



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



Flight Software Office (FSO) STS-120 In-Flight Anomaly Review

SR 4074

David Rutishauser/MS4
PRCB Nov. 8, 2007



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FSO STS-120 IFA Review, Overview

Presenter **D. RUTISHAUSER**

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Tracking #	Description	IFA?
STS-120-S-001 (MER-18)	SPEC 205 Displaying Incorrect Data	Y
AR2830	GPS YETI Events	N
STS-120-S-002 (INT-15)	PGSC Windecomm Anomaly	Y
STS-120-S-003 (MER-05, INT-09)	Trajectory Control Sensor (TCS) Error Message During RNDZ Tools Checkout	Y
STS-120-S-004 (INT-06)	PGSC Network Communication Issues	Y
STS-120-S-005 (MER-03)	Wireless Instrumentation System (WIS) GFE Laptop Local Timeouts	Y
STS-120-S-006 (MOD-2826)	STS6 PGSC Loss of Monitor	Y
STS-120-S-007 (INT-04)	Suspect Power Cable to WINDECOM PGSC	Y



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- **STS-120-S-001, (MER-18) Spec 205 Displaying Incorrect Data :**

- Shuttle crew reported unexpected data displayed on SPEC 205 testing a capability to command the ISS attitude control at dock and undock and attitude control handover procedures. Specifically, the orbiter crew can command the ISS to free drift upon contact, or to activate attitude control upon separation. All data was as expected per ISS ground control (ADCO). The procedure was aborted and the crew was directed to wait for a ground call to complete the handover. A minor timeline delay was incurred. The ADCO and GNC team executed 3.110 HANDOVER ATTITUDE CONTROL CMG TA TO ORBITER to complete the handover.
 - **IFA** - Analysis in work, root cause TBD. Daily meetings to status investigation. SAIL, SPF, and SMS testing in work.
 - **Post-flight plan** – TBD, per results of root cause investigation

- **(AR2830) GPS Y-code Erroneous Tracking Incident (YETI) Events :**

- Two YETI events occurred on Miniature Airborne Global Positioning Receiver-Shuttle (MAGRS)
 - First event at MET 001/18:24 hardware channel #2
 - Second event at MET 005/21:19, hardware channel #5
- Both events cleared using procedures documented in Ops Note 110646 (Moding receiver to INIT, then back to NAV)
 - **NO IFA**– Prior known failure condition documented in FSW DR 110646.
 - **Trending** – Log of all YETI occurrences maintained on GPS PRT website. STS-120 is the first flight to have more than one occurrence. Prior occurrences in lab facilities and on STS-112, STS-117.

- **STS-120-S-002, (INT-15) PGSC WINDECOM Anomaly :**

- Crew reported on FD2 that WinDecom was experiencing an anomalous condition. Data from WinDecom would exist for 5-6 seconds, then disappear with an error denoting loss of data. This error repeated itself several times during FD2, causing the Crew to deactivate the WinDecom application. On FD14, WinDecom was not activated during separation and flyaround, causing RPOP to be nonfunctional. The crew later reactivated the WinDecom application, and the intermittent data anomaly reoccurred.
 - **IFA**- WinDecom configuration not correct for new PCMMU card and new buffer sizes caused data dropouts.
 - **Post-flight plan** – POCCB Software CR, and verify in SAIL with actual PCMMU



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- **STS-120-S-003, (MER-05, INT-09) Trajectory Control Sensor (TCS) Error Message During Rendezvous Tools Checkout**
 - During Rendezvous Tools Checkout on FD2, the crew got an error message when starting up the Trajectory Control Sensor (TCS) application. The error was due to the TCS application not recognizing the RS-422 card on the COM2 port. The crew swapped out the Quatech RS-422 PCMCIA card and the RS-422 TCS Y data cable successfully. The ground also uplinked a corrected shortcut for the TCS application pointing to the correct .ini file. The card settings were verified as good when the procedure was run and the TCS operated nominally with the spare TCS cable. RPOP/TCS subsequently supported rendezvous and docking without any reported issues.
 - **IFA**- TCS application unable to communicate with A31P laptop system
 - **Post-flight plan** – PRACA reporting: FIAR B-PCS-219-F004 in system, Quatech card and cable checkouts upon return to Flight Crew Equipment (FCE)
- **STS-120-S-004, (INT-06) PGSC Network Communication Issues :**
 - The onboard network experienced intermittent network down time until FD5. Both crew and MCC could not access the standard network PGSCs during these times. Generically, when the network is down, no uplink/downlink capability exists, nor does onboard file and data transfer capability. Delays in data file uplink and downlink were experienced during the intermittent down time.
 - On 10/27/07 the crew had time to replace all the coax cables, T-connectors, and the two terminators. Since the replacement hardware was put into place no network issues were encountered by the crew. Coax cable was augmented by ISS transfer to accomplish complete replacement.
 - **IFA** – Isolation of failed cables/network components TBD; Will test cables upon return to FCE to verify failure
 - **Post-flight plan** – Developing plan for pre-flight tests of cables and network setup procedures more conducive to failure isolation
- **STS-120-S-005, (MER-03, MOD 2846) Wireless Instrumentation System (WIS) GFE Prime Laptop Lock Timeouts**
 - Several local laptop timeouts primarily during crew sleep. During crew day the commands executed nominally. There was no change in the laptop configuration. The Backup laptop STS5 RPOP2 laptop was switched to the Primary mode and nominal operation restored.
 - **IFA** – Root cause TBD, software or hardware failure not yet identified
 - **Post-flight plan** – System troubleshooting to isolate failure



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- **STS-120-S-006, (MOD-2826) STS6 PGSC Loss of Monitor**
 - Crew reported that the STS-6 (WLES) machine had a dark screen on the monitor even though the machine appeared to be up and running. Machine was on the network so problem appears to be with the monitor. Crew rebooted with no joy. Also verified that the knob/button that engages the screen saver when the monitor pane is closed appeared to be still mechanically functional. Preliminary conclusion is that the LCD backlight on the monitor may have permanently failed. WLES is now running on the backup STS5 unit. A new dedicated laptop will be brought online to run the WLES application.
 - **IFA** – Will test monitor upon return to Flight Crew Equipment (FCE) to verify failure
 - **Post flight plan** – PRACA reporting: FIAR B-PCS-219-F003 in system
- **STS-120-S-007, (INT-04) Suspect Power Cable to WINDECOM PGSC**
 - WINDECOM PGSC displayed error message during WINDECOM application initialization. Indicator light on the docking station was not illuminated. Crew replaced the power cable from the A31p PGSC power supply to docking station with a spare cable and the WINDECOM application started nominally.
 - **IFA** – Will test cable upon return to Flight Crew Equipment (FCE) to verify failure
 - **Post flight plan** – If failure verified, FIAR will be written



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Review and Recommendation

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- **Recommendation**
 - **Approve FSO IFA screening and assessment**
 - **Approve post flight plan for FSO IFAs STS-120-S-001, STS-120-S-002, STS-120-S-003, STS-120-S-004, STS-120-S-005, STS-120-S-006, STS-120-S-007**



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Backup

FSW DR MANAGEMENT

DR NUMBER: 110646

ORIG. DATE: 7/5/02

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REV: C DATE: 07/20/06

DR TITLE: MAGRS-3S HARDWARE CHANNEL CANNOT ACQUIRE Y-CODE (NON EOW)

FOUND BY: COLLINS ASSIGNED TO: MAGRS-3S SEVERITY CODE: 1 LOG DATE: 07/05/02

DESCRIPTION OF PROBLEM: DURING GROUND TESTING WITH A ROOFTOP ANTENNA AT CEDAR RAPIDS, A MAGRS-3S HARDWARE CHANNEL BECAME UNABLE TO ACQUIRE Y-CODE SIGNALS. THE PROBLEM HAS SUBSEQUENTLY BEEN OBSERVED DURING GROUND TESTING AT JSC AND DURING THE STS-112 MISSION.

HOW USER SEES EFFECTS: THE AFFECTED HARDWARE CHANNEL WILL NOT ACQUIRE Y-CODE SIGNALS. THE USER WILL TYPICALLY SEE FAILED Y-CODE ACQUISITIONS, FAILED C/A TO Y-CODE HANDOVERS, AND (MOST NOTABLY) EITHER FAILED IONOSPHERIC DELAY MEASUREMENTS (PERIPHERAL CHANNEL TRACKING SAME SATELLITE AS NAVIGATION CHANNEL, BUT ON DIFFERENT CODE/FREQUENCY COMBINATION) OR FAILED CHANNEL CALIBRATIONS (PERIPHERAL CHANNEL TRACKING SAME CODE/FREQUENCY COMBINATIONS AS NAVIGATION CHANNEL). PERFORMANCE DEGRADATION MAY ALSO OCCUR. DEGRADED PERFORMANCE WILL MANIFEST ITSELF IN ELEVATED FIGURE OF MERIT (FOM) AND GDOP VALUES RESULTING FROM TRACKING C/A CODE IN A NAVIGATION CHANNEL, AN INABILITY TO PERFORM IONO MEASUREMENTS, AND/OR FAILED SATELLITE SWITCH REQUESTS CAN RESULT. FAILURE TO COMPLETE A SATELLITE SWITCH CAN RESULT IN FOM VALUES THAT VIOLATE QA1 THRESHOLDS, POTENTIALLY PRODUCING A CONDITION THAT CAN VIOLATE THE GPS SERVICE LOSS REQUIREMENT.

REQUIREMENT (REQ VIOLATED/INADEQUACY): CP-MAGRS3S-001 REVISION E MAGRS-3S SOFTWARE DESIGN REQUIREMENTS PARAGRAPHS 3.3 & 3.3A

DISPOSITIONS:

LINK 613-9966-005	4B	OPS NOTE/WAIVER
*LINK 613-9966-006	4B	OPS NOTE/WAIVER
*LINK 613-9966-007	4B	OPS NOTE/WAIVER
*LINK 613-9966-008	1A	UNDER INVESTIGATION

RATIONALE FOR DISPOSITIONS: THE SEVERITY "1" ASSIGNMENT APPLIES TO THREE STRING GPS FLIGHTS. THE SEVERITY FOR SINGLE STRING FLIGHTS IS "3". ALTHOUGH THE SPECIFIC CAUSE OF THE CONDITION HAS NOT BEEN IDENTIFIED, ENOUGH EXPERIENCE WITH THE CONDITION HAS BEEN OBTAINED TO IDENTIFY AND CORRECT THE CONDITION (RESTARTING NAVIGATION MODE), SHOULD IT OCCUR IN FLIGHT. HOWEVER, IF THE PROBLEM WERE TO AFFECT ALL REMAINING RECEIVERS LATE IN ENTRY, THE WORKAROUND IS NOT GUARANTEED TO RECOVER THE AFFECTED RECEIVER(S) WITHIN THE 2.3 MINUTE SERVICE LOSS ENVELOPE. DUE TO THE LOW LIKELIHOOD OF THE "WORST CASE" MANIFESTATION OF *THE PROBLEM, A WAIVER IS REQUESTED. THIS DISPOSITION DOES NOT REPRESENT AN *INCREASE IN RISK.

*CONTACT: H. BUI - BOEING (281) 226-5870

SRE: D. RUTISHAUSER

PERSONS CONSULTED:

R. KIRPES	COLLINS	S. JAYNE	BOEING	S. MURRAY	NASA
G. HUDAK	COLLINS	G. POGUE	NASA/MOD	R. NUSS	NASA

USA CONCURRENCE _____ DATE _____

ASD CONCURRENCE _____ DATE _____

APPROVED BY:

SASCB CHAIRMAN _____ DATE _____

Rose Olsen 7/21/06

Denise E. Stamps 7/27/2006

AUTHOR: Hiep Bui	MAGR-S/3S PROGRAM NOTE	DR: 110646
ORG/PHONE: Boeing/281-226-5870		OPS NOTE (X) USER NOTE () RELEASE NOTE ()
OI/FLIGHT EFFECTIVITY: NO GPC FSW DEPENDENCY		USER AFFECTED: CREW (X) GROUND (X) KSC (X)
GPS FIRMWARE LINK EFFECTIVITY: 613-9966-005 & Subs		OPS MODES AFFECTED: G1, G2, G3, G6, G8, G9
TITLE: MAGR/S-3S Hardware Channel Cannot Acquire Y-Code (Non-EOW)		
<p>DESCRIPTION: An affected GPS receiver hardware channel will not be able to acquire Y-code signals. The user may see failed Y-code acquisitions, failed C/A to Y-code handovers, and (most notably) failed ionospheric delay and channel calibration measurements. (Ionospheric delay measurements are characterized by the peripheral channel tracking the same satellite as a navigation channel but in a different frequency. Channel calibration measurements are characterized by the peripheral channel tracking the same satellite as a navigation channel in the same code and frequency.) Performance degradation may also occur.</p> <p>The primary evidence of degraded performance will be elevated Figure of Merit (FOM) and Geometric Dilution of Precision (GDOP) values. Degradation will be the result of C/A-code tracking on a navigation channel, inability to perform ionospheric delay and channel calibration measurements, and inability to switch requested satellites into the navigation constellation. The onset of this condition has not been tied to any specific stimulus.</p>		
<p>USER RESPONSE: Monitor for the occurrence of the described condition. If detected, the response will depend on a number of factors. If in a non-critical flight phase, recover the receiver to nominal operations by keyboard command of the receiver to initialization (INIT) mode and then back to navigation (NAV) mode. If in a GPS-critical flight phase, monitor the receiver for degraded performance as described above. If there is no detected performance degradation, do nothing. If receiver performance is degraded to the point of an out-of-service condition, recover the receiver to nominal operations by keyboard command of the receiver to INIT and then back to NAV. Be aware the receiver recovery time may exceed out-of-service constraints (ref. DR 110649). Do not command INIT-NAV mode transitions during GPS signal blackout during entry.</p>		
<p>CONCURRENCE: .</p> <p>USA-FSW: <u>B Swindells</u> DATE <u>4/25/03</u></p> <p>GPS PRT: <u>Ray M. New</u> DATE <u>4/25/03</u></p> <p>ASD: <u>Scott M. ...</u> DATE <u>4-25-03</u></p> <p>BOEING: <u>[Signature]</u> DATE <u>4/24/03</u></p> <p>SSM</p>		<p>APPROVAL:</p> <p>SASCBC CHAIRMAN: DATE</p> <p><u>Daniel E. Jantz</u> <u>5/01/2003</u></p>