

ALFORD

STS 8
QUICK LOOK REPORT
6 SEPTEMBER 1983

GNC

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COAS CAL DIFFICULTY

During the first COAS CAL the crew reported difficulty marking the star because of ice or other debris floating through the field of view. The on-board display of delta biases for this CAL were .07 and .14. The actual delta biases were .01 and .1. At the crew's request we rescheduled a second CAL. During the second CAL, after the evening alignment, the crew reported an apparent degradation in control authority and a general sluggish vehicle response when trying to center the star from the -Z station. A review of the final COAS CAL data revealed that the AFT SENSE SWITCH was in the -Z SENSE position instead of the -X. We feel this axis ambiguity contributed to the perception of degraded vehicle response.

RECOMMENDATION -

Add a check of the AFT SENSE SWITCH to the COAS CAL procedure when using the aft station.

REFSMATS

MPAD analysis of the continuing problem of COAS CAL delta bias error in on-board display, has shown that there is a small non-orthogonality in the REFSMATS generated by gyro compass align. MPAD believes this is the major contributor to the COAS CAL error. This may also be a significant factor in the variation of gyro delta's and star align torquing angles with attitude. The STS-8 REFSMATS exhibited this error.

RECOMMENDATION -

REFSMATS be made orthogonal and uplinked to eliminate this error.

AFT DAP CONTROL PBS FALSE FAIL INDICATION

During two TDRS low bit rate passes beginning at GMT 243:07:09:21 and 243:08:08:30 contacts B on the AFT DAP AUTO and MAN pbs showed failed in the high state. A snapshot of the data showed that the two bits, which were in the same parent word (FF4,CD 09,CH 00), were set high coming high into building 30. Further: during GSTDN high data rate passes the contacts did not show failed and there was no indication of RM downmoding the switches. The problem recurred on FD5 during a TDRS low data rate pass, and demonstrated the same symptoms. See also MER/SPAN Mission Action Request attached.

RECOMMENDATION -

No action.

IMU DRIFT RATE CHANGE DURING -XSI ATTITUDE

IMU drift compensations for FD 1 were computed for a time when the vehicle was tracking -ZLV. On FD 3 we maneuvered to -XSI for a CANOPY COLD SOAK test (14 hours). During that time the IMU's exhibited drift rates in excess of 2.5 sigma. Because of the radical change in drift characteristics with attitude change and because we intended to return to a -ZLV attitude, we decided not to compensate the IMU's while in -XSI. Within minutes of returning to -ZLV the drift rates returned to the previous near zero values. This was a graphic illustration of the IMU's sensitivity to vehicle attitude changes.

RECOMMENDATION -

Refrain from making unnecessary IMU updates in response to attitude induced drift rate changes, unless that attitude is to be maintained for an extended period.

ROLLING IMU ALIGNMENT

On FD 4 the first alignment was conducted at 2/19:38 using the LVLH roll technique. The maneuver was initiated manually with a roll rate of .13 deg/sec, slightly less than the .2 deg/sec assigned to the DAP in PULSE mode. As the roll progressed; however, the rate did increase somewhat to an average value of about .15 deg/sec. This had no affect on star acquisition. Since the rate was less, the vehicle was still approximately 130 deg out of attitude when the 25-30 minute procedure time had elapsed. The crew wondered whether to return to DAP AUTO or just continue the LVLH roll to attitude; they were advised to go to AUTO. The roll rate then increased to .2 deg/sec and the maneuver was completed. To protect against future errors in the roll rate (high or low) the procedure time should allow for approximately 270 degrees of rotation before returning to AUTO. AUTO can be selected at any time after 180 degrees and before 360 degrees of rotation. This will also make precise adherence to the time unnecessary. This alignment and the several others performed during the remainder of the mission produced excellent results with star pair angular separations between 80 degrees and 100 degrees. The reason for the DAP not achieving the full .2 deg/sec pulse rate loaded was due to the fact that the rate deadband was too constraining in Pitch & Yaw. The DAP would not turn on jets on the right side of the vehicle to control Pitch and Yaw since these jets would directly violate the +Roll command still present in the jet select logic. The only alternative was for the DAP to turn off the +Roll jets it had on. This resulted in a degraded +Roll rate. If the rate deadband was wider, more time would elapse before a Pitch or Yaw response would be required giving Roll more time to achieve its rate.

RECOMMENDATION -

Open the rate deadband to .2 deg/sec to prevent the DAP from turning off the Roll jets needed to attain the .2 deg/sec rate and change the procedure time to approximately 22 minutes with the option to use roll (from the start roll attitude) of greater than 180 degrees and less than 360 degrees.

STAR TRACKER ACQUISITION TEST

This was an add-on test, the purpose of which was to permit subjective evaluation of the STAR TRACKER's sensitivity in acquiring targets in full field search over the sunlit horizon. Such information would be useful in planning rendezvous operation, etc.; where in a similar situation, sunlit debris might interfere with TRACKER acquisition. The test was conducted in accordance with the procedure attached. The orbiter was in a +XLV attitude payload bay forward.

Six acquisitions were made beginning at solar noon (3/21:35 orbit 63), and ending at sunset. The crew reported that they were surprised that the STAR TRACKERS did not immediately break lock when the item 8 was executed. The explanation for this was determined from the mechanics of the break-lock procedure. When the software issued the BREAK-LOCK the scanner skips four lines and continues. If the image is very bright and blooms over the four lines the tracker will immediately reacquire the object, giving the impression that lock was never broken. Track will then continue until the object passes from the field of view. The test was successful and meaningful data was obtained. The question did arise whether more meaningful results might be gained if the procedure used repeated item 8's rather than just one per lock.

A second test was conducted on FD 5 which included the repetitive item 8's to break-lock and also COAS observations to view the object. Four objects were tracked and the break-locks had no apparent affect. The COAS was of no help since the background was too bright.

RECOMMENDATION -

It may be necessary to modify the rendezvous target full field acquisition software to make use of offset mode to move the star tracker scan lines further from a bright object.

STAR TRACKER HORIZON LIMIT TEST

This was also an add-on test designed to demonstrate STAR TRACKER acquisition performance while tracking a star into the sunlit earth horizon. The test was initiated in an inertial attitude which was very close to a +XLV attitude bottom forward. Star 52 (magnitude +2.7) was repeatedly tracked and placed in the star table until the tracker would no longer acquire the star. During the test the elevation angle to the star diminished from 20 deg to 8 deg between the start time 3/23:08 and stop time 3/23:11. After 3/23:10 the crew could not get the star to go into the table. This indicated that the TRACKER would not track the star below approximately 12 degrees.

RECOMMENDATION -

None.

AUTOMATIC UPMODE TO PRCS ON FD 5

Following FCS checkout, during vehicle reconfiguration, the crew turned all three MLS's off simultaneously. This resulted in a commfault on all three strings including IMU's 1, 2, and 3. The commfault set the Attitude Data Good flag bad which downmoded the DAP to free drift. Immediately upon clearing the commfault (next comp cycle), the DAP upmoded to PRCS discrete rate.

RECOMMENDATION -

None. CR#59245 will fix the problem when it is applied.

HUD

During FCS Checkout Part 2 on FD 5 the crew reported seeing 20 knots indicated in the digital airspeed window on both HUD's. For this to occur the 100 foot altitude flag must have been set. The Low test is designed to be set for 200 feet. This is a fault in the HUD checkout initialization and not with the HUD itself. The same discrepancy was observed on STS-6 FCS C/O.

RECOMMENDATION -

Change the FDF to show the proper response.

AMI/AVVI CHECKOUT DISCREPANCIES

During FCS Checkout Part 2 the crew reported slight offsets in both AMI's and AVVI's. Both AMI's were reported to indicate 20.04 KFPS instead of 20.0 KFPS. The specification accuracy for this tape is +/- .034 KFPS. Also, the CDR's Altitude tape indicated 304 KFT instead of 300 KFT during the High test. The PLT's Altitude tape read 308 KFT. Specification accuracy for these tapes is 3.1 KFT. No failure threshold is specified for biases or offsets in these dedicated displays.

RECOMMENDATION -

Fix the dedicated displays to read within specification and establish a failure threshold for Entry planning.

IMU 2 MODING TO STANDBY

IMU 2 went to standby on FD 6 at 248:0054:26. The crew did not have the IMU Align display (Spec 21) called up, and there was no other readily apparent reason for the downmode. The IMU came back to operate on its own after a few seconds and although the crew performed the proper MAL procedures including an I/O RESET and an MDM power cycle, the IMU was already operating properly because IMU 2 had caged, an IMU to IMU alignment was performed. Since the downmode occurred just prior to a regularly scheduled star alignment, all three IMU's were then star aligned. After sufficient time had elapsed so that the nominal performance of IMU 2 could be assured it was reselected and used for the remainder of the flight. A review of the playback data revealed nothing exterior to the IMU that should have caused it to go to STBY. While the investigation is continuing, process of elimination suggests a transient internal to the IMU of the MDM which caused temporary loss of the operate discrete. A current status on this investigation has been hampered because data during the occurrence of this transient has not yet been available.

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seconds
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RECOMMENDATION -

Determine the source of the problem and fix or replace as necessary.

DTO/TITLE	SCHEDULED	COMPL.	REMARKS
#204 Aero PTIs	ENTRY	Y	Nominal
STAR TRACKER ACQUISITION TEST	3/21:35 4/22:50	Y	Performed a second time using COAS observations and repeated breaklocks
HORIZON LIMIT TEST	3/23:08	Y	Star 52 tracked to within 12 deg. of the horizon.
#771 TACAN TEST	1/04:00 4/20:30	Y	Test performed a second time due to noisy reception.

USE BLACK BALLPOINT PEN/ PRINT/TYPE		MER-SPAN MISSION ACTION REQUEST		USE BLACK BALLPOINT PEN/ PRINT/TYPE	
TIME (GMT) 245:10:00		REQUEST ORGANIZATION MER-Avionics	RESPONSE ORGANIZATION MOD-03		CONTROL NUMBER 029
ACTION REQ'D BY (TIME): 246:10:00			REQUESTER J.C. Boykin		
SUBJECT: ERRONEOUS Display DATA ON MSK 1520				APPROVAL	
<p>MSK 1520 has been observed several times in this mission to have apparently erroneous data for two parameters (V72K6491X and V72K6492X, the #2 contacts of the AFT DAP AUTO and MAN switches). Our review showed this condition to exist only while in low data rate (FMT 103), and further review indicates that neither of these parameters is even in the low data rate format. We are currently assuming that the observed data is a MOIE decom discrepancy and that there is neither a switch problem (which would also imply a flight software RM problem) or a vehicle downlist</p>				TEAM LDR. <i>J.C. Boykin</i> TIME: 245:09:46	
				CONTR REP	
				TIME: MER 10 <i>245:10:05</i> TIME: 245:10:05	
				SPAN MGR <i>CBS</i> TIME: 245:11:18	
RESPONSE:					
<ol style="list-style-type: none"> 1. AFT DAP CNTL SW MAN-2 IS V72K6496X NOT V72K6492X AS QUOTED. 2. THE TWO PARAMETERS V72K6491X AND V72K6496X ARE IN THE GN FMT 22 LOW DATA RATE. WE AGREE THEY ARE NOT IN OI LDR FMT 103 AND THEY SHOULDN'T BE. 3. ON LATER TDRS S-BND LDR PASSES THESE PARAMETERS INDICATED OFF AS THEY SHOULD. 4. WE HAVE NO EXPLANATION AS OF YET WHY ON THE EARLY TDRS S-BND LDR PASSES THESE TWO PARAMETERS INDICATED ON INSTEAD OF OFF AS THEY SHOULD BE. WE DID CONFIRM IT WAS COMING TO MCC FROM THE NETWORK WITH THESE TWO PARAMETERS READING 1 INSTEAD OF 0. <i>J. Johnson</i> 					
RESPONDER GNC - SPAN <i>J. Johnson</i> TIME 245:11:32		FOD REP TIME		SPAN MGR. <i>CBS</i> 245:11:45 TIME WLY	

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10.1.6

EVALUATION ACTION REQUEST
CONTINUATION SHEET

Pg. 2 of 2

TIME (GMT) 245:10:00	REQUEST ORGANIZATION MER-Avionics	RESPONSE ORGANIZATION MOD- SPAN SPAN	CONTROL NUMBER 029
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problem.

- ① Do you agree with our assumption?
WE AGREE IT IS A GROUND PROBLEM.
- ② Should the 2 parameters in question be displayed as "D" on MSK 1520?
No, BECAUSE THEY ARE IN FMT 22 LDR.
- ③ What data is actually being displayed on MSK 1520 for these 2 parameters?
1 INSTEAD OF 0 WHEN PROBLEM OCCURRED.
- ④ Can you provide a list of all erroneously displayed data for this mission (assuming these two are not the total)?
WE DON'T KNOW OF ANY OTHER PARAMETERS.

UNPLANNED COPY
TRADE
MET 3/29/42 3RB-55

35 RATIONALE: DEMONSTRATE THE ABILITY OF 3 TRY TO TRACK A STAR CLOSER
36 THAN 20 DEGREES TO SUNLIT EARTH HORIZON
37 TRACKING OPPORTUNITY FOR STAR 52 FROM 10 TO 8 DEG ELV
38 (3/23:08 TO 3/23:11)

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ADD:

1 AUTO MNVR

MNVR OPT: R + 26.4
P + 293.1
Y + 23.3

DAP A1/AUTO/VERN
MNVR EXEC 3/22:24

2 HORIZON TEST PREP

AT 3/23:06

C3 VDAP: A1/AUTO/VERN

IGNC 22 S TRK/CCRS CNTLI

TERM/IDLE - ITEM 9,10 EXEC (*)

CRT S TABLE CLR - ITEM 20 EXEC

NOTE: FOR ITEM 12, DO NOT ENTER ZERO FROM KEYBOARD
IF ITEM 12 IS NONZERO - COMMAND STAR TRK ITEM 4
THIS WILL ZERO ITEM 12 AND RETURN TO TERM IDLE

✓S TRK -2: RECD ID, ITEM 12 - 0
STATUS - (NO BITE)

MAN OP - ITEM 16 EXEC (*)

STAR TRK - ITEM 4 EXEC (*)

3 TRACK STAR

✓S TABLE: TRK ID 1 - 52

WAIT 15 SEC

S TABLE CLR - ITEM 20 EXEC

(REPEAT STEP 3 AS OFTEN AS REQD)

NOTE: IF STAR NOT ACQUIRED WITHIN 30 SEC, TERMINATE TEST AND RECORD
TIME: 3/23: : .

TERMINATE TEST AT 3/23:11

MAN OP - ITEM 16 EXEC (NO *)

STAR TRK ITEM 3 EXEC (*)

END OF MSG 0050, PAGE 1 OF 1

01 MSG NO. 0362 - (STOP TRKR ACQUISITION TEST UPDATE)
02 PAGE 1 OF 1, 29 LINES THIS PAGE

UPLOADED COPY
TRDE ORG 155
MET 3/09:42

03
04
05 1. AUTO ANVR TO -Z STAR TRKR TEST ATT
06

07
08 TGT ID +2
09 BODY VECT +5
10 P +353.7
11 Y +0.2
12 GN +2
13

14 DAP: R1/AUTO/VERN
15 3/21:35 INIT ANVR
16 GNC 22 STRK/COAS CNTL
17 CRT TERM IDLE - ITEM 10 EXEC (*)
18 MAN OP - ITEM 16 EXEC (*)
19

20 2. DATA COLLECTION
21

22
23 MONITOR S PRES (*)
24 WHEN * APPEARS - BREAK TRK ITEM 3 EXEC
25 REPEAT UNTIL SUNSET
26 STAR TRK ITEM 4 EXEC (*)
27

28
29 END OF MSG 0362, PG 1 OF 1

POSN ID	REV	APPROX GMT	TITLE / DESCRIPTION / IMPACT / RESOLUTION	IF ST	PLD IMP	OB IMP	VEH	KSC IMPCT
GNC-01*		248:00:51*	<p>IMU DOWNMODE FROM OPERATE TO STANDBY - LIEBMAN</p> <p>AT 248:00:51:01 IMU #2 WAS BYPASSED (LOS) DUE TO DOWNMODING FROM "OPERATE" TO "STANDBY" MODE. AT THE NEXT AOS, THE IMU APPEARED TO BE BACK IN "OPERATE" AND FUNCTIONING PROPERLY, WITH ITS GIMBALS AT THEIR CAGED POSITIONS AS EXPECTED.</p> <p>PLAYBACK DATA FOR THE LOS PERIOD CONTAINED DROPOUTS FOR ONE MINUTE PRIOR TO THE IMU BYPASS MESSAGE. OUR DATA SEARCH CONTINUES.</p> <p>WITHOUT ADDITIONAL DATA WE CANNOT YET DISTINGUISH BETWEEN A LOSS OF THE OPERATE COMMAND FROM THE MDM OR AN INTERNAL IMU POWER INTERRUPTION, EITHER OF WHICH WOULD HAVE RESULTED IN THE GPC BYPASS.*</p>	CL*			099*	Y*

*BOLD TYPE DENOTES CHANGE