



SPACE SHUTTLE PROGRAM
Flight Software Office
NASA Johnson Space Center, Houston, Texas



Flight Software Office (FSO) STS-126 In-Flight Anomaly Action Response S063997A

David Rutishauser/MS4
SICB Jan. 12, 2009
PRCB Jan. 15, 2009



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FSO STS-126 IFA Review Activities/Status

Presenter **D. RUTISHAUSER**

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- **STS-126-I-001, SM GPC Failure to Send GCIL Commands :**
 - MMT action 126-MMT-001 assigned to report all analysis results and preventative action plan to PRCB January 15th (PCIN S063997A)
 - IFA statused during the Dec. 9, 2008 SICB and Dec. 11 PRCB
 - Corrective actions reported
 - Provided status of root cause and preventative action investigation
 - SASCB reviews
 - DR126366 dispositioned at Dec. 4, 2008 SASCB to authorize corrective actions
 - Findings of root cause and preventative action investigation presented at Dec. 18, 2008 SASCB
 - Jan. 12, 2009 SICB
 - Presented findings of root cause and preventative action investigation and preventative action plan and obtained approval to close IIFA STS-126-I-001
 - Reviewed same material to be provided to PRCB Jan. 15, 2009 with request to close 126-MMT-001
 - Obtained concurrence for PRCB request to approve post-MMU release patch for STS-119 and STS-127 per corrective action plan



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FSW STS-126 IFA Review Summary

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- **Corrective actions**

- Patch for STS-119/127 developed and tested successfully in SAIL
- OI-34 source changes in work
- All OI-32, OI-33 and OI-34 output data locations audited for proper alignment, and no other issues found

- **Root causes and preventative actions identified**

- (Development) Interpretation of coding standard and rigor of implementation
 - Preventative action- Clarification of standard, identification and documentation of all instances where data alignment is not automatically enforced, and tool enhancements to warn developers working in these areas of this condition
- (Development) Insufficient training for developers on potential impacts of COMPOOL modifications
 - Preventative action- Enhancement to code standards to prohibit modifications causing these types of impacts unless peer-reviewed and approved by internal review board, and additional training



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- **Root causes and preventative actions identified, cont.**

- (Verification) Failing to monitor outputs to devices not modeled in the Software Production Facility (SPF) and coverage gaps in PASS Vehicle Cargo System (VCS) Level 7 (system health) testing
 - Preventative action- Modifications to the standard VCS Level 6 and 7 test setups to facilitate I/O verification where closed loop models are not present. Modifications to the VCS Level 7 tests to provide complete functional coverage. Added process requirement to re-run appropriate VCS Level 7 tests when Systems Management (SM) or Vehicle Utility (VU) source changes are applied to a flight system.
- (Verification) No documented IAV requirement for functions identified in this IIFA; SAIL test procedures coupled with hardware operational characteristics masked an opportunity to find the error; Anomalies associated with the problem were mistaken for prior hardware lab issues and not documented per IAV processes
 - Preventative actions – Reinforced training for SAIL personnel to follow established discrepancy reporting procedures strictly. Review test procedures to verify flight-like sequences of operations, and remove steps to reset hardware between runs. Add IAV requirements to test functionality associated with this IIFA.



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FSW STS-126 IFA Review Summary, cont.

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- **Root causes and preventative actions identified, cont.**
 - (Field use) The Shuttle Mission Simulator (SMS) is a training facility, not a verification facility, and therefore does not necessarily have full flight fidelity models of all avionics systems, including the command interface associated with this IIFA
 - Preventative action- SMS model enhancements in this identified area



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FSW STS-126 IFA Review Recommendations

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- Approve closure of 126-MMT-001

- Approve post-MMU release patch to implement corrective action on STS-119 and STS-127 per NSTS 07700