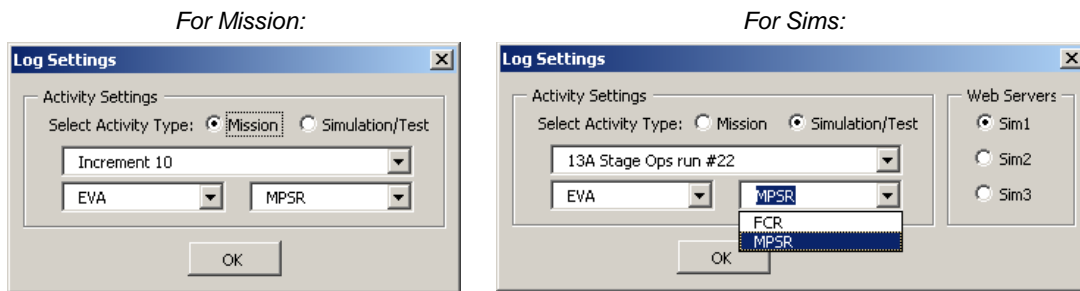


- For a new log, the template macros will then automatically ask the user to “Save As” a new file.

For Increment Ops, use the following format: “IncXX_YYYY_MM-DD to MM-DD”. Save to the default location (V:\EVA\Console Logs\Increment XX\position).

Note: The MS Word file log will also automatically be saved as a backup locally at D:\Consolelog\. (Do not change the name of the D:\Consolelog\ folder.)

- In the “*Log Settings*” window, click on the Mission radio button. The current Mission Activity will automatically be entered into the Select Activity textbox. (For Sims/Tests, click on Simulation/Test radio button, then click the applicable Web server: Sim1, Sim2, or Sim3.)



If the activity is not listed, an activity name can be entered manually. The first person to enter a name will define it for all other users (i.e., it will be available for all other EVA users to choose this activity as well).

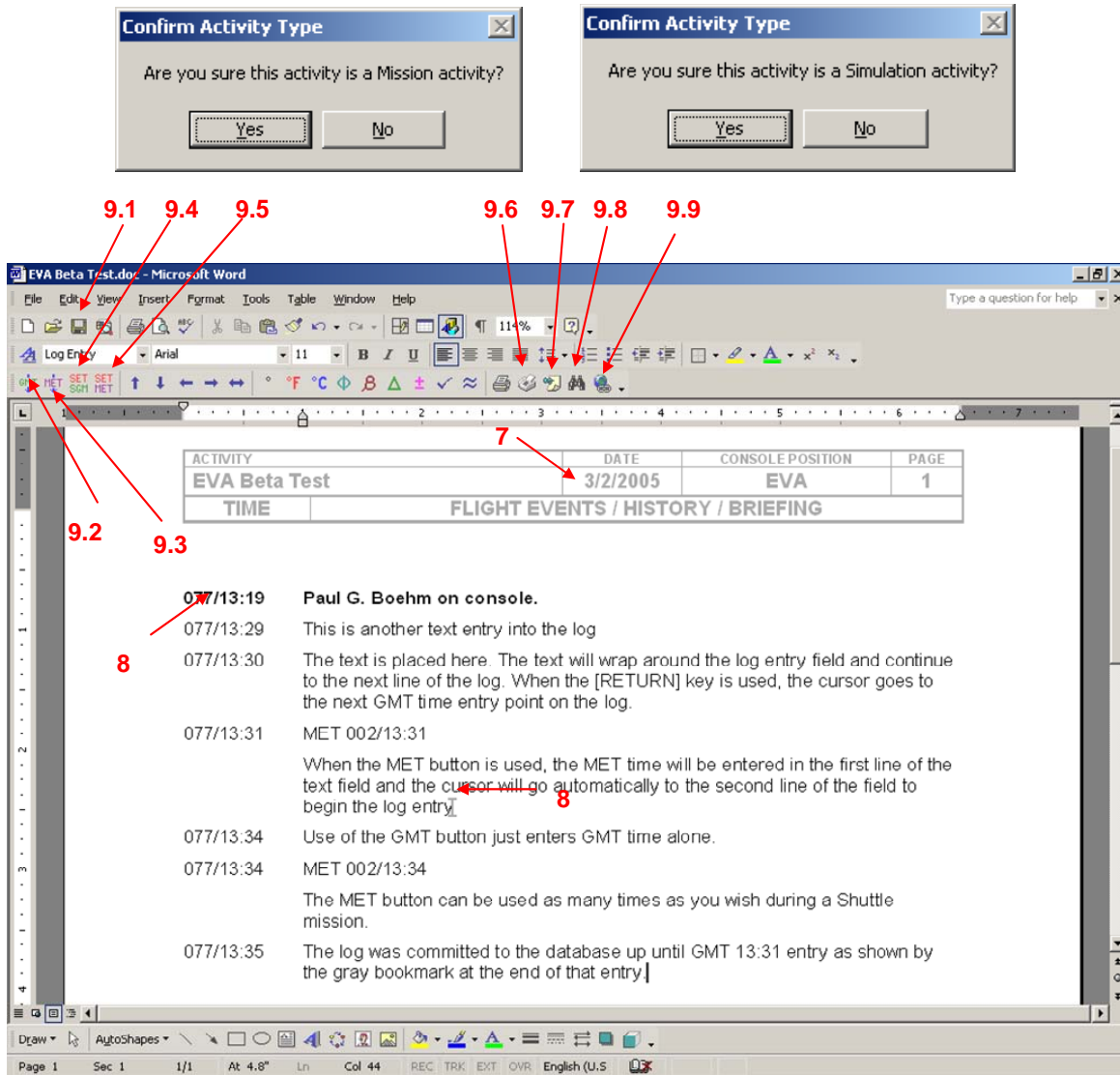
EVA should be the only discipline as the default.

Choose the appropriate FCR or MPSR setting.

Note: There is no distinction from EVA systems or EVA task for MPSR when exporting to CLDB. The JSC-MAS/userid (i.e., pboehm) is referenced along with MPSR indication. Separate MS Word files are used for each MPSR position on the V: drive.

If opening an existing MS Word file, the above log settings will be displayed again for the next user.

5. In the “Log Settings” window, click the “OK” button.
6. In the “Confirm Activity Type” window, click the “Yes” button if correct. (Clicking “No” sends the user back to the “Log Settings” window above.)



7. For a new log, double-click the header, and change the date, as required (mm/dd/yy -- mm/dd/yy for ISS Ops).
8. Remove the “Markup” option, the “()” around the GMT time from the file. Go to “View” menu, click on “Markup.” You need only to do this once for each new

MS Word file. The markup is a hidden item that allows the export function to identify the userid.

9. Make the export bookmark visible. In the MS Word file, select “Tools”, select “Options,” then under the “View” tab, check the “Bookmarks” box in the “Show” partition. Each user should do this (i.e., user specific).

10. Make appropriate log entries noting the following:

- (a) “SAVE” button – Intermittently saves the log, as required. (This saves the MS Word file log to the V: drive and local D: drive.)

Note: This action does not export log entries to the CLDB.

- (b) “GMT” button – Inserts current GMT time into time field (left column). SGMT is stamped if logging for Sims.
- (c) “MET” button – Inserts GMT time into time column and the MET time into the log field with the log entry starting under the MET time. The CLDB currently does not recognize MET times for exporting to the database; therefore, GMT times must still be located in the left column.
- (d) “SET SGM” button – To set the SGMT, click the “SET SGM” button to the right of the “GMT” button.

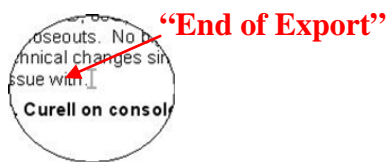


- (e) "SET MET" button – Opens the "Set MET" window. The "Set MET" window allows you to synchronize the MET time stamp with your current activity if required.



- (1) "Use This" – Enter GMT time reference for MET of 000/00:00. Clicking this button uses that time entered as the base reference (i.e., not MCC-H server setting).
 - (2) "Use Activity" – Use the MCC-H server setting for the MET time
 - (3) "Joint" and "STS Only" – Define which activity type to use for reference.
- (f) "Send Page" button – If you need to send a log entry to an owner of a text-pager, highlight the log text (limit: 180 characters) and click this button. A valid list of EVA text-pager owners appears in the next popup which enables the user to select the target recipient. The list of EVA pagers is based on the MCC Web EVA FCT contact list, and users must input their text pager entry in that list.
- (g) "Export to Web Database" button – This button enables the user to execute intermittent log exports prior to initiating closure of the MS Word log file.

Note: The last part of the log exported to the CLDB is bookmarked with the following:



IMPORTANT: Only export to the CLDB when the log entries are complete and final. Once log entries are exported to the CLDB, changes above the End of Export bookmark will NOT be exported. CLDB cannot be changed once the log is exported.

- (h) "Search Logs" button – This button brings up the CLDB Search Logs Page.
- (i) "Read Logs" button – This button brings up the CLDB View/Search Logs (Main) Page.

TYPING/EDITING NOTES

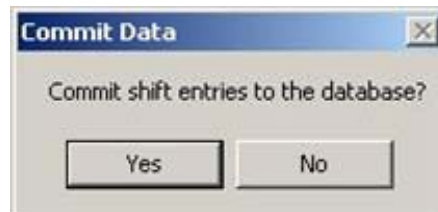
When entering information in the log field, pressing "RETURN" automatically moves the cursor to the GMT time field. To input a line space, you can "RETURN" to the time field and then tab to the log field. This is shown as a line space and not a new time entry (since no time is specified).

The CLBD site does not allow attachments, such as MPEG or audio files.

The GMT time can be manually copied, then pasted, and edited for entries. This does not affect the transfer of the time and user information to the CLDB when exported.

Future revisions of the log templates enable the user to have buttons to automatically link to ARs, CHITs, OCA messages, and PPCRs. FNs require a file security change but may also be in a future revision.

- 11. Closing the MS Word file – To close the MS Word file log, save one last time. When the file is closed, the "Commit Data" window pops up automatically; click the "Yes" button to export the log to the CLDB. If it is not time to export, simply save, and click the "No" button.



CONSOLE LOG TROUBLESHOOTING

PROBLEM/ISSUE	SOLUTION
V: drive goes down while using the logger	Do not worry; do NOT close the file; the logger continues saving automatically to the local D: drive. When the V: drive comes back up, the logger starts saving to it again, as long as the document is not closed. If the file is inadvertently closed, see the next troubleshooting tip
V: drive goes down before starting the logger	Go to the local D:\Consolelog, and start the log from there. NOTE: This is NOT the primary method of starting the log and should not be standard practice
Macros come up disabled	Change the macro security setting in MS Word by opening MS Word (new file or any file); select "Tools;" select "Macro;" select "Security...;" then, under the "Security Level" tab, select the "Medium" radio button, and click the "OK" button

PROBLEM/ISSUE	SOLUTION
To verify log exporting to CLDB	View/Search logs at: https://mod2.jsc.nasa.gov/df/df83/logs/default.asp
*Macros are enabled, but the "Select Activity" dialog box does not appear	Close the log. Look for a file called "import.txt" in either the C: or D: drive on the PC. If found, delete this file. Reopen the log. The "Select Activity" dialog box should now appear like normal. NOTE: If you are trying to access this system from a non-JSC-MAS computer, the macros will not work properly
*To view bookmarks (End of Export, etc.)	In the MS Word file, select "Tools," select "Options," then under the "View" tab, check the "Bookmarks" box in the "Show" partition

* Reference: CIO Console Log User's Guide (last two items from CIO writeup)

CONSOLE LOG CONTENTS

Flight controller logs must be kept in accordance with JSC-29229, FCOH for Station Operations, [Section 2.1](#) or JSC-26843, FCOH for Shuttle Operations, [Section 1.1](#).

The purpose of the console log is to capture, event by event, the details of the mission event. Several events may occur that do not appear to affect you, but with a little discretion, you should capture something about any event on station and shuttle, as time permits. For example, a "Main Bus A Alarm" on the shuttle might be the beginning of the loss of an APCU, which certainly affects ISS. If you do not write this down, and later the ISS team gets confused, it might be difficult to remember enough about the shuttle problem to communicate it effectively to your team.

Initial Conditions

For Sims, any Initial Conditions (ICs) given at the beginning of the Sim should be recorded first along with the prebrief or handover information.

Words

Verbiage should be clear and concise. Capture who said what to whom. Try to capture specifics such as part numbers, temperatures, flow rates, etc. If you do not have the information, and feel it is important, ask other consoles for it. Capture flight notes you have submitted, templates you have worked on, and words you have spoken to other consoles. Also, capture decisions made by different parties that affect the EVA console, and state where important information comes from (use phrases such as "Crew reports..." or "Flight states...").

To Do Lists

You need to prioritize your tasks and keep a list of action items to complete during your shift. This helps keep things in perspective and flows readily into the Handover log.

Handover

Handover should summarize the basic events, off-nominal events, and the current configuration. Capture work done on flight notes, templates, CHITs, ARs, flight plans reviewed, etc. A separate handover log should be completed for each shift. For handover logs, go to: V:\EVA\Handover Log\.

On-Orbit debriefs (ISS crew)

Capture any debriefs with the crew. If the debriefs are performed without a log and summarized by e-mail, then the e-mail should be copied into the log.

Crew calldowns e-mailed from ISS FD (ISS crew)

Capture any calldowns by the crew sent from the ISS FD/CAPCOM while EVA is not on console, even if these are in audio files. This ensures that the information is not lost if the audio files are misplaced.

CONSOLE LOG DATABASE

INTRODUCTION

The following three figures and captions provide a detailed description of the Console Log Database (CLDB). These three figures show the three interfaces to the CLDB: the main page, the view logs page, and the search logs page.

The Main CLDB Page link is <https://mod2.jsc.nasa.gov/df/df83/logs/>.

There is a shortcut link in the V:\EVA\Console Logs folder. Use your JSC Domain log in.

Main CLDB Page:

1. Select EVA.

2. Select Mission or Sim/Test.

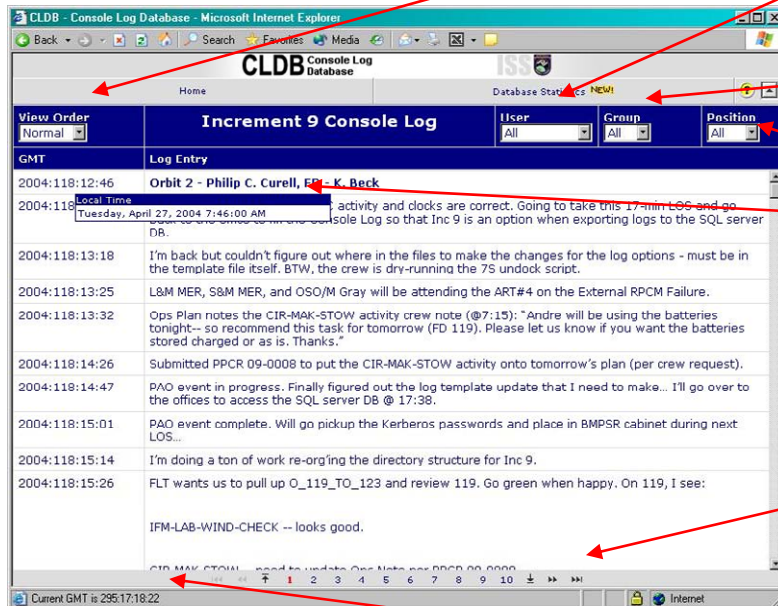
3. Select Activity.

4a. To view entire log for selected activity.
(This can sometimes take a while!)

4b. To perform a search of the log database.

View Logs Page: (Entire Log for Selected Activity)

View order of log entries in Normal (first at top) or Reverse (recent at top).



List of all users who made entries during selected activity. Can select one to see only that user's log.

Group (EVA)

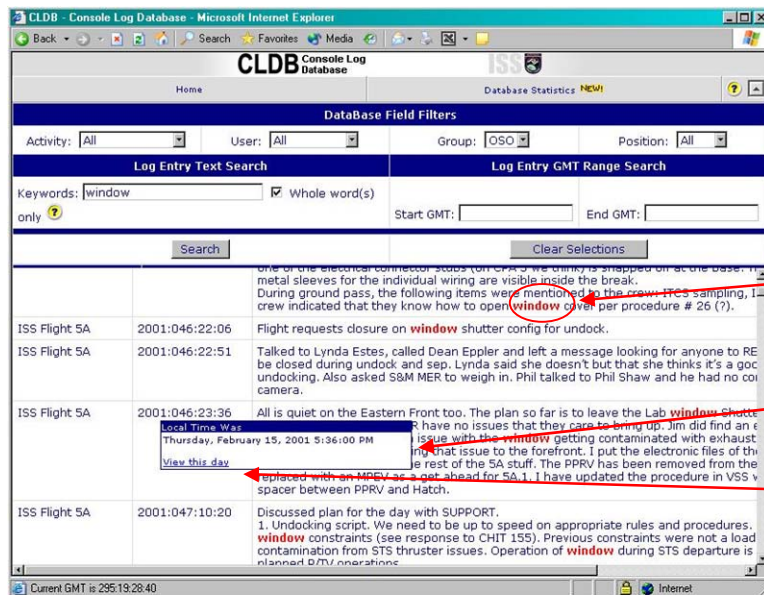
Position (FCR or MPSR)

Mouse-over GMT & left-click for pop-up of Julian date and local time.

View logs page by page (like viewing the different lists of the MCC-H Gateway products).

Running GMT Clock

Search Logs Page:



Search Filters (Activity, User, Group, Position, Keywords, Start/Stop GMT)

Keyword searches will return log entries with keyword in red & bolded.

Mouse-over GMT & left-click for pop-up of Julian date and local time.

Click on "View this day" to view all log entries for this day (useful to see what was logged before & after the keyword).

NOTE: Mouse-over and left-click entry for pop-up of Flight controller who made entry.

Running GMT Clock

Console Log Handover

The offgoing shift must make an entry that they are “off-console” BEFORE exporting the log to the database and BEFORE the file is opened by the next user. Otherwise, the entry is listed in the new user’s name. This is used as an electronic signature of the log by the operator.

CONSOLE SUPPORT DATA

CONSOLE SUPPORT DATA ARCHIVING

For increment operations, the operators should name the folders of data per activity name and GMT time of the activity on the V:\EVA drive.

Console data (MS Word files, MPEGs, photos, audio files, etc.), which are developed/stored on the V:\EVA drive during the mission or increment, should be copied to a CD-ROM after the end of a mission or increment by the flight-specific leads. The CDs are placed in the MPSR. A second copy of the CD should be kept in the office with the flight-specific personnel. This effort prevents excess storage and use of the V: drive and its limited storage space.

BACKUP CONSOLE LOG (PAPER)

As a backup, the console log can be written or printed on the Flight Controller’s Log, JSC Form 1441. All information at the top of the form (Flights/Sim/Test ID, Date, Orb, Console Position, and Page) should be filled in for each page. Logs may be printed or written longhand in ink but must be legible and reproducible.

REFERENCES

CIO Tools – Electronic Console Logs: <http://mod.jsc.nasa.gov/do5/cio/tools/ecl.asp>

JSC-26843 – SSP FCOH, Section 1.1

JSC-29229 – ISS FCOH, Section 2.1

EVA Console Log User's Guide – DX3/Paul Boehm

3.6 MCC GATEWAY

PURPOSE

To define procedures to be used by EVA flight controllers to access PC-based operations tools.

DESCRIPTION

The MCC Gateway provides access to the PC-based real-time operations tools. It provides a partition for both ISS and shuttle teams to communicate and report problems and system changes. The inventory management system tools (CHITs, Anomalies, planning tools, procedures, etc.) used to be generated from the Dec Alpha workstation, but for ease of integration, were incorporated into this PC-based system.

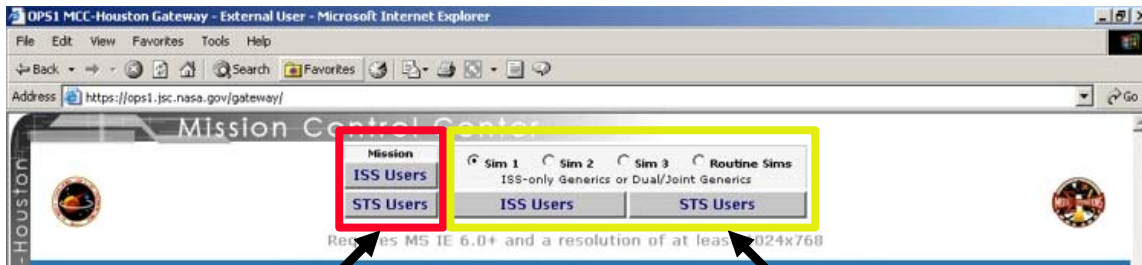
PROCEDURE

Access the gateway via the following URL: <https://ops1.jsc.nasa.gov/gateway/>

Users may access the gateway from an office PC but must use the “JSC-MAS\userid” format and their JSC-MAS password.



There are two separate partitions to the MCC Gateway: Mission and Simulation.

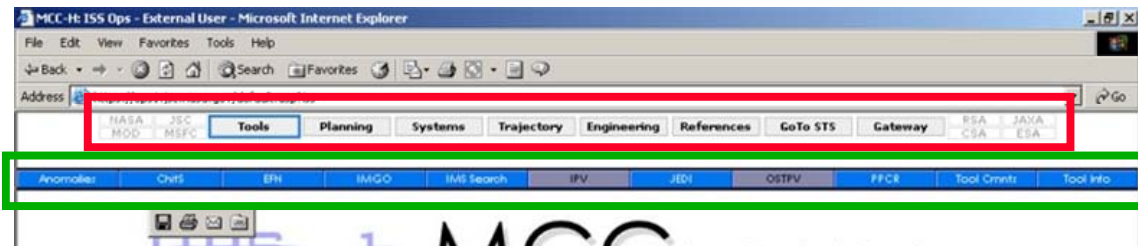


Mission Partition

Simulation Partition

During real-time operations, make selections from the Mission partition (red box). During a simulation, make selections from the Sim databases in the Simulation partition (yellow box). All interfaces are the same in either partition. ISS and shuttle data are available within both partitions. Select the button that corresponds to the partition you need.

Once your partition is selected, this screen will appear.



The bottom row shows subcategories or applications within the button selected (highlighted in blue). The “Gateway” button takes the user back to the Gateway page. The “Go To STS” button takes the user to the shuttle version of the MCC Web. In the shuttle partition, this button reads “Go To ISS.”

MCC Web – Tools Menu

ANOMALY REPORTS

ANOMALY LOG						
CONTROL #	DISCIPLINE	SUBJECT	STATE	GMT CREATED	GMT of ANOMALY	
000747	MOD C&TO	UHF 1 Transitioned to High Power during Transition to Prox Ops	OPEN	2005/059:00:23	2005/058:14:29	
000746	MOD RIO	Flight Rule D2-306 Part C Violation for 16P Undock	PRELIMINARY	2005/058:16:50	2005/058:16:03	
000745	MOD FLIGHT	BHPG file uplinked to wrong folder	OPEN	2005/057:23:23	2005/057:21:30	
000744	MOD ROBO	MBS POA VDU unexpected C&W messages	OPEN	2005/055:20:11	2005/055:13:05	

Anomalies reported by the crew or noted by ground controllers are documented using the anomaly reporting system. This directs the MER to provide information and a set of recommended actions (if required). The reports are used by NASA to track all anomalies that occur during a mission or increment. All reports are combined postflight in a list and are officially transferred to the Station or Shuttle Program Office for tracking

and resolution. Refer to SCP, Section 3.7, Anomaly Reporting, for details on the anomaly process.

CHITS

CONTROL #	REQ ORG	SUBJECT	STATE	GMT CREATED	GMT REQ'D
004700	MOD	USOS O2 Tank Use During US Stage EVAs 6-8	CLOSED	2007/067:19:50	2007/075:00:00
004692	ISSMER	EMU Gloves Picture Request	CLOSED	2007/065:15:54	2007/068:15:00
004686	ISSMER	EACP EMU 1 Switch Troubleshooting	CLOSED	2007/060:19:47	2007/088:23:00
004670	IMC	23P US Hardware Disposal List	CLOSED	2007/053:17:21	2007/058:18:00
004667	ISSMER	EVA - Tools Limited Life	CLOSED	2007/051:19:33	2007/086:18:00
004666	ISSMER	EVA - EMU Limited Life	CLOSED	2007/051:19:30	2007/068:18:00
004644	MOD	IVA Modification of Multiuse tether (MUT) and Body Restraint Tether (BRT) to return to nominal operation	CLOSED	2007/044:10:07	2007/044:23:00
004642	ISSMER	EVA - 3/8" Drive Ratchet - Palm Wheel Inspection	DISPOSITIONED	2007/043:19:17	2007/130:17:00
004638	ISSMER	RS EVA 17A General Purpose Cutter (GPC) tool Sharp Edge Constraint	CLOSED	2007/040:20:01	2007/047:00:00
004619	MOD	Request to fix SM Plane 2 Solar Array during U.S. EVA #8	CLOSED	2007/036:22:10	2007/038:00:00
004616	ISSMER	EVA 8: Body Restraint Tether Ball Stack Stiffness Adjustment	CLOSED	2007/034:23:00	2007/037:15:00
004611	ISSMER	EVAs 7 and 8: Operational constraints for APFRs	CLOSED	2007/032:19:25	2007/034:19:00
004607	ISSMER	ITCS Configuration for IPHX Reconfiguration on EVA 7	CLOSED	2007/031:21:23	2007/036:16:00
004601	MOD	Use of Russian Radiation Dosimeters (Pille) in EMU during US EVAs 6, 7, 8	CLOSED	2007/029:20:26	2007/030:23:59
004599	ISSMER	EVR: New EVA Sharp Edge Hazard on LEE B face	CLOSED	2007/029:17:31	2007/064:18:00
004595	MOD	EVA Camera Supplemental Restraint	CLOSED	2007/026:00:40	2007/030:00:00
004594	ISSMER	USOS EVAs 6, 7, and 8: Safety Tethering Constraint to Certified Handrails	CLOSED	2007/025:22:59	2007/029:18:00
004583	ISSMER	2B SAW Imagery Request During Stage EVAs	CLOSED	2007/022:17:52	2007/044:22:00
004581	MOD	Request to fix FGB Plane 4 Solar array during US EVA #7	CLOSED	2007/019:23:27	2007/034:00:00

A Mission Action Request (MAR), or CHIT, is a formal written request for information made during real-time operations from one discipline that requires a response from another discipline concerned with on-orbit operations. Historically, CHITs were most often used by the FCT to request engineering and safety analysis from the MER. CHITs are now being used for coordination among organizations as well; however, an organization cannot use a CHIT for internal communication. Refer to SCP, Section 3.8, Mission Action Request, for details on CHIT requests.

FLIGHT NOTES

PENDING	APPROVED	DAY SUM	EXEC PKG	INFO	ALL
EFN #	DISCIPLINE	SUBJECT	STATUS	GMT INPUT	GMT REQ'D
F005019	OPSPLAN	FCT Review of R_075_WED_16MAR05	Open	068/22:24	068/23:24
F005011B	PHALCON	R/T SODF CR for Warning Book PVTCS Procedures - part 2 of 2	Open	068/22:19	068/22:49
F005010B	PHALCON	R/T SODF CR for Warning Book PVTCS Procedures - part 1 of 2	Open	068/22:19	068/22:49

Flight notes are designed to provide official inquiries of the crew or to provide procedures and data for uplinking to the vehicle. The Electronic Flight Note (EFN) system is used by NASA to submit official flight notes during a mission. A flight note can be used to alter procedures, document status reports from the FCT, disseminate information among the flight control community, and update summaries to send to the crew. Flight notes serve as written records of actions taken by the FCT. There are three types of flight notes: flight, internal, and working. A working note can be seen only by other users within the group. These notes should be written first to coordinate revisions within a team prior to involving other groups. An internal note can be seen by those disciplines the author selects when writing the note. Internal notes should be used to precoordinate with other disciplines before promoting a note to flight note status. A flight note can be seen by anyone with access to the flight note system. This level is managed by the FD. Flight notes are not used to request changes, additions, or deletions to the timeline. Refer to SCP, Section 3.9, Electronic Flight Notes, for more detailed information.

IMGO

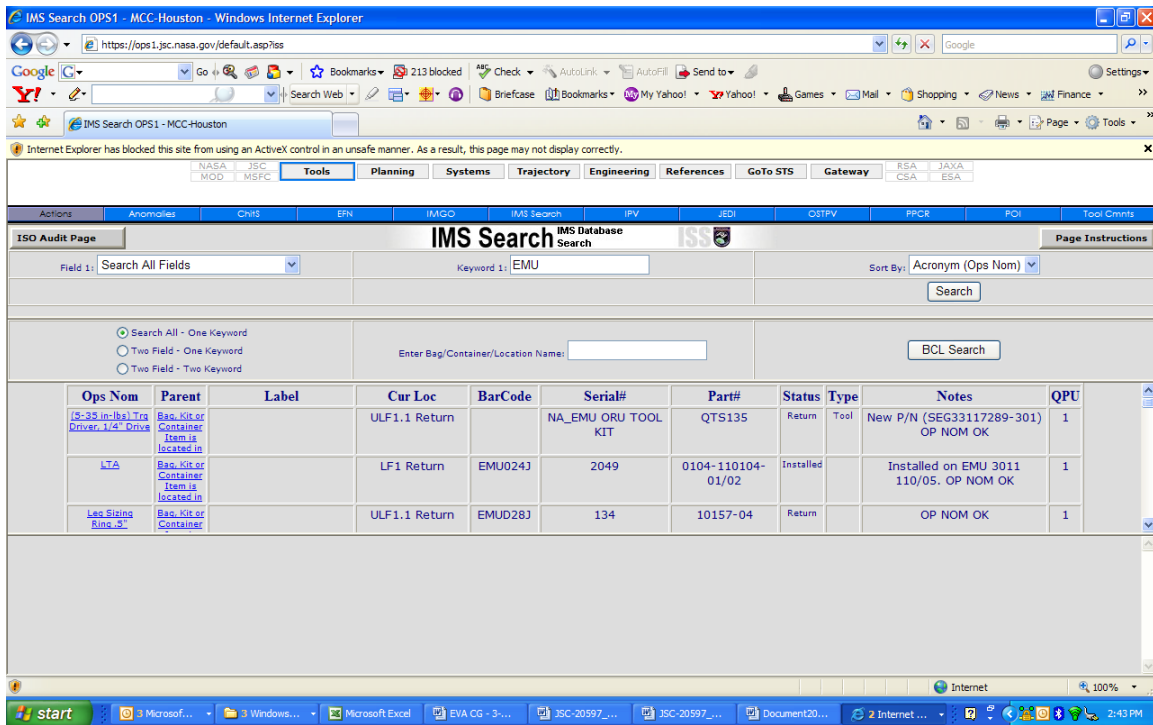
Amber on next Tues														Red	Amber	Green	Clear	Refresh	GUEST
ODIN	OSO	THOR	PHALCON	CATO	CIO	ROBO	EVA	VVO	Pointing	ATLAS	MER	IMC	HSG	ATV FD					
CAPCOM	ECLSS	Surg/BME	ADCO	Ops Plan	GC	RIO	TOPO	PAO	ACO	TITAN	SPAN	POD	MSG	COL FD					

IMGO (I'm Go) is a tool used to give the FD a visual status from each flight control position. The colored background gives that team's status. The FD uses this tool to pulse the FCT for a "go" for plan reviews, readiness to participate in FCT handovers, concurrence with Joint Execute Package Development and Integration (JEDI) messages, execute packages, daily summary inputs, concurrence with weekly planning and status reports, timeline reviews, etc. Click on IMGO, then click on "red," "green," or

“amber” to change to the “color” of choice. Only those in the EVA group with an EVA account are able to change the EVA color.

Note: When the IMGO tool is open and the FD indicates a new status color, the window with IMGO “pops” to the top of your screen even if it is minimized. To remove the IMGO status boxes from your browser, click the IMGO button again.

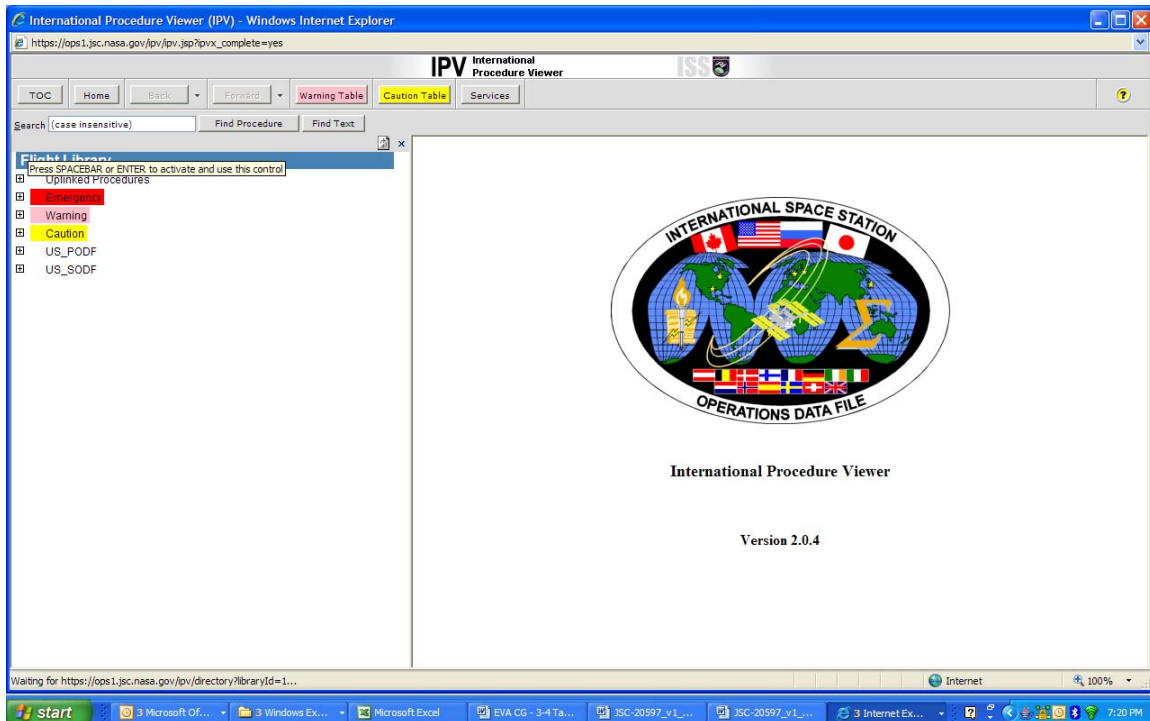
INVENTORY MANAGEMENT SYSTEM SEARCH



The Inventory Management System (IMS) search function on the MCC Web page is a convenient way to search for onboard items and is titled *IMS Search*. Instructions on how to perform a search can be viewed by clicking on the “Page Instructions” button on the upper right-hand corner of the screen. Audit activities, both current and historical, can be viewed on the Audit homepage by clicking the “ISO Audit Page” button located on the upper left-hand corner of the screen.

EVA works closely with the CIO to ensure that EVA hardware is properly stowed and tracked before and after each event. EVA logistics is complicated by consumables and transfers between crews and vehicles.

INTERNATIONAL PROCEDURES VIEWER AND OPERATIONS DATA FILE

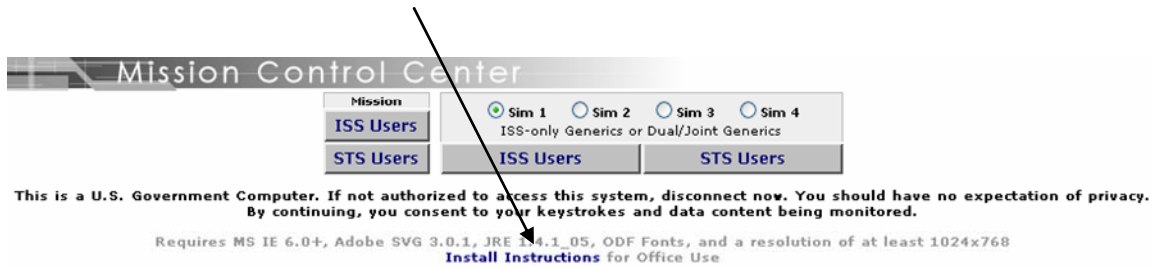


The Operations Data File (ODF) is the collection of nominal and off-nominal procedures required for ISS operations by the crew and ground controllers.

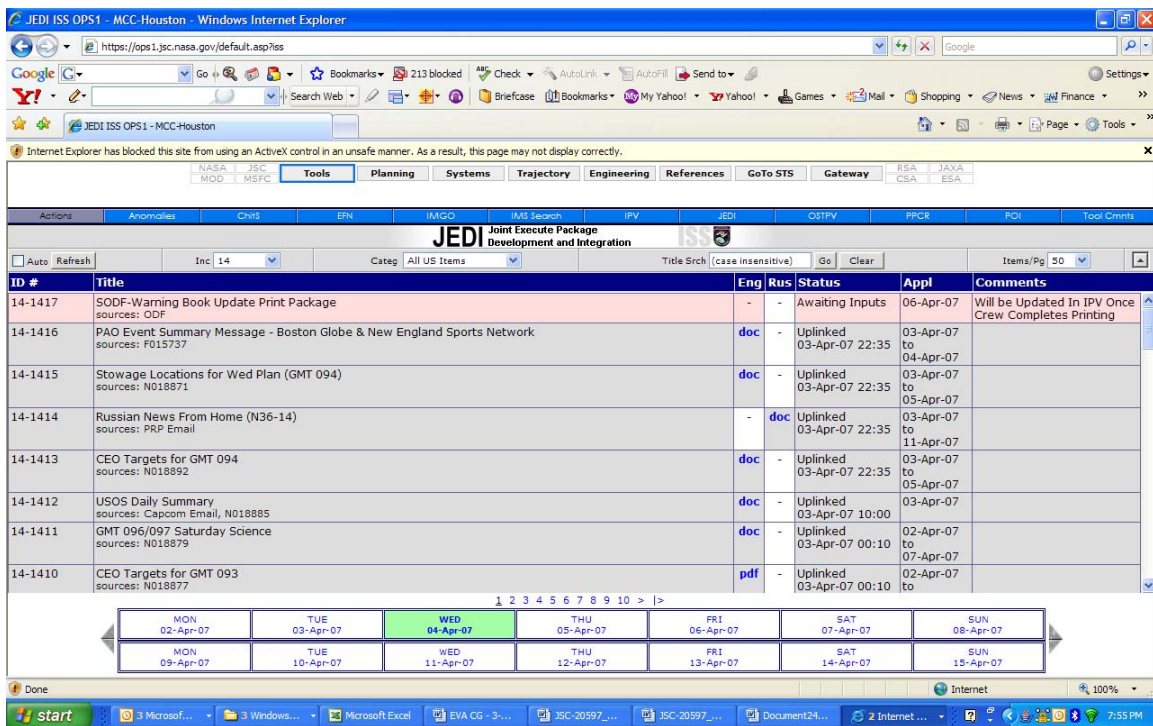
Any real-time changes to the ODF are available to the FCT via the JSC-MAS PC flight note system or via CHIT. All changes are flight noted, reviewed by affected controllers via the CHIT process (if required), approved by the FD, and uplinked to the crew. Permanent changes made via flight note are followed up by a formal CR. For a complete description of the Operations Flight Data form and change process, see the OIP, Generic, SSP-50643, Section 5.3.

The International Procedures Viewer (IPV) is a browser-based software tool for viewing electronic procedures. IPV provides capabilities for navigating the electronic libraries to locate a procedure. The search feature allows a keyword search to aid in locating a particular procedure. IPV supports hyperlinks to other referenced procedures. IPV can launch other applications to display other types of electronic documents in PDF format. A user can also add electronic notes to a procedure and enter data in text boxes that are stored for later use.

Note: Specific software is required for IPV and OSTPV to properly run. The JSC-MAS PCs in building 30 have the proper loads, but your office computer might not. Install instructions are located on the MCC Gateway page.



JEDI – JOINT EXECUTE PACKAGE DEVELOPMENT AND INTEGRATION



JEDI is a communication management database. Document transmission is one of the most important forms of communication with the crew (both ISS and shuttle).

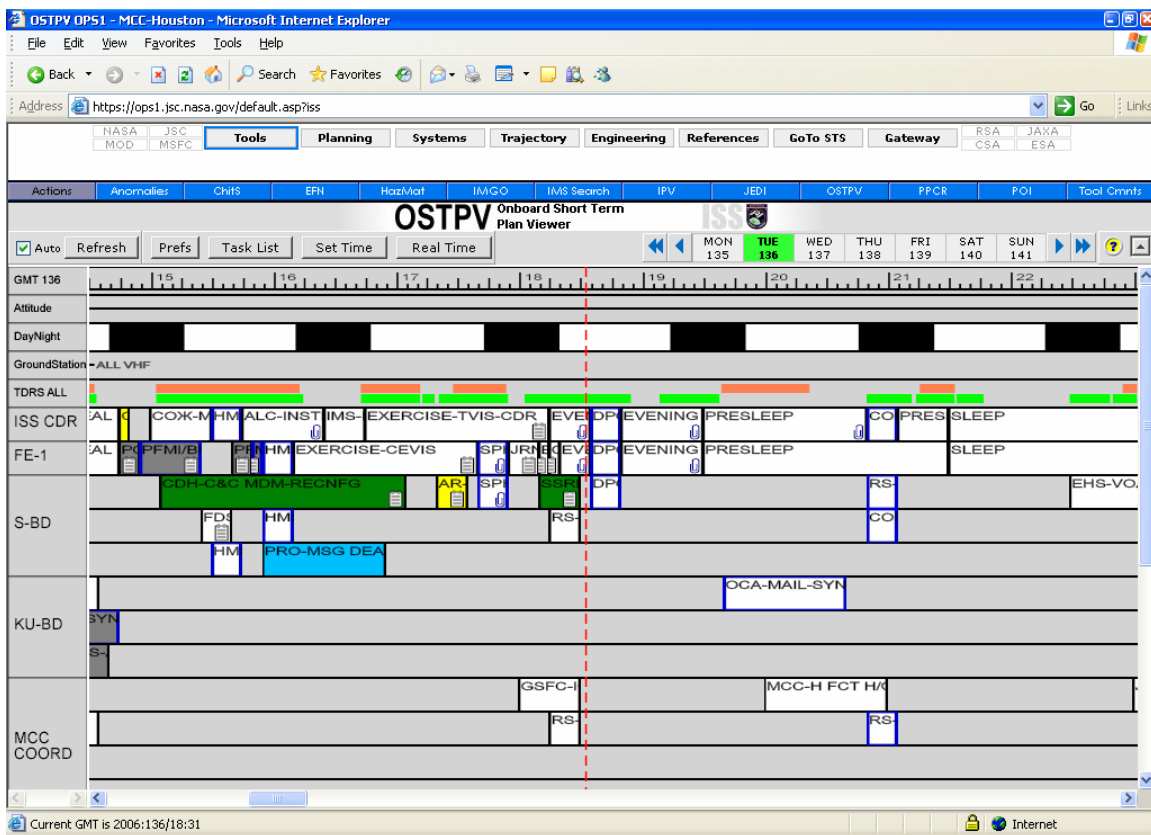
Documents created by MCC-H FCT and transmitted via U.S. assets are called On-orbit Communications Adapter (OCA) messages. Documents created by MCC-M FCT and transmitted via Russian assets are called Radiograms. JEDI is the database used to manage and archive all OCA messages and Radiograms. The FCT can stay informed of all messages to the crew by monitoring the JEDI. A message can be searched by category, flight, date, and title. This is a useful tool for searching for particular events and correspondence both for real-time operations and postflight analysis.

OCA's are messages authored by the MCC-H ground controllers that are sent to the ISS crew. These messages can provide procedures updates, daily plan updates,

IMS updates, etc. The USOS Daily Summary is a daily OCA message the crew receives first thing in the morning. It summarizes the day's activities for the crew, as well as changes in the Onboard Short Term Plan, Q&A between the ground and crew, and any other pertinent information to pass on to the crew before their day starts. If any flight notes are to be sent to the crew, they will be transferred into OCA messages. The FCT follows OCA messages for mission cognizance and tracking.

Radiograms are the Russian version of the MCC-H OCA messages. The radiograms are sent up from both the MCC-M and MCC-H. Radiograms contain similar information to OCA messages, procedure changes, daily plan updates, etc. The Form 24 is the Daily Plan from MCC-M that Russian cosmonauts use to complete each day's activities. Radiograms that are significant to the U.S. are translated into English here in MCC-H. These versions are also posted to JEDI for access by the entire FCT.

ON-ORBIT SHORT TERM PLAN VIEWER



The Onboard Short-Term Plan Viewer (OSTPV) is the viewer developed for ISS. It is the crew and ground interface for the real-time crew schedule. OSTPV is now Web based and accessed through the MCC Gateway.

Note: You must have the appropriate software downloaded on your computer to view the Web-based OSTPV or IPV. Installation instructions are located under the IPV section.

EVA FCs use the system to verify timeline inputs, track activities, and associated execution and operations notes. The S-band and Ku-band regions are helpful in tracking vehicle commanding and communications configuration. The OSTPV display can be customized to change the order of the bands, show or hide conditions, and add additional time bands.

Customize OSTPV by clicking on the Prefs (Preferences) Box. A dialog box with various preferences appears. Select display preferences by clicking the box next to the desired fields. Select the time band, (4, 8, 12, or 24 hours) from the scroll down list near the top under "Options." At the far right, a list with fields selected is displayed under "Band Order." The band order is managed by highlighting the name of the field and using the up or down arrow keys to raise or lower the location relative to other display fields. When the field is in the desired position, click on it again. The time window may also be customized. To save Preferences, click the "Save" button at the bottom, then click "Apply." Several files with different profiles can be saved.

Note: OSTPV is a very large file accessed by many users simultaneously. It may take a few seconds for changes to be updated or for the OSTPV display to load.

To save the display for printing, note that [Alt] Print Screen saves the entire page, including all Web fields. To make the OSTPV suitable for printing, perform an [Alt] Print Screen, and save to a PowerPoint file. The entire page, including Web fields, is displayed. To save the file without the MCC Gateway tool bar, click on the small "up arrow" button in the upper right-hand corner.

PLANNING PRODUCT CHANGE REQUESTS

Planning Product Change Requests (PPCRs) are written to change planning products. A PPCR can be written to change the Weekly Lookahead Plan (WLP) (the plan for 2 weeks out); the Short-Term Plan (STP) (the plan for 5 to 7 days out); or the Onboard Short-Term Plan (OSTP) (the plan for the next 5 days). PPCRs are also used to change or correct Ops notes and execution notes. All changes submitted via PPCR should have a requirement already defined to support scheduling the activity, or if not, should be accompanied by a CHIT requesting a new requirement. EVA makes inputs to new tasks at the Weekly Planning Review (WPR) on Thursdays in the action center. As PPCRs are reviewed by the FCT, EVA can provide suggestions/inputs either on the Flight Loop or through the Long Range Planner (LRP) or Ops Planner (Ops PLAN).

Generic PPCRs are written to change Guidelines, Groundrules, and Constraints (GGR&C) and are presented to the RIP.

PRODUCTS-OF-INTEREST REPORT

PDI #	PRODUCT	PRODUCT #	SUBJECT	STATUS	ECD
P3447	EFN	F012789	13S US Unpack List	ACTIVE	
P3446	EFN	F012889	EMU Resize Activity for GMT 267 (Sunday)	ACTIVE	
P3443	EFN	F012953	Post 12A A/L Restow Stowage Matrix	ACTIVE	
P3444	EFN	F012954	EVA Airlock Restow Big Picture Words for GMT 268	ACTIVE	
P3371	EFN	F012756	Undocking Powerdown Plan	RETIRED	
P3370	EFN	F012757	Food Message for Increment 13 9/16/06	RETIRED	
P3369	EFN	F012758A	12A EVA Tool Restow Stowage Matrix	ACTIVE	
P3235	EFN	W010136	PGT Changes for MBA Bolt Overrides	RETIRED	
P3234	EFN	W010134A	P1-P3 Capture Latch Override Deltas	RETIRED	
P3233	EFN	W010130	EVA 3 Inhibit Pad Update	RETIRED	
P3232	EFN	W010128	EVA 2 Inhibit Pad Update	RETIRED	
P3231	CHIT	004095	12A, 2 Fault Hazard Control Assessment	RETIRED	
P3230	EFN	W010126	EVA 1 Tool Config Deltas	RETIRED	
P3209	CHIT	004136	Metox Regen Assessment for 12A	RETIRED	
P3175	CHIT	004087	Check-out of helmet camera (ERCA) # 17	RETIRED	
P2986	AR	001732	Loss of Video from ERCA #17	RETIRED	
P2965	CHIT	004017	Flight STS-115 / 12A Mission Priority Requirements	RETIRED	
P2811	AR	001722	SAFER 1007 Latch Jammed	RETIRED	

For the MCC Gateway, there is a way to track EVA-related anomalies, CHITs, and flight notes. There is a flag column in those tools that can be checked for items pertaining to the EVA. The user can click on the “Products Of Interest (POI)” tab of the MCC Gateway to view those items. The items listed in the POI report are discipline specific and not user specific. Each discipline can flag a flight note, CHIT, or anomaly as a POI. The bookmarks are discipline specific. Users set or remove flags by clicking the flag icon on the master list. There is a “FLAGGED” filter to limit the master list to items flagged as POI.

This provides a tool to communicate the status and actions related to POI to the members of the team. These communications are visible only to the members of their teams. EVA team members should set flags on items of interest to simplify the handover process. When the item is no longer applicable or is outdated, the handover team should unmark it.

MCC Web – Planning Menu

CURRENT MONTH

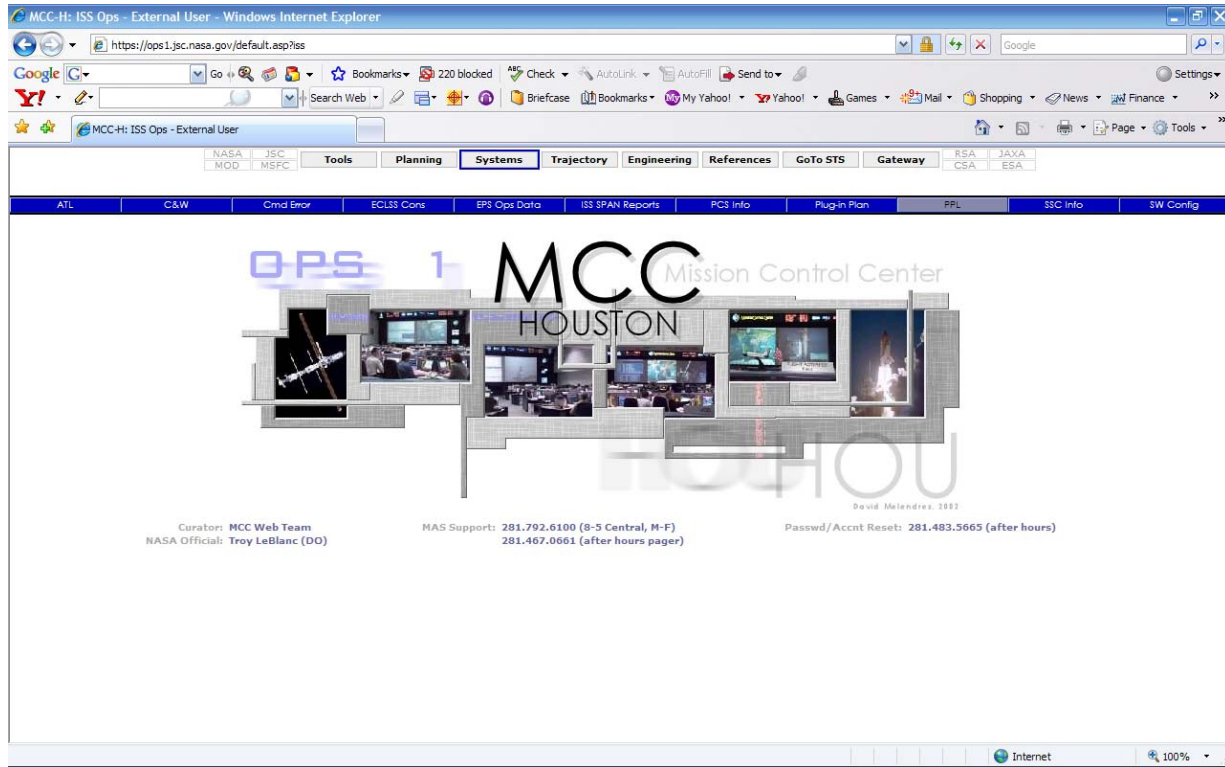
The screenshot shows a web browser window titled "MCC-H: ISS Ops - JSC User - Microsoft Internet Explorer". The address bar shows "https://ops1.jsc.nasa.gov/default.asp?iss". The page has a navigation menu with tabs: Tools, Planning (selected), Systems, Trajectory, Engineering, References, GoTo STS, Gateway. Below the navigation is a sub-menu with buttons: Current Month, Replan Policy, Milestones, IOP, TDRS, CSRD, ODFStatus, ODF CRs, Exec Ping Gr&Cs, Gen GR&Cs. A "Print" button and "Pre-Exec STPs" link are also visible. The main content is a calendar for "May 2006" with columns for days of the week (Mon-Sun) and rows for dates (01-14). Each date cell contains a list of crew activities and tasks, such as "CMS-TVIS WKLY-MNT_1", "EHS-WATER-CLCT", "P/TY-TVIS EXER-STOW", etc. A "WLP" column on the left lists "Metric", "TCR", and "STPN".

The “Current Month” button displays the Planning Calendar. This contains a calendar view of crew activities for the current and all past increments. For the current increment, a high degree of detail is available for the current week and the following 2 weeks. Beyond 2 weeks in the future, the calendar contains only significant events. The Planning Calendar also contains a link to the WLPs. These are available by clicking on the word “Metric” for the appropriate week. As execution occurs, this metric is edited to include an additional tab with the activity status information (as executed) data.

EVA FCs may find the IOP and GGR&C links helpful as a planning tool.

MCC Web – Systems Menu

This menu provides access to systems information for reference and mission cognizance. EVA is most likely interested in C&W, Span reports, Plug-in-plan, and PCS info.



MCC Web – Engineering Menu

The following section overviews what can be accessed from the MCC Web – Engineering Menu.



Programmatic problem tracking and resolution systems (e.g., the “Item for Investigation” database, PRACA, PVCS, etc.) shall be the primary means of tracking hardware and software related to long-term disposition of such anomalies.

ITEMS FOR INVESTIGATIONS

Items for Investigation (IFIs) are written to document on-orbit anomalies. The FCT uses the following definitions:

- A. Hardware failure – Any condition that results in a permanent loss of hardware capability. Recovery steps may or may not have been performed; not performing recovery steps should not delay the AR submission.
- B. Transients – Any condition that was off nominal and is now nominal as a result of crew action or no crew/ground action. No permanent reconfiguration was performed.
- C. Unexplained system response – Any off-nominal hardware or software condition that, at the time, is not explained by personnel or any authoritative document/source; i.e., flight controller systems brief.

IFIs are used to track on-orbit anomalies that affects mission requirement objectives, crew time, and overall vehicle status for the flight following. The open IFIs can be found at the Web site <https://ifi.iss.nasa.gov/index.cgi> or by using the link provided on the MCC Web – Engineering menu. ISS MER leads and conducts Anomaly Resolution Team and Flight Investigation Team meetings to troubleshoot and plan for resolution to on-orbit anomalies. EVA attends these meetings. A list of meetings can be found at the following Web site: http://iss-www.jsc.nasa.gov/cgi-bin/bbttools/org/calendar.cfm?org_id=SEDATA&class_id=142.

VMDB is also a useful engineering tool for EVA flight controllers.

MCC Web – References Menu



FLIGHT RULES

Flight rules are the precoordinated rules that define the operational limits within which the FCT flies the mission and vehicle. They are designed to minimize the amount of real-time discussion during time-critical and/or anomalous periods. All flight rules are written within the bounds of documented programmatic constraints and groundrules. Any operations occurring outside the defined flight rules are elevated to the ISS Mission Management Team (IMMT) and/or the joint shuttle/station MMT.

There are separate Generic Flight Rule documents for space shuttle and ISS (Vol. A and B, respectively), as well as combined generic volumes for ISS and Shuttle Joint Flight Rules, Vol. C, Progress/Soyuz Vol. D, and Automated Transfer Vehicle (ATV), Vol. E. There are also flight-specific annexes for each shuttle mission and/or increment.

IMAGERY

The Imagery tab takes you to the Digital Imagery Management System (DIMS) Web page. This is a standard reference for EVA flight controllers. Photo documentation is important for troubleshooting and procedure development. Closeout photos are accessible on DIMS. There are many useful links from the DIMS Web page.

EVA FCs may find the other reference items useful, especially FCOH, FCT oncall list, and hazard reports.

REFERENCES

IMC Operational Handbook, ULF1.1, Rev. K, May 2006.

Operations Support Officer Console Handbook, Volume I, Rev. H, July 24, 2006.

3.7 ANOMALY REPORTING

PURPOSE

To define procedures to be used by MCC flight controllers for submitting in-flight anomaly reports.

DESCRIPTION

Anomaly reporting is accomplished via the MCC gateway system for both shuttle and station flights. The reports are used by NASA to track all anomalies that occur during a mission or increment. All reports are combined postflight in a list and are officially transferred to the Station or Shuttle Program Office for tracking and resolution. Programmatic problem tracking and resolution systems (e.g., the Item for Investigation database, PRACA, and PVCS) are the primary means of tracking hardware/software for long-term disposition of such anomalies. This section summarizes the anomaly process and gives additional information from an EVA perspective. A more detailed description of the process for filling out and initiating an Anomaly Report (AR) is found in SOP 9.2 of ISS FCOH and SOP 1.7.1 of FCOH.

PROCEDURE

The AR program is accessible from the MCC-H gateway under “tools.”

CONTROL #	DISCIPLINE	SUBJECT	STATE	GMT of ANOMALY	GMT REQ'D
002247	EVA	METOX Regeneration at a Stack Pressure less than 14.5	CLOSED	2007/059:10:30	2007/064:21:00
002233	EVA	EVA General Purpose (GP) Cutter failure	OPEN	2007/053:12:30	2007/062:19:11
002231	EVA	RS EVA 17A: Lost Glisser camera stanchion	OPEN	2007/053:15:52	2007/068:21:00
002230	EVA	Orlan Sublimator Issue During RS EVA17a	CLOSED	2007/053:10:58	2007/058:21:00
002228	EVA	RS EVA 17A Prep: MUT S/N 1001 Will Not Fully Loosen	CLOSED	2007/044:10:07	2007/062:19:11
002207	EVA	Sunita Williams Prime Gloves RTV Missing	CLOSED	2007/037:20:00	2007/045:21:00
002206	EVA	US EVA 8 55' Safety Tether #73 Retraction Issues	CLOSED	2007/039:18:24	2007/045:21:00
002205	EVA	US EVA 8 Broken Connector Bail	CLOSED	2007/039:17:25	2007/045:21:00
002204	EVA	US EVA 8 SARJ Diagonal Strut Cup-Cone Bolt Difficult to Release	CLOSED	2007/039:16:11	2007/045:21:00
002198	EVA	US EVA 7 Body Restrain Tether (BRT) S/N 1009 Difficult to Use	DISPOSITIONED	2007/035:18:08	2007/039:17:42
002196	EVA	US EVA 7: Loose Gap Spanners tightened on Lab	CLOSED	2007/035:19:10	2007/045:21:00
002195	EVA	US EVA 7: 85-ft Safety Tether #28 (SN 1008) not retracting	CLOSED	2007/035:20:11	2007/045:21:00
002194	EVA	US EVA 7: Difficulty with electrical connectors on SSPTS cable	CLOSED	2007/034:18:56	2007/045:21:00
002193	EVA	US EVA 7: Ammonia (NH3) leak from Z1-F5 (mated to Lab-M7) after closing valve	CLOSED	2007/035:14:45	2007/045:21:00
002192	EVA	US EVA 7: Difficulty removing fluid QD caps	CLOSED	2007/035:14:19	2007/045:21:00
002191	EVA	US EVA 7: Pitch Lock Knob not locking properly on APFRs 2 and 3	CLOSED	2007/035:13:58	2007/045:21:00
002190	EVA	US EVA 7: Release of RET from SPD	CLOSED	2007/035:15:18	2007/045:21:00
002189	EVA	US EVA 7: Velcro on MLI strap near DDCU heat pipe not holding (Z1 fwd/stbd corner)	OPEN	2007/035:16:02	2007/072:21:00
002187	EVA	US EVA 6 MiniWorkstation End Effector (MWS EE) Difficult to Use	CLOSED	2007/031:15:00	2007/041:22:17
002186	EVA	US EVA 6 Body Restrain Tether (BRT) S/N 1001 Difficult to Use	CLOSED	2007/031:15:00	2007/041:22:17
002181	EVA	US EVA 6: TA r/lamn on FAS difficult to release	CLOSED	2007/031:21:11	2007/041:22:18

Figure 3.7-1. ANOMALY LOG

An AR should be written to document any of the following:

- A. Unexpected hardware or software performance or response, including exceeding cert life
- B. Unapproved flight rule violation or flight documentation error
- C. Operator error that significantly affects (as determined by the FD) crew or vehicle operations
- D. Facility problem that significantly affects (as determined by the FD) ground control and/or monitoring of the vehicle

The disposition of these anomalies will be tracked in the appropriate programmatic problem tracking and resolution system. The anomaly may be satisfied in real-time and thus CLOSED in MIS but remain OPEN in the program tracking systems.

Guidelines

- A. In most instances, the MOD flight controller on duty at the time of the anomaly will initiate the AR. This will verify that the information captured on the report form is from firsthand knowledge of the anomaly. The AR may be completed during the next shift as long as the FCR operators agree.
- B. Upon completion of the report, the proposed anomaly form will be submitted by the FCR operator to the MER via the SPAN loop. The proposed anomaly will be listed as PRELIMINARY, which will allow further editing by the initiator, affected disciplines, and SPAN.
- C. Any additional troubleshooting of the anomaly should be captured by the FC on duty at the time of the troubleshooting by making revisions to the original AR.

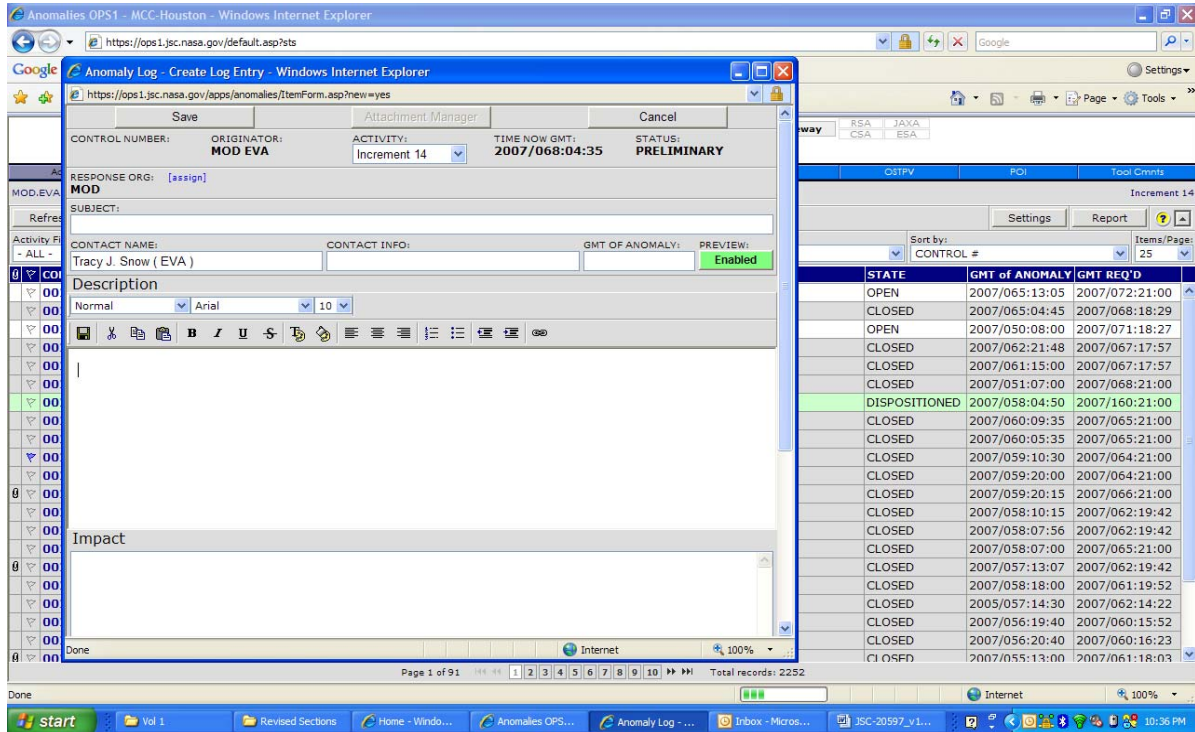


Figure 3.7-2. Create Anomaly Log

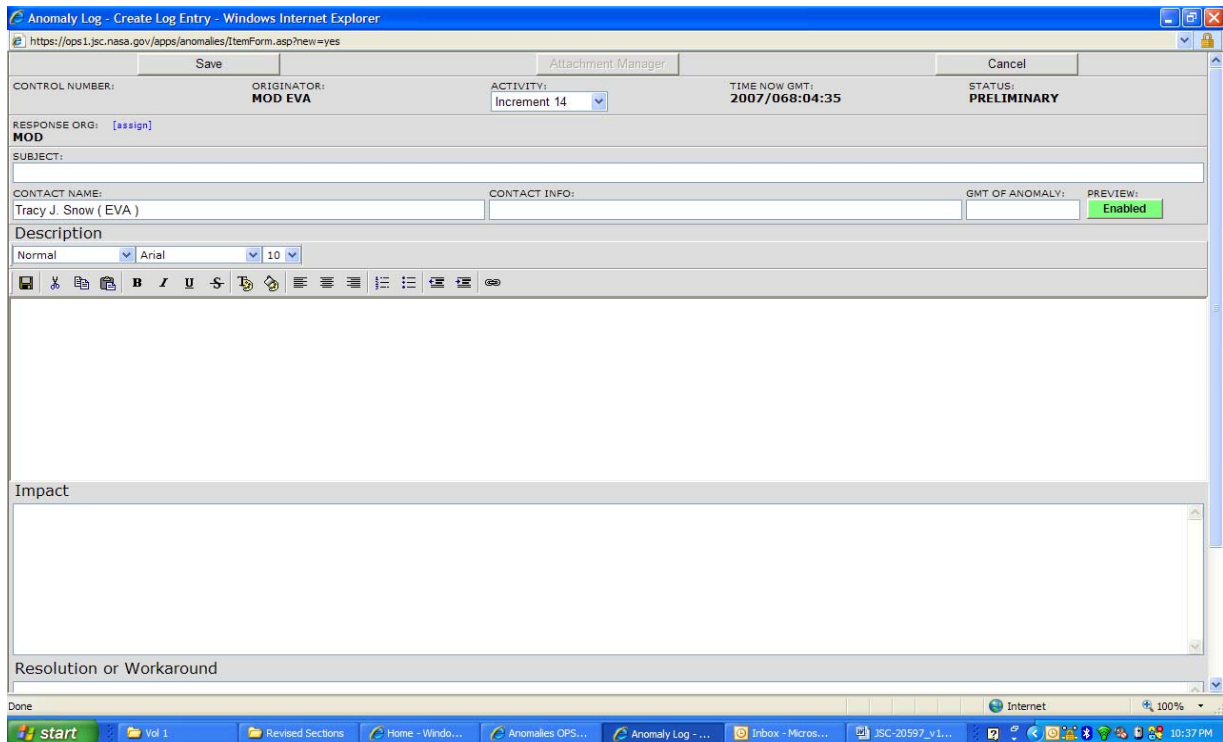


Figure 3.7-3. Anomaly Report Entry Form (detailed view)

Anomaly Log Fields

Control Number

The control number is assigned by the MER once submitted into the system.

Originator

The originator is the discipline initiating the anomaly report, and the system automatically displays the user's name currently logged into the MCC gateway.

Activity

The activity is the current flight number and is automatically inserted according to the flight in progress.

Time Now GMT

The time posted is the time the AR is initiated and is automatically displayed when a new AR entry is initiated.

Status

If troubleshooting of the anomaly is planned real time, this block should be marked "Open." EVA will work with SPAN until the anomaly is dispositioned or closed.

Response Org

The responsible organization for the AR is automatically displayed based on the initiator's organization.

Subject

The anomaly should be titled with descriptive words for ease of reference.

Contact Name

The full name of the initiator is automatically displayed based on the MCC gateway login credentials.

Contact Info

This field is used to add information needed to contact the initiator.

Preview

The default is "Enabled" and is highlighted in green.

GMT/MET of Anomaly

These blocks should be filled in with the time the anomaly occurred.

Description

All relevant details of the anomaly should be included in this block, including Greenwich Mean Time (GMT)/Mission Elapsed Time (MET) of the anomaly, any troubleshooting steps, and reference to any relevant data products, such as data plots, display screen captures, and audio clips that will be attached to the AR and sent to the MER, etc. In the description, avoid statements such as “This must be fixed before the next flight because...” This decision will be made by the Program Office.

Impact

There may or may not be any impact from the failure. If there were no impacts because of redundant systems or workarounds, identify what the alternatives or redundancies were that resulted in a no-impact situation.

Resolution or Workaround

It is important to include any steps that were taken to correct the anomaly or any steps that will be performed in the future.

Attaching Files

Each AR will allow two electronic attachments.

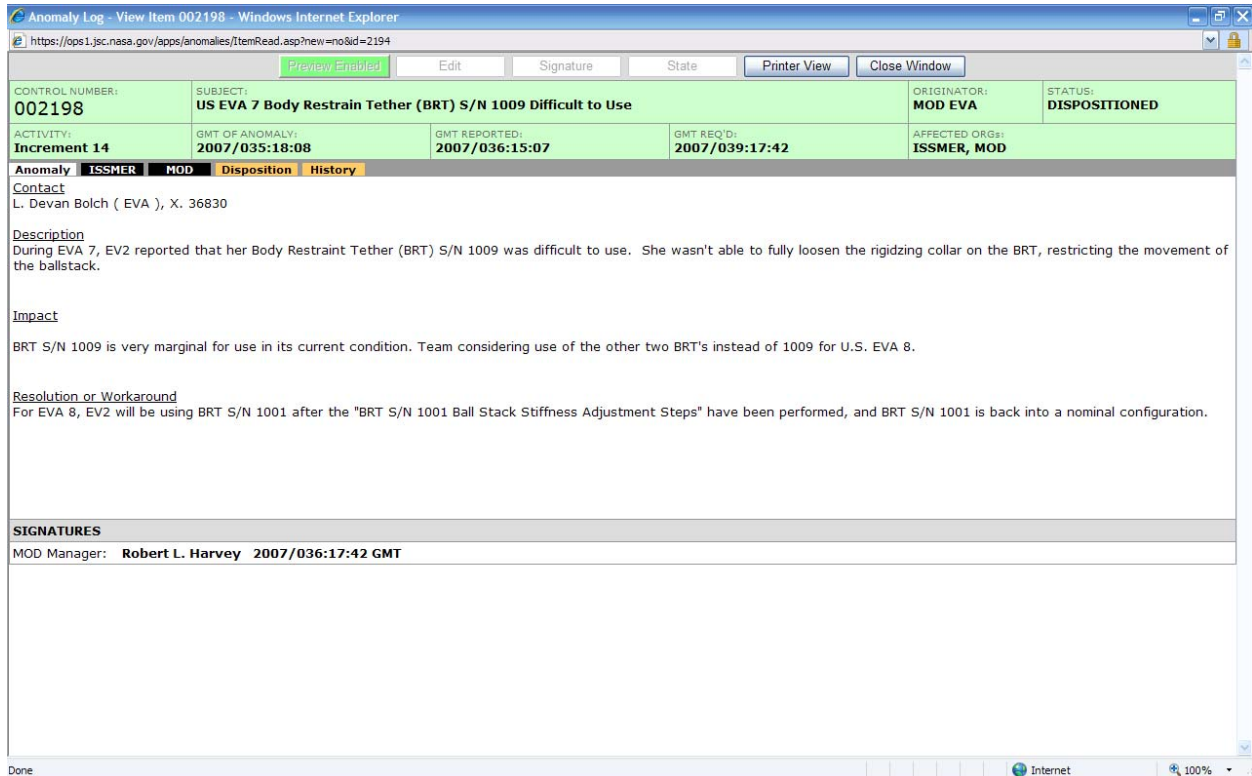


Figure 3.7-4. Sample EVA Anomaly – AR 2198

EVA example:

AR 2198 – Body Restraint Tether (BRT) Tightening – leave in disposition – XA would like us to close it per the tools panel statement that the BRT is operating within spec and this is a crew preference item. They do not want to approve modification unless something goes wrong with one of the two good BRTs and the crew requests to modify the remaining BRT. It is not uncommon to leave ARs in disposition until the anomalous tool is either fixed or no longer on orbit. Since this is unresolved, we want to leave this AR in DISPOSITION until the remaining BRT is modified or rotated.

Status Descriptions:

- A. **PRELIMINARY** state (light blue) – All ARs begin preliminary until it is opened or dispositioned by the MER.
- B. **OPEN** state (white) – When the originator considers the log entry sufficiently complete and has electronically signed it, notify SPAN that the anomaly is ready to be opened. SPAN will review it and assign other responders (if required) and change the status to OPEN.
- C. **DISPOSITIONED** state (light green) – Use this if there are open MOD actions that need addressing post flight, such as procedure fixes, Flight Rule CR's, etc.

Final closure rationale will be documented by SPAN on the DISPOSITION tab.

Items in DISPOSITIONED state will transition to CLOSED when all post flight actions are complete.

- D. **CLOSED** state (grey) – A log entry will be changed to **CLOSED** state once any of the following has occurred:
 - 1. The anomaly has been resolved through on-orbit repair or recovery actions.
 - 2. All near-term troubleshooting has been exhausted, no further real-time action is expected, and long-term tracking has been initiated through other offline systems (e.g., PRACA (for vehicle anomalies), DRTS (for facility ARs)).
 - 3. All associated action items related to this anomaly are closed or being accepted and tracked by other formal means.
- E. **WITHDRAWN** state (lavender) – An entry that is no longer in need of tracking due to repetition, error, or deemed unnecessary by the FCT.

When the initiator considers the entry complete and has electronically signed it, SPAN should be notified to change the state of the anomaly to OPEN. When SPAN reviews the anomaly and finds it satisfactory, they will sign as MOD manager and officially OPEN the anomaly. The initiator is always listed as a responder to allow for updating

the anomaly with new information even after it is OPEN. Delinquent ARs will be reported at the FD/FCT handover.

Each discipline can flag a flight note, CHIT, or anomaly as a product of interest. The bookmarks are discipline specific. Users set or remove flags by clicking the flag icon on the master list. The "FLAGGED" filter is used to limit master list to items flagged as products of interest.

EVA can use the tool to communicate to the members of their team the status and actions related to those products; these communications will be visible only to the members of the EVA team.

ITEMS FOR INVESTIGATION

The *Item For Investigation* (IFI) database is used by the ISS MER to track all on-orbit anomalies, their impacts to ISS operations and the crew, and the actions taken to mitigate those anomalies and prevent their recurrence. The IFI database is configured so that only the ISS MER manager is authorized to open and close IFI records within the database. The IFI database provides the ability to track detailed information for each anomaly, including but not necessarily limited to the following:

- A. Detailed description of the anomaly
- B. Time and date the anomaly initially occurred
- C. Impacts to the ISS and crew

IFIs are reported via the anomaly log system accessible on the MCC gateway. *IFIs are under jurisdiction of the MER community while ARs are under jurisdiction of MOD and used by the FCT for MOD tracking purposes.*

REFERENCE

JSC-29229 - ISS FCOH, Section 2.40, Flight Note, Anomaly Report, and CHIT Communications, 6/26/06.

JSC-29229 - ISS FCOH SOP, Section 9.2, Guidelines for ISS Anomaly Tracking/Reporting, 5/24/04.

OSO Console Handbook, Volume 1, Rev. H, 7/2006.

JSC-26843 - FCOH, Section 1.7.1, STS Anomaly Tracking/Reporting, 8/22/06.

3.8 MISSION ACTION REQUEST

PURPOSE

To define procedures used by MCC flight controllers for submitting an official inquiry to the MER or ISS Management Center (IMC)/Customer Support Room (CSR) via a Mission Action Request, also called a CHIT.

DESCRIPTION

Flight controllers should not make calls or take action based on any input that is not fully understood or agreed upon. The CHIT reports are used by NASA flight support agencies to make official inquiries for information from other groups during a mission. Historically, CHITs were most often used by the FCT to request engineering and safety analysis from the MER. CHITs are now being used for coordination among organizations as well; however, an organization cannot use a CHIT for internal communication. CHITs are not executable instructions but rather a source of information from which executable instructions will be developed. Executable instructions exist in the form of flight notes and published ODF/FDF procedures.

BACKGROUND

CHITs are written by flight controllers and are coordinated with the SPAN manager. CHITs are evaluated in the MER. The primary purpose of the SPAN is to provide a real-time technical management interface between the FCT and the external program, project/element, MER/Engineering, CSR/payload customers, SE&I, contractor, and manufacturer elements participating in a mission (reference FCOH SOP, Section 2.1, Span Operations, for more detailed information on the role of the SPAN). The SPAN manager directs CHITs to the MER manager who assigns appropriate engineering discipline personnel to analyze the MCC data requests. Within EVA, the EVA MER responds to CHITs from a technical perspective and the EVA IMC responds to CHITs from a programmatic perspective. Once engineering personnel in the MER have dispositioned a CHIT, it is sent to the MER manager and the SPAN manager. The SPAN manager contacts the appropriate MCC FCT and informs them that their CHIT request has been completed.

PROCEDURE

CHIT REPORT

All CHIT actions, initiating or responding, should be well-coordinated within the EVA community. The FCR operator will review the CHIT to ensure that it is clear and concise and will assign any cosigners necessary. The CHIT system is accessed from the MCC gateway under "Tools," (Figure 3.8-1, CHIT: Mission Action Request System).

CONTROL #	REQ ORG	SUBJECT	STATE	GMT CREATED	GMT REQ'D
004836	IMC	REQUIREMENTS: Increment 15 Stage 13A CSRD	RESPONDED	2007/129:13:34	2007/142:17:00
004834	ISSMER	Solar Array Blanket EVA Tool Construction	CLOSED	2007/127:18:40	2007/130:16:00
004829	ISSMER	EVA - HELMET LIGHT/PGT BATTERY RECHARGE FROM PSA UTILITY OUTLET	DISPOSITIONED	2007/124:15:56	2007/166:17:00
004813	ISSMER	EMU Oxygen Contamination	CLOSED	2007/114:21:12	2007/128:00:00
004787	ISSMER	EVA: SEMU 3008 FOD Strike Inspection	CLOSED	2007/100:21:27	2007/102:17:00
004700	MOD	USOS O2 Tank Use During US Stage EVAs 6-8	CLOSED	2007/067:19:50	2007/075:00:00
004692	ISSMER	EMU Gloves Picture Request	CLOSED	2007/065:15:54	2007/068:15:00
004686	ISSMER	EACP EMU 1 Switch Troubleshooting	CLOSED	2007/060:19:47	2007/088:23:00
004685	ISSMER	METOX Regen lower pressure limit 13.9 psi	OPEN	2007/060:17:40	2007/151:20:00
004670	IMC	23P US Hardware Disposal List	CLOSED	2007/053:17:21	2007/058:18:00
004667	ISSMER	EVA - Tools Limited Life	CLOSED	2007/051:19:33	2007/086:18:00
004666	ISSMER	EVA - EMU Limited Life	CLOSED	2007/051:19:30	2007/068:18:00
004644	MOD	IVA Modification of Multiuse tether (MUT) and Body Restraint Tether (BRT) to return to nominal operation	CLOSED	2007/044:10:07	2007/044:23:00
004642	ISSMER	EVA - 3/8" Drive Ratchet - Palm Wheel Inspection	CLOSED	2007/043:19:17	2007/213:17:00
004638	ISSMER	R5 EVA 17A General Purpose Cutter (GPC) tool Sharp Edge Constraint	CLOSED	2007/040:20:01	2007/047:00:00
004619	MOD	Request to fix SM Plane 2 Solar Array during U.S. EVA #8	CLOSED	2007/036:22:10	2007/038:00:00
004616	ISSMER	EVA 8: Body Restraint Tether Ball Stack Stiffness Adjustment	CLOSED	2007/034:23:00	2007/037:15:00
004611	ISSMER	EVAs 7 and 8: Operational constraints for APFRs	CLOSED	2007/032:19:25	2007/034:19:00
004607	ISSMER	ITCS Configuration for IFHX Reconfiguration on EVA 7	CLOSED	2007/031:21:23	2007/036:16:00
004601	MOD	Use of Russian Radiation Dosimeters (Pille) in EMU during US EVAs 6, 7, 8	CLOSED	2007/029:20:26	2007/030:23:59
004599	ISSMER	EVR: New EVA Sharp Edge Hazard on LEE B face	CLOSED	2007/029:17:31	2007/064:18:00

Figure 3.8-1. CHIT: Mission Action Request System

The following are items a flight controller should expect from the MER:

1. The MER should supply, on your request, data on your system, such as acceptance test data, other test data, design specs, failure history, etc.
2. On your request, the MER should organize analyses or special tests, as required, to determine the course of action for a specific case.
3. The MER should provide necessary data for in-flight procedure development and assist in verifying the procedure in an appropriate test facility.
4. The MER provides assessments on proposed courses of action. These should be based on the engineering data or programmatic issues (i.e., we are unable to manufacture a replacement; we cannot risk failure of this hardware).
5. The MER does not help you manage equipment within Flight Rule and Vehicle Master Database (VMDB) constraints or routinely operate equipment to keep within those limits; that is the responsibility of the flight controller.

Precoordination occurs to ensure that the requestor and the responder(s) understand what is being requested prior to opening the CHIT; however, a responder's concurrence to open a CHIT does not constitute concurrence with the request. Conversely, responders should not withhold concurrence to open a CHIT on the basis that they do

not concur with the request. No organization can prevent a CHIT from being opened if it meets the criteria of an appropriate CHIT. Once a CHIT is opened, the original wording of the request cannot be revised. A detailed description of the procedures that the MER uses to process CHITs is found in Section 2.1.1, SPAN Mission Action Request (CHIT) Processing of the FCOH. This SCP is focused on completing the report form from the EVA perspective.

The following data are typically exchanged by the EVA team via CHIT:

- A. Test data, hardware, historical information, and maintenance information applicable to current on-orbit operations.
- B. Near-real-time system performance, thermal, software, and loads analyses applicable to current on-orbit operations.
- C. Requests for modifications to the current mission objectives or mission priorities.
- D. New operational constraints or vehicle configuration changes, such as yellow tag lists, notification of updates to hazard reports, and OCADs applicable to current on-orbit operations.
- E. Agreements and traceability of transfer items to and from orbit.
- F. Requests/agreements for jettison of specific hardware.
- G. Requests for new operations data that are not already included in existing operations products (e.g., revised bolt data, EMU operational data) relevant to current on-orbit operations.
- H. Requests, with rationale and supporting data, for the EVA to operate temporarily using different data or constraints other than what is documented in Flight Rules, FCOH, or procedures. For example, a new procedure is generated for trouble shooting or data gathering and the procedure is an activity that is “outside the envelope” of approved operations or first-time operations that are new and unusual.
- I. Notification of items transferred between vehicles (transfer CHITs).
- J. Documentation on concurrence for real-time flight rule changes.
- K. Documentation of consumables used in support of assembly operations.

For information on communication and activities that do not require CHITs, reference ISS FCOH SOP, Section 2.40, Flight Note, Anomaly Report, and CHIT Communications.

Drafting a New CHIT

Select “new CHIT” to open a new CHIT form (Figure 3.8-2, CHIT Entry Form).

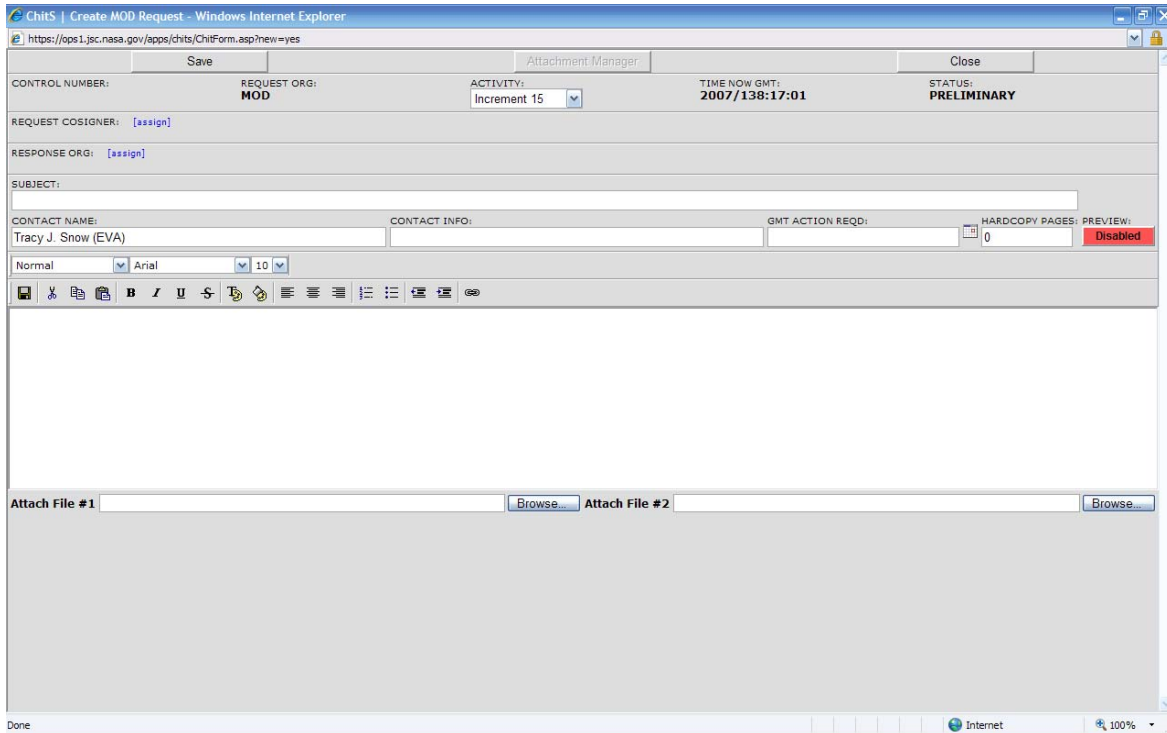


Figure 3.8-2. CHIT Entry Form

CHIT Entry Fields

Control Number A temporary control number is assigned upon saving the new report. The official control number is assigned once submitted into the system and officially “opened” by the MER.

Request Org The originator is the discipline initiating the CHIT, and the system automatically displays the organization based on the user currently logged into the MCC gateway.

Activity The activity is the current flight number and is automatically inserted according to the flight in progress. Any intent to open a CHIT in an activity other than the current increment must be coordinated with the ISS SPAN manager.

Time Now GMT The current GMT is automatically placed in the block when the CHIT is initiated.

<u>Status</u>	<p>Preliminary – This automatically displays when a new report is initiated.</p> <p>Open – This area changes when the SPAN manager makes it official.</p> <p>Closed – This changes when all requests have been answered and all signatures have been received.</p> <p>Withdrawn – A report can be withdrawn while in the “Preliminary” or “Open” state.</p>
<u>Request Cosigner</u>	<p>If additional teams are needed to sign the request, the originator assigns the appropriate team(s) in this field.</p>
<u>Response ORG(s)</u>	<p>The author shall carefully select the responding organizations, assigning actions to each one. The CHIT-submitting organization cannot be selected as a responder. ISS SPAN can add specific MOD teams as responders during the CHIT opening process.</p>
<u>Subject</u>	<p>The CHIT should be titled with descriptive words for ease of reference. The title should be descriptive enough to uniquely identify the CHIT but must be no more than 128 characters in length.</p>
<u>Contact Name</u>	<p>The full name of the initiator is automatically displayed, based on the MCC gateway login credentials. If circumstances require, this field may be changed to a different name, but the format is to remain the same.</p>
<u>Contact Info</u>	<p>This field is used to add contact information for the initiator.</p>
<u>GMT Action Required</u>	<p>This is the GMT that an answer is required. Agreement on this time is part of the required coordination prior to opening a CHIT. If required before a flight event, enter the flight event time in GMT. ASAP is not to be used. If the “Action Required” time needs to be modified after the CHIT is opened, only the ISS SPAN manager has the capability of making this change.</p>

Hardcopy Pages This block designates the number of attached paper copy pages that accompanies the electronic CHIT form. Any attached graphics/text are nominally electronically attached.

Preview When this block shows “Disabled” in the CHIT’s preliminary version, other disciplines are not able to view the report. This block may be “Enabled” to allow other disciplines to review the CHIT before it is submitted. After the MER manager saves the CHIT, the block automatically changes to “Enabled.” The “Preview” field allows operators from outside the originating organization to view the CHIT before it is opened. If the “Preview” field is “Disabled,” only ISS MER operators are able to see it. If the “Preview” field is “Enabled,” all other organizations are able to see the CHIT.

Description The body of the CHIT is used for all requesting information. The normal format for this section is to state the problem or background for initiating the CHIT and then to provide a list of questions that the MER or IMC/CSR should answer. If the CHIT has other associated paperwork, it should be listed here to maintain a clear paper trail throughout the issue. For all requests requiring crew time, the CHIT must include an estimate of how many crewmembers are involved and how much time is required of each of them. At the end of the field, the initiator includes the list of actions required of each responding organization.

Attaching Files Each CHIT allows two electronic attachments. The preferred method for attaching information to CHITs is via electronic files. If files from DEC Alpha are needed for attachment, refer to FCOH SOP, Section 9.3, for detailed instructions on transferring data from DEC Alpha to JSC MAS Server.

Upon completion of the report, the FCR operator submits the CHIT to the MER via the SPAN loop.

CONTROL NUMBER: 004829	SUBJECT: EVA - HELMET LIGHT/PGT BATTERY RECHARGE FROM PSA UTILITY OUTLET	REQUEST ORG: ISSMER	STATUS: DISPOSITIONED
ACTIVITY: Increment 15	GMT CREATED: 2007/124:15:56	GMT ACTION REQ: 2007/166:17:00	RESPONSE ORG: MOD

ISSMER MOD **Disposition** Translation History

RESPONSE
organization contact: Donald A. Hannsz (SPAN), 3-4912
cosigners: EVA, FLIGHT
APPLICABILITY: FCOH SOP 2.40.D.11.

EVA
discipline contact: Daryl J. Schuck (EVA), x34442
MOD EVA concurs with the procedure in this Chit, and will utilize it in the case where the affected charger is required for use. Generic CR *ISS_EVA_SysU488* is being submitted to make these changes to the generic procedures.

FLIGHT
[no response]

SIGNATURES
MOD Manager: **Robert L. Harvey** 2007/131:11:56 GMT
EVA: **Daryl J. Schuck** 2007/130:20:09 GMT
FLIGHT: **James R. Spencer** 2007/131:11:54 GMT

Figure 3.8-3. Sample EVA CHIT

Figure 3.8-3 illustrates a sample EVA CHIT to show the various tabs available once a CHIT is opened and dispositioned. It also gives an example of CHIT in which EVA is a required responder and has an action to complete.

CHIT Processing

Once a responder has completed the entry of the response, the appropriate management personnel will electronically sign the CHIT. SPAN or FD will sign as MOD Org manager for all MOD-related CHIT activities. Process owner (SPAN) and org manager have the ability to delegate or remove signature authority. The same org manager or another one from the same organization can remove the referenced signature. SPAN has the same capability also. SPAN manager's removal of anyone's signature must be precoordinated and documented.

1. Responding to CHITs from other organizations

The response field should include all technical data requested by the originator. The originator will place his/her response to the FCT coordination in the disposition.

2. Opening a CHIT

The SPAN manager, after reviewing the CHIT, will conduct a Preopening Coordination process. If a CHIT is disapproved at any level of review or approval in this procedure, the SPAN will inform the CHIT originator that additional

information needs to be provided. The Preopening Coordination process can be waived in case of time constraints and/or in emergency situations after informing supporting teams on the flight loop. The originator may request that the CHIT be opened as written. (In this case, the responders will provide any disagreement in their response to the CHIT after it is opened.) Following FC concurrence on all responses, the SPAN manager will change the state of the CHIT from "Open" to "Responded" electronically and notify the FCR that the CHIT is ready for disposition according to CHIT closure criteria. The FC will review the responses and will provide a disposition under the disposition tab of the CHIT.

3. Dispositioning of CHITs

CHITs with temporary or frequently changing requirements will be kept in "Disposition" status until superseded. This will allow agreements to be documented without causing excessive flight product CRs. For example, a CHIT waiting for a flight rule or procedure CR may not be "Closed" until the CR is approved and verified to have the change required by the CHIT. No action should be taken as a result of a CHIT until the CHIT is either dispositioned or closed.

4. Withdrawing a CHIT

CHITs may be withdrawn at any state prior to closure, but they should be withdrawn only if the information is incorrect or the request is no longer valid or needed. "Withdrawn" CHITs shall include a statement explaining why the CHIT is being withdrawn. A "preliminary" CHIT may be withdrawn by the initiator if the CHIT is no longer needed. The initiator adds the rationale for the withdrawal and contacts the ISS SPAN manager to withdraw the CHIT. Even though the CHITs are withdrawn, they remain in the CHIT system. Therefore, instead of withdrawing a "Preliminary" CHIT, the CHIT should be rewritten if possible. An opened CHIT can be withdrawn only by the ISS SPAN manager. If the CHIT is in any state other than "Preliminary," the withdrawal rationale is added to the "Disposition" field.

5. Closing a CHIT

CHITs may be closed when the requested action has been completed or the requirement(s) stated in the CHIT is being tracked by another ISS Program requirement. To actually close the CHIT, all teams' cosigners are required to state that they are ready to close the CHIT and sign the Disposition. If the CHIT is not ready to close, it will stay in "Dispositioned" state. When the CHIT is ready to close, the primary responder updates the disposition and notifies the MER manager that the CHIT is ready to close. Once all cosigners have signed, the MER manager will review the Disposition for completeness, sign it, and notify the ISS SPAN manager that the CHIT is ready to close. Once a CHIT is closed, its state can no longer be changed.

6. Initializing a CHIT from the ISS MER

All ISS MER teams are to coordinate with the ISS MER manager prior to initiating a preliminary CHIT. If the team can demonstrate a need for a task to be completed *in the current stage*, the CHIT will be submitted as soon as possible. If the task is not needed in the current stage, the task will be documented via a CR to the appropriate Increment Definitions and Requirements Document (IDRD). The MER manager reviews the CHIT for appropriate information, and also verifies that all cosigned have provided and signed their inputs.

Products of Interest

Each discipline can flag a flight note, CHIT, or anomaly as a product of interest. The bookmarks are discipline specific. Users set or remove flags by clicking the flag icon on the master list. A “FLAGGED” filter may be used to limit the master list to items flagged as products of interest.

Historical

The old version of the CHIT application (pre-July 2003) can be accessed via DNAV: Master || Global Apps | MIS | CHIT Report. These CHITs are available only via the Dec Alpha Workstations and are therefore not accessible outside of building 30.

For detailed CHIT format and date field operations, refer to Web-based MIS Users Guide on MCC-H gateway page located at <https://ops1.jsc.nasa.gov/gateway/>.

REFERENCES

JSC-29229 – ISS FCOH, Section 2.40, Flight Note, Anomaly Report, and CHIT Communications, 6/26/06.

JSC-29229 – ISS FCOH SOP, Section 9.3, SPAN CHIT Processing, 05/24/04.

JSC-26843 – FCOH, Section 2.1, SPAN Operations, 03/01/05.

JSC-26843 – FCOH, Section 2.1.1, SPAN MISSION ACTION REQUEST (CHIT) PROCESSING, 03/01/05.

1EVA-HDBK-0001 – EVA MER & Bldg. 7 CORE Support Operations Handbook, 02/07/07.

3.9 ELECTRONIC FLIGHT NOTES

PURPOSE

To define procedures for EVA flight controllers to submit Flight Notes (FNs) and use the Electronic Flight Note (EFN) system.

DESCRIPTION

FNs are designed to provide official inquiries of the crew or to provide procedures and data for uplinking to the vehicle. The EFN system is used by NASA to submit official FNs during a mission. It is a PC-based system via the MCC Gateway for real-time operations: <https://ops1.jsc.nasa.gov/gateway/>. Refer to Section 3.6 for information on utilizing the gateway system.

PROCEDURE

The screenshot shows the EFN Electronic Flight Notes interface. At the top, there are navigation tabs for NASA, JSC, MOD, and MSFC. Below that are various system tabs: Tools, Planning, Systems, Trajectory, Engineering, References, GoTo STS, and Gateway. The main header area includes 'Anomalies', 'Chits', 'EFN', 'IMGO', 'IMS Search', 'IPV', 'JEDI', 'OSTPV', 'PPCR', and 'Tool Cmnts'. The title bar reads 'ISSMER-L&M-BDICK EFN Electronic Flight Notes ISS Increment 10'. Below the title bar are controls for 'Auto Refresh', 'Search', 'Restore Defaults', 'Settings', and a help icon. There are also dropdown menus for 'Type' (Flight Note), 'Status' (- ALL -), 'DspIn' (- ALL -), 'View' (Last 14 days), and 'Items/Pg' (50). Checkboxes for 'ISS', 'GMT', 'STS', and 'MET' are visible. Below these controls is a table with columns: PENDING, APPROVED, DAY SUM, EXEC PKG, INFO, and ALL. The table contains three rows of flight notes:

	EFN #	DISCIPLINE	SUBJECT	STATUS	GMT INPUT	GMT REQ'D
<input checked="" type="checkbox"/>	F005019	OPSPLAN	FCT Review of R_075_WED_16MARD05	Open	068/22:24	068/23:24
<input type="checkbox"/>	F005011B	PHALCON	R/T SODF CR for Warning Book PVTCS Procedures - part 2 of 2	Open	068/22:19	068/22:49
<input type="checkbox"/>	F005010B	PHALCON	R/T SODF CR for Warning Book PVTCS Procedures - part 1 of 2	Open	068/22:19	068/22:49

A listing of all the FNs that have been submitted for that particular flight fills the primary display. Both the ISS and shuttle partitions have separate FN systems to document all correspondence for a particular mission. This listing shows the FN number, the console position that submitted the FN, subject (title), status, time of input, and action required by time.

An FN can be used to alter procedures, document status reports from the FCT, disseminate information among the flight control community, and update summaries to send to the crew. FNs are used to add words to the daily summary/execute package for the crew concerning EVA operations and related questions and answers.

FNs can be used for JEDI messages, real-time flight rule CRs, real-time ODF/FDF changes, Tracking and Data Relay Satellite (TDRS) management, summaries of program boards, general plan information and consumables, and stowage status. FNs are not used to request changes, additions, or deletions to the timeline except for some

joint mission operations, as defined in the FCOH. ISS timeline changes are implemented via a Planning Period Change Request (PPCR).

FNs serve as written records of actions taken by the FCT. There are three types of flight notes: flight, internal, and working.

Working Note

A working note can be seen only by other users within a group. These notes should be written first to coordinate revisions within a team prior to involving other groups.

Internal Note

Internal notes can be seen by those disciplines the author selects when writing the note. These notes should be used to precoordinate with other disciplines before promoting a note to flight note status.

Flight Note

An FN can be seen by anyone with access to the EFN system. This level is managed by the FD.

The status of the note can be open, approved, info-only, incorp, closed, or withdrawn. "Open" indicates an action to be accomplished; "closed" indicates the action is complete; and "withdrawn" indicates the action is no longer required. FNs are ultimately dispositioned by the FD.

ELECTRONIC FLIGHT NOTE SYSTEM

The EFN system is color coded. Refer to the "Legend" button in the upper right section of the EFN system layout. Active notes are not highlighted. Once the note is approved or inactive, it has a designated color. Safety Issues and "info only" notes are also highlighted. Action states change color when they are due (yellow) or late (red).

TO VIEW A FLIGHT NOTE

1. Bring up MCC Gateway Web site; select the "EFN" button on the MCC-H navigation frame toolbar.
2. Find the note of interest using search or sorting functions. (You may sort by discipline, type, or status.) Click on "EFN #."

- A new window, **MCC Flight Note**, appears. The following is an EVA flight note:

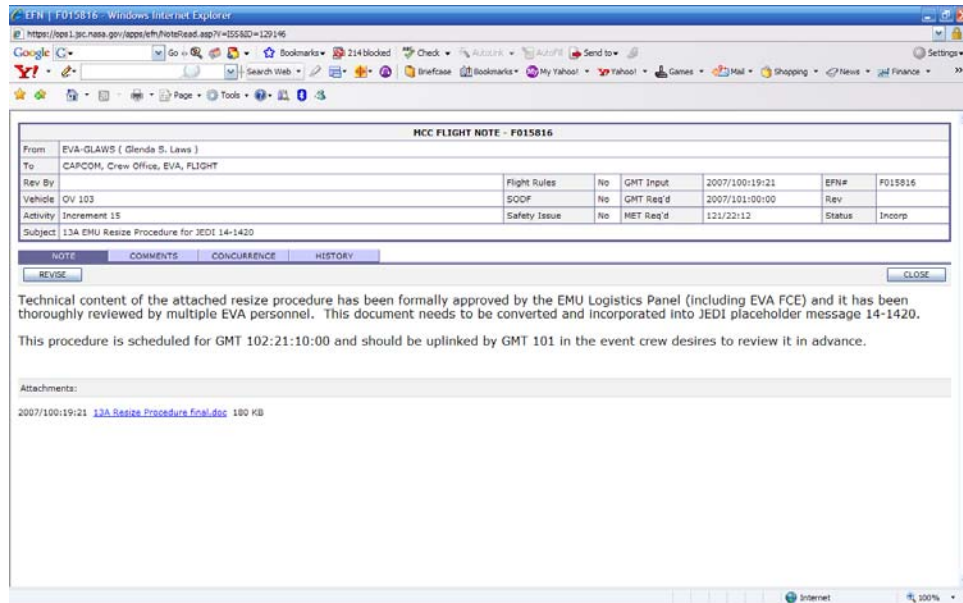


Figure 3.9-1. EVA Flight Note (Example)

TO CREATE A NEW FLIGHT NOTE

- Click "NEW NOTE" button.
- The following initial input screen appears:

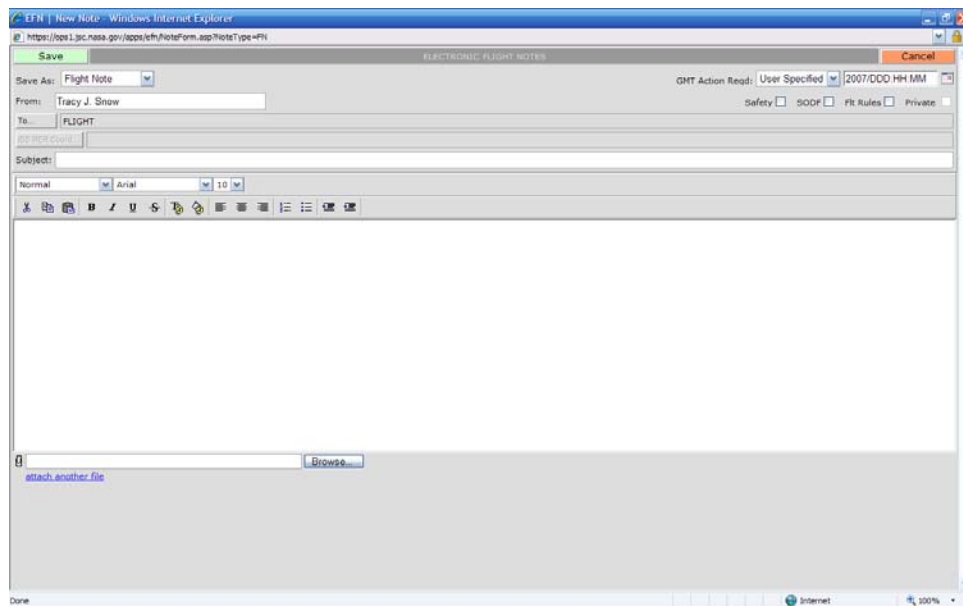


Figure 3.9-2. Initial input screen for flight notes

3. Enter a descriptive title of the FN in the "Subject" window box. (This is important for performing a search.)
4. Select position(s) to receive the FN by clicking on an individual's title under the "TO" window box. A "Select Recipients" window appears and allows the selection of multiple recipients. Use the Ctrl Key to choose multiple disciplines. The Recipients should then be automatically shown in the "TO" field.
5. Select an "Action Required By" time. Choose the closest of the times listed on the pulldown menu. The actual required time can be entered as "user specified" in the adjacent window.
6. Select the affected documentation: Safety SODF Flt Rules Private
7. Place the cursor in the text box, and enter the appropriate text for the FN.
8. Use the "browse" button to add attachments.

Note: Large attachments may cause problems when saving the note. If required, you can ask the ODF to create a PDF of the existing file, and put the file in an OCA message. Many EVA notes contain large files and require this route.

9. When completed, click the "Save as" pulldown menu to select "Flight Note," "Internal Note," or "Working Note." Then, click "SAVE."

The working note save option is used by front and backroom positions until the FN is ready to send to other disciplines. When an FN is saved as a working note, it is named W#####, where ### is the number given the FN. When a note is saved as a flight note, it becomes an official flight note, named as F#####.

TO CHANGE A FLIGHT NOTE STATUS

Only the FD can update the status of an FN. Only the owner of an internal note should update the status of an internal note.

REVISE EXISTING NOTES

Most revisions should be done in the working note stage. If a different discipline revises a note in the internal note stage, the ownership of the note is transferred to the discipline that made the revision. EVA is an automatic recipient of the note since they originally submitted it. Later, if this is submitted as an FN, EVA should be the one to revise it to make it an FN so that Flight is aware of the original owners of the note. If the state of the station or shuttle changes in such a way that the contents of the note should be completely reevaluated, then the FD should withdraw the FN, and the FCT should once again coordinate the contents of the note among the working note and internal note stages.

ADDITIONAL INFORMATION

- *Additions can be made to the "TO" field without revising the Flight Note. Deletions will continue to require a revision.*
- *SPAN will now have the capability to change the status of a Flight Note, but only with Flight Director approval.*
- *The following status fields will be added: In MER/IMC Review, In translation, and In IP Review. Once a Flight Note is put into one of these three statuses, all other users will be locked out. These three new statuses were added as part of the R/T Flight Rule CR process (which is still in development), but these new statuses can now be used.*
- *Added R/T Flight Rules indicator to note input form.*
- *Added filter to display only notes flagged as R/T Flight Rules CR.*
- *Added timestamp to attachment list to help with version identification.*
- *Current note status is retained when note is revised.*
- *Added modify GMT Action Required without revision.*

WRITING A NEW PROCEDURE IN REAL TIME

Whether the technical content of the procedure originates from the EVA or the MER, the draft SODF-formatted procedure must receive concurrence via the CHIT process. Refer to SCP, Section 3.8, for information on the CHIT process.

Once the procedure is agreed upon with the MER (via CHIT), the EVA console team reviews it through a working note in the EFN system. Most EVA procedures are written preflight to cover foreseeable situations, allowing time for fit-checks and procedure validation. However, it is not possible to write procedures to cover every possible situation that may occur. For this reason, procedures may be written or modified during real-time operations. Once the new procedure is drafted, the EVA console team reviews it through a working note in the flight note system. For details, reference SOP, Section 2.7 in the ISS FCOH, Real time Operations Data File Change Process.

A summary of the process is as follows:

1. Complete the FN
 - (a) Save as internal note to get concurrence from appropriate FCT disciplines.
 - (b) Save the working note as an FN for the FD to approve it.
 - (c) Once the procedure is approved, request ODF to create an OCA message.

- (d) Review the OCA message to ensure that the technical content is correct, and inform the FD that you concur with the message.
2. Submit an SODF Change Request if there is a permanent change

If the deltas to the procedure are to correct the procedure for the current event and all future events, then the SODF CR is required. Follow this process to submit the CR:
 - (a) Select the SODF CR workflow link at the top of the SODF Web page.
 - (b) Record the name of the FCT members that reviewed the FN and what level of review/validation it was put through (e.g., crewmembers that performed the assessment, facilities involved, etc.).
 - (c) Attach the approved FN or the final approved procedure to the CR.
 - (d) Do not select any internal reviewer for the CR; just submit the CR into workflow.
 3. For items requiring an SODF CR, be sure to inform your local File Manager (FM) and Book Manager (BM) that you have submitted the CR.

WRITING A FLIGHT RULE CHANGE IN REAL TIME

For a complete description of the Flight Rule form and change process, see the OIP, Generic, SSP-50643, Section 5.1. When a Real-Time Flight Rule Change is needed, MOD drafts an FN for review. This process is referred to as the Real-Time Flight Rule Change Request (RT FRCR) process. During the iterative review process, only the initiator/MCC-H FD or their designees are allowed to revise the FN. When the FCT has completed its review, then the FN changes its state for MER/IMC review. SPAN coordinates with ISS Management Center (IMC) for an FN review. The FN can be closed after the FN has been reviewed at the ISS Mission Management Team (IMMT). For further information, reference the Station Ops FCOH, Section 2.6. Shuttle-related information is referenced in Shuttle Ops FCOH SOP, Section 1.2.1.

MPSR Only

If the FCR is unavailable (press conference, etc.), or under circumstances in which the MPSR is the only console position, the MPSR position can submit the FN, as long as they have previous FCR concurrence.

REFERENCES

IMCOH, ULF1.1, Rev. K, 5/2006

OSO Console Handbook, Volume 1, Rev. H, 7/2006.

JSC-29229, ISS FCOH, Section 2.1.1, Electronic Flight Note (11/30/00 – content not procedure), document last updated 1/31/2007.

JSC-29229, ISS FCOH, Section 2.6, Real time Flight Rule Changes, 6/26/06.

JSC-26843, FCOH SOP, Section 1.2.1, Real time Flight Rule Changes, 6/29/06.

JSC-29229, ISS FCOH, Section 2.40, Flight Note, Anomaly Report, and CHIT Communications, 6/26/06.

Point of contact for Additional Information section: [SPAN Manager Dan Bahadorani](#).

3.10 EVA PHOTO DATABASE

PURPOSE

To define procedures for using the EVA Photo Database while on console.

DESCRIPTION

The EVA Photo Database contains pictures of EVA-related hardware, such as EMU components, ancillary equipment, orbiter interfaces, Simplified Aid For EVA Rescue (SAFER) components, and ISS segments and interfaces. The database is keyword-searchable for quick recall of relevant pictures. It resides on the EVA MPSR computer and is accessible from PCs with access to JSC-EVA-MPSR and the MOD Server Menu.

PROCEDURE

TO SEARCH THE PHOTO DATABASE

1. Open ThumbsPlus from the Windows Start Menu.
Start\MOD Server Menu\Applications\Utilities\ThumbsPlus3
2. Verify that the title of the open window is EMU.tDB.
3. If the title of the open window is not EMU.tDB, perform the following:
 - (a) Choose File\Open Database... from the menu bar. The database is located at \\JSC-EVA-MPSR\Share\EVA Photo DB\EMU.tDB.
4. To search the database by keywords, choose "Picture\Find by keywords..." from the menu bar. The following dialog box appears:

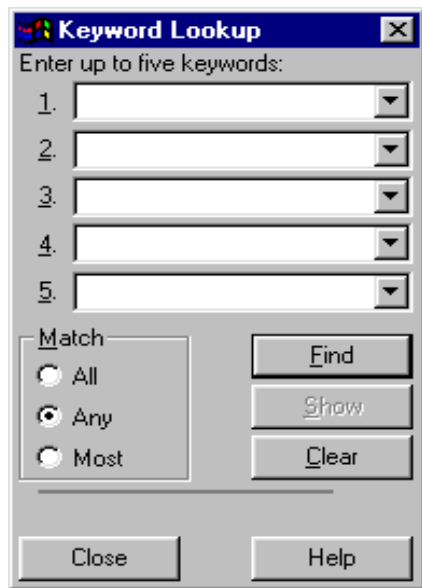


Figure 3.10-1. Keyword Lookup screen

5. Choose up to five keywords from the pull-down menus.
6. Choose the type of search. Choosing “All” returns pictures that have all of the keywords (functional AND). Choosing “Any” returns pictures that have at least one of the keywords (functional OR). Choosing “Most” returns pictures that have more than 50 percent of the keywords searched for (e.g., 3 of 4, 4 of 7).
7. Click on “Find.” The number of hits will appear under the “Clear” button.
8. To see thumbnails of the pictures that match the search criteria, click “Show.”

Note: The *Keyword Lookup* dialog box must be left open while viewing the search results. Closing the *Keyword Lookup* dialog box causes the search result thumbnails to disappear and redisplay the thumbnails from the most recently opened folder.

9. To view a large version of a picture, double-click on the thumbnail.
10. To see the keyword list for a picture, or the time and location in which the picture was taken, click on the corresponding thumbnail to select it and choose “Picture\Properties” from the menu bar.

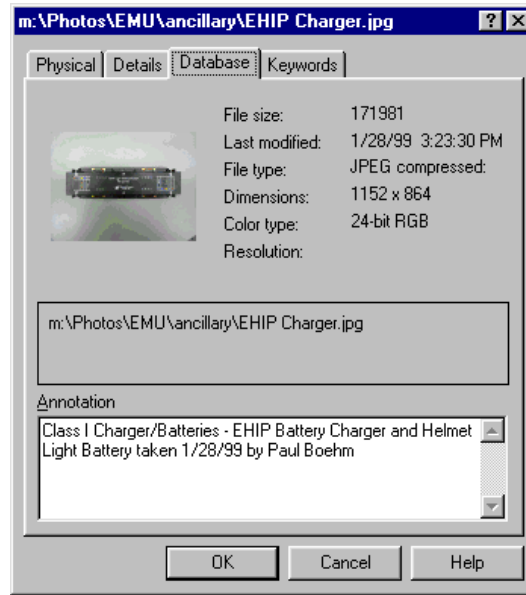


Figure 3.10-2. Keyword list Database tab



Figure 3.10-3. Keyword list Keywords tab

ADD TO THE PHOTO DATABASE

1. Verify that the pictures have been appropriately named. Filenames in ThumbsPlus are not restricted to 8 characters and may contain spaces.
2. Open the \\JSC-EVA-MPSR\Share\Photos\Drop Box folder.
3. Each person in the EVA group has a Drop Box folder. Copy the photos to the appropriate Drop Box folder.

4. Verify that \\JSC-EVA-MPSR\Share is mapped to a drive on the computer.
5. If \\JSC-EVA-MPSR\Share is not mapped to a drive on the computer, perform the following:
 - (a) Map it from the Windows Start menu by choosing "Start\Programs\Windows Explorer."
 - (b) In Explorer, choose Tools\Map Network Drive.... Choose an unused drive letter from the pull-down menu and type \\JSC-EVA-MPSR\Share in Path.
6. Open ThumbsPlus from the Windows Start Menu.
Start\MOD Server Menu\Applications\Utilities\ThumbsPlus3
7. Verify that the title of the open window is EMU.tDB
8. If the title of the open window is not EMU.tDB, perform the following:
Choose File\Open Database... from the menu bar. The database is located at \\JSC-EVA-MPSR\Share\EVA Photo DB\EMU.tDB
9. Click on the folder into which the new pictures were placed. Folders are displayed on the left side of the ThumbsPlus window.
10. Choose Thumbnail\Update All from the menu bar to build the thumbnails for the pictures.
11. Click on thumbnails to select them.
12. Open the keyword dialog box by choosing "Picture\Assign keywords." Choose keywords from the pull-down menu. If the desired keyword is not in the list, type it and press "OK." That will assign it to the picture and add it to the keyword list.

Note: Use the following guidelines to assign keywords: acronym, full name, item number, location (e.g., equipment lock, AW18H), function, system (e.g., LSS), subsystem (e.g., feedwater circuit).
13. Open the properties dialog box by choosing Picture\Properties from the menu bar. Under the Database tab in the Annotation box, type the name of the person responsible for the photo, the location, and the date.
14. Repeat Steps 11 to 13 until all of the pictures have keywords and are annotated.
15. Contact the database administrator to have the pictures moved from the drop box folder to the appropriate subject-organized database folder. The current database administrator is Ed Tom, edward.tom1@jsc.nasa.gov.

3.11 EVA MPSR AUDIO/VIDEO

TBD

4.1 CONSOLE MANNING GUIDELINES

PURPOSE

To define the required console support for EVA operators for mission operations.

PROCEDURE

The following is a list of console manning requirements for a flight having a nominal scheduled EVA:

- A. The lead FCR should consult with the FD prior to the mission on whether console manning for the 10.2 PSI CABIN procedure is required.
- B. Full-flight manning will start at least one shift prior to the scheduled A/L Prep shift for a nominal flight. For flights where the A/L Prep procedures are performed toward the end of the mission, it may be prudent for the lead FCR to sit in on at least one AFD conference to get a feel for how the mission is proceeding. Also, flight support may be required earlier for unplanned FNs, Flight Plan deltas, etc., on an as-needed basis. Refer to Section 3.1, On-call and Shift Change Personnel, for procedures on contacting the required personnel for unplanned situations.
- C. Once the Planning B team is on console for A/L Prep, the EVA FCR console will continue to be manned through the Post EVA Entry Prep (PEEP) procedure.
- D. For flights where there are more than 24 hours between EMU Checkout and the next EVA-related activity, FCR support will be required at a minimum, and continued MPSR support requirements will be determined by the FCR. MPSR personnel are still encouraged to support as time permits to get more on-console experience. The full-up MPSR team will be required one shift prior to the next EVA-related activity.
- E. Post-EVA, a minimum of FCR support will be required through PEEP, and continued MPSR support requirements will be determined by the FCR. Again, MPSR support is still encouraged.
- F. For periods of time where the FCR console is supported and there are few EVA issues, a list of "section working needs" will be provided. This list will be developed at the premission tag-up by the console operators assigned to the flight; e.g., workarounds document, Flight Note database, etc.
- G. Exceptions to this manning philosophy must be coordinated with and approved by the DX32 group lead and lead FD.

4.2 HANDOVER CHECKLIST AND GUIDELINES

PURPOSE

This section discusses the Handover Checklist form (Figure 4.2-1) and provides guidelines for filling it out.

DESCRIPTION

The purpose of the Handover Checklist is to provide the EVA flight controller with a standard list of items that may have had EVA impacts during the current shift and would be of concern to the oncoming flight controllers. The checklist ensures that all relative events are documented in a concise manner and that nothing is lost during the handover to the next shift.

PROCEDURE

A blank electronic version of the Handover Checklist is maintained on the C: drive of the local PC under a folder labeled "Handover Checklist." The console operator has the option of filling out the checklist electronically or printing out a copy and providing handwritten input.

GUIDELINES

1. The handover checklist is completed by the outgoing flight controller before the oncoming shift arrives.
2. After the oncoming FC has reviewed the checklist, it is placed in the console log binder after the last completed console log page.

HANDOVER MISSION ELAPSED TIME

This entry is the Mission Elapsed Time (MET) when the handover begins.

1. Big Picture

This section contains an overall summary of the major events of the shift. For instance, ISS Rendezvous, EVA 1, or EMU Checkout.

2. System Status

This section contains the current status, any anomalies, and any system changes that occurred during the shift. The Problem/Failure column contains a short description of the anomaly (e.g., ESS 1BC bus loss). The Impact/Workaround column contains a description of how the problem affects EVA (e.g., EMU 2 Sply H2O Vlv Cntl failed/Use SCU1 for water servicing). The Info Only column is for status information that is not failure related (e.g., EMUs temp stowed in middeck for transfer ops).

3. EVA Status

This section contains a detailed description of all EVA-specific events that occurred during the shift. Specifically, the items that were scheduled in that day's Execute Package that were completed go under "Timeline Events Completed." A brief overview of the scheduled EVA events that were not completed is placed under "Timeline Events Not Completed." The items that were not completed are discussed in detail in Section 4 of the form, "Open Work for Next Team."

4. Open Work for Next Team

This section contains a prioritized list of items that should be continued or completed by the oncoming team.

5. Execute Package

This section contains any items that need to be added to the upcoming Execute Package and the time deadline when these inputs are required. Also, any decisions that the offgoing FCT makes on EVA-related issues that need to be included in the upcoming Execute Package are listed in this section.

HANDOVER CHECKLIST

Handover FROM/TO: Execute / Planning A _____

 Planning A / Planning B _____

 Planning B / Execute _____

Handover MET: ___/___:___:___

1. Big Picture:

2. System Status: Problem/Failure Impact/Workaround Info Only

Orbiter:

Station:

Airlock:

EMU:

Payload:

Tools:

Figure 4.2-1. Handover Checklist form

3. EVA Status:

Timeline events completed:

Timeline events not completed: (ref. Open Work for Next Team)

4. Open Work for Next Team: (Prioritize)

Replanning:

Figure 4.2-1. Handover Checklist form (continued)

4. Open Work for Next Team cont:

Open issues: (MET of required resolution)

Open paper: (Msg. in work, CHITS, Flight Rules, Anomaly Reports, DRs,
FIWs, Flight Notes)

5. Execute Package: (circle one)

INPUTS Due: ___/___:___:___
REVIEW

(List EVA inputs and related
items in Execute Package)

Figure 4.2-1. Handover Checklist form (concluded)

4.3 TBD

4.4 FACILITY/HARDWARE CALLUP PROCEDURE

PURPOSE

This section defines the procedure for callup of EVA hardware for real-time console support and for callup of facilities for EVA replanning.

PROCEDURE

The following is the procedure for callup of hardware for real-time console support via the SPAN manager:

1. A CHIT is written and submitted to the MER requesting EVA hardware for mission support. Specifically, the CHIT should contain
 - (a) What hardware is required (including serial numbers when applicable)
 - (b) When the hardware is needed on console (MET/GMT)
 - (c) Who manages the hardware (Boeing, CTSD, Lockheed, PGs, etc.) and a phone number for a contact person
 - (d) Where the hardware is located (building 7, FEPC, etc.)
2. The MER works delivery of the hardware and notifies the originator of the CHIT when the hardware is available.
3. Return of the hardware to its manager consists of EVA console personnel notifying the MER via the SPAN manager that use of the hardware is complete. The CHIT that was used for request of the hardware is referenced, and the MER notifies the hardware manager to pick up the equipment.

The following is the procedure for callup of facilities for EVA replanning during shuttle missions or station increments:

1. A CHIT is written and submitted to the MER via the SPAN manager to request callup of a facility for EVA testing and replanning for mission support. Specifically, the CHIT should contain
 - (a) Which facility is required (NBL; building 9, FFT; building 9, PABF; building 7, Vacuum Chamber, etc.)
 - (b) When the facility test is needed (MET/GMT)
 - (c) Who manages the facility for testing and a phone number for a contact person

- (d) What mockups and hardware are required for the test
 - (e) A brief list of what specifically is to be tested or verified
2. The MER works the callup of the facility and notifies the originator of the CHIT when the facility is available.
 3. Once the facility has initiated its own personnel callup, specifics of the test may be worked out between Team 4 and the individual facility manager or test director.

4.5 REAL-TIME SAFETY ASSESSMENT

PURPOSE

This section provides instruction on how to accomplish a real-time safety assessment for EVA tasks that were not developed preflight and, therefore, were not evaluated by the standard EVA safety process.

DESCRIPTION

This procedure was first documented in IL DF4/91-43, dated November 4, 1991.

Unscheduled or contingency EVA operations developed during real-time flight operations are screened using the hazard list below, and the lead EVA FCR officer informs the FD of any concerns identified prior to performing the EVA operation. In addition to the following list, the new EVA tasks are reviewed with respect to any rapid safing requirement that applies to the mission.

LOSS OF HABITABLE ENVIRONMENT IN ORBITER CABIN

1. Excessive equipment in the A/L presents a hazard to cabin pressure integrity.

There is the potential for equipment that is inadequately restrained in the A/L to become uncontrolled. The free equipment may result in damage to the A/L walls or controls and/or cause a malfunction.

2. Contamination caused by hardware removed from the orbiter payload bay or the payload during EVA presents a hazard to the crew when brought into the orbiter cabin.

There is the potential for contamination to be introduced into the orbiter air supply following A/L repress because of the introduction of foreign hardware into the cabin from the payload bay.

3. Orbiter/cargo elements vent/leak corrosive/toxic products that contaminate the EMU and jeopardize crew health if returned to the cabin to contaminate the crew atmosphere.

There is the potential for contamination to be introduced into the orbiter air supply from the EMU following A/L repress. During the course of the EVA, the EMU may have become contaminated by a toxic product (e.g., hydrazine) from either the payload or the orbiter, as identified in the section on Externally Induced Hazards.

PHYSIOLOGICAL EVA HAZARDS

1. Excessive workload and/or task complexity causes fatigue, which could present a hazard to the EVA crewmember or the orbiter.

This hazard is addressed in two parts, excessive overall workload for the duration of the EVA and excessive workload or complexity of a specific task within the EVA. Both causes increase risk because of fatigue of either the EVA crewmember or the inability to complete a task. A fatigued crewmember is more prone to errors, and an incomplete task may preclude proper stowage of equipment for landing.

EVA COLLISION/RELEASE HAZARDS

1. Detached or inadequately restrained equipment collides with an EVA crewmember or the orbiter.

There is the potential for equipment that is inadequately restrained to become uncontrolled and/or free floating in the vicinity of an EVA crewmember. As a result, the free equipment may collide with the crewmember, causing damage to the EMU. There is also the potential for EVA equipment to become uncontrollable while still tethered to the EVA crewmember or the orbiter. Impact with the EVA crewmember may occur as a result of this uncontrolled motion, causing damage to the EMU. Uncontrolled equipment can also pose a hazard to critical payload or orbiter hardware elements.

2. EVA crewmember floats away from or collides with the orbiter or cargo elements because of inadequate restraints.

There is the potential for the EVA crewmember's motion to become uncontrolled while still properly tethered. Collision with the orbiter or payload in this situation could also cause damage to the EMU. There is also the potential for the EVA crewmember to collide with the payload or orbiter during translation because of inadequate translation path clearances. Collision of this type may cause damage to the EMU.

3. Inadvertent EVA crewmember release of hardware during EVA operations.

There is the potential for free floating or jettisoned EVA equipment to recontact the orbiter either upon its release or at some point later in the mission, causing damage to or loss of the orbiter.

STORED ENERGY HAZARDS

1. Release of stored energy from a payload device or EVA tool presents a hazard to the EVA crewmember.

Release of stored energy from a payload device or tool as it is being operated by an EVA crewmember could cause the payload hardware or tool to impact the EMU or the orbiter, resulting in damage or injury.

2. EVA crewmember handling of large masses with excessive rotation presents a hazard to the EVA crewmember.

There is the potential for injury to an EVA crewmember or damage to the EMU because of the inability to properly control the momentum of a large mass/volume or a mass with excessive rates during EVA handling.

EXTERNALLY INDUCED HAZARDS

1. Exposure to excessive nonionizing radiation from the combined cargo elements presents a hazard to the EVA crewmembers.
2. Exposure to excessive ionizing radiation from the combined cargo elements presents a hazard to the EVA crewmembers.
3. The orbiter/cargo elements vent/leak corrosive products, which jeopardize the EMU pressure integrity during EVA.
4. Hot gasses from an orbiter thruster or an Auxiliary Power Unit (APU) exhaust present a hazard to the EVA crewmembers.
5. Sharp edges, pinch points, or abrasion from adjacent cargo elements and EVA translation paths create hazards to the EVA crewmembers while performing EVA on an individual cargo element.
6. Entrapment of EVA crewmembers between cargo elements or large equipment items presents a hazard to the EVA crewmembers.
7. Excessive high or low temperatures of the payload bay or cargo elements presents a hazard to the EVA crewmembers.
8. The payload bay door radiators focus solar radiation, which exceeds the EMU thermal limits during EVA and presents a hazard to the EVA crewmembers.
9. Location of EVA crewmember precludes rapid return to A/L, presenting a hazard to the EVA crewmembers.
10. Premature or inadvertent cargo element operations create a hazard to the EVA crewmembers.

NONPHYSIOLOGICAL TASK COMPLETION HAZARDS

1. Inadequate or incompatible procedures, EVA interfaces, EVA tools, and/or training.
2. EVA crewmember-induced loads on EVA hardware during EVA exceed the loads for which the item was designed and certified.

There is the potential for the EVA crewmember to be established at the worksite and determine that the flight hardware is different from what they had expected (based on premission planning). As a result, it may be impossible for the crewmember to perform and/or complete the proposed task. There is the potential that the EVA tools available to support a task do not fit their intended interface or are inadequately designed. As a result, it may not be possible for the EVA crewmember to perform and/or complete the proposed task. There is also the potential for the EVA crewmember to be unable to perform and/or complete a proposed task because of inadequate or insufficient training. There is the potential for the EVA crewmember to exceed the design/certification loads of EVA hardware.

4.6 EMU LOGISTICS TRACKING DATABASE

PURPOSE

Due to the nature of ISS operations, a MOD will be required to track and capture additional data related to limited life and cycles on EVA hardware. The majority of the suit components are tracked by United Space Alliance Flight Crew Equipment (USA FCE), but the MOD will need to report the on-orbit operations to the USA FCE to accurately track the limited life.

The Logistics Tracking database is a workbook of EXCEL spreadsheets that are used to track the use of EMU components, their configuration onboard ISS, and required EMU support equipment. This database is a Mission Control console reference product under configuration control. It is not, however, the controlling document related to on-orbit stowage of EMU components. Please refer to the Inventory Management System (IMS) database for official stowage locations. The EMU EVA Support Equipment List (ESEL) can be found on the EVA Office (XA) Homepage.

For detailed information regarding requirements and constraints, refer to EMU On-Orbit Operation, Maintenance, Testing, Storage, and Tracking Requirements and Constraints (FEMU-R-003) and/or flight rules.

PROCEDURE

The spreadsheet should be updated and saved as events/activities occur.

This spreadsheet will be located on the V: drive in the following directory:

<\\jsc-mas-is1\Private\EVA\Generic Systems Items\Flight Support\Logistics Tracking Database\Logistics Tracking.xls>

The Increment and/or Flight EMU leads responsibilities are to verify flight equipment meets limited life requirements per FEMU-R-003, On-Orbit Operation, Maintenance, Testing, Storage, and Tracking Requirements and Constraints, prior to conducting an EVA.

EMU Logistics Tracking Database Item Tabs

The workbook can be navigated by selecting the various item tabs. The following sections are available: EMU PLSS, Metal Oxide (Metox), EMU Batteries, Quantity Tracking, Rechargeable EVA Battery Assembly (REBA), HL, Pistol Grip Tool (PGT), SAFER, PWR&UIA, Dump CWCs, and Airlock Cooling Loop Recovery (ALCLR).

EMU PLSS

This spreadsheet is used to help track the on-orbit certification life of the Primary Life Support System (PLSS) and the Secondary Oxygen Pack (SOP) oxygen.

EMU checkouts must be performed as defined in EMU/ISS Joint Airlock Functional Checkout Requirements flight rule and in FEMU-R-003, On-Orbit Operation, Maintenance, Testing, Storage, and Tracking Requirements and Constraints. The EMU

water tank dump/fill requirements are also defined in FEMU-R-003, On-Orbit Operation, Maintenance, Testing, Storage, and Tracking Requirements and Constraints.

Data to Capture

Capture data to determine what maintenance, if any, is required.

SOP Usage

Maintain a historical record of SOP Pressures vs. ambient temperature per PLSS which could be used to predict on-orbit life expectancy by documenting SOP leakage rates.

Serial #	3018	Event Code or # of EVAs	Location	On-Orbit	Estimated SOP Temp	Slope of P/T Ratio	Known "Features"
Barcode #							
Event	Event Date		SOP P				
Grnd Processing		= Start of On-orbit Cert. Life					BSEER s/n 1011 ID = pri 30 / alt 167 aCWS ID 015
12A.1 V1103	11/02/06		6190	70			
12A.1 C/O (STS)	12/10/06	c/o	6178	67			
12A.1 EVA 1	12/12/06	1	6294	73			-had several DCM display lockups during SSATA chamber run
12A.1 EVA 2	12/14/06	1	6285	72			
12A.1 EVA 3	12/16/06	1	6307				
Post 12A.1 ScrJb	12/22/06	alclr	6253	66			
Pre US EVA 6	01/23/07		6234	71			
H2O Rchrg	02/02/07		6258	76			
Pre US EVA 7	02/04/07		6200	71			
Post EVA 7 H2O	02/05/07		6238	74			
Post EVA 8 H2O	02/09/07		6260	76			
ALCLR Post EVA	02/16/07	ALCLR	6243	80			
<i>Unhide rows above as required</i>							
Time Since Last Ops Verification (Days):						82	
Time Left in On-orbit Cert Life (Days):						-38842	
EVAs Left until H2O Dump Req'd (EVAs):						9	

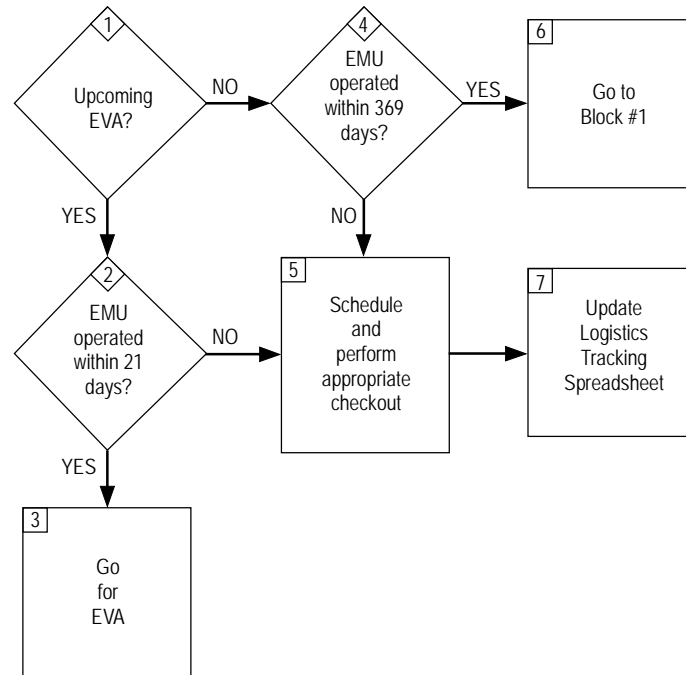
Figure 4.6-1. EMU PLSS

Field	Description
Serial #	Serial number of the Hard Upper Torso (HUT) associated with the PLSS.
Barcode	Barcode of the HUT if one is available.
Location	Drop-down menu. Choose On-Orbit or FCE/Ground. FCE/Ground will "grey out" the data to indicate that it is no longer active.

Field	Description
Size	Size of the HUT: Medium, Large, X-Large.
Event	Brief description of the activity. Record: V1103, Checkouts, Interface Check, EVAs, H2O Drain/Fill. Include Flight/Increment and airlock information. This, along with the date, will determine necessary maintenance.
Event Date	Record date of activity to help determine necessary maintenance.
Event Code or # of EVAs	Abbreviated form of the event (e.g., c/o for checkout) or the final number of EVAs after a series of EVAs.
SOP P	Final SOP tank Pressure. Add a comment giving the initial pressure before an SOP checkout.
Estimated SOP	Use the Airlock Common Cabin Air Assembly (CCAA) Inlet T1 Temp in degrees F. Do not record SOP data if airlock and SOP temperatures are unlikely to be stable.
Slope of P/T Ratio Time Since Last Verification (Days)	Ratio of the SOP tank Pressure to SOP Temperature Calculated field-time elapsed in days between the current date and last checkout or EVA.
Time Left in On-Orbit Cert Life (Days)	Calculated field – How many days until we reach the end of life of the PLSS.
EVAs left until H2O Dump Req'd	Calculated field – How many times we can go EVA before we have to do a full dump/fill of the EMU water tanks.
Known "Features"	Any information that might be relevant to maintenance.

EMU PLSS Logistics Process

An EMU Checkout must be performed prior to an EVA if an EMU has not been operated (EVA or Checkout) within the last 21 days (reference FR B15-106, EMU/ISS JOINT AIRLOCK FUNCTIONAL CHECKOUT REQUIREMENTS). An EMU Midterm checkout must be performed within 369 days of the last EVA, midterm checkout, or ground-based Pre-Installation Acceptance (PIA) testing. Coordinate with the upcoming flight EMU lead or the Increment lead to schedule and perform the appropriate checkout (EMU Checkout or Midterm Checkout). Once the checkout is complete, update the Logistics Tracking Database spreadsheet. Refer to Figure 4.6-2, EMU checkout/midterm checkout process.

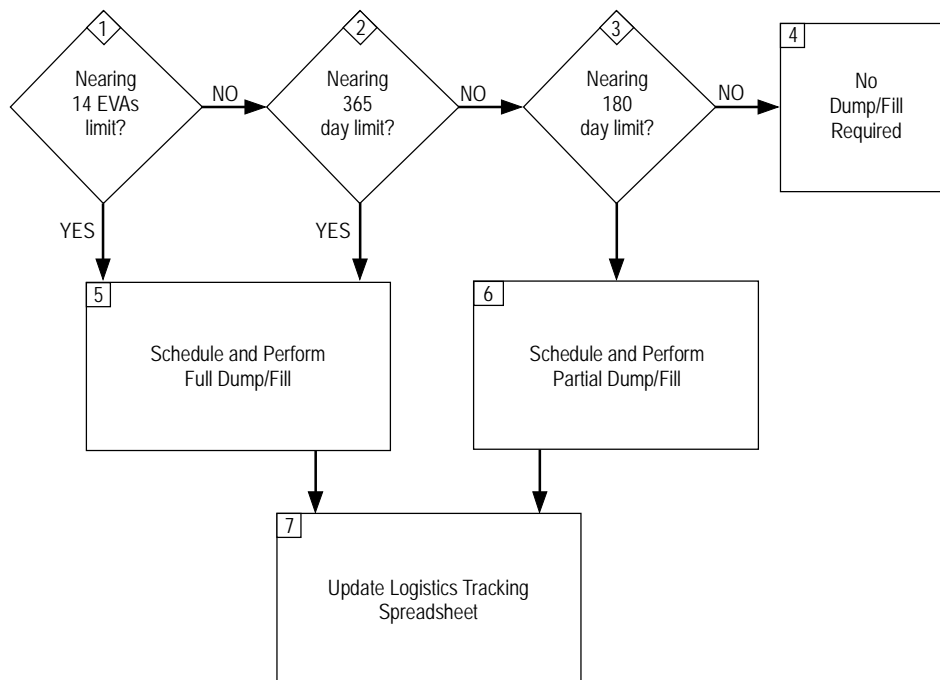


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Figure 4.6-2. EMU checkout/midterm checkout process

EMU Water Tank Maintenance

EMU water tanks must undergo a 4-lb minimum dump then fill if the EMU has not been used for an EVA or serviced within the last 180 days. Coordinate with the upcoming flight EMU lead or the Increment lead to schedule and perform the partial dump/fill. A complete dump/fill must be performed if it has been 365 days since the last full de-service (EVA with RESRV H2O message, ground charge, or full on-orbit de-service) or after 14 EVAs. Once the checkout is complete, update the Logistics Tracking Database spreadsheet. Refer to Figure 4.6-3, EMU water tank dump/fill process.



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Figure 4.6-3. EMU water tank dump/fill process

Metox

The Metox canister is installed in the EMU and used to scrub CO₂, odors, and trace contaminants during EVA operations. It may also be used to scrub CO₂ during Equipment Lock (E-Lk) operations when installed in the CO₂ Removal Receptacle, but is limited to a total of 16 man-hours when at 10.2 psia (16 hours for two crewmembers). The Metox may be left installed in the Short EMU (SEMU) for up to 369 days with minimal performance degradation (~3 percent).

Ground Processing in Red Book

Ground Charge Date *This is the date of the last regeneration prior to delivery for flight. This is obtained from the EVA Mission Evaluation Room (MER) via a CHIT prior to usage on ISS*

Ground Cycles *The number of discharge/regeneration cycles the canister went through on the ground during Acceptance Testing prior to delivery for flight. This is obtained from the EVA MER via a CHIT prior to usage on ISS*

Data to Capture

There are two items to track for Metox: O-ring cycle life (27 recharge cycles) and the canister life (55 recharge cycles); note that a Metox canister may have ground cycles on it prior to launching.

Bar Code #	007807J	Discharge Date	Discharge Amount %	Recharge Date
Serial #	0019	10/12/2002	50	
Ground Charge Date	1/1/1998	10/14/2002	50	10/22/2002
Ground Cycles	6	2/23/2003	50	
Cycle #	11	4/8/2003	50	5/8/2004
New O-ring ?		7/7/2006	50	8/11/2006
Canister Status	Regenerated	9/15/2006	100	9/16/2006
Location	ISS A/L stow	12/18/2006	100	12/19/2006
	1			

Figure 4.6-4. Metox

Field	Description
Bar Code	Bar Code of the Metox canister.
Serial #	Serial Number of the Metox canister.
Discharge Date	The date the canister was used regardless of whether it was used in the EMU or CO2 Removal Receptacle. Add a comment describing the event during which discharge took place.
Discharge Amount	The discharge amount relates to how the canister was used and for how long. Typically, EVA/Campout is considered 100 percent while exercise protocol is considered as 50 percent discharged.
Recharge Date	The date the canister was regenerated.
Ground Charge Date	This is the date of the last regeneration prior to delivery for flight. This is obtained from the EVA MER via a CHIT prior to usage on ISS.

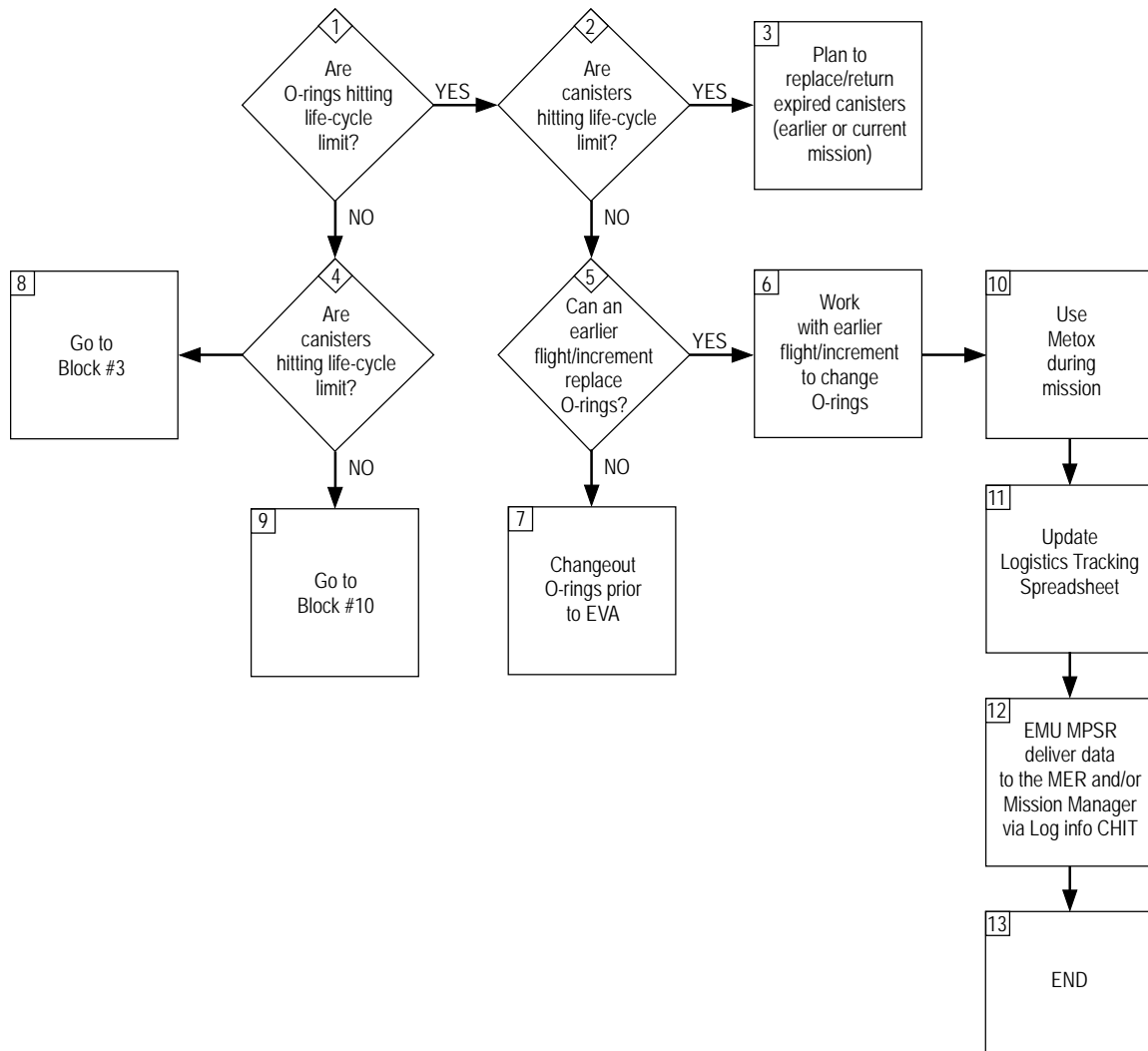
Field	Description
Ground Cycles	The number of discharge/regeneration cycles the canister went through on the ground during Acceptance Testing prior to delivery for flight. This is obtained from the EVA MER via a CHIT prior to usage on ISS.
Cycle Number	The total number of discharge/regeneration cycles on the canister.
New O-ring?	Date when O-rings replaced.
Canister Status Location	Regenerated or expended Drop down menu – Choose ISS A/L stow, FCE, Unknown. FCE/Ground will “grey out” the data to indicate that it is no longer active.

Metox Logistics Process

This process covers the preflight planning and the steps to take while on-console for Metox.

If an O-ring reaches its end-of-life cycle (27th discharge/regeneration cycle), both O-rings are changed at the same time to simplify cycle tracking. Coordinate with the upcoming flight EMU lead or the Increment lead to schedule and perform an O-ring change out prior to an EVA or prior to use in the CO2 Removal Receptacle. Once the O-ring change-out is complete, the EMU MPSR should update the Logistics Tracking Database spreadsheet.

Metox canisters should be regenerated before being used for an EVA. The Metox canisters can only undergo 55 discharge/regeneration cycles. If the Metox canister successfully completes the full 14-hour regeneration cycle with no indicated faults on the regenerator, the canister is considered regenerated regardless of the position of the state indicator. After 55 cycles, the Metox canister is considered expired and must be returned to the ground; it can no longer be used for any onboard operations. Coordinate with the upcoming flight EMU lead or the Increment lead to develop a return/replace plan.



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Figure 4.6-5. Metox process

EMU Batteries

EMU batteries are left on orbit for long-term use. MOD records the activities on these batteries. These activities include: discharge via an EVA or a discharge in the Battery Stowage Assembly (BSA), recharge, and top-offs. Ground cycle data should be available from the Flight Data Books (Red Books).

The Increased Capacity Battery (ICB) has a wet life of 425 days, and a limit of 32 charge/discharge cycles after the battery has been formed. The interim certification for the new cellophane EMU battery is limited to a wet life of 300 days and a cycle life of 12 cycles. The EMU batteries will be maintained as described in FEMU-R-003, On-Orbit Operation, Maintenance, Testing, Storage, and Tracking Requirements and Constraints.

Data to Capture

When a battery is used, the date of the discharge and the amp-hrs discharged are required. In addition, when the battery is recharged (or topped off), the date of the recharge and the amp-hrs charged are required.

Barcode#	EMUJ39J	Discharge Date	Discharge Event	To 16V?	Discharge Amount (Amp-Hrs)	Charge Date	Charge Amount (Amp-Hrs)	Charge Location
Serial #	2059	6/2/2006	Ground ULF1.1 EVA	Yes	42.75	6/3/2006	41.98	Ground ISS
Ground Cycles	0	7/8/2006	1 ULF1.1 EVA	No	25.84	7/9/2006	25.17	Portable
Cycle #	12	7/14/2006	3	No	24.66	7/24/2006	25.92	BSA
Top-off req'd after		8/3/2006	US EVA 5 Post US EVA	No	20.22	8/25/2006	37.57	BSA
85 Day Maint. Due	7/25/2007	8/5/2006	5	Yes	15.05	11/29/2006	33.86	BSA
Current Location		9/13/2006	115 EVA 2 Post 115 EVA2	No	24.43	12/5/2006	31.22	BSA
300 day wet life exp	3/15/2007	9/23/2006		Yes	11.43	12/21/2006	25.26	BSA
50 day Maint. Due	NA	12/1/2006	Maint Cycle	Yes	34.6	1/24/2007	28.83	BSA
		12/16/2006	116 EVA 3	No	25.92	2/2/2007	24.32	BSA
		12/21/2006	Maint Cycle	Yes	29.02	4/30/2007	27.15	Maint Cycle
		1/31/2007	US EVA 6	No	24.41			
		2/8/2007	US EVA 8	No	22.51			
		2/10/2007	BSA Dschrg	Yes	5.76			
		5/1/2007	Maint Cycle	Yes	26.72			

Figure 4.6-6. EMU Battery

Field	Description
Bar Code	IMS Bar Code of the battery.
Serial #	Serial Number of the battery.
Discharge Date	The date the battery was discharged regardless of location or amount.
Dschrg Event To 16V	Flight/Inc or activity during which discharge occurred. Was the battery discharged to 16V? Yes or No.
Discharge Amount (Amp-Hrs)	Discharging a battery can be accomplished in two ways. One is during an EVA – This value will come from the EMU Consumables spreadsheet when a battery is discharged during an EVA. The other way is to discharge a battery via the Battery Charger Assembly/Battery Stowage Assembly (BCA/BSA) using the software on the SSC. Add a comment describing how the discharge was accomplished and the time if that information is available.

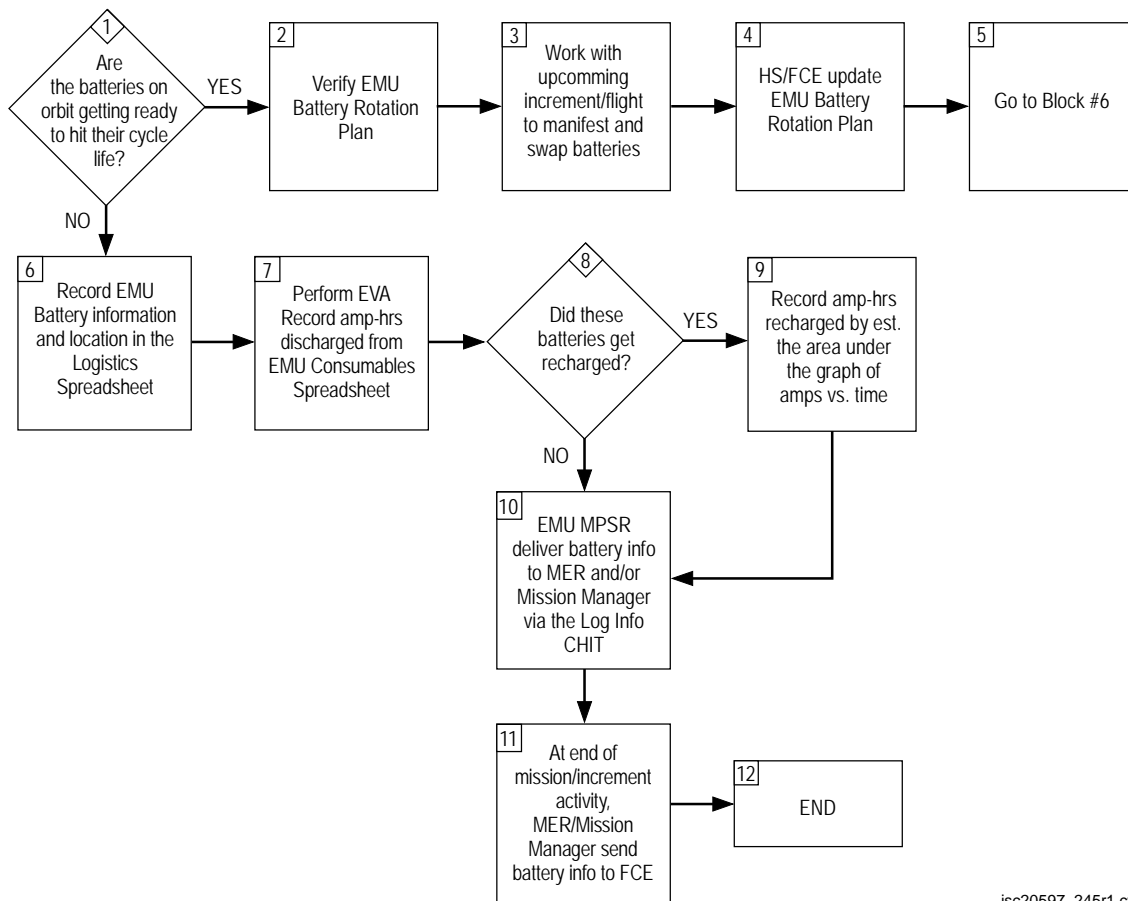
Field	Description
Charge Date	This is the date the battery was recharged. The ground charge date can be found in the Flight Data Book. Per USA FCE, this date reset both the 50-day and 85-day maintenance clock. This is used to calculate the 50- and 85-day clocks.
Charge Amount (Amp-Hrs)	The Recharge amount in amp-hrs is determined by estimating the area under the RTPLOT curve of UIA amps versus time during the recharge. The Umbilical Interface Assembly (UIA) data source is used since it has a more accurate amperage sensor.
Charge Location	Where the charge took place: ground, BSA, middeck battery charger on the orbiter (middeck), in-suit on the orbiter (orb in-suit), ISS EMU battery charger (ISS chrgr).
Ground Cycles	This allows the EMU MPSR to add any known ground cycles to the battery to correctly calculate "Cycle #." This data will have to be gathered from FCE and the Flight Data Book.
Cycle #	This calculation sums all the on-orbit recharge occurrences and adds the "Ground Cycles" that are manually entered in a separate field.
Top-off req'd after	This field was originally designed for inputting the expected date of a "top-off." If an EMU battery to be used in an upcoming EVA has been in a charged state for more than 50 days and the capacity is not sufficient to support the EVA, a topping charge should be performed.
85 Day Maint. Due	This date is determined by finding the most recent entry for Recharge Date and adding 85 days to that date.
Current Location	This is the current stowage location of the battery. If the battery is being brought back home, leave the historical charge/discharge information in the spreadsheet and put FCE as the location.
300 day wet life exp	Calculated field – It is 300 days after first activation.
50 Day Maint. Due	Calculated field – This date is determined by finding the most recent entry for Recharge Date that is above 2 amp-hours and adding 50 days to that date.

EMU Battery Logistics Process

This process covers the required steps for preflight planning and recording the discharge/recharge EMU Battery information during EVA activities. It does not include the maintenance cycle requirements; those are described in FEMU-R-003, On-orbit Operation, Maintenance, Testing, Storage, and Tracking Requirements and Constraints.

Record the discharge/charge information for each battery as the event occurs. Following an EVA, record amp-hr discharged from the EMU Consumables spreadsheet. If the batteries were recharged, record the amp-hrs recharged by estimating the area under the amps vs. time graph. Deliver this information to the EVA MER and/or Mission Manager via a Logistics Info Only CHIT or via e-mail. It is the responsibility of the MER/Mission Manager to ensure that this information is delivered to USA FCE.

If a battery is approaching its cycle limit, review the EMU Battery Rotation plan, and coordinate with an upcoming flight EMU lead or Increment lead to develop a plan to return/replace the affected batteries. Refer to Figure 4.6-7, Battery discharge/recharge recording process.



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Figure 4.6-7. Battery discharge/recharge recording process

Quantity Tracking

The summary sheet for Rechargeable EVA Battery (REBA), EVA Helmet Interchangeable Portable (EHIP) light or Helmet Light (HL), and Pistol Grip Tool (PGT) batteries is not automatically updated when new data is entered into the spreadsheet. Except for the "Quantity On-Orbit" and "Today is" fields, all inputs are done manually. Comments may be added to give a brief description of the associated event.

REBA/HL/PGT

The REBA/HL/PGT sheet (shown in Figure 4.6-8) contains information relating to each battery. They all use NiMH cells. It has been determined that these batteries will run out of shelf life before they run out of cycle life. Given that, it is not required to track the cycles now.

The PGT and EHIP or "HL" batteries have a shelf life of 5 years from date of manufacture. The batteries have a cycle limit of 250 cycles, but the shelf life will expire long before the cycle limit is reached. The EHIP charger will not cycle the batteries; only top them off. FCE/EVA tracks the cycles applied to each battery and there have been only approximately 50 cycles in 4 years. NiMH batteries will take a charge without having to cycle through a complete voltage drain. The shutoff voltage for the NiMH batteries is 1V per cell. That equates to 15V for the EHIP lights, and 30V for the PGT.

Data to Capture

Track the serial number, charge information and the activity for which they were used (discharged). Add a Comment for any information that might be relevant to the battery usage.

REBA s/n 1011 REBA1011J	CHARGE									DISCHARGE	
	Charge Location	REBA-30 CELL			REBA-10 CELL			REBA-10 CELL			
		Pre- Charge OCV	Total Charge Time	Post- Charge OCV	Pre- Charge OCV	Total Charge Time	Post- Charge OCV	Pre- Charge OCV	Total Charge Time		Post- Charge OCV
Date										Activity	
11/7/2005	BSA BC3 BSA BC4										US EVA 4
6/30/2006		n/a	1:18	n/a	12.8	1:22	n/a	12.8	1:31	n/a	
7/24/2006		39.7	0:37	n/a	13.3	0:38	n/a	13.3	0:38	n/a	
8/3/2006											US EVA 5

HL s/n 1015	CHARGE				DISCHARGE
	Charge Location	Pre- Charge OCV	Total Charge Time	Post- Charge OCV	
Date					
6/28/2006	BSA BC2 CH1	19.2	2:57	n/a	ULF1.1 EVA2
7/10/2006					
8/25/2006	BSA BC2 CH1	19.2	2:26	20.4	

PGT s/n 5013	CHARGE				DISCHARGE
	Charge Location	Pre- Charge OCV	Total Charge Time	Post- Charge OCV	
Date					
6/28/2006	BSA BC2 CH4	39.1	0:55	n/a	ULF1.1 EVA2
7/10/2006					
7/11/2006	BSA BC2 CH4	n/a	1:45	n/a	

Figure 4.6-8. REBA/HL/PGT

Field	Description
s/n	Serial number of the battery.
bar code	IMS bar code of the battery if available.
Date	The date the battery was charged/discharged.
Charge Location	Where the battery was charged. PGT and EHIP batteries may be charged in the BSA or using a standalone charger at the Power Supply Assembly (PSA) Utility Outlet. Include the details of the BSA location (Battery Charger (BC) and Channel). REBA batteries may be charged from the BSA Auxiliary Port or at the PSA Utility Outlet.
Pre-Charge OCV	This is the open circuit voltage of the battery prior to charging. This can be found in the serial data from the BCA.
Total Charge Time	This is the amount of time elapsed for charging the battery. This can be found in the serial data from the BCA.
Post-Charge OCV	This is the open circuit voltage of the battery after charging. This can be found in the serial data from the BCA.
Discharge Activity	Flight/Inc for which the battery was used.

REBA/HL/PGT Logistics Process

Determine which batteries are left on orbit. This data can be found on the On-Orbit EVA Support Equipment List (ESEL) and the Tools ESEL. There should be a block for each battery in the Logistics Tracking Database spreadsheet.

Charge REBA, EHIP or "HL," and PGT batteries prior to use on an EVA. Record the charge and discharge information in the Logistics Tracking Database spreadsheet.

SAFER

In order to capture the checkout of the Simplified Aid for EVA Rescue (SAFER) units that are on orbit, the information has been put in the Logistics Tracking Database spreadsheet. This will allow all flight leads to see the data across flights. This sheet also contains a link to the SAFER Rotation Plan maintained by XA.

Data to Capture

Record the same data that the crew fills out on the cue card and calls to MCC-H per the SAFER checkout procedure. There are 52 rows for the 52, 1-minute checkouts.


Serial #	1006	Location		On-Orbit 		
Barcode #		ON Time	GN2%	PWR %	BATT V	Event
	Date					
1	7/13/2001	1:10	94	84	40.2	7A EVA1
2	7/17/2001	0:57	94	83	39.9	7A EVA2
.
52						

Figure 4.6-9. SAFER

Field	Description
Serial #	Serial number of the SAFER unit.
Barcode #	Barcode number of the SAFER unit if available.
Location	Pull down menu: On-Orbit or FCE/Ground. FCE/Ground will "grey out" the data to indicate that it is no longer active.
Date	Date of checkout.
ON Time	Duration the SAFER was on for the checkout. The format is mm:ss.
GN2%	Percent of gaseous nitrogen.
PWR%	Percent of power.
BATT V	Battery volts.
Event	Flight/Increment and for which EVA the checkout was performed.

SAFER Logistics Process

As the crew calls down the information from the SAFER checkout, the EMU MPSR should record them in the console log and then update the Logistics Tracking Spreadsheet as time allows.

Payload Water Reservoirs and Umbilical Interface Assembly

This tab contains information for both the Payload Water Reservoirs (PWR) and the Umbilical Interface Assembly (UIA) Biocide Filters.

Payload Water Reservoirs

The PWRs store the water that is used to fill the EMU Feedwater Tanks. The PWRs are filled from the orbiter galley and are transferred to ISS for use in the Joint Airlock. The PWRs are then connected to the Inflight Refill Unit (IRU) in the Joint Airlock to pump the water into the EMU. Each can hold ~20 lbs of water, which is enough to recharge two EMUs.

The PWRs are certified for 12 on-orbit fills in addition to one ground fill. (A fill is any time the PWR is charged with water, even if it is a top-off of a partially full PWR.) The water expires 1070 days from the fill if it has been depleted below 5 lbs. If the fill is a top-off, it still counts as one of the 12 fill cycles and the expiration date of the water is the expiration date of the oldest water in the bag.

Upon undocking, there should be enough PWRs filled to support: nominal and contingency EMU water operations, any scheduled EVAs, two contingency EVAs during the stage, all deferred EVAs during the stage, plus the assembly EVAs during the next mission.

Data to Capture

The EMU MPSR will need to record the date when a PWR is filled and when it is drained.

Serial #	1024	Fill Qty. (lbs)	Top Off ?	Drain Qty. (lbs)	Error if Pump Dry
Bar Code #	00015017J	Fill Date	Event	Full Dump ?	
Initial Fill Date	7/27/2005	7/27/2005	LF-1	N	11.61
Cycle #	2	9/14/2006	115	N	9.92
Expiration Date	8/19/2009			2/9/2007	0.5
PWR Fill Status	Partial			3/5/2007	9.2
Bag Qty. (lbs)	12.80				
Location	ISS Airlock				

Figure 4.6-10. PWR

Field	Description
Serial #	Serial Number of the PWR
Bar Code	Bar Code of the PWR
Fill/Drain Date	Date of fill or drain
Event	Flight or Increment during which the fill or drain activity took place

Field	Description
Fill/Drain Qty. (lbs)	How much water was used during the fill and how much was used during the drain. For the fill, you can get this quantity from the EECOM position, and you can verify the data post-flight with EC. For the drain, you will need to get this information from the crew. They can see the value on the In-flight Refill Unit (IRU).
Top Off?	This only applies to the fill. If the PWR has more than 5 lbs of water prior to filling, this will be Yes (Y). Otherwise, this will be No (N). If the spreadsheet sees a "Y" in this column, it uses the expiration date of the oldest water in the bag, otherwise it calculates 1070 days from the fill date.
Full Dump?	This applies only to the dump. If the PWR was completely drained, this will be Yes (Y). Otherwise, this will be No (N).
Error if Pump Dry	If the PWR is completely drained, the "Error" is the difference between the Fill quantity and the Drain quantity.
Initial Fill Date	Date of the initial fill. This could be a ground fill date.
Cycle #	Calculated field – Total number of times the PWR has completed a fill/drain cycle.
Expiration Date	Calculated field – This applies only to the fill. It looks at the Top Off column; if there is an "N" in the column, the expiration date is 1070 days from the fill date, if there is a "Y," the expiration date is the expiration date of the oldest water in the bag.
PWR Fill Status	Quick status – Partial or Full.
Bag Qty	How much water remains in the PWR.
Location	Where the PWR is stowed. Drop down menu – ISS Airlock, B7 Bond, Shuttle, Multipurpose Logistics Module (MPLM).

PWR Logistics Process

As part of the preflight planning, the EMU lead should determine if

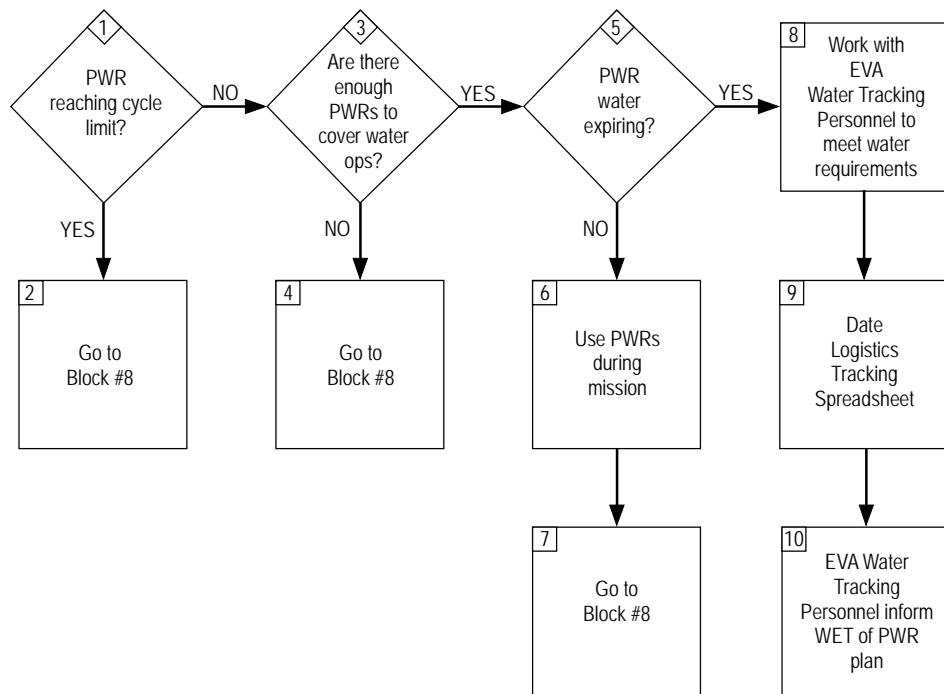
- A. PWRs are reaching the 12 on-orbit fill/drain cycle limit
- B. There is enough water to support all water requirements
- C. The water is within the expiration date

The EMU lead should discuss options for fill/dump cycles with the EVA Water tracking personnel who generate and maintain an up to date PWR Rotation Plan located on the V: drive in the same folder as the logistics tracking database. For shuttle flights,

the EMU lead will work with his Electrical Environmental and Communication (EECOM) officer to ensure that he/she is aware of the number of PWR fills/dumps required for this flight. The drain data can be verified during the flight by contacting the EECOM officer.

The EVA Water tracking personnel will also notify the Water Evaluation Team (WET) at one of the weekly tagups of the PWR plan for upcoming flights as this information will be used to generate a CHIT to be used during the flight which will call out the PWRs to be filled and their respective serial numbers. Refer to the PWR Rotation Plan for familiarization on the type of information contained therein.

Once a PWR is used, update the Logistics Tracking Database spreadsheet.



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Figure 4.6-11. PWR process

UIA

This portion of the spreadsheet contains information on the UIA biocide filters. The UIA biocide filters are iodine-based filters that treat the supply and waste water to/from the EMU. The waste/drain biocide filter information is not shown on the spreadsheet. However, it sees approximately 13 lbs H2O for each EMU water recharge (assuming two EMUs are recharged in parallel). Typically, both are replaced at the same time whenever the supply biocide filter nears its expiration.

Data to Capture

The UIA Supply Biocide Filter Usage Table does not automatically update when new data is entered for a PWR. The Table should be updated at least after every sortie of EVAs.

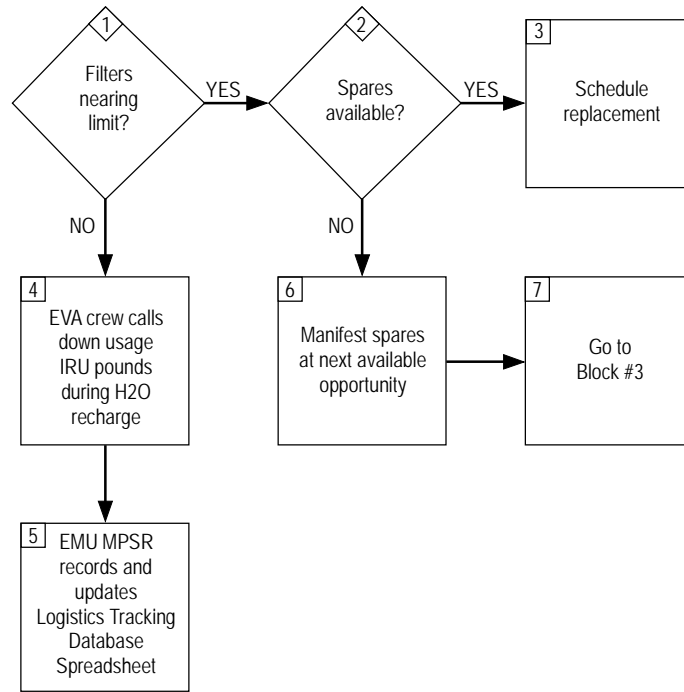
EMU Refill Date	Event	EVA CCC:	H2O Qty. (lbs)
4/11/2002	8A E1	LiOH	9.61
4/13/2002	8A E2	LiOH	6.68
4/14/2002	8A E3	LiOH	7.56
4/16/2002	8A E4	LiOH	5
6/9/2002	UF-2	LiOH	8.66
Total =			374.15

Figure 4.6-12. UIA supply biocide filter usage table

Field	Description
EMU Refill Date	Date when EMU water tanks were recharged
Event	Flight/Increment and which EVA for which the recharge was performed
EVA CCC	Which type of contaminant control cartridge was used during the associated EVA: Metox or LiOH
H2O Qty	The final IRU quantity the crew calls down
Total	Calculated field – sums the amount of water filtered by the UIA Supply Biocide Filter to date

UIA Biocide Filter Logistics Process

The filters must be changed out every 26 EVAs or after 520 lbs of water (63 gallons) is filtered through them. During IRU usage for EMU water recharging, the crew records and then calls down the final IRU quantity (lbs). The EMU MPSR updates the Logistics Tracking Database spreadsheet. If the filters are nearing their life cycle limit, coordinate with the upcoming EMU Flight/Increment lead to replace the filters. If no spares are available, work to get new ones manifested at the next available opportunity.



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Figure 4.6-13. UIA Biocide filter process

Dump CWC

A Contingency Water Container (CWC) can hold approximately 95 lbs of water. This spreadsheet is used to determine the available volume for EMU water operations.

Data to Capture

CWC 1026 is no longer tracked. It was brought down on STS-116. The information is left for reference only.

CWC 1059 is currently in use.

CWC S/N XXXX – P/N SEG33113140-303 Labeled "EMU WASTEWATER" on the Special fluids label	Qty added (+) /removed (-)	Date	GMT	Activity
	1	1/25/2007	25	LCVG Fill
	1	2/2/2007	33	H2O Recharge Post EVA 6 (EMU 3008/3018)
Total Quantity (lbs) currently in CWC		21.4		
Total Quantity (L)		9.71		
Total lbs remaining free in CWC		73.6		

Figure 4.6-14. Dump CWC

Field	Description
Qty added (+)/ Removed (-)	How many pounds of water were dumped to or from the CWC.
Date	Local date on which activity occurred.
GMT	Greenwich Mean Time associated with local date.
Activity	Brief description of the event. If it was associated with EMU maintenance, include the serial number of the HUTs.
Total Quantity (lbs) Currently in CWC	Calculated field. Sum of all water in pounds that has been dumped to the CWC.
Total Quantity (L)	Calculated field. Conversion of pounds to liters.
Total lbs remaining free in CWC	Calculated field. Difference in pounds between the amount a CWC can hold (95 lbs) and the Total Quantity (lbs) currently in CWC.

CWC 1026 is no longer tracked. It was brought down on STS-116. The information is left for reference only.

CWC Dump Logistics Process

EMU MPSR estimates how many pounds were dumped into the CWC depending on the water operation and updates the Logistics Tracking Database Spreadsheet. If the CWC is nearing full capacity, plans may be made to return the full CWC and replace it with a new bag. Other options may have to be discussed with the PWR Rotation Plan contact.

Airlock Cooling Loop Recovery

This spreadsheet tracks the usage of the filters associated with the Airlock Cooling Loop Recovery Kit (ALCLR).

The EMU Ion Filter is certified for 8 uses with a Service and Cooling Umbilical (SCU) or 60 uses without an SCU or 2 years after initial use. The EMU 3-Micron filter is certified for four uses or 2 years. The EMU Biocide Filter is certified for 100 uses with an SCU or 1500 uses without an SCU. The EMU Water Processing Jumper is certified for 2 years from the manufacture date.

Data to Capture

Track the usage of the filters associated with the Airlock Cooling Loop Recovery Kit.

EMU 3-Micron Filter(12A)					
s/n	Date	Activity	SCU	EMU	Run time
1018	12/22/2006	Post 12A.1	SCU2	300 6	1:27
	1/23/2007	Pre US EVA 6	EV-1	300 8	1:10
	2/16/2007	Post stage EVA	EV-1	300 8	2:17
1019					
1020					
1021					

Figure 4.6-15. EMU 3-Micron filter example

Field	Description
s/n	Serial number of the filter
Date	Date on which water operations occurred
Activity	Flight/Increment or water maintenance event
SCU	Which SCU was used (EV-1 SCU or EV-2 SCU)
EMU	Serial number of the HUT of the EMU being used
Run Time	Duration of water operations in hh:mm

ALCLR Logistics Process

As ALCLR activities occur, update the Logistics Tracking Database Spreadsheet. As filters near their capacity limit, coordinate with the EMU lead/Increment lead of an upcoming flight/increment to develop a plan to return and replace the expiring filter.

Logistics Tools Used by Other Disciplines

This section contains a brief description of some of the logistics tools used by other disciplines and referenced by EVA.

Inventory Management System

Inventory Management System (IMS) is an inventory tool that shows which serial numbers/barcodes of items are on orbit and where they are stowed.

IMS is managed by the DO5 inventory stowage officer. The DO5 inventory stowage officer receives EVA data from several sources: manifests, EMU ESELs, EVA Tools ESEL, and a listing from FCE for EMU piece parts. For each flight/increment, the EMU lead should coordinate with the Inventory Stowage Officers (ISOs) in order to verify the data in IMS.

IMS has a search page that is accessible from the DO5/ISO homepage (http://mod.jsc.nasa.gov/do5/iso/iso_products.htm).

SSA Rotation Plan

The SSA rotation plan defines the

- A. On-orbit increment suit configuration prior to docking
- B. Launch suit configuration
- C. EVA suit configuration
- D. Landing suit configuration
- E. On-orbit increment suit configuration post undocking

Each piece of hardware is color-coded so that you can see the movement of the hardware across flights and increments.

A copy of the plan can be found on the S: drive at

\\JSC-MOD-FS3\World\Divisions\DX\Eva\System\EMU Logistics & Rotation Plans

EMU Rotation Plan

The EMU Rotation Plan is managed by the EMU Logistics Panel. This plan shows the SEMU (fewer arms) rotation between shuttle flights and station increments.

A copy of the plan can be found on the S: drive at

\\JSC-MOD-FS3\World\Divisions\DX\Eva\System\EMU Logistics & Rotation Plans

Battery Rotation Plan

The battery rotation plan is currently managed by Hamilton Sundstrand (HS). This plan shows the EMU battery rotation between shuttle flights and station increments.

A copy of the plan can be found on the S: drive at the following location:

\\JSC-MOD-FS3\World\Divisions\DX\Eva\System\EMU Logistics & Rotation Plans

SAFER Rotation Plan

This plan shows the SAFER rotation between shuttle flights and station increments.

A copy of the plan can be found on the V: drive at the following location:

V:\EVA\Generic Systems Items\Flight Support\Logistics Tracking Database\Future Planning

On-Orbit ESEL

This ESEL shows what has been left on-orbit and the planned return flight. The HS Mission Management group maintains this ESEL. It is a good reference when planning for a flight.

The On-Orbit ESEL, as well as the Tools and EMU ESELS, are accessible from the XA Homepage.

<http://evaweb.jsc.nasa.gov/index.cfm>

On-Orbit ALCLR, Battery and FEMU-R-003 Maintenance Requirements

The On-orbit ALCLR, battery, and FEMU-R-003 maintenance requirements are called out in the FEMU-R-003, On-Orbit Operation, Maintenance, Testing, Storage, and Tracking Requirements and Constraints. The following items are listed in a matrix: SEMU, LCVG, EMU Battery, A/L CLR, and IEU. This matrix is reviewed at the Logistics IPT for currency and to ensure that the latest changes in ground planning have been incorporated. This matrix is also presented as a status at the EMU Panel. It is a good reference when planning for a flight or for use during increment Ops.

You can access the EVA-EMU Logistics IPT agendas from the XA Homepage (scroll down to EVA EMU Logistics IPT).

<http://evaweb.jsc.nasa.gov/boards.cfm?type=boards>

4.7 ONE EVA MISSION SUPPORT

PURPOSE

This section provides the One EVA real-time support plan and responsibilities for EVAs taken from the EVA MER & Bldg. 7 CORE Support Operations Handbook (1EVA-HDBK-0001). Section numbers are listed beside each subheading for quick reference.

DESCRIPTION

The One EVA Mission Support plan identifies the procedures that are followed by One EVA NASA and contractor personnel to provide real-time support for space shuttle and ISS flights that involve scheduled, unscheduled, or contingency EVAs and related activities. The plan is also used for simulation support, as required. Reference the subheading Mission Support Plan (10.1) for more details.

ON-ORBIT SUPPORT ROLES AND RESPONSIBILITIES (7)

During an on-orbit activity, event, or simulation, One EVA personnel provides real-time or on-call support from any number of possible locations. Real-time support is usually provided in the ISS MER, the Control Operations Room for EVA (CORE), and Hamilton Sustrand Windsor Locks (HSWL). On-call support can be provided from ILC Dover, HSWL, Oceanering Space Systems (OSS), USA, or other locations, depending on what hardware expertise is required for certain on-orbit activities. The One EVA Mission Support plan dictates support roles for each on-orbit activity or simulation.

On-Orbit Activity	EMU MER1	EMU MER2	Tools MER (x2)	CORE	HSWL
EMU Checkout	LSS	LSS		✓	✓
EVA Tools Checkout			✓		
SAFER Checkout				✓	
EMU Transfer/Airlock Reconfig.	LSS or SSA	LSS or SSA			
EVA Prep.	LSS	SSA	✓	✓	✓
EVA	LSS	LSS	✓	✓	✓
Post EVA EMU H2O Recharge/Maintenance	LSS	LSS		on-call	on-call
STS/Docked Ops – EMU Battery charge/discharge	LSS			on-call	on-call
STS/Docked Ops – Metox Regeneration	LSS			on-call	on-call
ISS – EMU Battery charge/discharge				✓	on-call
ISS – Metox Regeneration				✓	on-call
Cooling Loop Scrub, A/L CLR	LSS	LSS		✓	on-call
EMU Resize	LSS or SSA	SSA and LI		✓	
EVA Dry Run (EMU Fitcheck)	LSS	SSA		✓	✓
EMU Midterm Checkout	LSS	LSS		✓	✓
EVA Tool Transfer/Stow			✓		
EVA Procedure Reviews	LSS	LSS or SSA	✓	on-call	on-call
EVA Simulations	LSS	LSS or SSA	✓	on-call	on-call

- LSS = Life Support System Engineer from HS SLS-Houston or USA
- SSA = Space Suit Assembly Engineer form ILC JSC or USA
- EVA Tools = OSS and EC7
- CORE support positions consist of Scribe, Coordinator, SSA Engineer (if not at the MER), SAFER, Processing Engineer, Technician Support
- HSWL support consists of EMU Systems Engineer, EMU Electrical Engineer, with Reliability and Specialty Engineer on-call
- LI = EMU Logistics Integrator

Figure 4.7-1. Typical support roles

Figure 4.7-1 lists typical support roles. These console positions are described in detail in the following paragraphs.

MER1 (7.1)

The MER1 is a certified console position and is considered the shift lead for the MER EVA Console. The MER1 console position could be staffed with an EMU LSS engineer, an EMU SSA engineer, or an EVA Tools and Crew Aids (ETCA) engineer, depending on the on-orbit operations during the shift. The One EVA Mission Support Plan defines the different support positions and the expertise needed for certain on-orbit events. The MER1 position is the primary point of contact for MER EVA during on-orbit supported operations. As such, the MER1 console engineer is the primary lead for overall generic communication with MOD, the ISS MER managers, and IMC/XA on the Digital Voice Integration System (DVIS) loops. Those supporting the EVA MER Console who are most qualified on a particular subject will communicate on the DVIS loops (i.e., ETCA engineer discusses EVA tools issues if MER1 is EMU Life Support Systems (LSS) and vice versa).

One of the main responsibilities of the MER is to provide a complete historical record of all EVA operations. MER1 provides support to the ISS MER manager in all EVA actions. They are responsible to the FD and the Mission Management Team (MMT) for ensuring proper subsystem engineering support for flight. MER1 also provides EVA MPSR/MOD with EMU and ETCA technical support, as requested. MER1 should utilize CORE resources to track and delegate the actions necessary to resolve CHITs, “funnies,” In-Flight Anomalies (IFAs), and Items For Investigation (IFIs). MER1 is also responsible for coordinating any CHITs or issues with the ISS Management Center (IMC)/XA.

EVA Support Folder Setup (7.1.1)

Before a mission or an increment stage EVA, the appropriate folders are created on the Cumulus Drive for saving mission data and information (Cumulus\EVASupport\Flight Specific). At a minimum, these folders are included in the Flight-Specific Folder: MER Console Logs, MER Data Logs, MER Shift Reports, Flight Data Book, and Time Cycle Data.

MCC Operational Workstation Setup (7.1.2)

For real-time support of on-orbit events or simulations, the MER logs into the MCC Operational Workstation (DEC Alpha) and brings up the appropriate data screens for the oncoming shift.

- A. Joint Airlock Parameters
- B. EMU Pages 1 through 3
- C. ELOG
- D. RTPLOT

EMU MER Data Log (7.1.4)

If supporting an EMU-powered event, a MER Data Log is generated on the MER Laptop computer. The MER data log will be used to keep a detailed mission events log and also track EMU consumables. The log entries for MER1 are very similar to the logs generated in the CORE but in electronic format. The same mission events should be entered such as the following:

- A. All crew comments about EVA/EMU
- B. All EMU Status readouts
- C. All EMU switch throws (both called down and seen on telemetry data)
- D. Procedure steps completed
- E. Periodic logging of EMU parameters
- F. Phone calls\requests for support (ISS MER manager, MPSR, IMC, CSR, etc.)
- G. Shift changes
- H. Metabolic rates
- I. Any unusual data trends
- J. Time/cycle parameters and calculations

MPSR/MOD Support (7.1.5)

MER1 monitors real-time operations at all times and supports the MPSR/MOD with any technical questions or resolution of issues.

ISS MER Manager Shift Handover (7.1.7)

MER1 supports the ISS MER manager shift handover status on the DVIS loop ISS MER PROB 1. During every ISS MER manager shift handover (every 8 hours), the oncoming ISS MER manager calls on every console in the ISS MER for a shift status. Items to include in the status are the EVA summary, if at the end of an EVA (i.e., EVA time, any issues, hardware failures, etc.), any CHITs that are in work or planned to be initiated during the next 8-hour shift, any ARs that have been initiated in the last 8 hours, or any issues that are being worked or need coordination with other ISS MER consoles.

EVA CHIT Support (7.1.8)

MER1 provides CHIT disposition or initiates CHITs, as required. All CHIT dispositions or CHIT submittals should be coordinated with the appropriate SSM and the XA hardware manager. If during an EVA shift, all CHITs are worked by MER2 to allow MER1 to constantly monitor the EVA.

Time Cycle Data Sheets (7.1.9)

After the EVA or EMU activity, a Time Cycle Data Sheet is generated for each on-orbit EMU. The time cycle data can be obtained from the EMU MER Data Logs. The Time Cycle Data Sheets are completed and forwarded to the USA FCE Data Center approximately 3 days after the final EVA or EMU activity. The Time Cycle Data Sheets can be found in the Cumulus Drive\EVA Support\Time Cycle Component Changeout Folder. Reference HS SLS-Houston Standard Procedure SP201.10 Limited Life & Configuration Tracking of EMU & Ancillary Hardware On-Orbit for detailed instructions on how to fill out the Time Cycle Data Sheets.

MER2 (7.2)

The MER2 certified console position is considered the backup to MER1. The MER2 console position could be staffed with an EMU LSS engineer, an EMU SSA engineer, or an ETCA engineer, depending on the on-orbit operations during the shift. The One EVA Mission Support Plan defines the different support positions and the expertise needed for certain on-orbit events. In most instances, the MER2 position is used during high EVA hardware activity events, such as EVAs. MER2 is not usually scheduled during non-EVA shifts or planning shifts. One of the main responsibilities of the EVA MER is to provide a complete historical record of all EVA operations. MER2 provides support to MER1 and the ISS MER manager in all EVA actions. MER2 also provides EVA MPSR/MOD with EMU and ETCA technical support, as requested. MER2 is also responsible for verifying that the correct procedures are available in the MER, keeping track of on-orbit procedure status, and generating the shift reports at the end of the shift. MER2 also monitors real-time operations and supports the MPSR/MOD with any technical questions or resolutions, as well as coordinates with the CORE on any actions being worked or issues that need to be resolved. MER2 reviews the CHIT list on the MCC Web, verifies that there are no CHITs with pending EVA actions or any new CHITs that need to be addressed for EVA, and provides CHIT disposition or initiates CHITs, as required. If during an EVA shift, all CHITs are worked by MER2 to allow MER1 to constantly monitor the EVA.

MER- ETCA (7.3)

The MER One EVA ETCA position is a certified position that supports all EVAs and any time on-orbit tool operations are scheduled. When the EVA MER console is not manned, the ETCA console operator serves as MER1 when supporting scheduled tool activities. The CORE is also staffed with ETCA backup personnel to assist and monitor specific tools that are being used by EVA. The CORE ETCA is not a certified position as it supports the MER console only.

CORE Coordinator (7.4)

The CORE coordinator is responsible for all CORE operations during real-time support of on-orbit activities or simulations as scheduled in the One EVA Mission Support Plan. The CORE is active during EMU-powered operations, including EMU checkouts, A/L CLR operations, EVAs, EVA Dry Runs, etc. Also, the CORE is active during any EMU nonpowered suit intensive crew activities, such as EMU resize procedures. The CORE

can be activated at anytime per SSM or One EVA Program Office request. The primary purpose of the CORE is to provide a resource to the EVA MER for action and/or issue resolution to allow the MER to continue to monitor real-time activities. The CORE provides a central point of contact for coordinating testing, providing additional support, setting up meetings, tracking actions, providing hardware, or whatever action is required to support EVA operations. Most of the EVA hardware Subsystem Managers (SSMs) are located in the CORE during on-orbit EVA events. The primary duties of the CORE coordinator include the following: Flight Data System (FDS) Startup, CORE DVIS configuration, contact list coordination, personnel support coordination, resolution of conflicts, Team 4 coordination and activation when directed by MER or SSMs, maintenance and status of actions, and overall CORE management during critical on-orbit operations.

CORE SSA Engineer (7.6)

Depending on the on-orbit or simulation activity being supported, the tasks of the CORE SSA engineer may be performed in the MER or the CORE or both. The Mission Support Plan references the needed support. SSA engineers are needed to support activities involving suit-fit checks, EMU resize or reconfiguration, EMU donning, and suit component handling, transfer, or stowage by the crew. The SSA engineer monitors the A/G comm loops for any suit fit or suit component issue on orbit. The CORE SSA engineer coordinates any SSA-related mission support actions with the EMU, EMU SSA SSMs, ILC Dover, and USA FCE, as required. The SSA engineer also coordinates any hardware testing or Class III hardware transfer to the MCC.

Planning Team 4 (7.8)

Planning Team 4 is the backup team that can be activated at any time during real-time support to work actions or problems that arise during on-orbit operations. Planning Team 4 is usually used when a quick answer is needed to an on-orbit problem that is beyond the time capabilities of the MER and CORE support teams. They act as the "Tiger Team" for EVA issues. Planning Team 4 can be activated by the EVA hardware SSMs, the EVA hardware managers, or the One EVA Program Office. The team consists of two separate groups (Planning Team 4A and Planning Team 4B) that, if needed, can work 12-hour shifts each until the issue is resolved. Each team has a team lead, an LSS engineer, an SSA engineer, an ETCA engineer, a person to work logistics, and another person to work action tracking and coordination. Depending on the issue to be worked, one or more members of the team may not be required. The SSM can also change the members of the team, if required, to better support the problem at hand. In general, the persons assigned to work Planning Team 4 on the Mission Support Plan are not assigned a shift in the MER or the CORE during real-time support. This allows for uninterrupted support of the on-orbit activities while the problem is being addressed by the planning team.

Team Lead (7.8.1)

The team lead is usually assigned to management or lead personnel from one of the One EVA partner companies or the One EVA Program Office. The team lead is the focal point of the team and is responsible for ensuring that all actions are addressed and closed, and ultimately, the on-orbit issue is resolved.

LSS Engineer (7.8.2)

The LSS engineer is assigned to associate in the LSS engineering group from either HS, USA, or the One EVA Project Office LSS Project Lead. This person is responsible for working all LSS hardware actions and addressing any impacts to LSS hardware.

SSA Engineer (7.8.3)

The SSA engineer is assigned to associate in the SSA engineering group from either ILC, USA, or the One EVA Project Office project lead. This person is responsible for working all SSA hardware actions and addressing any impacts to SSA hardware.

ETCA Engineer (7.8.4)

The ETCA engineer is assigned to associate in the ETCA engineering group from OSS or the One EVA Project Office Project Lead. This person is responsible for working all ETCA hardware actions and addressing any impacts to ETCA hardware.

Logistics (7.8.5)

The Logistics support is assigned to EMU Logistics Integrator (HS), an associate from the USA EVA Hardware Planning Group, or the One EVA Project Office Logistics manager. This person is responsible for addressing any logistic impacts of the on-orbit problem and working backup plans to provide the necessary hardware needed to support EVA.

SPCE Support (7.9)

The One EVA contract has sustaining engineering responsibility for the Servicing Performance and Checkout Equipment (SPCE) with the exception of the Battery Charger Assembly (BCA) and the Battery Stowage Assembly (BSA) and, therefore, must provide real-time support for any operations involving SPCE. All SPCE hardware is located in the ISS Airlock (Equipment Lock and Crew Lock). In most cases, since most of the SPCE directly interfaces with the EMU, real-time support is already being provided by EMU engineers who are also the SPCE project engineers. Real-time support for the BCA and BSA operations are currently provided by NASA EC7 and Engineering and Science Contract Group (ESCG). One EVA provides CORE Coordinator support as needed to help with the FDS startup and data monitoring for PGT and Helmet Light Battery charging operations.

SAFER Support (7.10)

Real-time support for any Simplified Aid For EVA Rescue (SAFER) operations is provided by NASA ER. The mission support plan is coordinated with ER to ensure that real-time support is provided when the SAFERs are being checked out, installed, removed, and used. They provide support at the CORE for all SAFER operations and have an oncall list as part of the support plan and mission contacts information.

HSWL Support (7.11)

Hamilton Sundstrand Windsor Locks (HSWL) provides real-time support for all EMU checkouts and EVAs. An EMU systems engineer and an EMU electrical engineer support real time with a reliability engineer and a technical specialist on call during on-orbit operations. EMU telemetry data are received at HSWL, as well as limited DVIS communication loops from the CORE. The primary responsibility of HSWL real-time support is to provide EMU system and Original Equipment Manufacturer (OEM) technical expertise to help resolve issues and problems. Consumables are tracked during normal EVA operations by HSWL. The contact point for HSWL is through the CORE, but under certain circumstances, direct communication with the MER or XA is required. HSWL real-time support personnel also have the responsibility to contact and coordinate all HSWL support that is needed to resolve on-orbit issues.

Mission Support Plan (10.1)

The Mission Support Plan is a tool that is used to help coordinate and schedule all the required support for any EVA real-time simulation, mission, or increment activity. Per the One EVA Contract, the mission support plan should be released at launch - 10 days for shuttle missions and EVA events - 5 days for increment stage activities.

The EMU Logistics Integrators (ELI) coordinate, assemble, and release the support plan. The ELIs are most familiar with the mission and increment operations and schedules and work with the One EVA partner engineering leads to schedule the required support. The One EVA Actions Desk has the distribution list for the Mission Support Plans and distributes it via e-mail.

The One EVA Mission Support Plan defines the different support positions and the expertise needed for certain on-orbit events. The mission support plan includes contact information for One EVA NASA and contractor personnel, including Hamilton Sundstrand, ILC, Jacobs, Lockheed Martin, and USA. Contact information for the experts on EMU, Tools, SAFER, and SPCE is included. The plan provides shift assignments for all the positions mentioned above, including EMU MER (both CTSD and HSWL), EVA MER, CORE support, HSWL support, tech support and planning team support. Table 4.7-2 is a sample One EVA Mission Support Plan. It is truncated; the actual plan includes support assignments for EMU MER1, EMU MER2, MER3, MER4, CORE SAFER, CORE USA, CORE SSA, CORE Coordinator, CORE Scribe, technical support, and HSWL support (systems lead, electrical engineer).

Shuttle Flights (10.1.1)

For shuttle flights, preliminary mission timelines are used to view all the planned tasks for each crewmember during the mission. EVA tasks and durations are listed in chronological order in the mission support plan.

Increment Stage Activities (10.1.2)

Preliminary timelines for ISS increment tasks are usually not available until 1 week ahead of time. This leaves less time for support plan coordination. All ISS increment crewmember tasks can be found on OSTPV in the MCC Web. EVA tasks and durations are listed in chronological order in the mission support plan.

Table 4.7-1. One EVA Mission Support Plan Sample (truncated)

DATE	ON	EVENT	EMU MER1	EMU MER2	MER3	CORE SAFER
1/25/07	4:30 am	Battery Charge Term (4:40 am) Battery Charge Init (4:50 am) Reba Install & C/O (5:10 am) PGT C/O (5:55 am) LCVG Fill (3134/LA) (6:55 am)	Dennis Dawson	Rook Daley	Jessica Corral On call Brian Warkentine	N/A
1/26/07	5:00 am	SAFER C/O (5:30 am – 6:00 am) Battery & Metox Install (6:00 am – 6:30 am)	N/A	N/A	Jessica Corral On call	John Cladek On call
1/27/07	8:30 am	BSA-BATT RCHRG-TERM (9:00 am – 9:10 am)	N/A	N/A	Jessica Corral On call	N/A
1/29/07	4:00 am	EVA-FINAL TOOL-PREP (4:25 am – 5:55 am) EVA-T/L-REVIEW EVA-S/G-TAGUP	N/A	N/A	B. Warkentine	N/A
1/30/07	TBD	EVA-E/L-PREP EVA-S/G-TAGUP MASK PB/TOOL CONFIG PB/10.2 DPRS	Rolunda McDaniel On call	N/A	B. Warkentine TBD time for tools	N/A

Figure 4.7-2 represents the current EVA MER Console configuration, including DVIS and phone extensions. Figure 4.7-3 provides the communication network for scheduled EVAs.

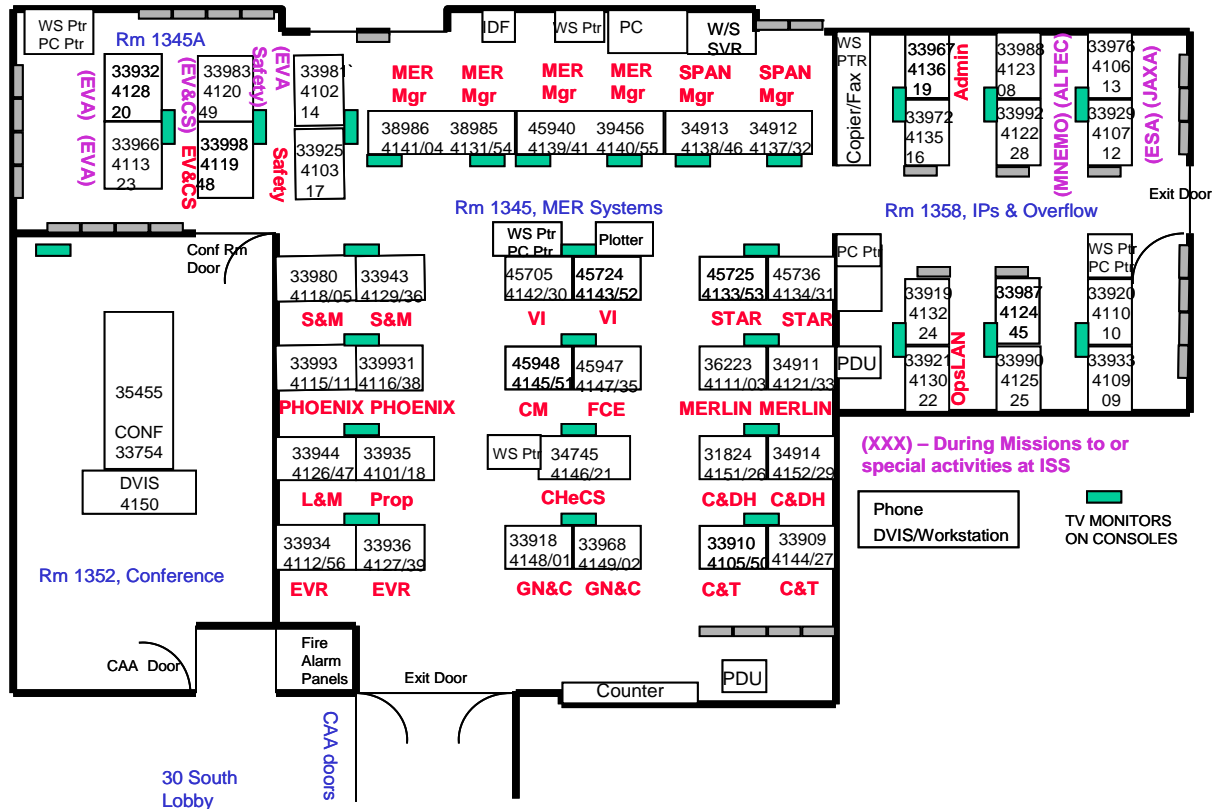


Figure 4.7-2. EVA MER Console configuration

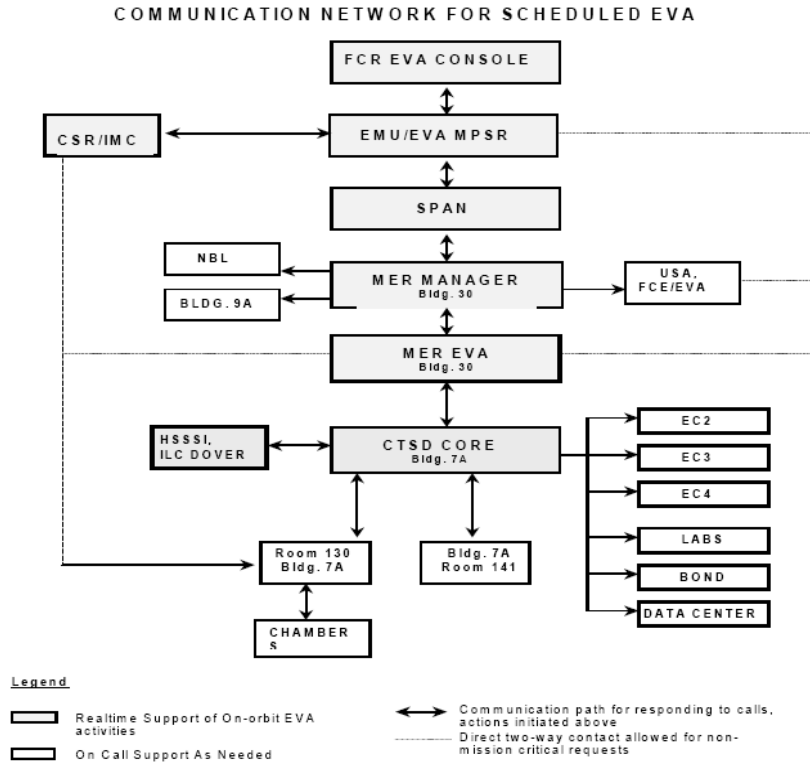


Figure 4.7-3. Communication network for scheduled EVAs

EVA Anomaly Reports and IFIs (11.1)

At landing + 5 calendar days, there is an XA formal review of the EVA-related anomaly reports and IFIs in order to properly disposition them prior to the Program Requirements Control Board (PRCB) review. The EVA flight/increment manager is responsible for coordinating the presentation of the anomalies and IFIs at the EVA CCB. Required attendees are the XA hardware group lead, XA EVA flight management lead, XA EVA increment (as required), EC5, ER, One EVA, MOD EVA (as required), and the EVA flight manager for the next flight. Attendance by the EVA flight manager for the next flight is mandatory since these issues are considered constraints to flight until dispositioned. This is considered the handover point for tracking of the anomalies and IFIs between the EVA flight manager and the hardware office. The intent of the meeting is as follows:

- A. Delegate tracking responsibility of individual anomalies and to the appropriate member of the hardware group.
- B. Determine which issues will be brought forward to the program at the PRCB and which ones are considered constraints to the next flight. The established policy within XA is for the EVA flight manager and flight support team to track/coordinate all anomalies and IFIs during the mission and for the hardware group to present them to the program post flight. In addition, all anomalies are considered as flight constraints for the next mission until rationale is provided to disposition them for

that flight. Following this meeting the anomalies are tracked via the EVA CCB until closure.

EVA Crew Debrief (11.2)

Following the completion of the flight/increment, the EVA community conducts an EVA debrief with members of the flight crew. DX is responsible for collecting questions from the EVA community and conducting this review. The flight or increment EMU LI coordinates all crew debrief question inputs from the One EVA partners.

Lessons learned (11.3)

The EVA flight and increment manager is responsible for presenting the EVA lessons learned to XA management and the shuttle/station programs post flight. DX, XA, and EVA Safety presents their EVA Lessons learned to the EVA CCB. One EVA and EC's lessons learned are incorporated into the EVA flight manager's presentation. The EVA flight manager then presents a subset of those lessons learned to the shuttle flight manager IPT lessons learned, and the EVA increment manager presents their lessons learned to an Increment manager IPT lessons learned. The flight manager then presents the top five lessons learned to the shuttle special ICB.

CTSD EVA MISSION SUPPORT FACILITIES

The following facilities, available in building 7A or building 30, are routinely used by CTSD and Hamilton Sundstrand Management Services/International Latex Corporation (HSMS/ILC) personnel to provide mission or mission-simulation support:

- A. MER, building. 30S, room 1345, x33932 EMU, x33966 ETCA
- B. CTSD Central Operations Room for EVA (CORE) building 7A, room 323, x37843
- C. Space Suit Systems Laboratory (Class I), building 7A, room 348, x39352
- D. Space Suit Assembly Laboratory (Class III), building 7, room 2027, x39382
- E. CTSD bonded stores, building 7A, room 320, x39302

The following support areas are available for flights involving payloads that require EVA interface:

- A. CSR, building. 30, second floor, x37995
- B. Conference Room, building 7A, room 130, x34933
- C. Auditorium, building. 7A, room 141, x34207

In the event of an in-flight anomaly, the following facilities may be used by CTSD and other supporting personnel:

- A. AAB11-foot chamber, building 7 high bay
- B. SSATA chamber, building 7 high bay
- C. 8-foot chamber, building 7 high bay
- D. Neutral Buoyancy Lab (NBL), Sonny Carter Training Facility
- E. Crew Compartment Trainer (CCT), building 9A
- F. Air bearing table, building 9A

REFERENCES

1EVA-HDBK-0001: EVA MER & Bldg. 7 CORE Support Operations Handbook, February 2007.

ISS 14 US EVAs 6 7 & 8 MSP Rev 1.xls.

5.1 MCC CONSOLE DISPLAYS

PURPOSE

This section contains information on MCC displays used by EVA personnel to monitor and track real-time ISS data.

DESCRIPTION

Program Unique Identifier Fields

Displays are populated with Program Unique Identifiers (PUIs). The various digits in PUIs used to populate the EVA displays are described below (reference Figure 5.1-1).

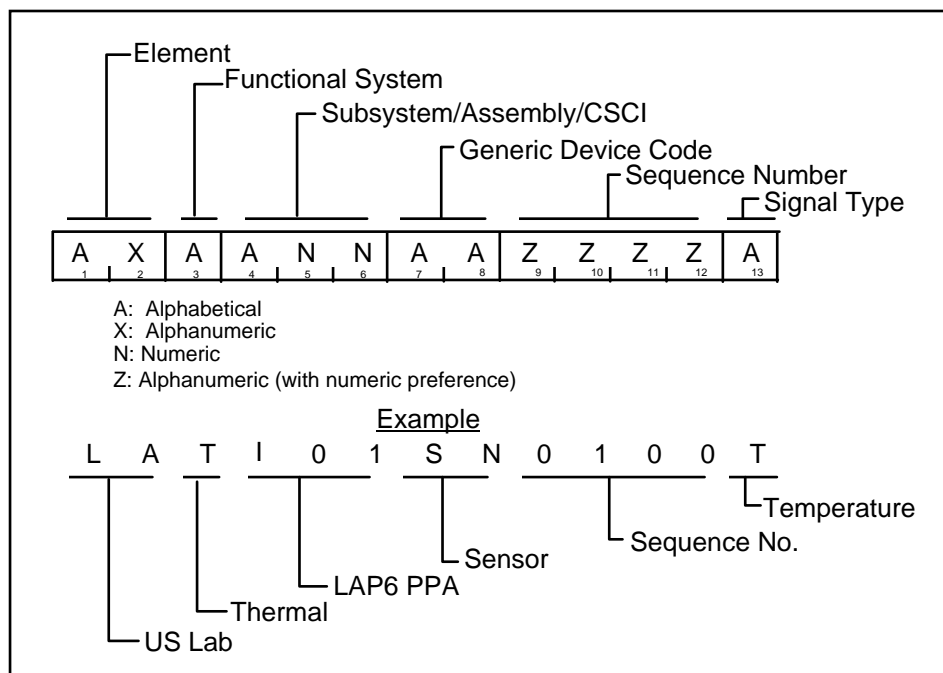


Figure 5.1-1. Signal PUI format

Element

AL = Airlock

Functional System

E = Life Support
D = CDH
C = C&T
P = EPS
T = TCS
X = EVA

Subsystem

(ALD) S15 = AL MDM
A3# = O2/N2 Pressure sensors
A7# = O2/N2 Temperature sensors

Generic Device Code

MD = MDM
SR = Sensor
CN = Controller
FC = Firmware Controller

Signal Type

P = Pressure
T = Temperature
V = Voltage
R = Flow Rate
C = Current
E = electrical Power
Q = Quantity
W = Time/Day/Year
J = Logic Status/Discrete Event
H = Position

DISPLAY DATA

During a Loss Of Signal (LOS) or at various other points during a mission, data on a given display may become static, dead, or missing. Static data indicates a loss of the telemetry stream from the ISS and is shown on the display by the data turning a cyan color and a cyan "S" just to the right of the data field. Dead data indicates that the parameter is defined for the telemetry stream, but is not currently being downlinked. This is shown on the display by a purple "D" in the data field. Missing data indicates that the user is not connected to the ISP server. This will affect all telemetry fields on all displays and is shown by a purple "M" in the data field.

REFERENCES

ISSP D684-10056-01, Rev. J, Prime Contractor Software Standards and Procedures Specification, Boeing, October 12, 2000.

5.2 JOINT AIRLOCK MEGA DISPLAY

PURPOSE

This section provides information on the items displayed in the Joint Airlock Mega Display on the MCC Workstations.

DESCRIPTION

The Joint Airlock Mega Display contains information on systems related to the ISS Airlock. (See Figure 5.2-1.)

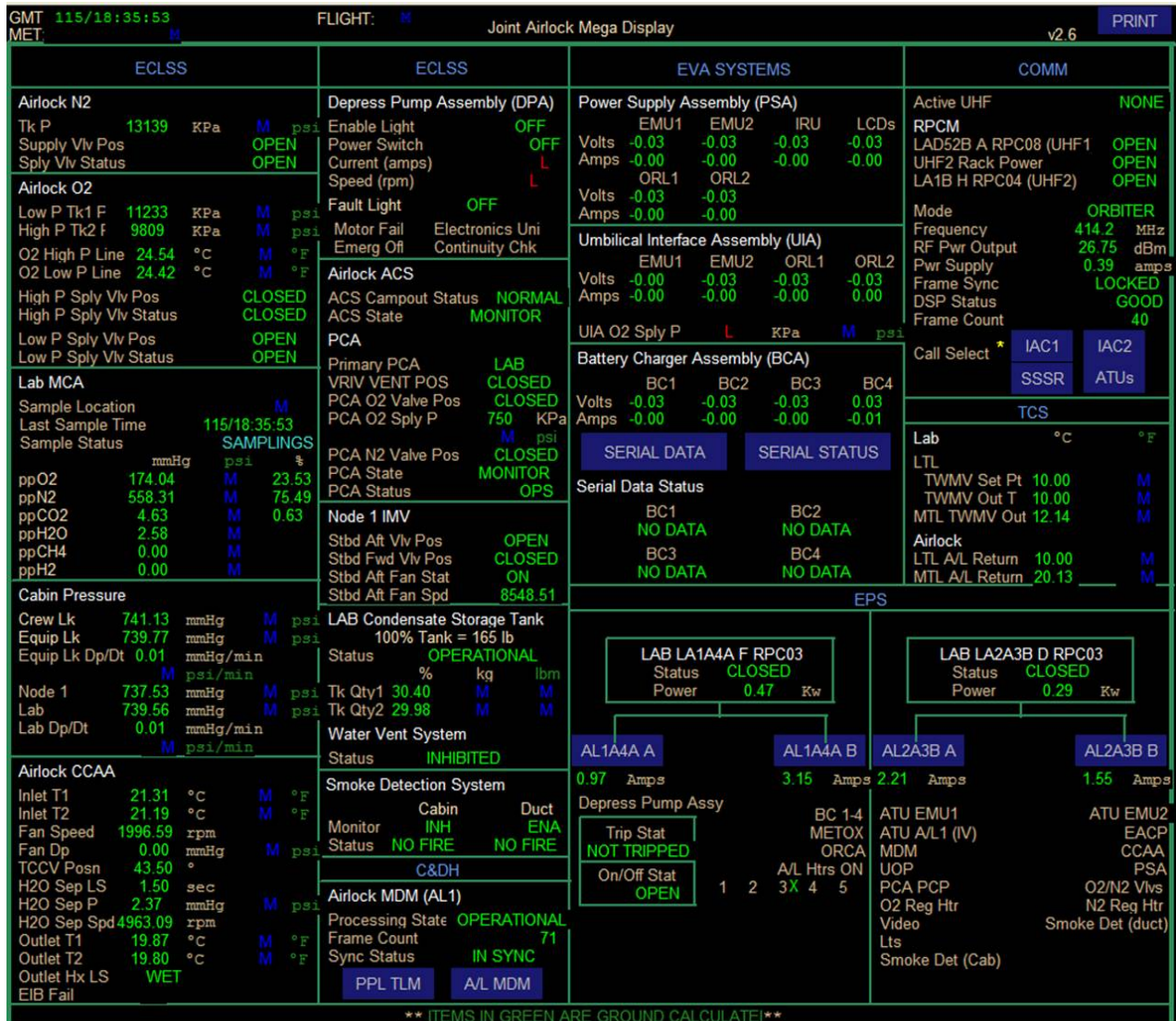


Figure 5.2-1. Joint Airlock Mega Display

Environmental Control and Life Support Systems Items

PUIs for Environmental Control and Life Support Systems (ECLSS) fields are sampled at 0.1 samples per second.

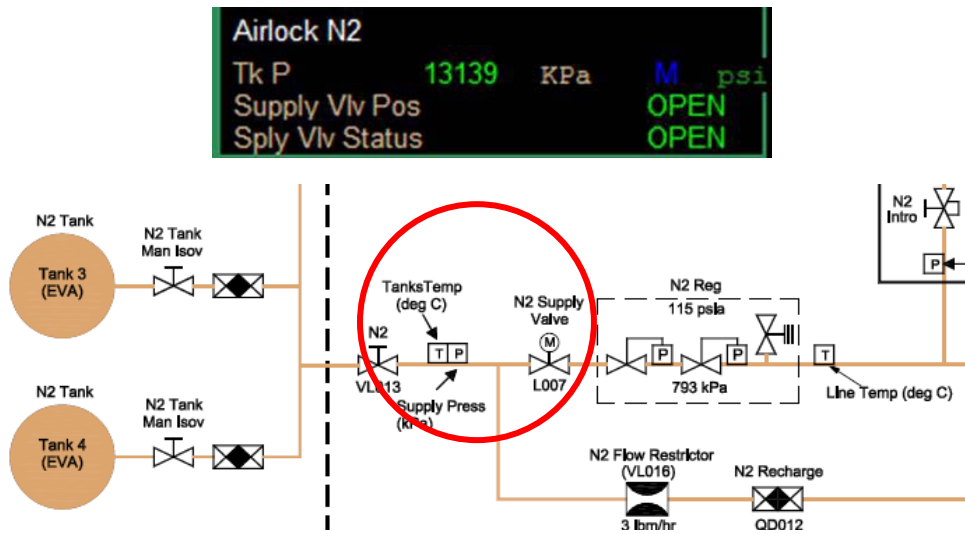


Figure 5.2-2. Airlock N2

Airlock N2	PUI	Comment
TK P (supply press)	ALEA34SR0001P	kPa, comped to psia
Supply Valve Position (L007)	ALDS15MD0046J	Actual: open, closed, in transit, failed
Supply Valve Status	ALDS15MD0049J	Expected: open, closed, in transit, failed; equal to position commanded

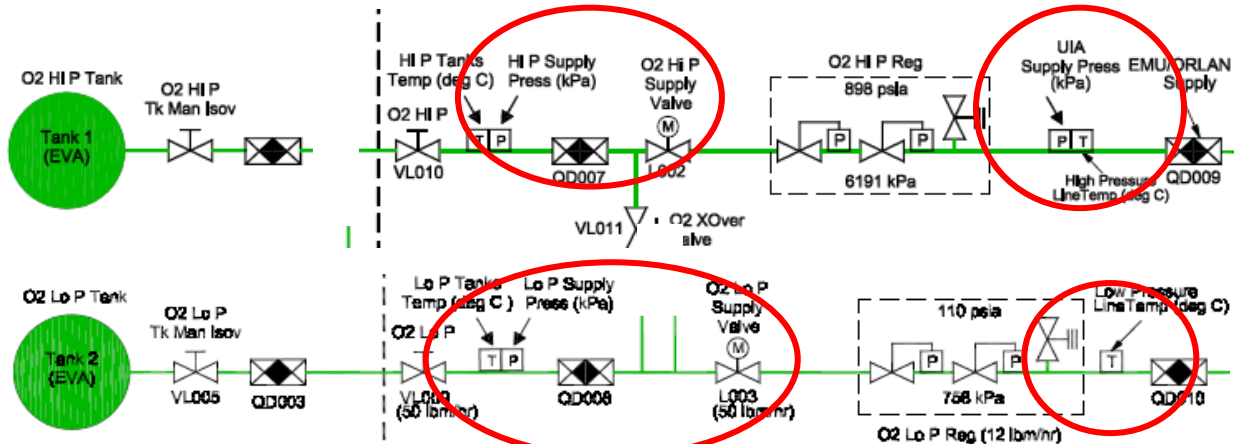
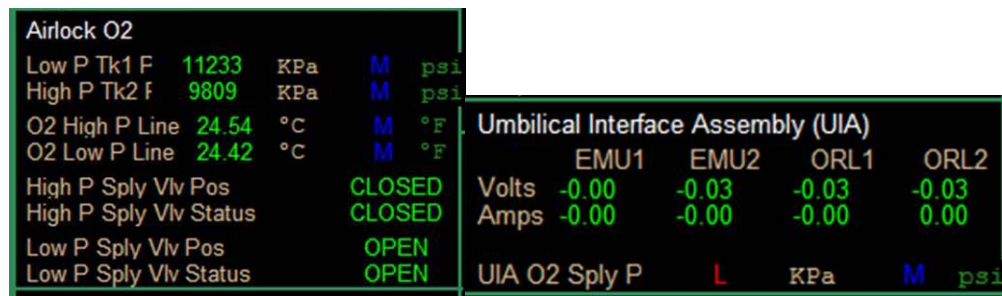


Figure 5.2-3. Airlock O2

Airlock O2	PUI	Comment
Tank		
Low P Tk1 P (supply press)	ALEA33SR0001P	kPa comped to psi
High P Tk2 P (supply press)	ALEA32SR0001P	kPa comped to psi
Line Temperature		
O2 High P Line T	ALEA78SR0001T	°C comped to °F
O2 Low P Line T	ALEA77SR0001T	°C comped to °F
Supply Valve		Emergency response = Close INT MDM transition = Close
High P Sply Vlv Pos (L002)	ALDS15MD0044J	Actual: Closed, Open, In Transit, Failed
High P Sply Vlv Status	ALDS15MD0047J	Expected: Closed, Open, In Transit, Failed
Low P Sply Vlv Pos (L003)	ALDS15MD0045J	Actual: Closed, Open, In Transit, Failed
Low P Sply Vlv Status	ALDS15MD0048J	Expected: Closed, Open, In Transit, Failed
Umbilical Interface Assembly		
UIA O2 Sply P	ALEA31SR0001P	kPa comped to psia. Psia is -40.7 psia from suit O2 P reading but still within accuracy of sensor. Valid when O2 High P Sply Vlv (L002) is open. Source of O2 is nominally Station O2 tank. Source of O2 is shuttle during docked Ops after O2 P/B Config is complete (Jnt Ops 3.120 Prebreathe Using Shuttle O2 Set-up)

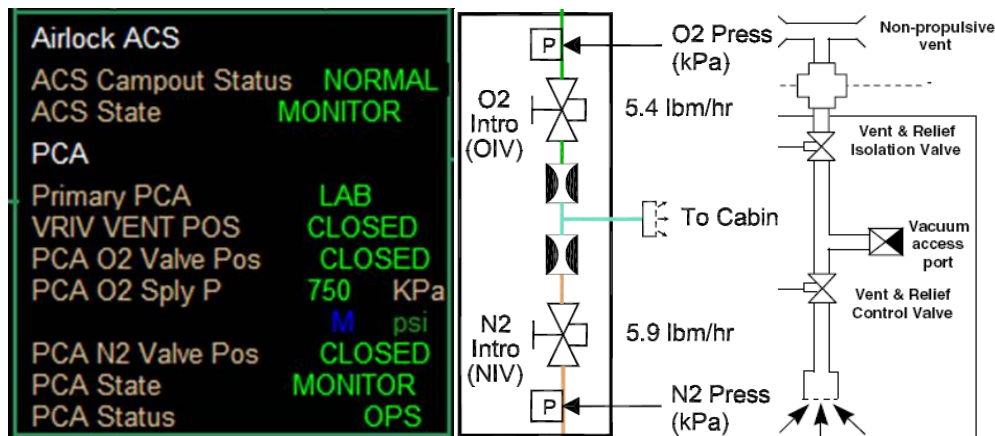


Figure 5.2-4. Airlock ACS

Airlock ACS	PUI	Comment
ACS Campout Status	LADP08MD2382J	Normal or Campout; When Campout is selected, Primary PCA = Lab/Airlock, A/L ACS State = Comp Control Sets MCA partial pressure limits to Campout
ACS State	LADP08MD2505J	Monitor or Comp Control; Monitor is default. For Campout with ACS State = Comp Control: when ppO2 > 147.3 mmHg/2.85 psia, then NIV opens for 2 minutes when ppO2 < 139.6 mmHg/ 2.70 psia, then OIV opens for 4 minutes After an OIV or NIV closure, the valves will not be reopened for 11 minutes (5 min. to mix the air, 6 min. to purge A/L) Nominally, Campout ACS state is Monitor and both OIV and NIV are closed until commanded by MCC
Primary PCA	LADP08MD2383J	None, Lab, Airlock, Lab/Airlock, None/Airlock, Lab/None
VRIV Vent Pos	ALEA22FC0016J	Open, Closed, In-Transit, Unknown
PCA O2 Valve Pos	ALEA22FC0014J	(OIV Pos) Open, Closed, In-Transit, Unknown
PCA O2 Sply P	ALEA22FC0003P	kPa comped to psi - 0.1 hz
PCA N2 Valve Pos	ALEA22FC0015J	(NIV Pos) Open, Closed, In-Transit, Unknown
PCA State	ALEA22FC0001J	Safe, Monitor, Introducing (if either O2 or N2 valve is open), Repress, Depress, PPR (inhibited in Airlock PCA), Venting (rapid), VRV Control
PCS Status (Failure)	ALEA22FC0011J	Ops, Failed If the PCA loses comm with the INT SYS MDM, it will close any open valves (OIV, NIV, VRCV, VRIV) and returns ACS State to Monitor

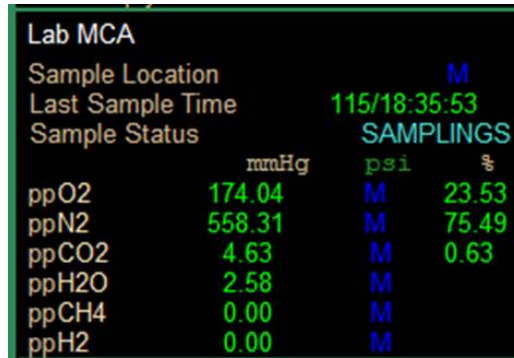


Figure 5.2-5. LAB MCA

Lab MCA	PUI	Comment
Sample Location	LADP08MD2428J (ECLSS uses LADP08MDC212J)	none, TCCS In, TCCS Out, Lab, Node 1, MPLM, Airlock, End
Sample Status	ecl_Sample_Status	Auto – Autosequence – alternates modules; data reported after SDS line purge Samplings – Rapid Sampling – same module; new data available every 2 sec after 54 sec stabilization; MCA automatically enters Rapid Sampling when 1 sample is out of limits; returns automatically to Autosequence when 10 consecutive samples show constituents within limits
Partial Pressures	MCA Raw values	ppO2 data is sent to the PCA

Partial Pressure Limits*

Mode	Hi ppO2 Caution Warning	Lo ppO2 Caution Warning	Hi ppN2 Caution	Hi ppH2 Caution Warning	Hi ppCO2 Caution Warning	Hi ppCH4 Caution Warning
Non-Campout	173.25 mmHg	146.35 mmHg	599.89 mmHg	5.02 mmHg	9 mmHg	3.98 mmHg
	24.1% total P	124.12 mmHg	-----	3% total P	9.98 mmHg	3% total P
Campout (for Airlock)	149.97 mmHg	131.87 mmHg	same	same	same	same
	30% total P	121.53 mmHg				

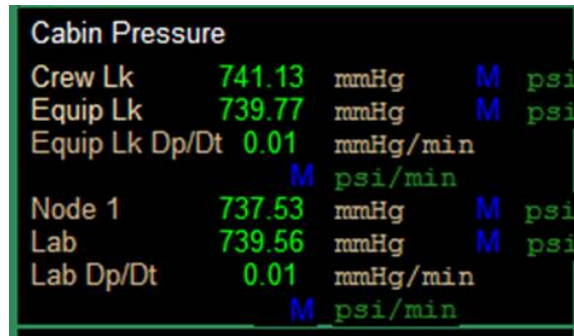


Figure 5.2-6. Cabin Pressure

Cabin Pressure	Sample rate 1 s/s	mmHg comped to psi
Crew Lk	ALXS03SR0001P Airlock Crewlock Cabin P	Sensor behind UIA – accuracy ±0.75% of FS (FS = 1034.3mmHg)
Equip Lk	ALEA22FC0001P Airlock PCA Cabin P	Sensor at Pressure Control Panel – accuracy ±0.3 mmHg
Equip Lk Dp/Dt	ALEA22FC0018J	



Figure 5.2-7. Node 1 IMV

Node 1 IMV		
Stbd Aft Vlv Pos	LADP08MD2786J	Closed, Open, In Transit, Unknown
Fan Stat	LADP08MD2656J	Off, On, Underspeed, Overspeed, In Transit, Inhibited
Fan Spd	N1EI37FA0002R	Upon fan deactivation, fan speed will read 7164 ± 50 rpm (0 volts)
Stbd Fwd Vlv Pos	LADP08MD2787J	Closed, Open, In Transit, Unknown

The Command and Control (C&C) emergency response uses the Campout version of ppl 073 which opens the Node Stbd Aft and Stbd Fwd IMV valves to equalize the Airlock with the rest of the stack.

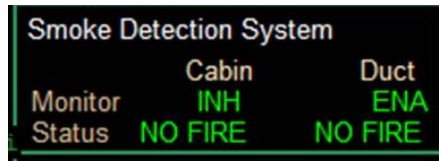


Figure 5.2-8. Airlock Smoke Detection

Smoke Detection System				
Cabin smoke detector		at inlet to AL CCAA	RPCM AL2A3B-B RPC 8, 3.5A	
Duct smoke detector		inhibited for 10.2 psia	RPCM AL2A3B-B RPC 7, 3.5A	
Monitor	Cabin Duct	ALDS15MD0065J ALDS15MD0021J	INH or ENA Duct SD is INH during campout	
Status	Cabin Duct	ALDS15MD0062J ALDS15MD0019J	No Fire, blank, Fire	

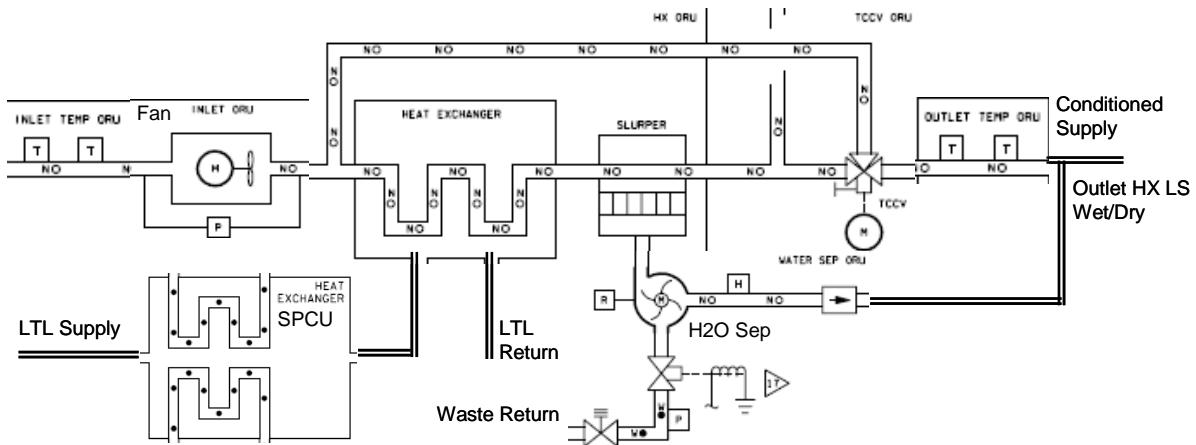
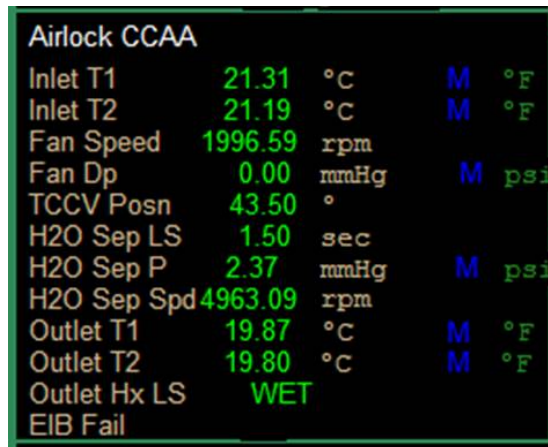


Figure 5.2-9. Airlock CCAA

Airlock CCAA	0.1 s/s	powered by RPCM AL2A3B-B
Inlet T	ALET24SR0201T ALET24SR0301T	°C comped to °F; reduced from 25°C to 13°C for Metox operations
Fan Speed (rpm)	ALET19FA0003R	3400 rpm is the min command able speed. Goes to 2000 rpm when OFF (0 vdc). Set to 5500 rpm then 3400 rpm for Metox Ops
TCCV Posn (°angle)	ALET14VL0003H	manual or command able; Operates at full heat exchanger position 4° to full bypass position 84°
H2O Sep Spd (rpm)	ALET09WS0002R	R
H2O Sep LS	ALET04IU0006Q	H: 0-3 seconds – nominally inhibited
Outlet Hx LS	ALET04IU0007J CCAA HX Liquid Sensor	Dry or Wet; Typically Dry unless EIB is Failed (0V)
EIB Fail	ALDS15MD0011J	blank or Fail; EIB interfaces with the water separator to get liquid sensor information
Outlet T	ALET14SR0201T ALET14SR0301T	°C comped to °F

ECLSS Airlock Display Temp/Humidity Control Common Cabin Air Assembly (CCAA) includes State ALDS15MD0058J: Reset, Drain (fan off, H2O sep on, 1 hour Ops), Dryout (fan low, H2O sep on, 15 min Ops), EIB OFF, OFF, ON, Startup, and Test.

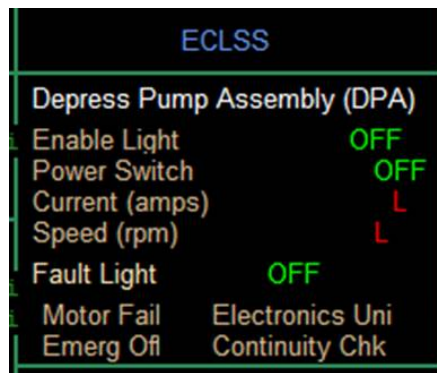


Figure 5.2-10. Depress Pump Assembly

Depress Pump Assembly	PUI	Comment
Enable Light	ALPR68FC1016J	Off, On, Unused, Failed
Power Switch	ALXD02CN0001H	Off, On
Current (amps)	ALXD01IU0002V	peak current at startup is 14A
Speed (rpm)	ALXD01IU0001V	
Fault Light On/Off	ALDS15MD0024J	
'X' Motor Fail Electronics Unit Emerg Off Continuity Check	ALXD01IU00xxJ xx = 03 xx = 04 xx = 05 xx = 06	

In order to remain < 25 amp draw during depress pump Ops to avoid tripping RPCM LA1A4A_F RPC 3, the combined load on Remote Power Control Modules (RPCMs) AL1A4A_A and AL1A4A_B should not be > 5 amps prior to operating the depress pump. AL1A4A_A powers only the depress pump and, therefore, has no loads prior to depress pump Ops.

TCS



Figure 5.2-11. TCS

TCS	Lab – 1s/s
Lab LTL TWMV Out T	LTL IFHX Bypass Vlv Outlet Temperature is LTL Supply temperature. LTL Supply is maintained at 40+/-2°F; goes into Airlock SPCU & CCAA condensing heat exchangers
Lab MTL TWMV Out T	MTL IFHX Bypass Vlv Outlet Temperature is the MTL Supply temperature. TWMV outlet goes into Loop Crossover ORU to LTL Return and/or MTL Supply. MTL Supply is maintained at 63+/-2°F
	Airlock – 1 s/s thru AL MDM
Airlock LTL Return	reading taken after flow through SPCU Heat Exchanger (for LCVG cooling) and Cabin Air Heat Exchanger (for CCAA) going back to LTL Return Rack Flow Control Assembly
Airlock MTL Return	A/L RSTS MTL Temp – reading taken after flow across Avionics rack equipment (except for IRU) going back to MTL Return Rack Flow Control Assembly. Depress Pump Assembly requires a coolant flow rate of 300-350 lbm/hr (145.4 - 158.8 kg/hr) during pump Ops



Figure 5.2-12. Lab Condensate Storage Tank

LAB Condensate Storage Tank	PUI	(100% Tank = 165 lb)
Status	LADP08MD2390J	Idle, Operational, Degraded, Failed
Tk Qty 1, 2		(%) comped to kg and lbm
Water Vent System Status	LADP08MD2778J	Idle. Initialization, Enabled, Inhibited, Man by State, Man by Effect, Shutdown, Failed

C&DH

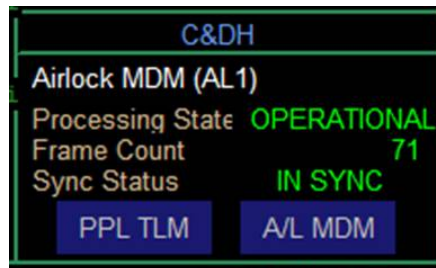


Figure 5.2-13. C&DH Airlock MDM

Airlock MDM (AL1)	PUI	Comments
Processing State	ALDS15MD4984J	Offline, Standby, Min Ops, Operational (no back up)
Frame Count	ALDS15MD4353J	10 Hz frame counter used to identify the cyclic data acquisition packet
Sync Status	ALDS15MD4263J	In Sync, Loss of Sync – time sync CDH uses ALDS15M4347J – Loss of Sync Flag set by the RT (AL MDM) when it detects a loss of sync with the BC, the INT MDM

Airlock MDM, powered by AL2A3B-A RPC 2, is a Tier III MDM that interfaces the INT MDM (Tier II) on the LB SYS-HAB-2 bus. Assuming no hard-failures are detected during the Boot/Startup state, AL MDM transitions to “Standby” and must be manually commanded to “Operational.” Any hard errors detected during Boot/Startup sends the

MDM to Diagnostic state. Boot/Startup and Diagnostic states are not identified on JAL MEGA. If communication is lost with the MDM's BC (INT), the AL MDM transitions to a minimal operations state to maintain critical functionality. This state allows for 24 hours of autonomous operation without a BC. It continues to listen for BC commands and transitions back to "Operational" when a valid command is received.

EVA Systems

A. Power Supply Assembly

EVA SYSTEMS				
Power Supply Assembly (PSA)				
	EMU1	EMU2	IRU	LCDs
Volts	-0.03	-0.03	-0.03	-0.03
Amps	-0.00	-0.00	-0.00	-0.00
	ORL1	ORL2		
Volts	-0.03	-0.03		
Amps	-0.00	-0.00		

Figure 5.2-14. Power Supply Assembly

The typical voltage reading for IRU channel is ~0.48 volts when the IRU/Utility Outlet is not powered. Typical amp draw of EMU is 0.1 amps when powered, 0.5 amps when in hardline, and 1.0 with the radio on. Amp draw of the fan varies with O2 actuator position and Airlock pressure.

B. UIA

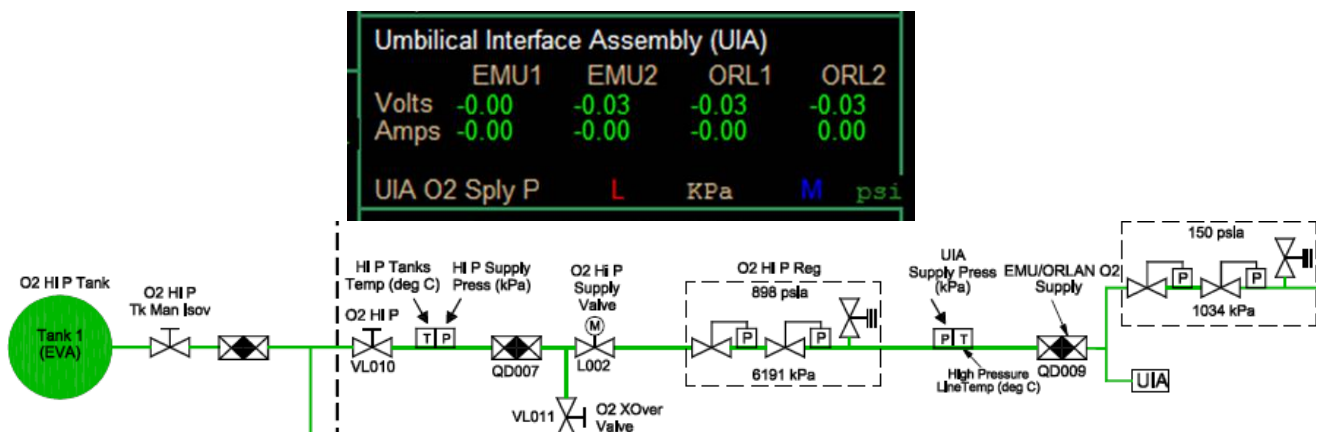


Figure 5.2-15. Umbilical Interface Assembly

UIA O2 Sply P (Airlock ECLSS Display UIA Sply P) – ALEA31SR0001P, kPa comped to psi. This reflects the orbiter O2 supply when docked and the O2 P/B Config is complete.

C. Battery Charger Assembly (BCA)

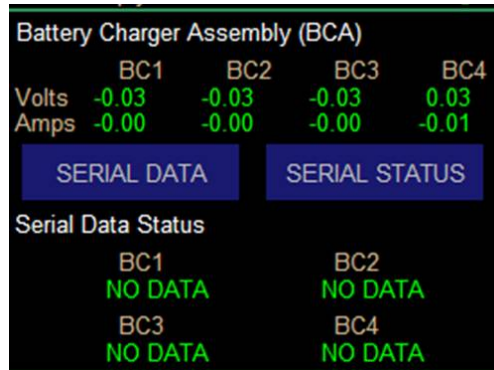


Figure 5.2-16. Battery Charger Assembly

Battery Charger Assembly (BCA)	PUI	Comment
Volts	ALXSO1BT0*02V * is the charger number	Displays the battery voltage of the battery being charged. It starts at the current battery voltage and increases during charge and decreases during discharge
Amps	ALXSO1BT0*03C * is the charger number	The amps are dependent on the battery profile EMU battery Charge 1.55 + 0.05 amps Discharge 1.50 + 0.05 amps (-301) Discharge 3.0 + 0.05 amps (-305) PGT battery 0.5 + 0.05 amps EHIP battery 1 + 0.05 amps REBA battery 1.0 + 0.05 amps
Serial Data Status	BC1 ALDS15MD5301J BC2 ALDS15MD5333J BC3 ALDS15MD5365J BC4 ALDS15MD5397J	(0) Normal = BCM powered on, (1) No Data, (2) Missing Data, (3) Extra Data Data not available in LSC downlink data format

EPS

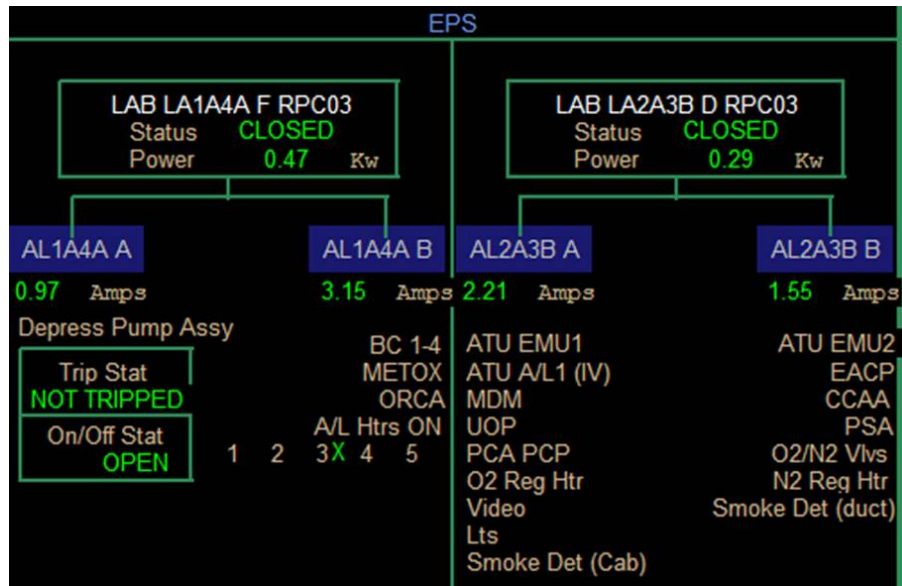
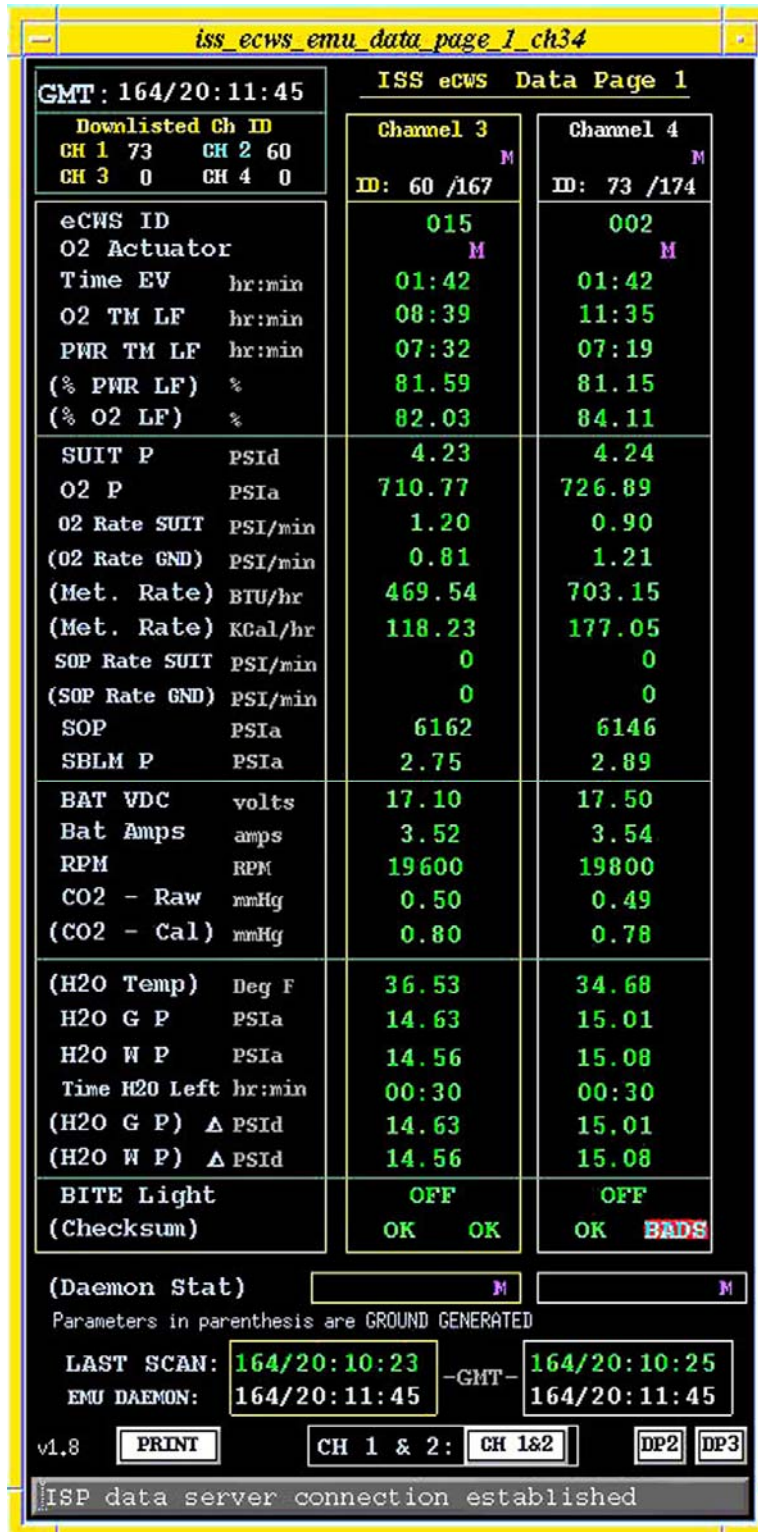


Figure 5.2-17. RPCM status

EPS	PUI	Comment
LAB LA1A4A F RPC03		
Status	LAPR37FC1018J	(0) OPEN, (1) CLOSED, (2) blank, (3)?
Power	LAPR37IR01OPWR	kw
LAB LA2A3B D RPC03		
Status	LAPR28FC1018J	(0) OPEN, (1) CLOSED, (2) blank, (3)?
Power	LAPR28IR01OPWR	kw
AL1A4A A amps	ALPR68FC1000C	Click blue to open RPC status
DPA Trip Stat	ALPR68FC0396J	(0) NOT TRIPPED, (1) TRIPPED
DPA On/Off Stat	ALPR68FC1016J	(0) OPEN, (1) CLOSED, (2) blank, (3)?
AL1A4A B amps	ALPR65FC1000C	Click blue to open RPC status
A/L Htrs ON	ALPR65FC1022J Htr 1 ALPR65FC1023J Htr 2 ALPR65FC1024J Htr 3 ALPR65FC1025J Htr 4 ALPR65FC1026J Htr 5	(0) blank, (1) X
AL2A3B A amps	ALPR67FC1000C	Click blue to open RPC status
AL2A3B B amps	ALPR66FC1000C	Click blue to open RPC status

5.3 ISS EMU DATA PAGE 1



jsc20597_239.tif

Figure 5.3-1. ISS EMU Data Page 1

Table 5.3-1. ISS EMU Data Page 1 Parameters

Parameter	PUI	Comment
CH 1, 2, 3, 4	1 – LACU03FC1000U 2 – LACU03FC2000U 3 – LACU03FC3000U 4 – LACU03FC4000U	Displays the currently down-linked radio ID for the appropriate channel. Radio IDs can be found at the following location: http://ea.jsc.nasa.gov/eawebfiles/ea-projects/flightgfe/Sscs/Html/RadioFlightHistory/SSER.htm
	ISS_EMU_ASTRO_NAME	Name or title of each column can be added on the first workstation to be initialized. First, initialize the workstation. Second, select SETUP from the <i>ecws_emud::Station v 3.1.1</i> window. Third, input the names or titles into the EMU DAEMON:Config Dialog window
ID	ISS_EMU1_RADIO_ID ISS_EMU1_BU_RADIO_ID ISS_EMU2_RADIO_ID ISS_EMU2_BU_RADIO_ID	Primary and Backup radio IDs can be added on the first workstation to be initialized. First, initialize the workstation. Second, select SETUP from the <i>ecws_emud::Station v 3.1.1</i> window. Third, input the radio IDs into the <i>EMU Daemon:Config Dialog</i> window. This will set the radio IDs for the current column
eCWS ID	ISS_EMU1_CWS_ID ISS_EMU2_CWS_ID	Displays the eCWS serial number
O2 Actuator	ISS_EMU1_O2_ACTUATORS ISS_EMU2_O2_ACTUATORS	Uses the discrete inputs from O2 Actuator and EVA Actuator microswitches to determine the actuator position. Valid states are IV, OFF, Press, and EVA
TIME EV	ISS_EMU1_TIME_EVA_HRS ISS_EMU2_TIME_EVA_HRS	Displays the amount of time the power mode switch has been in the battery position
O2 TM LF	ISS_EMU1_TIME_LEFT_O2_HRS ISS_EMU2_TIME_LEFT_O2_HRS	The time left is the total mass of usable oxygen left divided by the flow rate. The usable oxygen mass left is the sum of the oxygen mass minus the unusable masses. The flow rate is the change in the total mass of the system during one-minute time interval
PWR TM LF	ISS_EMU1_TIME_LEFT_BATT_HRS ISS_EMU2_TIME_LEFT_BATT_HRS	The battery amp seconds left is derived by subtracting the running total of the current measured each second from the battery capacity which has been selected pre-EVA
(% PWR LF)	ISS_EMU1_PWR_PCT_REMAIN ISS_EMU2_PWR_PCT_REMAIN	% power remaining based on ground calculated consumables from EMU data
(% O2 LF)	ISS_EMU1_O2_PCT_REMAIN ISS_EMU2_O2_PCT_REMAIN	% O2 remaining based on ground calculated consumables from EMU data
SUIT P	ISS_EMU1_SUIT_P ISS_EMU2_SUIT_P	The output of Suit Pressure Sensor (114) with a range of 0 to 6 psid
O2 P	ISS_EMU1_PRIME_O2_P ISS_EMU2_PRIME_O2_P	The output of the Primary O2 Source Pressure Sensor (112) with a range of 0 to 1100 psid

Table 5.3-1. ISS EMU Data Page 1 Parameters (continued)

Parameter	PUI	Comment
O2 Rate SUIT	ISS_EMU1_O2_USE_RT ISS_EMU2_O2_USE_RT	The primary oxygen use rate is determined by subtracting the current primary oxygen pressure from the pressure 1 minute prior
(O2 Rate GND)	ISS_EMU1_GND_O2_USE_RT ISS_EMU2_GND_O2_USE_RT	Rate of O2 use based on ground calculated consumables from EMU data
(MET. Rate)	ISS_EMU1_MET_RATE_BTU ISS_EMU2_MET_RATE_BTU	Metabolic rate in BTU/hour based on ground calculated consumables from EMU O2 use
(MET. Rate)	ISS_EMU1_MET_RATE_KC ISS_EMU2_MET_RATE_KC	Metabolic rate in Kcal/hour based on ground calculated consumables from EMU O2 use
(SOP Rate SUIT)	ISS_EMU1_SO2_USE_RT ISS_EMU2_SO2_USE_RT	The secondary oxygen use rate is determined by subtracting the current secondary oxygen pressure from the pressure 1 minute ago
(SOP Rate GND)	ISS_EMU1_GND_SO2_USE_RT ISS_EMU2_GND_SO2_USE_RT	The time left is the total mass of usable oxygen left divided by the flow rate. The usable oxygen mass left is the sum of the oxygen mass minus the unusable masses. The flow rate is the change in the total mass of the system during 1-minute time interval
SOP	ISS_EMU1_SEC_O2_P ISS_EMU2_SEC_O2_P	The output of SOP Pressure Sensor (215) with a range of 0 to 7400 psid
SBLM P	ISS_EMU1_SUBLIMATOR_P ISS_EMU2_SUBLIMATOR_P	The output of the Feedwater Pressure Sensor (138) with a range of 0 to 16 psid. This sensor will determine the Airlock (ambient) pressure when the feedwater switch is not on
	ISS_EMU1_AIRLOCK_P_DIR ISS_EMU2_AIRLOCK_P_DIR	If value < 2 - ;=2;=3>3 The Airlock pressure is rising if one of the following conditions is true: DeltaP > 0.5 PSI and the pressure was stable RateP > 0.12 PSI in 10 seconds The airlock pressure is falling if any of the following is true: DeltaPv > -0.5 PSI and the pressure was stable RateP > -0.12 PSI in 10 seconds
BAT VDC	ISS_EMU1_BATT_VOLTAGE ISS_EMU2_BATT_VOLTAGE	Battery voltage
BAT Amps	ISS_EMU1_BATT_CURRENT ISS_EMU2_BATT_CURRENT	Battery Amps
RPM	ISS_EMU1_MOTOR_TACH_BYTE ISS_EMU2_MOTOR_TACH_BYTE	Motor Tachometer
CO2 Raw	ISS_EMU1_CO2_LVL ISS_EMU2_CO2_LVL	The output of PPCO2 Sensor (122) with a range of 0.1 to 30 MM HG

Table 5.3-1. ISS EMU Data Page 1 Parameters (concluded)

Parameter	PUI	Comment
(CO2 – Cal)	ISS_EMU1_CO2_CORRECTED ISS_EMU2_CO2_CORRECTED	The eCWS compensates the reading of the sensor for the PPCO2 Sensor using the absolute pressure (the sum of the suit pressure and airlock pressure) of the suit. This makes it possible to delay issuing a message until a higher threshold of CO2 is reached
(H2O Temp)	ISS_EMU1_SUBLIMATOR_T ISS_EMU2_SUBLIMATOR_T	The output of Sublimator Outlet Temperature Sensor (139) with a range of 32° to 104° F
H2O GP	ISS_EMU1_GAS_P ISS_EMU2_GAS_P	The output of Feedwater Supply Pressure Sensor (132A) with a range of 0 to 40 psid. This sensor will read the actual pressure of the feedwater supply pressure
H2O WP	ISS_EMU1_WATER_P ISS_EMU2_WATER_P	The output of H2O Feedwater Supply Pressure Sensor (132B) with a range of 0 to 40 psid. This sensor will read the actual pressure of the H2O feedwater pressure
Time H2O Left	ISS_EMU1_WATER_LEFT_HRS ISS_EMU2_WATER_LEFT_HRS	The time left on water is initialized to 30 minutes. When the H2O gas pressure rises above the H2O water pressure by more than 2.1 psi and vehicle power is not available
(H2O GP)	ISS_EMU1_GAS_PRESS_DEL ISS_EMU2_GAS_PRESS_DEL	The output of Feedwater Supply Pressure Sensor (132A) minus the ambient pressure
(H2O WP)	ISS_EMU1_WATER_PRESS_DEL ISS_EMU2_WATER_PRESS_DEL	The output of H2O Feedwater Supply Pressure Sensor (132B) minus the ambient pressure
BITE Light	ISS_EMU1_BITE_STATUS ISS_EMU2_BITE_STATUS	Signifies if there is a BITE light condition present in the EMU caution and warning system
(Checksum)	ISS_EMU1_CHKSUM1 ISS_EMU1_CHKSUM2 ISS_EMU2_CHKSUM1 ISS_EMU2_CHKSUM2	Shows whether the telemetry pass contained good or bad data. The left checksum verifies the first half of the data, and the right checksum verifies the second half of the data
(Daemon Stat)	EMU1_DATA_STATUSW EMU2_DATA_STATUSW	Indicates the status of the Daemon program. Options are Searching, Getting Data, Search Low, & Wait 5 Cycles, and No Data
LAST SCAN	ISS_EMU1_LAST_SCAN_TIME ISS_EMU2_LAST_SCAN_TIME	Time of the last data pass received by MCC
EMU DAEMON	ISS_EMU1_TIME ISS_EMU2_TIME	Current operating time

5.4 ISS EMU DATA PAGE 2

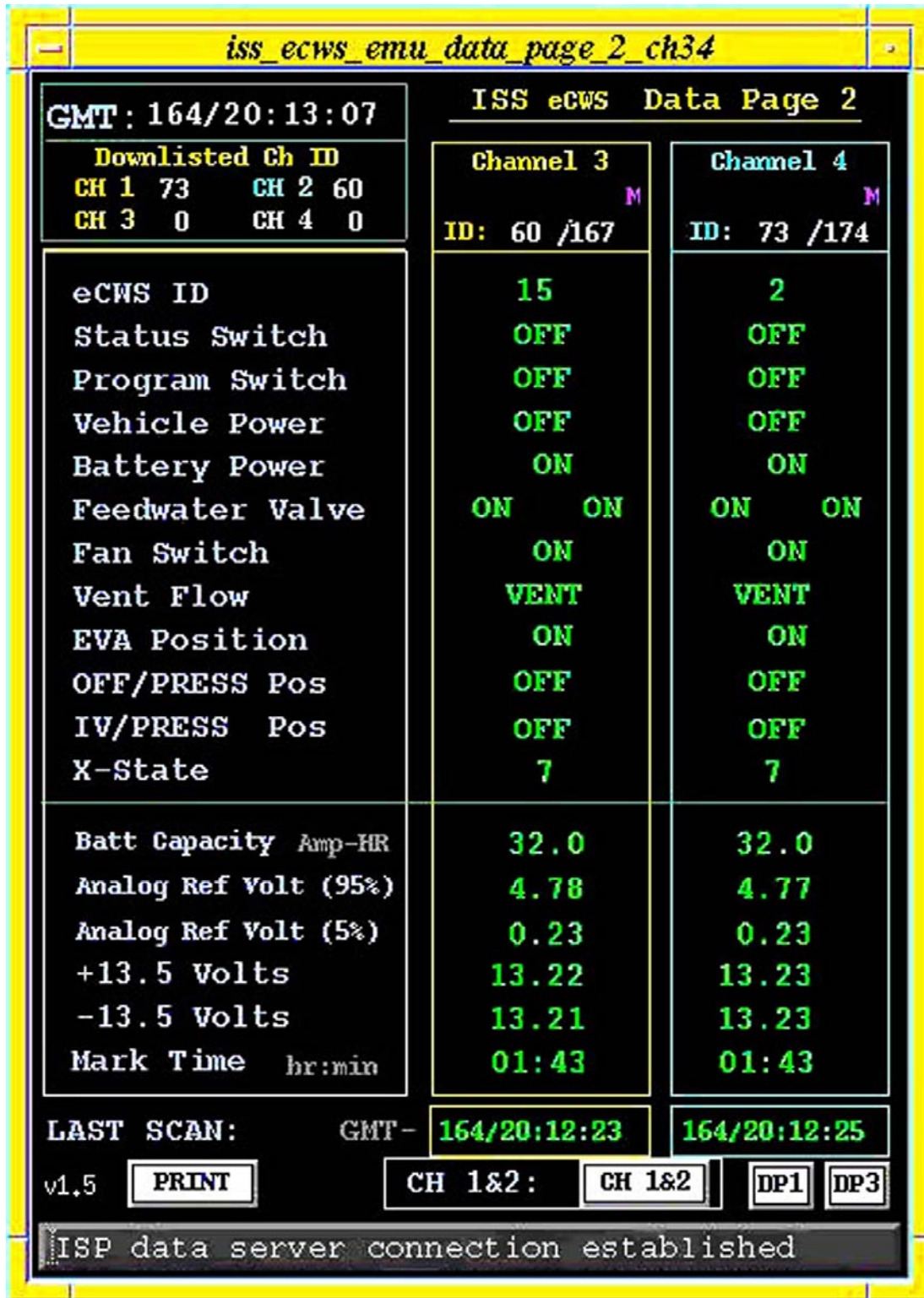


Figure 5.4-1. ISS EMU Data Page 2

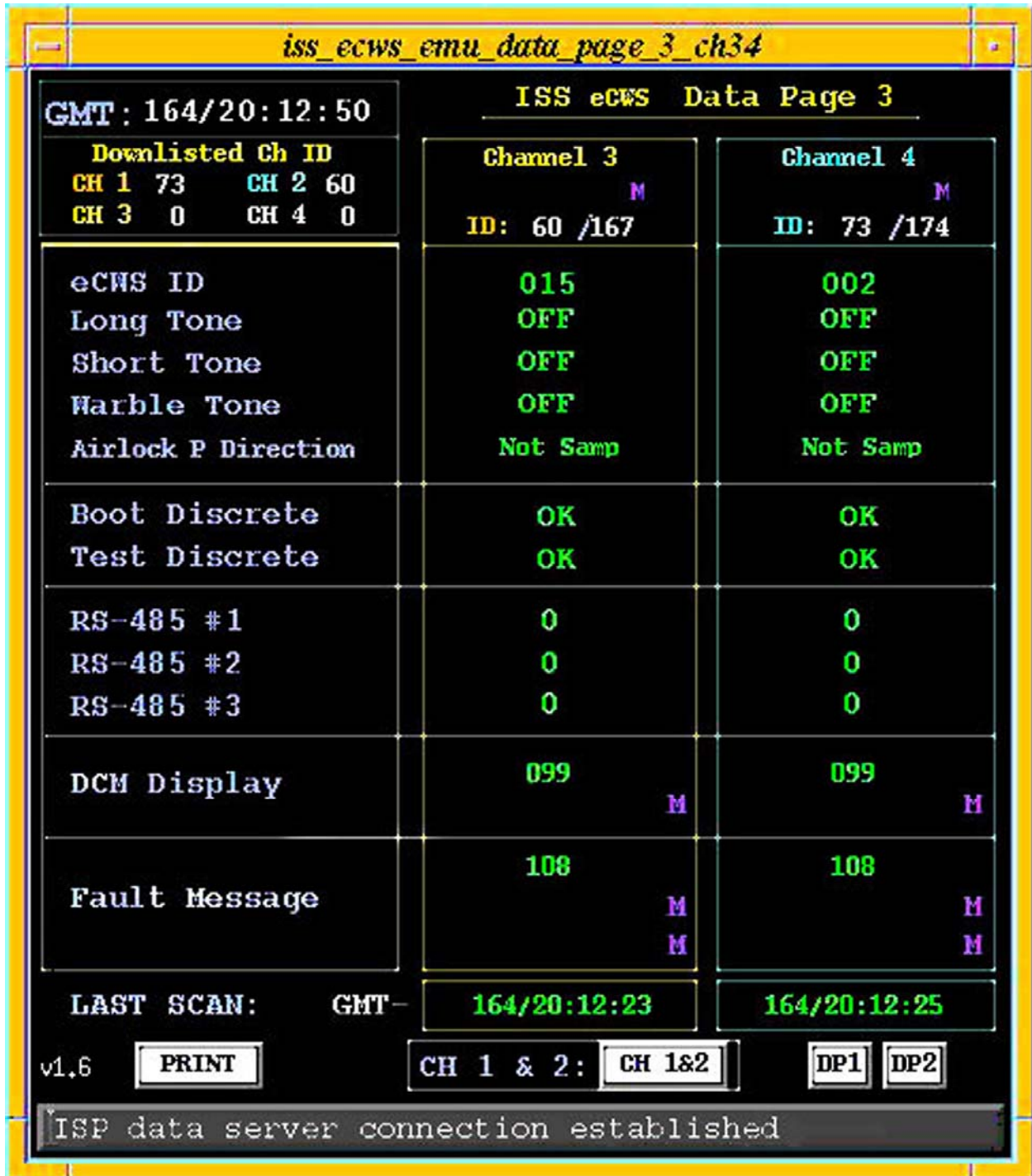
Table 5.4-1 ISS EMU Data Page 2 Parameters

Parameter	PUI	Comment
Downlisted Ch ID: CH 1, 2, 3, 4	1 – LACU03FC1000U 2 – LACU03FC2000U 3 – LACU03FC3000U 4 – LACU03FC4000U	Displays the currently down-linked radio ID for the appropriate channel. Radio IDs can be found at the following location: http://ea.isc.nasa.gov/eawebfiles/ea-projects/flightgfe/Sscs/Html/RadioFlightHistory/SSER.htm
	ISS_EMU_ASTRO_NAME	Name or title of each column can be added on the first workstation to be initialized. First, initialize the workstation. Second, select SETUP from the ecws_emud::Station v 3.1.1 window. Third, input the names or titles into the EMU Daemon:Config Dialog window
ID	ISS_EMU1_RADIO_ID ISS_EMU1_BU_RADIO_ID ISS_EMU2_RADIO_ID ISS_EMU2_BU_RADIO_ID	Radio IDs can be added on the first workstation to be initialized. First, initialize the workstation. Second, select SETUP from the ecws_emud::Station v 3.1.1 window. Third, input the radio IDs into the EMU Daemon:Config Dialog window. This will set the radio IDs for the current column
eCWS ID	ISS_EMU1_CWS_ID ISS_EMU2_CWS_ID	Displays the eCWS serial number
Status Switch	ISS_EMU1_STATUS_SW ISS_EMU2_STATUS_SW	Discrete displaying if the Display switch is in the "Status/No" position
Program Switch	ISS_EMU1_PROGRAM_SW ISS_EMU2_PROGRAM_SW	Discrete displaying if the Display switch is in the "Pro/Yes" position
Vehicle Power	ISS_EMU1_VEH_PWR ISS_EMU2_VEH_PWR	Discrete displaying if the Power switch is in the "Vehicle Power" position.
Battery Power	ISS_EMU1_BATT_PWR ISS_EMU2_BATT_PWR	Discrete displaying if the Power switch is in the "Battery Power" position
Feedwater Valve	ISS_EMU1_FEED_WATER_OP1 ISS_EMU1_FEED_WATER_OP2 ISS_EMU2_FEED_WATER_OP1 ISS_EMU2_FEED_WATER_OP2	Discrete displaying if the Feedwater valve is in the "Open" position
Fan Switch	ISS_EMU1_FAN_ON ISS_EMU2_FAN_ON	Discrete displaying if the Fan switch is in the "On" position
Vent Flow	ISS_EMU1_VENT_FLOW ISS_EMU2_VENT_FLOW	Discrete displaying if the Vent Flow/check valve switch is in the "Open" position

Table 5.4-1 ISS EMU Data Page 2 Parameters (concluded)

Parameter	PUI	Comment
EVA Position	ISS_EMU1_EVA_POS ISS_EMU2_EVA_POS	Discrete displaying if the O2 Actuator EVA microswitch is in the "On" position
OFF/PRESS Pos	ISS_EMU1_OFF_PRESS_HIGH ISS_EMU2_OFF_PRESS_HIGH	Discrete displaying if the O2 Actuator OFF/PRESS microswitch is in the "On" position
IV/PRESS Pos	ISS_EMU1_OFF_PRESS_LOW ISS_EMU2_OFF_PRESS_LOW	Discrete displaying if the O2 Actuator IV/PRESS microswitch is in the "On" position
x-state	ISS_EMU1_X_STATE_BYTE ISS_EMU2_X_STATE_BYTE	Displays the current X-state of the EMU caution and warning system
Batt Capacity	ISS_EMU1_BATTERY_CAPACITY ISS_EMU2_BATTER_CAPCITY	Battery capacity set in the EMU caution and warning system. Range is from 26.4 to 40.0 amp-hours. Default is 32. The value is set via the battery amps submenu
Analog Ref Volt (95%)	ISS_EMU1_ANALOG_REF_V_95 ISS_EMU2_ANALOG_REF_V_95	Displays the voltage of the 95% analog reference voltage
Analog Ref (5%)	ISS_EMU1_ANALOG_REF_V_5 ISS_EMU2_ANALOG_REF_V_5	Displays the voltage of the 5% analog reference voltage
+13.5 Volts	ISS_EMU1_POS_13_VOLT ISS_EMU2_POS_13_VOLT	Displays the voltage for the +13.5 volts source
-13.5 Volts	ISS_EMU1_NEG_13_VOLT ISS_EMU2_NEG_13_VOLT	Displays the voltage for the -13.5 volts source
Mark Time	ISS_EMU1_TIME_MARK_HRS ISS_EMU2_TIME_MARK_HRS	The elapsed time in 10 second increments since the last power restart
LAST SCAN	ISS_EMU1_LAST_SCAN_TIME ISS_EMU2_LAST_SCAN_TIME	Displays the time of the last EMU data pass

5.5 ISS EMU DATA PAGE 3



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Figure 5.5-1. ISS EMU Data Page 3

Table 5.5-1. ISS EMU Data Page 3 Parameters

Parameter	PUI	Comment
Downlisted Ch ID: CH 1, 2, 3, 4	1 – LACU03FC1000U 2 – LACU03FC2000U 3 – LACU03FC3000U 4 – LACU03FC4000U	Displays the currently down-linked radio ID for the appropriate channel. Radio IDs can be found at the following location: http://ea.jsc.nasa.gov/eawebfiles/ea-projects/flightgfe/Sscs/Html/RadioFlightHistory/SSER.htm
	ISS_EMU_ASTRO_NAME	Name or title of each column can be added on the first workstation to be initialized. First, initialize the workstation. Second, select SETUP from the ecws_emud::Station v 3.1.1 window. Third, input the names or titles into the EMU Daemon:Config Dialog window
ID	ISS_EMU1_RADIO_ID ISS_EMU1_BU_RADIO_ID ISS_EMU2_RADIO_ID ISS_EMU2_BU_RADIO_ID	Radio IDs can be added on the first workstation to be initialized. First, initialize the workstation. Second, select SETUP from the ecws_emud::Station v 3.1.1 window. Third, input the radio IDs into the EMU Daemon:Config Dialog window. This will set the radio IDs for the current column
eCWS ID	ISS_EMU1_CWS_ID ISS_EMU2_CWS_ID	Displays the eCWS serial number
Long Tone	ISS_EMU1_LONG_TONE ISS_EMU2_LONG_TONE	Displays if the EMU long tone (statue tone) is annunciating
Short Tone	ISS_EMU1_SHORT_TONE ISS_EMU2_SHORT_TONE	Displays if the EMU short tone (alert tone) is annunciating
Warble Tone	ISS_EMU1_WARBLE_TONE ISS_EMU2_WARBLE_TONE	Displays if the EMU warble tone (warning tone) is annunciating
Airlock P Direction	ISS_EMU1_AIRLOCK_P_DIR ISS_EMU2_AIRLOCK_P_DIR	Options: "Not Samp", "ERR!", "Stable", "Increase", "Decrease"
Boot Discrete	ISS_EMU1_BOOT ISS_EMU2_BOOT	Indicates if the EMU is in the maintenance and test mode of operations. It can only be entered during power up. This mode is currently not used on orbit
Test Discrete	ISS_EMU1_TEST ISS_EMU2_TEST	This mode is used during processing operations to set parameters. Flight mode functionality is available in this mode as long as X-state is not 1

Table 5.5-1. ISS EMU Data Page 3 Parameters (concluded)

Parameter	PUI	Comment
RS-485 #1	ISS_EMU1_RS485_1 ISS_EMU2_RS485_1	Indicates the EMU is interfacing with 1 RS485 device during Boot, Test, or Flight modes
RS-485 #2	ISS_EMU1_RS485_2 ISS_EMU2_RS485_2	Indicates the EMU is interfacing with 2 RS485 device during Boot, Test, or Flight modes
RS-485 #3	ISS_EMU1_RS485_3 ISS_EMU2_RS485_3	Indicates the EMU is interfacing with 3 RS485 device during Boot, Test, or Flight modes
DCM Display	ISS_EMU1_MSG_NUM ISS_EMU2_MSG_NUM	Displays the current message on the DCM display during the data pass
Fault Message	ISS_EMU1_FAULT_MSG_NUM ISS_EMU2_FAULT_MSG_NUM	Displays the highest fault message in the Fault Stack
LAST SCAN	ISS_EMU1_LAST_SCAN_TIME ISS_EMU2_LAST_SCAN_TIME	Displays the time of the last EMU data pass

APPENDIX A ***EVA EMU CONSUMABLES WORKSTATION USERS GUIDE AND APPLICATION CALCULATIONS, VERSION 2.4.1***

<i>DATE</i>	<i>APPLICATION VERSION AFFECTED</i>	<i>AUTHOR</i>	<i>DETAILED CHANGE</i>	<i>FLIGHT EFFECTIVITY</i>
02/08/97	RTDSver2.xls STATver1.xls	P. Boehm	Baseline Spreadsheets	STS-82 and subs
09/19/97	RTDSver3.xls STATver2.xls	P. Boehm	1) Changed calculation of Power per update instead of average amps 2) Updated/Added LiOH calculations based on O ₂ Tank Pressure 3) Updated User's Guide file	STS-86 and subs
09/29/97	RTDSver4.xls STATver3.xls	P. Boehm	Added ability for holding on SCU during EVA 1) Changed Time EV calculation on Details page to be delta time from PWR-SCU while holding 2) Updated User's Guide file	STS-87 and subs
4/18/00	RTDS Version 5.0	P. Boehm	1) Incorporated changes per Hamilton Sunstrand EMUM 0404 "Consumable Tracking During EVA" 3/15/00 <ul style="list-style-type: none"> • RQ value standard at 0.87 • O₂ Tank temp standard at 60 F • Created Initial Battery Capacity Calculations for multiple EVAs • Created CCC BTUs 30 minute reserve cut-off (2700 BTUs) • Set P/B met rate to standard 400 BTU/hr • Created Latest EVA PET redline times for start of EVA Clean-up 2) Updated User's Guide and Change Log	STS-101 and subs

<i>DATE</i>	<i>APPLICATION VERSION AFFECTED</i>	<i>AUTHOR</i>	<i>DETAILED CHANGE</i>	<i>FLIGHT EFFECTIVITY</i>
4/26/00	RTDS Version 5.0a	P. Boehm	<ol style="list-style-type: none"> 1) Corrected problems with RTDS Version 5.0 per verification 2) Updated User's Guide and Change Log 3) Added highlight for lowest EVA PET value 	STS-101 and subs
5/18/00	N/A	P. Boehm	<ol style="list-style-type: none"> 1) Updated User's Guide with STS-96 water data and corrected Flight Data book BTU calculation error 	
3/06/01	RTDS Version 6.xls	P. Boehm	<ol style="list-style-type: none"> 1) Incorporated changes: <ul style="list-style-type: none"> • Changed 2700 BTU LiOH reduction (30 min resrv) to 1500 BTUs per EC/MOD agreement • Added additional rows on Details sheet for 8hr EVA • Added O₂ limit of 150 psi for recharge to O₂ Time Left calculations per MOD/XA/EC agreement • Added variable CWS Battery capacity for two part EVA, and corrected CWS %PWR and Time left calculations • Revised Initial Data sheet for two part EVA • Added SCU time into EVA PET calculations on Updates sheet for two part EVA • Deleted sheets for equations and notes, already covered in other sheets 2) Updated User's Guide and change log 	STS-102 and subs
8/16/01	N/A	L. Shore	<ol style="list-style-type: none"> 1) Updated User's Guide with METOX and ICB data per Hamilton Sunstrand EMUM#0598. 2) Incorporated data from STS-104, the first EVA to use METOX and the first out of the ISS Joint Airlock 	STS-108/UF-1 and subs

<i>DATE</i>	<i>APPLICATION VERSION AFFECTED</i>	<i>AUTHOR</i>	<i>DETAILED CHANGE</i>	<i>FLIGHT EFFECTIVITY</i>
3/15/05	Xess Spreadsheet on workstation	P. Boehm	1) Replaced PC Spreadsheets with DEC Alpha based Xess spreadsheet based on RTDS Version 6.xls from the PC. Move done to put spreadsheet on controlled platform in response to Columbia Investigation. User's guide not updated.	STS-114 and subs
3/10/06	New workstation Version 2.2 baselined	P. Boehm	1) Xess Spreadsheet version replaced by new automated workstation version 2.2. (Version 2.2 based on original non-certified workstation version) User's guide not updated.	STS-121 and subs
5/15/08	Workstation Version 2.3.1	P. Boehm	1) Revised entire document to describe automated workstation version 2.3.1 consumables application, removed all PC spreadsheet descriptions. 2) Revised redline limits to match flight rules for EMU consumables. Also due to eCWS changes for CO2. 3) Revised EMU battery capacity calculations to match FEMU-R-003 Rev L-3	STS-124 and subs
03/23/09	Workstation Version 2.4.1	A. Luta	1) Updated displays with new parameter AVG gives entire EVA data Total gives AVG (10) - last 10 EVA passes	STS-126 and subs

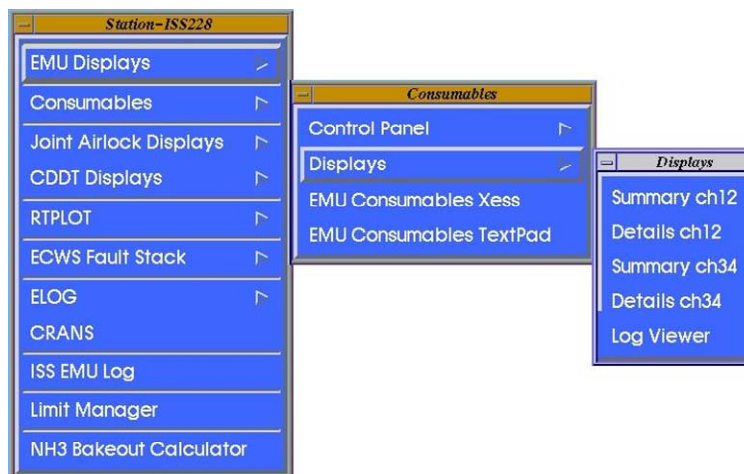
A.1 INTRODUCTION

This user's guide is for the MCC Workstation "EVA EMU Consumables" real-time telemetry application for automated calculation of estimates of Time Left for EMU consumables during an EVA. The application takes the EMU Real-Time Data System (RTDS) downlink input of the suit Time EV, O₂ P, and battery amps, and provides time left to SCU connection for the four major consumables (i.e., O₂, Battery, CCC, and Water).

The actual downlink RTDS data (battery volts, CO₂, O₂ P) always has priority when one is making decisions on EMU consumables if a conflict occurs with the application calculations (e.g., sensors begin to indicate shortened time left). In this condition, sensor readings override the calculations and should be used to estimate time left by rate of change of the parameter.

A.1.1 DISPLAYS

The application has four user interface displays found under the EVA DNAV



A. Summary display (MSKView software type display)

This display is intended to be use by the EVA FCR. This display contains the four consumable parameters and their associated Time Left to SCU connections.

iss_cons_summary_ch12					
GMT: 328/19:08:52		ISS EMU Consumable Summary			
PROCESSING		Channel 1		Channel 2	
CH 1	CH 2	ID	M / M	ID	M / M
M	M				
LAST SCAN	hh:mm		M		M
Time EV	hh:mm		M		M
Limiting Consumable			M		M
Time Left To SCU (w/ Req Reserve)					
02	hh:mm		M		M
Battery	hh:mm		M		M
CCC	hh:mm		M		M
Water	hh:mm		M		M
02 EVA Avg	hh:mm		M		M
CCC EVA Avg	hh:mm		M		M
v2.1					
ISP data server connection established					

B. *Details display (MSKView software type display)*

This display is intended to be used by the EVA Systems MPSR. It contains details of the usage rates and Time Left of the consumables.

iss_cons_details_ch12							
GMT: 328/19:09:23		ISS Consumable Details					
PROCESSING		Channel 1		Channel 2			
CH 1	CH 2	ID	M/	M	ID	M/	M
LAST SCAN	hh:mm			M			M
Time EV	hh:mm		M			M	
Limiting Consumable			M			M	
O2							
Total O2 PET (to SCU)							
EVA avg:	hh:mm		M			M	
Use Rate - EVA Avg	PSI/m		M			M	
Total O2 PET (to SCU)	hh:mm		M			M	
Use Rate Avg (10)	PSI/m		M			M	
Use Rate - Inst	PSI/m		M			M	
Delta P	PSI		M			M	
CCC							
Total CCC PET (to SCU)							
EVA avg:	hh:mm		M			M	
MET Rate - EVA Avg	BTU/hr		M			M	
Total CCC PET (to SCU)	hh:mm		M			M	
MET Rate Avg (10)	BTU/hr		M			M	
MET Rate - Inst	BTU/hr		M			M	
Total BTUs Used	BTU		M			M	
Power							
Actual Battery							
Total Batt PET (to SCU)	hh:mm		M			M	
Total Amp-Hr Used	Amp-Hr		M			M	
CWS Battery							
Message PET	hh:mm		M			M	
Time Left	hh:mm		M			M	
BTU/LB O2			M			M	

ISP data server connection established

C. Initial Values display (Perl software type display)

This display is intended to be used by the EVA Systems MPSR. It starts when the application is started. It contains the fields for input of the initial values to be used by the application for the start of calculations of the remaining consumables. The initial values can be saved to a file for later use so that the user is not required to retype them. A generic file is located in the default directory that the user can start with for EVAs and subsequently edit only the values needed.

D. *Consumables log (Perl software type display)*

This display is intended to be used by the EVA Systems MPSR. It contains a recorded log of results of all the calculations, usage rates, and time left for each valid data pass. The log is created each time the application is started and continually written during an EVA. The EVA Systems MPSR can review the log file on the workstation at any time to see the previous trends.

showlog 1.1 - /amd/user3/eva/DATA/ISS024-MIS/iss_consume_ch1_2007_299_14_34_52.log

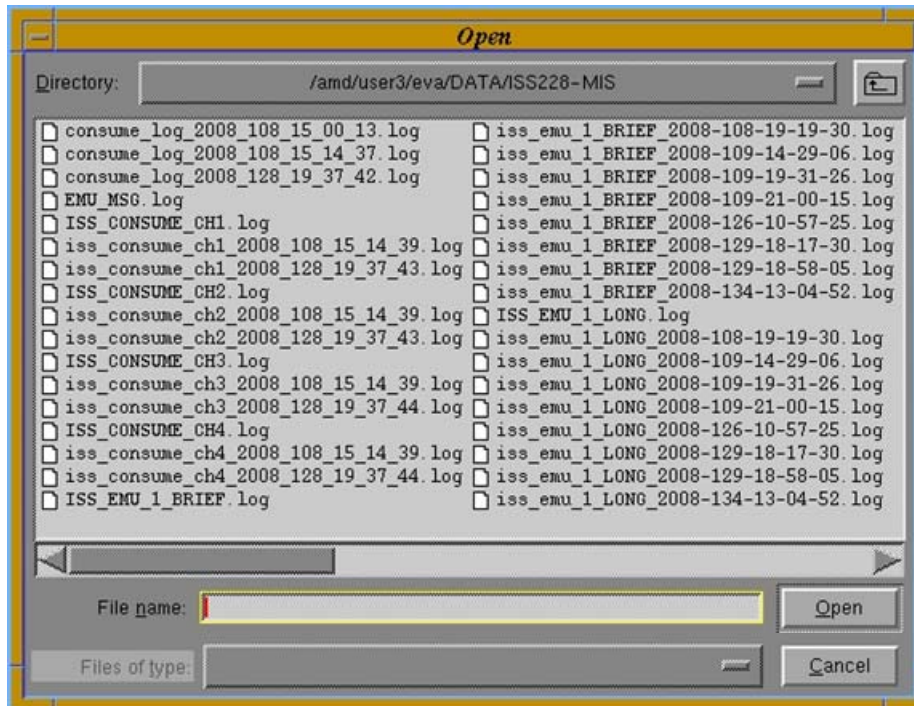
Log File: /amd/user3/eva/DATA/ISS024-MIS/iss_consume_ch1_2007_299_14_34_52.log Refresh Interval: 20 sec

Linked To: N/A

Time EV [hh:mm]	Time [hh:mm]	O2 Time Left [hh:mm]	Power - Reserve Time Left [hh:mm]	CCC Time Left [hh:mm]	Water Time Left [hh:mm]	Limiting Consumable	O2 PET [hh:mm]	Power - PET Message [hh:mm]	Power - Actual PET [hh:mm]
00:14:00	01:59:03	20:36:37	09:22:54	18:57:08	08:57:14	H2O	20:50:37	07:52:54	09:36:54
00:16:00	02:05:33	07:55:11	09:24:58	07:16:48	08:55:14	CCC	08:11:11	07:56:16	09:40:58
00:24:00	03:25:42	05:34:45	09:22:47	05:07:04	08:47:14	CCC	05:58:45	08:01:11	09:46:47
00:26:00	03:45:33	08:28:31	09:15:12	07:46:17	08:45:14	CCC	08:54:31	07:56:21	09:41:12
00:30:00	04:25:38	07:18:11	09:21:42	06:41:22	08:41:14	CCC	07:49:11	08:05:19	09:51:42
00:40:00	06:05:41	05:04:56	09:02:16	04:38:33	08:31:14	CCC	05:44:56	07:57:09	09:42:16
00:48:00	07:25:33	06:14:40	08:22:38	05:41:33	08:23:14	CCC	07:02:40	07:30:50	09:10:38
00:50:00	07:45:33	07:35:10	08:14:59	00:32:57	08:21:14	PWR	08:25:10	07:26:49	09:04:59
00:52:00	08:05:43	03:56:45	08:18:23	03:35:38	08:19:14	CCC	04:48:45	07:31:27	09:10:23
00:56:00	08:45:31	06:46:11	08:10:51	06:09:33	08:15:14	CCC	07:42:11	07:28:22	09:06:51
00:58:00	09:05:43	06:15:25	08:08:45	04:41:22	08:13:14	CCC	07:13:25	07:28:22	09:06:45
01:00:00	09:25:33	06:13:38	08:07:50	05:39:35	08:11:14	CCC	07:13:38	07:29:16	09:07:50
01:08:00	10:45:43	06:02:54	07:57:42	05:08:55	08:03:14	CCC	07:10:54	07:27:28	09:05:42
01:10:00	11:05:44	06:01:18	07:54:56	05:27:19	08:01:14	CCC	07:11:18	07:26:53	09:04:56
01:12:00	11:25:43	06:13:42	07:49:06	05:38:27	07:59:14	CCC	07:25:42	07:23:42	09:01:06
01:14:00	11:45:43	06:46:40	07:45:16	06:08:11	07:57:14	CCC	08:00:40	07:22:17	08:59:16
01:16:00	12:05:35	06:35:49	07:57:33	05:58:07	07:55:14	CCC	07:51:49	07:34:11	09:13:33
01:18:00	12:25:43	05:55:25	07:43:45	05:21:22	07:53:14	CCC	07:13:25	07:24:02	09:01:45
01:20:00	12:45:43	06:35:46	07:39:20	05:57:44	07:51:14	CCC	07:55:46	07:22:21	08:59:20
01:22:00	13:05:43	06:35:13	07:48:58	05:57:00	07:49:14	CCC	07:57:13	07:32:01	09:10:58
01:24:00	13:25:43	07:23:09	07:40:45	06:40:17	07:47:14	CCC	08:47:09	07:26:35	09:04:45
01:26:00	13:45:43	06:54:28	07:35:11	06:14:03	07:45:14	CCC	08:20:28	07:23:48	09:01:11
01:28:00	14:05:43	07:50:07	07:38:08	07:04:14	07:43:14	CCC	09:18:07	07:27:58	09:06:08
01:30:00	14:25:43	07:47:57	07:35:16	07:02:03	07:41:14	CCC	09:17:57	07:27:08	09:05:16
01:32:00	14:45:43	07:51:46	07:24:19	07:05:22	07:39:14	CCC	09:23:46	07:19:48	08:56:19
01:34:00	15:05:43	07:55:54	07:31:55	07:08:59	07:37:14	CCC	09:29:54	07:27:55	09:05:55
01:36:00	15:25:43	08:15:29	07:18:48	07:26:23	07:35:14	PWR	09:51:29	07:18:31	08:54:48
01:40:00	16:05:43	08:31:54	07:27:49	07:40:43	07:31:14	PWR	10:11:54	07:29:31	09:07:49
01:42:00	16:25:43	08:05:41	07:22:37	07:16:52	07:29:14	CCC	09:47:41	07:26:32	09:04:37
01:44:00	16:45:43	08:20:44	07:17:35	07:30:10	07:27:14	PWR	10:04:44	07:24:09	09:01:35
01:46:00	17:05:43	06:56:48	07:11:40	06:14:22	07:25:14	CCC	08:42:48	07:21:01	08:57:40
01:48:00	17:25:43	07:26:10	07:14:18	06:40:32	07:23:14	CCC	09:14:10	07:24:55	09:02:18
01:54:00	18:25:42	06:48:45	07:03:24	06:06:19	07:17:14	CCC	08:42:45	07:20:47	08:57:24
01:56:00	18:45:42	06:26:19	07:05:36	05:45:55	07:15:14	CCC	08:22:19	07:24:20	09:01:36
02:00:00	19:25:42	06:08:24	06:57:42	05:29:29	07:11:14	CCC	08:08:24	07:21:03	08:57:42
02:02:00	19:45:42	05:47:10	07:03:19	05:10:18	07:09:14	CCC	07:49:10	07:27:21	09:05:19
02:04:00	20:05:42	06:01:56	06:49:58	05:23:22	07:07:14	CCC	08:05:56	07:17:55	08:53:58
02:06:00	20:25:42	05:45:11	06:56:38	05:08:09	07:05:14	CCC	07:51:11	07:25:17	09:02:38
02:08:00	20:45:42	05:46:28	06:56:30	05:09:06	07:03:14	CCC	07:54:28	07:26:32	09:04:30
02:10:00	21:05:42	05:41:30	06:44:54	05:04:28	07:01:14	CCC	07:51:30	07:18:44	08:54:54
02:14:00	21:45:42	06:00:06	06:40:57	05:20:30	06:57:14	CCC	08:14:06	07:25:29	09:02:57
02:18:00	22:25:42	05:54:31	06:41:03	05:15:15	06:53:14	CCC	08:12:31	07:22:07	08:59:03
02:20:00	22:45:42	05:20:57	06:34:15	04:45:01	06:51:14	CCC	07:40:57	07:18:23	08:54:15
02:22:00	23:05:49	05:33:26	06:37:18	04:55:54	06:49:14	CCC	07:55:26	07:22:34	08:59:18
02:24:00	23:25:42	05:31:39	06:30:01	04:54:07	06:47:14	CCC	07:55:39	07:18:11	08:54:01
02:26:00	23:45:42	05:29:42	06:35:00	04:52:10	06:45:14	CCC	07:55:42	07:23:56	09:01:00
02:28:00	00:05:41	04:47:37	06:35:02	04:14:30	06:43:14	CCC	07:15:37	07:25:20	09:03:02
02:34:00	01:05:43	04:53:01	06:23:54	04:18:45	06:37:14	CCC	07:27:01	07:21:11	08:57:54
02:38:00	01:45:43	04:39:24	06:16:55	04:06:12	06:33:14	CCC	07:17:24	07:18:58	08:54:55
02:40:00	02:05:43	04:55:01	06:17:51	04:19:53	06:31:14	CCC	07:35:01	07:21:23	08:57:51

A.1.2 Log Files

The log files are saved using a standardized naming convention. An example is "iss_consume_ch1_2007_299_14_34_52.log," which is the ISS (as opposed to shuttle) version of the consumables application for Channel 1 data with application start at GMT 2007/299:14:34:52. A log file is created each time the Consumables application is started. Each of these files is saved in its corresponding flight directory based on the workstation activity into which the user is logged (i.e., ISS228-MIS for an ISS mission activity, SSP123 for a shuttle activity).



The window above shows the log files for the STS-120 mission under the ISS225-MIS mission flight directory. All log files for both the Consumables application and EMU Daemon are saved in the "/amd/user3/eva/DATA/XXXX" flight directories. After an EVA, the "iss_consume_chX..." (ISS) or "consume_log_..." (SSP) consumable log files can be exported in ASCII format (using the MCC workstation FTP utility) to be imported and displayed in an Excel tab delimited spreadsheet for graphing and manipulation.

A.1.3 No RTDS Data Consumables

If no RTDS EMU data are being received in MCC, and the ground is relying on DCM statuses from the EVA crew, a backup spreadsheet on the PC exists to allow back calculation of the remaining EMU consumables from the short list parameters provided on the DCM. The file is called STAT VerX.xls. This file is designed for use when no ground data is available and the user is relying on EV crew hourly short status of TIME EV, % PWR, % O2, and TIME LF as inputs to the file. This file is located on the MCC V: drive under the EMU consumables directory.

A.2 OPERATING THE EVA CONSUMABLES APPLICATION

The application is started and controlled by the EVA Systems MPSR position using the EVA DNAV menu item Control Panel→Start. When the application initializes, it starts the Initial Values display. The user can then input the initial values. The function of the items on the Initial Values display are described below. A simple error check of values inputted can also be performed; values for error checks are also described below.

The consumables application requires certain conditions in order to complete a calculation. The application does not start computations unless the following conditions are met:

- A. TIME EV > 0:00. The application sits dormant until TIME EV is greater than 0.
- B. EMU check sums are valid. An invalid check sum (either part) causes the application to ignore the data pass.
- C. One of the three inputs (TIME EV, O2 P, Amps) has been updated.
- D. TIME EV, O2 P, Amps are all valid updates (i.e., status is good). If any one of these is not valid, the application ignores the data pass.

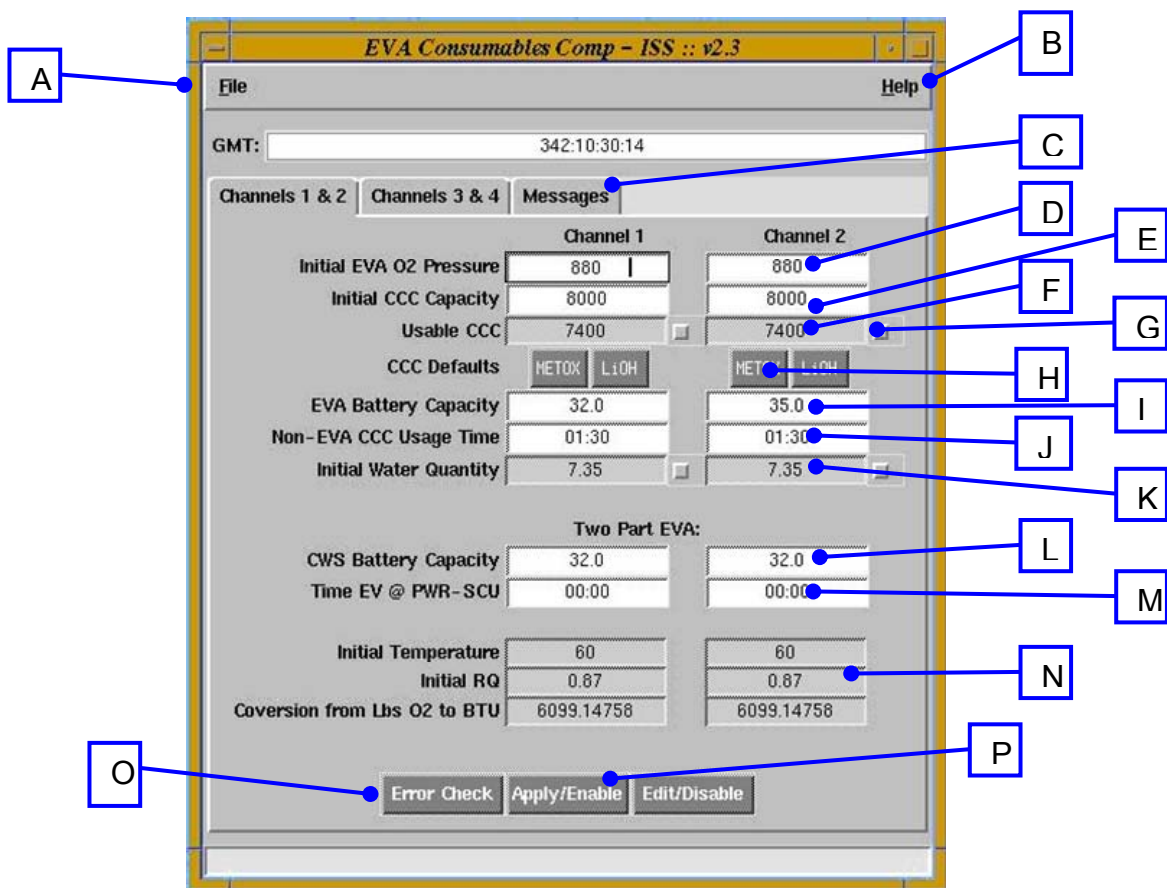


Figure A-1. EVA Consumables application Initial Values display

- A. The File menu allows the user to save or load an initial inputs file.
- B. The Help menu provides an overview of calculations.
- C. Tabs allow the user to select inputs for ISS channels and view messages associated with the control of the application.

- D. *Initial EVA O₂ Pressure allows input for initial primary O₂ tank pressure after SCU is disconnected. The error checks value is < 1,600 psi (this value was chosen to allow higher than 900 input for O₂ recharges).*
- E. *Initial CCC Capacity is from the EMU Flight Data book (LiOH) or standard 8,000 BTUs for Metox. The error check value is < 15,000 BTUs.*
- F. *Usable CCC displays CCC capacity to be used in calculations after the 30-minute reserve is removed. Grayed areas cannot be edited unless the manual override check box is activated. The error check value is < 15,000 BTUs.*
- G. *Manual override check boxes allow the user to edit grayed fields manually, if required.*
- H. *CCC Defaults allow the user to select the appropriate button to subtract the standardized 30 minute reserve capacity from the Initial CCC capacity. Values removed are 600 BTUs for Metox and 1,500 BTUs for LiOH.*

Note: The LiOH reserve is now 1,200 BTUs; therefore, manual entry is required until the application is changed.

- I. *The EVA Battery Capacity field is used to enter battery Amp-Hr capacity. The standard used is 32 amp hours for any battery over 32 to match the EMU eCWS default value. Lower values are added, as required. The error check value is < 40.0 Amp-Hr.*
- J. *The Non-EVA CCC Usage Time field is used to enter non-EVA CCC time. Nominally, this is the time from EMU fan on to start of EVA PET (donning, purge, P/B, depress). Time is entered in HH:MM format. The error check value is < 8:00 hr.*
- K. *Initial Water Quantity is fixed valve but may be edited using the check box. This can be used if the user suspects that a bubble is in one of the EMU water tanks. The error check value is < 10.0 lbs.*
- L. *The CWS Battery Capacity field is used to input eCWS battery capacity that EMU uses for its PWR TIME LF calculations. This value should match what the EV crew has on the EMU BATT A-H display. The error check value is < 40.0 Amp-Hr.*
- M. *The Time EV @ PWR-SCU field is used to enter TIME EV from EMU Data Page 1 when EMU is returned to battery power after hold in airlock on SCU. This field provides new EVA PET=0:00 start point for calculations of EMU consumables since TIME EV stops while on SCU power and requires a new reference base for TIME EV.*
- N. *The Initial RQ fields are not editable; they show the agreed to constants used to convert O₂ lbs used to BTUs.*

- O. *The Conversion from Lbs O₂ to BTU button performs a simple error check on values entered manually by the user (i.e., “sanity check”).*
- P. *The APPLY/ENABLE button locks the display fields (turning green), applies values, and enables the application to begin calculations when required conditions are met. The EDIT/DISABLE button unlocks the display fields (turning white) for the user editing and prevents the application from performing calculations. The status of enable/disable is available on the Summary and Details displays.*

A.2.4 Loading or Saving Initial Values

Initial values may be entered manually, loaded from a file, or loaded from the current memory of the telemetry (ISP) stream. The File menu contains the options for loading values from file or telemetry. A generic file set of initial values are saved in the “/amd/user3/eva” directory (see Figure A-2).

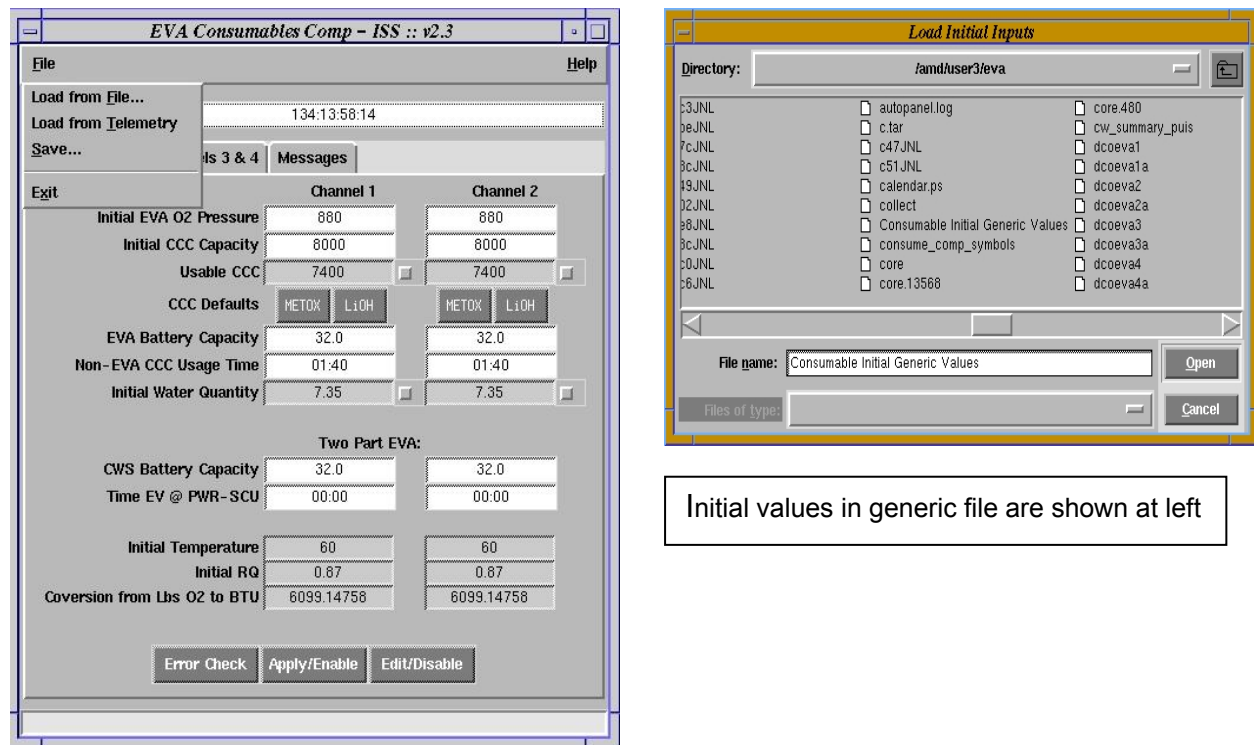


Figure A-2. Loading and saving initial values

Initial values in generic file are shown at left

A.2.5 *Performing an O₂ Recharge during EVA*

(Reference O₂ Recharge Cue Card Summary that follows.)

When performing only an O₂ recharge during an EVA (not switching to SCU power while in the airlock), the application must be restarted and a new Initial O₂ P value input for the recharging crewmember. The philosophy is that the entire first part of the EVA before O₂ recharge usage will be recreated in the application's first data pass after the recharge and the user will not need to subtract BTUs used and power used from the initial values of part 1. The key is to add the O₂ that the recharging EV crewmember had already used in the first part of the EVA, then let the application calculate the delta for part 1 of the EVA during the first data pass after recharge.

As an example, EV1 goes in for an O₂ recharge. The initial value started at 880 and is now down to 650 at TIME EV of 2:10. EV1 recharges to 860 and then gets off the SCU. The delta O₂ value is added (880 - 650 = 230) to the recharge value (860) for a new EV1 initial O₂ value of 860 + 230=1,090. All the rest of the initial values stay the same from part 1. The application must be restarted for this to work.

On the first data pass after EV1 is off the SCU, the consumables take the current TIME EV (possibly 2:25) and calculate the BTUs using the O₂ delta (1090-860 x current TIME EV) and power used by Amp-Hr used (amps x current TIME EV). The application has now calculated the part 1 consumables used.

All values for part 1 of EV2 are calculated on the first data pass as well. It would be similar to the case of not starting the consumables until 2:25 into the EVA so it would be more of an average over that first 2:25 for use rates. Therefore, more data passes from this point on would help converge/refine the Time Left numbers.

O2 RECHARGE CUE CARD

To Restart EMU Consumables Application for O2 Recharge Only:

- 1) SAVE Initial Values to a file
(remember file name – saved to “/amd/user3/eva” directory – generic values in “Consumables Generic Initial Values” file)
File > Save...
- 2) DETERMINE Δ O2 Used for EVx during part 1
 Δ O2 used during part 1 = _____ (Initial - minimum)
- 3) When EVx connects to SCU
Restart Consumables
Consumables > Control Panel > Recycle
- 4) LOAD Initial values from file created in step 1
File > Load from File....
- 5) All values will be the same as part 1 except:
Edit new EVx Initial EVA O2 Pressure
--NEW-- = Recharge O2 value + Δ O2 used during part 1
- 6) When EVx disconnects from SCU
Click **Apply/Enable**

The screenshot shows the 'EVA Consumables Comp - ISS :: v2.3' application window. It features a menu bar with 'File' and 'Help', and a status bar showing 'GMT: 342:10:30:14'. The main interface is divided into sections for 'Channels 1 & 2', 'Channels 3 & 4', and 'Messages'. Under 'Channels 1 & 2', there are two columns for 'Channel 1' and 'Channel 2'. Channel 1's 'Initial EVA O2 Pressure' is set to '--NEW--' (highlighted in red). Other parameters for Channel 1 include Initial CCC Capacity (8000), Usable CCC (7400), EVA Battery Capacity (32.0), Non-EVA CCC Usage Time (01:30), and Initial Water Quantity (7.35). Channel 2's parameters include Initial EVA O2 Pressure (880), Initial CCC Capacity (8000), Usable CCC (7400), EVA Battery Capacity (35.0), Non-EVA CCC Usage Time (01:30), and Initial Water Quantity (7.35). Below these are 'Two Part EVA' settings: CWS Battery Capacity (32.0), Time EV @ PWR-SCU (00:00), Initial Temperature (60), Initial RQ (0.87), and Conversion from Lbs O2 to BTU (6099.14758). At the bottom, there are three buttons: 'Error Check', 'Apply/Enable', and 'Edit/Disable'.

NOTES:

- 1) The first data pass will “recreate” the part 1 usage of consumables for both EV crew for the entire EVA up to that point. Values for O2, CCC, and battery power used will be totaled for the first part of the EVA as the first data point.
- 2) Data passes after the first will continue nominally for delta values for the EVA.
- 3) Since the usage for first part of the EVA is averaged over the whole TIME EV on the first data pass, the O2, CCC, and battery time left may be slightly off from the ending of the part 1 times. The times should converge with more data passes.

A.2.6 Performing a Two-Part EVA

If the EV crew returns to the airlock to hold on SCU and then returns to complete the EVA (part 2), this must be processed as a “two part” EVA. The first part of the EVA is before SCU connection, and the second part is after the crew returns to the EVA. TIME EV is continued starting at the time the EMUs go to SCU (i.e., the first data pass after PWR-BATT). The TIME EV from the EMU does not reset unless a cold restart is performed. It holds at the last time shown when power is taken to SCU and starts counting again when power is taken back to battery. The user must record the power and BTUs consumed from the first part manually to restart the application with these “new” initial values for the second part. Table A-1 provides a checklist for this process and Table A-2 shows new inputs.

Table A-1. Checklist for recording power and BTUs consumed

Step	Item	Value
1	Record last updated Time EV (from EMU data page 1 after PWR - SCU)	
2	Record Total Amp-hr used from Details display	
2A	Calculate Amp-hr remaining =	
3	Record Total BTUs used from Details display	
3A	Calculate BTUs remaining =	
4	SAVE Initial Values to a file	
5	RECYCLE consumables application	
6	LOAD Initial values from file	
7	Manually Input Second Part EVA Initial Values per table below	
8	AFTER >> PWR - BATT and SCU disconnected Click Apply/Enable to start application	

Table A-2. New consumable inputs

<i>New Initial Item</i>	<i>How calculated</i>	<i>New Value</i>
<i>Initial EVA O2 P (psi)</i>	<i>Refilled tank pressure =</i>	
<i>CCC Capacity (BTUs)</i>	<i>CCC Capacity Part 1 - Total BTUs Consumed with P/B Part 1 = ENTER VALUE MANUALLY in the "Usable CCC" field</i>	<i>From Step 3A</i>
<i>Current EVA Capacity (amp-hrs) (actual)</i>	<i>Current EVA Capacity Part1 - Total Pwr Used Part 1 = ENTER VALUE MANUALLY in the "EVA Battery Capacity" field</i>	<i>From Step 2A</i>
<i>Non-EVA CCC usage time (hh:mm)</i>	<i>Time holding on SCU between Part 1 and Part 2 = This must be entered so that the EVA PET times will be correct using the EMU data page 1 Time EV during the second part</i>	
<i>Usable Water (lb)</i>	<i>7.35 - (Part 1 Time EV x 0.8 lb/hr) =</i>	
<i>CWS Battery Capacity</i>	<i>Remains unchanged from Part 1 =</i>	
<i>TIME EV @ PWR - SCU</i>	<i>TIME EV last data pass (EMU Data Page 1) going on SCU power =</i>	<i>From Step 1</i>

For a quick "sanity check" on the Part 2 PET times after returning the the EVA

O2 Time to SCU ~ Part 1 Time EV + hold time + Part 1 Total O2 PET (to SCU)

Batt Time to SCU ~ Part 1 Total Batt PET (to SCU) + hold time

CCC EVA PET ~ Part 1 EVA PET (due to lower Met Rate on SCU)

A.2.7 Restarting the Application between EVAs

The application should be stopped and restarted before each EVA. This ensures that the log files are created (with naming GMT) close to each EVA and the file contains data from one EVA only. The quickest way to stop and restart the application is to use the RECYCLE menu item. Note that the application should restart automatically if closed (exited) accidentally. To stop the application permanently, the Autopilot application must be used to "deregister" the consumables.

A.3 CONSUMABLE CALCULATION REQUIREMENTS

The Oxygen, Battery, and LiOH ending points are based on REDLINE limits with respect to the time when the EV crew must be connected to the SCU with reserve to protect against having a 30-minute reserve of each consumable when SCU connection is made after airlock ingress (by Flight Rules A15-157 and B15-110). It should be noted that the initial version of this application contained "time left to clean-up," which was removed per DX3 group request to display all time remaining until SCU, allowing the Flight Control Team to manage the remaining time as they see fit and synch with flight rules.

Due to the rapid changes in O2 USE RATE, an average of the last 10 data inputs is used to calculate O2 TIME LF and CCC Time Left. This provides some filtering of the O₂ use but enables one to react to changes in crew workload. Battery Use Rate is a summation of all inputs.

Due to the potential time lapse between data, total EVA averages are used for rates for the STATverX.xls PC file.

A.3.1 O₂ Calculations

The consumption of O₂ by the crewmember varies greatly depending on the amount of work the EV crew is doing. O₂ TIME LF from the EMU can vary between data passes by as much as 1 or 2 hours. Due to this often rapid and constantly changing consumable, an average of the last 10 use rates is used to determine the O₂ TIME LF in the application. Per agreement with EC/XA/MOD in November 2000, a Primary O₂ pressure of 150 psi is used as the required time for an O₂ recharge. This protects the 30-minute reserve of O₂ at SCU connection required by the Flight Rules. The O₂ equation includes the 150 psi value as the lower O₂ P instead of the 75 psi value used by the eCWS.

O₂ REDLINE: The latest O₂ EVA PET for SCU = $[(\text{Current O}_2 \text{ P} - 150) \times 10 \text{ Avg Use Rate}] / 10 \text{ Average Use Rate}$

OR

O₂ REDLINE: Primary O₂ P = 150 psi must recharge O₂

A.3.2 Battery Power Calculations

Calculation of power Time Left by the EMU flight controller is critical in determining the actual battery power Time Left as opposed to the CWS power Time Left (based on 32 amp-hrs). The actual PWR Time Left can be calculated as follows:

Actual PWR TIME LF = $(\text{Actual Amp-hrs Remaining}) / \text{Amps}$

The application begins by calculating

(1) $Total\ Amp\text{-}hr\ Used = (Current\ Time\ EV - Last\ Time\ EV) \times Amps + SUM\ (previous\ Amp\text{-}hr\ Used)$

Equation (1) is used instead of the straightforward

(2) $Total\ Amp\text{-}hr\ Used = Average\ Amps \times Total\ Time\ EV$

since it does not quickly reflect a decrease in amp usage (i.e., due to LCVG Bypass or other amp decrease) and, therefore, gives an Amp-hr used value higher than the actual value. Table A-3 illustrates this for the case of EMU1 on STS-82 EVA#5 when a decrease in amps occurred near the end of the EVA.

Table A-3. Battery power of EMU1 on STS-82 EVA#5

Time EV	Amps(RTDS)	Amp*Hr Used (delta)	Total Amp*Hr Used (Eq 1)	Total Amp*Hr Used (Eq 2)
2:53	3.14	0.104667	9.095667	9.098839
2:55	3.13	0.104333	9.2	9.202801
2:57	3.14	0.104667	9.304667	9.30725
3:01	3.14	0.209333	9.514	9.516865
3:03	3.14	0.104667	9.618667	9.62132
3:09	3.14	0.314	9.932667	9.936069
3:17	2.99	0.398667	10.33133	10.34847
3:25	2.85	0.38	10.71133	10.75332
3:29	2.85	0.19	10.90133	10.94791
3:35	2.85	0.285	11.18633	11.24699
3:47	2.87	0.574	11.76033	11.86021
3:53	2.88	0.288	12.04833	12.15976
4:01	2.88	0.384	12.43233	12.56324

Equations (1) and (2) are the same for a relatively stable amp value of ~3.13 throughout the EVA until Time EV = 3:09. At this point, the averaged value of Equation (2) does not track the drop in amps as rapidly as the addition method used in Equation (1). There is a difference of 2.7 minutes in TIME LF (at 2.88 amps) at this point. An increase in amps is also tracked faster.

Once the Total Amp-hr used is determined, the actual Amp-hr remaining can be determined using the charged EVA Capacity which is performed by the flight controller and provided as an initial value to the application. Subtracting the Total Used Amp-hr from the Initial EVA Capacity gives the remaining capacity.

EVA Capacity - First Usage of ICB Battery

Definitions:

SELF: Self Discharge per month = 5%/month = .05

MOS: Number of Months since last charge

FULL: Full charge capacity from 16V (from Flight Data Book)

$$\text{EVA Capacity} = (0.98 \times \text{FULL}) - (\text{FULL} \times \text{SELF} \times \text{MOS})$$

EVA Capacity - Second Usage of ICB Battery

After the first usage, the value for a FULL charge is recalculated based on the previous EVA usage and 98% of the recharge amount. Afterwards, any charged stand time is accounted for by derating the estimated capacity 5%/month.

Definitions:

FULL: = Previous FULL charge calculation (Ah)

SELF: = Self-discharge in %/month

MOS: = Number of months since last charge

EVAPREV: = Previous FULL charge calculation (Ah)

RECHARGE: = PostEVA recharge (Ah)

$$\text{FULL}_{\text{new}} = \text{FULL} - \text{EVAPREV} + (.98 \times \text{RECHARGE})$$

$$\text{EVA Capacity} = \text{FULL}_{\text{new}} - \text{FULL}_{\text{new}} \times \text{SELF} \times \text{MOS}$$

A battery capacity for 30 minutes of reserve (i.e., time to 16.0 volts) is determined by the average of the last two RTDS amp readings multiplied by 0.5 hours to determine Amp-hrs to be subtracted from the above remaining capacity. Therefore, the remaining Time Left for battery includes the 30-minute reserve.

PWR REDLINE: Latest Actual PWR EVA PET for SCU = [Initial Batt Capacity - Total Used - {(30 min) x avg amps}/Current Amps

OR

PWR REDLINE: Battery voltage in EMU of 16.5 = 30 minutes until 16.0 volts (This is actually the reserve margin required per Flight Rules; therefore, this level should be reached only when the SCU is being connected.)

It should be noted that the voltage sensor has an error range of +/- 0.6 volts per EVA Console Handbook, Hamilton Standard EMUM 0404, and HSWL/V. Margiott, the max resistance is 0.06 ohms, resulting in a max line loss of ~ 0.2 volts from battery terminal to DCM sensor.

A.3.3 CCC (METOX and LIOH) Calculations

The time left of the CCC (LiOH or METOX) is calculated by first determining the total BTUs consumed (from delta O₂ pressure) and then dividing the remaining BTU capacity by the BTU/hr use rate. Since the BTU/hr use rate is dependent on the O₂ use rate (which can vary rapidly), the average of 10 O₂ use rates is used when determining the BTU/hr rate for CCC time remaining. The total time EV along with the total delta pressure in O₂ (from start of EVA) is used to determine the EVA AVG Met Rate.

BTUs consumed is determined by first calculating the mass of O₂ consumed (lbs) per the PV = mRT equation for the primary O₂ tanks, then multiplying by the conversion factor of BTUs/lbs O₂.

For the mass of O₂

Initial conditions and assumptions:

T = Primary O₂ Tank Temp (F°) = Initial Data Inputs sheet = 60 F°

V = Primary O₂ Tank Volume = 480 in³

R_u = Universal Gas Constant = 1546 ft-lb/lb•mol R°

m = Molecular Weight of O₂ = 32 lb/lb•mol

R = O₂ Gas Constant = R_u/ m

$$m = PV / R T$$

$$\text{lb O}_2 = \frac{[\Delta\text{O}_2 P \text{ lb/in}^2] \times (144 \text{ in}^2/\text{ft}^2) \times (32 \text{ lb/lb}\cdot\text{mol}) \times [(480 \text{ in}^3) / (1728 \text{ in}^3/\text{ft}^3)]}{[(1546 \text{ ft}\cdot\text{lb/lb}\cdot\text{mol R}^\circ) \times (60 \text{ F}^\circ + 460 \text{ R}^\circ)]}$$

$$(a) \quad \text{lb O}_2 = (\Delta\text{O}_2 \text{ P lb/in}^2) \times 0.001592198$$

to determine a use rate: $\text{lb O}_2/\text{hr} = (\Delta\text{O}_2 \text{ psi/min}) \times 60 \text{ min/hr} \times 0.00159219$

$$(b) \quad \text{lb O}_2/\text{hr} = (\Delta\text{O}_2 \text{ psi/min}) \times 0.0955318$$

It should be noted that the O₂ tank temperature used (60°) is fairly close to the observed external airlock temperatures from STS-82 and other flights. The external airlock was noted to be 10° F cooler than the middeck during STS-82 EMU C/O. The EMUs in the airlock recorded an ambient H₂O temperature of 62° while the middeck stowed EMU recorded an ambient H₂O temperature of 72°. Per EMUM 0404, the standard temperature used is 60°F.

The BTU/lb O₂ conversion

Per data obtained from Maria Keilich of Hamilton Standard, Hamilton Standard Internal Memo dated September 30, 1988, ANL 88-333 O₂ Consumption and CO₂ Production in the Shuttle EMU provides the following equation:

$$\text{lb O}_2 / \text{BTU} = (0.1708\text{E-}3 - (\text{RQ} - 0.707) \times (0.123\text{E-}4 / 0.293))$$

Where RQ = Respiratory Quotient

The RQ value is dependent on the crewmember's diet. A carbohydrate diet yields a higher RQ (RQ = 1.0), while a fat diet yields RQ = 0.7. The SVHS 7800 Hamilton Standard document uses 0.9 for RQ. The referenced memo indicates an EMU standard of 0.881 while Hamilton Standard at JSC uses 0.87. See also Bioastronautics Data Book, 2nd Ed., NASA 1973. Per Hamilton EMUM 0404, the standard the community uses is 0.87. This gives

$$\text{lb O}_2/\text{BTU} = (0.1708\text{E-}3 - (\text{RQ} - 0.707) \times (0.123\text{E-}4 / 0.293)) = 0.0001639573$$

$$0.1639573 \text{ lb O}_2/1000 \text{ BTU}$$

$$(c) \quad \text{BTU/lb O}_2 = 6,099.148$$

Using Equations (a) and (c) above, the BTUs consumed can be calculated from the O₂ tank pressure delta

$$\text{BTU consumed} = \text{lb O}_2 \times \text{BTU/lb O}_2$$

The Metabolic rate is also calculated from the O₂ tank pressure decrease in psi/min. Using Equations (2) and (3), the metabolic rate can be obtained by using

$$\text{Met Rate (BTU/hr)} = (\text{lb O}_2/\text{hr}) \times \text{BTU/lb O}_2$$

or the more commonly known

$$\text{Met Rate (BTU/hr)} = 582.66 \times (\text{O}_2 \text{ rate psi/min})$$

from which the remaining CCC capacity in BTUs can be determined and the CCC Time Left can be calculated

$$\text{CCC Time Left} = \text{BTUs remaining} / \text{Met Rate (10 Average)}$$

The standard use rate per Hamilton EMUM-0404 that the community uses for a crewmember during prebreathe or in airlock during depress/repress is 400 BTUs/hr. This is based on data gathered during ETA and SSATA chamber runs during prebreathe. The application uses this value with the initial input Non-EVA CCC Usage Time to calculate BTUs used during these periods.

METOX Initial Capacity Calculation

The calculation starts with 8,000 BTUs, which equates to approximately 1.6 lbs CO₂ absorption. Six-hundred BTUs are subtracted to protect a 30-minute margin (30 min @ 1,200 BTU/hr ref. EMUM1-0598). The basis for the value 1.6 lbs is the acceptance test data from every canister, which has been at 1.8 lbs and the consistent capacity of the cans over the 55 cycle life.

The limit for METOX to get on the SCU is 2.0 mmHg with a rising trend. METOX breakthrough curves for both ISS and STS profiles indicate that it is approximately 20 to 30 minutes between 2.0 mmHg and the 3.0 mmHg CWS alert. It is another 20 to 40 minutes between the CWS alert at 3.0 mmHg and the CWS warning at 8.0 mmHg. Both assume ~850 BTU/hr.

Without preconditioning the Metox canister, there is not enough water to promote CO₂ absorption. This can cause an initial spike or rise in PP CO₂ and has been seen in several chamber tests. A 40-minute precondition period is required before airlock depress for acceptable operation of the Metox canister during EVA (before being subjected to a large Metabolic load).

For METOX real-time determination

- A. The application calculation shall be used when the CO₂ sensor reading is less than 2.9 mmHg compensated (2.0 mm uncompensated). If the EVA PET to SCU calculation end is reached before the CO₂ reaches the 2.9 mmHg indicated, then the EV crewmember should terminate without delay since the slope of CO₂ increase is now more likely to be greater.

- B. *If the CO₂ sensor increases above 2.9 mmHg compensated (2.0 mm uncompensated) and continues rising before the EVA PET SCU time calculation expires, monitoring of the CO₂ sensor level will determine when terminate should occur. The affected EV crew should be connected to the SCU at a CO₂ value of 3.2 mmHg compensated.*

METOX REDLINE: Latest EVA PET CCC Time to SCU =
(30 min CCC Capacity - Total BTUs Consumed) / 10 AVG Met
Rate reached before the CO₂ sensor is reading 2.9 mmHg.

OR

METOX REDLINE: CO₂ sensor reading 3.2 mmHg and rising trend before
calculation. Monitoring of CO₂ beginning at 2.9 mmHg
determines in real time when terminate should commence.
Action should begin to ensure EV crew is on SCU at a CO₂
reading of 3.2 mmHg with a rising trend.

LiOH Initial Capacity Calculation

Per EMUM 0404 and HSWL/V. Margiott, the following values were derived using canned man LiOH breakthrough curves and the calibration of the CO₂ sensor at 8.0 psi:

Actual CO₂	IR CO₂ reading	CWS message
1.5 mmHg	1.7 mmHg	
5.6 mmHg	3.0 mmHg	MONITOR CO2
13.0 mmHg	8.0 mmHg	CO2 HIGH/OPEN PURGE VLV

CCC Capacity (in BTUs) is listed in the USA Flight Data Book. These values are derived from the amount of LiOH packaged in the container. The equations for the conversion were provided by HSWL/V. Margiott on 4-20-00.

CO₂ removal capability (lbs)

$$\begin{aligned} \text{at 85 percent efficiency} &= \text{LiOH Qty (g)} \times (\text{lb}/453.593\text{g}) \times (\text{mol LiOH}/23.94 \text{ lb}) \times \\ &(\text{mol CO}_2/2 \text{ mol LiOH}) \times (44.01 \text{ lb CO}_2/\text{mol CO}_2) \times 0.85 \\ &= \text{LiOH Qty (g)} \times 0.001722463 \end{aligned}$$

Metabolic Capacity (BTUS)

$$\begin{aligned} \text{at 85 percent efficiency} &= [\text{LiOH Qty (g)} \times (\text{lb}/453.593\text{g}) \times (6099.15 \text{ BTU}/\text{lb O}_2) \times \\ &(32 \text{ lb O}_2/\text{mol O}_2)] / [\text{RQ} / 47.88 \text{ lb}/\text{LiOH}/\text{mol O}_2] \times 0.85 \\ &= \text{LiOH Qty (g)} \times 8.780065751 \end{aligned}$$

The USA Flight Data Book (redbook) provides the 85 percent capacity number for BTUs. This is the value used as the Initial CCC Capacity in the application. The full BTU capacity is the point of 15.0 mmHg actual in the EMU.

It should be noted that the LiOH performance depends on the temperature environment. For a Hot/Neutral environment, the BTU capacity is multiplied by 0.85 for efficiency of the reaction conversion. For a cold environment (< -75° F) determined by preflight thermal analysis, the BTU LiOH capacity was originally multiplied by 0.70 derating due to lower conversion rates. Per EVAM-0361 in May 2007, the 70 percent value was increased to 75 percent based on flight data for environment and metabolic loading.

LiOH performance also depends on conditioning of the LiOH with moisture during prebreathe. A longer prebreathe provides greater BTU capacity. During a SESL run in April 2000, a LiOH was installed only 24 minutes prior to depress. The crewmember also had a very high metabolic rate during prebreathe (~600 BTU/hr) and the run (~1200). The crewmember received several MONITOR CO₂ messages. It is suspected that the high metabolic rate (producing heat) and the short duration before lower pressure (retaining heat in the CCC) did not provide enough moisture for the intermediate reaction to convert fully. Postrun evaluation of the LiOH revealed conversion rates of only 50 to 60 percent.

LiOH 30-Minute Reserve Capacity

The quantity for 1.5 mmHg actual to 15.0 mmHg actual initially was decided to be 2,700 BTUs based on 1,000 BTU/hr met rate for 2.7 hours. This was the worst case BTU quantity for the breakthrough curves available. Other curves showed the following, per HSWL/V. Margiott:

“Most of the data came from canned manned testing where there is a met rate profile which ends with ‘continue at 1,000 BTU/hr until 15 mmHG CO₂ is reached. The system is a function of met rate. The worst case was 2,700 BTU, which was 2.7 hours at 1,000 BTU/hr. I had data points where 15 minutes at 2,000 + 1 hour at 1,500 + 1/2 hour at 800 = 2,400 BTU. Another was 15 min at 1,600 + 15 min at 1,000+ 30 min at 400 + 30 min at 800 + 1.25 hrs at 1,000 = 2,320 BTU. LiOH capacity and breakthrough is a function of many things such as water loading and met rate. The data I had was variable; sometimes there would be 1,500 BTUs; however, 70 percent of the data points were above 2,000 BTUs.”

Discussions between EC and MOD in late 2000 and early 2001 have lead to an agreement on a less conservative 1,500 BTUs to be deducted from the CCC Capacity since the 2,700 value was making LiOH a limiting consumable and did not reflect real experience with the CCCs.

Further review of the breakthrough curves indicates that for the 1,500 BTU case (1,000 BTU/hr @1.5 hr), the 30-minute reserve can be accomplished with a worst-case CO₂ value of 2.0 mmHg (i.e., 30 minutes from 2.0 to 3.0 mmHg sensor reading on that curve).

Additional discussions in May 2007 in EVAM-0361 proposed reducing the LiOH reserve to 600 BTUs. MOD EVA did not agree with reducing the 30-minute reserve this far, from 1,500 to 600, with little data to substantiate the recommendation. As shown in the curves below, the shortest time observed was on a curve for 1,150 BTUs from 1.7 mmHg to 15 mmHg. Therefore, MOD EVA proposed the current agreement that the reserve be reduced to 1,200 BTUs until additional data is gathered. Therefore, for the workstation application, manual entry of the Usable CCC Capacity must be entered with the 1,200 BTUs removed until the application is upgraded.

For use onconsole, it has been agreed (per Flight Rules) that monitoring of the CO₂ begins at 2.4 mmHg compensated (1.5 mmHg uncompensated) to determine rates for the increase and time remaining estimate. A CO₂ reading of 2.75 mmHg compensated (1.7 mmHg uncompensated) and steady/rising is the point at which terminate EVA action needs to be taken.

For real-time LiOH determination

- A. The calculation shall be used when the CO₂ sensor reading is less than 2.4 mmHg compensated (1.7 mmHg uncompensated). If the EVA PET to SCU calculation end is reached before the CO₂ reaches the 2.4 mmHg (1.7 mmHg) indicated, then the EV crewmember should begin terminate without delay since the slope of CO₂ increase is now more likely to be greater.
- B. If the CO₂ sensor increases above 2.4 mmHg compensated (1.7 mmHg uncompensated) before the EVA PET to SCU time calculation expires, monitoring of the CO₂ level determines when terminate should occur. Action should begin to ensure that the affected crewmember is connecting to the SCU at a CO₂ value of 2.75 mmHg (2.0 mmHg). This monitoring is due to the fact that the slope of the CO₂ increase is likely to be less, and therefore there is more time than 30 minutes between 2.0 and 3.0 mmHg.

LiOH REDLINE: Latest EVA PET CCC Time to SCU = (30 min CCC Capacity - Total BTUs Consumed / 10 AVG Met Rate reached BEFORE CO₂ sensor is reading 2.4 mmHg compensated (TBD).

OR

LiOH REDLINE: CO₂ sensor reading 2.75 mmHg and rising trend before calculation. Monitoring of CO₂ beginning at 2.4 mmHg (TBD) determines in real time when terminate should commence. Action should begin to ensure EV crew is on SCU at a CO₂ reading of 2.75 mm Hg (TBD) with a rising trend.

Note: Curves below based on old ECWS.

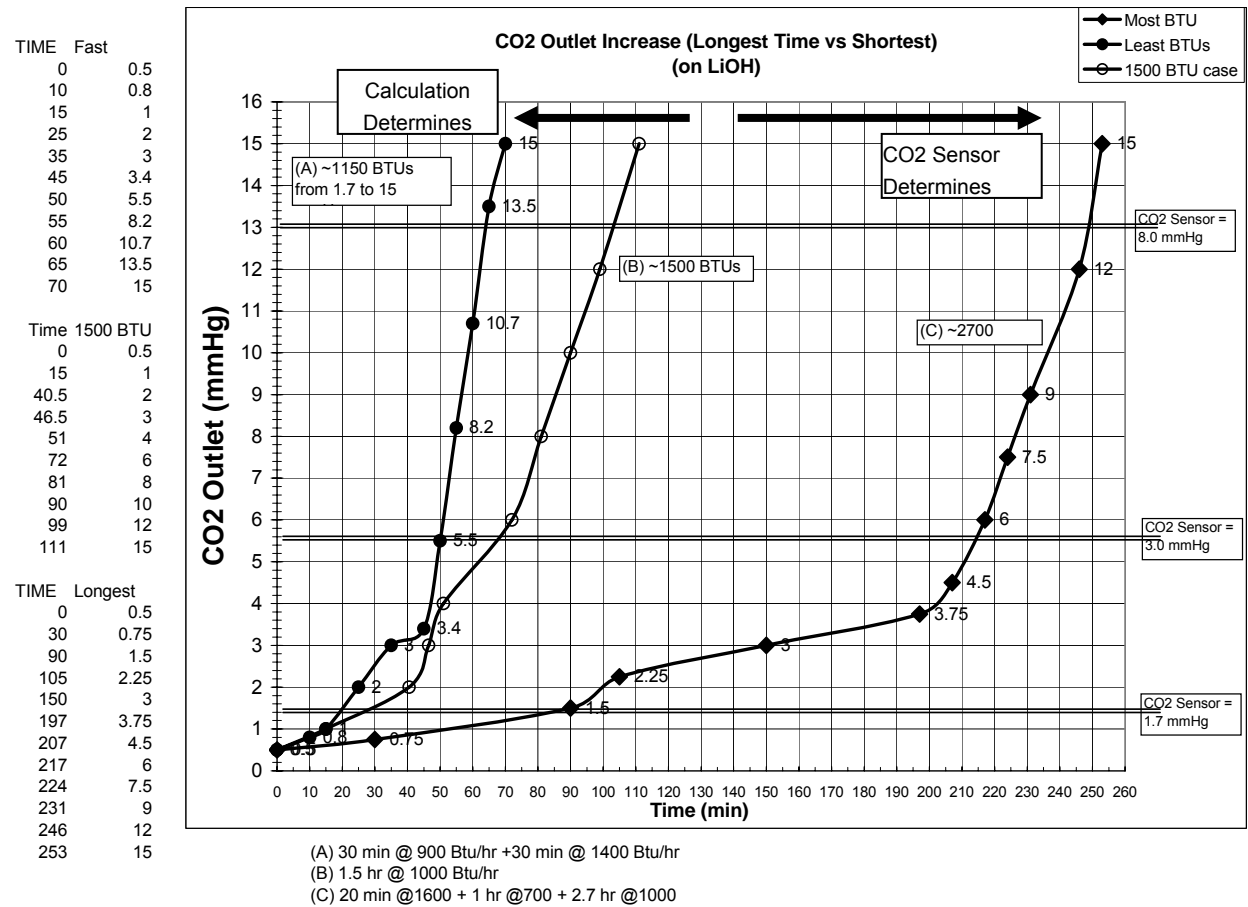


Figure A-3. CO₂ Outlet Increase (Longest Time vs Shortest) curve 1

Figure A-3 shows the shortest time rise (1,150 BTUs case), a 1,500 BTUs case, and the longest time rise (2,700 BTUs) on the same plot. As a reminder, about 70 percent of the curves fall to the right of a 2,000 BTU curve (to the right of the 1,500 curve shown). Therefore, most increases are gradual, and the calculation protects for the sharp increase (1,500 BTU or less) to the left.

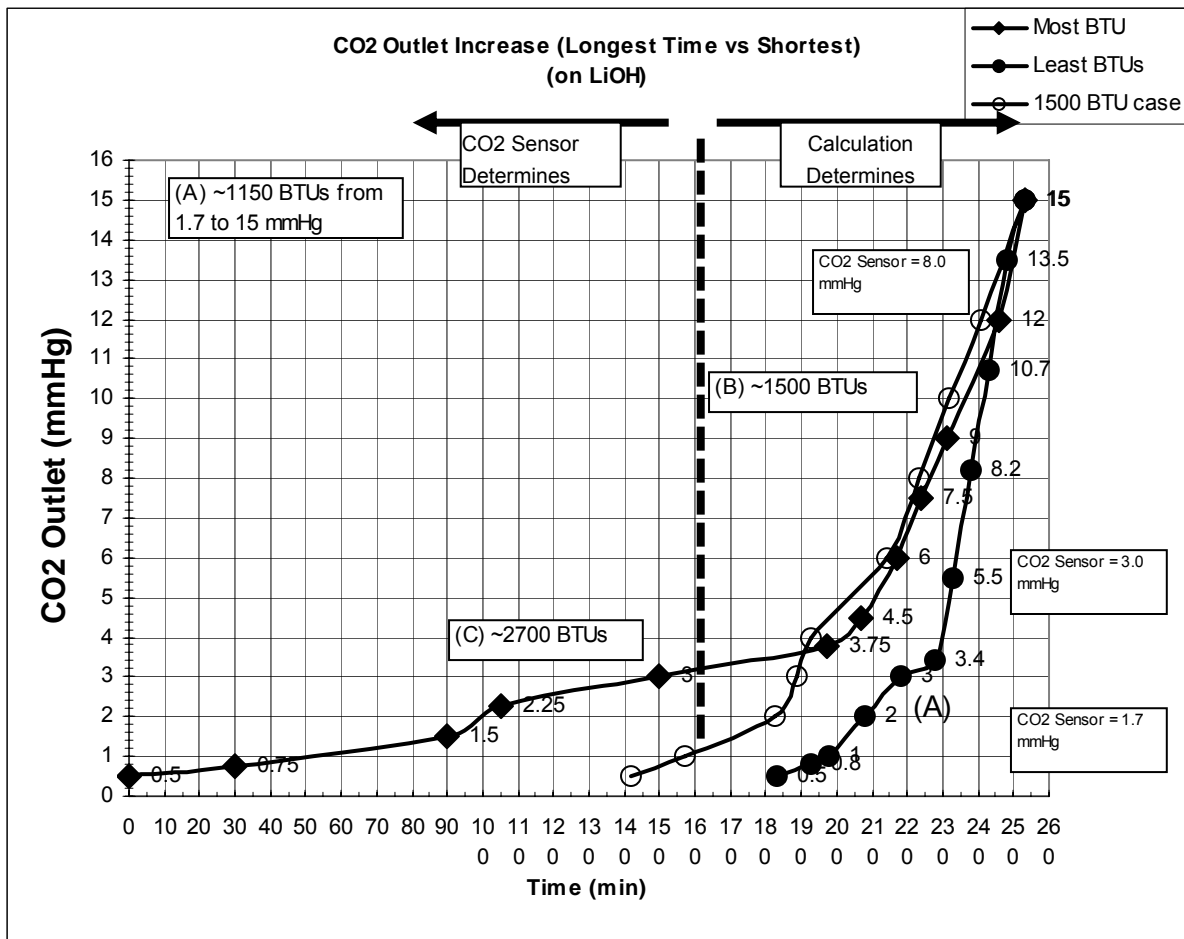


Figure A-4. CO₂ Outlet Increase (Longest Time vs Shortest) curve 2

A.3.4 Water Usage Calculations

There is no insight into the water usage rate during an EVA. For LiOH-based EVAs, a rate of 0.8 lbs/hr is assumed as a conservative rate. For a METOX-based EVA, this rate increases to 1.0 lb/hr as a realistic usage rate.

The automated application performs a straight calculation of water usage based on 0.8 lbs/hr usage (Time EV x 0.8lbs/hr). Since water usage depends on metabolic rate and EMU thermal environment, the usage rate can vary; therefore, in the case of water, the CWS message is used as the official indication that termination is required.

WATER REDLINE: CWS message RESERVE WATER ON/TIME LF = 0:30

For historical reference, rates for the five EVAs for STS-82 and the three EVAs for STS-104 based on the refill quantity are shown in Table A-4 and Table A-5.

Table A-4. Water usage rate for STS-82

STS-82

EVA	EVA time	Met rate (avg)	TK C qty (percent)	H ₂ O lbs refill (two EMUs)	H ₂ O lbs refill (per EMU, with 1 lb ullage)	Usage Rate (lbs/hr)	Percent used of primary tanks (7.47 lbs)
1	6:42	758/800	5.2	8.666	3.407	0.508	45.6
2	7:27	760/800	5.1	8.5	3.324	0.443	44.5
3	7:11	732/782	5.6	9.333	3.74	0.521	50.1
4	6:34	743/690	4.6	7.666	2.907	0.447	38.9
5	5:17	751/695	3.3	5.5	1.824	0.345	24.4

Table A-5. Water usage rate for STS-104

STS-104

EVA	EVA time	Met rate (avg)	TK C qty (percent)	H ₂ O lb refill (two EMUs)	H ₂ O lb refill (per EMU, with 1 lb ullage)	Usage rate (lbs/hr)	Percent used of primary tanks (7.47 lbs)
1	5:59	???/???	4.6	7.6	2.8	0.468	37.3
2	6:29	744/668	4.4	7.25	2.6	0.401	34.7
3*	3:55	957/797	N/A	12.8	3.9	0.996	52.0

* EVA 3 was the first out of the ISS Joint Airlock and the first to use METOX

For water dump after fill, a dump rate of 0.9257 lb/min is used in the tables above based on data of 420 cc/min from STS-82 V1103.01 (Airlock Functional) test. Data collected during STS-104 indicates 1.0 lb/min dump rate for Joint Airlock.

Since a feedwater recharge was not performed onorbit during STS-96, this offered a rare opportunity to find out the actual water used during the EVA. Using the preflight water charge data and the postflight water drain performed at USA FCE/EVA, the actual water usage was determined to be 2.69 lbs for EV1 (on RMS) and 5.43 lb for EV2 (free floater).

The average metabolic rate for EV1 was approximately 615 BTU/hr, and the average metabolic rate for EV2 was approximately 875 BTU/hr.

REFERENCES:

- *Hamilton Sunstrand Engineering Memorandum EMUM-0404, Consumable Tracking During EVA; March 15, 2000*
- *HSWL/V. Margiott - LiOH Curves and data*
- *Hamilton Sundstrand Engineering Memorandum EMUM1-0598 for ICB and Metox.*
- *Hamilton Standard Internal Memo, Sept. 30, 1988, ANL 88-333 O2 Consumption and CO2 Production in the Shuttle EMU*
- *Hamilton Sundstrand Engineering Memorandum EVAM-0215, IRCO2 Sensor Pressure Compensation with ECWS; February 22, 2006*
- *Hamilton Sunstrand Engineering Memorandum EVAM-0361, LiOH Consumable Tracking for EVA; May 4, 2007*
Note: This EVAM was not agreed to by MOD, and later agreement with Engineering of 1,200 BTUs reserve vs 600 BTUs recommendation in EVAM

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