

STS-117 MER 08

MDM OA-2 CARD 5 FAILURE

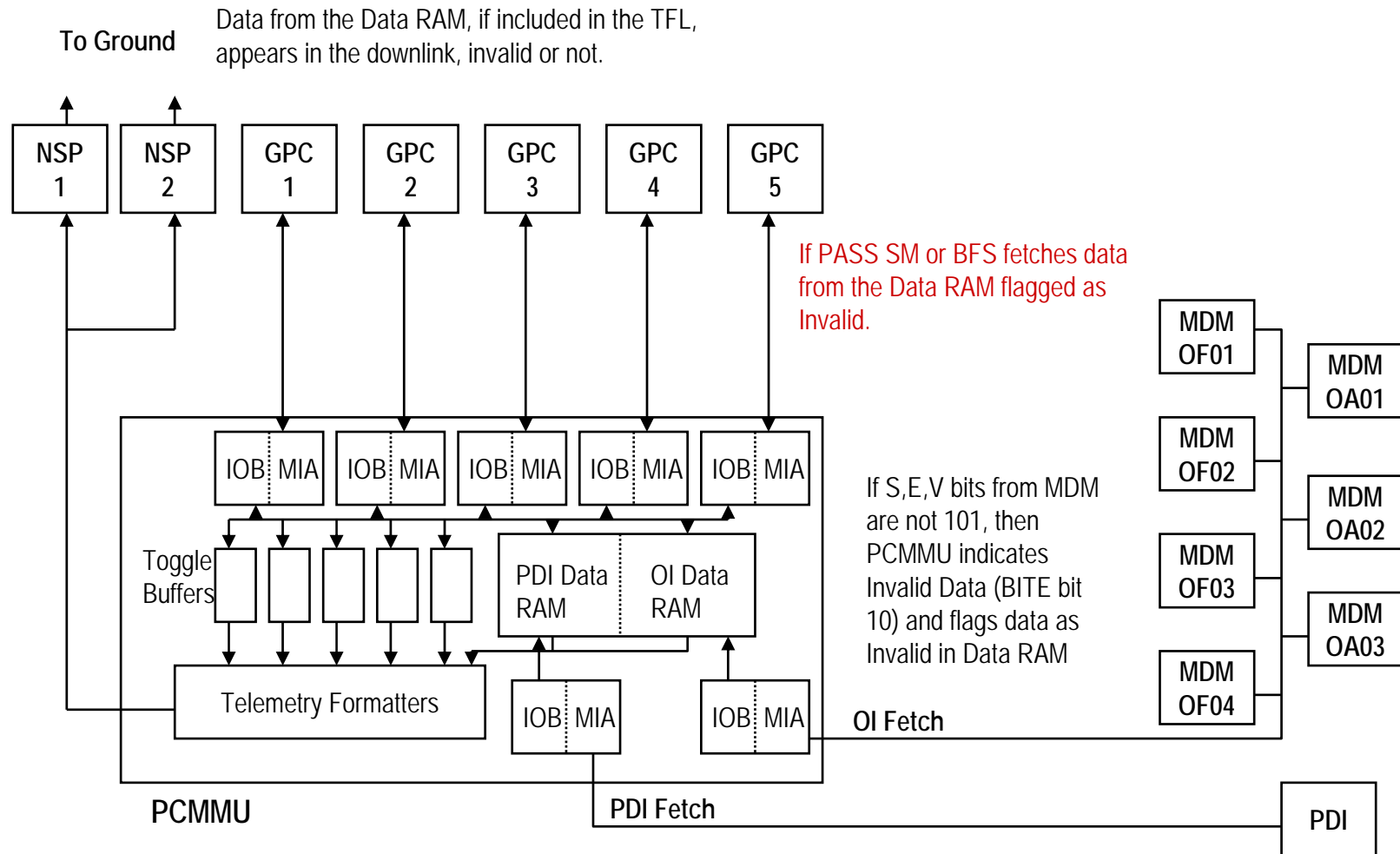
MER 08: TIMELINE

- **GMT ~163/07:54:41.517 CARD 05 IN MDM OA-2 FAILS**
 - ALL DATA AFTER THE EVENT IS INVALID
 - MDM SETS BITE WORD TO INDICATE A FAILURE
- **GMT 163/07:54:43.73 SM ALERT “S62 BCE BYP OA” ANNUNCIATED**
 - TRIGGERED BY MDM OA-2 BITE
- **GMT 163/07:55:06.77 SM ALERT “S86 APU GBX P 2” ANNUNCIATED**
 - NEW PRESS LIMIT SET SELECTED DUE TO FAILED CARD 05 PARAMETER

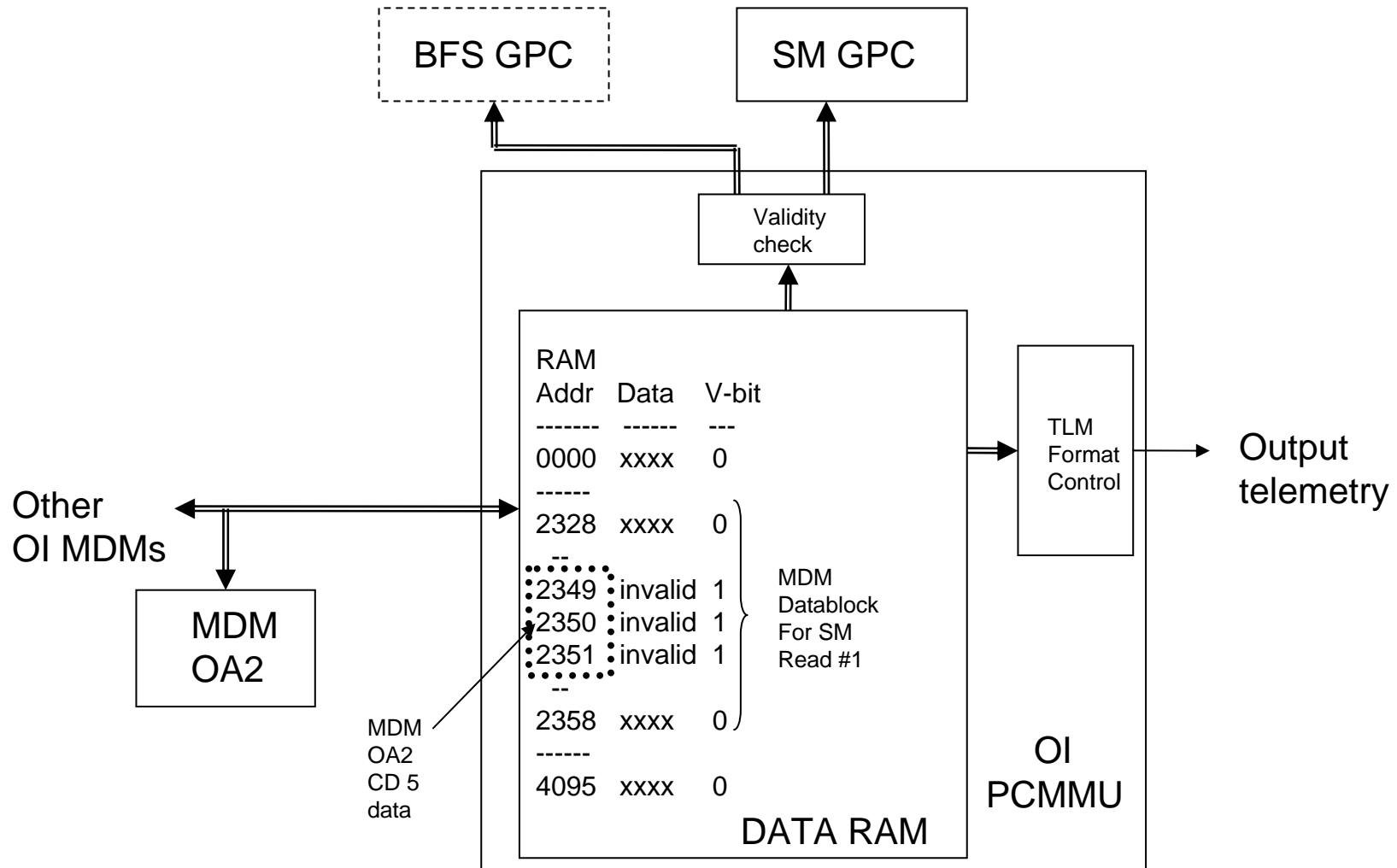
MER-08 MDM Failure History

- The MTBF for the DIH is 1,792,727 hours
 - or a failure rate of 5.58E-7
 - per the Reliability and Maintainability Report.
- 25 failures found searching the MDM p/n MC615-004-6410
 - One failure of the S/N 127
- Further failure history searches revealed:
 - 14 failures related to BIT 4
 - 34 failures related to BIT 9
 - 23 failures related to DIH

MER 08: MDM/PCM/GPC INTERFACES



MER 08: MDM OA-2 DATA FLOW



MER 08: INVESTIGATION STATUS

- MDM OA-2 CARD 05 FAILED
- MDM OA-2 CARD 06 GOOD
- SPEC 62 ALERT DIRECTLY CAUSED BY CARD 05
- SPEC 86 ALERT INDIRECTLY CAUSED BY CARD 05 TRIGGERING A COMMFAULT
- SYSTEM IMPACTS FOR PASS SM AND BFS IN WORK

MER 08: SPEC 86 MSG TIMELINE

- GMT ~163/07:41.517 CARD 05 IN MDM OA-2 FAILS (BITE FAILED)
- GMT 163/07:54:43.73 SM ALERT “S62 BCE BYP OA” ANNUNCIATED
 - OA-2 PARAMETERS ARE COMMFAULTED AND BYPASSED
- SM PRE-CONDITIONING: MSID V46R0235A (APU 2 TURBINE SPEED) DETERMINES WHICH OF THE TWO LIMIT SETS IS APPLIED TO V46P0253A (APU 2 GEARBOX LUBE OIL PRESS)
 - LIMIT SET 2 HAD ONLY AN UPPER LIMIT (150 PSI) AND IS THE NORMAL ON-ORBIT SELECTION
 - LIMIT SET 1 HAS A LOWER LIMIT OF 25 PSI AND AN UPPER LIMIT OF 150 AND IS THE ASCENT SET
- GMT ~163/07:54:44 AFTER TEN 1 Hz CYCLES THE COMMFAULT FOR MSID V46R0235A (APU 2 TURBINE SPEED DIRECTS THE PASS SM TO SELECT LIMIT SET 1 FOR V46P0253A
 - NEW LIMITS APPLICABLE TO V46P0253A (APU 2 GEARBOX LUBE OIL PRESS) AFTER 9.6 SECONDS
- AT GMT ~163/07:54:54 PASS SM COMPARES THE READING OF APU 2 GBX PRESS (~18 PSI) WITH THE NEWLY SELECTED LIMIT SET
 - THE READING BUSTS THE LOWER LIMIT WHICH INITIATES A NOISE FILTERING VIOLATION COUNTER
 - THE SM COMPARES THE APU 2 PRESS AT 1.92 SECOND INTERVALS AND INCREMENTS THE VIOLATION COUNTER
 - WHEN THE VIOLATION COUNTER REACHES 7 THE SM DECLARES THE VIOLATION (~14 SECONDS AFTER SELECTING THE NEW LIMIT SET)
- AT GMT 163/07:55:06.77 (23 SECONDS AFTER CARD FAILURE) PASS SM ANNUNCIATES “S86 APU GBX P 2”

MER 08: SM PROCESSING

- SM data parameters that are bypassed or commfaulted retain their previous value but will not be processed
- SM parameters may have multiple limit sets assigned (up to 3 limit sets for SM alerts and possibly a concurrent limit set for backup C&W)
 - Selection of the SM alert limit set is based on a preconditioned parameter equation
 - Uses corresponding limit set for analog parameters or bit state for discrete parameters in the equation
 - Can have multiple parameters in the equation
 - Each limit set has an equation
 - If any parameter in an equation is commfaulted, the first limit set is used (?verify?)
 - If none of the equations are true, then the first limit set is used
 - There is a delay when switching limit sets
- SM will utilize a noise filter for the annunciation message in order to suppress transient conditions
 - The noise filter and switching delay are reconfigurable by flight and vary by parameter
 - The two delays can be sequential

MER 08: PASS SM IMPACTS

BECAUSE OF THE MDM OA-2 CARD 5 FAILURE, THERE ARE 31 PARAMETERS FROM OA-2 THAT ARE COMMFAULTED

- DOWNLINK OF THESE PARAMETERS IS GOOD
- CREW DISPLAYS WILL NOT SHOW VALUES FOR THE PARAMETERS (OVERWRITTEN WITH "M")
- GPCs WILL NOT PROCESS OR INVOKE SM APPLICATIONS FOR THESE PARAMETERS

MER 08: PASS SM OA-2 BYPASSED PARAMETERS

| ADDR | CD | CH | MSID | NOMENCLATURE |
|-------|------|------|-----------|--|
| ----- | ---- | ---- | ----- | ----- |
| 2328 | 02 | 08 | V76V3092A | AFT PCA-5 VOLTAGE |
| 2329 | 02 | 09 | V58P0231A | HYD SYS 2 RSVR FLUID PRESS |
| 2330 | 02 | 13 | V46T0242A | APU 2 TURBINE EXHAUST TEMP #1 |
| 2331 | 02 | 14 | V46P0205A | APU 2 FUEL TANK OUTLET PRESS |
| 2332 | 02 | 17 | V76C2811A | PAYLOAD AFT MAIN B CURRENT |
| 2333 | 04 | 00 | V43T5641A | OMS-R ENG OX VLV TEMP |
| 2334 | 04 | 03 | V42T3204A | RCS-R AFT OX MANF TEMP-1 DSC OR1 |
| 2335 | 04 | 04 | V46T0202A | APU 2 FUEL TANK SURFACE TEMP |
| 2336 | 04 | 05 | V45T0699A | FCP H2 VENT LINE TEMP 1 |
| 2337 | 04 | 06 | V58T0269A | HYD SYS 2 BODY FLAP RTN LN TEMP |
| 2338 | 04 | 07 | V58T0883A | HYD SYS 2 LH OTBD ELVN RTN LN TEMP |
| 2339 | 04 | 09 | V46T0208A | APU 2 FUEL LINE TEMP #1 |
| 2340 | 04 | 10 | V58T0220A | HYDR SYS 2 FLUID HEATER OUT TEMP |
| 2341 | 04 | 11 | V63T1207A | FCL 1 EVAP OUT TEMP |
| 2342 | 04 | 12 | V46T0222A | APU 2 GAS GENERATOR BED TEMP |
| 2343 | 04 | 16 | V46T0386A | APU 3 FUEL PUMP DRAIN LINE TEMP 1 |
| 2344 | 04 | 19 | V63T1879A | FLASH EVAP TOPPING NOZ RH T-HTR G |
| 2345 | 04 | 24 | V58T0305A | HYD SYS 3 H2O BLR GN2 TANK TEMP 1 |
| 2346 | 04 | 25 | V58T0361A | HYDR SYS 3 H2O BLR TANK TEMP 1 |
| 2347 | 04 | 26 | V58T0362A | HYDR SYS 3 H2O BLR TEMP 1 |
| 2348 | 04 | 27 | V58T0365A | HYDR SYS 3 BLR VENT TEMP 1 |
| 2349 | 05 | 00 | V75M3740P | DIH CARD 05 CHAN 00 |
| 2350 | 05 | 01 | V75M3741P | DIH CARD 05 CHAN 01 |
| 2351 | 05 | 02 | V75M3742P | DIH CARD 05 CHAN 02 |
| 2352 | 06 | 10 | V46P0200A | APU 2 FUEL TANK PRESSURE |
| 2353 | 06 | 11 | V46R0235A | APU 2 TURBINE SPEED |
| 2354 | 06 | 14 | V46P0251A | APU 2 GEARBOX GN2 PRESSURE |
| 2355 | 06 | 15 | V76C3096A | AFT PCA MAIN BUS B AMPS |
| 2356 | 06 | 17 | V58Q0202A | HYD SYS 2 RSVR FLUID VOLUME |
| 2357 | 06 | 24 | V58P0304A | HYD SYS 3 H2O BLR GN2 REG OUTLET PRESS |
| 2358 | 06 | 25 | V58P0247A | HYDR SYS 2 H2O BLR GN2 TK PRESS |

MER 08: BFS IMPACTS

INSERT BFS

MER 08: BFS OA-2 BYPASSED PARAMETERS

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MER 08: CHIT 4942 RESPONSE

1. Verify that CSAS_ERT_DL in module APPL.SRC.CSAERT will provide the desired insight
 - **Yes**
 - **Some more insight can already be gleaned by looking at**
 - V92U0599C CSAV_ERT_PMU_LAST_BYPASS_ELENUM
 - V92U0597C CSAV_ERT_PMU_LAST_BYPASS_CYCLE
2. Verify correct addresses are 48B6 through 48D9 inclusive for the above words
 - **Addresses for variable downlist are correct.**
3. Provide interpretation for bits to be downlinked by VP
 - **Full data on all bypass bits for all SM transactions will be provided**
 - **Bits expected to be set ON**
 - **CSAS_ERT_DL_BYPASS\$(1,1,1) .5Hz Timer Read Cycle 1 #1**
PMU 2328 (31 words)
 - **CSAS_ERT_DL_BYPASS\$(3,1,14) 1 Hz Timer Read Cycle 2/8 #5**
PMU 2349 (3 word)
4. Verify that BFS will receive good data except for OA2 Card 5 MSIDs
 - **Incorrect. BFS bypasses (commfaults) all data on OA 2 MDM**
5. Verify that Card 5 is failed and concur with recommendation to publish failure
 - Card 5 is failed and MER concurs with failure publication

MER 08: CHIT 4942 RESPONSE

6. Provide rationale for power cycling MDM OA1/2/3 or not
- **Power cycle of MDM OA2 can be performed in 2 methods.**
 - Requires taking down OA1, OA2 and OA3 together via panel switch O17 Row D
 - Take down 6 of 9 control buses.
 - **Pros of either method:**
 - Potential regain the full capability of MDM OA2 Card 5
 - Odds of success is considered very low
 - **Cons of 1st method – OA1, OA2 and OA3 power switch**
 - Temporarily take down all operational instrumentation data from the 3 AFT OI MDMs
 - **Cons of 2nd method – 6 of 9 control buses**
 - Temporarily will take down equipment such as:
IDP/MDU 1, 2, 3, & 4 S-BAND STRING 1 & 2 MMU 1 & 2
TOP/HI LOAD HTRS A, B & C FES PRI A, PRI B ON & GPC
F1, 2, & 3 JETS

RECOMMENDATION:

Safety Assessment

- Evaluated 31 Affected PASS parameters & Card 05 MSIDs.
 - No additional hazard impacts identified at this time.
 - Worse Case MDM OA2 Failure addressed in ORBI 038 Cause G.
 - MDM OA2 Card 5 failure is loss of insight. Other data exists to assess subsystem health.