

Space Transportation Vehicle Division



STS-129 MOD FRR

October 15th , 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	432.7	22.8	68.2
O2	5	3886.4	3790.6	95.8	96.8

- NOTES:
- 1) Assumes 11+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- 47.5 hrs
 - 4) 20.0 lbm O2 protected for PMA/ODS Repress & 4 ISS-based EVAs
 - 5) Margins include an Additional Day with an unscheduled EVA. Average Power for the 24 hr day is 13.90 kW, which equates to 28.8 lbm H2 and 246.5 lbm O2
 - 6) Margins protect for 3 hours of extended postlanding power for GLACIER, MDS, and NLP/CGBA payloads
 - 7) 112.7 kWh buyback is required for a 96 hour launch hold, H2 limited. This equates to a 615.6 W docked powerdown
 - 8) CSCS capability allows for 16 days docked with 60 lbm O2 margin and unmanned undock on FD19. 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}	300.1³	21.6
Supply H2O (lb)	353⁴	353	0
LiOH (cans)	33⁵	33	0

NOTES: 1) Assumes 11+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) 75 LiOH canisters are required for a 11+1+3 day mission. 33 cans will be stowed in the Shuttle Middeck. 6 pre-positioned canisters will be taken from the LiOH stockpile, and the equivalent of 36 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.

- 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-129 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 10/15

Status of Non-Standard Open Work Shuttle (MEL)

- 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:

LCC ROEU-01,02,03,04,05,06 – The LCCWG has approved changes to ROEU-01,02,03 and new LCCs ROEU-04,05,06 to document the dual ROEU configuration flying for the first time on STS-129. Final approval at the Noon Board is expected on 10/19/09.

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:

Variable ALT Delay - As ISS became larger, 1-Jet ALT control authority steadily deteriorated beginning with STS-120 and became uncertified with STS-127. In order to regain ALT control authority of the mated stack, a Variable ALT Delay control mode is being designed for STS-129 and subsequent flights.

Variable ALT Delay uses a 10-element array of scale factors for the ALT delay time that is already in the flight software. Previously the array only held values of “1” such that the delay was non-variable. The variable delay provides the capability to perform maneuvers with 2-jet ALT without violating load constraints. Flight rules and FDF will be updated as required per the final Draper Memo.

2D PRCS Reboost Configuration - STS-129 has a new ALT reboost that will be flown in configuration 4. The new pattern cycles between the two forward down jet groups instead of cycling between the two forward and two aft groups as with config 1. This reduces the chance for a reboost failure as with configuration 1 by preventing the aft down jets from “slamming” into the - pitch deadband and exceeding the 4x attitude deadband limits.

The old PRCS reboost will continue to be flown in configuration 1. Configuration 4 was previously a duplicate of the VRCS reboost pattern. Flight rules and FDF will be updated as required per the final Draper Memo.

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

RAMBO-2 - STS-129 is the first flight of the RAMBO-2 DoD Payload of Opportunity. RAMBO-2 is different than RAMBO-1 such that it collects stereo views of plumes using two satellites and can view PRCS and OMS burns. The experiment requires a dedicated crew procedure (~15 minutes) to perform a sequence of 3 burns: RAM, WAKE and an Out-of-Plane Burn. The procedure has been PVED with the STS-129 crew and placed into the ORB OPS FS. An FRD update is currently in work to remove a PLB lighting constraint that the PI no longer requires.

6 Hooks Closed Attitude Control - Previously there were no mated attitude control options permitted by analysis/loads constraints when less than 12 APAS hooks were closed. The Russian APAS loads team is working to approve the use of RS thrusters (probably won't get analysis in time for flight) and VRCS to regain attitude control and maneuver with only 6 hooks driven in a one-time contingency scenario event should the situation arise. This operation is not required for STS-129 but desired for contingency scenarios.

Items of Interest

- **Ku-Band Radar during R-Bar Pitch Maneuver (RPM)** - When the crew took Ku – AUTO during RPM setup during STS-128, the Orbiter moved slightly and lost track of ISS. When this occurred, the Ku radiated (into space) at High power in an attempt to regain track...even though the output power was in LOW. This is a known function of the Ku band system in auto track, yet has not been seen before during flight (to our knowledge). Flight rule [C11-4](#) was not violated in this case because the Orbiter was outside the range of 681 feet, and the ISS was not radiated because the dish was pointing into space. But, to prevent this from happening during STS-129, we will modify the APPROACH cue card to delete the AUTO TRACK call in RPM setup and add KU - STBY and KU - ON during the RPM.
- **Power Contactor Failures:** Four recent Power Contactor Failures (two in SAIL, two on OV-103) have occurred. Failure Analysis to date has revealed the occurrence of intergranular brittle fracture along the grain of the core metal in the Power Contactor leaves. Potential contributing factors to failure may also include workmanship issues, static stresses on the materials, and number of contactor cycles. PRT is working to develop a testing plan which may include NDEs (non-destructive evaluations). An NFC (non-flight constraint) for STS-129 has been submitted, and the STS-128 flight rationale and the RJD power-up workaround will be applied for STS-129.

Items of Interest

- **WCS Mounting Bracket R&R** - Due to cracks found in the WCS aft attachment brackets on OV-103 and OV-105, the OV-104 WCS aft attachment bracket was R&R'd. During removal, the urine QD would not detach and was subsequently R&R'd as well. Work is complete and no impacts to on orbit operations are expected.
- **STS-128 LH2 Inboard Fill/Drain Valve Closed Indicator Anomaly** - During the second STS-128 LH2 tanking (8/25/2009) the LH2 Inboard Fill/Drain valve (PV12) did not indicate closed when commanded at the transition to reduced fast flow. Launch was scrubbed due to violation of associated LCC MPS-04. Post scrub troubleshooting including valve cycles found no anomalies. A preplanned contingency procedure including valve cycles was put in place via an LCC Deviation for the subsequent successful launch attempt on 8/28/2009 but the anomaly did not repeat. The MPS Problem Resolution Team and Propulsion System Integration Group is recommending no changes to any Fill/Drain LCCs for STS-129. If the problem repeats on STS-129, a scrub would occur and the STS-128 troubleshooting plan would be used. As of 10/6/2009 the Program has not made a final decision on this. Plans for future flights are also under development.

STS-129 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

October 8, 2009

Gregory T. Oliver

Chief, Space Transportation Vehicle Division

As compiled by: DS1/Mike Interbartolo