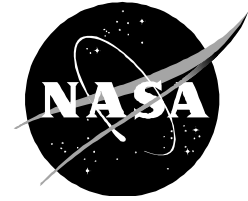


National Aeronautics and  
Space Administration

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2101 NASA Parkway  
Houston, Texas 77058-3696



Reply to Attn of: DS-09-0010

August 17th, 2009

TO: Distribution

FROM: DS/Chief, Space Transportation Vehicle Division

SUBJECT: STS-128 MOD Space Transportation Vehicle Division Flight  
Readiness Review (FRR) Delta Data Pack/Prelaunch Systems Issues

The enclosed data pack is provided to aid in the preparation for STS-128. The inputs are provided from Space Transportation Vehicle Division Flight Control Team disciplines for STS elements (Orbiter, SSME, SRB, and ET). The focus of this data pack is in-flight operations and the list of items in each section is not necessarily comprehensive.

This publication coincides with the L-1 Week Division Flight Readiness Review for the flight. Changes or issues that require updates after this publication will be provided by the on console team at the L-1 briefing.

If you wish to be removed from distribution for future data packs, please reply to DS Shuttle Technical Assistant/Michael Interbartolo.

*Original signed by:*  
Greg Oliver

Enclosure  
Distribution: See list

## A. Open Flight Anomalies

### BOOSTER:

**STS-127 ET Foam Losses** - Three significant ET foam loss events occurred during STS-127: a larger than expected loss at the Xt=718 LO2 Ice Frost Ramp (IFR), a larger than expected loss at the -Y bipod ramp, and numerous adhesion failures on the Intertank foam. The IFR loss is believed to be caused by a void in the foam, which expands during ascent, resulting in a foam loss event. ET Project and KSC are looking at options to modify part of the IFRs with sprayed BX-265 foam (currently poured PDL), with the end goal being to minimize the amount of foam that is liberated. The Bipod Ramp loss is believed to occur due to cryo-ingestion of N2 around the bipod heater wires, which expands during ascent, resulting in a foam loss event. The large number of Intertank foam losses is believed to be caused by inadequate surface preparation of the primed substrate prior to foam application. Approximately 170 tensile test plug pulls were successfully performed on the STS-128 ET, verifying that the foam has an adequate bond to the tank substrate. Hardware modifications are not planned for the Bipod and Intertank areas. On 8/13, the PRCB opted to not perform any hardware changes on the LO2 IFRs for STS-128, due to the uncertainty in the failure mode and the efficacy of the modification. Instead the SSP is going to rely on successful Non-Destructive Evaluation of the affected ET-133 LO2 IFRs. If the NDE comes back with no significant voids, then most likely the SSP is going to press with launch, assuming closure of the IFR IFA. Otherwise, a rollback is possible to perform NDE on the ET-132 IFRs. The Intertank risk is being mitigated by an additional 18 plug pulls, and the Bipod risk has been assessed to be acceptable from a Debris Transport/Probabilistic Risk Assessment standpoint. Booster will continue tracking this issue to closure, and no Booster products or processes are affected.

## A. Open Flight Anomalies

### EGIL:

**AC Bus 3 Phase C** - AC Bus 3 Phase C was commanded OFF in support of S0024, and its associated indicator V76X1852E (Main Bus DC input to the AC3 Phase C Inverter) remained "ON". Troubleshooting to date ruled out instrumentation problems and confirmed possible discrepancies within the Forward Load Control Assembly #3 (FLCA #3), the Forward Power Control Assembly #3 (FPCA #3) and/or the wiring between the two LRUs. The power contactor in FPCA #3 part number MC455-0134-0003 is also suspect, since there have been two recent failures in these assemblies. The two recent failures were on MC455-0134-0001 power relays in the FPCAs at SAIL. Break out Box testing will isolate the failure to either a problem in the FLCA #3 or FPCA #3 or the wiring in between. The FPCA#3 was replaced and the team is reevaluating the STS-127 flight rationale for these parts since the high cycle fatigue theory may no longer be valid. The team is also evaluating the criticality and usage of the hardware that is on OV-103 as part of the flight rationale (see preliminary table on next page)

SPACE TRANSPORTATION VEHICLE DIVISION FLIGHT READINESS REVIEW  
 FRR DELTA DATA PACK  
 STS-128 (OV-103)  
 August 17, 2009

## A. Open Flight Anomalies

FPCA-1	V070-763320-034 / ER5979	System	CRIT	FMEA/CIL	Powered
K1	AC Inverter 1, Phase A Power	EPDC	1R3	05-6-2139-02	Continuously
K2	AC Inverter 1, Phase B Power	EPDC	1R3	05-6-2139-02	Continuously
K3	AC Inverter 1, Phase C Power	EPDC	1R3	05-6-2139-02	Continuously
K11	RJDF Bus A	FWD RCS	1R3	05-6KF-2130-01 (F)	ASC, Docking, Undocking, Entry
<b>FPCA-2</b>	<b>V070-763340-006 / ER3011</b>				
K1	AC Inverter 2, Phase A Power	EPDC	1R3	05-6-2139-02	Continuously
K2	AC Inverter 2, Phase B Power	EPDC	1R3	05-6-2139-02	Continuously
K3	AC Inverter 2, Phase C Power	EPDC	1R3	05-6-2139-02	Continuously
K13	RJDF-1 Bus B PWR (RPC#36)	FWD RCS	1R3	05-6KF-2130-01 (F)	ASC, Docking, Undocking, Entry
<b>FPCA-3</b>	<b>V070-763360-020 / 620749</b>				
K-1	AC Inverter 3, Phase A Power	EPDC	1R3	05-6-2139-02	Continuously
K-2	AC Inverter 3, Phase B Power	EPDC	1R3	05-6-2139-02	Continuously
K-3	AC Inverter 3, Phase C Power	EPDC	1R3	05-6-2139-02	Continuously
K-6	RJDF-2B Manif F4/F5 Drivers	FWD RCS	1R3	05-6KF-2130-01 (F)	ASC, Docking, Undocking, Entry
<b>MPCA-1</b>	<b>V070-764400-040 / J43443</b>				
K4	Was OMS PBK Cntl Assembly		N/A	SPARE	
K5	ODS	ODS	N/A		On FD2 - Off D/O Prep
<b>MPCA-2</b>	<b>V070-764430-033 / AW2439</b>				
K4	Spare		N/A	SPARE	
K5	ODS	ODS	N/A		On FD2 - Off D/O Prep
<b>MPCA-3</b>	<b>V070-764450-022 / AU7720</b>				
NONE					
<b>APCA-1</b>	<b>V070-765310-004 / EN4406</b>				
K1	Reaction Jet Driver Bus A	APS	1R3	05-6KA-2130-01 (F)	ASC*, Docking*, Undocking*, Entry
<b>APCA-2</b>	<b>V070-765320-004 / EN4407</b>				
K1	Aft Payload Bay Power B	EPDC	1R3	05-6KA-2130-01 (F)	On FD1 - Off FD16
K2	RJDA Manif Drivers Bus B	APS	1R3	05-6KA-2130-01 (F)	ASC, Docking, Undocking, Entry
<b>APCA-3</b>	<b>V070-765330-010 / EK9813</b>				
K1	Aft Payload Bay Power C	EPDC	1R3	05-6KA-2130-01 (F)	On FD1 - Off D/O Prep
K2	RJDA Manif Drivers Bus C	EPDC	1R3	05-6KA-2130-01 (F)	ASC*, Docking*, Undocking*, Entry

\* Repowered for vernier control after turned off (e.g. 2nd cycle)

## B. New Operations

### MMACS:

**Seat Power Reconfig** - A Flight Data File Change Request has been submitted to have the commander and pilot turn off power to their seat during Post-Insertion and then turn the power back on during Deorbit Prep. These steps were previously added to the Flight Plan for STS-119 and subsequent flights due to a safety concern after a seat in one of the Bldg 9 mockups started smoking after power had been left on for a long duration. CR# 00866

**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 incorporated in the 17A\_C10-2 Hook Requirements for Docked Operations flight rule (Tracking #536) which was approved at the JPRCB on 8/10/09.

**Brake Line Heaters** - With the launch slip of STS-128, undocking will occur at a beta angle of approximately +58°. In an attempt to gather main landing gear brake line temperature data, ES submitted a preliminary CHIT (Control #7365) to request Brake Line Heaters B & C be turned on approximately 72 hours prior to undocking and turned off after undocking. No TFL swaps will be required. The CHIT will be opened post-launch.

**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. New constraints have also been identified with regards to EVA and exercise limitations, as well as, OBSS contamination concerns. The new constraints required additional analysis and engineering discussions; the results of this analysis are being used to complete the 17A\_C10-1 APU Operations While Docked flight rule (Tracking #849).

## B. New Operations

### EECOM:

LiOH Plan with 6 ISS Crew - Shuttle crew will install 2 LiOH cans per day on the Orbiter while docked to cover the additional CO<sub>2</sub> removal required with 6 crew on ISS. The ISS will run CDRA at the required speed to maintain a 5 mmHg shuttle limit without requiring extra LiOH can usage.

The ISS U.S. LiOH allotment is planned to be increased from 16 to 24 (28 if the EOM+3 requirement is dropped).

### GNC:

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-128.

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.

## B. New Operations

### INCO:

**JAXA ICS Radiation Management Flight Rule** - The new flight was approved for publication but was removed from final revision at the request of the lead ISS Flight Director. ISS Flight Director will submit another rule stating that there will be no ICS operations during the STS-128/17A mission.

**BFS TDRS Vector Management for Entry**- During STS 127 entry, the BFS pointed at a satellite that was geometrically LOS, thus causing a loss of comm. INCO recommended mitigation techniques and Ascent/Entry Flight techniques panel approved using TDRS 174 (171 longitude) in order to mitigate the BFS pointing discrepancies. This action was concurred by the network director.

## C. Operational Workarounds

### MMACS:

**EVA Aft Winch Removal** - Due to a clearance constraint between the aft EVA winch and the ammonia tank assembly (ATA), the aft winch was removed from the aft bulkhead. Per the OCCB 5/26/09, the winch will be demanifested on STS-128 due to suitable EVA workarounds using the rope reel and a payload retention device (PRD) to close the payload bay doors in a contingency scenario.



## D. Anomaly Resolution

### INCO:

#### Anomalies Occurred During STS-127 (last flight)

- **Elbow camera over bright video color anomaly** - Several times during the STS-127 mission the elbow camera produced a pink and/or blue hue on over bright areas of the video image. This generally occurred when the sun was reflecting off the clouds. The image was still usable and did not hinder operations. **No issues for STS-128.**
- **Sequential Still Video (SSV) deframing computer anomaly**– The prime SSV deframing computer lost lock on the data stream several times before it was swapped out with the backup computer. The backup computer worked fine for the rest of the mission and will be utilized for STS-128. **No issues for STS-128.**
- **Defective P/TV cable** - During the entry video setup the crew discovered a defective HUD video cable. The cable was replaced and the entry video worked nominally. **No issues for STS-128.**
- **Failed Headset Interface Unit (HIU)** - During entry preparations the crew reported that the pilot's HIU had failed and they replaced it with a spare. **No issues for STS-128.**

## D. Anomaly Resolution

### INCO:

#### Anomalies occurred during STS-119 (last flight of OV-103)

- **Unable to retrieve Umbilical Well Camera Images** - On FD 1, the crew was unable to retrieve camera imagery during Post Insertion at approximately GMT 075/05:30 (MET 0/05:46). In addition, it was noticed in video from the ET during ET separation that the Umbilical Well TPS Camera flash did not appear to function properly. It is not known at this time if these two occurrences are related. The crew verified cable connections were in a proper configuration for image retrieval. Per SSP request in CHIT 7074, a second attempt to retrieve images was performed on FD6 at approximately GMT 079/17:51 (MET 04/18:07). Conditions for the second test included camera warm up of 7.5 hours and a laptop reboot. No images were retrieved on the second attempt. This is documented in AR # 3854. During post flight troubleshooting in the OPF, the team was unable to capture images or confirm flash on the ET/TPS umbilical well camera; camera was removed and replaced. A PRT is currently formed and tracking ET Umbilical Well Camera issues that are occurring on all 3 ships.
- **Flight Deck Audio/Video Interface Unit Failed** - The Flight Deck audio/video interface unit failed. This failure was discovered prelaunch, but after swapping cables it appeared to work fine. During post insertion setup, the AVIU failed again. The crew stowed the failed AVIU and worked the mission with the remaining five. This is documented in AR #3829. **No issues for STS-128.**

## D. Anomaly Resolution

### INCO:

- **No HUD Video received at MILA** – During Entry, HUD video was not received at MILA. This was tested during the L-1 comm checks, but not verified with the crew. When HUD video was not received during the L-1 checks, it was erroneously assumed that Entry Video Setup was not complete. A postflight review showed that the crew was able to successfully record the video onboard. This issue occurred on STS-125 with a loose cable to the AVIU. **No issues for STS-128.**
- **Corrupted data received from AGO** - Data dumped at the Santiago, Chile ground site (AGO) occasionally had corrupted data for selected parameters. INCO personnel helped the MCC Data Flow Engineer (DFE) evaluate the data after it was played back a second time from AGO. All data played back the second time passed spot checks and was saved to the Operational Data Reduction Complex (ODRC). Further troubleshooting and analysis verified AGO has the same rate of corrupted data as the other 3 STDN sites. **No issues for STS-128.**

### Anomalies occurred during KSC Processing

- **Ku-band gyro heater** - The Rate Sensor Assembly(RSA) control circuit is not operating correctly. The gyro heater is turning off at 90 degrees instead of heating up to the normal 130 degrees. The RSA has been R&R'd. **No issues for STS-128.**
- **Wireless Video System(WVS) Transeiver #1 telemetry failure** - The laptop computer is not showing the correct antenna selected while using WVS transeiver #1. Transeiver #2 was tested and was nominal. A software data file update corrected the problem. **No issues for STS-128.**
- **MADS PCM BITE failed ON indication** - Troubleshooting has revealed that the problem is isolated to a single card and does not affect any data measurements. This failure will only mask any future MADS BITE type failures. A waiver is being processed for STS-128. **No issues for STS-128.**

## D. Anomaly Resolution

### MMACS:

**(AR 3889) APU 3 Z-Axis Accelerometer Trending High** - The Z-Axis Accelerometer on APU 3 (V46D0381A) began to trend higher than expected between approximately MET 12/19:16 and MET 12/19:31. Within this time period, the accelerometer varied between 11 and 100 (OSH) Gs Peak-to-Peak. Post-flight the APU was removed and replaced.

**(AR 3888) APU 2 EGT 1 Erratic Transducer** - At MET 12/19:07:54, EGT 1 (V46T0242A) on APU 2 became erratic and remained erratic throughout the rest of entry. Postlanding, at MET 12/20:12:09, the EGT suddenly recovered and trended according to the expected temperature profile. Failure of these transducers is common. The transducer was removed and replaced.

**LH2 HYD Sys 2 ET Umbilical Retract Failure** - During ground processing, post STS-119, it was discovered that the LH2 Hyd Sys 2 ET Umbilical Actuator failed to retract into the lock when it was nominally commanded post ET separation. This actuator has been R&R'd

**STS-127 ET Door Foam** - Post STS-127, foam was found to be adhered to the forward right-hand ET door bellcrank. Investigation and analysis has determined that the foam was the result of ascent debris that adhered to the metal due to the high temperatures seen in that area. Foam adhesion in particular areas around the ET door perimeter and mechanism could lead to a jam, causing an unacceptable door step on entry. This is not an issue for flight since ascent debris is already addressed in the hazard report. In addition, paint stripes are nominally painted around the ET door edges and are photographed during the RPM to verify the door is properly closed.

## D. Anomaly Resolution

### EGIL:

#### Anomalies occurred during STS-119 (last flight of OV-103)

**FC3 O2 Flow Transducer Failed** – Failed to OSL. Troubleshooting revealed a blown fuse on MPCA3. While removing the fuse cap, the cap was found to be broken. MPCA3 and FC3 were R&R'd.

**Waste Management Compartment Floodlight Failed** – Signature was typical of end of life bulb, was R&R'd on 5/14/1009.

**SSPTS OPCU 2A Failure to Transfer Power** – During STS-119 OPCU 2A - FM03 (SN GFE09005089) experienced two inadvertent trips during power up. The Fault Isolator (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 enabled and the load is between 15 and 20 ampere. After the second trip occurrence on STS-119, it was decided to control power transfer by adjusting the output voltage down via RTCs (vs. opening and closing the ISS RPC) 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 OPCU power down operations. The potential impacts to crew time and mission margin will be considered when deciding to use this workaround option.

## D. Anomaly Resolution

### EGIL:

#### **Anomalies that Occurred During STS-127 (Last Flight)**

**Fuel Cell 3 High Condenser Exit Temperature High** - During Prelaunch it was discovered that Fuel Cell 3's Condenser Exit Temperature was being controlled to a temperature which would violate the Fuel Cell KO concentration instrumentation limit of 29 % (FR A9-1 F). The rule was violated only at the low power levels the Fuel Cell would experience during SSPTS operations. A CHIT and a Real Time Flight Rule were generated that allowing operation of the fuel cell between the instrumentation limit and the hardware limit of 24%.

**Fuel Cell 3 Extended Sustaining Heater Cycle** - On Flight Day 9, Fuel Cell 3 experienced a sustaining heater cycle that lasted 20 minutes, warming the fuel cell up beyond its expected turn off point. At that point the bus tie was broken and power transfer to MNC was terminated to increase fuel cell loading and temperatures to keep fuel cell 3 above its nominal sustaining heater setpoint in an attempt to preclude any additional sustaining heater cycles. This action resulted in a ~6 hour margin impact at non-SSPTS power levels.

## D. Anomaly Resolution

### EGIL:

**Fuel Cell 3 Extended Sustaining Heater Cycle (cont.)** The fuel cells currently installed on OV-103 have not experienced any sustaining heater cycles on orbit. However, since fuel cell 3 removal and testing will not be completed by the STS-128 launch date, EGIL will evaluate ways to reduce the number of sustaining heater cycles should they occur

The current plan is to run nominally until we see a sustaining heater cycle, at that point we can evaluate our options to prevent other sustaining heater cycles (if it is deemed necessary) and their margin impacts. If we don't expect to see many cycles, we will likely do nothing. If it is cycling more than we are comfortable with, then we can purge Fuel Cell 2 and bring its minimum power level back up another 100-200W. The projected average min kW for fuel cell 2 in the STS-128 SOCRATES analysis is higher than the lowest power level seen on STS-119 (at which point no sustaining heater cycles were seen). Any other options would likely be a margin impact and not worth pursuing unless we saw the heater stick on like on 127.

**FWD STBD and PORT Payload Bay Floodlight Failed** - On FD2, the Forward Starboard Payload Bay Floodlight Failed and then on FD4 the Forward Port floodlight failed. **This is no impact to STS-128.**

**MIC Key Light on Panel A2 failed to illuminate** - On FD1, when the crew did their lamp test, they reported that the mic key light on panel A2 failed to illuminate, and also failed to illuminate when the mic key was depressed. On FD6, the crew reported that the light was functional and had been so on FD5. While the cause of the failure is unknown, the speaker unit at panel A2 suffered no loss of function during the flight. **The unit will be R&R'd, no impact to STS-128.**

## D. Anomaly Resolution

### EGIL:

#### Anomalies occurred during KSC Processing

**Broken fuse on MPC2** – During troubleshooting for an ODS power issue some collateral damage was done to MPCA-2 – one of the fuses holders on the side of the box was broken. R&R complete.

**SSTPS IPR-0029** – An open circuit was found on OPCU 1 channel B return. The X2 connector on the ODS was later found to not be fully seated, SSTPS testing was completed with no other anomalies.

**SRB Bus Voltage Drop** - When power was initially applied to SRGA 1, SRB Bus voltages dropped 3.5V. The expected drop is closer to 1V. *Waiting on disposition.*

**Panel O3 FWD Mission Event Timer** - The upper right hand segment of the tens digit for the hours number on the timer is failed on. During nominal operation, this segment is always on anyway as the tens digit for hours is always 0,1, or 2. This is a known condition of this event timer, and it has flown this way before.



## D. Anomaly Resolution

### EGIL:

#### Anomalies occurred during KSC Processing

**RH VENT DOOR 6 Motor 2 2 Phase Drive.** - During vent door ops supporting V1202, right hand vent door 6 was positioned from closed to open. The vent door observer noticed the motor noise during the operation was abnormal. Engineering review of the vent door data revealed that AC Bus 2 Phase B current (Motor 2) did not show an increase during the vent door operation, and slightly higher current draw on start-up for phases A & C. Historical data for this vent door shows no abnormal current draws or motor run times. Later operations included a cb cycle of AC2 MID 4 on MA73C. After which, the vent drove nominally. Closed as explained condition.

### EECOM:

**GIRA Microbe Filter Water Leak** - (MMACS AR 004070) : On FD1, while installing the Galley Iodine Removal System (GIRA), the crew reported that the towel wrapped around the microbial filter was soaked with water. The crew swapped to the spare microbial filter and reported that the fittings on both ends of the filter were loose. The leak could not be recreated in postflight testing, speculation is that the crew hand tightened the fittings during the swap and stopped the leak. No impact to STS-128/17A.

**GIRA Water Transfer Hose Leaking** - (MMACS AR 004071): On FD2, the crew reported that a sizeable ball of water had accumulated overnight at the T-fitting on the GIRA transfer hose. After cleaning that up another (smaller) ball of water had formed in 45 minutes on FD2. The crew cleaned up the water and tightened the fitting with a wrench. There were no further reports of leakage from this area during the mission. The leak could not be recreated in postflight testing, it appears that tightening the fitting did stop the leak. No impact to STS-128/17A.

## D. Anomaly Resolution

### PROP:

### **STS-119 (Last Flight of this Vehicle)**

**FRCS Helium Press A Fuel Valve Anomaly** - During the post-landing OMS/RCS valve test, the FRCS helium A fuel valve did not initially indicate closed after the switch was taken closed, but did indicate closed after approximately two minutes. The switch was later cycled again and the valve indicated as expected.

Extensive retesting was performed without the anomolous indication repeating, and “wiggle tests” were performed on associated wiring without any discrepancies being found. Previous indications of this type have generally found to be indication problems only and that is the leading theory at this time, though this has not been conclusively shown. A UA has been approved for this problem.

## D. Anomaly Resolution

### BOOSTER:

**STS-125 Main Propulsion System (MPS) Left Gaseous Hydrogen (GH2) Outlet Pressure Transducer Erratic During Ascent (MER-01/STS-125-V-0001)** - During the STS-125 Ascent, the MPS Left Engine GH2 Outlet Pressure transducer was erratic. This behavior started at SSME ignition and continued throughout powered flight until MECO. The erratic measurement annunciated the associated BFS Caution and Warning message four times, and the MCC directed the crew not to take any action. During powered flight, this measurement is used in combination with other cues to determine whether an SSME is running behind a loss of data. This sensor is not used post MECO therefore there were no impacts to the remainder of the mission. The sensor assembly will be inspected post landing, and no new Booster operations or product updates are expected for STS-128.

**STS-127 Ground Umbilical Carrier Panel (GUCP) Leaks** - During STS-127 launch attempts on 6/13/2009 and 6/17/2009 GUCP leaks were experienced, resulting in launch scrubs. Measurements taken during GUCP disassembly implied that the cause of the leak was likely misalignment, and it was decided to replace the one-part flight seal with a two-part flight seal which is thought to have a greater misalignment capability. The two-part seal was used on STS-116 and STS-117 but no other flights because it leaked twice on STS-116 (but was within the Launch Commit Criteria limit). The GUCP Pyro bolt has also been replaced with a new unit. The carrier plate was realigned using high fidelity alignment pins and an interference problem was found between the Right GUCP foot and hinge pin bracket (this was not unexpected). Both the right and left hand GUCP feet were modified to be centered on the hinge pins and washers were installed to restrain the motion of the feet on the hinge pins. A successful tanking test was performed on 7/1/2009 with no further leaks. No changes are expected to STS-128 at this time.

## **E. Miscellaneous (i.e. catch all category)**

### **DPS:**

**FF4 and FA4 MDM Failures and Changeout**– Both FF4 (S/N 110) and FA4 (S/N 122) encountered anomalies while in vehicle processing and have been changed out with spare MDMs. During waveform testing, the secondary port of FA4 showed a discrepancy with the waveform output being out of family low (IPR 128V-0018). It was subsequently replaced with a new MDM (S/N 009). Unrelated, FF4 experienced a problem with its primary port (IPR 128V-0022) and was also swapped out with a new MDM (S/N 154).

Previously, OV-103 was flown with String 4 on Secondary Ports (STS-119) to avoid diodes from previously identified questionable lot date codes (LDC) which were on FF4/FA4 primary ports. The replacement MDMs do not contain any of these diodes. Therefore, STS-128 will be flown with all strings operating on primary ports.

## E. Miscellaneous (i.e. catch all category)

### DPS:

**CRT MDUs Port Configuration** – During the STS-126 flow, an unexplained MEDS error (IPR 126V-0066) was observed on a CRT MDU during IDP/CRT powerup. Upon further investigation, the error appears to have been a manifestation of a MEDS User note (109734). Due to the method which KSC powers on IDP/CRTs, they are exposed to a small timing window which can result in this condition. This same method is not typically used on orbit for IDP/CRT powerup.

To avoid this potential User Note condition, KSC will be leaving all CRT MDU's in MAN (manual) Reconfiguration Mode. This eliminates the chance of getting the MEDS error. During flight, nominally all MDUs are set to AUTO Reconfiguration Mode which allows them to automatically be driven by either IDP to which the MDUs are connected. However, CRT MDUs are connected only to a single IDP which eliminates the need to keep them in AUTO. Due to this, there is no need to require the CRT MDUs to be selected to AUTO for flight. The CRT MDUs in MAN mode is no impact to vehicle flight operations.

This will be documented in the Ascent Checklist 'MEDS CONFIGURATION FOR INGRESS' table. It will be included in the typical 482 which contains changes to this table for the crew's MEDS preferences for launch. This table is not flown and is only used for coordination with KSC.

**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. All DS open work is complete.

## **E. Miscellaneous (i.e. catch all category)**

### **MMACS:**

**APDS Docking System Power System 2 Talkback** - During ground operations, post STS-119, when the Docking System Power System 2 switch was taken to ON, the corresponding talkback was not received. Other items downstream of the switch were also non-operational; however, the electrical bus was healthy. A later attempt at repowering the system was successful. The problem is believed to be related to a relay or switch issue in the MPC 2 box. This issue is being documented as an unexplained anomaly (UA), but the MPC 2 box was R&R'd.

**PLBD C/L Latches 1-4** - While closing and latching the payload bay doors in the OPF, centerline latches 1-4 motor 2 took 40.8 seconds to drive (s/b 40 seconds max). The latches were released and relatched with no issues. The same problem occurred with this motor on the ground prior to STS-114 and STS-116. It is believed that the problem is related to ground induced misalignments in the vehicle/doors causing a higher torque to close C/L 1-4. Since the problem cleared by cycling the latches, it suggests that the first closure attempt on the latch helped overcome the door's misalignment and thus made the second attempt easier. This item is being documented as a UA.

**HYD Sys 1 Hydraulic Pressure** - During ground operations the vehicle pressure reading on Hyd Sys 1 pressure was 3440 psi while the GSE pressure was 3040 psi. The high pressure reading from the vehicle transducer triggered the GSE equipment to shutdown. The problem appears to be with the GSE equipment (there have been previous issues with this equipment) and is being looked into further. The pressure that was seen on the system was below the orbiter relief valve cracking value, and the vehicle is certified to the level of pressure that was experienced.

## **E. Miscellaneous (i.e. catch all category)**

### **MMACS:**

**RSB Thermal Tab Redesign** - Implementation of the thermal tab redesign is basedlined to occur no earlier than STS-129; however, the lack of suitable existing spares required the installation of two new tabs on OV-103. These tabs include increased spot welds as well as a mechanical fastener to insure liberation during RSB cycling does not occur. Old and new style thermal tabs are interchangeable. An MR has been processed to account for this new flight configuration for STS-128

**STS-128 LON (OV-104) Window 5 Stuck Knob Issue** - A knob from a crew work lamp was discovered lodged between the pressure pane of window 5 and the dashboard panel. The knob has been removed and damage to the window can be seen, but the extent of the damage is unknown. Analysis will determine if the window pane needs to be R&R'd. There will be significant impacts to the schedule if it is determined that the window pane needs to be replaced. We may request a visual inspection of the windows and dashboard area on upcoming missions.

## **E. Miscellaneous (i.e. catch all category)**

### **EECOM:**

**Shuttle Crew Using ISS WHC** - To avoid contamination of the JEM-EF, dumping urine while docked is not permitted. As a result, some Shuttle crewmembers will have to use the ISS WHC during the docked timeframe. The number of crew equivalent required to use ISS facilities will be determined based on mission duration and number of crew returning in the Shuttle. This number will be updated in the MIP closer to flight to allow for any late changes in mission duration or number of crew returning in the Shuttle.

**Docked Waste Management** - To help with waste management between the Shuttle WCS and ISS WHC, EECOM is currently evaluating providing a plot to the crew showing the waste tank rate required to avoid having to offload the waste tank into CWCs while docked. The goal is to help minimize status and Shuttle WCS and ISS WHC allocation calls to the crew by better preparing the crew to manage waste themselves.

**Mouse Drawer System (MDS) and Glacier Leakage waivers** - The MDS and Glacier experiments both exceeded their allotted leakage requirements. These exceedances are being waived. This is leakage between the Av Bays where the experiments are housed and the Cabin. The only impact is in the event of a halon discharge the time that the halon levels are sufficient to extinguish fires is reduced to 8 hours



## **E. Miscellaneous (i.e. catch all category)**

### **GNC:**

**Free Drift for GPC Set Contractions** – During STS-119 PHALCON and ADCO expressed concern over the couple of minutes of free drift during the set contractions. The concern was that this free/auto toggle could have violated the solar array constraints. This concern originally came up during STS-126 when the GPC set contraction was performed during the maneuver to the the post-docking TEA. For STS-128 the set contraction will be performed after the post-docking maneuver is complete, and ADCO and PHALCON are satisfied that this does not violate any SAW constraints. Also, the GPC set expansion and contraction procedure currently calls for the crew to wait 30 sec prior to going back to attitude control, however with the size of the mated stack, the DAP takes longer to converge. The 128 crew has been told about this concern and have noted it in their GPC set contraction/expansion procedures. GNC and DPS plan to remind the crew about this limitation prior to the execution of the GPC set contraction/expansion procedure.

**B DAP for Mated Attitude Holds and Undock** - For STS-119 and subs, Draper developed a second set of DAP settings for mated operations that provides better stability and Prop usage when just holding attitude. These DAP settings have been loaded into DAP B12 and will be used for periods of extended attitude hold. These DAP settings are also tuned and will be used to ensure that the Shuttle can safely meet the recently updated rate error requirements (<0.020 deg/sec/axis) for undock and separation from the ISS.

**DAP for JEM RMS operations** - Draper is working on a generic flight control analysis of the mated stack with the JEM RMS holding a payload. If this generic analysis shows that the DAP is not sensitive to a loaded JEM RMS, the only constraint on orbiter control during loaded JEM RMS ops will be JEM RMS structural analysis which is ongoing. The JEM RMS is 0FT.

## **E. Miscellaneous (i.e. catch all category)**

### **GNC:**

**ASA 1 Power Fail during Ascent (AR 003947):** Just prior to liftoff on STS-125, ASA 1 power failed and bypassed across all the Channel 1 Aerosurfaces. Several indications (RPCs tripped, currents to ASA 1 increased, noise on FA1 and OA1MDM measurements) pointed to the most likely cause of the problem being a short to ground of the ASA 1 26V 400Hz supply power. FCS Channel 1 was taken to the OFF position and left there for the duration of the mission. The ASA 1 switch was taken to OFF until FCS C/O and Entry when it was turned ON to provide isolation power to Channel 1 Aerosurface Actuators. Post-flight inspection to locate the source of the short is planned. Flight rationale for STS-127 and subs was developed based on system redundancy and likelihood of a similar failure.

The OV-103 RHIB and LHIB elevon actuator harnesses have recently had wire protection installed as a preventative measure to mitigate the possibility of a short similar to the one that occurred on OV-104 during STS-125.

**OMS TVC Controller issue (AR 003365):** On STS-124, the Left OMS Secondary TVC (S/N 131) pitch and yaw position transducers failed to null during ascent. The L OMS engine was parked through the end-of-mission c.g. position until the Deorbit Burn, when it was burned active using the Primary system. Subsequent testing and troubleshooting has determined that the problem was due to a low likelihood failure of the A6 circuit card becoming unseated, the exact cause of which has not been identified. Previously, it was thought that cause of the failure was compression set of the viton foam strips between the circuit cards and the TVC cover. However, testing has proven that the foam strips alone do not provide circuit card retention, so the 124 failure was not due to degradation in the viton foam. Flight rationale for STS-119 and subs was developed based on system redundancy and likelihood of a similar failure.

## E. Miscellaneous (i.e. catch all category)

### GNC:

**-Z Star Tracker Pressure Fail BITE (AR 003877)**: On STS-119, the -Z Star Tracker annunciated a Pressure Fail BITE after being powered up for the Group B powerup prior to undocking. The -Z Star Tracker performed nominally for the remainder of the mission. This star tracker (S/N-012) has a history of annunciating pressure fail BITEs and has been repressurized several times. After STS-119, the star tracker was removed from the OV-103, repressurized, permanently sealed (to avoid pressure loss in the future), and reinstalled on the OV-103. Pressure loss will not affect star tracker on-orbit performance. Due to decreased internal pressure, the star tracker may ingest moisture during re-entry caused by differential pressure. If this should occur, it will require removal, cleaning, and testing after the flight.

**Unexpected TCS Message (AR 003878)**: On STS-119, the TCS annunciated a “Checksum Error Re-Transmit Command” message in TCS CADS during TCS Activation prior to undocking. TCS data looked nominal to GNC and TCS MER, so no troubleshooting actions were performed and TCS performed nominally during undocking and flyaround. It was determined that this is a known issue where a command from TCS CADS was corrupted prior to reaching the TCS. This message is generated by TCS CADS to inform the operator that the command was retransmitted to TCS. The TCS functioned correctly and responded automatically to the unsuccessful command transmit.

## **E. Miscellaneous (i.e. catch all category)**

### **GNC:**

**Radar Altimeter Anomaly during FCS C/O (AR 003882)**: On STS-119, Radar Altimeter (RA) 2 displayed on out-of-tolerance altitude of 1961ft during FCS C/O (nominal is ~1000ft). The crew reported good data for the first 5 seconds of the test (980ft), then reported that the data read 1961ft for the remainder of the test. The ground had good data for both RAs for the duration of the self-test period (975ft & 980ft for Ras 1 & 2, respectively). It was determined that the problem seen on the crew display was due to a timing error between the RA and the associated FF MDM that causes the altitude reading which is double the actual reading. Also, the self-test logic reads the RA input data 19 seconds after self-test initiation, after which the data is frozen on the display for the test duration. The timing error combined with the self-test logic caused the erroneous reading on the crew display to be frozen. There has been one other instance of a nearly identical issue (IPR 29RV-0115), which also occurred on the same RA (S/N-20) and was closed as being due to a timing issue. Both RAs performed nominally during Entry.

**STS-125 GPS Tilt**: During STS-125, the GPS MAGR experienced a Tilt when it was powered ON and left to operate standalone for ~12hrs behind the FF2 MDM which was still OFF . The GPS was powered up so that it could download the daily encryption key prior to Entry. The Tilt was only present for the very first MDM read after FF2 MDM was powered up and the I/O reset was performed to clear the bypass. The Tilt was due to a benign User Note condition (SAIL IDR DIT996234) and recovered on its own after the bypass was cleared. There are no concerns about this issue for subsequent flights.

## **E. Miscellaneous (i.e. catch all category)**

### **GNC:**

**128/17A Hydraulic Actuator IPR 128V-0012:** During aerosurface and SSME repositioning in the OPF after STS-119, the GSE shutdown after a spike in hydraulic pressure. The command sequence continued, and when hydraulic pressure was restored, a step function of greater than 2 degrees was introduced to the Right SSME Yaw actuator. GSE shutdown again, and was again restarted this time resulting in a step of greater than 2 degrees to the Speedbrake. It was determined that though both actuators stepped by more than 2 degrees, the system pressure was only at around 2000 psi which is less than the nominal 3000 psi and considered well within the limits that the lines are capable of. Additionally, the movements seen were within the movements of a standard FRT. Analysis concluded that water hammer on the SSME actuator was benign. There is still some work being done to mitigate concerns over the water hammer effect on the Speedbrake, but the current feeling is that it was a benign event. Ground ops is requesting that a FRT and SRT be performed at the pad, and a waiver is being generated for this event, but no further action has been identified unless a problem is found with the Speedbrake. Finally, to close the IPR procedures are being updated to reduce the chance that this sort of incident will occur in the future.

## **E. Miscellaneous (i.e. catch all category)**

### **GNC:**

**Boundary Layer Transition Flight Experiment (BLT FE)** – OV-103 is being modified to perform the second of four flights of the BLT FE. A 4” long, 0.35” high protuberance is being placed on the bottom of the port wing in an attempt at studying the effects on boundary layer transitions at high mach numbers. Analysis has been performed which suggests that no significant impact to flight control margins or propellant usage can be expected from this experiment. This effort is expected to play a significant role in understanding boundary layer transition and influencing development of high-fidelity computational modeling techniques. The results from the 1/4” protuberance on STS-119 were favorable. Additional DTO’s are planned with higher protuberances on subsequent flights, based on the results for STS-119 and STS-128.

As part of the BLT DTO, a catalytic coating material has been applied to two instrumented tiles downstream of the BLT protuberance to evaluate catalytic/turbulent entry heating performance.

**TriDAR Automated Rendezvous & Docking Sensor (AR&D) DTO** - The TriDAR Sensor DTO will be integrated into the Space Shuttle Orbiter to demonstrate technologies for autonomous rendezvous and docking in Low Earth Orbit (LEO). The complete vision system will incorporate laser ranging and imaging capability along with software to process the resulting data for determination of six-degree-of-freedom pose, range/bearing, and imaging. Demonstration of the TriDAR during proximity operations with the ISS would prove the system capabilities and provide valuable insight into a potential applicability to CEV, COTS and other programs.

The design of the DTO is such that there are minimal crew inputs and very limited crew training required. TriDAR should not to interfere with TCS during RPOD and does not pose a hazard to the Shuttle or ISS crew. GNC has no direct insight to TriDAR. ACO is the FCR position responsible for the TriDAR DTO.

## **E. Miscellaneous (i.e. catch all category)**

### **GNC:**

**IMU Slip Ring Issue:** A flaw exists in the design of the IMU tape cables used to transmit data to and from its inertial components (gyros, accelerometers, etc.) and the clamp used to hold the wires in place. The current design can create a small amount of flexure in some of the wires. This condition can, and has, led to breakage of slip ring wires during ground calibrations and flight operations. A modification to the IMU hardware has been designed and successfully implemented on S/N 208; this IMU has been installed in OV-103 in slot 2. The remaining IMUs on OV-103 have not had the modification performed and are susceptible to this failure mode. The modified IMUs eliminate the susceptibility of all three IMUs to the generic failure mode, and thus the need for early mission termination under the generic failure mode section of the flight rules.

**IRAMS OI-34 Issue:** An OI-34 SCR (93239) removed the IMU Operate Command Status bit from several downlist formats which affect the OPS 9 pre-launch time frame to solve a violation of downlist requirements. This parameter was used by both the KSC and JSC versions of the Inertial Reference Alignment Monitor System (IRAMS) software which is used by the MER to monitor IMU performance pre-launch. KSC IRAMS has successfully implemented and tested a workaround to use the IMU Operate feedback parameter instead of the command. JSC IRAMS has implemented a similar workaround and final testing is in work. Loss of IRAMS is not a constraint to launch and pre-launch IMU performance can also be monitored with GNC displays.

## **E. Miscellaneous (i.e. catch all category)**

### **PROP:**

**Multi-Stage Deorbit** - The flight design process implemented multi-stage deorbit in the final design cycle (FRR cycle) for the mission as a get well for the low APM (Ascent Performance Margin). This process allows them to commit the RCS propellant “margins” shown in the pre-flight budgeting process to contingency payload return. While this does mean there will be less propellant available for on-orbit operations, capability is still more than adequate for all planned mission activities. A meeting was held with DA8, DS63, flight dynamics and flight design personnel and no issues were identified with implementation for this mission.

### **BOOSTER:**

**MPS High Point Bleed Valve Cracked Seal** - During STS-128 LH2 system decay tests, the MPS High Point Bleed valve ball seal was found to be cracked. The valve was removed from the vehicle and replaced with a spare, so there should be no further impacts to the STS-128 processing and mission. The High Point Bleed valve is only open during propellant loading to help bleed off excess GH2, and is closed at T - 26 seconds by the Ground Launch Sequencer. There are several other valves that use the same design and material for ball seals; however, this is believed to be an isolated event by the MPS community, and OMRSDs and LCCs are in place to screen for any further failures. A waiver has been processed for STS-128 due to the low likelihood of failure and multiple levels of redundancy for a Crit 1 condition.



## **E. Miscellaneous (i.e. catch all category)**

### **BOOSTER:**

**RTLS Dump Valve Solenoid Actuator Leakage** - During STS-128 MPS Pneumatic Decay checks, excessive helium leakage occurred, which was later attributed to a leaking solenoid on the Inboard RTLS Dump Valve open actuator. The observed leak rate was 66 SCIM, which is approximately  $6.6 \times 10^{-6}$  lb/sec of gaseous helium. Since this leak will only be present while the open actuator is energized, no leakage should occur during powered flight, only during post-MECO during the MPS propellant dump and vacuum inerts, as well as the Entry vacuum inert. Due to the small leak rate and the limited exposure time, a decision was made to not R&R the actuator. No procedural or operational changes are expected for STS-128 as a result of this condition.

**Left Solid Rocket Booster (SRB) Hydraulic Power Unit (HPU) Check Valve Filter Assembly (CVFA) Failure** – During standard high pressure leak checks on the Left SRB Tilt hydraulic system, a KSC employee heard an off-nominal sound coming from the Left SRB aft skirt. The operator felt the Tilt system hydraulic pump and it was hot to the touch, and the associated Gas Generator temperature rose approximately 15 degrees F. Based on this limited amount of data, KSC postulated that the Tilt system CVFA failed, and caused the Left SRB Tilt Hydraulic Pump and the Auxiliary Power Unit (APU) turbine to spin backwards. The failure was isolated to the Tilt system, and the Rock system performed nominally. KSC removed and replaced the Check Valve Filter Assembly, the HPU/Hydraulic Pump, and the APU for the Left Tilt system. After removing the CVFA, a snap retention ring had backed out and an o-ring showed significant damage, confirming the postulated failure mode. After a successful hot fire test on 8/16 no further work is planned, and the system will be GO for launch. No Booster products or console procedures are affected by this issue.

## E. Miscellaneous (i.e. catch all category)

### BOOSTER:

#### Equipment Replacements/Additions

STS-128 is the 37th flight of OV-103  
 Inclination: 51.6 degrees  
 Launch PAD: 39A/MLP 2  
 External Tank: S/N 132 (Super Light Weight Tank)  
 RSRM Set: RSRM-107: Left Side (A), Right Side (B)  
 SRB Assembly: BI-139  
 Orbiter Software: OI-34

#### SSME Hardware<sup>1</sup>

Position Number	1(C)	2(L)	3(R)
Engine Number	2052	2051	2047
Engine Type	Block II	Block II	Block II
Last Hotfire	STS-126	STS-119	STS-126
Powerhead	6009	6018	6016
Main Injector	6007	2035	4027
MCC	6006	6022	6011
Nozzle	5004	5007	4027
Controller	AF62	AF60	AF39
HPFTP	8028	8027R1	8024R1
HPFTP R/L Deg. R	1860	1860	1860
LPFTP	4207	6005	2225
HPOTP	8224	8230	(8325)
HPOTP R/L Deg. R	1660	1660	1660
LPOTP	2231	6103	4207

NOTE: Items in parentheses have been changed out since the last hot-fire of the SSME.

SPACE TRANSPORTATION VEHICLE DIVISION FLIGHT READINESS REVIEW  
FRR DELTA DATA PACK  
STS-128 (OV-103)  
August 17, 2009

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