

Space Transportation Vehicle Division



STS-128 MOD FRR

July 9th, 2009

DS1/Mike Interbartolo

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	356.9	98.6	259.2
O2	5	3434.5	3222.1	212.4	181.7

- NOTES:
- 1) Assumes 13+1+2 day mission with 3+1 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- 40.5 hrs
 - 4) 450 lbm O2 offloaded evenly from Tanks 1, 2, 3, 4, and 5
 - 5) 22 lbm O2 protected for 4 ISS-based EVAs, MPLM repress, and PMA/ODS repress
 - 6) SSPTS output energy provided is 1324.3 kWh based on:
 - 4 converters at full power for 208.68 hrs (including additional day)
 - SSPTS deactivated during EVA 3, the unscheduled EVA, and one Water Dump for a total of 19.5 hrs
 - 7) Analysis includes an Additional Day with an unscheduled EVA and all SSPTS converters deactivated for 6.5 hrs during the EVA. Average power for the 24.0 hr day is 9.19 kW, which equates to 18.6 lbm H2 and 166.1 lbm O2.
 - 8) CSCS capability with 4 SSPTS converters allows for 21 days docked with 32.9 lbm O2 margin and unmanned undock on FD24. 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)	320.3^{1,2}	289.2³	31.1
Supply H2O (lb)	353⁴	353	0
LiOH (cans)	55⁵	55	0

NOTES: 1) Assumes 13+1+2 day mission

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

3) N2 loading protects for 3 scheduled ISS based EVAs and 1 unscheduled ISS based EVA

4) Supply H2O loading reflects a 180 lbm offload

5) 59 LiOH canisters are required for a 13+1+3 day mission.

The equivalent of 12 canisters will be provided from ISS resources. Liftoff quantity reflects planned stowage for this flight; 31 LiOH canisters stowed/installed in middeck, 24 stowed in MPLM. 8 cans stowed in MPLM will be transferred to the ISS stockpile.

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.

- LCC/MEL/MIL - The Launch Commit Criteria Minimum Equipment List and Mandatory Instrumentation Lists have been reviewed and verified as complete and accurate. Any flight unique requirements have been specified, exceptions as noted:
 - STS-128 MEL-13: The Flight Specific Mission Equipment List has been reviewed by the FOR and LCCWG and is in the process of being scheduled for a daily PRCB OSB disposition.

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 7/15

ALT PRCS Mated Maneuvers Not Certified - Draper's analysis for STS-127 has shown that 1-jet ALT PRCS is no longer acceptable for mated attitude maneuvers due to the high frequency of "maneuver chasing," which is a phenomenon where the degraded control authority of 1-jet ALT PRCS results in delaying maneuver completion, or in the extreme, the inability to converge to the desired attitude. Maneuver chasing does not present a safety of flight concern, and will not violate ISS loads constraints. The primary flight control concern with use of 1-jet ALT PRCS for mated attitude maneuvers will be the potential for extended maneuver times and higher propellant usage.

Draper's analysis shows that mated attitude hold and Reboost using 1-jet ALT PRCS are still considered certified. ALT PRCS may be used to provide a degraded maneuver capability in a contingency where no other control mode is available. The Draper analysis performed for STS-127 also applies to STS-128.

Status of 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:

Crew Review of IFAs- Previous in-flight Anomalies (STS-127) have not been reviewed with the crew yet.

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 Operation While Docked** - Analysis to examine the effect that the stack would experience from running a single APU while docked to ISS is complete. The results of this analysis are being used to complete the 17A_C10-1 APU Operations While Docked flight rule (Tracking #535).
- **Hook Requirements for Docked Operations** - Analysis to examine the docking interface loads that would be experienced with multiple hooks out scenarios. The results of this analysis are being used to complete the 17A_C10-2 Hook Requirements for Docked Operations flight rule (Tracking #536).
- **JAXA ICS Radiation Management Flight Rule** - A new flight rule has been submitted to the workflow system for the Japan Aerospace Exploration Agency (JAXA) Inter-Satellite Communication System (ICS) Ka-band radiation management. The Ka-band system poses a hazard to the shuttle and the new rule states that the system shall be inhibited from radiating within 5 degrees of orbiter structure during all periods when the shuttle is within 381 feet (116.1 meters) or docked. Currently, JAXA is on 'standby' to sign off on this Flight Rule as soon as they have a hardcopy of the Hazard Report.

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
DPS	DTEX	DTEX 'Lag' Issues with Mercury 1.1
INCO	WAMS	Update Workstation Antenna Management System for MPLM that is flying in the PLBD.

DTEX 'Lag' Issues with Mercury 1.1 - During the first sim with the new Mercury 1.1 Baseline, performance issues were noticed with DTEX. When using the 'acknowledge' button, it took considerably longer than expect to take effect. Additionally, during periods of static data, DTEX would drop its labels and delay refreshing for several seconds upon data acquisition. An AR has been opened documenting the problem. A fix for this problem is not mandatory for flight. STS-128 is the expected first flight of Mercury 1.1.

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.

OI-34

- **OI-34 First Flight-** STS-128 is the first flight of OI-34. Inputs were collected from the various disciplines to document any open work required to support the first flight of this OI. The majority of changes for OI-34 are either documentation only or required minimal changes. The only remaining open work are minor console documentation updates for GNC and PROP.
- CR 93252 – Raise FWD RCS Tank T FDA
 - Increased the Fwd RCS Tank Temp FDA from 90 deg to 100 deg
 - Ref Data 482 Submitted
 - Minor PROP console documentation updates required
 - ECD: TBD
- 93234B: IMU RM Undesirable Behavior Correction
 - Sets ADI attitude flag to invalid if no IMU candidates in OPS 8
 - Resets IMU dilemma counter if IMU FDI changes from 2-level to 0, 1, 3-level.
 - Minor GNC updates to ADI and IMU systems briefs
 - ECD: 7/31/09
- 93194A: BFS HUD Additions
 - Makes BFS HUD more like PASS
 - Adds capability for High G-Load and Body Flap warnings
 - Allows for use of actual runway length (instead of a constant) and improves deceleration command

STS-128 Space Transportation Vehicle Division Readiness Statement

The Space Transportation Vehicle Division has performed the reviews necessary to assess the flight readiness relating to vehicle systems requirements definition, crew and flight controller training, and operations. We have determined all applicable responsibilities acceptable for flight pending closure of the identified open work and issues.

Original signed by

July 6, 2009

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As compiled by: DS1/Mike Interbartolo

Backup

Detailed OI-34 CR/DR Listing

OI-34 CRs

- CR 93226 – Stop Blinking Phugoid Symbol
 - Disable display of phugoid symbol until after closed-loop-guidance init
- CR 93251 – Correction to Stop Blinking Phugoid Symbol
 - Requirements correction to CR 93226
- CR 93227 – HUD Position and Altitude Limits
 - Variables to single precision- prevents overflow
- CR 93241 – Requirements Update to Fix DR 126157
 - Blanks HAC display at TAEM guidance terminate
- CR 93257 – OI-34 BFS I-Load Constraint Deletion
 - Removes un-needed constraint on BFS RTLS TRAJ 2 display
- CR 93264 – BFS HUD Blanking
 - Blank HAC TAEM display at TAEM guidance terminate
- CR 93228 – No RNDZ Target Tracking with RNDZ Nav Disabled
 - Makes selection of tracking an orbiting vehicle on the Universal Pointing display illegal without first enabling rendezvous navigation

OI-34 CRs

- CR 93242 – Correct Orbit GN&C Switch Dilemma Processing
 - Clears OPS 2 & 8 dilemma indications for LH & RH Body Flap, RHC Trim, Panel Trim, and FCS Mode switches if deselected or reselected in OPS
- CR 93250 – Enhanced Star Tracker Power On/Off Requirements
 - Changes FSW to look at I/O serial data as well as power discrete (-Z ST POWER ON CMD) to determine actual power status
- CR 92816 – Delete FICS
 - Delete software hooks for hardware that was never installed
- CR 93233 – BFS RCS Activity Lights
 - Makes the modes the BFS will drive the RCS activity lights identical to the PASS
- CR 93267 – Reset of Commands for RCS Tank Isol Valves
 - Requirements change as part of resolution for DR 126279
 - Terminate the RCS tank Isolation open commands on the first pass of the OMS-RCS Interconnect (Currently termination of commands is only after the 1st pass)
 - Protects for failures that cause a delay in the closing of the RCS Tank Isolation valves (such as a single phase of AC bus being failed)

OI-34 CRs

- CR 93172 – Move Horizontal Situation Display Backgrounds to MEDS
 - Moves some SPEC 50 data to MEDS, frees up GPC memory
- CR 93179 – Move GNC Utility Routines to MFB
 - Moves routines to upper memory
- CR 93220 – Move DPS Utility Backgrounds to MEDS
 - Move SPEC 1 data for storage on the IDP
- CR 93176 – Remove Active MPLM Support from BFS
 - Unused capability removed
- CR 93240 – RMS Encoder Bias And Arm Avail Parameter Update
 - Updates the joint encoder biases for RMS S/N 202 and the value of the Arm_Avail_Indicator
 - Eliminates the need DCR or TMBU these parameters each flight
- CR 93262 – Film ET Camera
 - Turns ET Camera ON for 10-second intervals early in ascent.

Documentation Only CRs

- CR 93157 – BFS SMSP PRD Cleanup
 - MMACS changes: Submitted change for known drawing error for SSSH, updated MMACS Systems Briefs
- CR 93170 – Interface Tables in PRD-106 Cleanup
- CR 93192 – Change Effectively to SCR 93179B
- CR 93212 – Cleanup of FSSR 5, 20 and BFS PRDS
- CR 93237 – GN&C Application FSSR Documentation Cleanup
- CR 93238 – On Orbit DAP Initialization Cleanup
- CR 93239 – Delete Duplicate/Unneeded DL Software Measurement
- CR 93243 – FSSR-20 Documentation Cleanup
- CR 93246 – GN& C Level B CPDS Clean Up
- CR 93253 – Correct to SCR 93239
- CR 93254 – OI-34 Constraint Modification
- CR 93255 – GRTLS Guidance Roll Command Correction
- CR 93260 – Uncouple PASS and BFS High Rate GPS I-Loads
- CR 93266 – Clarify Critical Format Use for BFS Listen Displays
- CR 93268 – BFS DDU/MTURM Requirements Update – DR 121423
- CR 98198 – OI-34 FSW Performance Verification Plan
- CR 98109 – BFS OI-43 Performance Test Specifications

DRs

Fixed in OI-34 Baseline (No corresponding CRs)

- DR 107135 – Downlist of Format 24 Delayed at SM OPS 2 Transition
 - Taking up to 4 sec to D/L SM format 24 after going from OPS 2 in format 26 to OPS 0 and back to OPS 2.
- DR 111120 – Zero Suppression Not Working on SPEC 71's Last OP Fields
- DR 121407 – BFS Unresolved I/O Reset
 - BFS I/O Rest causes BFS not to track after complete redundant set split
- DR 121415 – NZ Blanked on BFS Ver Sit 1 Display when ISLECT_GIUD=11
 - During RTLS abort, the BFS VERT SIT 1 display may not show overbright "NZ" during the NZ HOLD phase.
- DR 124969 – ADI Positioned Incorrectly Before REFS_RDY
 - ADI Display Issue Only (vehicle and FSW performance not affected).
 - *Issue:* Incorrect orientation is displayed from start of OPS 1 until dynamic data is provided by Att Proc, about four minutes prior to launch.
- DR 126154 – Switch RM Inhibit Freezes Display of THC Commfaults
 - OPS 2 Display Issue Only.
 - *Issue:* If Switch RM has been inhibited (Spec 25 Item 16), any change in the THC commfault status is not displayed on SPEC 25 until Switch RM has been re-enabled.
- DR 126183 – Forward Rotation Switch Dilemma OPS Carryover
 - OPS 2/8 downlist issue only (vehicle performance not impacted).
 - *Issue:* Dilemma status for 6 forward rotation switches that are set in OPS 1/3 (not downlisted) would not carry over on OPS transition (due to status being different FSW variables)
- DR 126242 – Commfault Protection Missing for Star Tracker Data Word 1
 - Display Issue Only (orbiter performance not affected).
 - *Issue:* BITE status on Spec 22 can continue to be updated even after a commfault has occurred.