

Space Transportation Vehicle Division



STS-133 MOD FRR
September 24, 2010
DS/Whitney Maples

DS Shuttle CoFR Status Summary

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

SSP Electrical Summary

Reactants	Tanks	Liftoff Load	Min L/O	Margin	Padhold
		(lbm)	(lbm)	(lbm)	(hrs)
H2	4	364.4	311.4	53.0	184.6
O2	4	3008.6	2798.0	210.6	251.8

- NOTES: 1) Assumes 11+1+2 day mission with 2+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- 43.0 hrs
 4) 100 lbm O2 offloaded evenly from Tanks 1, 2, 3, and 4
 5) 43.0 lbm O2 protected for PMA/ODS repress, PMM Vestibule repress, 3 EVAs, and 25 lbm ISS transfer
 6) SSPTS output energy provided is 1239.2 kWh based on:
 - 4 converters at full power for 153.9 hrs (including additional day)
 - 2 converters at full power for 25.5 hrs
 7) Analysis includes an Add'l Day with an unscheduled EVA and 4 SSPTS converters activated except 6.5 hrs of only 2 SSPTS converters during the EVA. Average power for the 24.0 hr day is 7.72 kW, which equates to 15.6 lbm H2 and 140.1 lbm O2.
 8) 2 KSC - 2 KSC - 2 EDW deorbit opportunities protected
 9) Increasing ISS O2 transfer to 75 lbm reduces O2 padhold to 192 hours
 10) CSCS capability with 4 SSPTS converters allows for 20 days docked with 94 lbm O2 margin and unmanned undock on FD23. 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)	321.8^{1,2}	288.4³	33.4
Supply H2O (lb)	353⁴	353	0
LiOH (cans)	29⁵	29	0

NOTES: 1) Assumes 11+1+3 day mission

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

3) N2 loading protects for 2 scheduled ISS based EVAs and 1 unscheduled ISS based EVA

4) Supply H2O loading reflects a 180 lbm offload

5) 66 LiOH canisters are required for a 11+1+3 day mission. 29 LiOH cans stowed/installed on middeck. 4 pre-positioned canisters will be taken from the ISS stockpile, and the equivalent of 33 canisters will be provided by ISS CDRA (dual bed) and Vozduhk to support Shuttle docked operations.

Status of Standard Open Work

Title	Actionee	Std / Non-Std	Mand / Non-Mand	ECD
LiOH/Supply H2O/Pressure Plan	EECOM	Std	Mand	ongoing
LCC/MEL/MIL	SSP TA	Std	Mand	9/29/10
APDS Hook Requirements for Docked Operations Flight Rule	MMACS	Std*	Mand	9/30/10
APU Operation While Docked Flight Rule	MMACS	Std*	Mand	9/30/10
Draper Labs Memo and PM Vent Analysis	Draper	Std	Mand	10/1/10
Certification/Proficiency/Physical	Various	Std	Mand	10/15/10
Complete crew training	Various	Std	Mand	10/26/10
Complete Integrated training	Various	Std	Mand	10/26/10

Status of Non-Standard Open Work Shuttle (LCC/MEL/MIL)

- 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:
 - ECL-5 LCC Change - During scheduled testing, one of the Cabin Relief Valves on OV-103, and one on OV-104 were found to have different crack pressures than previous (still within requirements). This results in updates to upper limits on the cabin pressure and A/L-PLBD pressure sensors, and the need to update the LCC. The LCN is in work to document the new values and will be approved prior to STS-133/ULF5. *ECD 10/15/10*. No open work remains for DS.

Status of Non-Standard Open Work Shuttle (LCC/MEL/MIL), cont.

- SSME TVC and Elevon Hydraulic Switching Valve Failure Analysis - In response to a S0044 NO-GO call for an SSME TVC switching valve out of config, the risk and credibility of a switching valve failure was reviewed. No LCC exists for the scenario where the sole switching valve status indicates that a valve has unexpectedly swapped or failed to transition. There are no sufficient secondary indications to exonerate all the cases that were considered. The data gathered indicated that these valves have extensive design requirements, controls, and verifications in place to ensure that they do not fail. Hydraulic fluid contamination, the leading candidate to cause a failure, is also extensively controlled. The current, informal recommendation is that no LCC is needed; however, the data is being presented to the Launch Integration Manager for further review and direction. *ECD 10/1/10*

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:
 - DAP configurations and constraints - (Awaiting C. S. Draper Laboratory Memo): The current version of the flight rules and crew procedures 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. Final memo expected L-30 days (10/1/10).
 - PM Venting Attitude Control Analysis - The venting of the failed pump module (PM) has been added to EVA 2. Draper is currently working to certify Shuttle attitude control (VRCS and ALT) during the PM venting. This capability will be documented in the DAP Loads and Constraints Memo as well as in CHIT 8931. *ECD 10/1/10*

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

- RAMBO-2 Procedure Updates
- MAUI Procedure Updates

- Water Dump Constraint Flight Rule Update
- Deorbit Prep Coldsoak and Comm Attitudes Flight Rule Update

Status of Non-Standard Open Work Shuttle (Cmd Proc)

- CMD PROC - Command procedures have been reviewed by personnel with command responsibility to assure clarity, completeness and compatibility with this vehicle/flight. Where necessary, any changes have been approved by the FOIG or other designated approving authority. Personnel are prepared and ready to execute the command procedures as documented and per MOD Command Policy/Flight Rules. Exceptions are noted below:
 - Ascent Satellite Handover - With Air Force Remote Tracking Site (RTS) support going away the TDRS network has provided overlapping satellite support for remaining missions in case of a TDRS failure. Proposed handover techniques were approved by A/E Flight Techniques and were used in generic and flight specific simulations. These operations are only for the case of a failed satellite; nominal operations remain unchanged. The INCO Console Handbook Command section and Command Procedures Handbook are being updated to reflect new procedures. *ECD 10/15/10*

STS-133 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

September 24, 2010

Gregory T. Oliver

Chief, Space Transportation Vehicle Division

As compiled by: DS/Whitney Maples

Backup

Training-MCC FCRs

Position	Name	Team	Open Item	ECD
Booster	Rick Henfling	Ascent	Certification	Awaiting Signatures
EECOM	Sarah McGregor	A/E	Certification	Paperwork only; 10/01/2010
GNC	John McGregor	Orbit 3	Certification	Paperwork only; 10/01/2010
DPS	Amanda B. Coots	Orbit 3	Certification	Final Scheduled 10/04/2010
GNC	Kevin Dunn	Orbit 4	Physical (Part 1 scheduled 9/16/10)	10/01/2010
Booster	Rick Henfling	Ascent	Physical (Part 1 Scheduled 9/24/2010)	10/15/2010
GNC	Kevin Dunn	Orbit 4	Proficiency (expires 10/06/2010)	10/01/2010
INCO	Jubee Varkey	A/E	Proficiency (expires 10/31/10)	10/01/2010

Training-MCC MPSRs

Position	Name	Team	Open Item	ECD
GNC SPT	Ole Nilssen	Orbit 1	Certification	Final eval scheduled 9/29/10
Thermal	Eddie DeSimpleaere	Orbit 2	Certification	Paperwork only; 10/1/2010
DPS SPT	Terra D. Sovinsky	Orbit 1	Certification	10/8/2010
Life Support	Ian Anchondo	Planning	Certification	Final eval scheduled10/15/2010
Control	Michelle Jones	A/E	Proficiency (expires 11/04/2010)	10/01/2010
Sensors	Ramon Gonzalez	A/E	Proficiency (expires 12/2/2010)	10/15/2010
GNC SPT	Doug Wilson	Orbit 1	Proficiency (expires 11/4/2010)	10/01/2010
GNC SPT	Steve Koester	Orbit 4	Proficiency (expires 10/3/2010)	10/01/2010

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:
 - 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. The preliminary form of the ULF5_C10-1 APU Operation While Docked flight rule has been submitted to the appropriate book manager. The results of the flight specific analysis was expected to be delivered on 9/16/10. The analysis itself has been completed but the report to document the analysis is still in the approval process. Once the report is released, the flight rule will be updated with the appropriate information. ECD 09/30/2010
 - Hook Requirements for Docked Operations - Analysis to examine the docking interface loads that would be experienced with multiple hooks out scenarios is complete. Updates with information from this analysis was made to the ULF5_C10-2 Hook Requirements for Docked Operations flight rule and was submitted as a CR into Workflow on 9/13/10.

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

- **RAMBO-2 Procedure Updates** - DoD reported that the window for RAMBO-2 is ~5 minutes versus the original 14 minutes. Due to the shorter window, the ORB OPS FS Crew procedure was reworked to be more flexible and accomplish any combination or number of desired burns. Per the DoD request, the procedure was also modified to perform each burn at a specified TIG within an opportunity window instead of simply starting the sequence at a specified MET. The crew procedure was PVED with the STS-133 crew on 6/15/10. The corresponding JOIP procedure has been updated and the ORB OPS FS procedure change has been submitted.

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

- **MAUI Procedure Updates** - During the STS-130 MAUI procedure this accel mode firing resulted in cross coupling which the DoD is afraid could degrade the experiment data. Thus the DoD has requested this accel mode firing be deleted for the full VRCS and PRCS sequence but maintained for a PRCS only sequence. In addition, three MAUI procedures are being placed in the STS-133 ORB OPS FS to cover full sequence and for the PRCS only and VRCS only procedures. All three procedures were Pved with the STS-133 crew on 6/15/10. The corresponding MAUI JOIP Procedure has been updated and the ORB OPS FS changes have been submitted.

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

- **Water Dump Constraint Rule Update** - On STS-131, a water dump was performed in a biased posigrade attitude when it should have been performed in a retrograde attitude. Flight Rule A2-109 Preferred Attitude for Water Dumps did not cover the FD3 dump situation and an incorrect attitude was chosen for the dump. An updated version of this rule will be published in the flight specific annex for all remaining flights. The new version will cover the situation from STS-131 where the phasing rate was greater than 50 nm/rev. If the phasing rate is greater than 50 nm/rev, the dump will now be constrained to occur from ten minutes after the relative apogee to fifteen minutes prior to the next relative apogee. This will not negatively affect the dump plan. The Flight Rule update has been coordinated and approved at the Flight Techniques Panel and is currently working its way through the CR system.

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

- **Changes to the Deorbit Prep Coldsoak and Comm Attitudes** - Changes to the deorbit prep coldsoak and comm attitudes were proposed and approved by the Flight Techniques Panel. They will be documented in Flight Rule A2-110 Structures Thermal Conditioning. The new flight rule will add +/- 10 deg in pitch flexibility to the current biased tail sun inertial Radiator Coldsoak attitude to improve comm coverage, while continuing to satisfy thermal constraints and provide an adequate coldsoak. In an effort to reduce structural thermal gradients and stresses on the vehicle during entry/landing the new flight rule also specifies a yaw bias to the deorbit thermal/comm attitude dependent on beta angle (direction of yaw bias opposite of beta angle). Flexibility in the magnitude of yaw bias has also been added to improve comm coverage if required. Changes to the Flight Rule are in the system and will be added to the flight specific annex of all remaining missions.