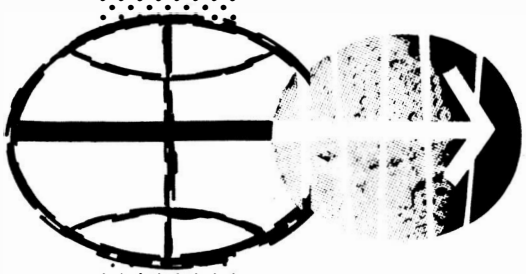
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NETWORK CONTROLLER'S MISSION REPORT

APOLLO 5



MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
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F O R E W O R D

The Apollo 5 Network Controller Mission Report is compiled by the Apollo 5 Network Controller with the majority of the information and data provided by the Instrumentation Support Team at the Mission Control Center for inclusion in this report. The purpose of this report is to provide a quick look at the instrumentation support provided by the MCC and MSFN. Because of the lack of time and data available on a quick look basis, this report does not attempt to perform a detailed analysis. This report is intended to be a factual documentory of significant MCC and MSFN events observed during the Apollo 5 mission.

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APOLLO 5 NETWORK CONTROLLER'S
REPORT

1.0 INTRODUCTION AND SUMMARY

GENERAL

The Mission Control Center (MCC) and the Manned Space Flight Network (MSFN) were placed in mission status for Apollo 5 (NCG 722) on January 4, 1968. Official launch of the mission occurred on January 22, 1968 at 22:48:09Z.

Overall quick-look analysis of ground instrumentation support for this mission indicates that the support was highly successful.

The remoted high speed command system functioned extremely well.

The remoted site personnel performed in a most outstanding manner under conditions of near fatigue.

The ARIA personnel are to be congratulated for a job well done for their normal support and in acquiring the spacecraft when nominal pointing data was not available.

The following significant problems occurred:

A. MAJOR PROBLEMS

1. Redstone Telemetry Computer Faulting - Red at Lift Off.

   The problem was isolated post-mission to an EI wiring error made during installation. The EI (EI 2396) concerns the Erasable Memory Unit (EMU). The clock phase timing was wired incorrectly in chassis A7. A wiring connection was made to a terminal with plus 15 volts instead of the minus 4.5 volts required. This caused the problem with the telemetry 642B computer. The problem was corrected post-mission.

2. GWM data not received at MCC on Rev 4.

   The problem was isolated to an operator error in patching the Communications Line Terminal (CLT) at GSFC. CLT's were switched just after the pass and the static data looked good at MCC. GWM did receive, record and transmit data to GSFC, but it was not transmitted to Houston.

3. ACN did not acquire on Rev 3.

The problem was due to an erroneous acquisition message transmitted from MCC.

4. CAL late acquisition on Rev 2.

The problem was due to an erroneous acquisition message transmitted from MCC.

5. CAL did not support Rev 3.

The problem was in the 1218 computer adder affecting high speed data. It was green by the next pass.

6. WHS high speed data not received at MCC on Rev 1.

GSFC had WHS data tagged with a Redstone ID. Problem was corrected immediately after it was detected.

7. MCC CP Polynomial Buffer Terminal (PBT) hang-ups.

PBT output hang-ups occurred 14 times on the standby system and 11 times on the online system. The PBT's were manually cleared and were reinitialized within ten seconds of each occurrence. It is believed that the problem was hardware rather than software. Work is now in progress to modify the PBT's by February 10, 1968. The modification will give each PBT an individual I/O channel to interface with the CP's, thus eliminating the scanner selector on the PBT to CP interface.

8. Program Request Module/Manual Entry Device (PRM/MED) Inter-Action Problem.

When attempting to load clear load 2507 at GDS during a command interface test, a UHF uplink request for a CSM NAV update 0001 was output. The problem was identified as an inter-action between a simultaneous MED and PRM input. After thoroughly investigating the problem and its cause, it was decided to continue, using the following procedural ground rules.

a. No PRM execute requests to MIL from T minus 27 minutes to insertion.

b. No PRM execute requests to any site in acquisition.

c. All load clear functions to be accomplished by remote site M&O's only.

9. "B" Master Instrumentation Timing Equipment (MITE) Blown Fuse.

This problem occurred at approximately T plus 24 minutes and required a switchover and restart of the RTCC computers. The fuse was replaced and both timing systems were in sync within three minutes.

B. MINOR PROBLEMS

1. Computer Faults at TEX, HAW, CRO and CYI.

These faults occurred during the minus count except for CYI. CYI faulted when the GMTLO load was transmitted after CYI LOS. CYI was attempting to cut a LS summary message, format 68, at the time. In addition, during the receipt of GMTLO, MCC executed a S-IVB history request. At this time, both computers went into a loop. The computers were subsequently reloaded. The reason for the faults has not yet been determined and is under investigation.

2. CAL and WHS Side Lobe Track on Rev 2.

This problem was due to an erroneous acquisition message transmitted from MCC.

3. CYI Intermittent Range Bias of 2000 yards on Rev 1.

The problem was attributed to a drifting fine range adjustment. It was corrected after the pass.

4. GSFC CP Faults during Minus Count.

The GSFC CP's faulted six times within approximately forty minutes during the minus count. Hardware problems were found on the "A" system. A software problem associated with a DSDA message header was also found. This problem was procedurally remedied by not using DSDA headers. The computers were green for launch.

5. Erroneous load to CRO during Minus Count.

After switching to the standby CP ("B" System) Load Control indications showed a load to be transferred to CRO. Load Control force non-val'd load 4563, the last load sent to CRO, with no action. Load Control then retransmitted the

previous load 2509 which caused load 4563 to be transferred. It is concluded that the standby CP had dropped its input during the time the val was received from CRO for load 2509 and load 4563 was stacked behind it. The load was cleared for the site.

6. MCC CP Guard Faults.

These occurred at T minus nine minutes and three times during plus time. No loss of data was experienced except at T plus 4:41:00 when PRE data did not get to the RTCC. All message traffic was overflowed to other RO's on the rotary. The problem is still under investigation.

7. CRO playback bit set on Rev 3.

CRO had the playback bit set at the start of Rev 3 pass (23/0420Z). Houston TIC had CRO reset it immediately and approximately 5 seconds of data was lost.

8. Acquisition Message Problems - General.

The problem is concluded to be due to the non-nominal first DPS burn and the use of an erroneous telemetry vector to anchor the ephemeris. Further investigation is still required.

Further detail on these problems and others can be found in Section 3.0 of this report.

2.0 CONFIGURATION

The MCC configuration and MSFN configuration at launch were as specified in paragraphs 2.1 through 2.5.

2.1 MCC HARDWARE

The configuration of MCC hardware and equipment was per AS-206/LM-1 FCDAR Part III (2/9/67) plus MRR AS-206-1 through AS-206-54 and MRR SA-204L-55 through SA-204L-265.

2.2 RTCC

2.2.1 Hardware

The RTCC configuration for the Apollo 5 mission was: "F" 360/75 MOC (online) with the "B" 360/75 (standby) as DSC.

2.2.2 Software

Mission version program 105 with RTOS 7.1.16 and calibration tape number 2389.

2.3 CCATS

2.3.1 Hardware

The CCATS CP configuration was: CP "A" online and CP "B" as standby.

2.3.2 Software

The CP program was SA-204L/A with errata tape #15 and card errata #165U.

2.4 GSFC CP

2.4.1 Hardware

The "B" system was the online system with "A" system as standby; wide band data line GP58526 was the prime data path between MCC and GSFC.

2.4.2 Software

Program number 128 and errata 1 through 130 was loaded into the online and standby systems.

2.5 RSDP

2.5.1 Data Core Decom Programs were as follows:

S1B - 107.3L 9/18/67
S4B - 109.1L 9/24/66
IU - 108.1L 9/23/66
LM - 001.1 9/18/67

2.5.2 ALDS

Program SA-204L 7.7 revision I was utilized at ALDS during the Apollo 5 mission.

2.5.3 ETR/1218

The 1218 operational program dated November 29, 1967, was utilized at GBI and ANT during the mission.

2.5.4 CSQ, RKV and CRO Gemini Sites

The CSQ, RKV and the CRO Gemini Sites utilized the 1218 program ASPECT-1 dated 9/29/67.

2.5.5 642B

The Remoted (Unmanned) program was NCG-722-4 with telemetry errata U1 - U7 and command errata C1 - C20.

2.5.6 The Dynatronics Decom Programs were as follows:

LM - 10/10/67
IU/S-IVB - 6/27/67
40.8 - 6/27/67

3.0 SYSTEMS PERFORMANCE

Systems performance for the ground instrumentation is listed in the following paragraphs.

3.1 RTCC

3.1.1 Performance

The only two problems of any significance throughout the mission were:

A. The "B" MITE blown fuse which, although not an RTCC problem, required a switchover of computers and a restart of one machine. This occurred at approximately T+24 minutes.

B. The erroneous acquisition messages. This problem is still under investigation.

3.2 CCATS CP

3.2.1 Mission status was established at 0001Z on January 4, 1968. The following is a day-by-day summary of CP anomalies:

A. Launch Simulation Day, January 5, 1968.

(1) Program Support

a. 204L/A (version one of the AS-204L CCATS program).
b. 204L/A-ER-13 (revision thirteen of the errata tape was compiled on December 21, 1967)
c. Corrections for Discrepancy Reports 73U, 109, 118, 135U, 146U, 147U and 149U.

(2) Communications

The teletype package experienced three Guard Mode Faults. DR-146U was in the system to partially solve this problem.

B. Terminal Count Exercise, January 5, 1968.

(1) Program Support

a. 204L/A.
b. 204L/A-ER-13.
c. Corrections for discrepancy reports 73U, 109, 118, 135U, 146U, 147U, 149 and 150U.

(2) Communications

a. Experienced approximately four PBT buffer 4-stops. Discrepancy reports 204-153U and 204-155U apply.
b. PBT's hung on several occasions. Discrepancy reports 204-162U and 204-163U were written.
c. The CP had several EXEC 4-stops. This was isolated to Redstone high speed tracking data being input from Goddard with bad data format codes. Discrepancy reports 204-147U and 204-129 were written.

(3) Hardware

The "B" system had four memory 3 faults. Engineers took corrective action.

C. Network Validation, January 8, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-14

(2) Communications

The system 4-stopped with a PBT buffer problem when White Sands high speed tracking data was received. Discrepancy Reports 204-147U and DR 204-131 were written.

D. Command Validation, January 8, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-14

(2) Command

CCATS command reported that he experienced light logic problems when he was doing pre-conditioning of a CCC overlay. Discrepancy Report 204-156U applies.

(3) Communications

RTCC was not seeing California high speed tracking data. Discrepancy Report 204-132 was written.

E. Network Simulation, January 9, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-14
c. Corrections for Discrepancy Reports 154U, 132, 129, 156U, 158U, 151U and 152U.

(2) Communications

a. PBT hung on standby system. Cleared and reinitialized PBT upon each occurrence.
b. Experienced a Guard Mode fault in PBT 16 and lost text receive. Validation restart was done to process text receive data.

F. Network Simulation, January 11, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-14
c. Corrections for Discrepancy Reports 124, 127, 129, 132, 128U, 151U, 152U, 154U, 155U, 156U, 157U and 158U.

(2) Command

Transfer of GMTLO load caused system to fault. Problem was resolved to bug in correction for Discrepancy Report 152U.

(3) Communications

PBT's hung several times on both systems. Engineers and programmers checked each occurrence. The hang condition was cleared each time by master clearing and reinitializing PBT's.

G. Tracking Validation, January 13, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-15 (version fifteen of the errata tape was compiled on January 12, 1968).

(2) No problems were encountered.

H. Tracking Validation, January 14, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-15

(2) No problems were encountered.

I. Tracking Validation, January 15, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-15

(2) No problems were encountered.

J. Launch Simulations, January 15, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-15
c. 422 errata

(2) Command

a. Several English translation messages were not output by the CP when loads were transferred. Discrepancy Report 165U was written.
b. CCATS Load Control attempted a transfer of an S-IVB load to CYI and got an invalid request. The high speed printer indicated presence of LM load. A recycle cleared the problem.

(3) Communications

One guard mode fault occurred in PRT 16. There was no apparent loss of data.

K. Network Simulation, January 16, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-15

(2) Communications

Twelve PBT hang ups occurred primarily on the standby system. The systems were dumped several times. No software problem could be found.

L. Countdown Demonstration Test, January 17, 1968.

(1) Program Support

a. 204L/A
b. 204L/A-ER-15
c. Corrections for discrepancy report 165U.

(2) Communications

a. PBT hang ups were experienced. The cause of these hang ups could not be determined.

b. One guard mode fault occurred in PRT 16. CLT 1-13 was set busy.

(3) Telemetry

TIC reported loss of main and sub-frame sync on several occasions. Delogs indicated missing data segments.

(4) Command

A CP high speed printer translator went bad and caused a command MED problem. The MED routine was hung when it tried to print an advisory and did not gain control back from the high speed printer routine.

(5) Hardware

Acknowledgements to the GSFC CP were not good when operating on the "B" system. This problem was due to a maintenance device which was hooked to the PBT to check the hang up problem.

M. AS-204L Terminal Count and Mission, January 21 - 23, 1968

(1) Program Support

a. AS-204L/A
b. AS-204L/A-ER-15
c. Discrepancy Report 156U

(2) The following is a summary of the anomalies, by time/date, noted from T-28:00 hours to mission termination.

a. 0959Z/21 - During normal closed loop ORACT configuration, with "B" system on line, TIC and MDC HSP's hung and PCM output stopped. Dump number 204-291 was taken. Systems were recycled to clear the problem.

After above recycle, it was noticed that the "A" system was not outputting MSFN data to the RTCC while in standby. CIM inputs were noted during previous recycle and this is the suspected cause of the problem. Dump number 204-292 was taken and both systems were recycled to keep them in sync.

No problems were encountered during the 5040 validation test with GSFC.

b. 0133Z/22 - A 4-stop occurred on the "B" system (standby). The operator was in the process of switching log tapes when the 4-stop occurred. The CPC had requested a log of PBT input to track down MILA data dropouts reported by the TIC. EXEC programmer reported that if both tapes were moving (one rewinding, the other attempting to interlock), it was possible for the EXEC buffers to deplete causing a 4-stop. Operational procedures were implemented to prohibit a reoccurrence of this problem.

c. 2200Z - 0600Z/22 - MILA data dropped randomly throughout this portion of the Terminal Count. Delogs indicated random loss of segments of different messages between MCC and GSFC.

d. At 0849Z/22 - T-1:11:00 - TIC reported that the ALDS IU "buffer ready" light went out and the CP had stopped outputting to RTCC. Upon redepression of the PBI the CP resumed outputting. RTCC received an LFI when TIC's light went out. This problem occurred several times and was not limited to the IU buffer. "B" system was brought online at 1324Z, when it was finally determined that the "A" system was not processing TLM data properly.

e. At 1347Z/22 CCATS Load Control attempted to initiate a "RSCC Load Clear" from the PRM. Instead, a CSM navigation update execute structure was transmitted. The remote site rejected the execute and gave an invalid request printout. This Load Clear was immediately set up and reinitiated without any problem. The CPC was notified of this problem at 1210Z and was unable to get a dump of the system immediately after transmission of the erroneous execute.

This problem was later duplicated at approximately T-1:17:00 (2130Z) and a dump of the MDC routines indicated that the PRM Load Clear information was lost due to a conflict with the CCATS CMD MED routine being used at the same time. It was recommended to the CCATS CMD personnel that the MED or CSSM not be used during the same period of time that CCATS Load Control was setting up and transmitting a PRM Load Clear to a remote site.

f. Shortly after "B" system was brought online at 0324Z/22, CCATS Load Control site selected CRO on his PRM LSSM. When this was done, an indication of a load in transmission (load light illuminated was received). Load Control non-val'd the following loads - 4563, 2501, 2509. When the 2509 load was non-val'd the 4563 load was transferred. A check of the CPC log and CCATS Load Control log showed that at approximately 1205Z - 1209Z/22 these loads had been transferred to CRO with "A" system online and "B" system PBT's were hung and cleared at 1206Z/22. Thus, it was concluded that the "B" system did not see a validation message for load number 2509 and held subsequent load transfers to that site (per requirements) until it did see a validation (or non-validation).

g. At 1729Z/22 (holding at T-2:30:00) the "A" system, online, received an output sync fault on MOC output. There was no degradation of the system.

h. 2107Z/22 - The TIC high speed printer was continuously printing out the last buffer requested and the CLT indicated output. TIC turned the printer power off, then on, and successfully initiated another buffer printout. Cause of the problem is undetermined.

i. TIC reported drop outs for data from all MSFN sites at approximately 2135Z/22 (T-1:11:00). Drop outs were random with respect to sites. A delog of PBT input and output was taken and indicated that segments of messages were being lost between MCC CP and GSFC CP; it appeared most often when eight to ten telemetry sites were being output to Houston CP.

j. At 2143Z/22 CCATS Tracking reported no Redstone high speed data. Problem is still unresolved. CP was processing the data when the problem was reported.

k. PRT 16 Guard Faults occurred on "A" system (online) at 2239Z/22 (T-0:09:00), 0229Z/23 (T+4:41:00), 0254Z/23 (T+05:06:00), and at 0634Z/23 (T+08:40:00). Two faults caused output CLT's to be set busy, but message traffic overflowed to other RO's on the rotary. The fault at 0229Z caused loss of low speed Pretoria tracking data to RTCC. None of these faults caused the online system to go down.

l. RTC reported two CIM failures at 2246Z. They did not harm the system or cause erroneous outputs of executes. The CIM inputs were confirmed erroneous by CCATS CMD high speed printer, light logic, Franklin printers, 1218 history and CP delog.

m. At 0022Z/23 (T+2:34:00) tracking reported that RTCC was not seeing high speed data from White Sands. Problem was determined to be at GSFC, and caused by erroneously identifying the White Sands data as Redstone data in the 600 bit header.

n. At 0215Z/23 TIC reported loss of LM and LGC data without seeing an LFI. Reselection of those vehicles corrected the problem.

o. At 0301Z/23 both CP's were recycled at Network's request in order to clear the results of the Guard Mode faults.

p. At 0545Z/23 RTC reported the transmission of load number 3701 at 0529Z/23 to CRO (prime) and HAW (backup) without a printout of an ET for HAW. No action was taken. This is a known problem.

q. TIC reported transfer of static data to RTCC; both systems were recycled to keep them in sync.

r. PBT output hung 14 times on the "B" system (standby) and 11 times on the "A" system (online). These were cleared immediately and the PBT's were reinitialized within 10 seconds of each occurrence. There was one indication that command data was lost during PBT hang ups.

3.3 COMMAND

3.3.1 Performance

A. January 5 and 6, 1968 - Terminal Count Exercise.

MCC

During ORACT, the CP hung up when a VAL but no VER was recieved on a Unique Priority Command. Problem was subsequently corrected on January 12, by a software change. Both CP's faulted due to PBT problems at 1419Z, 1434Z, 1443Z, 1642Z (GET 00:12, BDA, Rev 1), 1924Z (GET 01:54, HAW, Rev 2 Acq.), 2054Z (GET 04:24, during commanding at HAW, Rev 4), 2111Z (GET 04:41, TEX, Rev 4). CP did not generate an E/T for load 6001 for CRO, HAW, TEX, GDS, GYM and RED because of receipt of HSD VAL's before the E/T was generated. Errata was available but not implemented.

GSFC

CP faulted just prior to MILA/DRUL I/F test at 0534Z. A high speed interface was established at 0550Z, and the TTY I/F was established at 0554Z. The CP was recycled at 0622Z to ensure a good configuration. GSFC had a bad CLT set in for CRO during the command interface tests.

MSFN

BDA

Did not receive VAL on LD INV and RTC 75B executes during second I/F test. Both executes were accepted by BDA. Problem was determined to be a loss of incoming data from BDA. The TLM computer was down for the Rev 1 pass and faulted during Rev 3.

RED

Redstone had a RED Magnetic Tape Unit (MTU) for the first command I/F test which prevented the processing of command histories. TTY was received at GSFC garbled, but was not received at MCC. Considerable difficulty

was encountered in establishing a HSD link for the second I/F; TTY was still not available due to a computer problem onboard with the "B" output. This I/F was not completed due to a bad Updata Buffer on the ship.

GDS

TTY traffic during command I/F test was garbled; some messages were not forwarded by GSFC to MCC due to garbled headers. The problem was determined to be the "A" TTY send line to GSFC which was restored between GDS and GSFC; the rerun was satisfactory after correction.

CRO

GSFC had a bad CLT during the command I/F test. On the rerun, the first TTY messages were not received due to being held at the site. Support was nominal through the remainder of the test.

ACN

The command computer faulted before the command I/F test. A rerun was attempted but not completed. MCC received HSD VAL's but no TTY. ACN switched off of SATCOM and MCC received TTY but no HSD VAL's.

CNB

Honeysuckle could not load a type 25 load, but could load a 45 type and other LM loads. The problem disappeared when the command computer was reloaded.

B. January 8, 1968 - Network Validation.

MCC

Command validation tests were conducted with CRO, RED and HAW. The CP faulted several times attempting to process WHS tracking data due to a GSFC CP problem. The CP was also down at 1725Z due to an operator error.

GSFC

The CP was passing erroneous WHS tracking data, causing MCC to fault. The problem was later identified and corrected. Some trouble was encountered establishing communications with HAW.

MSFN

CRO

The telemetry computer faulted six times during the 2041 command validation testing. The Phantom Dump procedure was followed the first time, but ommitted on the remainder of the faults because of time constraint. Power to the acq. bus was inadvertently removed during the execution of a portion of the SLV loads, removing the UHF on indication to the UDB. This gave question marks (???) for the data part of the command histories during this period of time.

RED

An SLV load that was uplinked during the transfer of a SLV load did not appear on the command history. This is a known problem and is still unresolved.

C. January 9, 1968 - Network Simulations.

MCC

Supported Network Simulations. The CP was unable to transfer HSD loads after 2120Z. Problem was corrected by errata. CRO and HAW loaded via TTY tapes.

GSFC

Support was nominal.

MSFN

CRO

The command computer faulted prior to the command I/F test, but was up during the rerun period; CRO was GO for command at that time. At GET 01:12, after Rev 1, the command computer went into a loop; the Phantom Dump and CBARF routines were exercised. During the remainder of the simulation, the command computer faulted two more times; the reason for these faults is still unexplained.

RED

The command computer was red during scheduled command I/F for a high speed printer problem, but was "go" for rerun.

MIL

The command computer faulted right after the second pass. CBARF was used to recover the program, but the loads could not be recovered. MIL loaded all applicable loads via TTY.

D. January 10, 1968.

MCC

Console was manned for the purpose of answering queries, RIC's and station MMR's.

E. January 11, 1968 - Network Simulations

MCC

The CP hung up on transfer of GMTLO; the second transfer was proper after a recycle. The CP hung up two more times on load transfers. The CP was then recycled to delete errata DR-152U, which was to correct the load transfer problem encountered January 9, 1968. This appeared to clear the problem. Additional errata was generated.

One procedural error was encountered when the MOC recycled and reset the sequence number of all loads back to 00. When the 47 type of load was stepped to 03, and transferred to CYI, that site all ready had a 4703 load, and it was rejected. The load number was incremented to 4704 and was successfully transferred.

The CCATS command high speed printer went out at GET 03:20 and was replaced by a spare unit.

The GMTLO load was still not outputting E/T's to all sites (see January 6). In addition, the ANG TTY was being routed to GANT.

MSFN

CYI

The Magnetic Tape Unit would not write loads during the first attempt to run the command I/F test. The site configured in the reverse configuration, and the rerun was satisfactory.

GDS

Some TTY traffic was received garbled and some was received on the intercept machine due to garbled headers. Other TTY was not forwarded by GSFC CP because of garbles.

BDA

The TLM computer faulted just before the scheduled command I/F test, but was "go" for the rerun. It also faulted 30 seconds before lift off when the M&O went to Load Disable, but was up to support the Rev 1 pass.

RED

A blower was running backwards on the command Magnetic Tape Unit (MTU), causing the head to overheat. The command history for Rev 1 contained a LM NAV update that had been executed as part of the support count command interface, indicating that the writing or reading of an EOF was not proper.

F. January 12, 13 and 14, 1968.

MCC

Console was manned for the purpose of answering queries, RIC's and station MMR's.

G. January 16, 1968 - Network Simulation.

MCC

The CP four stopped early in the count for an executive buffer problem. There were two CP recycles during the minus count to sync the two systems. At about T-7 minutes, the CP faulted but was back online, conditioned for commanding, prior to lift off.

During the ANG interface, it was noted that the command load E/T messages still contained GANT vice GANG in the header. After launch, WBD was lost and the online CP was recycled. Later, a recycle was performed to establish sync and another recycle was performed after a PBT hang up was experienced on both systems. A WBD dropout occurred during a NAV update execute sequence and one execute function was lost.

GSFC

A (simulated) CP fault was introduced. Otherwise, support was nominal.

MSFN

CYI

During the countdown interface test, the command history reflected question marks vice octal data. The M&O then advised that there had been a "UDB hang-up" when the commands were uplinked. The executes were repeated but a LM history could not be obtained (the SLV history was good). The system was turned over to the M&O and NST for analysis.

The interface test was later conducted successfully. Subsequently, the command computer four stopped and was restarted from location 1002_8. Two MCC executes (load inventory and LM RTC 75B) were performed to verify the interface prior to launch.

After launch, the command computer again four stopped but was promptly recovered. A flip-flop card was replaced for bit 23 of the "U" register.

CRO

The initial interface with CRO revealed that VAL suppression was not entered. The M&O then entered VAL suppression and LM RTC 75B produced a S/C REJ. It was determined that LM data was not active on the command computer input although the telemetry computer was processing normal. The station was released to resolve their problem while other interfaces were performed.

Both computers faulted on the next interface attempt and the station was again by-passed. Subsequently, the CRO command interface was completed satisfactorily. No problems were reported after launch.

ACN

The ACN interface was satisfactory except there was no TTY received from the site. GSFC reported no TTY and/or garbled TTY from the station. ACN later found 25 per cent distortion on the command 1259.

ANG

The ANG interface was satisfactory except the station received no TTY from MCC due to the error in the header (GANT vice GANG).

RED

The command computer failed to output TTY on the initial interface attempt. The subsequent rerun was successful though it was necessary to have the M&O enter VAL suppression during the interface test.

GYM

GYM M&O reported one command computer fault after lift off.

GBM

The command computer faulted during the launch phase and recovery via CBARF was not successful. It was returned to a "green" status prior to the next pass.

BDA

BDA reported a GET problem with their computers after launch and both systems were restarted.

H. January 17, 1968 - CDDT.

MCC

Command participation for the CDDT support count began with Closed Loop ORACT which was delayed approximately 90 minutes due to procedural difficulties. A hardware

failure experienced during ORACT did not significantly impact the test but did disclose an undesirable CCATS software dependency upon proper hardware responses in which a HSP translator hung up during the attempted print out of a MED entered 4901 load. A good translator, when put online, allowed the inadvertent transfer of the load. As a result, additional procedures were prepared in the CP area.

Command procedures were implemented as prescribed for each of the (approximately) ten CP recycles required during the countdown.

GSFC

Nominal support except two CP recycles reported.

MSFN

BDA

The M&O reported an intermittent problem of picking up a two in the tens of minutes (timing problem) and apparently causing GET processing problems in the computer. The interface test was conducted satisfactorily on theinitial attempt with no evidence of a problem.

RED

Initial interface testing was good except a command history could not be obtained via either TTY or HSP. The command computer was reloaded and the interface test was completed.

An interface test was attempted via HF but was not a success. Subsequently, the interface test was conducted via satellite satisfactorily.

CRO

The M&O reported the command computer RED (no ETO) due to repetitive faults but cleared the problem and the system was GREEN within 30 minutes. Subsequently, the command computer was reloaded.

The initial interface was completed satisfactorily after the M&O entered VAL suppression.

GDS

The interface test was satisfactory except all TTY from the station was either garbled or missing.

TEX

The initial interface test was a success except the first LM history did abort for causes unknown. The second attempt to obtain the history produced correct results.

ANG

The interface was satisfactory except the station did not receive TTY traffic (MCC TTY header problems).

MIL

The M&O reported during the T-50 minutes hold a series of illegal command requests accompanied by (1232 I/O) HSP stack overflow printouts. Subsequently, it was determined that interrupts had been generated through inadvertent grounding while replacing the abort interrupt/enable switch in the (MIL) abort console. This console was not a requirement for this mission. No command was executed as a result but work in the console was immediately terminated.

Support was otherwise nominal from remoted sites.

I. January 21 and 22, 1968 - Terminal Count to T-02:30.

MCC

Closed Loop ORACT was conducted successfully; however, both CP and ORACT computers were recycled to clear up loss of data.

Validation test 5040 and MILA CMD I/F was conducted successfully. All other countdown support was nominal except as noted in the following paragraphs.

BDA

During the first command I/F test, TTY was not received from BDA. BDA switched to the Alpha-circuit, and TTY messages were received. BDA then switched back to the BRAVO circuit and TTY was also received. The second I/F test was successful.

GYM

Support for command I/F test was nominal. However, GYM had an intermittent timing problem. The site conducted diagnostics but found nothing. CMD CADFISS was successfully conducted and the site was back for support.

TEX

Support was nominal. However, TEX reported an inter-computer problem. Maintenance tests were run but no problem was found. The computer was reloaded.

J. January 22, 23, 1968 - SA-204/LM-1 Mission.

MCC

Picked up the count at T-2:30, at 2018Z/22. Launch was at 22:48:08.355.

When selecting consoles to MIL at T-6 minutes, an apparent faulty CIM input was experienced that gave an erroneous indication. Post-mission testing could reveal no problem, but it has been demonstrated that the simultaneous depression of the adjacent PBI could cause the identical indication.

Another CIM error was experienced on the Load Status Site Select Module. In this case, a bit was dropped in the PBI number. The problem could not be duplicated and is still under investigation.

GMTLO Load 6001 was transferred after CYI LOS with the maximum allowable number of HSD CLT's (10) set in at Goddard. This transferred the HSD load to MIL, GBM, BDA, RED, CYI, CRO, HAW, GDS, GYM and TEX. A HSD VAL was received from all sites except RED (who had no TLM computer) and CYI (see CYI for remarks). Of these sites, BDA, CRO, HAW, GDS, GYM and TEX returned their HSD VAL before their ET was generated, causing the loss of the low speed load. ANG, ACN, CNB and GWM received only the low speed ET, which was loaded at those sites. As ANG's ET was still addressed to GANT, a TTY tape for this load was punched in GCC, where the header was changed to GANG and manually transmitted.

Both CP's were recycled at 0547Z/23, following a transfer of load 3801 to CRO and HAW, and as a result, the ET's for this load was only partially transferred. The load was successfully loaded via HSD at both sites.

There were 378 uplink requests executed for the Spacecraft or Launch Vehicle during prelaunch and mission. Only five of these failed to get to the remoted site. One was executed during a PBT hang up, three are suspected to have occurred when the Wide Band data line was attempting to fail over to the alternate line, and one loss of an execute request is unexplained.

During prelaunch and mission, there were 36 loads transferred. The RTCC generated 32 loads, 9 for prime site only, 22 for prime and backup sites and 1 (GMTLO) for all sites. CCATS Manual Entry Device (MED) was used to generate four loads, two for prime site only, and two for prime and backup sites. On 11 occasions, a site did not receive, or rejected, the HSD load. For five of these, the load was retransmitted, once by RTCC and four times from CCATS. Eight low speed ET's were not output from MCC (six GMTLO and two 3801). One ET was not received at the site, as TTY line checks were in progress at the time the load was transferred. See Section 5.0 for disposition of individual loads.

GSFC

Support was nominal throughout the mission.

MSFN

MIL/ETR

The backup high power UHF transmitter at CNV became RED at 1901Z/22, for a faulty Klystron (about eight hours needed). CNV satisfactorily supported the mission with one HP transmitter only. Eighty-four RTC's and four loads were executed through MIL in prelaunch and 86 RTC's and two loads were executed after lift off.

BDA

Support was nominal throughout the mission. There were no uplink requests through BDA.

RED

Redstone had only one computer available for support of the mission. It was utilized as a command computer for Rev 1 and 4, and as a TLM computer for Rev 2 and 3. No uplink requests were made through RED.

CYI

A problem was experienced when the GMTLO load was transferred at CYI's LOS. At the time of the transfer, CYI was outputting a type 68 LM summary, and had not entered a ROS. As such, MCC was not receiving any CAP words from CYI. The 6001 GMTLO has the pecularity of being accepted by the RSCC regardless of sequence number, so in effect, CYI received six. Each was written on the recovery tape. An S-IVB Type I history request appears to have been executed while the sixth GMTLO was being written on tape, and the command computer went into a loop. The M&O then attempted to request a high speed printer history request, and received an acknowledgement of the CAM (A1 215) input. However, the execute request was not accepted by the TLM computer, which also appeared to be in a loop. As a result, CYI had to recycle both computers, and lost the S-IVB history. Only one execute request was made through CYI.

CRO

Support from CRO was nominal throughout the mission. Seventy-eight RTC's and six load (including EMU Address/Data) executes were requested through CRO.

HAW

Support from HAW was nominal throughout the mission. Fifty-nine RTC executes were requested through HAW.

TEX

The backup FRW-2 was RED for the first four passes; FRW-2, No. 1 support the mission. There were execute requests for 55 RTC's and 1 load number through TEX.

3.4 TELEMETRY

3.4.1 Perfcrmance

A. January 5 - 6, 1968 - Terminal Count Exercise

MCC

During the GBM TLM CADFISS, Tracking Data was being shipped to the ORACT/360 which resulted in bad compares. Tracking data was inhibited at Goddard and a rerun was made with GBM with good results. Houston CP went down (1419Z) with a 4-stop and required a recycle.

GSFC

During the MILA TLM interface, data was not transmitted to MCC because the CLT was erroneously set out at GSFC.

(1750Z) On TIC console, main and subframe sync was dropping from GDS. Problem was found to be a bad CLT at Goddard.

MSFN

BDA

(1200Z) During the BDA TLM CADFISS, the TLM computer was outputting fill data for all LGC words. After a reload of the TLM computer and the LM decom, the problem was cleared.

(1630Z) TIC went to BDA for readouts on the IU vehicle and received erroneous readings because of out-of-date decom listings. All sites were requested to insure they were using updated listings.

(1800Z) During Rev 2 high speed TLM was not received from BDA. The TLM computer went into a loop and had to be reloaded.

(1948Z) At this time, the BDA TLM computer faulted and again had to be reloaded.

C. January 8, 1968 - Network Validation.

MCC

(0625Z) A 1040 validation test was conducted with GBI/ALDS. Errors were encountered at MCC on compares of ALDS data. The problem was found to be the S-IVB Decom at Data Core. After a reload of the S-IVB Decom, the problem was cleared. Parameters in error were K112-404, K126-404 and K127-404.

(2211Z and 2237Z) During a FIDO trajectory run the Houston CP went down. Dumps were taken to isolate the problem and it was determined that simultaneous reception of RED high speed TIM and tracking data caused the Houston CP to go down. The CP was recycled.

MSFN

TEX

(0845Z) During a F/C confidence run the TEX TLM computer was not being updated by the IU vehicle. A memory dump was made at TEX from the AC-8 tape, but no problem could be found. After a reload, the TLM computer correctly output the IU data.

D. January 9, 1968 - Network Simulation.

MCC

The support count for the network simulation was conducted with no significant problems at MCC.

GSFC

(1120Z) Goddard computers went down and could not run GBM CADFISS; GBM was completed on reruns.

(1900Z) Goddard had CLT problems; indication on TIC console was main and subframe sync dropping at a one second rate from CRO, ACN and GYM.

MSFN

CRO

(1420Z) The CRO TLM computer faulted, and could not complete CADFISS. The rerun was successful.

TEX

(1544Z) The TEX TLM computer faulted and had to be recycled.

E. January 11, 1968 - Network Simulation

MCC

During the support of the network simulation, it was necessary to recycle the Houston CP at 1411Z and 1452Z. At 1645Z, the Houston CP could not process TLM data and a switchover to the standby was required to clear the problem.

MSFN

GYM

(0927Z) During GYM TLM CADFISS, errors were encountered on all LM bilevels. GYM switched to the backup LM decom and the test was completed with good compares. GYM later found a hardware problem on their prime LM decom.

CRO

(1000Z and 1050Z) During CRO TLM CADFISS errors were discovered on the LM vehicle parameters.

(1134Z) CRO reloaded their TLM computer and the interface test was completed with no errors.

BDA

(1338Z) BDA TLM computer faulted when the M&O attempted to go to load disable for CMD. A recycle was unsuccessful and after a reload, the TLM computer was processing correctly.

TEX

(1657Z) TEX TLM computer faulted and had to be recycled.

ALDS

(1700Z) F/C at Houston reported the LVDC words from ALDS were not updating. The problem was found to be a bad simulations tape at ALDS/ Data Core.

(1847Z) Houston TM reported the FM/FM from ACN was at a very low level. This problem was verified at ACN and was corrected before LOS.

F. January 12, 1968

MCC

A 1040 validation test was run with ALDS/Data Core to reverify switch selector processing and a new parameter (K204-404) that was incorporated in the ALDS programs. The Val Test was successful.

G. January 14, 1968 - Network Validation.

MCC

Console was manned to answer RIC's and queries and to review documentation.

H. January 15, 1968 - Launch/Abort Simulation

MCC

During the simulation, the CP was switched to the standby and began decomming the previous site data. Problem was determined to be that the standby CP was not in sync with the online CP.

I. January 16, 1968 - Network Simulation.

MCC

(0430Z) ALDS primary 40.8 KBS line, GP58245, was turned over to TELCO for maintenance.

(1251Z) All telemetry data was lost because the Houston CP went down; a switch to the backup CP was required.

MSFN

RKV

(0955Z) The FM/FM remoting from the RKV was very noisy due to HF propagation problems.

CSQ

(1047Z) The FM/FM remoting from the CSQ was also very noisy due to propagation problems.

J. January 17, 1968 - CDDT.

MCC

Console was manned in support of the CDDT. No significant problems occurred.

K. January 18 - 19, 1968 - CDDT.

MCC

(0816Z) During the MILA TLM CADFISS many sync losses were observed on the TIC console. NST TLM reported their decom was locked solid on MILA data.

(1250Z) MILA 2.4 TLM was lost and after a CP switch-over at Houston, the problem was cleared.

(2115Z) MILA 2.4 TLM was lost because of a PBT hang up at Houston. A PBT clear corrected the problem.

MSFN

CRO

(0813Z) During the CRO TLM CADFISS, The Houston CP could not achieve main and subframe sync. CRO reloaded the TLM computer for a rerun.

(0930Z) CRO TLM CADFISS was completed with success.

L. January 21, 1968 - Terminal Count.

MCC

(0400Z) During Closed Loop ORACT, the CP was not outputting the PCM buffer on CLT 3-1; after a CP recycle, the problem was cleared.

GSFC

Between 1937Z and 2005Z, the Goddard CP went down four times which caused a delay in the MILA TLM interface.

M. January 22, 1968 - Terminal Count.

MCC

(0845Z) While processing ALDS data, LFI's were received in the RTCC MOC for no apparent reason. ALDS reported that no LFI's were sent.

(0939Z) LFI's were again transferred to MOC. Reselection was made on the TIC console and data was transferred normally.

(1537Z) Occasional dropouts in Main/Sub-frame sync was observed at the TIC console in the data from BDA, RED, MILA, and GYM. NST TLM reported the data solid. The problem cleared with no explanation.

MSFN

RED

(0259Z) Redstone TLM computer faulted and the Phantom Procedure was attempted to aid in determining the cause of the problem. The computer was reloaded after no problem was found.

RKV

(1209Z) During the RKV FM/FM interface, IRIG #6 and #7 were very noisy due to propagation.

(1250Z) Redstone TLM computer faulted while running TLM CADFISS. A recycle was attempted but the TLM computer faulted again.

(1253Z) Redstone reloaded TLM computer.

(1327Z) Redstone reloaded TLM computer.

(1342Z) Redstone TLM computer faulted and station was released to run diagnostics.

(1447Z) TLM CADFISS was again attempted with Redstone.

(1455Z) Redstone TLM computer faulted with no ETO.

(1520Z) Goddard computers successfully conducted TLM CADFISS with RED, and were determined to be go for TLM.

(1552Z) RED TLM computer faulted with no ETO.

(2200Z) Redstone was still having TLM computer problems and was declared no go for launch.

HAW

(1640Z) HAW TLM computer faulted with a 15 minute ETO.

(1656Z) HAW TLM computer was reloaded with static data back online.

TEX

(1700Z) TEX TLM computer faulted, and after a reload, static data was back online.

CRO

(1900Z) CRO TLM computer faulted, and after a reload, Goddard computers conducted a successful CADFISS.

Q. January 22, 1968 - Mission Activity from T:0.

MCC

At lift off, telemetry data was solid from ALDS; a few minor sync dropouts were noted from MILA and BDA. No specific problems were encountered with telemetry data during the launch phase of the mission.

(2307Z) During CYI AOS of Rev 1, the RTCC was not processing TLM data; after a switch to the Dynamic Standby Computer, processing was normal. This problem was due to the loss of timing to the MOC when the GSFC MITE went down because of a blown fuse.

GSFC

GWM

(0435Z) During Rev 3, no high speed telemetry was received at MCC. The problem was isolated to be an operator error in patching the Communications Line Terminal (CLT) at GSFC. At LOS, Goddard CP switched CLT's and the static data was received at Houston CP.

MSFN

CYI

(2318Z) After CYI LOS of Rev 1, the station was directed to reconfigure for a high speed telemetry playback of IU data.

(2326Z) CYI reported their TLM computer was hung up with a loss of inter-computer channel. A recycle was requested and the P/B was continued without high speed telemetry with CYI providing readouts from the decom.

(2359Z) CYI reported the TLM computer green.

R. January 23, 1968.

MCC

(0216Z) Before ACN AOS, LM static data was requested for decommutation at the TIC console; one frame of static data was shipped to the RTCC because of this procedural error.

(0500Z) During TEX AOS on Rev 3, numerous PBT hang ups occurred at the Houston CP causing dropouts in TLM data from the CP to the RTCC.

MSFN

GYM

(0017Z) GYM reported numerous dropouts on the IU air-to-ground link. GYM did not observe any S-IVB dump transmission.

TEX

(0020Z) AOS - TEX reported the same fading on the IU downlink as witnessed by GYM. TEX was also unable to lock on the S-IVB downlink.

RED

(0032Z) During Rev 2 RED supported high speed telemetry with the TLM program loaded into the command computer.

ACN

(0351Z) Due to a very weak signal on Rev 3, ACN could not lock the decoms on LM VHF or USB. No usable data was received at MCC.

CRO

(0421Z) During Rev 3, CRO transmitted data FMT 3 with the tape playback bit set. TIC had CRO remove the tape playback bit with a resultant loss of approximately five seconds of high speed TLM.

3.5 TRACKING

3.5.1 Radar and USB Performance

A. January 8, 1968 - Network Validation.

A high speed validation test with CAL-18 was attempted, but problems were experienced getting data through GSFC. CAL boresight data was received and it was determined that the azimuth and elevation data was reversed.

B. January 9, 1968 - Network Simulation.

All radar and USB trajectory data for the first few rev's was brought into MCC with the exception of CAL data and IP high speed orbital data which was not available. No major problems were encountered.

C. January 10, 1968 - Network Validation.

MCC processed WHS and RED high speed trajectory data during validation testing with no problems encountered.

D. January 11, 1968 - Network Simulation.

All radar and USB high and low speed trajectory data was brought into MCC and processed with the exception of CAL high speed data which was not available. It was found that the high speed tape supplied by Houston Track was bad.

E. January 12, 1968 - Network Validation

A high speed validation test with CAL-18 was attempted but CAL-18 was red and could not support.

F. January 13, 1968 - Network Validation.

CAL-18 was scheduled for three satellite passes in an attempt to provide high speed tracking data to RTCC. During the test, it was discovered that CAL could not use the IRV supplied by ETR because of a wrong date set in the 4101 computer. Track was not obtained on any of the three passes. Boresight data was successfully transmitted and received in the proper format.

G. January 14, 1968 - Network Validation.

CAL-18 was scheduled for four satellite passes to again attempt to provide high speed tracking data to RTCC. CAL was able to process the ETR IRV messages at this time but the orbital elements of the objects were not up to date and CAL-18 could not obtain valid track.

H. January 15, 1968 - Network Simulation.

All high and low speed trajectory data was brought into MCC and processed, with the exception of IP high speed orbit data. IP did not support this simulation.

During the simulation, the CAL-18 was scheduled to attempt track on a satellite and provide high speed trajectory data to MCC. The orbital elements had been updated by an ETR radar and this time CAL did acquire track and transmitted high speed data to MCC which was accepted and processed. CAL-18 was considered validated.

I. January 17, 1968 - CDDT.

During the T-14 hour M&O trajectory run, the data from the Redstone was not passing through GSFC to MCC. It was determined that the Redstone was configured to send 2.4 KBS trajectory data while GSFC was configured to receive only 1.2 KBS tracking data. The problem was corrected and the station successfully tested. No other problems were encountered.

J. January 20, 1968.

During the CDDT, all trajectory runs were conducted on schedule. On the final run, at T-1:50:00, the IP computer faulted at about +500 seconds into the run. After diagnostics were run, no apparent reason for the fault could be given. A second run was made with no problems.

K. F-O, January 22, 1968.

Several radars went red during the Terminal Count but were able to support at T-O.

CAL-18	Range Problems.
CAL-18	1218 Problems.
WHS-16	1218 Problems.
CYI-26	Fine Range Encoder.

After lift off and CYI LOS, it was discovered that CYI had an intermittent range bias of 2000 yards which was caused by a drift in the final range adjustment.

NST radar advised that both CYI and BDA "C" Band radars saw a target 500 yards farther out in range than expected. This anomaly was thought possibly to be the LM "C" band beacon triggered by a series of pulses both from the ground station and from the IU "C" band beacon reply pulse. No problems were encountered from this anomaly.

During Rev 1, high speed data from WHS was not processed due to an error at GSFC. The Goddard Comm Manager sent WHS high speed data to MCC tagged with a RED site ID.

On Rev 2, CAL-18 and WHS acquired side lobe track on the LM vehicle as a result of erroneous acquisition messages. All sites reported having difficulties acquiring as a result of erroneous acquisition messages sent from MCC. Data Select personnel advised Track that for a period of twenty minutes the ephemeris was anchored to a telemetered spacecraft vector. This is still under investigation.

CAL-18 went red at approximately T+1:11:50 for 1218 computer problems which affected high speed tracking data. CAL did not support the Rev 3 pass, but were operational at T+2:40:00.

ASC did not acquire the LM vehicle on Rev 3 and possibly was a result of an erroneous acquisition message. After HAW LOS on Rev 5, no "C" or "S" band site was able to acquire the spacecraft.

3.6 COMMUNICATIONS

3.6.1 Performance

Overall, communications significant to the support of F-minus day activity and exercises were excellent. A marked improvement was noted in OIS Channel quality. Similarly, KSC communications operational response showed marked improvement. Slower response in correcting circuit troubles was noted in the ETR X-Y communications area where several vital MCC voice circuits are serviced. ETR X-Y response and handling of troubles lacked the close support which was provided throughout Gemini and early Apollo flights. Numerous voice and teletype problems (particularly with ships) were encountered during the early F-minus days but decreased as the mission approached.

A. January 4, 1968 - Software Integration Test.

During the SIT, dropouts of MILA TM data required trouble-isolation efforts in several areas. At GSFC, the "B" PBT's were substituted for "A" PBT's which appeared initially to have cured the problem. However, a later recurrence caused initiation of Fredricks testing (non-dynamic) on the Wide Band lines. Results of this test were good and it was determined that the Wide Band Circuits were not at fault.

B. January 5, 1968 - Launch Simulation.

There was no significant communications problems during the 204L Launch Simulation conducted on this date.

C. January 6, 1968 - Network Terminal Count.

Numerous teletype problems were experienced with Redstone and the Rose Knot. Several incidents of telemetry dropouts occurred again this date and GSFC made every effort to isolate the reason for these dropouts. The Rose Knot was not yet on TSP and it was believed that this was the cause for the TTY problems. Four teletype circuits linking GSFC and Houston were lost for approximately five minutes due to a problem in the commercial facility at Greenbelt.

D. January 7, 1968.

There was no significant communications activity this date.

E. January 8, 1968.

One of the two redundant ALDS Wide Band Telemetry lines (GW58246) experienced dropouts and had to be realigned by Telco. During the hour's release of this circuit, the alternate circuit performed satisfactorily.

F. January 9, 1968 - Network Validations, Net Sim.

Multiple communications outages were realized with both Rose Knot and the Coastal Sentry; most of these were associated with either propagation conditions or man-made interference. Similarly, the Redstone experienced teletype problems on several occasions; however, they were restored on COMSAT paths.

G. January 10, 1968.

There was no significant communications activity this date.

H. January 11, 1968 - Network Simulation.

The majority of the communications outages experienced during the simulation was with the Coastal Sentry and the Rose Knot. Other communication outages were experienced with Redstone, Bermuda, Guam and Ascension. Reasons for outages were primarily due to propagation; however, carrier failures in Australia and a power failure at Andover were among some of the problems reported. A hardware problem with PBT's at GSFC caused a loss of some tracking data; Carnarvon and White Sands were noted as sites which were affected. GSFC advised MSC of plans to call up additional, leased circuitry to the Coastal Sentry and Rose Knot and forecasted an improvement in communications reliability to these ships.

I. January 12, 1968.

There was no significant communications activity this date.

J. January 13 - 14, 1968.

The sole activity these dates which involved communications was the California High Speed Tracking Validation Test. No communications problems were noted during this period.

K. January 15, 1968.

There were no communications problems reported during the Flight Control Simulations conducted this date.

L. January 16, 1968.

During the validation of the ALDS Wide Band Telemetry lines in preparation for the 204L Network Simulations, the primary line (GW58245) had to be referred to Telco as unsatisfactory. The circuit was returned within the hour and was acceptable. The trouble had been a Voice Frequency System failure between Houston and Lake City, Florida. Numerous problems were experienced this date but none were long-term or recurring hindrances to overall support.

M. January 17, 1968.

Initial configuration and in-house communications validations were conducted this date in preparation for CDDT. No significant problems were noted.

N. January 18, 1968.

Preparation for the CDDT was continued this date. At 0814Z, dropouts of MILA data were reported. GSFC advised that the GSFC-Houston Wide Band circuits switched over several times during the period of the reported dropouts. Failovers were again reported approximately two hours later but no further data losses were noted.

O. January 19, 1968.

Support of CDDT continued this date with the count holding at T-10:00:00. A problem was reported on the signalling on the Mission Director's Private Lines to KSC, but attempts to isolate the problem were unsuccessful. Plans were made for an extensive investigation into the signalling problems.

Net 1 and 2 were out to CYI at 0704Z but were restored by 0717Z. The Redstone was in and out on communications on several occasions.

P. January 20, 1968.

After further investigation into the signalling problem on the Mission Director's Private Lines, it was determined that an incompatibility existed between the KSC signalling and the interface at MCC. Communications Engineers at MCC stated that they could not effect an engineering change in time for the Terminal Count; therefore, the Mission Director would not have signalling capability for this mission.

Q. January 21, 1968.

Intermittent microwave fades were noted throughout the night when they affected some of the voice lines. The single user most affected was Houston OSBORNE (DOD Recovery Communications Coordinator). The servicing commercial communications agency advised that the fades were taking place in the Lake City, Florida area. Many communications validation tests were conducted successfully this date (both external and internal). Only one circuit (GP58368 - PAO Coordination) failed to pass test criteria; the circuit was referred to Telco for hum/echo. The circuit was repaired and returned to service. After completion of validation, GP58210 (Network Coordination circuit linking Houston Network with the MILA USB site, CIF, ALDS and ETR SRO) encountered problems. Only two NASCOM teletype outages were experienced this date after activation text and low speed data lines. The CSQ suffered a one-hour outage on both "A" and "B" channels. The Watertown experienced a 15 minute outage on their send TTY to GSFC. Overall status was "green" at the close of this date.

R. January 22, 1968.

Support of the Terminal Count was continued. Teletype outages were experienced with CSQ, RKV, HAW, GWM, CYI, BDA and the Watertown. All were minor or of short duration with the possible exception of the Watertown which sustained a rather long send teletype outage on the single teletype channel. During the period of the hold, nearly all Houston-terminated circuits were affected by microwave fade in nearly all directions. Just prior to the scheduled time for launch, two circuits (GP58224 and GP58239 [P.L.]) were in trouble. Outages occurred within minutes of each other and local overhead restoration and special efforts by the commercial servicing agency helped to overcome these problems. These circuits were restored to service several hours prior to launch. Commercial longline video, initiated two hours before launch produced an excellant picture in the MCC. Complaints received from the distant-end concerning their receipt of high levels were referred per FOD TV Editor request to AT&T. Point-by-point trouble-measuring traced the source of the high levels back to the MCC. The trouble pointed strongly to inaccuracy within the test equipment employed in setting the signal levels. However, no further clarification on the matter was reported after the situation had been corrected. On at least two occasions, interruptions in MCC transmit video signal were caused by KSC direction to Southern Bell to break the circuit and inject test patterns. All circuits were green and go at launch.

S. January 23, 1968.

Until 0702Z, when the transmit video service to KSC was terminated, the MCC communications environment remained at full strength in support of the flight. Network communications were good; CSQ and WTN sustained some teletype outages, however the RKV appeared to stay in well either through New York or via Wheeler.

Two isolated problems were encountered in MCC/ ALDS voice circuitry. Some two hours of cross-talk was experienced in the Orbital Status Room, MSOB, between the Flight Director loop and the APO Chief Engineer Loop. The problem of isolation was difficult in real time and was finally solved by the total isolation of the APO Chief Engineer circuit. The other problem concerned a "popping" noise on the PAO release circuit which was known to originate from the Huntsville monitor drop. The MCC Comm Controller ordered the Huntsville leg dropped in order to correct the problem. On a non-interference basis, Telco cooperated in tracing the problem to a bad relay in an SF unit at HOSC. The incident resulted in Huntsville missing several minutes of a press release.

3.7 APOLLO RANGE INSTRUMENTATION AIRCRAFT

3.7.1 Performance

AS-204L was the second support mission in which the ARIA fleet participated in manned space flight network operation. Again, as in AS-501, the aircraft were undergoing Category III testing concurrent with the mission support activities.

ARIA supported AS-204L staging from three geographical areas. ARIA 1 and 2 in the Australian Sector, staging from Pearce Royal Australian Air Force Base (RAAFB), provided coverage during the S-IVB passivation exercise on Rev 2 and the first DPS burn on Rev 3. ARIA 3 and 7 staged from Patrick AFB, Florida, into the Atlantic Sector. ARIA 3 provided coverage from launch through insertion and Rev 2 and 3 coverage in the Atlantic, North of Antigua. ARIA 7 launched with ARIA 3 to provide an airborne real time backup in the event ARIA 3 developed problems. ARIA 6, with the ALOTS POD installed, provided photographic coverage of the early launch phase after lift off prior to insertion. ARIA 4 and 5 staged from Ascension Island to the Ascension Sector providing coverage for Rev's 3, 4 and 5 in the broad ocean area of the Atlantic.

ARIA 5 experienced an aircraft engine problem soon after take off. However, the problem was cleared enabling ARIA 5 to proceed to its support area. During Rev 3, ARIA 3 and 4 achieved active USB lock and handover. ARIA 5 failed to achieve 2-way lock during this pass for reasons unknown at this time. However, they had solid track and participated in the handover to ARIA 4 and Ascension USB site.

When the LM failed to achieve a normal DPS BURN over Australia, AOCC was alerted to this contingency situation. AOCC then had to determine new TSP's, look angles and acquisition times for ARIA 4 and 5 in the Ascension Sector. A short time later, the LM did not burn on its' state side pass which further compounded the AOCC problem. AOCC plotted an approximate trajectory from which TSP's, times, and angles

were determined. This information was passed to the aircraft and both ARIA 4 and 5 acquired and tracked during Rev 4. ARIA 4 and 5 were released from further support on Rev 5 because of the extreme range and low elevation angle. Although released, new TSP's were chosen for the return leg to Ascension and ARIA 4 and 5 again acquired and tracked. ARIA 4 tracked for 12 minutes and ARIA 5 tracked for 15 minutes after which they recovered to Ascension. The only preplanned objective not achieved during the mission, was the data transfer to Ascension USB site between Rev 6 and 7, however, this activity has been rescheduled for Antigua USB site on ARIA's return flight to Patrick.

A. F-29, December 17, 1967.

Initial mission briefings for flight crews.

B. January 3, 1968.

Began sterilization of ARIA 1 and 2; final maintenance activity was initiated, and AOCC was placed on mission status.

C. January 6, 1968.

Final mission briefings were conducted for flight crews. Began sterilization of ARIA 4 and 5; final maintenance activity was initiated.

D. January 8, 1968.

MAC C-141 logistics support aircraft arrived at Patrick. Crew briefed on AS-204L mission and their support role in Australia.

E. January 9, 1968.

AOCC manned on a 24-hour basis. ARIA 3 and backup aircraft began sterilization. First simulation with MSFN was conducted. ARIA 1, 2 and C-141 was scheduled to depart. Deployment to staging base was delayed due to mission slippage.

F. January 11, 1968.

AOCC participated in second F-8 day network simulation.

G. January 14, 1968.

ARIA 1, 2 and C-141 departed Patrick AFB for March AFB, California. F-8 through F-4 A/G remoting checks and simulations were conducted while enroute.

H. January 15, 1968.

ARIA 1, 2 and C-141 departed March AFB, California; arrive Hickam AFB, Hawaii.

I. January 16, 1968.

ARIA 1, 2 and C-141 departed Hickam AFB, Hawaii; arrived Townsville, Australia. AOCC participated in third Network Simulations.

J. January 17, 1968.

ARIA 4 and 5 conducted final PMEE calibration checks (comprehensive) prior to deployment.

K. January 18, 1968.

ARIA 1, 2 and C-141 departed Townsville, Australia; arrived Pearce (RAAFB), Perth, Australia. ARIA 4 and 5 departed Patrick AFB; refueled at Ramey AFB. Cape Comm Tech conducted A/G remoting checks to destination at Ascension Island.

L. January 19, 1968.

AOCC conducted a simulation using the Cape 3600 computer to provide real time acquisition messages.

ARIA 4 and 5 arrived at their staging and recovery base, Ascension Island.

M. January 20, 1968.

Final PMEE checks (brief) were conducted by all ARIA at their staging bases; fleet was declared green and can support.

N. January 21, 1968.

Crew rest day.

O. Mission Activities

The delays and holds in the Terminal Count created ARIA's first serious problem on launch day. These holds unfortunately occurred late enough in the count to have occurred after "crew duty day" time had started. The crews for ARIA 3 and 6 were most affected by this delay. The 16 hour crew duty time maximum would become critical late in the evening, however, crew augmentation eliminated the problem and moved the maximum launch delay time to 1230Z on January 23. ARIA 3 and 6 became airborne at 2116Z followed by ARIA 7 at 2117Z. Acquisition occurred at GET 00/02/10. Excellent signal strength was received and solid track was achieved with an LOS at 00/13/09. ARIA 1 and 2 became airborne at 2325Z and proceeded to their TSP's in the Australian Sector. On Rev 2, ARIA 3 acquired at 01/27/35; excellent signal strength was received and solid track was achieved with an LOS at 01/36/28. ARIA 6 proceeded to Bermuda for data pickup from that site which was scheduled for 0130 hours. ARIA 1 in the Australian Sector acquired at 02/21/54 and had LOS at 02/31/54. ARIA 2 acquired at 02/24/01 and had LOS at 02/31/54. ARIA 2 acquired at 02/24/01 and had LOS at 02/34/00. This coverage included the S-IVB passivation exercise.

ARIA 5 became airborne in the Ascension Sector at 0104Z. Shortly after take off, ARIA 5 experienced a fire warning light and low power indication on one engine. The problem diminished and ARIA 5 was able to proceed to it's TSP. On Rev 3, ARIA 3 acquired at 03/10/52 and had carrier on at 03/19/00. ARIA 3 achieved two-way lock and the carrier was turned off at 03/22/00 with a handover to ARIA 4 which had AOS at 03/23/21. ARIA 4 achieved two-way lock and conducted handover to ARIA 5 at 03/28/01. ARIA 5 AOS was 03/28/03 with two-way lock. Carrier was off at 03/21/00 when a handover to Ascension was completed. LOS occurred at 03/39/38.

ARIA 1 in the Australian Sector acquired at 03/54/56, with an LOS at 04/04/55. ARIA 2 acquired at 03/58/53 with an LOS at 04/08/51. At approximately 4 hours in the mission, the first DPS ignition occurred. An automatic shutdown occurred prior to a large thrust build up. This no-burn contingency was passed to ARIA control for information and action. ARIA 3 was released from further support at 0254Z. ARIA Control plotted the approximate trajectory by hand from which the TSP, look angles and times were determined for ARIA 4 and 5. ARIA 4 acquired at 04/56/59 with an LOS at 05/03/54. Two-way lock was achieved even though the maximum elevation angle during the pass was only two degrees above the horizon. ARIA 5 acquired at 05/03/41 with an LOS at 05/11/29. Two-way lock and solid track was achieved.

ARIA Control was given coordinates for Rev 6 which passed over South America with a GET for Antigua LOS as reference. From this plot it was concluded that ARIA 4 and 5 would be over the horizon and normal range for ARIA support. ARIA 4 and 5 were released at 0456Z. Since the upcoming state-side burn would materially increase the altitude of the LM, ARIA Control decided to have ARIA 4 and 5 search for the vehicle even though both had been released. ARIA 4 acquired at 06/28/57 with an LOS at 06/40/54. The signal strength was good with a maximum elevation angle of four degrees. ARIA 5 acquired at 06/34/56 with an LOS at 06/50/38 and good signal strength. Maximum elevation angle was 10 degrees. The planned data transfer to Ascension USB site was cancelled due to conflict with Ascension's pass and the short time remaining for aircraft endurance. ARIA Control was released by network at 0603Z.

SECTION 4 - CONCLUSIONS/RECOMMENDATIONS

4.0 The following specific conclusions and recommendations are drawn from an analysis in the time available.

4.1 COMMAND

A. It is felt that all command objectives were met by the CCATS/RSDP command system. A new command handover procedure was instituted just before Network Simulations and appeared to work satisfactorily with some minor shortcomings.

B. The Remote Site Telemetry Program should be modified to permit the transmission of current CAP words during the period from LFI to ROS, or, the procedure of entering LFI should be abolished. The failure to receive VAL's on command history requests required excessive voice coordination.

4.2 TELEMETRY

A. A complete Network Simulation should be run at an earlier date prior to launch. This would aid in correcting procedural problems and minimize the changes and ISI's that have to be generated the last few days prior to launch.

B. During Network/MCC Interface, all sites should use the program and documentation as specified by NC/IST.

C. During Network Validation, there should be an improved test written in order to checkout Goddard CP and Houston CP for maximum loading. This is in reference to the problem encountered during the mission with main and subframe sync dropouts from all MSFN sites.

4.3 TRACKING

A. Only one source of USB high speed trajectory data was utilized (GYM - Rev 4) and it was somewhat noisy but this can be attributed to low elevation angle. Further evaluation should be conducted on high speed USB processing.

B. "C" band high speed data was utilized from CRO, CAL, WHS and ETR IP. All sources appeared usable but was extremely noisy with the exception of WHS on Rev 4 which was excellent. Most passes where the noise was greatest can be attributed to low elevation angles. The data from CAL-18 and WHS side lobe tracks was not analyzed.

C. Acquisition Messages

No comment can be made pending further investigation of the problem.

D. The SCM format and useage requires re-evaluation. Nominal mission SCM's are a reiteration of what has previously been published in the Instrumentation Support Plan. When a mission goes non-nominal, it has been difficult to make a timely issuance (H-30 minutes) to the sites involved. This requires voice coordination on overcrowded voice circuits.

4.4 COMMUNICATIONS

Communications support for this mission was excellent. However, the following are recommendations which would provide a more efficient operation and/or effective utilization.

A. The KSC Communications Switchers at CDSC were frequently reported as the cause of circuit failures and problems. Since the voice switchers themselves are required in the conduct of trouble-shooting it is recommended that action be taken to insure proper maintenance and operation of these switchers.

B. Apollo 5 is the second mission where end-to-end, definitive validation testing was not conducted on voice circuitry connecting MCC and the KSC area (particularly the MSOB and Launch Complex). A need for such check was recommended in the Apollo 4 Network Controller's Mission Report and is still recommended. Serious consideration should be given to the allocation of a block of time within the Terminal Count to allow voice technicians to make tests from user positions in the MSOB and Launch Complex to user positions in the MCC. It is suggested that this sequenced validation test become part of the pad OCP or TCP.

C. Longline video problems (or suspected problems) were not handled under the same ground rules as other communications problems by KSC. The Communications Service Authorization (CSA) for longline video service is issued for control by

the MCC Communications Controller and all troubles, regardless of their source or location, are to be reported initially to only the Houston Five Toll Test Center (MSC) for action. In at least two cases, video from MCC was interrupted when KSC technicians requested commercial communications servicing agency in that area to break the Houston transmission and place test patterns on the circuit. It is recommended that KSC procedures be initiated to insure that all MCC communications circuitry (to include video longline circuits) which require possible referral to the carrier be reported to the MCC for clearance and action.

D. Each mission has been entered into without spare longlines with which to temporarily restore critical circuits which have failed. No mission, including Apollo 5, has ever been conducted without the need for such spare (or overhead) circuits. As a consequence, circuits can only be restored by taking lower priority circuits from other users. It is recommended that additional longline circuitry connecting Houston with Cape Kennedy be provided on an on-call (temporary) basis to provide for a one-month critical period. At least one spare circuit per 15 dynamic, dedicated circuits is suggested.

E. Definitive network communications information in the form of schematics, routing charts and other essential data is needed by the MCC Communications Controller 30-60 days prior to each mission. Early validation testing and network operations have, in the past, been conducted without knowing the network configuration of teletype, voice nets and data nets. A current chart issued by GSFC reflects, generally, all circuitry available to all users but is not mission-oriented. Mission-oriented charts arrive too late and do not include specifics such as intended usage, channels, nets, etc. It is recommended that this information and planned updates be provided prior to each manned space flight mission.

TABLE 1

Network Configuration for the AS-204 LM Mission

Systems / Facilities	TRACKING							USB		TLM					CMD					DATA PRO-CESSING				COMM				OTHER			REMARKS
	C-band (High Speed)	C-band (Low Speed)	ODOP	Glotrac	USB (High Speed)	USB (Low Speed)	Optical	Ranging	TLM	VHF Links	High-Speed Data	Low-Speed Data	Decoms	Displays	UHF Updata	CMD Destruct	CMD Processor	CMD Remote	DRUL	642B TLM	642B CMD	1218 L/S	ETR Computer	High-Speed Data	Wideband Data	TTY	Voice (SCAMA)	FC Manned	Riometer	SPAN	
PAT	X	X																						X		X	X				
CNV	X		X	X			X								X	X			X					X		X	X				
MLA	X	X																						X		X	X				
TEL IV										X															X	X	X				
CIF										X													X		X	X	X				
MIL					X	X		X	X	X	X	X	X		X		X	X		X	X			X	X	X	X				USB-4
GBI	X	X								X	X		X		X	X		X	X				X	X	X	X				
GBM					X	X		X	X	X	X	X	X				X			X	X		X	X		X	X				USB-4
ANT	X	X									X				X	X		X	X				X	X	X	X	X				
ANG					X	X			X	X	X	X	X				X			X	X		X	X		X	X				
BDA	X	X			X	X		X	X	X	X	X	X		X	X	X	X		X	X			X		X	X				
CYI		X			X	X		X	X	X	X	X	X				X			X	X					X	X		X	X	USB-4
ASC	X									X														X		X	X				
ACN					X	X		X	X	X	X	X	X				X			X	X			X		X	X				TLM-Rec & Rcd only
PRE		X																								X	X				
TAN		X																								X	X				TLM-Rec & Rcd only TLM-Rec & Rcd only
CRO	X	X			X	X		X	X	X	X	X	X	X	X		X	X		X	X	X		X		X	X	X	X	X	
WOM																															642B OR 1218 to be used
GWM					X	X		X	X	X	X	X	X				X			X	X			X		X	X				
HAW		X				X		X	X	X	X	X	X		X		X	X		X	X			X		X	X				
CAL	X	X																								X	X				
GDS					X	X		X	X		X	X	X				X			X	X			X		X	X				C-BAND (LOW SPD) POSTPASS
GYM					X	X		X	X	X	X	X	X				X			X	X			X		X	X				
WHS	X	X																						X		X	X				
TEK					X	X		X	X	X	X	X	X		X		X	X		X	X			X		X	X				FM/FM remoting postmission
RED	X	X			X	X		X	X	X	X	X	X		X		X	X		X	X			X		X	X				
RKV										X		X	X	X	X		X					X				X	X	X			FM/FM remoting postmission
CSQ										X		X	X	X	X		X					X				X	X	X			
ARIA*																										X	X				FM/FM remoting postmission
ATF				X																						X	X				
GTK				X																						X	X				
LIMA																										X	X		X	X	
ARIA 3										X																X	X				
WTN (ENG. EV.)	X				X	X		X	X	X	X	X														X	X				
CNB					X	X		X	X		X	X	X							X	X			X		X	X				

TABLE 2

MISSION APOLLO 5 COMMAND LOAD SUMMARY

Command Loads Generates and Transferred from MCC:	
RTCC generated:	
Prime Site only	9
Prime and Backup Site	22
All Sites	1
CCATS MED generated:	
Prime Site only	2
Prime and Backup Sites	2
TOTAL LOADS	36
HS load transmission (1-RTCC, 4-CCATS)	5
HS loads not received or rejected at site	11
Low Speed ET's not output by MCC	8
Low speed ET's transferred but not received at site	1

APOLLO 5 COMMAND LOADS

A total of 32 command load Types (19 LM, 12 S-IVB and GMTLO) could be generated and transferred by MCC. The following were the AS-204L loads for LM and S-IVB.

LOAD NO.	LM LOADS
20XX	Navigation update (LNV)
21XX	DPS1 burn update (DPB)
22XX	DPS2 burn update (DPB)
23XX	APS1 burn update (APB)
25XX	LMP command update no. 1 (LMP)
26XX	LMP command update no. 2 (LMP)
27XX	LMP command update no. 3 (LMP)
28XX	Time increment update (LTI)
29XX	GET timer update no. 1 (GET)
30XX	GET timer update no. 2 (GET)
31XX	GET timer update no. 3 (GET)
32XX	GET timer update no. 4 (GET)
33XX	Mission phase and timer update no. 1 (MPT)
34XX	Mission phase and timer update no. 2 (MPT)
35XX	Mission phase and timer update no. 3 (MPT)
36XX	Mission phase and timer update no. 4 (MPT)
37XX	Erasable memory update no. 1 (EMU)
38XX	Erasable memory update no. 2 (EMU 2)
39XX	Erasable memory update no. 3 (EMU 3)

LOAD NO.	S-IVB LOADS
40XX	Time Base Update
41XX	Sequence Initiate Update No. 1 (SIU)
42XX	Sequence Initiate Update No. 2 (SIU)
43XX	Sequence Initiate Update No. 3 (SIU)
44XX	Sequence Initiate Update No. 4 (SIU)
45XX	Switch Selector Update No. 1 (SSU)
46XX	Switch Selector Update No. 2 (SSU)
47XX	Switch Selector Update No. 3 (SSU)
48XX	Switch Selector Update No. 4 (SSU)
49XX	Navigation Update (SNU)
50XX	Sequence Initiate Update No. 5 (SIU)
51XX	Sequence Initiate Update No. 6 (SIU)
60XX	GMT Lift Off Update (GMTLO)

TABLE 3

MISSION LOAD TABLE

LOAD	SITE(S)	REV	RESULTS
3701	MIL	Pre-launch	GO - No ET at site GSFC line check in progress.
3801	MIL	Pre-launch	GO
4501	MIL/BDA	Pre-launch	GO/GO
4601	MIL/BDA	Pre-launch	GO/GO
4701	MIL/BDA	Pre-launch	GO/GO
4801	MIL/BDA	Pre-launch	GO/GO
4101	MIL	Pre-launch	GO
4502	RED/CYI	Pre-launch	RED - RSDP RED CYI - CLT SET OUT GSFC
4502R	RED/CYI	Pre-launch	GO - RED CYI - Retransmit GO
4602	RED/CYI	Pre-launch	RED GO - CYI
4702	RED/CYI	Pre-launch	GO/GO
4802	RED/CYI	Pre-launch	GO/GO
4102	CYI/CRO	Pre-launch	GO/GO
4503	HAW	Pre-launch	GO
4603	HAW	Pre-launch	GO
4703	CRO	Pre-launch	GO
4803	CRO	Pre-launch	GO
4103	HAW/TEX	Pre-launch	GO - TEX MCC did not output ET
6001	ALL	Pre-launch	GO - MIL, GBM, CYI LS only - load ECOM TTY tape ANG, ACN, GWM and RED. HSD only - BDA, CRO, HAW, GDS, GYM, TEX - LS not output by MCC.

LOAD	SITES	REV	RESULTS
2301	CRO	1	GO
2501	CRO	1	GO
2601	CRO	1	GO
4604	CRO	1	GO
4704	MIL/BDA	1	GO
4605	RED/CYI	1	RED - FV - TTY VAL - GO CYI CCATS retransmit - VAL REC
2502	TEX/MIL	1	GO
4705	RED/CYI	1	RED load to TTY - GO GO - CYI
2303	CRO/HAW	3	GO - CRO HAW CCATS retransmit loaded TTY - FV - GO HSD line out to HAW
2001	CRO/HAW	3	GO
3401	CRO/HAW	3	GO
2003	MIL	4	TEMP VAL - to load enable PERM VAL
3701	CRO/HAW	4	GO - LS not output by MCC
2301	CRO/HAW	4	GO
3801	CRO/HAW	4	GO - MCC CP recycle cut off TTY
3001	CRO/HAW	4	GO
2301	CRO/HAW	5	GO

TABLE 4

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
PRE	MIL	Single Word Dump #1	X			22 02 41 24.4	BSE	
PRE	MIL	Sector Dump	X			02 41 36.8	BSE	
PRE	MIL	DCA Self Test	X			15 35 17.5	ECOM	
PRE	MIL	All Zeros	X			28.4	GUID	
PRE	MIL	Error Reset	X			36.9	GUID	
PRE	MIL	V	X			45.0	GUID	
PRE	MIL	3	X			53.5	GUID	
PRE	MIL	4	X			59.9	GUID	
PRE	MIL	E	X			15 36 06.3	GUID	
PRE	MIL	EMU #1	X			18.0	GUID	
PRE	MIL	E	X			28.5	GUID	
PRE	MIL	Address/Data	X			36.4	GUID	
PRE	MIL	E	X			48.1	GUID	
PRE	MIL	V	X			56.2	GUID	
PRE	MIL	0	X			15 37 03.0	GUID	
PRE	MIL	1	X			10.3	GUID	
PRE	MIL	N	X			16.7	GUID	
PRE	MIL	0	X			24.4	GUID	
PRE	MIL	1	X			32.1	GUID	
PRE	MIL	E	X			38.5	GUID	
PRE	MIL	0	X			47.9	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
PRE	MIL	1	X			15 37 54.3	GUID	
PRE	MIL	3	X			15 38 01.9	GUID	
PRE	MIL	5	X			08.4	GUID	
PRE	MIL	1	X			16.1	GUID	
PRE	MIL	E	X			23.8	GUID	
PRE	MIL	EMU #2	X			35.9	GUID	
PRE	MIL	E	X			47.7	GUID	
PRE	MIL	Address/Data	X			56.4	GUID	
PRE	MIL	E	X			15 39 07.3	GUID	
PRE	MIL	V	X			15.4	GUID	
PRE	MIL	0	X			22.2	GUID	
PRE	MIL	1	X			28.2	GUID	
PRE	MIL	N	X			34.6	GUID	
PRE	MIL	0	X			42.2	GUID	
PRE	MIL	1	X			48.2	GUID	
PRE	MIL	E	X			54.6	GUID	
PRE	MIL	1	X			15 40 03.6	GUID	
PRE	MIL	3	X			10.4	GUID	
PRE	MIL	5	X			18.1	GUID	
PRE	MIL	1	X			24.1	GUID	
PRE	MIL	E	X			31.3	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
PRE	MIL	V	X			15 40 40.3	GUID	
PRE	MIL	3	X			15 40 46.3	GUID	
PRE	MIL	4	X			52.2	GUID	
PRE	MIL	E	X			58.6	GUID	
PRE	MIL	V	X			16 23 56.6	GUID	
PRE	MIL	3	X			16 24 03.4	GUID	
PRE	MIL	4	X			11.5	GUID	
PRE	MIL	E	X			20.5	GUID	
PRE	MIL	Single Word Dump #1	X			22 05 38.8	BSE	
PRE	MIL	Sector Dump	X			06 08.6	BSE	
PRE	MIL	DCA Self Test	X			20 41.8	EECOM	
PRE	MIL	All Zeros	X			20 54.8	GUID	
PRE	MIL	Error Reset	X			21 02.5	GUID	
PRE	MIL	V	X			21 10.6	GUID	
PRE	MIL	3	X			21 17.4	GUID	
PRE	MIL	4	X			21 25.1	GUID	
PRE	MIL	E	X			21 31.1	GUID	
PRE	MIL	V	X			21 52.0	GUID	
PRE	MIL	2	X			21 59.7	GUID	
PRE	MIL	4	X			22 22 07.0	GUID	
PRE	MIL	N	X			22 13.8	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
PRE	MIL	0	X			22 22 21.9	GUID	
PRE	MIL	1	X			29.2	GUID	
PRE	MIL	E	X			35.6	GUID	
PRE	MIL	1	X			41.9	GUID	
PRE	MIL	7	X			49.6	GUID	
PRE	MIL	6	X			56.9	GUID	
PRE	MIL	4	X			22 23 02.8	GUID	
PRE	MIL	E	X			09.2	GUID	
PRE	MIL	2	X			16.1	GUID	
PRE	MIL	5	X			23.3	GUID	
PRE	MIL	4	X			31.4	GUID	
PRE	MIL	6	X			39.6	GUID	
PRE	MIL	3	X			47.6	GUID	
PRE	MIL	E	X			55.8	GUID	
PRE	MIL	0	X			22 24 04.7	GUID	
PRE	MIL	6	X			11.1	GUID	
PRE	MIL	3	X			17.9	GUID	
PRE	MIL	1	X			25.2	GUID	
PRE	MIL	5	X			31.6	GUID	
PRE	MIL	E	X			39.7	GUID	
PRE	MIL	PRA Seq. #7	X			49.5	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
PRE	MIL	Forward Search	X			22 24 57.2	GUID	
PRE	MIL	V	X			22 43 05.9	GUID	
PRE	MIL	6	X			14.8	GUID	
PRE	MIL	Prime Relay OFF	X			33.0	GNC	
LIFT	OFF					22 48 09.0		
1	MIL	5	X			15.1	GUID	
1	MIL	E	X			16.4	GUID	
1	CYI	SLA Deploy	X			23 09 21.7	BSE	
1	TEX	PRI S-Band OFF	X			230021:22.0	EECOM	
1	TEX	SEC S-Band ON	X			38.3	EECOM	
1	TEX	V	X			00 22 26.7	GUID	
1	TEX	6	X			34.8	GUID	
1	TEX	7	X			42.9	GUID	
1	TEX	E	X			51.0	GUID	
1	TEX	LMP #1 2502	X			00 23 02.6	GUID	
1	TEX	V	X			18.3	GUID	
1	TEX	3	X			27.7	GUID	
1	TEX	3	X			35.8	GUID	
1	TEX	E	X			44.7	GUID	
1	TEX	V	X			00 24 10.8	GUID	
1	TEX	6	X			18.9	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GMD RJ	GMT	F/C	REMARKS
1	TEX	7	X			00:24:34.7	GUID	
2	MIL	E	X			25:43.4	GUID	
2	MIL	LMP #2 - 2602	X			25:53.6	GUID	
2	MIL	V	X			26:06.8	GUID	
2	MIL	3	X			14.0	GUID	
2	MIL	3	X			21.0	GUID	
2	MIL	E	X			27.9	GUID	
3	MIL	DCA Self Test		X		01:58:20.7	EECOM	LM UHF Signal Strength Fluctuating.
3	MIL	DCA Self Test		X		01:58:34.8	EECOM	LM UHF Signal Strength Fluctuating.
3	MIL	DCA Self Test	X			02:01:07.5	EECOM	
3	MIL	PRA Sequence #5	X			54.6	GUID	
3	MIL	Forward Search	X			02:02:01.5	GUID	
3	ANT	SS LOX Vent Closed		X		02:03:14.3	BSE	MIL had TLM LOS.
3	ANT	SS LOX Vent Closed		X		02:03:26.3	BSE	Same as above.

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
3	CRO	Prime Relay Reset		X		02:49:26.0	GNC	LM UHF Signal Strength Fluctuating.
3	CRO	Prime Relay Reset		X		47.7	GNC	Same as above.
3	CRO	Prime Relay Reset	X			02:50:24.8	GNC	
3	CRO	V	X			51:42.5	GUID	
3	CRO	1	X			49.7	GUID	
3	CRO	5	X			57.8	GUID	
3	CRO	N	X			52:05.6	GUID	
3	CRO	5	X			20.0	GUID	
3	CRO	E	X			35.4	GUID	
3	HAW	ERR Reset	X			03:15:40.6	GUID	
3	HAW	V	X			51.3	GUID	
3	HAW	3	X			58.9	GUID	
3	HAW	4	X			03:16:07.5	GUID	
3	HAW	E	X			15.6	GUID	
3	HAW	PRA Sequence #3	X			35.6	GUID	
3	HAW	Forward Search	X			42.4	GUID	
3	TEX	V	X			03:29:36.9	GUID	
3	TEX	2	X			45.3	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
3	TEX	1	X			03:29:51.7	GUID	
3	TEX	N	X			56.4	GUID	
3	TEX	0	X			03:30:04.0	GUID	
3	TEX	1	X			11.0	GUID	
3	TEX	E	X			18.2	GUID	
3	TEX	7	X			26.7	GUID	
3	TEX	6	X			31.0	GUID	
3	TEX	E	X			38.7	GUID	
3	TEX	6	X			46.8	GUID	
3	TEX	0	X			49.4	GUID	
3	TEX	0	X			52.8	GUID	
3	TEX	2	X			56.6	GUID	
3	TEX	5	X			03:31:03.0	GUID	
3	TEX	E	X			09.9	GUID	
3	TEX	V	X			30.3	GUID	
3	TEX	2	X			37.5	GUID	
3	TEX	5	X			41.0	GUID	
3	TEX	N	X			45.2	GUID	
3	TEX	2	X			52.0	GUID	
3	TEX	6	X			56.3	GUID	
3	TEX	E	X			03:32:07.9	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
4	MIL	0	X			03:32:44.6	GUID	
4	MIL	4	X			46.4	GUID	
4	MIL	0	X			48.0	GUID	
4	MIL	0	X			49.8	GUID	
4	MIL	1	X			52.8	GUID	
4	MIL	E	X			03:33:00.0	GUID	
4	MIL	0	X			08.0	GUID	
4	MIL	2	X			09.9	GUID	
4	MIL	0	X			11.6	GUID	
4	MIL	6	X			13.4	GUID	
4	MIL	7	X			15.0	GUID	
4	MIL	E	X			22.3	GUID	
4	MIL	7	X			31.6	GUID	
4	MIL	0	X			34.2	GUID	
4	MIL	0	X			35.5	GUID	
4	MIL	6	X			37.2	GUID	
4	MIL	3	X			38.9	GUID	
4	MIL	E	X			46.2	GUID	
4	MIL	V	X			03:34:22.8	GUID	
4	MIL	2	X			26.7	GUID	
4	MIL	1	X			28.4	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
4	MIL	N	X			03:34:35.6	GUID	
4	MIL	0	X			39.5	GUID	
4	MIL	1	X			42.5	GUID	
4	MIL	E	X			49.7	GUID	
4	MIL	1	X			52.7	GUID	
4	MIL	6	X			54.5	GUID	
4	MIL	3	X			56.2	GUID	
4	MIL	1	X			57.5	GUID	
4	MIL	E	X			03:36:06.5	GUID	
4	MIL	1	X			12.9	GUID	
4	MIL	1	X			15.0	GUID	
4	MIL	0	X			17.6	GUID	
4	MIL	3	X			19.4	GUID	
4	MIL	1	X			21.0	GUID	
4	MIL	E	X			54.9	GUID	
4	MIL	E	X			03:37:11.0	GUID	
4	MIL	1	X			20.0	GUID	
4	MIL	6	X			20.9	GUID	
4	MIL	3	X			22.2	GUID	
4	MIL	2	X			23.0	GUID	
4	MIL	E	X			49.0	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
4	MIL	4	X			03:37:58.9	GUID	
4	MIL	5	X			03:38:00.2	GUID	
4	MIL	7	X			01.9	GUID	
4	MIL	6	X			03.3	GUID	
4	MIL	1	X			05.9	GUID	
4	MIL	E	X			11.4	GUID	
4	MIL	E	X			18.3	GUID	
4	MIL	1	X			27.7	GUID	
4	MIL	6	X			28.6	GUID	
4	MIL	3	X			29.8	GUID	
4	MIL	3	X			31.0	GUID	
4	MIL	E	X			39.7	GUID	
4	MIL	0	X			46.5	GUID	
4	MIL	1	X			47.8	GUID	
4	MIL	3	X			49.0	GUID	
4	MIL	0	X			54.2	GUID	
4	MIL	6	X			55.5	GUID	
4	MIL	E	X			03:39:01.0	GUID	
4	MIL	V	X			23.6	GUID	
4	MIL	3	X			28.7	GUID	
4	MIL	0	X			32.6	GUID	
4	MIL	E	X			39.0	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
4	CRO	V	X			04:21:37.0	GUID	
4	CRO	7	X			46.0	GUID	
4	CRO	2	X			48.2	GUID	
4	CRO	E		X		56.7	GUID	LM UHF Signal Strength Fluctuating.
4	CRO	E	X			04:22:15.9	GUID	
4	CRO	2	X			27.0	GUID	
4	CRO	E	X			34.7	GUID	
4	CRO	MPT #2 - 3401	X			44.0	GUID	
4	CRO	V	X			57.3	GUID	
4	CRO	3	X			59.8	GUID	
4	CRO	3	X			04:23:02.4	GUID	
4	CRO	E	X			09.7	GUID	
4	HAW	Prime Relay OFF		X		04:47:32.0	GNC	LM UHF Signal Strength Fluctuating.
4	HAW	Prime Relay OFF		X		04:47:41.0	GNC	Same as above.
4	HAW	Prime Relay OFF	X			04:48:06.6	GNC	
4	HAW	BATT #5 B/U	X			37.3	EECOM	
4	HAW	Master Arm ON	X			55.6	EECOM	
4	TEX	AGS SEL	X			05:01:48.7	GNC	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
4	TEX	AGS Select	X			05:01:49.5	GUID	
4	TEX	PGNS SEL	X			05:02:12.7	GNC	
4	TEX	Prime Relay Reset				17.0	GNC	PBT Hang - Up MCC.
4	TEX	Prime Relay Reset	X			25.2	GNC	
4	TEX	V	X			05:04:59.7	GUID	
4	TEX	2	X			05:05:07.7	GUID	
4	TEX	1	X			05.0	GUID	
4	TEX	N	X			11.8	GUID	
4	TEX	O	X			13.9	GUID	
4	TEX	1	X			15.2	GUID	
4	TEX	RCS Main A Closed	X			18.8	GNC	
4	TEX	E	X			21.7	GUID	
4	TEX	3	X			29.8	GUID	
4	TEX	7	X			31.0	GUID	
4	TEX	2	X			32.4	GUID	
4	TEX	E	X			39.7	GUID	
4	TEX	O	X			45.6	GUID	
4	TEX	E	X			52.9	GUID	
5	MIL	V	X			05:12:56.4	GUID	
1	1	7	X			05:13:05.0	GUID	
5	MIL	6	X			06.3	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
5	MIL	E	X			05:13:12.3	GUID	
5	MIL	LM NAV - 2003	X			18.2	GUID	
5	MIL	V	X			55.7	GUID	
5	MIL	3	X			05:14:00.4	GUID	
5	MIL	3	X			01.7	GUID	
5	MIL	E	X			07.7	GUID	
5	CRO	EMU #1 - 3701	X			05:56:58.0	GUID	
5	CRO	E	X			05:57:07.8	GUID	
5	CRO	A/D	X			15.8	GUID	
5	CRO	E	X			27.5	GUID	
5	CRO	A/D	X			36.3	GUID	
5	CRO	E	X			50.2	GUID	
5	CRO	RCS Main B Closed	X			05:58:23.2	GNC	
5	CRO	RCS Main B Closed Reset	X			39.4	GNC	
5	CRO	RCS Main A Open	X			05:59:02.4	GNC	
5	CRO	RCS Main A Open Reset	X			06.2	GNC	
5	CRO	Prime Relay OFF	X			16.0	GNC	
5	CRO	V	X			29.0	GUID	
5	CRO	6	X			30.4	GUID	
5	CRO	7	X			31.7	GUID	
5	CRO	E	X			39.0	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
5	CRO	3	X			05:59:48.4	GUID	
5	CRO	7	X			49.7	GUID	
5	CRO	4	X			51.8	GUID	
5	CRO	E	X			59.0	GUID	
5	CRO	V	X			06:00:08.9	GUID	
5	CRO	3	X			10.0	GUID	
5	CRO	3		X		11.0	GUID	TM Drop-Out Downlink
5	CRO	E	X			31.0	GUID	
5	CRO	V				40.4	GUID	Suspect Wide-Band Data Drop-Out
5	CRO	6				41.3	GUID	
5	CRO	7				42.6	GUID	
5	CRO	V	X			06:01:14.0	GUID	
5	CRO	6	X			22.2	GUID	
5	CRO	7	X			23.0	GUID	
5	CRO	E	X			31.0	GUID	
5	CRO	3	X			39.7	GUID	
5	CRO	7	X			41.7	GUID	
5	CRO	5	X			42.3	GUID	
5	CRO	E		X		51.2	GUID	Downlink TM Drop-Out.
5	CRO	V	X			06:02:03.6	GUID	
5	CRO	X				05.3	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
5	CRO	3	X			06:02:06.6	GUID	
5	CRO	E	X			14.3	GUID	
5	CRO	EMU #2 - 3801	X			29.4	GUID	
5	CRO	E	X			39.8	GUID	
5	CRO	A/D	X			55.8	GUID	
5	CRO	Clear	X			06:03:34.8	GUID	
5	CRO	1		X		50.5	GUID	LM UHF Signal Strength Fluctuating.
5	CRO	3		X		52.7	GUID	
5	CRO	3		X		54.0	GUID	
5	CRO	7	X			56.5	GUID	
5	CRO	Clear	X			06:04:20.8	GUID	
5	CRO	1		X		30.6	GUID	Downlink TM Drop-Out.
5	CRO	3	X			48.0	GUID	
5	CRO	3	X			48.5	GUID	
5	CRO	7	X			49.4	GUID	
5	CRO	E	X			58.8	GUID	
5	CRO	3	X			06:05:04.7	GUID	
5	CRO	5	X			06.5	GUID	
5	CRO	E	X			24.8	GUID	
5	CRO	E	X			32.4	GUID	
5	CRO	3		X		41.0	GUID	Low Signal Strength

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
5	CRO	7		X		06:05:42.7	GUID	Low Signal Strength.
5	CRO	5				43.6	GUID	
5	CRO	5	X			06:06:07.8	GUID	
5	CRO	E	X			15.5	GUID	
5	CRO	Clear		X		28.7	GUID	Low Signal Strength.
5	HAW	V	X			06:36:40.8	GUID	
5	HAW	6	X			48.9	GUID	
5	HAW	7	X			49.8	GUID	
5	HAW	E		X		57.0	GUID	Low Signal Strength.
5	HAW	E	X			06:27:18.3	GUID	
5	HAW	1	X			29.0	GUID	
5	HAW	7	X			30.7	GUID	
5	HAW	6	X			32.4	GUID	
5	HAW	E	X			40.9	GUID	
5	HAW	V	X			49.0	GUID	
5	HAW	3	X			55.9	GUID	
5	HAW	3	X			57.2	GUID	
5	HAW	E	X			06:28:04.8	GUID	
5	HAW	V	X			14.7	GUID	
5	HAW	6	X			17.6	GUID	
5	HAW	7	X			18.9	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
5	HAW	E	X			06:28:25.8	GUID	
5	HAW	7	X			35.0	GUID	
5	HAW	4	X			38.0	GUID	
5	HAW	E	X			45.0	GUID	
5	HAW	V	X			54.3	GUID	
5	HAW	3	X			55.6	GUID	
5	HAW	3	X			56.5	GUID	
5	HAW	E	X			06:29:05.0	GUID	
5	HAW	V	X			15.3	GUID	
5	HAW	6	X			17.4	GUID	
5	HAW	7	X			19.5	GUID	
5	HAW	E	X			34.5	GUID	
5	HAW	7	X			45.0	GUID	
5	HAW	6	X			46.8	GUID	
5	HAW	E	X			54.0	GUID	
5	HAW	V	X			06:30:07.7	GUID	
5	HAW	3	X			10.3	GUID	
5	HAW	3	X			12.0	GUID	
5	HAW	E	X			23.5	GUID	
5	HAW	PRA Sequence #5	X			39.3	GUID	
5	HAW	Forward Search	X			47.9	GUID	

MCC EXECUTES

REV	STA	CMD	S/C VER	S/C RJ	GND RJ	GMT	F/C	REMARKS
5	HAW	RCS Main B Open	X			06:31:07.0	GNC	
5	HAW	AGS Select	X			16.9	GUID	
5	HAW	PRA Start		X		28.8	GUID	Low Signal Strength
5	HAW	PRA Start	X			06:32:04.2	GUID	
5	HAW	Engine Start	X			24.8	GNC	
5	HAW	Engine Start	X			27.8	GNC	
5	HAW	Engine Start	X			30.4	GNC	
5	TEX	Prime Relay Reset			X	06:43:35.4	GNC	TEX UHF CMD Carrier not up.
5	TEX	PGNS Select		X		06:46:18.6	GNC	TEX not in acquisition.
7	HAW	SEC S-Band OFF		X		09:50:53.0	EECOM	Transmit in the Blind.
7	HAW	Prime S-Band Enable		X		59.5	EECOM	Same as above.
7	HAW	Prime S-Band OFF		X		09:51:30.7	EECOM	Same as above.
7	HAW	SEC S-Band ON		X		42.4	EECOM	Same as above.

TABLE 5

TELEMETRY FORMATS

1.0 ALDS Line Format 1 (ALDS F1). This format was applicable to ALDS and represented the WBD requirements from the ETR and KSC. The format was transmitted to MCC at those times when the sites had TLM acquisition of the vehicles. This format applies to all mission phases.

2.0 High Speed Data (MSFN) Formats 1 through 10.

2.1

Format	Data Source	
1	IU and LM	Required during launch to insertion (BDA and RED).
2	IU and LM	Required during insertion to end of IU monitoring (all HSD stations).
3	LM	Required during LM maneuver and update to mission termination (all HSD stations).
4	LM	LM EECOM contingency format.
5	LM	LM PGNS contingency format.
6	LM	LM CES contingency format.
7 through 10	LM	Contingency formats for use in event of PAM gate failure.

TABLE 6

REV	STA	FMT	VEH	LINK	DATA QUALITY
1	ALDS	WBD	SI, S-IVB, IU, LM	VHF	During L/O until LOS the data was excellent. No sync problems.
1	MIL	1	IU, LM	VHF	Back up for ALDS - data was good.
1	BDA	1	IU, LM	VHF	Good.
1	RED	1	IU, LM	VHF	TLM computer was Red, no H/S TLM data.
1	CYI	2	IU, LM	VHF	Good.
1	TAN	N/A	S-IVB, IU	VHF	Record only. S-IVB dump was good.
1	CRO	3/2	IU, LM,	VHF	Random data dropouts on IU and LM, but useable.
			S-IVB	VHF	Did not observe S-IVB dump.
1	GYM	2	IU, LM	VHF	Constant dropouts on IU due to fading - LM was solid.
1	TEX	2	IU, LM	VHF	IU was noisy due to fading - LM was good.
2	ALDS	WBD	S-IVB, IU LM	VHF	Data was good.
2	MIL	2	IU, LM	VHF	Backup for ALDS - data was good.
2	BDA	2	IU, LM	VHF	Data was good.
2	RED	2	IU, LM	VHF	IU was marginal, LM data was good.
2	CYI	2	IU, LM	VHF	LM data was noisy (marginal).

REV	STA	FMT	VEH	LINK	DATA QUALITY
2	TAN	N/A	S-IVB, IU	VHF	S-IVB dump was marginal.
2	CRO	2	IU, LM	VHF	Good data.
2	HAW	2	IU, LM	VHF	Good data. S-IVB dump was good.
2	GDS	3	LM	USB	Good data.
2	GYM	3	LM	VHF	Good data.
2	TEX	3	LM	VHF	Good data.
3	MIL	3	LM	VHF	Good data.
3	ALDS	WBD	S-IVB, IU	VHF	Good data.
3	BDA	3	LM	VHF	Some dropouts experienced. Good.
3	RED	3	LM	VHF	Data good.
3	ACN	3	LM	VHF	DECOM lost lock on LM momentary. Good.
3	CRO	3	LM	VHF	Noisy data, random M/S sync loss. Usable.
3	HAW	3	LM	VHF	Good data, CP PBT Clear caused loss of data.
3	GDS	3	LM	USB	Good data.
3	GYM	3	LM	VHF	Good data.
3	TEX	3	LM	VHF	Good data.
4	ALDS	WBD	S-IVB, IU	VHF	Noisy but usable.
4	MIL	3	LM	VHF	Good data.
4	ANG	3	LM	VHF/USB	Both downlinks had dropouts, due to elevation. H/O.
4	ANT	WBD	LM	VHF	To backup ANT VF/F, good data.
4	ACN	3	LM	VHF/USB	Both downlinks were unusable, bad.
4	CRO	3	LM	VHF	Good data.

REV	STA	FMT	VEH	LINK	DATA QUALITY
4	GWM	3	LM	VHF	Bad, CLT's at Goddard could not lock on data.
4	HAW	3	LM	VHF	Random sync dropouts M/S, useable.
4	GDS	3	LM	USB	Noisy data (marginal).
4	GYM	3	LM	VHF	Good data.
4	TEX	3	LM	VHF	Good data - CP did four PBT clears causing loss of data.
5	ALDS	WBD	S-IVB/IU	VHF	Marginal due to elevation.
5	MIL	3	LM	VHF	Marginal due to elevation.
5	ANG	3	LM	USB	Marginal due to elevation.
5	ANT	WBD	LM	VHF	H/O to backup site marginal.
5	ACN	3	LM	VHF/USB	Both downlinks noisy, marginal.
5	CRO	3	LM	VHF	Noisy data. Random dropouts M/S sync. Marginal.
5	GWM	3	LM	USB/VHF	USB noisy switched to VHF solid, random dropouts M/S sync.
5	HAW	3	LM	VHF	Good data.
5	GYM	3	LM	VHF	Dropouts A/G - useable. GYM was the last site to see a useable signal.
					Excellent - No dropouts.
					Good - Minimum dropouts.
					Marginal - Useable but excessive dropouts.
					Bad - Unusable.