

Space Transportation Vehicle Division



STS-127 MOD FRR

May 5th, 2009

DS1/Mike Interbartolo

Agenda Item 5

DS Shuttle CoFR Status Summary

REQUIREMENT	Training	Analysis	DPS	INCO	MMACS	EGIL	EECOM	GNC	PROP	BOOSTER
Critical Processors /Applications	N/A	N/A	N/A	G	G	G	N/A	G	G	G
Non-Crit Processors /Applications	N/A	G	G	G	G	G	G	G	G	G
EMCC	N/A	N/A	G	G	G	G	G	G	G	N/A
Training - MCC/POCC	G	G	G	G	G	G	G	G	G	G
Training - Crew	G	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training - SMS	G	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LCC/MEL/MIL	N/A	N/A	G	G	G	G	G	G	G	G
FTP - New Ops	N/A	N/A	G	G	G	G	G	G	G	G
Flight Anomaly Resolution	G	N/A	G	G	G	G	G	G	G	G
Anomaly – Procedures	G	N/A	G	G	G	G	G	G	G	G
Exceptions/Action Items from prior reviews	G	G	G	G	G	G	G	G	G	G
CIL/Hazards	G	N/A	G	G	G	G	G	G	G	G
No Constraints	G	G	G	G	G	G	G	G	G	G
Level II Actions	G	G	G	G	G	G	G	G	G	G
Mission Requirements	G	G	G	G	G	G	G	G	G	G
Engineering Drawings	N/A	N/A	G	G	G	G	G	G	N/A	G
Command Procedures	N/A	N/A	G	G	G	G	G	G	G	G
Fit Prep Process Plan Requirements Met	G	G	G	G	G	G	G	G	G	G
Contractor Process Insight	N/A	G	G	G	G	G	G	N/A	G	G
MOD Work Guidelines	N/A	N/A	G	G	G	G	G	G	G	G

SSP Electrical Summary

Reactants	Tanks	Liftoff Load (lbm)	Min L/O (lbm)	Margin (lbm)	Padhold (hrs)
H2	5	455.5	403.9	51.6	147.3
O2	5	3886.4	3634.4	251.9	249.8

- NOTES:
- 1) Assumes 16+0+2 day mission with 5 ISS-based EVAs
 - 2) Assumes H2 target load obtained and loading completed at L- 45 hrs
 - 3) Assumes O2 target load obtained and loading completed at L- 47.5 hrs
 - 4) 24 lbm O2 protected for 5 ISS-based EVAs and PMA/ODS repress.
 - 5) SSPTS output energy provided is 1636.2 kWh based on:
 - 4 converters at full power for 72.6 hrs
 - 3 converters at full power for 161 hrs
 - 2 converters at full power for 9.5 hrs
 - 1 converters at full power for 22 hrs
 - SSPTS deactivated during EVA1 & ODS Depress for a total of 9.5 hrs.
 - 6) CSCS capability with 3 SSPTS converters allows for 28 days docked with 89 lbm additional O2 margin and unmanned undock on FD31. O2 margin includes metabolic for 6 ISS crew for the docked duration.

SSP Environmental Summary

Consumable	L/O Load	Min L/O	Margin
N2 (lb)	387.3^{1,2}	350.9³	36.4
Supply H2O (lb)	353⁴	353	0
LiOH (cans)	31⁵	31	0

NOTES: 1) Assumes 16+0+2 day mission

2) N2 L/O load protects/reflects KSC 6 lbm prelaunch usage requirement

3) N2 loading protects for 5 scheduled ISS based EVAs and 0 unscheduled ISS based EVA

4) Supply H2O loading reflects a 180 lbm offload

5) 67 LiOH canisters are required for a 16+0+3 day mission.

The equivalent of 36 canisters will be provided from ISS resources. 20 pre-positioned canisters will be taken from the LiOH stockpile, and the equivalent of 16 canisters will be provided by ISS CDRA (dual bed) and Vozduhk to support Shuttle docked operations.

Status of Standard Open Work Shuttle (Training – MCC)

- **MCC Team Certification Status:**

- All SMS training instructors have completed required training according to their Certification Guides. All operators have been certified and all certification records are complete.
- All Flight Controller certification requirements are complete except as follows:

Various Physicals, Proficiency and Final Certifications to be completed prior to flight with backup personnel available if required for all positions.

Status of Standard Open Work Shuttle (FTP- New Ops)

- **New Ops Work Status:** All significant differences from previous flights have been reviewed by FTP, POWG, or other appropriate operations forum and where required documented in either new procedures or new flight rules, except as follows:

DAP configurations and constraints - (Awaiting C. S. Draper Laboratory Memo) The current versions of the flight rules contain the preliminary data from C. S. Draper Laboratory. Upon receipt of the official memo, GNC will review the document, and update any DAP constraints in the FDF and Flight Rules as required.
ECD 5/11

Status of Non-Standard Open Work Shuttle (FTP- New Ops)

- **New Ops Work Status:** All significant differences from previous flights have been reviewed by FTP, POWG, or other appropriate operations forum and where required documented in either new procedures or new flight rules, except as follows:

APU Operations While Docked - Analysis is in work to examine the effect that the stack would experience from running a single APU while docked to ISS. A CR with the expected modifications to the 2JA_C10-1 APU Operations While Docked flight rule is currently in workflow. ECD 5/4/09

Hook Requirements for Docked Operations - Analysis to examine the docking interface loads that would be experienced with multiple hooks out scenarios is complete. A CR is currently in workflow with the required changes to the 2JA_C10-2 Hook Requirements for Docked Operations flight rule. ECD 5/4/09

Status of Non-Standard Open Work Shuttle (FTP- New Ops)

Single Non-Universal I/O Error - Flight Rules and Procedures do not currently address Single Non-Universal I/O errors on Flight Critical buses. DPS presented options at the Ascent/Entry Flight Techniques Panel (AEFTP) on 04/13/09 for dealing with non-universal input/output I/O errors (NUIEs) that do not cause elements to bypass. The discussion grew out of an STS-124 preflight anomaly during ground processing where a NUIE preceded a redundant set split by about six minutes. Current flight rules call for “safing” a string by powering off equipment on the offending data bus or deassigning the string following a NUIE when the NUIE causes a bypass. However, the rule restricts the action from being applied when it would affect SSME redundancy. DPS is proposing that the flight rule be expanded such that the safing actions are taken even when the errors do not cause a bypass and that the safing action of deassigning a string be implemented during powered flight. The discussion primarily centered on whether or not SSME redundancy should be sacrificed in order to mitigate the potential of the set split due to the presence of a NUIE. DS was given an action to provide data on all non-universal I/O Errors throughout the history of the Shuttle Program and to refine the list of trade-offs associated with deassigning a string during powered flight. AEFTP will meet at a future date to review these actions and formulate a decision on the NUIE responses during dynamic flight. If needed, DPS will work with the 127 A/E Flight Team for a planned response specific to this flight.

Status of Non-Standard Open Work Shuttle (FTP- New Ops)

Water Fills Using CWC-Iodine Bags – The ISS Program has requested that new CWC-I bags be filled for transfer rather than CWCs containing Silver Biocide (Ag Bio). These CWC-I bags are half the size of Ag Bio CWCs and are filled using a different procedure. The procedure needed to fill the new CWC-I's were previously PV'd and are currently published in the FDF but have not been performed during a mission. A second PV session focused on changes that will decrease the duration of the CWC-I fill by increasing the water flowrate, along with additional crew training sessions have been scheduled. Changes to the CWC-I fill procedure may result and will be put into work as soon as concurrence from the community is obtained.

Sep Burn with OBSS on SRMS - (Awaiting Engineering concurrence): Rendezvous is working a flight rule change to allow sep burns up to 10 fps (current rules only allow 5 fps) with the OBSS on the SRMS. A larger sep 2 burn is required with the deployable payloads on STS-127. The flight rule CR is currently in work and should be complete for PCN-1. If this rule is not approved two 5 fps burns will be required which is slightly more operationally complex.

Status of Non-Standard Open Work Shuttle (Non-Critical Processors)

- NON-CRITICAL PROCESSORS/APPLICATIONS - Non-critical processing (e.g., applications, utilities, and scripts) have followed defined development and change control constraints (Software Management Plan for Mission Control Center Applications - JSC 27029) and have been tested and certified for operational use, except as noted:

Discipline	Application Name	Open Item
MMACS	PRLAMON	Requires certification testing.
EECOM	RTPLOT	MSIDs will be added to the EECOM RT Plot to allow plotting of ISS WHC urine quantities during STS-127.

PRLAMON – PRLAMON is an application that was written for the STS-127 flight specific PRLA configuration. Either modifications to existing applications or the creation of a new application was necessary because of additional insight that will be monitored for STS-127 only. The new application is completed and currently installed in uncert apps and being used for flight specific sims. The open work remaining is to complete certification testing. ECD 5/08/09

Status of Non-Standard Open Work Shuttle (Flight Anomaly Resolution)

- FLIGHT ANOMALY RESOLUTION - All previous in-flight anomalies have been resolved and all operational or procedural changes required have been implemented and verified. Exceptions are noted below:

MO10W Panel R&R - The MO10W panel was R&R'd after STS-126 due to a faulty O2 Crossover valve. The new panel has the expanded-range flow sensors that measure from 0-25 lb/hr. The replacement of this panel requires updates to the Cabin Pressure and Flow Sensor cal curves. The following changes are required:

- FEP will be updated preflight using the Telemetry Services application.
- PASS will be updated in Ops 2 using the PLD Calibration Coefficient application.

No changes are required in the BFS. Command procedures are documented and will be reviewed and verified prior to flight.

Crew Review of IFAs- Previous in-flight Anomalies (STS-125) have not been reviewed with the crew yet.

Status of Non-Standard Open Work Shuttle (Mission Requirements)

- MISSION REQUIREMENTS - MOD has provided the contractor with the flight specific requirements needed to execute flight preparation processes and generate flight products. All requirements deviations have been documented. Exceptions are noted below:

Shuttle Crew Using ISS WHC - To avoid contamination of the JEM-EF, dumping urine while docked is not permitted. As a result, four Shuttle crew members will have to use the ISS WHC during the entire docked timeframe. The number of crew equivalent required to use ISS facilities has been determined based on mission duration and number of crew returning in the Shuttle. The MIP will be updated to document the accepted risk.

Misc Items

- **LiOH Plan with 6 ISS Crew** - Shuttle crew will install 2 LiOH cans per day on the Orbiter while docked to cover the additional CO2 removal required with 6 crew on ISS.
- **ISS LiOH Stockpile Shortfall** - If CDRA fails, STS-127 will have to be shortened by as many as 4.4 docked days due to a shortage in the ISS LiOH Stockpile. The MIP will be updated to document the accepted risk. A flight specific flight rule has been published to document the potential shortened docked duration .
- **SSSH 14.1-1** - The STS-127 flight specific PRLA configuration required the creation of a new SSSH that depicts the PRLA configuration for the ELM-ES and JEM-EF. The drawing has gone through several check print cycles and peer reviews.
- **SSSH 12.1-1** - The APU GN2 heater modification drove a change to the APU heater drawing. The change has already been approved and STS-127 is the first flight that it is expected to be in the generic book. ECD 5/11/09
- **Deboost for Debris Avoidance Maneuvers** – During STS-119, a deboost was required to avoid orbital debris. Several options were considered in realtime, and holding the undocking attitude was selected to provide the necessary deboost delta v without executing a dedicated reboost. Postflight, GNC has worked with Engineering to develop options for deboost, Draper will be providing additional data to plan for either attitude hold deboost, or deboost using the reboost capability in the flight software in the event deboost is required for STS-127.

Misc Items (cont.)

- **SSPTS OPCU Fault Isolator Trip (OV-103)** - During STS-119 OPCU 2A - FM03 (SN GFE09005089) experienced two inadvertent trips during power up. The FI circuitry has a known sensitivity to bus noise during the power up; this was first seen during Qualification Testing. Susceptibility testing was performed to characterize the FI tripping. The inadvertent trip occurs approximately 2% of the time and more frequently when the output is enable and the load is between 15 and 20 ampere; also sensitive to lower temperatures (-6 deg C). After the second trip occurrence on STS-119 it was decided to adjust the output voltage down to control power transfer to avoid the potential of additional trips; since crew action is required for recovery. The option to send voltage adjust shuttle commands to terminate power transfer will be considered for future powerdown operations. The potential impacts to crew time and mission margin will be considered when deciding to use this workaround option.
- **MDM S-MIA Diode Mitigation** - Prior to STS-124, MDM FA2(S/N 124) failed, which caused a set split due to a non-universal I/O Error (IPR 124V-0048). After a review of flight hardware, diodes from these suspect lot codes were found in FA-1 (S/N 123). FA-1 has been swapped with an Enhanced MDM (S/N 215). Enhanced MDMs use micro S-MIAs which have different technology and are not vulnerable to the suspect diodes issue. The only remaining non-enhanced MDM on OV-105 is MDM FA-3 (S/N 132), which contains diodes from LDC 7816. There is currently no plan to change out this MDM. As part of the mitigation plan, the OPO has directed that the waveforms of MDM's on all vehicles be screened using oscilloscope. OV-105 has been tested and the results show no sign of weak MDM signals.

Conclusion Shuttle

All identified open work will be
completed in time to support
STS-127