

STS-5

GNC

Quick Look Report

22 Nov 82

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7.1:0

## Anomalies:

### Radar Altimeter 1 Failure

Although the unit passed self test during OPS 8, RA 1 (SN 18) showed continuous lock and an altitude of  $\approx 8$  ft for all of OPS 3. RA 1 (SN 5) was changed out the day before flight when the unit failed self test. Failure analysis is in progress.

### GNC Event Light Problem

1. On day 2 of the flight GDSD (FS 5) asked GNC to give up 4 event lights which are driven by a total of 27 GNC parameters because they discovered that when any of these lights came on, a large number of other non-GNC DDD's would be inoperative. The four event lights were Left RHC Ground Fail, Left RHC RM Fail, FCS Channel 2 Override Switch and FCS Channel 2 override. The main impact on GNC was loss of the audible critical alarm and red light indication for the Left RHC RM Fail parameters. To detect the RHC failure would require seeing the RHC fault summary message and then calling up a history tab to verify the cause and extent of the failure.

### STS-6 Impact

This problem has been fixed for STS-6 and DR 85071 has been closed out.

2. The Left and Right DDU Power Supply fail DDD lights were noted to have a problem after the above four DDD lights were disabled. This problem may or may not be connected with the above problem. In OPS 2, 8 and 3 the DDU Power Supply Fail Lights would remain on when they should be off. The lights are used to detect THC/RHC/RPTA problems. 3 of 3 power supplies are required to engage the BFS from that RHC. Loss of two power supplies on one DDU would result in loss of the L(R) THC/RHC/RPTA. DR 87710 was written to cover the Left and Right DDU Power Supply Fail DDD light problem.

### STS-6 Impact if not fixed

GNC must use DTE Display to check status of Left and Right DDU Power supplies A, B and C.

### STS-5 TACAN Performance

Vehicle attitude at Blackout Exit was not favorable for early lock on for any of the three TACAN's. As attitudes became more favorable, TACAN #2 locked on in both Bearing and Range, as expected, followed very shortly by TACAN #3. TACAN #1 locked on last, significantly lower than on previous missions, but in agreement with vehicle attitude/antenna conditions. Following lock on all units performed well with fewer Bearing jumps than on previous missions.

## COAS Calibration

COAS CALs on STS-5 strongly indicate that calibrations should be planned to use the brightest star that is reasonably available. Star 54 (visual magnitude 2.7, very dim) was "washed out" by the COAS reticle. No reticle adjustment could be found that was bright enough to see the reticle and dim enough to see the star as it approached the crosshairs. The crew experienced the same problem with the aft station cal using star 33 (visual magnitude 1.6, brighter than 2.7 but still dim). Previous flights have used star in the brightness region of star 33 with no reported problems. It was reported by the STS-5 crew that the forward windows and the -Z window were covered with a film which apparently reduced star brightness significantly. This appears to be the real problem with both of the initial cals, (+X and -Z). Since it cannot be predicted when the windows may get dirty prelaunch or during ascent a reasonable way to minimize the probability of a cal problem due to star brightness or dirty windows is to select the brightest star available for cals. Star brightness should also be a major factor in selecting stars for a COAS alignment. Stars brighter than visual magnitude 0.6 (star 20) should be used if availability and star separation permit.

The first +X cal used excessive RCS propellant in part due to many attempts to center the star and in part to DAP misconfiguration. To make a satisfactory mark, the crew tried to use discrete rate to obtain better control. Because rotation compensation was enabled for the normal COAS CAL DAP configuration of manual pulse, selecting discrete rate put the DAP in conflicting control modes.

This is the first flight that the crew had difficulty getting a COAS verification delta bias less than 0.12. Preliminary analysis of the vectors stored at the marks indicate that the actual delta bias was less than 0.12. The discrepancy between actual and crew display delta bias is caused by the slightly less than unity vector stored as the cal vector. The slight non-unity is caused by a non-orthogonal matrix through which the vector must be multiplied. This non-unity vector poses no problem except in the determination of the angle between two vectors when that angle is very small. Our previous experience with the first four flights has been very favorable using the 0.12 limit. We do plan to reevaluate the .12 delta bias limit. A software CR to correct the non-orthogonal matrix has been proposed and was disapproved by the software review board.

## STS-6 Impact

Remain with .12 COAS delta bias. Update the number if required after reevaluation.

Recommendations

1. Select brightest star available for COAS Cals.
2. Select stars with visual magnitude 0.6 (stars 11 through 20) for COAS alignments if available and star separation permit.
3. Reevaluate the .12 COAS delta bias.

FTO

See attached sheets for FTO Summary

STEP

See attached sheet

GNC(1) STS-5

SYSTEMS

DTO'S - QUICK LOOK

DTO NO	TITLE	DAY FLOWN	COMPLETED (YES/NO)	DATA OK?	REFLT REQ'D?	BRIEF STATEMENT OF RESULTS (Add Pages if req'd) - OR EXPECTED DATE all data collected OK - analysis in work
001	ASC PERF DATA	-	YES	YES		all data collected OK - waiting for blackout date - analysis in work
002	ENTRY PERF DATA	-	YES	YES		
201	PTI'S	6				
213	POPUS	6				
217	ASC AERO	-	NO	YES		
301	ASC STRUC CAP	-	NO			
308	VIB & ACOUSTIC	EXCON				
309	ASC FLUTTER	0				

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BRIEF STATEMENT OF RESULTS

REFLT REQ'D?

DATA OK?

COMPLETED Y/N

DAY FLOWN

TITLE

DTO NO

REAL TIME ANALYSIS SHOWED THE MODE TO OPERATE AS ADVERTISED. ALL 3 AXES BEHAVED AS EXPECTED DURING THE TEST.

LEFT PROBE WAS DEPLOYED AT M15. NO DEGRADATION TO AIR DATA WAS OBSERVED INDICATING THAT NO STRUCTURAL DAMAGE WAS DONE BY THE DEPLOY AT HIGHER THAN NOMINAL (M3.5) MACH NUMBER. BOTH PROBES WILL BE DEPLOYED AT M5 ON STS-6 PERMITTING THE GROUND TO DO AN EARLIER EVALUATION OF ADTA PERFORMANCE BASED ON PRESSURES. DATA COLLECTED ON STS-6 CAN BE USED TO CALIBRATE AIR DATA PARAMETER CALCULATION ABOVE M3.5.

CREW HAD PROBLEMS WITH ALL COAS CALS AND THIS WAS NO EXCEPTION. A REPEAT OF THE CAL WAS NECESSARY AND WAS ACCOMPLISHED SUCCESSFULLY. THE CREW COMPLAINED THAT THE STAR ON THE 1ST TRY WAS TOO DIM.

THIS WAS A SHOPPING LIST DTO ON THIS FLT. MATCHING SITE AVAILABILITY W/ OPS MODE (OPS 8) COULD NOT BE ACCOMPLISHED. DEVELOPMENT OF THE TACAN NAV SOFTWARE IS PRECEDING WITH DATA COLLECTED ON EARLIER FLTS. MORE DATA IS DESIRABLE PARTICULARLY FROM

NO

YES

YES

5

LVLH DAP

757

YES

YES

YES

6

AIR DATA @ M5

750

YES

YES

YES

2+5

AFT COAS CAL

770

YES

NO

NO

4

ORB TACAN NAV

771

BRIEF STATEMENT OF RESULTS

DTO NO

TITLE

DAY  
FLOWN

COMPLETED  
Y/N

DATA  
OK?

RE FLT  
REQD?

772

VISUAL STAR  
DATA

-

NO

N/A

YES

NO TIME WAS AVAILABLE FOR THIS SHOPPING LIST DTD, HENCE IT WAS NOT ACCOMPLISHED.

774

STRK THOLD

243

YES

YES

NO

STAR TRACKER THRESHOLD APPEARS TO WORK CORRECTLY. WE OBSERVED THE TRACKER TO REJECT STAR 54 ON THRESHOLD SETTINGS 3, 2, & 1. STAR 54 WAS TRACKED ON THRESHOLD SETTING 0 (ZERO). FURTHER ANALYSIS IS IN WORK.

SYSTEM	Spec Ref	Proc. Loc.	Approx Times	P/T Sites	Notes
FLIGHT CONTROL SYSTEM RECONFIGURATION, SECOPAK PCY FORMATION, FCS MODE/ON SWITCHES PWC, THC & SWITCHES MODE LARPS  SENSORS MLS, TAC, RA, AA, RGA, AOTA, DEN DISP, FLAGS	CRT ↓	ORB OPS CK ↓	2:22:45:00 - 2:23:25:00 (MET)	CONKS, DXR, A-11	FCS C/O 10:17Z 1 1/2

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FLIGHT TEST PROBLEM REPORT

NO. STS-5-21

Statement of problem: Radar Altimeter No. 1 False Lock-On.

Discussion: The no. 1 radar altimeter experienced a false lock-on during STS-5. Data indicated that during ascent, on-orbit OPS-8, and entry phases of the mission radar altimeter 1 indicated a lock-on at approximately 8 feet. This altitude value remained until the vehicle reached 43 feet during landing at which time no. 1 began to track properly. No. 2 altimeter performance was nominal throughout the mission.

Three days prior to STS-5 launch, no. 1 radar altimeter had been replaced due to a self-test problem. The normal zero-altitude calibration was made on the new unit and apparently the technician accidentally turned an unused analog adjustment in addition to the proper digital output adjustment. This increased the low-altitude gain of the receiver to the extent that the false lock-on occurred from the leakage between antennas.

Postflight tests on the vehicle have verified that the analog output was badly misadjusted. Further testing duplicated the flight problem at which time the adjustment was properly made. Normal operation was restored.

Conclusions: The analog output adjustment on radar altimeter no. 1, was improperly set after installation just prior to launch. This increased the low-altitude gain of the receiver causing a false lock-on during flight.

Corrective action: A new procedure is being issued to verify proper analog adjustment after each unit is installed. The altimeter adjustments on OV-099 will be properly verified prior to flight.

WTR. APPROVED  
12-13-82

*[Signature]*  
A. Aldrich

12-15-82  
Date

Effect on subsequent missions: None.

Personnel assigned: D. Rhoades/EE6; R. J. Ward/WA3

*[Signature]* EE6 12/10/82

Resolution: CLOSED 12/15/82

## APPENDIX A

## DETAILED TEST OBJECTIVES (DTO's) ON STS-5

\* Means test directly involved the crew

NOTE: All DTO's were completed except 0611 (EMU/EVA Evaluation). DTO 0771 was completed but was not successful.

<u>DTO</u>	<u>TITLE</u>
0001	Ascent Performance Data Collection
0003*	Entry/Approach and Landing Verification
0102*	Nonsymmetrical/Cold OMS Pod TCS Test
0109*	ARCS Three-Engine Soakback Test
0110*	ARCS Single-Engine Duty Cycle Soakback Test
0111*	VRCS Single Engine Soakback Test
0201*	Entry Aerodynamic Test No. 1
0213*	Entry Aerothermal Test No. 1
0217	Ascent Aerodynamic Verification
0218	Ascent Plume Heating
0219	ET and SRB Ascent Heating
0301	Ascent Structural Capability Evaluation
0303	TPS Entry Heating Evaluation
0305	Ascent Compartment Venting Evaluation
0306	Descent Compartment Venting Evaluation
0307	Entry Structural Capability
0308	Vibration and Acoustic Evaluation
0309	Ascent Flutter Boundary Evaluation
0312*	ET TPS Performance

<u>DTO</u>	<u>TITLE</u>
0313	SRB Recovery
0314*	Flight Debris Investigation
0317*	Airframe Unsymmetrical Distortion
0401*	PRSD Stratification Test
0404*	Cold OMS Engine Restart
0406*	Hydraulics/ATCS Thermal Interaction
0506*	PLBD Centerline Latch Performance
0508*	Orbiter Braking Test
0611*	EMU/EVA Evaluation
0613*	Stowed Radiator Performance
0615*	WCS Modifications Evaluation
0616*	Cabin Atmosphere Sampling
0705	SLSS Communications Performance
0706*	S-Band/UHF Antenna Test
0713	Orbiter/Detached Payload Communications
0750*	Air Data Subsystem Performance
0757*	DAP Performance in LVLH Mode
0770*	AFT Station COAS Calibration
0771*	On-Orbit TACAN Navigation
0774*	Star Tracker Threshold Level Verification
0904	OEX Tile Gap Heating Experiment
0905	Catalytic Surface Effects
0906	DATE
0907	Aerodynamic Coefficient Identification Package (ACIP)

TOTAL  
43 25

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## APPENDIX B

## DETAILED SUPPLEMENTARY OBJECTIVES (DSO's)

\* Means test directly involved the crew

NOTE: All DSO's were completed except 0405 which was not performed due to technical difficulties and 0406 which was only partially completed.

<u>DSO</u>	<u>TITLE</u>
0301*	Evaluation of Oxygen Interaction of Material
0401	Validation of Predictive Tests and Countermeasures for Space Motion Sickness
0402	Cardiovascular Deconditioning Countermeasures Assessment
0403*	Head and Eye Motion During Ascent and Entry
0404*	On-orbit Head and Eye Tracking Task
0405*	Acceleration Detection Sensitivity
0406*	Kinesthetic Repeatability
0407*	Body Fluid Shift Study
0408*	Near Vision Acuity
0901*	Documentary Television
0902*	Documentary Motion Picture Photography
0903*	Documentary Still Photography
0904*	Investigation of STS Atmospheric Luminosity
TOTAL	
13 11	