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APOLLO EXPERIENCE REPORT - ENGINEERING AND ANALYSIS MISSION SUPPORT

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16. Abstract

The tasks performed by the team of specialists that evaluated hardware performance during prelaunch checkout and in-flight operation are discussed. The organizational structure, operational procedures, and interfaces as well as the facilities and software required to perform these tasks are discussed. The scope of the services performed by the team and the evaluation philosophy are described. Summaries of problems and their resolution are included as appendixes.

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SUMMARY

A major task of the mission evaluation team was the real-time identification and analysis of the problems that occurred during Apollo missions. This task was performed by a team of specialists whose combined experience in a technological discipline or a particular system extended from the initial design phase through the development and testing phases. The team was selected from NASA and contractor organizations and operated as an entity under a NASA team manager who was a member of the Apollo Spacecraft Program Office. Contractor senior engineering managers, who had immediate access to their own company personnel and facilities, assisted the team manager. The team provided engineering and analysis support to the Mission Control Center through the Apollo Spacecraft Program Office manager. Following the Apollo 13 mission, the team was also responsible for assisting the NASA John F. Kennedy Space Center in resolving the problems that occurred during the checkout of the Apollo spacecraft and experiment hardware after the space vehicle had been moved from the Vehicle Assembly Building to Launch Complex 39.

INTRODUCTION

As the Apollo missions grew in duration and complexity, the exposure of crewmen and hardware to space-travel problems increased. A means was needed for supporting launch operations and mission operations in the solution of these problems as they occurred at the launch pad and during flight. To help resolve real-time problems within the allowable time, a team of specialists was established. The organization of this team, its communication network, and actual incidents and successes that characterized team operations are described in this report.

MISSION EVALUATION PLANNING

The concept of a team of specialists to help solve mission problems in real time first evolved during the Gemini Program. A mission evaluation plan, published in August 1968, formally established the mission evaluation team, which provided engineering and technical support to the Mission Control Center (MCC) throughout each

Apollo mission. The document outlined the reporting requirements of the Apollo Spacecraft Program Office (ASPO) and the organizational structure and interfaces of the NASA Lyndon B. Johnson Space Center (JSC) (formerly the Manned Spacecraft Center (MSC)). A supplement that defined the specific evaluation tasks and personnel assignments was issued for each mission. Appendix A is the supplement published for the Apollo 14 mission. The team plans and assignments for the Apollo 4 to 7 missions, made before the publication of the formal plan, were documented in evaluation instructions that contained essentially the same information as did the basic plan and supplements

Although the original intent of the individual mission evaluation plan was to provide the assignments and to define the responsibilities for personnel participating in the in-flight and postflight mission evaluation, it later became evident that other mission-related information had a distribution similar to that of the plan. Consequently, many similar items were incorporated into the plan to reduce the number of separate documents distributed for each mission; for example, the table containing the telemetry data summary (appendix A) had been published separately. As the process for developing the postmission reports evolved, the report editing, review procedure, and schedule requirements were also included in the mission evaluation plan.

ORGANIZATION

A group of specialists was assigned to each engineering discipline necessary for a mission evaluation. The organizational structure of the overall mission evaluation team is shown in figure 1 for a single typical shift. The evaluation team provided support 24 hours a day during the mission, using three shifts of personnel. The specialists were organized under individual shift team leaders (one for each discipline) for each of three daily shifts. All teams reported to a NASA shift manager (also called the team leader) who was responsible to the evaluation team manager, both of whom were members of ASPO. The specific disciplines represented for the spacecraft systems were telecommunications, crew systems, electronic systems, propulsion and power, guidance and control, structures and mechanics, and thermal control. In addition, there were specialists for the Apollo lunar surface experiments package (ALSEP); scientific instrument module (SIM) experiments; the lunar roving vehicle (LRV); safety, reliability, and quality assurance; and flightcrew training. Each shift team of specialists (selected from contractor and NASA organizations) worked as a unit under a NASA team leader (fig. 1) who directed team efforts, resolved problems, scheduled evaluation tasks to meet time constraints, coordinated with other team leaders to ensure that resolutions or recommended actions did not jeopardize other systems, and reviewed and approved the systems evaluations (made every 2 hours) and the daily summary reports. Examples of these reports are included as appendix B.

Corresponding teams of specialists were located in a mission support room at each of the two spacecraft contractor facilities. The efforts of each support team were coordinated through a contractor senior engineering manager, who was assigned to the mission evaluation team and worked directly with the shift manager and the evaluation team manager.

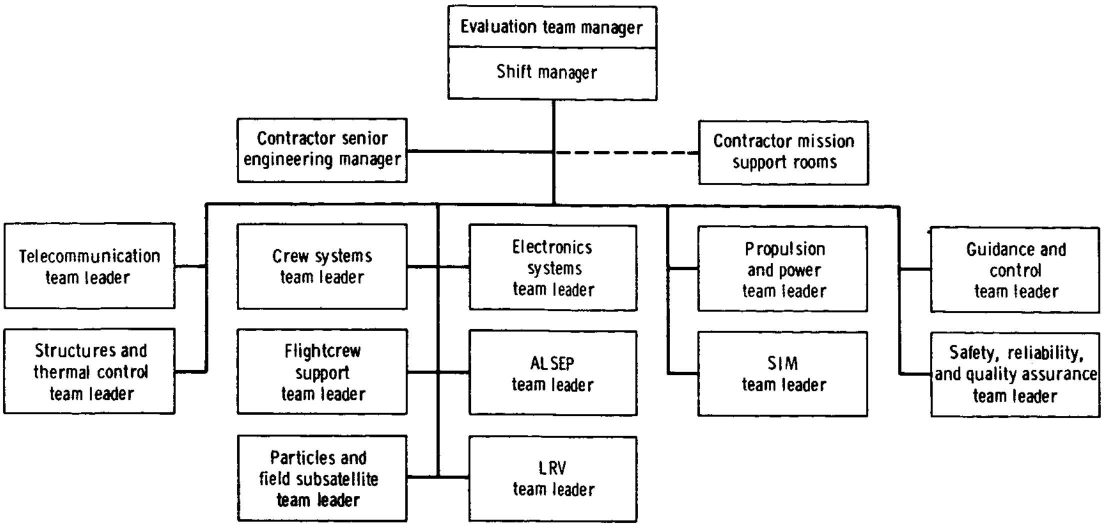

Figure 1.- Mission evaluation team organization for a typical shift.

As a result of the aborted Apollo 13 mission, major changes to the mission evaluation team were made. An investigation team recommended that MSC subsystem personnel help resolve launch-site vehicle-checkout problems. Because sending numerous experts to the launch site in after-the-fact investigations would have fragmented the overall mission effort, the scope of the mission evaluation team was broadened to include prelaunch surveillance. Additional requirements and disciplines for the prelaunch checkout were added to the mission evaluation plan. Following this action, the period of responsibility included continuous coverage from the beginning of the integrated systems tests at the launch pad to mission termination.

Specialists for the SIM, the particles and fields subsatellite, and the LRV were added to the team for the Apollo 15 mission. The mission evaluation team interfaced with the MCC through the ASPO manager or his designated representative in the spacecraft analysis (SPAN) room. This room was also manned by flight control personnel who, in conjunction with ASPO personnel, developed the requirements for many of the evaluation tasks performed by the mission evaluation team.

EVALUATION FACILITIES AND SUPPORT

Each team had assigned positions in the mission evaluation room (fig. 2), where the major portion of the evaluation work was done, and had areas outside the room for additional support personnel. Each position in the mission evaluation room was capable of monitoring 14 voice circuits at any time. These circuits were connected to the NASA John F. Kennedy Space Center (KSC) checkout circuits during preflight operations and to MCC circuits during the mission. Any 3 of the 14 circuits could be relayed to the contractor mission support rooms.

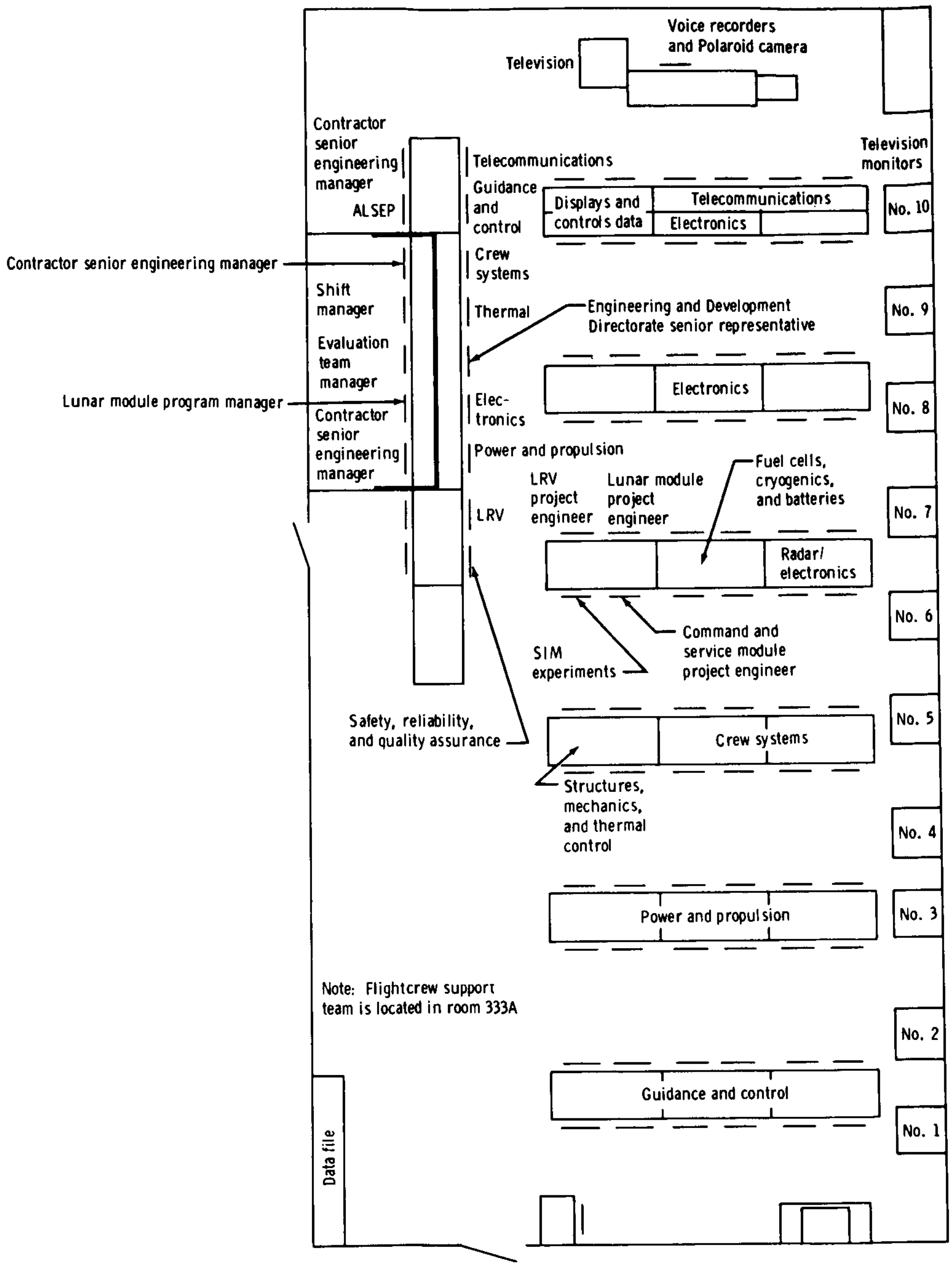

Figure 2.- Mission evaluation room.

Communications through active direct lines were provided between KSC, the mission evaluation room, and the MCC. The Apollo chief engineer circuit (fig. 3) was used for coordination with the launch center during preflight operations and for coordination with the ASPO manager's representative in the SPAN room of the MCC during mission operations. Two additional direct lines between the mission evaluation room and the representative of the ASPO manager's representative in the SPAN room were used to coordinate the evaluation requests and replies with the manager's representative.

Each team leader in the mission evaluation room had an intercommunication system that linked the teams with their support room personnel. Teletypewriter and facsimile facilities for communicating with the launch center and with contractor mission support rooms also were provided.

Flight data received by the Manned Space Flight Network (MSFN) were processed by the MCC. The processed data were displayed in real time on closed-circuit television in the MCC and the mission evaluation room. The display capability for the mission evaluation team, which was limited originally to 4 lines, had been increased to 12 lines by the time of the Apollo 15 mission because of the increased need for data as well as the increased reliance on the evaluation capability in the evaluation room.

Upon request, all the data recorded in the MCC were made available to the mission evaluation team. Also, if required for special evaluations during the mission, any data received at MSC could be processed on an expedited basis. Summary messages, which contained selected systems data, were telegraphed to the contractor support rooms approximately every hour throughout the mission.

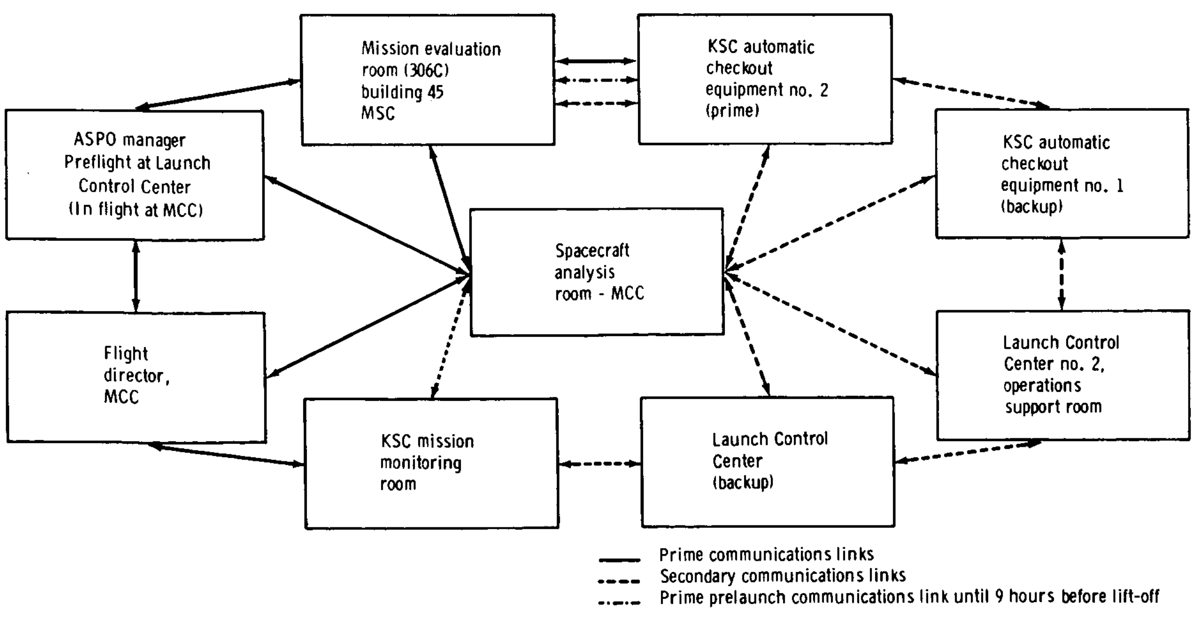

Figure 3.- Apollo chief engineer circuit.

Normally, data for use in the evaluation of preflight problems were processed at the launch center and transmitted by facsimile to the mission evaluation room. However, preflight checkout data could be sent to and processed by MSC. The team manager could request the visual display of launch center data in the mission evaluation room.

PREFLIGHT OPERATIONS

Team operations were initiated at the time of vehicle checkout at the launch pad. During the preflight checkout period, testing was monitored in the mission evaluation room by a NASA shift manager. Participation by team specialists was optional during most checkout periods; however, a representative from each technical discipline was on call at all times. Participation was mandatory during the countdown demonstration test conducted as the final major prelaunch test before each mission. Also, preflight testing was monitored in the contractor mission support rooms.

When an evaluation action request (fig. 4) was received from the launch center, the shift manager requested the responsible team leader, the project engineer, the contractor senior engineering manager at MSC, and, if appropriate, a spacecraft project engineer to initiate the required action. In addition, the appropriate program office manager was notified of the problem. A copy of the request was transmitted to the contractor mission support room.

The team leader was responsible for the coordination of the technical content in the written response (fig. 5). The shift manager ensured that both contractor and program management were in agreement with the response. When MSC initiated an action request, the request was processed on an MSC request form (fig. 6) and transmitted to KSC.

Examples of problems evaluated during the preflight checkout period are as follows.

1. During the Apollo 14 checkout, a leaking weld joint was found after a cryogenic oxygen line had been bumped by a technician. Investigation was required to develop a rationale to prove that no generic problem existed that could affect other joints or welds. In addition, a repair technique had to be developed, tested, and implemented.

2. After a lightning discharge near the Apollo 15 vehicle, the mission evaluation team was made responsible for defining spacecraft retest requirements. An existing set of retest requirements was reviewed and modified and, after approval by MSC management, was supplied to KSC for implementation.

3. As a result of three motor-operated-switch failures, KSC requested criteria for ensuring that the Apollo 15 switches were acceptable. Analyses of the available data and the failed switches provided the criteria for acceptance testing. Application of these criteria to the data collected during a retest of the motor switches resulted in replacement of one switch before the flight.

A summary of the Apollo 15 preflight requests and responses between the mission evaluation team and KSC is included as appendix C.

KSC REQUEST

REQUEST ORG. LS-ENG-32	CONTROL NUMBER KL-33
ACTION REQ'D BY (TIME) EST: 16:00 (KSC) 6-14-71	REQUESTER B. Lang

SUBJECT: Back Flow of the -3100 High Pressure O_2 Module During the D/S GOX Check Valve Flow Test. (Ref. TCN LC-168)

CONCURRENCE

SYS. SPEC. CONT.

PROJECT ENGR.

RASPO.

One of the D/S GOX check valve flow tests will be with the D/S GOX tanks pressurized to 1000 psig and the cabin repress valve open for 2 minutes. The pressure on the upstream side of the -3100 module will drop to approximately 700 psia and the volume of gas between the -3100 module and the HI PLSS O_2 fill valve will flow backwards through the -3100 module.

GAC ECS subsystems indicated per telecon that since the -3100 reg is open at 1000 psia and that the volume between the -3100 module and the HI PLSS O_2 fill valve is very small, the back flow condition in question is acceptable and will not be detrimental to the -3100 reg module.

We would like to know if you concur that this condition is acceptable. Your response to this question is requested by 16:00 on 6-14-71.

We would also like to know the criteria for a back flow condition that would be detrimental to either the -3100 module or the -3392 module. Your response to this question is requested by 7-6-71.

REF. IDR.

MSC Form 430C (Oct 70) NASA — MSC

Figure 4.- John F. Kennedy Space Center prelaunch evaluation request.

MSC RESPONSE

CONTROL NUMBER KL-33	RESPONSE ORG. EC

The -3100 high pressure module has a 5nom./18 absolute micron filter in its inlet and outlet. Therefore, reverse flow of test gas will not be detrimental to the performance of this module.

The -3392 high pressure module has no outlet filters and therefore is susceptible to [redacted] downstream contamination which might enter into the module during reverse flow.

The O_2 check valve test would cause the -3100 downstream gas pressure to drop from 1000 psia to approx. 700 psia, due to the small volume and the pressure change rate of approx. 2 min., The gas velocity is very low.

You are advised that this approval of reverse flow for the -3100 module is for LM-10 only for the specified tests as outlined in TCN LC-168.

Normal servicing and deservicing procedures for the descent and ascent O_2 tanks should be designed to assure that back-flow does not occur in either module.

With regard to criteria for back flow conditions, [redacted] KSC should advise MSC of conditions under which back flow would result and MSC would then advise if acceptable.

APPROVAL

M.E. MGR. E Salbon
TIME 6/15/71 15:50

TEAM LDR.
TIME [signature]

CONT. SR. REP. R. Monaco 6-15-71
TIME 14 45 CST

RESPONDER J. Brady

CHIEF ENGINEER, NASA TIME	CHIEF ENGINEER, CONT. TIME	RASPO TIME

MSC Form 438D (Oct 70)

NASA — MSC

Figure 5.- Manned Spacecraft Center evaluation response.

MSC REQUEST

REQUEST ORGANIZATION MER-PT-EP	CONTROL NUMBER MC-10
ACTION REQ'D BY TIME (EST): ~~2300~~ (KSC) PARTIAL S/C REMAINDER ASAP AFTER THAT	REQUESTER S L. Owens 1630 5/25/71

SUBJECT: IDR050 and IDR051

APPROVAL

MISS. EVAL. MGR. 1655 5/25/71

TEAM LEADER 1650 5/25/71

CONTR. REP. NR 1655 5/25/71

Question #1

During troubleshooting on IDR 050. Time 1900 to 2100 EDT - 5/23. Please advise S/C oxygen heater configuration. Believed to be auto on all heaters. During above time period, analysis of current changes, when oxygen heaters cycled on and off in auto, should show if O_2 Tk 1 had 3 or 2 operating heaters. If 3 heaters ≈10 amps, this means that s/c switch in auto does interface correctly to a correctly wired cryo control box. If data shows only 2 heaters, problem could still be in switch or box.

Recommend measurements SC0092X,93X,GC5025c,29c

Question #2

During fuel cell operations troubleshooting on IDR050. Oxygen Tank #1 heaters were in auto - oxygen tank #2 heaters were placed in off - and heaters cycled in auto. Approx. time 0300 + 00900 EDT 5/23. A check of same data in Question #1 should also verify or disprove 3 heaters were working in auto mode. Look for current increase of about 5 amps for 3 heaters.

Recommend measurements SC0096X and 98X be added to data request so Tank #3 oxygen heater cycles will not confuse data analysis.

REF. IDR.

MSC Form 438A (Oct 70) NASA — MSC

Figure 6.- Manned Spacecraft Center evaluation request.

MISSION OPERATIONS

The original mission evaluation concept was to supply technical support by means of verbal inputs to MCC personnel. After the unmanned Apollo flights, the concept was changed to provide written requests to the evaluation team and responses to the ASPO manager's representative, who was stationed in the SPAN room of the MCC. Appendix D is a typical operation plan (in this instance, for Apollo 16) for SPAN room personnel. Action requests were initiated by a member of the flight control team or by the ASPO manager in the MCC on the form shown in figure 7; requests from the mission evaluation team to the MCC were initiated on the form shown in figure 8. These requests produced a disciplined effort and enabled performance of an ASPO management review before submittal to the flight director. When responses had to be expedited, they were given verbally to the ASPO manager or his representative, then logged. If required, an action request form was prepared after the fact.

In addition to providing formal request and response items to the flight director, the team provided periodic systems reports (usually every 2 hours) and a daily report. Both reports (appendix B) were distributed to the appropriate levels of management. The team manager also briefed the program manager on all significant areas of concern before major mission milestones.

The following examples are representative of the many unexpected problems that occurred during Apollo missions and of the resolution of such problems. The mission evaluation team responded to approximately one request for each hour of elapsed mission time.

1. When the cryogenic oxygen supply was lost during the Apollo 13 mission, the mission evaluation team, through the MCC SPAN room, became the focal point for providing alternate procedures for using the lunar module as a lifeboat. Because of its experience and training in the evaluation of unexpected problems, the team played a major role in the successful return of the Apollo 13 crewmen.

2. The Apollo 14 crewmen required six attempts to achieve a satisfactory docking. This problem required resolution before the spacecraft could be committed to a lunar landing. The team developed special troubleshooting procedures that the crewmen performed. The team supplied alternate methods of undocking before descent and of docking after lunar rendezvous. A complete briefing of these alternatives was presented to the mission director before committing the mission to a lunar landing. Because the docking system operated satisfactorily, procedures to circumvent such docking problems were not required. To facilitate return of the docking probe for analysis, the team provided a procedure and established a location for stowing the probe in the command and service module for entry and landing.

3. The Apollo 15 crewmen reported that the service propulsion system "thrust on" light was illuminated during transposition and docking. As a result, the team was requested to appraise the situation and determine a safe way to perform the lunar-orbit-insertion maneuver. A troubleshooting procedure was developed, and the fault was determined to be a short circuit on the downstream side of a switch. With the problem identified, an alternate procedure was developed for engine operation, thereby enabling the crewmen to complete the mission as planned.

USE BLACK BALLPOINT PEN	SPAN / MISSION EVALUATION ACTION REQUEST	USE BLACK BALLPOINT PEN

TIME (T-MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER
21 + 54	G, N, and C	45	C-24

ACTION REQD BY (TIME): ASAP — REQUESTER ALDRICH

SUBJECT:

It is requested that actual spacecraft circuitry be tested to determine whether a short on the high (+) side of propellant control pilot valve solenoids will cause a visibly lower illumination of the EMS SPS thrust light than the illumination resulting from having the SPS thrust switch in "DIRECT ON". Delta V thrust switch should remain open for this evaluation.

APPROVAL
FOD REP /s/ A. A. TIME :
SPAN MGR /s/ SHS TIME :

RESPONSE:

1. Testing was not accomplished in S/C. It was done at Autonetics using an EMS and simulated SPS solenoid valve driver CKTS.

2. Purpose of test was to determine the minimum voltage level at which a change in intensity level is discernable.

3. Results indicate that a voltage drop of 0.3V on the ground side of the light was adequate to cause change of intensity. The voltage drop that would occur across the solenoid is approx 0.4 volts.

4. During the test, 5 subjects were used and the filter was placed in front of the light.

CONCUR
TEAM LDR /s/ C. Finch /s/ A. Campos TIME :
CON SR REP /s/ B. Boykin TIME :
ME MGR /s/ S. Jones TIME :
SPAN MGR /s/ R. Kohrs TIME :

RESPONDER

FOD REP		SPAN MANAGER
/s/ M. F. Brooks TIME :	/s/ G. B. Merrick	/s/ R. Kohrs TIME

MSC Form 1214A (Feb 70) (OT) — NASA — MSC

Figure 7.- Mission Control Center evaluation request.

USE BLACK BALLPOINT PEN | **SPAN / MISSION EVALUATION ACTION REQUEST** | USE BLACK BALLPOINT PEN

45 45

TIME (T-MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER
58:36	ECS	ECOM	L-70

ACTION REQD BY (TIME): | REQUESTER D. Hughes

SUBJECT: LM Cabin Oxygen Enrichment

APPROVAL

TEAM LDR /s/ DEH TIME 59:20

CON SR REP /s/ LHG TIME 59 :27

ME MANAGER /s/ S. Jones TIME 59:22

SPAN MGR /s/ RWK TIME 60 11

Based on calculations with the LM/CM Delta p of 4 psid at 5.45 psia in the CM, the LM O_2 content at SEVA in the suit will be 94.7% considering no cabin leakage. With cabin leakage the oxygen will be 95.8%.

45 45

Based on calculations with the LM/CM delta p of 4 psid at 4.8 psia in the CM, the LM O_2 content in the suit at SEVA will be 95% in the suit considering no cabin leakage. With cabin leakage, the oxygen will be 96%.

These numbers are based upon performing a regulator check in the LM which is called for in the Flight Plan.

(95% oxygen in suit at SEVA is acceptable)

45 RESPONSE: CONCURRENCE 45

FOD REP /s/ Roach TIME 60 : 43

SPAN MGR /s/ RWK TIME 60:44

TEAM LDR /s/DEH TIME 61:54

CON SR REP /s/ LHG TIME 61 :59

Signed: TELMU - RMM. We are go with the above

45 45

RESPONDER

45 45

ME MANAGER		SPAN MANAGER
/s/ S. C. Jones TIME 62:00		/s/ R. W. Kubicki TIME 62:27

MSC Form 1214B (Feb 70) (OT) NASA — MSC

Figure 8.- Mission evaluation team request.

4. The Apollo 15 crewmen reported that, while entering the lunar module after the second extravehicular activity, they broke a fitting on the water-gun bacteria filter. After the filter was removed, the crewmen reported that an insignificant amount of water had leaked from the system; however, a detailed analysis of the data available at the contractor support room indicated that approximately 15 900 cubic centimeters of water had leaked into the cabin. Further evaluation, based on the location of the water gun and the attitude of the lunar module on the surface, resulted in a most probable location of the water in the cabin. A procedure for collecting the water in the stowage containers that had been provided for the lithium hydroxide canister was agreed on by the MCC flightcrew support team and the mission evaluation team. The procedure then was verified in a ground-based mockup of the lunar module. Using this procedure, the crewmen disposed of the water before the third extravehicular activity.

A summary of the Apollo 14 mission in-flight problems and their status is included as appendix E.

CONCLUDING REMARKS

A mission evaluation team of specialists with problem-evaluation and procedural-change experience is necessary to assist in the performance of complex space missions. Such a team provided a single point of contact with the Mission Control Center for the resolution of problems during Apollo missions. The team also provided NASA and contractor management with an up-to-date evaluation status of systems operation. The evaluation team management techniques, operational procedures, and support facilities that were used in the Apollo Program have provided a basis for developing mission evaluation and support functions for future programs.

Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas, January 22, 1975
914-89-00-00-72

APPENDIX A

APOLLO 14 MISSION EVALUATION PLAN

MSC-03699

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

APOLLO 14 MISSION EVALUATION PLAN

DISTRIBUTION AND REFERENCING

This paper is not suitable for general distribution or referencing. It may be referenced only in other working correspondence and documents by participating organizations.

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

December 1970

MSC-03699

APOLLO 14 MISSION EVALUATION PLAN

PREPARED BY:

Apollo Test Division

APPROVED BY:

Donald D. Arabian

Donald D. Arabian
Chief, Test Division

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
December 1970

INTRODUCTION

This plan outlines the purpose, functions, and operational procedures of the Mission Evaluation Team supporting the Apollo 14 Mission. Additionally, the responsibilities of the key personnel are identified and defined. The interfaces of the Mission Evaluation Team are also explained.

Comments concerning this document are invited and should be transmitted to PT2/Test Division, Apollo Spacecraft Program Office.

RESPONSIBILITIES

During the mission, the NASA and contractor engineering and system specialists on the third floor of building 45 will provide continuous (24-hour) real-time support to the Spacecraft Analysis (SPAN) Room in building 30 and subsequently to the Mission Operations Control Room. This group will provide the system history knowledge, as evolved through qualification programs, acceptance tests, and factory and launch site testing, for resolving inflight problems. Further, this group will assist in preparing the postflight reports which are the responsibility of the building 45 support teams.

The technical support from the NASA and contractor personnel in building 45 has been integrated and grouped into ten teams supervised by Analysis Managers assigned from the Manned Spacecraft Center. Table I contains a listing of the teams and Analysis Managers. The Mission Evaluation Team organization is defined as follows:

a. Team Manager - Responsible to the Apollo Program Manager for the overall planning, direction, and coordination of all mission support activities in building 45. The Team Manager is also responsible for the postflight evaluation activities. The Team Manager is the single point of contact between the team and the Spacecraft Analysis Room.

b. Deputy Manager - Assists the Team Manager in carrying out the team responsibility.

c. Data Manager - Responsible to the Team Manager for all data processing, handling, and distribution of hard copy data supplied to the system specialists.

d. Contractor Senior Representative (NR/GAC/Bendix) - Responsible to the Team Manager for the effective utilization of all contractor resources.

e. Contractor Data Manager (NR/GAC) - Responsible to the applicable Contractor Senior Representative and Team Manager for the coordination of data exchange with the contractor facility.

f. Engineering and Development Directorate Senior Representative - Responsible to the Team Manager for the effective utilization of the resources of the Engineering and Development Directorate.

g. Analysis Managers - Responsible to the Team Manager for directing and coordinating the mission evaluation activities of their respective teams.

BUILDING 45 INTERFACES

The Building 45 Management Team (Table II) will interface with the Spacecraft Analysis Room Management Team (Table III) and with the Contractor Team in the Mission Support Rooms at Grumman Aircraft Corporation (Bethpage, New York) and at North American Rockwell (Downey, California). The primary points of contact between building 45 and the Spacecraft Analysis Room are the Team Manager and the Operations Manager, respectively. (Appendix A describes the procedure to be followed.) Data exchange from the building 45 activity and the contractor plant is the responsibility of the Contractor Data Manager.

DATA

GENERAL

The data available to the systems analysis personnel operating in the Mission Evaluation Room (room 306C, building 45) (fig. 1) are essentially those which are available to the flight control organization in the Mission Control Center. Typically, these data include the telemetry and voice information received by the Mission Control Center from the Manned Space Flight Network and Goddard Space Flight Center. The GOSS-conference loop and other voice channels are also linked to building 45. Tables IV and V summarize by measurement the telemetry data available to the Mission Evaluation Team, by telegraph, television, near-real-time and postmission reduction. Table VI summarizes the near-real-time data available from the Manned Space Flight Network format 30 by system, measurement number, and sub-format.

TELEVISION DATA

Eight television channels, four selectable and four fixed, are available in the Mission Evaluation Room. For all mission times, other than lunar module activation, the command and service module formats will be given priority. The Data Manager will select in coordination with the Team Manager and Senior Engineering and Development Representative the four selectable channel call-ups. Available displays listed in the television guide are controlled by Flight Operations Directorate personnel in building 30. The Data Manager will contact the Spacecraft Analysis Mission Staff Engineer for call-up of channels not in the television guide.

The four television channels referred to as fixed channels are reserved for constant display of the following systems:

a. Guidance and navigation

b. Electrical power and batteries

c. Propulsion

d. Environmental control.

These channels are slaved to and controlled by the Mission Control Center and will not be used for call-up of special data.

The channels are displayed on ten television monitors located in the Mission Evaluation Room. Polaroid camera facilities will be available when hard copies of the displays are needed quickly. Error codes used on the television displays are shown in Table VII.

TELEGRAPHIC DATA

The telegraph summaries are tabular form printouts (summary message enable keyboard rebroadcasts) and will be available throughout the mission. Preliminary copies of the various formats have been distributed, and cardboard overlays will be available prior to the mission for reference by the various system personnel assigned to the Mission Evaluation Room. The data will be sorted and delivered to the appropriate system groups (Table VIII). Prior to the mission, each Analysis Manager should inform the Data Manager of any changes in his requirements for summary message delivery. Essentially, the printed data will be delivered within minutes of its reception from the Manned Space Flight Network.

RECORDED DATA

The Manned Space Flight Network data transmitted from the Goddard Space Flight Center to the Mission Control Center will be processed by the Computation and Analysis Division and printed out in standard tab groups. These data will be delivered to the Data Library (room 307, building 45), validated and logged in, sorted and placed in system bins for use by the data analysts. They will generally be available within a few hours of real time. Standard tab groups are defined in the Data Processing Plan and in Tables IV and V. Each Manned Space Flight Network tab group has one column of time tabs to enable time correlation of any data value. For this mission, Manned Space Flight Network data will be plotted in building 12 with plot group identical to the tab groups. Selected Manned Space Flight Network parameters will be available on brush records (see Data Manager for additional information). Tabulation of certain system tabs (spacecraft summary tabulations) are printed out every 4 hours in building 30. These will be available in the Data Library for use by the system analysts. For special events and particular problem times, printouts (DELOG) can be made of the display television formats by personnel in building 30. These will cover the complete format page once each second. Special requests for other than normal data from the Manned Space Flight Network should be submitted to the Data Manager. In general, special requests should be limited to those required to facilitate resolution of anomalies.

Apollo lunar surface experiments package (ALSEP) data for anomaly resolution will be available in the Data Library. In addition, a copy of all high-speed printer data will also be available in the Data Library. Special requests for other ALSEP data will be submitted to the Data Manager.

DOCUMENTATION

The Data Library has on file all available documentation for Apollo 14 (Table IX). Personnel are on duty continuously during the mission and during normal working hours for the evaluation period.

MISSION EVALUATION REVIEW REQUIREMENTS

The following reviews are conducted for each mission:

a. Mission Evaluation Team Manager premission briefing for Analysis Managers

b. Flight crew technical debriefing report review by Analysis Managers

c. Flight crew systems debriefing to technical specialists

d. Mission Evaluation Team Manager summary review with Analysis Managers

e. Apollo Program Manager review of mission report.

SECURITY REQUIREMENTS

Access to the third floor of building 45 will be restricted during the Apollo 14 mission. All personnel requiring access on a continuing basis will be badged. The badging identification will be as follows:

a. Mission Control Center green badges with names printed thereon authorize access to the third floor of building 45 and to room 306C.

b. Building 45 third floor access badges (black on white) with black numeral 14 authorize access to the third floor of building 45.

The third floor of building 45 will be controlled by a security guard stationed at the elevators. The third floor stairway doors will be locked during the mission. At the request of the Analysis Managers, the Team Manager or his designee will arrange with the guard for access of technical specialists as the need for their support arises. The Analysis Managers are responsible to the Team Manager to insure that the total number of personnel is held to a minimum to avoid an overcrowded and noisy condition.

MISSION REPORT REQUIREMENTS AND RESPONSIBILITIES

The Apollo 14 mission reporting requirements are defined in Apollo Program Directive no. 19C. The schedule of post-mission report activities is shown in figure 2.

A summary of the reports to be generated by the Mission Evaluation Team is as follows:

Building 45 status reports.- A status report keyed to significant flight events approximately every 2 hours during the mission.

Analysis of propulsion system major firings.- A verbal report to the Mission Evaluation Team Manager and input to the 2-hour status report. Propulsion analysis personnel will be provided with real-time or near-real-time high-bit-rate data for assessment of propulsion system firings. Special procedures are also being implemented for the timely assessment of these data.

Daily Mission Reports.- A description of the events of the preceding 24-hours, including mission progress, accomplishments, systems performance, failures, and anomalies.

Five-Day Mission Report.- An abbreviated "quick look" description of the mission, including primary mission and detailed test objectives accomplished, as well as failures and anomalies.

Thirty-Day Failure and Anomalies Listing Report.- A complete report describing all significant failures and anomalies including time of occurrence, mode or cause, and results of failure analysis, and in addition, the failure/anomaly criticality, subsequent mission impact/constraint, testing required to support corrective action, and final resolution.

Final Mission Report.- A complete and detailed report covering all mission aspects from launch through recovery. (Publication date is 90 days after end of mission.) Significant topics covered are:

a. Spacecraft configuration, trajectory, and sequential events

b. Spacecraft and system performance

c. MSFN tracking, communications, and data acquisition

d. GSE performance

e. Recovery operation

f. Failure and anomaly analysis/resolution

g. Scientific experiments and sampling summary (part II-Basic Report).

MISSION REPORT SCHEDULES AND PROCEDURES

The schedule of reporting for the Apollo 14 mission is shown in figure 2. This schedule indicates when each portion of the report is to be submitted by the Analysis Managers to the Apollo Test Division (PT2), as well as the anticipated publication date of each report. The flow of the individual report inputs within the Test Division is shown in figure 3 and the procedures are as follows:

1. As sections are drafted by the Analysis Managers, each section (or sub-section) will be delivered to the Branch Secretary, PT2, who will log the submission and reproduce a copy for editing.

2. The original draft of the input will be routed to the Senior Technical Editor for editing and general composition arrangement. The copy will be routed, within two hours of receipt, to an assigned writer/editor and be incorporated into a loose-leaf notebook. The notebook will be available at all times to interested parties and will form a part of the archives and records.

3. Following the technical editing, each section will be submitted to the Branch Chief for review and schedule awareness.

4. With minimum delay, the technically edited sub-section will be routed to a writer/editor for grammatical editing. Following the final editing of a draft, it will be retyped (as second draft) and committed to tape. As each iteration is developed, it will be committed to a loose leaf record notebook.

5. The second draft will be returned to the appropriate Analysis Manager for review and comment. Second draft comments will be returned to the PT2 Branch Chief and all differences will be resolved, on an individual basis, between the Analysis Manager and the Senior Technical Editor.

6. After resolution of the required revisions, the second draft will be resubmitted to a writer/editor for final grammatical correction.

7. All report sections which are available forty-five days after the mission are prepared for a review copy. (Normally, this will include <u>all</u> report sections; however, flight or experiment problems could account for extensive investigations which may result in reporting delays.) Review copies are to be distributed to the Analysis Managers at the same time that a copy is made available to the Chief, Test Division.

8. Upon receipt of the Division Chief's comments, an editorial meeting will be called with all Analysis Managers and other interested parties. Revisions resulting from the editorial meeting will be incorporated into the report and a final review copy will be submitted to the Apollo Spacecraft Program management.

9. The changes resulting from the Apollo Spacecraft Program Manager's review shall be incorporated after coordinating the specific changes with the appropriate Analysis Manager.

10. The magnetic tapes will have final corrections incorporated and a copy of the text will be reproduced for final composition. The tables and figures shall be interdigitated with the text.

11. The report will be sent to publication for printing and distribution no later than T + 75 days.

TABLE I.- APOLLO 14 TEAMS AND ANALYSIS MANAGERS IN BUILDING 45

Engineering and Development Directorate

J. B. Lee, E and D Senior Representative
P. Deans
R. Burt

Telecommunications

R. Irvin, Analysis Manager
A. D. Travis
E. Lattier

Crew Systems

P. F. Hurt, Analysis Manager
F. A. Samonski
E. Tucker

Electronic Systems

R. Munford, Analysis Manager
A. Olsen
A. Campos
J. Alexander

Propulsion and Power

H. White, Analysis Manager
C. Gibson
R. Taeuber
W. Dusenbury

Guidance and Control

C. Finch, Analysis Manager
T. Lewis
E. Dickinson

Structures and Mechanics

P. Glynn, Analysis Manager

Thermal Control

L. Palmer, Analysis Manager
J. T. Taylor
R. Harris
R. Brown

Apollo Lunar Surface Experiments Package

J. D. Harris, ALSEP Manager
T. J. Nelson
H. J. Lowery
R. F. Irwin

Flight Crew Support

H. Kuehnel, Analysis Manager
C. Perner
G. Franklin

Trajectory

E. D. Murrah, Analysis Manager

TABLE II.- APOLLO 14 MISSION EVALUATION MANAGEMENT TEAM (BUILDING 45)

Team Manager, D. D. Arabian

Position	Shift 1	Shift 2	Shift 3
Shift Manager	J. Dodson	S. Jones	R. Malley
Deputy Manager	J. Mechelay	T. Grace	T. Libby
Data Manager	G. Foster	W. Kelley	C. Walsh/E. Gammon
NR Senior Representative	D. Levine/B. Boykin	F. Patterson	M. Silver
Bendix Senior Representative	L. Lewis	W. Tosh	H. Reinhold
GAC Senior Representative	J. Marino	Marino/Devaney	J. Devaney
NR Data Coordinator	W. Fitzpatrick		
GAC Data Coordinator	L. Gran	Gran/Moncsko	R. Moncsko
E&D Senior Representative	J. Lee/L. Chauvin	P. Deans	R. Burt
R&QA Senior Representative	C. Rice	J. Seigler	E. Fields

TABLE III.- APOLLO 14 SPACECRAFT ANALYSIS MANAGEMENT TEAM (BUILDING 30)

Team Managers, S. H. Simpkinson and R. W. Kubicki

Position	Shift 1	Shift 2	Shift 3
SPAN Operations Managers	J. Sevier	D. Nebrig	R. Kohrs
Mission Staff Engineer	J. Peacock	S. Blackmer	N. Stewart
Log Manager	K. Vogel	H. Bullock	A. Shapiro
Administration Support	R. Bailey	Bailey/Rayl	J. Rayl
SPAN Documentation	H. Tash	Tash/Davis	H. Davis
NR Management Representative	G. Merrick	Merrick/Smith	E. Smith
GAC Management Representative	W. Bischoff/G. Smith	Bischoff/Elliott	F. Elliott
MIT Management Representative	P. Felleman	G. Silver	R. Larsen

TABLE IV.- LUNAR MODULE TELEMETRY DATA SUMMARY

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range																	
			Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
GC0071V	AC BUS VOLT	VRMS	0	120	1022069	1			.2	.2						70	21B		LP-2	1001, 1310
GC0155F	AC BUS FREQ	HZ	380	420	1041069	1			.2	.2						70	21B		LP-2	1001, 1310
GC0201V	BAT 1 VOLT	VDC	0	40	1019101	1			.2	.2						70	21A		LP-1	1001
GC0202V	BAT 2 VOLT	VDC	0	40	1011101	1			.2	.2						70	21A		LP-1	1001
GC0203V	BAT 3 VOLT	VDC	0	40	1021101	1			.2	.2						70	21A		LP-1	1001
GC0204V	BAT 4 VOLT	VDC	0	40	1015101	1			.2	.2						70	21A		LP-2	1001
GC0205V	BAT 5 VOLT	VDC	0	40	1003037	1			.2	.2						70	21B		LP-2	1001, 1310
GC0206V	BAT 6 VOLT	VDC	0	40	1010037	1			.2	.2						70	21B		LP-2	1001, 1310
GC0301V	CDR BUS VOLT	VDC	0	40	1033069	1			1	1						70	21B		LP-2	1001, 1310
GC0302V	SE BUS VOLT	VDC	0	40	1035069	1			1	1						70	21B		LP-2	1001, 1310
GC1201C	BAT 1 CUR	AMP	0	60	1024101	1			1	1						70	21A		LP-1	1001
GC1202C	BAT 2 CUR	AMP	0	60	1032069	1			1	1						70	21A		LP-1	1001
GC1203C	BAT 3 CUR	AMP	0	60	1017069	1			1	1						70	21A		LP-1	1001
GC1204C	BAT 4 CUR	AMP	0	60	1018069	1			1	1						70	21A		LP-1	1001
GC1205C	BAT 5 CUR	AMP	0	120	1018101	1			1	1						70	21B		LP-2	1001
GC1206C	BAT 6 CUR	AMP	0	120	1020069	1			1	1						70	21B		LP-2	1001
GC4361X	BAT 1 HI TAP		OFF	ON	1035098H	1			.2	.2							41	50	LE-3	
GC4362X	BAT 1 LOW TAP		OFF	ON	1005098G	1			.2	.2							41	50	LE-3	
GC4363X	BAT 2 HI TAP		OFF	ON	1035098F	1			.2	.2							41	50	LE-3	
GC4364X	BAT 2 LOW TAP		OFF	ON	1035098E	1			.2	.2							41	50	LE-3	
GC4365X	BAT 3 HI TAP		OFF	ON	1035098D	1			.2	.2							41	50	LE-3	
GC4366X	BAT 3 LOW TAP		OFF	ON	1035098C	1			.2	.2							41	50	LE-3	
GC4367X	BAT 4 HI TAP		OFF	ON	1035098B	1			.2	.2							41	50	LE-3	
GC4368X	BAT 4 LOW TAP		OFF	ON	1035098A	1			.2	.2							41	50	LE-3	
GC4369X	BAT 5 B/U CDR		OFF	ON	1039098H	1			1	1							41	50	LE-3	
GC4370X	BAT 6 NORM CDR		OFF	ON	1039098G	1			1	1							41	50	LE-3	
GC4371X	BAT 5 NORM SE		OFF	ON	1039098F	1			1	1							41	50	LE-3	
GC4372X	BAT 6 B/U SE		OFF	ON	1039098E	1			1	1							41	50	LE-3	
GC9961U	BAT 1 MAL		ABS	PRS	1034100H	1			.2	.2							41	50	LE-3	1001
GC9962U	BAT 2 MAL		ABS	PRS	1034100G	1			.2	.2							41	50	LE-3	1001
GC9963U	BAT 3 MAL		ABS	PRS	1034100F	1			.2	.2							41	50	LE-3	1001
GC9964U	BAT 4 MAL		ABS	PRS	1034100E	1			.2	.2							41	50	LE-3	1001
GC9965U	BAT 5 MAL		ABS	PRS	1034100D	1			.2	.2							41	50	LE-3	1001
GC9966U	BAT 6 MAL		ABS	PRS	1034100C	1			.2	.2							41	50	LE-3	1001
GF1083X	SUIT FAN 1 MAL		NO	YES	1007098H	1			.2	.2							42	50	LE-3	1001, 1051, 1310
GF1084X	SUIT FAN 2 MAL		NO	YES	1007098G	1			.2	.2							42	50	LE-3	1001, 1051, 1310
GF1201X	CDR SUIT DISC		FLOW	DISC	1004098H	1			1	1							42	50	LE-3	1001, 1051, 1310
GF1202X	SE SUIT DISC		FLOW	DISC	1004098G	1			1	1							42	50	LE-3	1001, 1051, 1310
GF1211X	SUIT RLF CLSD		NOT CLOSED	CLOSED	1007098F	1			.2	.2							42	50	LE-3	
GF1212X	SUIT RLF OPEN		NOT OPEN	OPEN	1007098E	1			.2	.2							42	50	LE-3	
GF1221X	SUIT DIV EGRESS		CAB	EGR	1007098D	1			.2	.2							42	50	LE-3	1051, 1310, 1001
GF1231X	CABIN RET CLSD		NOT CLOSED	CLOSED	1005098H	1			.2	.2							42	50	LE-3	
GF1232X	CABIN RET OPEN		NOT OPEN	OPEN	1005098G	1			.2	.2							42	50	LE-3	
GF1241X	SEC CO2 SEL		PRI	SEC	1007098C	1			.2	.2							42	50	LE-3	1001, 1051, 1310
GF1281T	SUIT TEMP	°F	20	120	1045005	1			.1	.1						70	22A		LP-3	1001, 1310, 1051
GF1301P	SUIT PRESS	PSIA	0	10	1034069	1			1	1						70	22A		LP-3	1001, 1002, 1011, 1051, 1310
GF1521P	CO2 PART PRESS	MMHG	0	30	1005037	1			.1	.1						70	22A		LP-3	1001, 1051, 1310
GF1651T	CABIN TEMP	°F	20	120	1034005	1			.1	.1						70	22A		LP-3	1001, 1310, 1051
GF2021P	PRI GLY PMP DEL P	PSID	0	50	1016069	1			1	1						70	22B		LP-4	1001, 1051, 1310
GF2531T	MAIN W/B GLY IN	°F	20	120	1036037	1			.2	.2						70	22B		LP-4	1001, 1051, 1310
GF2581T	MAIN W/B GLY OUT	°F	20	120	1033101	1			.2	.2						70	22B		LP-4	1051, 1310, 1001
GF2921P	REDUN PMP PRESS	PSIA	0	60	1005005	1			.1	.1							22B		LP-4	1001, 1051, 1310
GF2936X	SEL GLY PMP FAIL		NO	YES	1005098B	1			.2	.2							42	50	LE-2	1001, 1051, 1310
GF3071X	DMD REG A CLSD		NO	YES	1005098F	1			.2	.2							42		LE-2	1310
GF3073X	DMD REG B CLSD		NO	YES	1005098D	1			.2	.2							42	50	LE-2	1051, 1310
GF3571P	CABIN PRESS	PSIA	0	10	1022101	1			1	1						70	22A	50	LP-3	1001, 1051, 1310
GF3572X	REPR ELEC OPEN		NO	YES	1004098	1			1	1							42	50	LE-2	1001, 1310, 1051
GF3582P	ASC 1 O2 PRESS	PSIA	0	1000	1004005	1			.2	.2						70	22C		LP-5	1001, 1051, 1310
GF3583P	ASC 2 O2 PRESS	PSIA	0	1000	1020005	1			.2	.2						70	22C		LP-5	1001, 1051
GF3584P	DES O2 PRESS	PSIA	0	3000	1034101	1			.2	.2						70	22C		LP-5	1001, 1051, 1310
GF3589P	O2 MANIFOLD PRESS	PSIA	0	1400	1024069	1			.2	.2						70	22C		LP-5	1001, 1051, 1310
GF3591P	U/H PLF PRESS	PSIA	0	25	1050069	1			.2	.2						70	22B		LP-3	1001, 1051, 1310
GF3592P	F/H RLF PRESS	PSIA	0	25	1047101	1			.2	.2						70	22B		LP-3	1001, 1310
GF4101P	PRI H2O REG DEL P	PSID	0	2	1037037	1			.2	.2						70	22D		LP-6	1001, 1310, 1051
GF4501P	DESCENT H2O PRESS	PSID	0	60	1009065	1			.1	.1							22C		LP-5	1001, 1051, 1310
GF4511T	PRI W/B H2O TEMP	°F	20	260	1040069	1			.1	.1						70	22D		LP-6	1001, 1051, 1310
GF4581Q	DES H2O QTY	PCT	0	100	1016037	1			.2	.2						70	22D		LP-6	1001, 1051, 1310
GF4582Q	ASC 1 H2O QTY	PCT	0	100	1006037	1			.2	.2						70	22D		LP-6	1001, 1051, 1310
GF4583Q	ASC 2 H2O QTY	PCT	0	100	1007037	1			.2	.2						70	22D		LP-6	1001, 1051, 1310
GF4585T	ASC 1 H2O TEMP	°F	-200	+200	1035101												22D		LP-6	
GF4586T	ASCENT 2 H2O TEMP	°F	-200	+200	1004037												22D		LP-6	
GF9986U	GLY ACCUM LL		NORM	LOW	1004098	1			1	1							42	50	LE-2	1001, 1051, 1310
GF9997U	GLY PUMP PRESS	PSIA	0	60	1005101	1			.2	.2						70	22C		LP-5	1001, 1051, 1310
GF9998U	SELECTED COOLANT LOOP TEMP	°F	20	120	1032005	1			.2	.2						70	22B		LP-4	1001, 1051, 1310
GF9999U	H2O SEP RATE	RPM	0	3600	1007069	1			.1	.1						70	22D		LP-6	1001, 1051, 1310

TABLE IV.- LUNAR MODULE TELEMETRY DATA SUMMARY - Continued

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range Low	Approximate Range High		1	2	3	4	5	6	7	8	9	10		STD	SP		
GG1040V	VDC PIPA SUPPLY	VDC	84	134	1001069	1			.2	1							23		LP-7	1137
GG1110V	2.5 VDC TM BIAS	VDC	0	5	1007005	1			.2	1							23		LP-7	1137
GG1201V	IMU 28 VAC 800	VRMS	0	31	1032037	1			.2	1						71	23		LP-7	1137
GG1331V	IRIG SUSP 3.2 KC	VRMS	0	31	1002037	1			.2	1						71	23		LP-7	1137
GG1513X	IMU STBY		OFF	ON	1008098	1			1	1							45	50	LE-2	
GG1523X	LGC OPR		OFF	ON	1008098	1			1	1							45	50	LE-2	
GG2001V	X PIPA OUT IN PH	VRMS	-2.1	+2.6	5101058	1			.2	.2								29A	LO-3, LP-16	
GG2021V	Y PIPA OUT IN PH	VRMS	-2.7	+2.7	5101057	1			.2	.2								29A	LP-3, LP-16	
GG2041V	Z PIPA OUT IN PH	VRMS	-02.7	2.7	5101059	1			.2	.2								29A	LO-3, LP-16	
GG2107V	IG SVO ERR IN PH	VRMS	-2.9	2.9	1201017	10			1	5								29A	LO-3, LP-16	
GG2112V	IG RSVR OUT SIN	VRMS	-22	+21	1102099	1			1	1								29B	LO-3, LP-17	
GG2113V	IG RSVR OUT COS	VRMS	-21	+21	1102067	1			1	1								29B	LO-3, LP-17	
GG2137V	MG SVO ERR IN PH	VRMS	-2.9	+2.9	1201019	10			1	5								29A	LO-3, LP-16	
GG2142V	MG RSVR OUT SIN	VRMS	-21	+21	1102034	1			1	1								29B	LO-3, LP-17	
GG2143V	MG RSVR OUT COS	VRMS	-21	+21	1002101	1			1	1								29B	LO-3, LP-17	
GG2167V	OG SVO ERR IN PH	VRMS	-2.9	+2.9	1201030	10			1	5								29A	LO-3, LP-16	
GG2172V	OG RSVR OUT SIN	VRMS	-22	+22	1103067	1			1	1								29B	LO-3, LP-17	
GG2173V	OG RSVR OUT COS	VRMS	-21	+21	1017101	1			1	1								29B	LO-3, LP-17	
GG2219V	PITCH CDU DAC OUT	DEGS	-20	+20	1104068	4			3	3								29C	LO-1, LP-18 LO-2	
GG2249V	YAW CDU DAC OUT	DEGS	-20	+20	1102100	4			3	3								29C	LO-1 LP-18 LO-2	
GG2279V	ROLL CDU DAC OUT	DEGS	-20	+20	1103066	4			3	3								29C	LO-1, LP-18 LO-2	
GG2300T	PIPA TEMP	°F	119	139	1032101	1			.1	1						71	23		LP-7	1137
GG3304V	RR SHFT SIN	VRMS	-22	+22	1104065	1			1	1								29C	LP-7, LP-18 LO-3	
GG3305V	RR SHFT COS	VRMS	-22	+22	1102035	1			1	1								29C	LP-7, LP-18 LO-3	
GG3324V	RR TRUN SIN	VRMS	-23	+23	1102036	1			1	1								29C	LP-7, LP-18 LO-3	
GG3325V	RR TRUN COS	VRMS	-22	+22	1103035	1			1	1								29C	LP-7, LP-18 LO-3	
GG9001X	LGC WARNING		ABS	PRS	1003098H	1			1	1							45	51	LP-7, LE-2	
GG9002X	ISS WARNING		ABS	PRS	1003098G	1			1	1							45	51	LE-2	
GH1204X	OUT DET		NO	YES	1037098H	1			1	1							44	50	LO-1, LE-2	
GH1214X	AUTO ON		NO	YES	1020908	1			1	1							44	50	LE-2	
GH1217X	AUTO OFF		NO	YES	1037098G	1			1	1							44	50	LE-2	1123
GH1230X	APS ARM		NO	YES	1047098H	1			1	1							44	50	LE-2	1001
GH1240V	X TRANS CMD	VDC	-10	10	1101065	1			1	1							43	30A	LP-8, LP-19	
GH1241V	Y TRANS CMD	VDC	-10	10	1102033	1			1	1							43	30A	LP-8, LP-19	
GH1242V	Z TRANS CMD	VDC	-10	10	1103033	1			1	1	.5						43	30A	LP-8, LP-19	
GH1247V	YAW LC IMPUT ERR	VDC	-12	12	1036101	4			1	1						71		30A	LO-1, LP-19	1123
GH1248V	PITCH LC INPUT ERR	VDC	-12	12	1040101	4			1	1						71		30A	LO-1, LP-19	1123
GH1249V	ROLL LC INPUT ERR	VDC	-12	12	1045101	4			1	1	1					71		30A	LO-1, LP-19	1123
GH1260X	APS ON		OFF	ON	5101024H	1			1	1							44	50	LO-2, LE-2	1001
GH1283X	ABORT STAGE		NO	YES	5101024	1			1	1							44	50	LE-2	1001
GH1286X	ENG FIR OVERRIDE		NO	YES	1037098	1			1	1							44	50	LE-2	1123
GH1301X	DPS ON		OFF	ON	1029098	1			1	1							44	50	LO-2, LE-2	
GH1311V	MAN THRUST CMD	PCT	0	9	1035005	1			1	1						71		30B	LO-2, LP-20	1123
GH1313V	PITCH GDA POS	VRMS	-15	+15	1006101	1			1	1						71		30B	LO-2, LP-20	1001, 1123
GH1314V	ROLL GDA POS	VRMS	-15	+15	1003101	1			1	1						71		30B	LO-2, LP-30	1001, 1123

TABLE IV.- LUNAR MODULE TELEMETRY DATA SUMMARY - Continued

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
GH1323X	R TRM FAIL		NO	YES	1029098F	1			1	1							44	50	LE-2	1001, 1123
GH1330X	R TRM FAIL		NO	YES	1029098E	1			1	1							44	50	LE-2	1001, 1123
GH1331V	AUTO THRUST CMD	PCT	0	.3	1048069	1			1	1						71		30B	LO-2, LP-20	1123, 1137
GH1348X	DPS ARM		OFF	ON	1047098	1			1	1							44	50	LE-2	1001, 1123
GH1418V	JDB4U OUTPUT		OFF	ON	1201008A												43		LO-1,2 LO-5, LE-3	
GH1419V	JDA4D OUTPUT		OFF	ON	1201008												43		LO-1,2 LO-4, LE-3	
GH1420V	JDB4F OUTPUT		OFF	ON	1201048A												43		LO-1,2 LO-5 LE-3	
GH1421V	JDA4R OUTPUT		OFF	ON	1201048B												43		LO-1,2 LO-4, LE-3	
GH1422V	JDA3U OUTPUT		OFF	ON	1201008C												43		LO-1,2 LO-4, LE-3	
GH1423V	JDB3D OUTPUT		OFF	ON	1201008D												43		LO-1,2 LO-5, LE-3	
GH1424V	JDB3A OUTPUT		OFF	ON	1201048C												43		LO-1,2 LO-5, LE-3	
GH1425V	JDA3B OUTPUT		OFF	ON	1201048D												43		LO-1,2 LO-4, LE-3	
GH1426V	JDB2U OUTPUT		OFF	ON	1201008E												43		LO-1,2 LO-5, LE-3	
GH1427V	JDA2D OUTPUT		OFF	ON	1201008F												43		LO-1,2 LO-4 LE-2	
GH1428V	JDA2A OUTPUT		OFF	ON	1201048E												43		LO-1,2 LO-4, LE-3	
GH1429V	JDB2L OUTPUT		OFF	ON	1201048F												43		LO-1,2 LO-5, LE-2	
GH1430V	JDA1U OUTPUT		OFF	ON	1201008G												43		LO-1,2 LO-4, LE-2	
GH1431V	JDB1D OUTPUT		OFF	ON	1201008H												43		LO-1,2 LO-5, LE-2	
GH1432V	JDA1F OUTPUT		OFF	ON	1201048G												43		LO-1,2, LO-4	
GH1433V	JDB1L OUTPUT		OFF	ON	1201048H												43		LO-1,2 LE-3 LO-5	
GH1455V	YAW ATT ERR	DEG	-12	+12	1007101	4		2	3							71		30C	LO-1, LP-21	1123, 1137
GH1456V	PITCH ATT ERR	DEG	-12	+12	1016101	4		2	3							71		30C	LO-1, LP-21	1123, 1137
GH1457V	ROLL ATT ERR	DEG	-12	+12	1030101	4		2	3							71		30C	LO-1, LP-21	1123, 1137
GH1461V	RGA YAW RATE	DEG/SEC	-25	+25	1103034	10		3	5							71		30C	LO-1,2 LO-4,5, LP-21	1123, 1137
GH1462V	RGA PITCH RATE	DEG/SEC	-25	+25	1104034	10		3	5							71		30C	LO-1,2, LO-4,5, LP-21	1123, 1137
GH1463V	RGA ROLL RATE	DEG/SEC	-25	+25	1105034	10		3	5	1						71		30C	LO-1,2, LO-4,5 LP-21	1123, 1137
GH1603X	WIDE DBND SEL		NAR	WIDE	1047098F	1		1	1								44	50	LO-1, LE-3	1137
GH1621X	AGS SEL		PGNS	AGS	1029098D	1		1	1								44	50	LO-1,2, LE-3	1137, 1123
GH1628X	ROLL PLSD/DIR		OUT	IN	1033098H	1		1	1								44	50	LE-3	1123
GH1629X	PITCH PLSD/DIR		OUT	IN	1033098G	1		1	1								44	50	LE-3	11,23
GH1630X	YAW PLSD/DIR		OUT	IN	1033098F	1		1	1								44	50	LE-3	1123
GH1641X	AGS MODE AUTO		OFF	ON	1037098A	1		1	1								44	50	LE-3	1123
GH1642X	AGS MODE ATT HOLD		OFF	ON	1037098B	1		1	1								44	50	LE-3	1123
GH1643X	PGNS MODE AUTO		OFF	ON	1037098E	1		1	1								44	50	LE-3	1123, 1137
GH1644X	PGNS MODE ATT HLD		OFF	ON	1037098D	1		1	1								44	50	LE-3	1123, 1137
GH1893X	X TRANS OVERRIDE		ON	OFF	1047098E	1		1	1								44	50	LE-3	
GH1896X	UNBAL CPLS		NO	YES	1037098C	1		1	1								44	50	LE-3	
GI3301T	ASA TEMP	°F	20	200	1018005	1		.2	.2							71	23		LP-7	
GI3305X	AGS WARMUP		OFF	ON	1033098E	1		1	1								45	50		
GI3306X	AGS STBY		OFF	ON	1033098D	1		1	1								45	50		

TABLE IV.- LUNAR MODULE TELEMETRY DATA SUMMARY - Continued

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range																	
			Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
GL0400X	OSC FAIL DETCT		NO	YES	1009098A	1			.2	.2							46	50	LE-4	1001
GL0401V	CAL 85 PCT	VDC	0	5	1103099	1			.1	.1						70	24		LP-8	1001
GL0402V	CAL 15 PCT	VDC	0	5	1104099	1			.1	.1						70	24		LP-8	1001
GL0422V	OSC FAIL DETCT 2	VDC	0	5	1044101	1			.2	.2							24		LP-8	1001
GL0423V	OSC FAIL DETCT 3	VDC	0	5	1023037	1			.2	.2							24		LP-8	1001
GL4026X	CES AC POWER FAIL		NO	YES	1001098H	1			1	1							46	51	LE-4	
GL4027X	GES DC PWR FAIL		NO	YES	1009098G	1			1	1							46	51	LE-4	
GL4028X	AGS PWR FAIL		YES	NO	1009098F	1			1	1							46	51	LE-4	
GL4047X	EPS BATTERY CAUT		YES	NO	1009098C	1			.2	.2							46	50	LE-4	1001
GL4054X	C W PWR FAIL		YES	NO	1009098E	1			1	1							46	51	LE-4	1001
GL4069X	MASTER ALARM ON		YES	NO	1009098D	1			1	1							46	51	LE-4	1001, 1468
GL8275T	RTG CASK SHLD TEMP	°F	-200	500	1047005	1			.1	.1							24		LP-8	1310, 1051, 1001
GM5000X	LAND GEAR DEPLOY		NO	YES	1045098H	1			1	1							46	50	LE-4	1001
GN7521X	LR RANGE BAD		NO	YES	1002098H	1			1	1							46	51	LE-4	
GN7557X	LR VEL BAD		NO	YES	1002098G	1			1	1							46	51	LE-4	
GN7563T	LR ANT TEMP	°F	-200	200	1043005	1			.1	.1						71	24		LP-8	1137
GN7621X	RR NO TRACK		TRK	NTRK	1002098	1			1	1							46	51	LE-4	1137
GN7723T	RR ANT TEMP	°F	-200	+200	1009005	1			.1	.1						71	24		LP-8	1137
GP0001P	APS HE 1 PRESS	PSIA	0	4000	1040037	1			.2	.2						71	25A		LP-9	1123, 1310
GP0002P	APS HE 2 PRESS	PSIA	0	4000	1025037	1			.2	.2						71	25A		LP-9	1123
GP0018P	APS HE REG PRESS	PSIA	0	300	1019037	1			.2	.2						71	25A		LP-9	1123
GP0025P	APS HE REG PRESS	PSIA	0	300	1010069	1			.2	.2						71	25A		LP-9	1123
GP0041P	P NO2 HE SUPP 1	PSIA	0	4000	1101068	1			1	1							25B		LP-10	
GP0042P	P NO2 HE SUPP 2	PSIA	0	4000	1103065	1			1	1							25B		LP-10	
GP0318X	APS HE 1 CLSD		OPEN	CLSD	1049098H	1			.1	.1							47	50	LE-4	1123
GP0320X	APS HE 2 CLSD		OPEN	CLSD	1049098G	1			.1	.1							47	50	LE-4	1123
GP0718T	APS FUEL TEMP	°F	20	120	1030069	1			.1	.1						71	25B		LP-10	
GP0908X	APS FUEL LOW		NORM	LOW	1029100	1			.1	.1							47	50	LE-4	1123
GP1218T	APS OX TEMP	°F	20	120	1034037	1			.1	.1						71	25B		LP-10	
GP1408X	APS OX LOW		NORM	LOW	1029100	1			1	1							47	50	LE-4	1123
GP1501P	APS FUEL PRESS	PSIA	0	250	1017037	1			1	1						71	25A	50	LP-9	1123
GP1503P	APS OX PRESS	PSIA	0	250	1017005	1			1	1						71	25A	31A	LP-9	1123
GP2010P	THRUST CHAMBER PRESS	PSIA	0	150	1045037	1			2	5						71	25B	31	LP-10	1001, 1123
GP2997U	APS DELTA POS A		CLD/ OPN	MID	1038098F	1			.1	.1							48	50	LE-4	
GP2998U	APS DELTA POS B		CLD/ OPN	MID	1038098E	1			.1	.1							48 27A	32A 50	LE-4	
GQ3015P	DPS START TANK P	PSIA	0	1750	1011069	1			.2	.2						71	26A		LP-11	1123
GQ3018P	DPS HE REG PRESS	PSIA	0	300	1012005	1			.2	.2						71	26A		LP-11	1123
GQ3025P	DPS HE REG PRESS	PSIA	0	300	1029005	1			.2	.2						71	26A		LP-11	1123
GQ3435P	DPS HE PRESS	PSIA	0	200	1002069	1			.2	.2	.2					71	26A		LP-11	1123
GQ3603Q	DPS FUEL 1 QTY	PCT	0	95	1028005	1			.1	.1							26B	32	LP-12	1123
GQ3604Q	DPS FUEL 2 QTY	PCT	0	95	1027027	1			.1	.1						71	26B	32	LP-12	1123
GQ3611P	DPS FUEL PRESS	PSIA	0	300	1005069	1			1	1						71	26B	32	LP-12	1123
GQ3718T	DPS FUEL 1 TEMP	°F	20	120	1002005	1			.1	.1						71	26A		LP-11	
GQ3719T	DPS FUEL 2 TEMP	°F	20	120	1031037	1			.1	.1						71	26A		LP-11	
GQ4103Q	DPS OX 1 QTY	PCT	0	95	1043037	1			1	1	.2						26B	32	LP-12	1123
GQ4104Q	DPS OX 2 QTY	PCT	0	95	1035037	1			1	1						71	26B	32	LP-12	1123
GQ4111P	DPS OX PRESS	PSIA	0	300	1003069	1			1	1	1					71	26B	32	LP-12	1123
GQ4218T	DPS OX 1 TEMP	°F	20	120	1001101	1			.1	.1						71	26A		LP-11	
GQ4219T	DPS OX 2 TEMP	°F	20	120	1009101	1			.1	.1						71	27A		LP-11	
GQ4220T	DPS BALL VALVE TEMP	°F	-200	+500	103037												25B		LP-10	
GQ4455X	DPS PROP LOW		NORM	LOW	1038098G	1			1	1						71	47	50		
GQ6510P	DPS TCP	PSIA	0	200	2201014	1			2	5						71	26B	32	LP-12	
GQ6806H	VAR INJT ACT POS	PCT	0	100	1050037	1			1	1						71	26B	32	LP-12	1123, 1137
GR1085Q	RCS PROP A QTY	PCT	0	103.5	1042069	1			.2	.2						71	27A		LP-13	1123
GR1095Q	RCS PROP B QTY	PCT	0	103.5	1038069	1			.2	.2							27A		LP-13	1123
GR1101P	RCS A HE PRESS	PSIA	0	3500	1033037	1			.2	.2						71	27A		LP-13	1123
GR1102P	RCS B HE PRESS	PSIA	0	3500	1029069	1			.2	.2						71	27A		LP-13	1123
GR1201P	RCS A REG PRESS	PSIA	0	350	1030005	1			.2	.2						71	27A		LP-13	1123
GR2121T	RCS A FUEL TEMP	°F	20	120	1018037	1			.1	.1						71	27A		LP-13	
GR2122T	RCS B FUEL TEMP	°F	20	120	1020037	1			.1	.1						71	27A		LP-13	
GR2201P	A FUEL MFLD PRESS	PSIA	0	350	1004069	1			.2	.2						71	27B		LO-4, LP-14	1123
GR1202	RCS B REG PRESS	PSIA	0	350	1037005	1			.2	.2	.2					71	27A		LP-13	1123
GR2202P	B FUEL MFLD PRESS	PSIA	0	350	1004101	1			.2	.2						71	27B		LO-5, LP-14, LP-16	1123
GR3201P	A OX MFLD PRESS	PSIA	0	350	1006069	1			.2	.2	1					71	27B		LO-4, LP-14 LP-16	1123
GR3202P	B OX MFLD PRESS	PSIA	0	350	1010101	1			.2	.2	1					71	27B		LO-5, LP-14, LP-16	1123
GR5031X	RCS TCP B4U		OFF	ON	2201006A	SPECIAL PROCESSING											43		LO-5, LE-5	
GR5032X	RCS TCP A4D		OFF	ON	2201006B	SPECIAL PROCESSING											43		LO-4, LE-5	
GR5033X	RCS TCP B4F		OFF	ON	2201006C	SPECIAL PROCESSING											43		LO-5, LE-5	

TABLE IV.- LUNAR MODULE TELEMETRY DATA SUMMARY - Concluded

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
GR5034X	RCS TCP A4R		OFF	ON	2201006D	SPECIAL PROCESSING											43		LO-4, LE-5	
GR5035X	RCS TCP A3U		OFF	ON	2201006E	SPECIAL PROCESSING											43		LO-4, LE-5	
GR5036X	RCS TCP B3D		OFF	ON	2201006F	SPECIAL PROCESSING											43		LO-5, LE-5	
GR5037X	RCS TCP B3A		OFF	ON	2201006G	SPECIAL PROCESSING											43		LO-5, LE-5	
GR5038X	RCS TCP A3R		OFF	ON	2201006H	SPECIAL PROCESSING											43		LO-4, LE-5	
GR5039X	RCS TCP B2U		OFF	ON	2201007A	SPECIAL PROCESSING											43		LO-5, LE-5	
GR5040X	RCS TCP A2D		OFF	ON	2201007B	SPECIAL PROCESSING											43		LO-4, LE-5	
GR5041X	RCS TCP A2A		OFF	ON	2201007C	SPECIAL PROCESSING											41		LO-4, LE-5	
GR5042X	RCS TCP B2L		OFF	ON	2201007D	SPECIAL PROCESSING											43		LO-5, LE-5	
GR5043X	RCS TCP AID		OFF	ON	2201007E	SPECIAL PROCESSING											43		LO-4, LE-5	
GR5044X	RCS TCP BID		OFF	ON	2201007F	SPECIAL PROCESSING											43		LO-5, LE-5	
GR5045X	RCS TCP AlF		OFF	ON	2201007G	SPECIAL PROCESSING											43		LO-4, LE-5	
GR5046X	RCS TCP BlL		OFF	ON	2201007H	SPECIAL PROCESSING											43		LO-5, LE-5	
GR6001T	QUAD 4 TEMP	°F	-60	+260	1003005	1			.1	.1						71	27B		LP-14	1123
GR6002T	QUAD 3 TEMP	°F	-60	+260	1010005	1			.1	.1	.1					71	27B		LP-14	1123
GR6003T	QUAD 2 TEMP	°F	-60	+260	1022005	1			.1	.1						71	27B		LP-14	1123
GR6004T	QUAD 1 TEMP	°F	-60	+260	1023005	1			.1	.1						71	27B		LP-14	1123
GR9609U	RCS MAIN A CLSD		OPEN	CLSD	1013098F	1			.1	.1							49	51	LE-5	1123
GR9610U	RCS MAIN B CLSD		OPEN	CLSD	1013098E	1			.1	.1							49	51	LE-5	1123
GR9613U	A/B XFEED OPEN		CLSD	OPEN	1013098B	1			.1	.1							49	51	LE-5	1123
GR9631U	FUEL INCNT A OPN		CLSD	OPEN	1013098D	1			.1	.1							49	51	LE-5	1123
GR9632U	FUEL INTCNT B OPN		CLSD	OPEN	1013098C	1			.1	.1							49	51	LE-5	1123
GR9641U	OXID INTCNT A OPN		CLSD	OPEN	1013098H	1			.1	.1							49	51	LE-5	1123
GR9642U	OXID INTCNT A OPN		CLSD	OPEN	1013098G	1			.1	.1							49	51	LE-5	1123
GR9661U	4A ISO CLSD		OPEN	CLSD	1048098H	1			.1	.1							49	51	LE-5	
GR9662U	4B ISO CLSD		OPEN	CLSD	1048098G	1			.1	.1							49	51	LE-5	
GR9663U	3A ISO CLSD		OPEN	CLSD	1048098F	1			.1	.1							49	51	LE-5	
GR9664U	3B ISO CLSD		OPEN	CLSD	1048098E	1			.1	.1							49	51	LE-5	
GR9665U	2A ISO CLSD		OPEN	CLSD	1048098D	1			.1	.1							49	51	LE-5	
GR9666U	2B ISO CLSD		OPEN	CLSD	1048098C	1			.1	.1							49	51	LE-6	
GR9667R	1A ISO CLSD		OPEN	CLSD	1048098B	1			.1	.1							49	51	LE-6	
GR9668U	1BISO CLSD		OPEN	CLSD	1048098A	1			.1	.1							49	51	LE-6	
GT0441X	DUA STATUS				5101097	60											49		LE-6	
GT0454	ST ANT ELEC ASSY	DEG	-200	+250	1028101	1			.1	.1							28		LP-15	1468
GT0625	VHF RLVR B	VDC	0	5	1022037	1			.1	.1							28		LP-15	1468
GT0992B	S-BND ST PH ERROR	KHZ	-166	+218	1048037	1			1	1						70	28		LP-15	1468
GT0993B	S-BND XMTR PO	MW	-207	3604	1050101	1			1	.2	.2					70	28		LP-15	1468
GT0994V	S-BND RCVR SIG	DBM	-133	-50	1040005	1			1	1						70			LP-17	1468
GY0050X	ABORT CMD		NO	YES	1014098H	1			1	1							49	51	LE-6	1001
GY0201X	ED SYS A REL XFER		NO	YES	1014098C	1			1	1							49	51	LE-6	1001
GY0202X	ED SYS B REL XFER		NO	YES	1014098B	1			1	1							49	51	LE-6	1001
GY0231X	SYS A FED REL CLSD		OPEN	CLSD	1014098E	1			1	1							49	51	LE-6	1001
GY0232X	SYS B FED REL CLSD		OPEN	CLSD	1014098D	1			1	1							49	51	LE-6	1001
GT8101V	EVCS 1 CAL 0 PCT	VDC	0	5					.1	.1										1310
GT8102V	EVCS 1 CAL 100 PCT	VDC	0	5					.1	.1										1310
GT8110P	PLSS FEED NO 1 H2O	PSIA	0	5					.5	1							34A		LP-23	1310
GT8124J	EKG NO 1	VDC	0	5															LP-25	
GT8140C	PLSS BATTERY CURRENT NO 1	AMP	0	10					1	1							34A		LP-23	1310
GT8141V	PLSS NO 1 BATTERY	VDC	12	20					.2	.5							34A		LP-23	1310
GT8154T	LCG H2O INLET NO 1	°F	40	90					.5	1							34B		LP-23	1310
GT8168P	PGA O2 NO 1	PSIA	2.5	5					1	1							34B		LP-23	1310
GT8170T	PLSS 1 SUB O2 OUT	°F	40	90					.2	.5							34B		LP-23	1310
GT8175P	PLSS 1 CO2 PARTIAL PRESSURE	MMHG	0	30					.1	.1							34C		LP-25	1310
GT8182T	PLSS O2 SUPPLY NO 1	PSIA	0	1100					.2	.5							34A		LP-23	1310
GT8196T	LCG H2O DELTA T	°F	0	15					.5	1							34B		LP-23	1310
GT8201V	EVCS 2 CAL 0 PCT	VDC	0	5					.1	.1										1310
GT8202V	EVCS 2 CAL 100 PCT	VDC	0	5					.1	.1										1310
GT8210P	PLSS NO 2 FEED H2O	PSIA	0	5					.5	1							34A		LP-23	1310
GT8224J	EKG NO 2	VDC	0	5															LP-25	
GT8240C	PLSS BATTERY CURRENT NO 2	AMP	0	10					1	1							34A		LP-23	1310
GT8241V	PLSS NO 2 BATTERY	VDC	12	20					.2	.5							34A		LP-24	1310
GT8254T	LCG H2O INLET NO 2	°F	40	90					.5	1							34B		LP-24	1310
GT8268P	PGA O2 NO 2	PSIA	2.5	5.0					1	1							34B		LP-24	1310
GT8270T	PLSS 2 SUB O2 OUT	°F	40	90					.2	.5							34B		LP-24	1310
GT8275P	PLSS 2 CO2 PARTIAL PRESSURE	MMHG	0	30					.1	.1							34C		LP-25	1310
GT8282P	PLSS O2 SUPPLY NO 2	PSIA	0	1100					.2	.5							34A		LP-24	1310
GT8296T	LCG H2O DELTA T	°F	0	15					.5	1							34B		LP-24	1310

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY

Measurement: Number	Measurement: Title	Measurement: Unit	Approximate Range: Low	Approximate Range: High	Loading number	MSFN format Sample rates, S/S: 1	2	3	4	5	6	7	8	9	10	Summary TWX number	PCM analog tabs and plots: STD	SP	Strip chart record setup number	Primary MSK number
CA1820T	TEMP CREW HS ABL SUR LOC 1A	°F	-260	+830	1022084	1	.1			.1			.1	.1	.1	3,5	1		CP-1	404
CA1821T	TEMP CREW HS ABL SUR LOC 4A	°F	-260	+830	1024052	1	.1			.1			.1	.1	.1	3,5	1		CP-1	404
CA1822T	TEMP CREW HS ABL SUR LOC 7A	°F	-260	+830	1025084	1	.1			.1			.1	.1	.1	3,5	1		CP-1	404
CA1823T	TEMP CREW HS ABL SUR LOC 10A	°F	-260	+830	1027052	1	.1			.1			.1	.1	.1	3,5	1		CP-1	404
SA1830T	TEMP SM SKIN SURF LOC 1A	°F	-109	+264	1014052	1				.5			.1	.1	.5	3,5	2A		CP-2	404
SA2377T	TEMP BAY 2 OX TANK SURFACE	°F	-100	+200	1048052	1	.1			.1			.1	.1	.1	3,5	2A		CP-2	404
SA2378T	TEMP BAY 3 OX TANK SURFACE	°F	-100	+200	1046084	1	.1			.1			.1	.1	.1	3,5	2A		CP-2	404
SA2379T	TEMP BAY 5 FUEL TANK SURFACE	°F	-100	+200	1047052	1	.1			.1			.1	.1	.1	3,5	2A		CP-2	404
SA2380T	TEMP BAY 6 FUEL TANK SURFACE	°F	-100	+200	1047084	1	.1			.1			.1	.1	.1	3,5	2A		CP-2	404
SC0030Q	QUANTITY H2 TANK 1	PCT	0	100	1047116	1	.1			.1			.1	.5	.1	4	4D		CP-8	613
SC0031Q	QUANTITY H2 TANK 2	PCT	0	100	1048116	1	.1			.1			.1	.5	.1	4	4D		CP-8	613
SC0032Q	QUANTITY O2 TANK 1	PCT	0	100	1049116	1	.1			.1			.1	.5	.1	4	4B		CP-6	613
SC0033Q	QUANTITY O2 TANK 2	PCT	0	100	1014116	1	.1			.1			.1	.5	.1	4	4B		CP-6	613
SC0037P	PRESS O2 TANK 1	PSIA	50	1050	1050116	1	.2			.2			.5	.5	.2	4	4B		CP-6	613
SC0038P	PRESS O2 TANK 2	PSIA	50	1050	1022116	1	.2			.2			.5	1	.2	4	4B		CP-6	613
SC0039P	PRESS H2 TANK 1	PSIA	0	350	1012116	1	.2			.2			.5	1	.2	4	4D		CP-7	613
SC0040P	PRESS H2 TANK 2	PSIA	0	350	1013116	1	.2			.2			.5	1	.2	4	4D		CP-8	613
SC0041T	TEMP O2 TANK 1	°F	-325	+80	1018116	1	.1			.1			.1	.5	.1	4	4C		CP-7	613
SC0042T	TEMP O2 TANK 2	°F	-325	+80	1019116	1	.1			.1			.1	.5	.1	4	4C		CP-7	613
SC0043T	TEMP H2 TANK 1	°F	-425	-200	1020116	1	.1			.1			.1	.5	.1	4	4D		CP-8	613
SC0044T	TEMP H2 TANK 2	°F	-425	-200	1021116	1	.1			.1			.1	.5	.1	4	4D		CP-8	613
SC0051Q	QUANTITY O2 TANK 3	PCT	0	100	1105041	1	.1			.1			.1	.1	.1	4	4B		CP-6	613
SC0053P	PRESS O2 TANK 3	PSIA	50	1050	1105012	1	.2			.2			.2	.2	.2	4	4B		CP-6	613
SC0055T	TEMP O2 TANK 3	°F	-325	+80	1028116	1	.1			.1			.1	.1	.1	4	2B, 4C		CP-7	613
SC0069P	PRESS O2 TANK 2 and 3 MANIF	PSIA	50	1050	1102044	1	.2			.2			.2	.2	.2	4	4B		CP-6	613
SC0070T	TEMP O2 TANK 1 HEATERS	°F	-300	+600	1036116	1	.1			.1			.1	.1	.1	4	2B, 4C		CP-7	613
SC0071T	TEMP O2 TANK 2 HEATERS	°F	-300	+600	1037116	1	.1			.1			.1	.1	.1	4	2B, 4C		CP-7	613
SC0072T	TEMP O2 TANK 3 HEATERS	°F	-300	+600	1045116	1	.1			.1			.1	.1	.1	4	2B, 4C		CP-7	613
CC0175T	TEMP STATIC INVERTER 1	°F	32	248	1029084	1	.1			.1			.1	.5	.1	3	3A		CP-3	518
CC0176T	TEMP STATIC INVERTER 2	°F	32	248	1030052	1	.1			.1			.1	.5	.1	3	3A		CP-3	518
CC0177T	TEMP STATIC INVERTER 3	°F	32	248	1030084	1	.1			.1			.1	.5	.1	3	3A		CP-3	518
CC0200V	AC VOLTAGE MAIN BUS 1 PHASE A	VRMS	0	150	1105011	10	.2			.2	10		.2	1	.2	3	3B		CP-4	518
CC0203V	AC VOLTAGE MAIN BUS 2 PHASE A	VRMS	0	150	1102074	10	.2			.2	10		.2	1	.2	3	3B		CP-4	518
CC0206V	DC VOLTAGE MAIN BUS A	VDC	0	45	1102075	10	.2			.2	10		.2	1	.2	3	3B		CP-4	518
CC0207V	DC VOLTAGE MAIN BUS B	VDC	0	45	1102076	10	.2			.2	10		.2	1	.2	3	3B		CP-4	518
CC0210V	DC VOLTAGE BATTERY BUS A	VDC	0	45	1103073	10	.2			.2	10		.2	1	.2	3	3B		CP-4	518
CC0211V	DC VOLTAGE BATTERY BUS B	VDC	0	45	1103075	10	.2			.2	10		.2	1	.2	3	3B		CP-4	518
CC0215C	DC CURRENT BATT CHARGER OUT	AMP	0	5	1103009	5	.1			.2			.2	1	.2	3	3A		CP-3	518
CC0222C	DC CURRENT BATTERY A	AMP	0	100	1103010	10	.2			.2	5		.2	1	.2	3	3A		CP-3	518
CC0223C	DC CURRENT BATTERY B	AMP	0	100	1104009	10	.2			.2	5		.2	1	.2	3	3A		CP-3	518
CC0224C	DC CURRENT BATTERY C	AMP	0	100	1104010	5	.2			.2			.2	1	.2	3	3A		CP-3	518
SC0230V	DC VOLTAGE, SM BATTERY	VDC	0	45	1101090	1	.2			.2			.2	.2	.2	3	3B		CP-4	518
CC0232V	DC VOLTAGE BATTERY RELAY BUS	VDC	0	45	1103011	10	.2			.2	5		.2	1	.2	3	3B		CP-4	518
SC2066P	O2 PRESSURE FC 1 REGULATED	PSIA	0	75	1102108	1	.2			.2			.2	1	.2	3	4E		CP-9	518
SC2067P	O2 PRESSURE FC 2 REGULATED	PSIA	0	75	1102113	1	.2			.2			.2	1	.2	3	4E		CP-9	518
SC2068P	O2 PRESSURE FC 3 REGULATED	PSIA	0	75	1102121	1	.2			.2			.2	1	.2	3	4E		CP-9	518
SC2069P	H2 PRESSURE FC 1 REGULATED	PSIA	0	75	1102122	1	.2			.2			.2	1	.2	3	4E		CP-9	518
SC2070P	H2 PRESSURE FC 2 REGULATED	PSIA	0	75	1102123	1	.2			.2			.2	1	.2	3	4E		CP-9	518

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY - Continued

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range																	
			Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
SC2071P	H2 PRESSURE FC 3 REGULATED	PSIA	0	75	1102124	1	.2			.2			.2	1	.2	3	4E		CP-9	518
SC2081T	TEMP FC 1 COND EXHAUST	°F	145	250	1017116	1	.1			.1	1		.1	.5	.1	3	4G		CP-11	518
SC2082T	TEMP FC 2 COND EXHAUST	°F	145	250	1041116	1	.1			.1	1		.1	.5	.1	3	4G		CP-11	518
SC2083T	TEMP FC 3 COND EXHAUST	°F	145	250	1023116	1	.1			.1	1		.1	.5	.1	3	4G		CP-11	518
SC2084T	TEMP FC 1 SKIN	°F	80	550	1024116	1	.1			.1			.1	.5	.1	3	4G		CP-11	518
SC2085T	TEMP FC 2 SKIN	°F	80	550	1025116	1	.1			.1			.1	.5	.1	3	4G		CP-11	518
SC2086T	TEMP FC 3 SKIN	°F	80	550	1026116	1	.1			.1			.1	.5	.1	3	4G		CP-11	518
SC2087T	TEMP FC 1 RADIATOR OUTLET	°F	-50	+300	1042116	1	.1			.1			.1	.5	.1	3	4H		CP-12	518
SC2088T	TEMP FC 2 RADIATOR OUTLET	°F	-50	+300	1043116	1	.1			.1			.1	.5	.1	3	4H		CP-12	518
SC2089T	TEMP FC 3 RADIATOR OUTLET	°F	-50	+300	1044116	1	.1			.1			.1	.5	.1	3	4H		CP-12	518
SC2090T	RAD INLET TEMP FC 1	°F	-50	+300	1044052	1	.1			.1			.1	.5	.1	3	4H		CP-12	518
SC2091T	RAD INLET TEMP FC 2	°F	-50	+300	1044084	1	.1			.1			.1	.5	.1	3	4H		CP-12	518
SC2092T	RAD INLET TEMP FC 3	°F	-50	+300	1023052	1	.1			.1			.1	.5	.1	3	4H		CP-12	518
SC2113C	DC CURRENT FC 1 OUTLET	AMP	0	+100	1103012	10	.5			.5	10		.5	1	.5	3,4	4A		CP-5	518
SC2114C	DC CURRENT FC 2/SM BATTERY	AMP	0	100	1103043	10	.5			.5	10		.5	1	.5	3,4	4A		CP-5	518
SC2115C	DC CURRENT FC 3 OUTPUT	AMP	0	100	1103044	10	.5			.5	10		.5	1	.5	3,4	4A		CP-5	518
SC2139R	FLOW RATE H2 FC 1	LB/HR	0	.2	1103017	1	.2			.2			.2	1	.2	3,4	4F		CP-10	518
SC2140R	FLOW RATE H2 FC 2	LB/HR	0	.2	1103025	1	.2			.2			.2	1	.2	3,4	4F		CP-10	518
SC2141R	FLOW RATE H2 FC 3	LB/HR	0	.2	1103026	1	.2			.2			.2	1	.2	3,4	4F		CP-10	518
SC2142R	FLOW RATE O2 FC 1	LB/HR	0	1.6	1103027	1	.2			.2			.2	1	.2	3,4	4F		CP-10	518
SC2143R	FLOW RATE O2 FC 2	LB/HR	0	1.6	1103028	1	.2			.2			.2	1	.2	3,4	4F		CP-10	518
SC2144R	FLOW RATE O2 FC 3	LB/HR	0	1.6	1103041	1	.2			.2			.2	1	.2	3,4	4F		CP-10	518
SC2160X	PH FACTOR WATER COND FC 1		NORM	HIGH	1105066A	1	1			1			1	1	.5	3	1	10	CE-1	518
SC2161X	PH FACTOR WATER COND FC 2		NORM	HIGH	1105066B	1	1			1			1	1	.5	3	1	10	CE-1	518
SC2162X	PH FACTOR WATER COND FC 3		NORM	HIGH	1105066C	1	.5			1			1	1	1	3	1	10	CE-1	518
CC2962C	CSM TO LEM CURRENT MONITOR	AMP	0	10	1102042	10	.1			.1	5		.1	1	.1	3	4A		CP-5	518
CD0005V	DC VOLTAGE PYRO BUS A	VDC	0	40	1101028	5	.5			.5			.5	1	.1	3		11	CP-27	518
CD0006V	DC VOLTAGE PYRO BUS B	VDC	0	40	1101017	5	.5			.5			.5	1	.1	3		11	CP-27	518
CD0023X	CM-SM RELAY CLOSE A			SEP	1104067A	1	1			1			1	1	1		2	10	CE-1	
CD0024X	CM-SM SEP RELAY CLOSE B			SEP	1104068A	1	1			1			1	1	1		2	10	CE-1	
CD0123X	SLA SEPARATION RELAY A			SEP	1104067E	1	1			1			1	1	1		2	10	CE-1	
CD0124X	SLA SEPARATION RELAY B			SEP	1104068G	1	1			1			1	1	1		2	10	CE-1	
CD0130X	HAND CONTROLLER INPUT A			ABORT	1103065C	1	1			1			1	1	.5		2	10	CE-1	
CD0131X	HAND CONTROLLER INPUT B			ABORT	1103065F	1	1			1			1	1	.5		2	10	CE-1	
CD0132X	EDS ABORT LOGIC INPUT NO 1		VOTE/ OFF	ARM	1103066A	1	1			1			1	1	.5		2	10	CE-1	
CD0133X	EDS ABORT LOGIC INPUT NO 2		VOTE/ OFF	ARM	1103066B	1	1			1			1	1	.5		2	10	CE-1	
CD0134X	EDS ABORT LOGIC INPUT NO 3		VOTE/ OFF	ARM	1103066D	1	1			1			1	1	.5		2	10	CE-1	
CD0135X	EDS ABORT LOGIC OUTPUT A			ABORT	1103065G	1	1			1			1	1	.5		2	10	CE-1	
CD0136X	EDS ABORT LOGIC OUTPUT B			ABORT	1103065D	1	1			1			1	1	.5		2	10	CE-1	
CD0170X	RCS ACTIVATE SIG A			ENABLE	1104067C	1	1			1			1	1	1		2	10	CE-1	
CD0171X	RCS ACTIVATE SIG B			ENABLE	1104068C	1	1			1			1	1	1		2	10	CE-1	
CD0173X	CM RCS PRESS SIG A			PRESS	1104067G	1	1			1			1	1	1		2	10	CE-1	
CD0174X	CM RCS PRESS SIG B			PRESS	1104068E	1	1			1			1	1	1		2	10	CE-1	
CD0200V	DC VOLTAGE LOGIC BUS A	VDC	0	40	1101027	5	.5			.5			.5	1	.1	3		11	CP-27	518
CD0201V	DC VOLTAGE LOGIC BUS B	VDC	0	40	1101025	5	.5			.5			.5	1	.1	3		11	CP-27	518
CD0230X	FWD HS JETTISON A			JETT	1104097A	1	1			1			1	1	1		2	10	CE-1	
CD0231X	FWD HS JETTISON B			JETT	1104099E	1	1			1			1	1	1		2	10	CE-1	
CD1154X	CSM-LEM LOCK RING SEP RELAY A			SEP	1103067F	1	1			1			1	1	1		7	10	CE-4	
CD1155X	CSM-LEM LOCK RING SEP RELAY B			SEP	1103067G	1	1			1			1	1	1		7	10	CE-4	
CE0001X	DROGUE DEPLOY RELAY CLOSE A			DEPLOY	1105067A	1	1			1			1	1	1		3	10	CE-1	
CE0002X	DROGUE DEPLOY RELAY CLOSE B			DEPLOY	1105068F	1	1			1			1	1	1		3	10	CE-1	

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY - Continued

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range																	
			Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
CE003X	MAIN CHUTE DEPL DRG REL RLY A			DEPLOY	1105067H	1	1			1			1	1	1		3	10	CE-1	
CE0004X	MAIN CHUTE DEPL DRG REL RLY B			DEPLOY	1105068C	1	1			1			1	1	1		3	10	CE-1	
CE0321X	MAIN CHUTE DISCONNECT RELAY A			DISC	1105067E	1	1			1			1	1	1		3	10	CE-1	
CE0322X	MAIN CHUTE DISCONNECT RELAY B			DISC	1105068H	1	1			1			1	1	1		3	10	CE-1	
CF0001P	PRESSURE CABIN	PSIA	0	17	1002116	1	.2			.2			.2	1	.1	4	5B		CP-14	613
CF0002T	TEMP CABIN	°F	40	125	1043084	1	.1			.1			.1	.5	.1	4	5B		CP-14	404, 613
CF0003P	PRESS O2 SUIT TO CABIN DIFF	IN H2O	-5	+5	1102009	1	.2			.1			.1	1	.1	4	5D		CP-16	613
CF0005P	PRESS CO2 PARTIAL	MM HG	0	+23	1001116	1	.1			.1			.1	.5	.1	4	5B		CP-14	613
CF0006P	PRESS SURGE TANK	PSIA	50	1050	1101012	1	.2			.2			.2	1	.2	4	5B		CP-14	613
CF0008T	TEMP SUIT SUPPLY MANIF	°F	20	95	1015116	1	.1			.1			.1	.5	.1	4	5B		CP-14	613
CF0009Q	QUANTITY WASTE WATER TANK	PCT	0	100	1003116	1	.1			.1			.1	.5	.1	4	5B		CP-14	613
CF0010Q	QUAN POTABLE H2O TANK	PCT	0	100	1027116	1	.1			.1			.1	.5	.1	4	5B		CP-14	613
CF0012P	PRESS SUIT DEMAND REG SENSE	PSIA	0	16	1101009	1	.2			.2			.2	1	.1	4	5D		CP-16	613
CF0015P	PRESS SUIT COMPRESSOR DIFF	PSID	0	.9	1101010	1	.2			.2			.2	1	.1	4	5D		CP-16	613
CF0016P	PRESS GLYCOL PUMP OUTLET	PSIG	0	59	1111011	1	.2			.2			.2	.	.1	4	5D		CP-16	613
CF0017T	TEMP GLYCOL EVAP OUTLET STEAM	°F	20	95	1045052	1	.2			.1			.2	.2	.1	4	5C		CP-15	613
CF0018T	TEMP GLY EVAP OUTLET LIQUID	°F	25	75	1004116	1	.1			.1			.1	.5	.1	4	5A		CP-13	613
CF0019Q	QUANTITY GLYCOL ACCUM	PCT	0	109	1101044	1	.1			.2			.2	.5	.1	4	5A		CP-13	613
CF0020T	TEMP SPACE RADIATOR OUTLET	°F	-50	+100	1005116	1	.1			.1			.1	.5	.1	4	5A		CP-13	613
CF0034P	BACK PRESS GLYCOL EVAPORATOR	PSIA	0	.25	1002052	1	.2			.2			.2	1	.1	4	5A		CP-13	613
CF0035R	FLOWRATE ECS O2	LB/HR	.2	1.0	1101049	1	.2			.2			.2	.5	.1	3,4	5D		CP-16	613
CF0036P	PRESS OUTLET O2 REG SUPPLY	PSIG	0	149	1102073	1	.2			.2			.2	1	.1	4	5D		CP-16	613
CF0070P	PRESS SEC GLYCOL PUMP OUTLET	PSIG	0	59	1105044	1	.2			.2			.2	1	.1	4	5C		CP-16	613
CF0071T	TEMP SEC EVAP OUTLET LIQUID	°F	25	75	1104041	1	.1			.1			.1	.5	.1	4	5C		CP-15	613
CF0072Q	QUANTITY SEC GLYCOL ACCUM	PCT	0	102	1104075	1	.1			.1			.1	.5	.1	4	5C		CP-15	613
CF0073P	PR SECONDARY EVAP OUT STEAM	PSIA	0	.25	1003084	1	.1			.1			.1	.5	.1	4	5C		CP-15	613
CF0120P	PRESS H2O AND GLYCOL TANKS	PSIA	0	50	1034084	1	.2			.2			.2	1	.1	4	5A		CP-13	613
CF0157R	RATE GLYCOL FROM THERMAL LOAD	LB/HR	112	300	1103057	1	.2			.2			.2	1	.1	4	5D		CP-16	613
CF0181T	TEMP GLYCOL EVAP INLET	°F	35	100	1034052	1	.1			.1			.1	.5	.1	4	5A		CP-13	613
SF0260T	TEMP PRIMARY RADIATOR INLET	°F	55	120	1016116	1	.1			.1			.1	.5	.1	4	5A		CP-13	613
SF0262T	TEMP SECONDARY RADIATOR INLET	°F	55	120	1029116	1	.1			.1			.1	.5	.1	4	5G		CP-15	613
SF0263T	TEMP SEC RADIATOR OUTLET	°F	30	70	1030116	1	.1			.1			.1	.5	.1	4	5C		CP-15	613
SF0266X	RADIATOR FLOW CONT SYS 1 OR 2		SYS 1	SYS 2	1101098H	1	1			1			1	1	1	4	4	10	CE-2	613
CF0460T	TEMP URINE DUMP NOZZLE	°F	0	100	1038116	1	.1			.1			.1	.5	.1	4	5C		CP-15	613
CF0461T	TEMP WASTE WATER DUMP NOZZLE	°F	0	100	1028052	1	.1			.1			.1	.5	.1	4	5C		CP-15	613
CG1040V	120 VDC PIPA SUPPLY DC LEVEL	VDC	85	135	1028084	1	.1			.2			.2	1	.5	6	6		CP-17 CO-3	
CG1110V	2.5 VDC TM BIAS	VDC	0	5	1046116	1	.5			1			1	1	1	6	6		CP-17 CO-3	
CG1201V	IMU 28V .8KC 1 PCT	VRMS	0	30	1031052	1	.2			.2			.2	1	.2	6	6		CP-17 CO-3	
CG1331V	3.2 KC 28 V SUPPLY	VRMS	0	32	1029052	1	.2			.2			.2	1	.2	6	6		CP-17 CO-3	
CG1513X	28 V IMU STANDBY		OFF	STBY	1103067B	1	1			1			1	1	1		9	10	CO-3, CE-4	
CG1523X	28 V CMC OPERATE		OFF	OPR	1103067C	1	1			1			1	1	1		9	10	CO-3, CE-4	
CG1533X	28 V OPTX OPERATE		OFF	OPR	1103067D	1	1			1			1	1	1		9	10	CO-3, CE-4	
CG2112V	IG 1X RESOLVER OUTPUT SIN	VRMS	-21	+21	1102060	5	.5			1			1	1	1	6	9	12A	CO-3	
CG2113V	IG 1X RESOLVER OUTPUT COS	VRMS	-21	+21	1102081	5	.5			1			1	1	1	6		12A	CO-3	

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY - Continued

Measurement			Approximate Range		Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
CG2117V	IGA SERVO ERROR IN PHASE	VRMS	-3	+3	1201014	5	.5			1			1	1	.5	6		12B	CO-3	
CG2142V	MG 1X RESOLVER OUT-PUT SIN	VRMS	-21	+21	1102089	5	.5			1			1	1	1	6		12A	CO-3	
CG2143V	MG 1X RESOLVER OUT-PUT COS	VRMS	-21	+20	1102090	5	.5			1			1	1	1	6		12A	CO-3	
CG2147V	MGA SERVO ERROR IN PHASE	VRMS	-3	+3	1201013	5	.5			1			1	1	.5	6		12B	CO-3	
CG2172V	OG 1X RESOLVER OUT-PUT SINE	VRMS	-21	+21	1102091	5	.5			1			1	1	1	6		12A	CO-3	
CG2173V	OG 1X RESOLVER OUT-PUT COS	VRMS	-21	+21	1102092	5	.5			1			1	1	1	6		12A	CO-3	
CG2177V	OGA SERVO ERROR IN PHASE	VRMS	-3	+3	1201015	5	.5			1			1	1	.5	6		12B	CO-3	
CG2300T	PIPA TEMPERATURE	°F	+119	+140	1032116	1	.1			.1			.1	.1	.1	6	6		CP-17 CO-3	0683
CG3721V	SHAFT CDU DAC OUT-PUT	VRMS	-12	+12	1102058	5	.2			1			1	5	5	6		12A	CO-3	0683
CG3722V	TRUNNION CDU DAC OUTPUT	VRMS	-12	+12	1102059	5	.2			1			1	5	5	6		12A	CO-3	0683
CG5040X	CMC WARNING		WARN		1103099A	1	.5			1			1	1	1		9	10	CO-3, CE-4	
CH3500H	FDAI CM/SM ATT ERROR PITCH	DEG	-5 -15	+5 +15	5101062	5	.5			1			1	5	5	6		13B	CO-1	0683
CH3501H	FDAI CM/SM ATT ERROR YAW	DEG	-5 -15	+5 +15	5101063	5	.5			1			1	5	5	6		13B	CO-1	0683
CH3502H	FDAI CM/SM ATT ERROR ROLL	DEG	-5 -15	+5 +15	1201016	5	.5			1			1	1	1	6		13B	CO-2, CO-1	0683
CH3503R	FDAI SCS BODY RATE PITCH	DEG/ SEC	-1 -5 -10	+1 +5 +10	1201021	5	.5			1			1	5	3	6		13A	CO-2, -1,-5	0683
CH3504R	FDAI SCS BODY RATE YAW	DEG/ SEC	-1 -5 -10	+1 +5 +10	1201022	5	.5			1			1	5	3	6		13A	CO-2, -1,-5	0683
CH3505R	FDAI SCS BODY RATE ROLL	DEG/ SEC	-1 -5 -50	+1 +5 +50	1201023	5	.5			1			1	5	1	6		13A	CO-2, -1,-5	0683
CH3517H	GIMBAL POSITION PITCH 1 OR 2	DEG	-4	+4	1201024	5	.5			1			1	5	5	6		13B	CO-2, CO-5	0683
CH3518H	GIMBAL POSITION YAW 1 OR 2	DEG	-4	+4	1201046	5	.5			1			1	5	5	6		13B	CO-2, CO-5	0683
CH3546X	RCS SOLENOID ACT C3/13/X		FIRE/ OFF	ARM	2201018A												5		CO-1, CE-2	
CH3547X	RCS SOLENOID ACT A4/14/X		FIRE/ OFF	ARM	2201018B												5		CO-1, CE-2	
CH3548X	RCS SOLENOID ACT A3/23/-X		FIRE/ OFF	ARM	2201018C												5		CO-1, CE-2	
CH3549X	RCS SOLENOID ACT C4/24/-X		FIRE/ OFF	ARM	2201018D												5		CO-1 CE-2	
CH3550X	RCS SOLENOID ACT D3/25/X		FIRE/ OFF	ARM	2201018E												5		CO-1, CE-2	
CH3551X	RCS SOLENOID ACT B4/26/X		FIRE/ OFF	ARM	2201018F												5		CO-1, CE-2	
CH3552X	RCS SOLENOID ACT B3/15/-X		FIRE/ OFF	ARM	2201018G												5		CO-1, CE-2	
CH3553X	RCS SOLENOID ACT D4/16/-X		FIRE/ OFF	ARM	2201018H												5		CO-1, CE-2	
CH3554X	RCS SOLENOID ACT B1/11/Z		FIRE/ OFF	ARM	2201019A												5		CO-1,2 CE-2	
CH3555X	RCS SOLENOID ACT D2/22/Z		FIRE/ OFF	ARM	2201019E												5		CO-1,2 CE-2	
CH3556X	RCS SOLENOID ACT D1/21/-Z		FIRE/ OFF	ARM	2201019F												5		CO-1,2 CE-2	
CH3557X	RCS SOLENOID ACT B2/12/-Z		FIRE/ OFF	ARM	2201019B												5		CO-1,2 CE-2	
CH3558X	RCS SOLENOID ACT A1/Y		FIRE/ OFF	ARM	2201019G												5		CO-1,2 CE-2	
CH3559X	RCS SOLENOID ACT C2/Y		FIRE/ OFF	ARM	2201019C												5		CO-1,2 CE-2	
CH3560X	RCS SOLENOID ACT C1/-Y		FIRE/ OFF	ARM	2201019D												5		CO-1,2	
CH3561X	RCS SOLENOID ACT A2/-Y		FIRE/ OFF	ARM	2201019H												5		CO-1,2 CE-2	
CH3574X	TRANSLATIONAL CONTROLLER +X CMD		OFF	ON	1104067D	1	1			1			1	1	1		6	10	CE-3	
CH3575X	TRANSLATIONAL CONTROLLER -X CMD		OFF	ON	1104067F	1	1			1			1	1	1		6	10	CE-3	
CH3576X	TRANSLATIONAL CONTROLLER +Y CMD		OFF	ON	1104067H	1	1			1			1	1	1		6	10	CE-3	
CH3577X	TRANSLATIONAL CONTROLLER -Y CMD		OFF	ON	1104068F	1	1			1			1	1	1		6	10	CE-3	
CH3578X	TRANSLATIONAL CONTROLLER +Z CMD		OFF	ON	1104068H	1	1			1			1	1	1		6	10	CE-3	

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY - Continued

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range																	
			Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
CH3579X	TRANSLATIONAL CONTROLLER -Z CMD		OFF	ON	1104097B	1	1			1			1	1	1		6	10	CE-3	
CH3582V	SCS TVC AUTO COM-MAND PITCH	VDC	-9	+9	1201055	5	.5			1			1	5	5	6		13B	CO-2	0683
CH3583V	SCS TVC AUTO COM-MAND YAW	VDC	-9	+9	1201053	5	.5			1			1	5	5	6		13B	CO-2	0683
CH3585H	ROT CONTROL/MTVC PITCH CMD	VDC	-10	+10	5101096	5	.5			1			1	2	2	6		13A	CO-1, -2	0683
CH3586H	ROT CONTROL/MTVC YAW CMD	VDC	-10	+10	5101125	5	.5			1			1	2	2	6		13A	CO-1, -2	0683
CH3587H	ROT CONTROL/MTVC ROLL CMD	DEG	-10	+10	5101126	5	.5			1			1	5	1	6		13A	CO-1, -2	0683
CH3588X	ATTITUDE DEADBAND MINIMUM		MAX	MIN	1102067B	1	.5			1			1	1	1		6	10	CO-1, CE-3	
CH3590X	HIGH PRO RATE LIMIT		LOW	HIGH	1102067D	1	.5			1			1	1	1		6	10	CO-1,-2 CE-3	
CH3592X	FDAI SCALE ERROR 5, RATE 5		OFF	ON	1102067E	1	.5			1			1	1	1		6	10		
CH3593X	FDAI SCALE ERROR 50/15, RT50/10		OFF	ON	1102067F	1	.5			1			1	1	1		6	10	CO-1,-2 CE-3	
CH3600X	SCS DELTA V CG-LM/CSM POS		CSM	LM/	1102068C	1	1			1			1	1	.5		6	10	CE-3	
CH3601X	DIR RCS SW NO 1 ENABLE POS		OFF	ENABLE	1104097C	1	1			1			1	1	1		6	10	CE-3	
CH3602X	DIR RCS SW NO 2 ENABLE POS		OFF	ENABLE	1104097D	1	1			1			1	1	1		6	10	CE-3	
CH3604X	SPS SOLENOID DRIVER NO 1		FIRE/ OFF	ARM	1101098D	1	1			1			1	1	1		6	10	CO-2, CE-3	
CH3605X	SPS SOLENOID DRIVER NO 2		FIRE/ OFF	ARM	1102068D	1	1			1			1	1	1		6	10	CE-3, CO-2	
CH3606X	LIMIT CYCLE SW OFF POS		ON	OFF	1104098A	1	.5			1			1	1	1		6	10	CE-3	
CH3607X	SC CONTROL SOURCE SWITCH		CMC	SCS	1102068E	1	1			1			1	1	1		6	10	CE-3, CO-1, CO-2	
CH3609X	ROLL MAN ATT SW ACCEL CMD POS		OFF	ON	1104098G	1	.5			1			1	1	1		6	10	CE-3	
CH3610X	R MAN ATT SW MIN IMP CMD POS		OFF	ON	1104098H	1	.5			1			1	1	1		6	10	CE-3	
CH3612X	PITCH MAN ATT SW ACCEL CMD POS		OFF	ON	1104098C	1	.5			1			1	1	1		6	10	CE-3	
CH3613X	P MAN ATT SW MIN IMP CMD POS		OFF	ON	1104098D	1	.5			1			1	1	1		6	10	CE-3	
CH3615X	YAW MAN ATT SW ACCEL CMD POS		OFF	ON	1104098E	1	.5			1			1	1	1		6	10	CE-3	
CH3616X	YAW MAN ATT SW MIN IMP CMD POS		OFF	ON	1104098F	1	.5			1			1	1	1		6	10	CE-3	
CH3623X	GYRO 1 COMB SPIN MTRS RUN DET		LOW	NORM	1102067H	1	.5			1			1	1	1		6	10	CE-3	
CH3624X	GYRO 2 COMB SPIN MTRS RUN DET		LOW	NORM	1102067H	1	.5			1			1	1	1		6	10	CE-3	
CH3635X	BMAG MODE SW-ROLL ATT 1 RT 2		OFF	ON	1105099A	1	.5			1			1	1	1		6	10	CE-3	
CH3636X	BMAG MODE SW-ROLL RATE 2		OFF	ON	1105099B	1	.5			1			1	1	1		6	10	CE-3	
CH3638X	BMAG MODE SW-PITCH ATT 1 RT 2		OFF	ON	1105099C	1	.5			1			1	1	1		6	10	CE-3	
CH3639X	BMAG MODE SW-PITCH RATE 2		OFF	ON	1105099D	1	.5			1			1	1	1		6	10	CE-3	
CH3641X	BMAG MODE SW-YAW ATT 1 RT 2		OFF	ON	1105099E	1	.5			1			1	1	1		6	10	CE-3	
CH3642X	BMAG MODE SW-YAW RATE 2		OFF	ON	1105099F	1	.5			1			1	1	1		6	10	CE-3	
CH3666C	TVC PITCH DIFF CLUTCH CURRENT	MAMP	-625	+625	2201008	5	.5			1			1	5	5	6		13A	CO-2	0683
CH3667C	TVC YAW DIFF CLUTCH CURRENT	MAMP	-625	+625	1201056	5	.5			1			1	5	5	6		13A	CO-2	0683
CJ0060J	EKG COMMANDER LH COUCH	MV	-2.5	+2.5	2201007													14	CP-28	
CJ0061J	EKG COMMANDER CTR COUCH	MV	-2.5	+2.5	2201005													14	CP-28	
CJ0062J	EKG LM PILOT RH COUCH	MV	-2.5	+215	2201006													14	CP-28	
CJ0200R	RESP RATE CMD LH COUCH	OHM	-5	+5	5101064													14	CP-28	
CJ0201R	RESP RATE CM PILOT CTR COUCH	OHM	-5	+5	5101093													14	CP-28	
CJ0202R	RESP RATE LM PILOT RH COUCH	OHM	-5	+5	5101094													14	CP-28	

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY - Continued

Measurement: Number	Measurement: Title	Measurement: Unit	Approximate Range: Low	Approximate Range: High	Loading number	MSFN format Sample rates, S/S: 1	2	3	4	5	6	7	8	9	10	Summary TWX number	PCM analog tabs and plots: STD	SP	Strip chart record setup number	Primary MSK number
CK0026A	CM ACCEL X-AXIS	G	-2	+10	1201045	5	.1			1			1	1	.1	5		15	CO-4, CP-29	
CK0027A	CM ACCEL Y-AXIS	G	-2	+2	1201047	5	.1			1			1	1	.1	5		15	CO-4, CP-29	
CK0028A	CM ACCEL Z-AXIS	G	-2	+2	1201048	5	.1			1			1	1	.1	5		15	CO-4 CP-29	
CK1040X	16 MM DATA ACQ CAMERA HIGH GAIN ANT POS PITCH	VDC	CLOSED	OPEN	1201031													16		
CK1043X	70 MM CAMERA SHUTTER	VDC	CLOSED	OPEN	1201031													16		
CK1044X	LUNAR TOP CAMERA SHUTTER	VDC	CLOSED	OPEN	1201031													16		
CK1051K	RADIATION DOS-IMETER 1	VDC	0	5	1105090	1				.1			.1	.1				17A	CP-30	
CK1052K	RADIATION DOS-IMETER 2	VDC	0	5	1101058	1				.1			.1	.1				17A	CP-30	
CK1053R	DOSIMETER RATE CHANGE	VDC	0	5	1050084	1				.1			.1	.1				17A	CP-30	
SP0001P	HE PRESS TANK	PSIA	0	5000	1101041	2	.5			.5			.5	1	1	5	7B		CP-19	0683
SP0002T	HE TEMP TANK	°F	-100	+200	1006052	1	.2			.2			.2	.5	.5	5	7C 2B		CP-20	0683
SP0003P	PRESS OXIDIZER TANKS	PSIA	0	250	1101042	2	1			1			1	5	2	5	7B		CP-19	0683
SP0006P	PRESS FUEL TANKS	PSIA	0	250	1101043	2	1			1			1	5	2	5	7B		CP-19	0683
SP0022H	POSITION FUEL/OX VLV 1 POT B	DEG	0	90	1101108	5	.5			.5			.5	5	5	5	7A		CP-18	
SP0023H	POSITION FUEL/OX VLV 2 POT B	DEG	0	90	1101113	5	.5			.5			.5	5	5	5	7A		CP-18	
SP0024H	POSITION FUEL/OX VLV 3 POT B	DEG	0	90	1101121	5	.5			.5			.5	5	5	5	7A		CP-18	
SP0025H	POSITION FUEL/OX VLV 4 POT B	DEG	0	90	1101122	5	.5			.5			.5	5	5	5	7A		CP-18	
SP0045T	TEMP ENG VALVE BODY	°F	0	+200	1013052	1	.1			.2			.2	.1	.2	5	7C		CP-20	0683
SP0048T	TEMP ENG FUEL FEED LINE	°F	0	+200	1039116	1	.1			.2			.2	.1	.2	5	2B		CP-20	0683
SP0049T	TEMP ENG OX FEED LINE	°F	0	+200	1040116	1	.1			.2			.2	.1	.2	5	2B		CP-20	0683
SP0054T	TEMP 1 OX DISTRI-BUTION LINE	°F	0	+200	1015084	1	.1			.2			.2	.1	.2	5	2B		CP-20	0683
SP0057T	TEMP 1 FUEL DISTRI-BUTION LINE	°F	0	+200	1020084	1	.1			.2			.2	.1	.2	5	7C		CP-20	0683
SP0061T	ENG INJECTOR FLANGE TEMP NO 1	°F	0	600	1016084	1	.1			.2			.2	.2	.2	5	7C		CP-17	
SP0062T	ENG INJECTOR FLANGE TEMP NO 2	°F	0	600	1017052	1	.1			.2			.2	.2	.2	5	7C		CP-20	
SP0600P	SPS PRPLNT TKS N2A PRESS	PSIA	0	5000	1004052	1	.2			.5			.5	1	1	5	7B		CP-19	0683
SP0601P	SPS PRPLNT TKS N2B PRESS	PSIA	0	5000	1004084	1	.2			.5			.5	1	1	5	7B		CP-19	0683
SP0655Q	QUAN OX TANK 1 PRI-TOTAL AUX	PCT	0	50	1009084	1	.1			1			1	1	1	5	7A		CP-18	0683
SP0656Q	QUAN OX TANK 2	PCT	0	60	1010052	1	.1			1			1	1	1	5	7A		CP-18	0683
SP0657Q	QUAN FUEL TANK 1 PRI-TOTAL AUX	PCT	0	50	1010084	1	.1			1			1	1	1	5	7A		CP-18	0683
SP0658Q	QUAN FUEL TANK 2	PCT	0	60	1011052	1	.1			1			1	1	1	5	7A		CP-18	0683
SP0661P	PRESS ENGINE CHAMBER	PSIA	0	150	1201054	5	1			1			1	5	5	5		18		0683
SP0930P	PRESS FUEL SM/ENG INTERFACE	PSIA	0	300	1105027	5	.2			.5			.5	5	2	5	7B		CP-19	0683
SP0931P	PRESS OX SM/ENG INTERFACE	PSIA	0	300	1105059	5	.2			.5			.5	5	2	5	7B		CP-19	0683
CR0001P	HE PRESS TANK 1	PSIA	0	5000	1006116	1	.5			1			1	1	.2	5	8		CP-21	0683
CR0002P	HE PRESS TANK 2	PSIA	0	5000	1007117	1	.5			1			1	1	.2	5	8		CP-21	0683
CR0003T	HE TEMP TANK 1	°F	0	+300	1105042	1	.1			1			1	.5	.1	5	8,2C		CP-21	0683
CR0004T	HE TEMP TANK 2	°F	0	+300	1105043	1	.1			1			1	.5	.1	5	8,2C		CP-21	0683
CR0035P	PRESS CM-RCS HE MANIFOLD 1	PSIA	0	400	1101075	5	.5			1			1	1	.2	5	8		CP-21	0683
CR0036P	PRESS CM-RCS HE MANIFOLD 2	PSIA	0	400	1101076	5	.5			1			1	1	.2	5	8		CP-21	0683
SR5001P	HE PRESS TANK A	PSIA	0	5000	1008116	1	.2			1			1	1	.2	5	9A		CP-22	0683
SR5002P	HE PRESS TANK B	PSIA	0	5000	1009116	1	.2			1			1	1	.2	5	9A		CP-22	0683
SR5003P	HE PRESS TANK C	PSIA	0	5000	1010116	1	.2			1			1	1		5	9A		CP-22	0683
SR5004P	HE PRESS TANK D	PSIA	0	5000	1011116	1	.2			1			1	1	.2	5	9A		CP-22	0683
SR5013T	HE TEMP TANK A	°F	0	+100	1105073	1	.1			.2			.2	.2	.1	5	9C, 2C		CP-24	0683
SR5014T	HE TEMP TANK B	°F	0	+100	1105074	1	.1			.2			.2	.2	.1	5	9C, 2C		CP-24	0683
SR5015T	HE TEMP TANK C	°F	0	+100	1105075	1	.1			.2			.2	.2	.1	5	9C, 2C		CP-24	0683
SR5016T	HE TEMP TANK D	°F	0	+100	1105076	1	.1			.2			.2	.2	.1	5	9C, 2C		CP-24	0683
SR5025Q	QUAN SM RCS PRO SYS A	PCT	0	100	1031116	1	.1			.2			.2	.2	.1	5	9C		CP-24	0683

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY - Continued

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range																	
			Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
SR5026Q	QUAN SM RCS PRO SYS B	PCT	0	100	1033116	1	.1			.2			.2	.2	.1	5	9C		CP-24	0683
SR5027Q	QUAN SM RCS PRO SYS C	PCT	0	100	1034116	1	.1			.2			.2	.2	.1	5	9C		CP-24	0683
SR5028Q	QUAN SM RCS PRO SYS D	PCT	0	100	1035116	1	.1			.2			.2	.2	.1	5	9C		CP-24	0683
SR5065T	TEMP ENGINE PACKAGE A	°F	0	+300	1046052	1	.1			.1			.1	.1	.1	5	9D		CP-25	0683
SR5066T	TEMP ENGINE PACKAGE B	°F	0	+300	1006084	1	.1			.1			.1	.1	.1	5	9D		CP-25	0683
SR5067T	TEMP ENGINE PACKAGE C	°F	0	+300	1007052	1	.1			.1			.1	.1	.1	5	9D		CP-25	0683
SR5068T	TEMP ENGINE PACKAGE D	°F	0	+300	1007084	1	.1			.1			.1	.1	.1	5	9D		CP-25	0683
SR5729P	A HE MANIFOLD PRESS	PSIA	0	400	1102011	1	.2			1			1	1	.2	5	9A		CP-22	0683
SR5733P	OX MANIFOLD PR SYS A	PSIA	0	300	1101081	1	.2			1			1	1	.2	5	9A		CP-22	0683
SR5737P	FUEL MANIFOLD PR SYS A	PSIA	0	400	1103074	1	.2			1			1	1	.2	5	9A		CP-22	0683
SR5776P	B HE MANIFOLD PRESS	PSIA	0	400	1102012	1	.2			1			1	1	.2	5	9A		CP-22	0683
SR5780P	OX MANIFOLD PR SYS B	PSIA	0	300	1101089	1	.2			1			1	1	.2	5	9B		CP-23	0683
SR5784P	FUEL MANIFOLD PR SYS B	PSIA	0	400	1103076	1	.2			1			1	1	.2	5	9B		CP-23	0683
SR5817P	C HE MANIFOLD PRESS	PSIA	0	400	1102041	1	.2			1			1	1	.2	5	9B		CP-23	0683
SR5820P	OX MANIFOLD PR SYS C	PSIA	0	300	1101092	1	.2			1			1	1	.2	5	9B		CP-23	0683
SR5821P	OX MANIFOLD PR SYS D	PSIA	0	300	1101105	1	.2			1			1	1	.2	5	9B		CP-23	0683
SR5822P	FUEL MANIFOLD PR SYS C	PSIA	0	400	1104011	1	.2			1			1	1	.2	5	9B		CP-23	0683
SR5823P	FUEL MANIFOLD PR SYS D	PSIA	0	400	1104012	1	.2			1			1	1	.2	5	9B		CP-23	0683
SR5830P	D HE MANIFOLD PRESS	PSIA	0	400	1104076	1	.2			1			1	1	.2	5	9B		CP-23	
BS0080X	EDS ABORT REQUEST A		NORM	ABORT	1101098E	1	1			1			1	1	1		7	10	CE-4	
BS0081X	EDS ABORT REQUEST B		NORM	ABORT	1101098C	1	1			1			1	1	1		7	10	CE-4	
CS0150X	MASTER CAUTION-WARNING ON		WARN/OFF	NORM	1101098F	1	1			1			1	1	1		7	10	CE-4	1465
LS0200H	ANGLE OF ATTACK	PSID	0	5	1102057	5												11	CP-27	
CS0220T	TEMP DOCKING PROBE	°F	-100	+300	1008052	1	.1			.1			.1	.2	.1	3	1		CP-1	404, 518
CT0012X	DSE TAPE MOTION MONITOR		OFF	MOTION	1103066E	1	1			1			1	1	.5	3	8	10	CE-4	404, 1465
CT0015V	SIG COND POS SUPPLY VOLTS	VDC	0	22	1101105	5	.2			.2			.2	.1	.1	3	10A		CP-26	404, 518
CT0016V	SIG COND NEG SUPPLY VOLTS	VDC	-22	0	1101107	.5	.2			.2			.2	.1	.1	3	10A		CP-26	404, 518
CT0017V	SENSOR EXCITATION 5 VOLTS	VDC	0	5.6	1105123	5	.2			.2			.2	.1	.1	3	10A		CP-26	404, 518
CT0018V	SENSOR EXCITATION 10 VOLTS	VDC	0	11	1102028	5	.2			.2			.2	1	.1	3	10A		CP-26	404
CT0120X	PCM BIT RATE CHANGE 8 BIT		LOW	HIGH	1001020	1	1			1			.5	1	.5	3,4	8		CP-32 CE-4	404, 518, 1465
CT0125V	PCM HI LEVEL 85 PERCENT REF	VDC	0	5	1102043	5	.2			.2			.2	1	.1	3	10A		CP-26 CP-32	404, 518
CT0126V	PCM HI LEVEL 15 PERCENT REF	VDC	0	5	1101123	5	.2			.2			.2	1	.1	3	10A		CP-26 CP-32	404, 518
ST0152H	HIGH GAIN ANT POS PITCH	DEG	-90	+90	1104042	1	.2			.5			.5	1	.5		10B		CP-34	
ST0153H	HIGH GAIN ANT POS YAW	DEG	0	360	1104043	1	.2			.5			.5	1	.5		10B		CP-34	
CT0161X	HGA BEAM WIDTH SW POS-NAR	NA	OFF	ON	1102068A	1	1			1			1	1	1		8	10	CP-34 CE-4	
CT0162X	HGA BEAM WIDTH SW POS-MED	NA	OFF	ON	1102068B	1	1			1			1	1	1		8	10	CP-34 CE-4	
CT0163X	HGA TRACK SW POS-AUTO	NA	OFF	ON	1102068	1	1			1			1	1	1		8	10	CP-34 CE-4	
CT0164X	HGA TRACK SW POS-REACQ	NA	OFF	ON	1102068H	1	1			1			1	1	1		8	10	CP-34 CE-4	
CT0262V	UDL VALIDITY SIG 4-BIT		NA	NA	510110	60	1			1			1	1	1	3	10B		CP-31	
CT0340X	PCM SYNC SOURCE EXT OR INT		INT	EXT	1105098H	1	.5			1			1	1	1	3	8	10	CE-4	404, 518
CT0620E	S-BAND REC 1-2 AGC VOLTAGE	DBM	-127	-51	1104044	5	.2			.2			.2	1	.1	3	10B		CP-33	518, 1465
CT0640F	S-BAND RCVR 1-2 STATIC PH ERR	KHZ	-100	100	1102049	5	.2			.2			.2	1	.1	3	10B		CP-33	1465

TABLE V.- COMMAND AND SERVICE MODULE TELEMETRY SUMMARY - Concluded

Measurement					Loading number	MSFN format Sample rates, S/S										Summary TWX number	PCM analog tabs and plots		Strip chart record setup number	Primary MSK number
Number	Title	Unit	Approximate Range																	
			Low	High		1	2	3	4	5	6	7	8	9	10		STD	SP		
ST0820K	PROTON COUNT RATE CHANNEL 1	KHz	0	100	1101059	1				.1			.1	.1				17B	CP-31	
ST0821K	PROTON COUNT RATE CHANNEL 2	KHz	0	10	1101060	1				.1			.1	.1				17B	CP-31	
ST0822K	PROTON COUNT RATE CHANNEL 3	KHz	0	10	1101073	1				.1			.1	.1				17B	CP-31	
ST0823K	PROTON COUNT RATE CHANNEL 4	KHz	0	10	1101074	1				.1			.1	.1				17B	CP-31	
ST0830K	ALPHA COUNT RATE CHANNEL 1	KHz	0	10	1102010	1				.1			.1	.1				17B	CP-31	
ST0831K	ALPHA COUNT RATE CHANNEL 2	KHz	0	10	1102017	1				.1			.1	.1				17B	CP-31	
ST0832K	ALPHA COUNT RATE CHANNEL 3	KHz	0	10	1102025	1				.1			.1	.1				17B	CP-31	
ST0838K	PROTON-ALPHA INTEGR COUNT RATE	KHz	0	100	1102026	1				.1			.1	.1				17B	CP-31	
ST0840T	TEMP NUCLEAR PAR TICLE DET	°F	-109	+200	1021052	1				.1			.1	.1				17A	CP-27	
ST0841T	TEMP NUCLEAR PAR-TICLE ANALYZER	°F	-109	+200	1021084	1				.1			.1	.1				17A	CP-27	

TABLE VI.- MANNED SPACEFLIGHT NETWORK FORMAT 30

(a) Command and Service Module

Sub format numbers					
*Word/bit no.	01	02	03	04	05
A -	SC0032Q	SC0030Q	SC0001P	CF0001P	SC0055T
B -	SC0033Q	SC0031Q	CF0012P	CF0012P	CF0017T
C -	SC0041T	SC0043T	CF0003P	CF0120P	CF0018T
D -	SC0042T	SC0044T	CF0015P	CF0036P	CF0008T
E -	SC0037P	SC0039P	CF0035P	CF0035P	CF0020T
F -	SC0038P	SC0040P	CF0036P	CF0006P	SF0260T
G -	CF0006P	CD0200V	CF0006P	SC0037P	CF0071T
H -	ST0152H	CD0005V	CF0005P	SC0038P	SC0230V
I - 1	-	CD0130X	CS0150X	-	SF0266X
I - 2	-	CD0173X	-	-	-
I - 3	-	CD0023X	-	-	-
I - 4	-	CD0123X	-	-	-
I - 5	-	CD0170X	-	-	-
I - 6	-	CD1154X	-	-	-
I - 7	-	CE0321X	-	-	-
	06	07	08	09	10
A -	CF0010Q	CF0019Q	CF0072Q	ST0153H	SC2113C
B -	CF0009Q	CF0016P	CF0070P	SC0053P	SC2139R
C -	SC0072T	SF0260T	SF0263T	SC0051Q	SC2142R
D -	CF0460T	CF0020T	CF0020T	CT0640F	SC2081T
E -	CF0035R	CF0181T	CF0071T	CT0620E	SC2090T
F -	CF0120P	CF0018T	CF0073P	CT0262V	SC2087T
G -	CD0201V	CF0034P	SF0262T	CT0125V	SC2066P
H -	CD0006V	CF0157R	SF0260T	SC0069P	SC2069P
I - 1	CD0131X	SF0266X	SF0266X	CT0012X	SC2160X
I - 2	CD0174X	-	-	CT0340X	CS0150X
I - 3	CD0024X	-	-	-	-
I - 4	CD0124X	-	-	-	-
I - 5	CD0171X	-	-	-	-
I - 6	CD1155X	-	-	-	-
I - 7	CE0322X	-	-	-	-

*Words A, B, C, D sample rate = 10 samples/second
Words E, F, G, H sample rate = 50 samples/second
Word I sample rate = 10 samples/second

TABLE VI.- MANNED SPACEFLIGHT NETWORK 30 - Continued

(a) Command and Service Module

Sub format numbers					
*Word/bit no.	11	12	13	14	15
A -	SC2114C	SC2115C	CC0210V	CC0206V	CT0015V
B -	SC2140R	SC2141R	CC0222C	CC0207V	CT0016V
C -	SC2143R	SC2144R	CC0211V	CC0200V	CT0126V
D -	SC2082T	SC2083T	CC0223C	CC0203V	SC2084T
E -	SC2091T	SC2092T	CC0232V	CC2962C	SC2085T
F -	SC2088T	SC2089T	CC0224C	SC2113C	SC2086T
G -	SC2067P	SC2068P	CC0206V	SC2114C	CC0215C
H -	SC2070P	SC2071P	CC0207V	SC2115C	-
I - 1	SC2161X	SC2162X	CD0130X	CS0150X	CD0230X
I - 2	CS0150X	CS0150X	CD0131X	SF0266X	CD0231X
I - 3	-	-	CD0132X	BS0080X	CE0001X
I - 4	-	-	CD0133X	BS0081X	CE0002X
I - 5	-	-	CD0134X	-	CE0003X
I - 6	-	-	CD0135X	-	CE0004X
I - 7	-	-	CD0136X	-	-
	16	17	18	19	20
A -	CG2112V	-	CG3721V	-	CG1040V
B -	CG2113V	-	CG3722V	-	CG1110V
C -	CG2142V	-	CH3503R	CH3502H	CG1201V
D -	CG2143V	CH3582V	CH3504R	CH3505R	CG1331V
E -	CG2172V	CH3583V	CH3517H	CH3500H	CG2300T
F -	CG2173V	CH3585H	CH3518H	CH3503R	CG3721V
G -	CH3503R	CH3586H	CH3666C	CH3501H	CG3722V
H -	CH3504R	CH3587H	CH3667C	CH3504R	-
I - 1	CH3607X	CH3592X	CH3607X	CH3606X	CH3609X
I - 2	CG1513X	CH3593X	CH3604X	CH3635X	CH3610X
I - 3	CG1523X	CH3588X	CH3605X	CH3636X	CH3612X
I - 4	CG1533X	CH3590X	CH3601X	CH3638X	CH3613X
I - 5	CG5040X	CH3635X	CH3602X	CH3639X	CH3615X
I - 6	CH3592X	CH3638X	CH3623X	CH3641X	CH3616X
I - 7	CH3593X	CH3641X	CH3624X	CH3642X	-

*Words A, B, C, D sample rate = 10 samples/second
Words E, F, G, H sample rate = 50 samples/second
Word I sample rate = 10 samples/second

TABLE VI.- MANNED SPACEFLIGHT NETWORK FORMAT 30 - Continued

(a) Lunar Module

Sub format numbers					
*Word/bit no.	21	22	23	24	25
A -	SP0001P	SP0022H	SR5013T	SR5015T	CR0001P
B -	SP0003P	SP0023H	SR5729P	SR5817P	CR0003T
C -	SP0931P	SP0024H	SR5733P	SR5820P	CR0035P
D -	SP0006P	SP0025H	SR5737P	SR5822P	-
E -	SP0930P	SP0655Q	SR5014T	SR5016T	CR0002P
F -	SP0022H	SP0656Q	SR5776P	SR5830P	CR0004T
G -	SP0025H	SP0657Q	SR5780P	SR5821P	CR0036P
H -	SP0661P	SP0658Q	SR5784P	SR5823P	-
I - 1	CH3607X	-	CH3574X	-	-
I - 2	CH3574X	-	CH3575X	-	-
I - 3	CH3600X	-	CH3576X	-	-
I - 4	-	-	CH3577X	-	-
I - 5	-	-	CH3578X	-	-
I - 6	CH3604X	-	CH3579X	-	-
I - 7	CH3605X	-	-	-	-
	26	27	28	29	30
A -	SR5065T	SP0045T	CC0175T	SR5001P	ST0152H
B -	SR066T	SP0048T	CC0176T	SR5025Q	ST0153H
C -	SR5067T	SP0049T	CC0177T	SR5002P	CT0120X
D -	SR5068T	SP0054T	SP0002T	SR5026Q	CT0620E
E -	CS0220T	-	SP0057T	SR5003P	CT0640F
F -	CK0026A	SP0062T	CG2117V	SR5027Q	CT0262V
G -	CK0027A	SP0600P	CG2147V	SR5004P	-
H -	CK0028A	SP0601P	CG2177V	SR5028Q	-
I - 1	-	-	-	-	CT0161X
I - 2	-	-	-	-	CT0162X
I - 3	-	-	-	-	CT0163X
I - 4	-	-	-	-	CT0164X
I - 5	-	-	-	-	CT0012X
I - 6	-	-	-	-	-
I - 7	-	-	-	-	-

*Words A, B, C, D sample rate = 10 samples/second
Words E, F, G, H sample rate = 50 samples/second
Word I sample rate = 10 sample/second

TABLE VI.- MANNED SPACEFLIGHT NETWORK FORMAT 30 - Continued

(b) Lunar Module

Sub format numbers					
*Word/bit no.	31	32	33	34	35
A -	GH1463V-2	GH1463V-2	GH1463V-2	GH1457V-2	GR1101P-2
B -	CG2279V-2	GH1462V-2	GG2279V-2	GH1314V-4	GR1201P-4
C -	GH1314V-4	GH1461V-2	GH1314V-4	GH1456V-4	GR1102P-4
D -	GH1462V-2	GH1455V-4	GH1455V-4	GH1313V-3	GR1202P-4
E -	GG2219V-4	GG2279V-2	GH1247V-4	GH1455V-4	GR2201P-3
F -	GH1313V-3	GH1457V-2	GH1462V-2	GH1311V-4	GR3201P-3
G -	GH1331V-4	GG2219V-4	GG2219V-4	GQ6806HB4	GR2202P-1
H -	GH1311V-4	GH1456V-4	GH1313V-3	CQ6510P-2	GR3202P-1
I - 1	GH1621	GH1644	GH1431	GH1642	GR9609
I - 2	GH1330	GH1642	GH1422	GH1204	GR9641
I - 3	GH1204	GH1204	GH1418	GH1339	GR9631
I - 4	GH1641	GH1896	GH1423	GH1896	GR9613
I - 5	GH1323	GH1628	GH1430	GH1323	GR9610
I - 6	GH1643	GH1260	GH1419	GH1348	GR9642
I - 7	GH1301	GH1629	GH1426	GH1301	GR9632
	36	37	38	39	40
A -	GP0001P-1	GQ3015P-3	GQ3435P-3	GG1040V-3	-
B -	GF4585T-1	GQ3435P-1	GP0001P-2	GG1110V-4	GG2249V-4
C -	GP0002P-2	GQ3018P-4	GP1501P-4	GG1201V-2	GG2041V-2
D -	GF4586T-2	GQ3025P-4	GP1503P-4	GG1331V-2	GG2021V-1
E -	GP0025P-3	GQ3611P-1	GP2010P-2	GG3304V-1	GG2001V-2
F -	GP1501P-2	GQ4111P-1	GQ3611P-4	GG3305V-3	GG2167V-2
G -	GP1503P-2	GQ6806HA4	GQ4111P-2	GG3324V-4	GG2137V-3
H -	GP2010PA3	GQ6510P-3	GQ6510P-3	GG3325V-3	GG2107V-1
I - 1	GP0318	GQ4455	GQ4455	-	-
I - 2	GP0320	GH1348	GH1230	-	-
I - 3	GP1408	GH1301	GH1260	-	-
I - 4	GP0908	-	GP1408	-	-
I - 5	GH1230	-	GP0908	-	-
I - 6	GH1260	-	GH1348	-	-
I - 7	GH1283	-	GH1301	-	-

*Words A, B, C, D sample rate = 10 samples/second
Words E, F, G, H sample rate = 50 samples/second
Word I sample rate = 10 samples/second

TABLE VI.- MANNED SPACEFLIGHT NETWORK FORMAT 30 - Concluded

(b) Lunar Module

Sub format numbers					
*Word/bit no.	41	42	43	44	45
A -	GG2112V-3	GH1240V-1	GF3582P-4	GF3589P-3	GT0454T-1
B -	GG2113V-3	GH1241V-1	GF3583P-4	GF3591P-3	GT0992BB2
C -	GG2142V-2	GH1242V-1	GF3584P-1	GF3592P-1	GT0993E-1
D -	GG2143VB1	GL0401V-1	GF4581Q-2	GF9997U-1	GT0994V-4
E -	GG2172V-3	GL0402V-4	GF4582Q-2	GF9998U-4	GT0441X
F -	GG2173VA1	-	GF4583Q-2	GF1521P-2	-
G -	-	-	GF9999U-3	GF1651T-4	-
H -	-	-	GF4101P-2	GF1281T-4	-
I - 1	-	GL4069	-	-	-
I - 2	-	-	-	-	-
I - 3	-	-	-	-	-
I - 4	-	-	-	-	-
I - 5	-	-	-	-	-
I - 6	-	-	-	-	-
I - 7	-	-	-	-	-
	46	47	48	49	50
A -	GQ3611P-1	GH1463V-2	-	-	-
B -	GQ4111P-2	GH1457V-2	-	-	-
C -	GQ6510P-2	GH1249V-2	-	-	-
D -	GP2010PA3	GH1314V-4	-	-	-
E -	GQ3603Q-1	GH1462V-2	-	-	-
F -	GQ3604Q-3	GH1456V-4	-	-	-
G -	GQ4103QB4	GH1248V-2	-	-	-
H -	GQ4104Q-3	GH1313V-3	-	-	-
I - 1	GH1283	GH1301	-	-	-
I - 2	GH1260	GH1260	-	-	-
I - 3	GY0050	GH1603	-	-	-
I - 4	GQ4455	GH1642	-	-	-
I - 5	-	GH1204	-	-	-
I - 6	GP0908	GH1896	-	-	-
I - 7	GP1408	GH1621	-	-	-

*Words A, B, C, D sample rate = 10 samples/second
Words E, F, G, H sample rate = 50 samples/second
Word I sample rate = 10 samples/second

TABLE VII.- CRT ERROR CODES

*	Out of normal limits (4 hr)
$	Out of normal limits (TWX)
◊	Out of normal limits (Display)
P	Parity error
S	Low bit rate - data not available
H	Off scale high
L	Off scale low
D	Not in format
M	Computed quantity - one parameter not available

TABLE VIII.- TWX SUMMARY DISTRIBUTION

Data category	[a]Distribution	
	Group/Folder	Room
1. CSM summary messages		
A. Format 3	Communications/MSFN	306C
	Electronic Systems	306C, 331
	Structures/Thermal	306C
	Propulsion and Power	326
B. Formats 4 and 5	Electronic Systems	306C, 331
	Crew Systems	348
	Propulsion and Power	326
C. Formats 6, 20, 21, 22, 23 and 24	Guidance and Control	306C
2. LM summary messages		
A. Format 60	Electronic Systems	306C, 331
	Guidance and Control	306C
	Communications/MSFN	333
B. Formats 61, 62, 63, 64, 65 and 66	Guidance and Control	306C
C. Format 70	Communications/MSFN	333
	Electronic Systems	306C
	Structures/Thermal	306C
	Crew Systems	348
D. Format 71	Electronic Systems	306C
	Guidance and Control	306C
	Structures/Thermal	306C
	Propulsion and Power	326
	Communications/MSFN	333
3. Command history	GAC/NR	306C
	Communications/MSFN	306C
	Electronic Systems	
4. DSE dump	Electronic Systems	306C
	Communications/MSFN	306C, 333
	B. Johnson folder	315B
	D. Goldenbaum folder	315B

TABLE VIII.- TWX SUMMARY DISTRIBUTION - Concluded

Data category	[a]Distribution	
	Group/Folder	Room
5. Mission reconfiguration requests (MRR)	Communications/MSFN MRR folder	306C, 333 315B
6. Data recorded messages	Communications/MSFN B. Johnson folder D. Goldenbaum folder	306C 315B 315B
7. Site configuration messages	Communications/MSFN B. Johnson folder	306C 315B
8. Instrumentation summary instruction	Communications/MSFN B. Johnson folder D. Goldenbaum folder	306C 315B 315B

[a]One copy to each group at designated locations

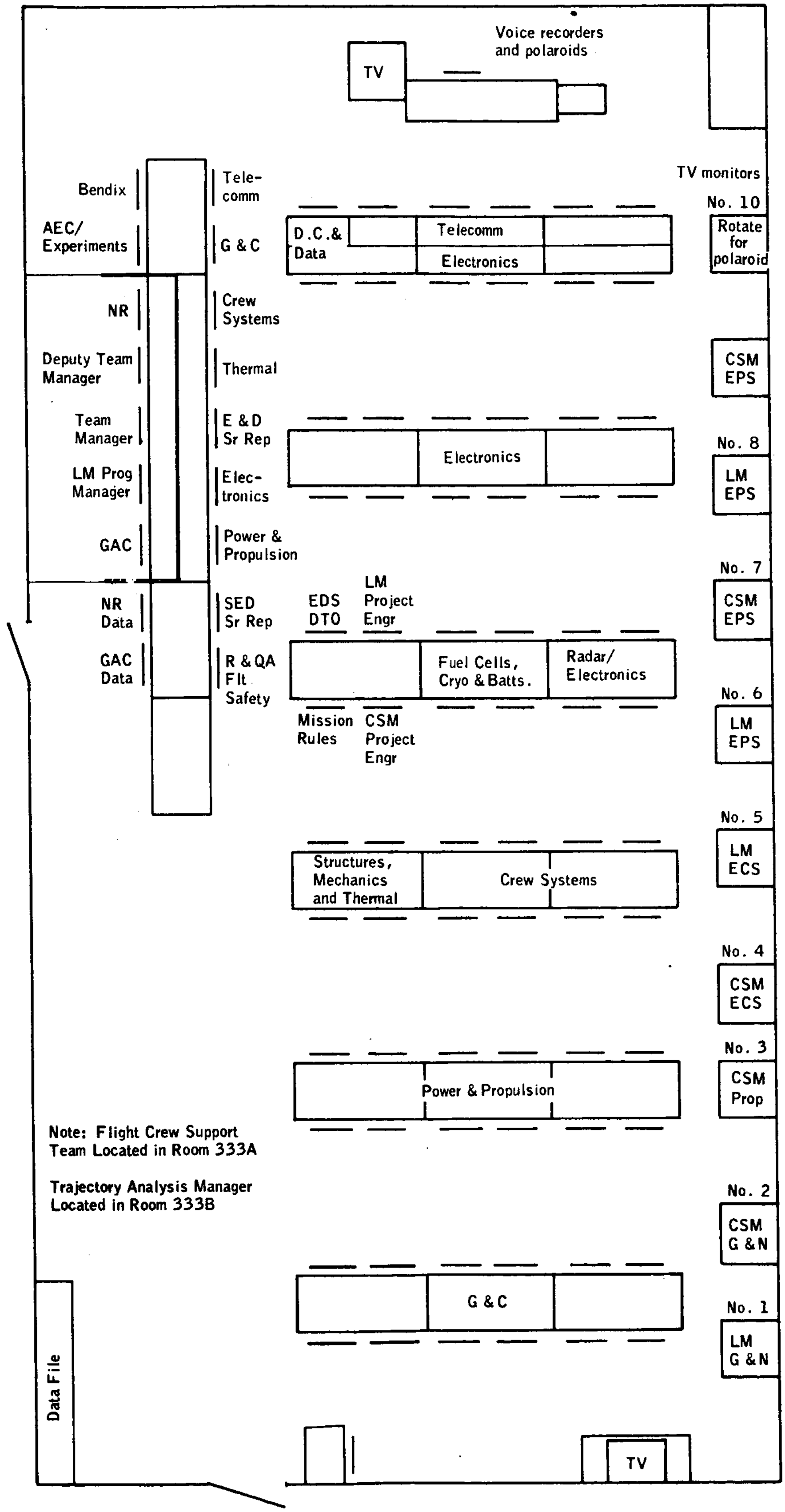

Figure 1. - Mission Evaluation Room (Room 320, Building 45).

Section No.	Section Title	Responsibility
1.0	Summary	Mechelay
2.0	Introduction	Fricke
3.0	Lunar Surface Exploration	Stephenson
3.1	Apollo Lunar Surface Experiment Package	Stephenson
3.2	Solar Wind Composition	Stephenson
3.3	Lunar Geology and Sample Analysis	Stephenson
3.4	Lunar Surface Photography	Stephenson
4.0	Lunar Descent and Ascent	Finch
4.1	Landing Site Selection	Hackler
4.2	Descent Guidance and Control	Hanaway
4.3	Landing Site Coordinates	Hackler/Joosten
4.4	Ascent and Rendezvous Guidance and Control	Murrah/Finch
5.0	Trajectory	Murrah
6.0	Command and Service Module Performance	Fletcher
6.1	Structures and Mechanical	Glynn
6.2	Electrical Power	Melliff/Ferguson
6.3	Communications, TV, and VHF Ranging	Irvin
6.4	Cryogenics Storage	White
6.5	Instrumentation	Munford/Foster
6.6	Guidance, Navigation, and Control	Finch
6.7	Reaction Control	White
6.8	Service Propulsion	White
6.9	Environmental Control	Hurt
6.10	Crew Station	Hurt/Munford
6.11	Consumables	Mechelay
7.0	Lunar Module Performance	Fletcher
7.1	Structures and Mechanical	Glynn
7.2	Electrical Power	Munford/White
7.3	Communications, Radar, and TV	Irvin
7.4	Instrumentation	Munford/Foster
7.5	Guidance and Control	Finch
7.6	Reaction Control	White
7.7	Descent Propulsion	White
7.8	Ascent Propulsion	White
7.9	Environmental Control	Hurt
7.10	Crew Station	Hurt/Munford
7.11	Extravehicular Mobility Unit	Hurt/Irvin
7.12	Consumables	Mechelay
8.0	Pilots' Report	Shepard
9.0	Biomedical Evaluation	Hawkins
10.0	Mission Support Performance	Murrah
11.0	Assessment of Mission Objectives	Peacock
12.0	Launch Vehicle Performance	Fricke
13.0	Anomaly Summary	Gadbois
14.0	Conclusions	Mechelay
Appendix A	Vehicle Description	Fletcher
Appendix B	Vehicle History	Cordiner
Appendix C	Postflight Testing	Libby
Appendix D	Data Availability	Foster
Appendix E	Mission Report Supplements	Fricke
Appendix F	Glossary	Fletcher
	Five-Day Report	Arabian
	30-Day Report	Arabian

Section No.	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
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2.0															1	2	3		
3.0																			
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Appendix A						1	2	3	3	3			4	4					
Appendix B	1	2	3			3	4	4											
Appendix C																			
Appendix D																			
Appendix E																			
Appendix F																			
Five-Day Report	¾											(Original inputs due in at splashdown)							
30-Day Report																			

Section No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
1.0								1	1	2	3	3			4				
2.0	4	5																	
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3.1												1			2	3	3	3	4
3.2												1			2	3	3	3	4
3.3												1			2	3	3	3	4
3.4									1	2	3	3			4	4			
4.0				1	1			1	2	3	3	3			4	4			
4.1	1	2	3	3	4			4											
4.2				1	1			2	3	3	3	4			4	4			
4.3				1	2			3	3	3	4	4							
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7.12	2	3	3	4	4														
8.0	1	2	3	3	3			3	4	4									
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11.0									1	2	3	3			4	4			
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13.0																			1
14.0																			1
Appendix A																			
Appendix B																			
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Appendix D															1	2	3	3	4
Appendix E															1	2	3	3	4
Appendix F																			
Five-Day Report																			
30-Day Report				1	⅔			4	4	Printing									

Section No.	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6 thru	9
	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	59
1.0											Arabian Review				Program Manager Review				
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Appendix B																			
Appendix C				1	2	3	3			4									
Appendix D			4																
Appendix E			4																
Appendix F				1	2	3	3			4									
Five-Day Report																			
30-Day Report																			

1. Analysis and Writing
2. Analysis Manager Review
3. Editing and Typing
4. Analysis Manager Approval

60th through 74th day - Final copy preparation and composition
75th through 90th day - Printing and distribution

Figure 2. - Apollo 14 mission reporting schedule.

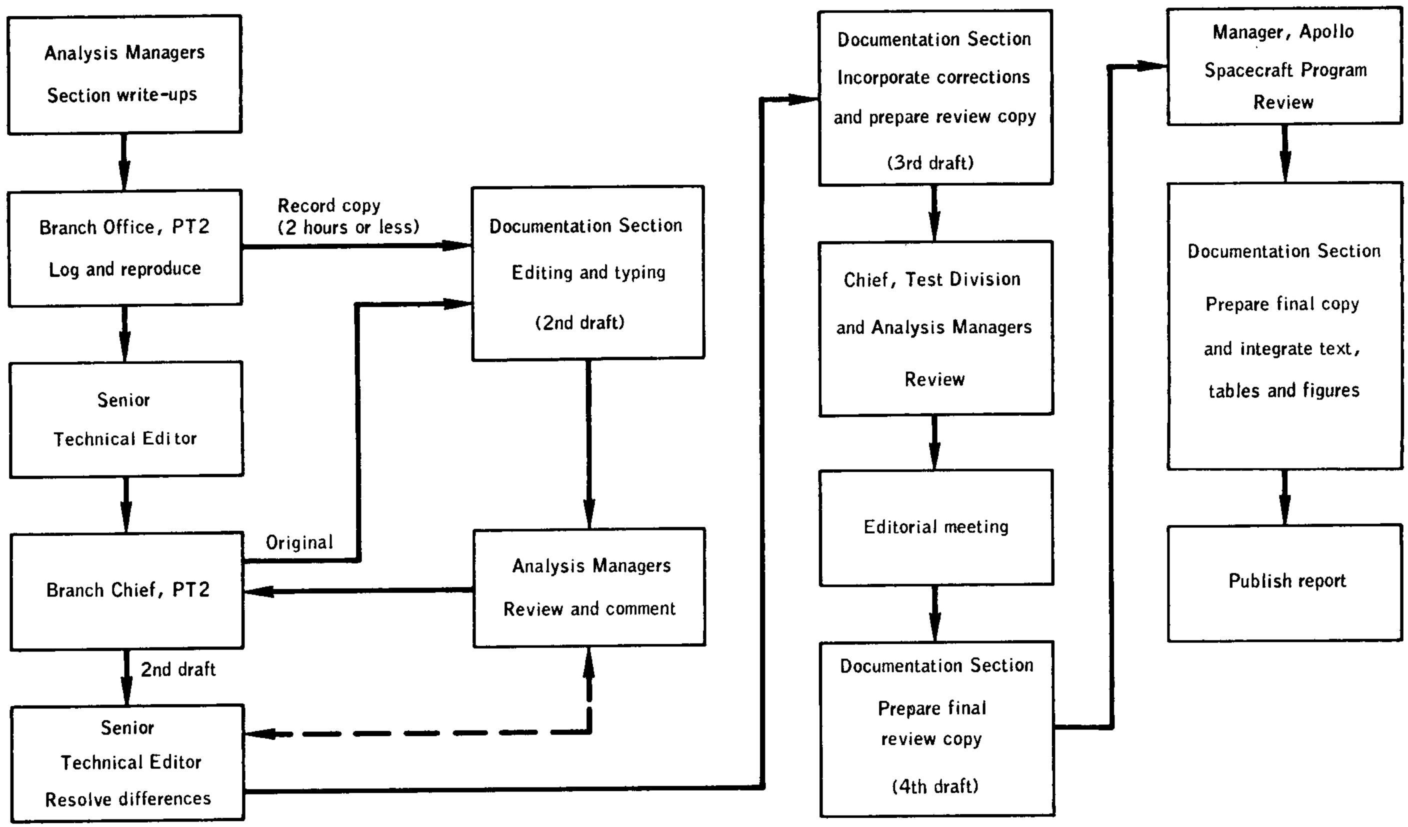


Figure 3. - Mission report preparation flow chart.

APPENDIX

BUILDING 45/SPAN ACTION REQUEST/RESPONSE FORMS

The SPAN/Mission Evaluation Request forms (figs. A-1 through A-3) shall be the official coordinating documents for action requests and responses between building 45 and Spacecraft Analysis Room mission monitoring personnel. Since the forms are self-explanatory, no special instructions are required for their preparation.

USE BLACK BALLPOINT PEN	SPAN / MISSION EVALUATION ACTION REQUEST		USE BLACK BALLPOINT PEN
TIME (T- MINUS / GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER
ACTION REQD BY (TIME):		REQUESTER	

45 45

SUBJECT:

	APPROVAL
	TEAM LDR TIME :
	CON SR REP TIME :
	ME MANAGER TIME :
	SPAN MGR TIME :

45 45

RESPONSE:

	CONCURRENCE
	FOD REP TIME :
	SPAN MGR TIME :
	TEAM LDR TIME :
	CON SR REP TIME :

45 45

45 45

RESPONDER

ME MANAGER TIME :		SPAN MANAGER TIME :

45 45

Figure A-1.- Sample action request form for use in Building 45.

USE BLACK BALLPOINT PEN

SPAN / MISSION EVALUATION ACTION REQUEST

USE BLACK BALLPOINT PEN

30 TIME (T- MINUS/GET) | REQUEST ORGANIZATION | RESPONSE ORGANIZATION | CONTROL NUMBER 30

ACTION REQD BY (TIME): | REQUESTER

SUBJECT: | APPROVAL

FOD REP

TIME :

SPAN MGR

30 TIME : 30

30 RESPONSE: | CONCUR 30

TEAM LDR

TIME :

CON SR REP

TIME :

ME MGR

TIME :

30 SPAN MGR 30

TIME :

RESPONDER

30 FOD REP | | SPAN MANAGER 30

TIME : | | TIME :

Figure A-2.- Sample action request form for use in SPAN room.

SPAN / MISSION EVALUATION ACTION REQUEST
(CONTINUATION SHEET)
(PLEASE USE BLACK BALLPOINT PEN)

TIME (T- MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER

Figure A-3.- Sample action request continuation form.

APPENDIX B

DAILY AND HOURLY STATUS REPORTS

APOLLO 14 STATUS REPORT
February 3, 1971

AET: 64:00

THERMAL

The following is a comparison of LM parameters prior to launch, and at LM checkout, 61:55 AET.

		Prelaunch	AET 61:55
RCS Tanks	GR2121T	71	72
	GR2122T	71	73
RCS Clusters	GR6001T	69	113
	GR6002T	72	127
	GR6003T	69	120
	GR6004T	68	72
APS	GP0718T	70	70
	GP1218T	70	71
DPS	GQ3718T	69	69
	GQ3719T	69	68
	GQ4218T	69	68
	GQ4219T	68	68
LT Antenna	GN7563T	67	72.2
PIPA	GG2300T	67	129.6
ASA	GF3301T	121	121
SHe Press	GQ3435P	347	751
GOX Press	GF3584P	2361	2337
Cabin	GF1651T	71	74
Glycol PMP	GF9998U	70	72.4
Main W/B In	GF2531T	70	74.2
Main W/B Out	GF2581T	70	74.5
Water	GF4511T	69	77
RTG	GL8275T	151	82

All LM temperatures are within allowable limits.

CSM temperatures are nominal. However, all SPS propellant tank temperature transducers are exhibiting erratic behavior 1-1/2% noise similar to that previously reported on SA2379T, but they are acceptable.

CREW SYSTEMS

CM ECS parameters continue normal. LM ECS parameters are as expected. The descent oxygen tank is 2337 psia and for projected normal conditions at 113:00 hours GET, a requirement for dumping is not expected.

GUIDANCE AND CONTROL

System operation nominal.

COMMUNICATIONS

CSM Communications: HGA antenna operation was discontinued at AET 63:06.

LM Communications: LM communications system was activated and the MSFN reported AOS at AET 61:48. Telemetry data was received at AET 61:53. All communications checks were apparently completed successfully.

VHF B receiver AGC measurement (GT0625) did not respond at any time during the communication activation period. Requesting additional information on status during communication checks.

DISPLAYS AND CONTROLS

No change.

INSTRUMENTATION

No change.

POWER DISTRIBUTION AND SEQUENCING

No change.

PROPULSION AND POWER

CSM SPS: Parameter values remain virtually unchanged and completely nominal. Use of the SPS for MCC-4 (approximately 4 fps delta V) is satisfactory, based on SPS altitude tests at AEDC and the two 0.5 second burns during the Apollo 7 flight.

CSM RCS: Pressures and temperatures have been nominal.

SM RCS Propellant Remaining:		A	B	C	D	TOTAL
Actual Remaining (Wpu)	:	254	255	255	260	1024
Planned Remaining (Flight Plan)	:	260	261	260	261	1042
Red Line (Flight Plan)	:	180	195	195	194	764
*Delta from Planned	:	-6	-6	-5	-1	-18
*Delta from Red Lines	:	+74	+60	+60	+66	+260

Used RCS for attitude hold since TV activity.

CM Batteries:

Battery A: AH_o 1.33
Battery B: AH_o 0.83
Battery C: AH_o 1.64

Fuel Cell/Cryogenics:

Status - normal.

	Quantity, %	Quantity, lb.	Bulk Fluid Temp. F°	Heater Temp. F°
O_2 #1	88.59	286.5	-231	-166
O_2 #2	87.82	282.7	-227	-170
O_2 #3	39.10	126.4	-169	-173
H_2 #1	75.43	21.23	-411	
H_2 #2	75.46	21.23	-408	

Quantities in Oxygen Tank #3 are fluctuating up and down (one bit) indicating a little stratification.

Oxygen tanks #1 and #2 are in "AUTO" and tank #3 is "OFF."

LM APS: The ascent propulsion parameters at time of LM housekeeping and activation (AET approximately 62 hours) were completely nominal. Helium tank pressures are approximately the same as launch pressures. The helium manifold pressure is decaying at its predicted rate and completely satisfactory. Propellant temperatures are holding their exact launch values. The propellant interface pressures are above their respective maximum solubility pressure bands and also are completely satisfactory.

LM DPS: At LM activation (AET 61:52:00), all DPS parameters were reading normal. The SHe pressure was reading 743 psia, flipping to 751 psia occasionally, giving an average rise rate from launch of 6.25 psi/hr. Regulator outlet pressure was 83 psia which was very close to the nominal curve of helium manifold pressure versus SHe tank pressure. Oxidizer and fuel interface pressures indicate tank pressures above minimum levels expected with maximum helium solubility.

LM RCS: All parameters are normal. The quad temperatures are (1) 66 degrees F, (2) 121 degrees F, (3) 128 degrees F, (4) 113 degrees F. Quad 1 and 3 are diagonally opposed and the temperature status indicates that quad 1 is in the shade while quad 3 is in direct sunlight. All other parameters are consistent with the lift-off values.

LM Batteries:

Descent State - Total AH remaining 1581.59
Ascent Stage - Total AH remaining 592

During LM housekeeping, a LM ascent battery #5 open circuit voltage of 36.7v was observed. This is down from the lift-off open circuit voltage of 37.0v. Ascent battery #6 open circuit voltage equals 37.0v. Problem is presently in work. All other batteries nominal.

Connelly 84:45

APOLLO 14

EIGHTH DAILY REPORT

(144 hours to 168 hours)

The mission has progressed satisfactorily during this period. The major activities have included jettisoning of the lunar module, lunar module impact on the lunar surface, transearth injection, and a midcourse correction.

The lunar module was jettisoned at 146:25:00 ground elapsed time and a command module separation burn was performed 5 minutes later. The lunar module deorbit burn was performed with the reaction control system at 147:54. The lunar module impacted at about 148:22:25. Impact coordinates were 3° 25' south and 19° 40' west, approximately 63 nautical miles from the Apollo 12 landing site and 36 nautical miles from the Apollo 14 landing site. Seismometers at both sites responded: at the Apollo 12 site, 79 seconds after impact, and at the Apollo 14 site, 45 seconds after impact.

The transearth injection burn was made at 149:16:04 ground elapsed time and a midcourse correction burn was made at 166:14:59 ground elapsed time. Systems performance was nominal.

The realignment of the Apollo lunar surface experiment package antenna at the end of the second extravehicular activity resulted in a 0.5 to 1.0 dB improvement in received signal strength. Good data is being received at all ground stations.

Consumables status as of 168 hours is as follows:

CSM BATTERIES

Entry		Planned Remaining	Actual Remaining
A		N/A	36.1 ampere hours
*B		N/A	34.7 ampere hours
C		N/A	38.4 ampere hours
	Total	110.0 ampere hours	109.2 ampere hours

*Battery B was put on charge at 167:14. All batteries are nominal.

OXYGEN

Tank 1		227 pounds	225 pounds
Tank 2		231 pounds	220 pounds
Tank 3		58 pounds	63 pounds
	Total	516 pounds	508 pounds

HYDROGEN

Tank 1	12.2 pounds	11.9 pounds
Tank 2	12.0 pounds	10.9 pounds
Total	24.2 pounds	22.8 pounds

REACTION CONTROL

SM (Quads 1 through 4)	546 pounds	588 pounds

LM BATTERIES

Ascent 5 and 6 (at impact)	N/A	310.3 ampere hours

All systems continue to operate satisfactorily and temperatures and consumables remain within expected limits.

Donald D. Arabian
D. D. Arabian
Mission Evaluation Manager

APPENDIX C

APOLLO 15 PROBLEM TRACKING LIST

APOLLO 15 PROBLEM TRACKING LIST

July 25, 1971

Request no.	Title	Date of request	Assigned to	Response
KL-1	Reaction of sodium omadine solution with aluminum in descent stage waste management container.	3/10/71	P. Hurt	No data are available to confirm sodium omadine is not deleterious to tank materials. Therefore, request waste management tank be purged with distilled water prior to altitude chamber run.
KX-2	The PCM telemetry and alpha experiment do not have a synchronizing pulse to insure in-phase operation.	3/12/71	R. Giesecke	Software fix developed by KSC not required for flight. Not planned to establish correlation between alpha count and detector for real-time support. Principal investigator uses modified computer program to detect and eliminate data-phasing ambiguity.
KL-3	Rendezvous radar has preference for primary gyros when locked on to transmitting source in auto track mode. No preference in slew mode.	3/15/71	R. Irvin	Preference for primary gyros is normal operation in auto-track mode. No preference in slew mode is normal operation.
KC-7	Criteria for proper operation of CSM motor switches.	5/17/71	R. Munford	Using battery which is on the peroxide level, switch operating time is not to exceed 70 milliseconds for any one of 6 transfers during three tests.
KC-8	Questionable flight worthiness of motor switches S31A3S1 and C19A1S1 because of slow transfer times.	5/19/71	R. Munford	Data indicates problem with brush/commutators or the brake; most probably a dirty commutator on S31A3S1. Black box containing S31A3S1 switch should be changed. Switch C19A1S1 is acceptable for flight.

K - KSC initiated   L - Lunar module
C - Command module   X - Experiments
Numbers not shown were either MSC initiated or voided.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KC-9	RCS motor switch data.	5/19/71	R. Munford	Tests at NR on like motor switches (C19A1S1) showed traces to be nominal. Dip on trace caused by brush bounce.
KC-12	Drift in earth landing system baroswitch data. Replace by KSC unless rationale given for accepting switch for flight.	5/26/71	G. Johnson	Relative pressure change in four switches between Downey and KSC appear same. Changes can be expected. No leak is indicated and baroswitch is acceptable for flight. Waiver will be given.
KC-13	High-gain antenna PCM measurements change with PCM bit rate.	5/28/71	R. Irvin	Shifts occurred on Apollo 14 without affecting antenna operation. No dynamic antenna response from shifts. Antenna acceptable for flight.
KL-14	Rendezvous radar access point 7 (low frequency tone amplitude) inadvertently shorted to ground during compatibility checks.	5/28/71	R. Irvin	Tests at RCA indicate that the short did not damage the rendezvous radar.
KC-15	Specification waiver to allow electrolytic etching of the Gamma ray spectrometer.	5/28/71	J. Goree	Waiver is proper and acceptable. Waiver was accepted and etching completed.
KC-16	Mapping camera and panoramic camera switch positioning prior to lift-off.	5/31/71	R. Giesecke	Switches are positioned by backup crew switch position check. (AOH-March 25, 1971) However, switches will not remain in positions indicated longer than 16 hours.
KL-17	Ground controlled television assembly responded to invalid commands.	6/1/71	R. Irvin	Fix has been established and Apollo 15 unit will be modified to prevent reception of invalid commands.
KC-18	Test procedure to verify failure resolution of panoramic camera slit width.	6/1/71	R. Giesecke	KSC proposed test plan for detection of discontinuity is approved.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KC-19	Possible damage to subsatellite deployment motor.	6/2/71	P. Smith	Motor qualified for power application of 1 minute with motor blocked. Twenty-four-(24) second power application should not have damaged motor.
KC-20	Mass spectrometer boom cable jams at each retraction.	6/2/71	R. White	Motor current traces normal; 15-pound force to pull cable could do no damage. The cable operation experienced is normal for 1g. Cable and boom acceptable for flight.
KC-21	Tone on S-band downlink in relay mode.	6/2/71	R. Irvin	KSC troubleshooting plan approved by telecon.
KC-22	Sequencer measurement anomaly.	6/2/71	R. Munford	When power is applied or removed from Z5K1 and Z5K2, voltage is momentarily expected on CD0171. Relays are satisfactory for flight.
KC-24	Change in spacecraft panel configuration for launch vehicle engine gimballing.	6/3/71	P. Smith	Spacecraft panel configuration data given for one-time only use.
KC-25	Down voice backup mode operation interferes with high bit rate data.	6/2/71	R. Irvin	Backup voice and high bit rate are known to interfere and this is the inherent design of the system. PCM and voice time-share in this mode and PCM loss results.
KC-26	Hydrogen tank pressure fluctuations of 15 psi at 2 hertz.	6/3/71	W. White	Similar oscillations have been noted before countdown and flight. No effect on performance. Based on analysis and review of data, pressure fluctuations have no effect on system operation and safety.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KC-27	Alpha spectrometer exhibits erroneous response peaks immediately following removal of hand-held source.	6/4/71	K. LeBlanc	Hand-held source causes phantom peaks. System functions properly with onboard calibration source. Alpha spectrometer satisfactory for flight.
KL-28	Recheck of and flow through descent propulsion system fuel quad check valves.	6/4/71	H. White	KSC plan for recheck and purging of fuel quad check valves approved.
KL-29	Water boiler steam duct overpressurization and inspection procedure for damage.	6/4/71	P. Hurt	Inspection procedure satisfactory; however, for future tests outside altitude chamber, relief valve should be installed on sublimator GSE duct cover.
KL-30	Service module panels and door configuration.	6/4/71	P. Smith	Requested configuration is acceptable.
KC-31	Service module panels and door configuration.	6/6/71	P. Smith A. Cohen	Panel configuration data furnished for use on one-time-only basis.
KL-32	Is main propulsion fuel pressure indicator required to be operational for flight?	6/7/71	R. Munford	Indicator is required for flight.
KL-33	Back flow of high pressure oxygen module during descent stage gaseous oxygen check valve flow test.	6/11/71	P. Hurt	Reverse flow will not harm the 3100 module; however, the 3392 module has no filters and contamination could enter module. Approval for reverse flow of 3100 module is given for Apollo 15 only.
KL-34	Plan for purge of supercritical helium tank and descent propulsion heat exchanger.	6/11/71	H. White	MSC does not concur with purge plan. A Hiese gage will be used to monitor pressure in tank.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KC-35	Spacecraft panel configuration for launch vehicle engine gimballing.	6/11/71	A. Cohen	Panel configuration approved as requested for one-time use only.
KL-36	Supercritical helium tank purge.	6/12/71	H. White	Request received after test began. Closed by D. D. Arabian.
KL-37	ALSEP passive seismic experiment connector failure at low temperature.	6/14/71	R. Cox	Concur with modified test procedure. Replacement of connectors hinges required for flight.
KL-38	Comments requested on SHe screening test.	6/14/71	H. White	Helium flow should not be initiated prior to 00:00 hours of 6/17/71 per previous agreements.
KL-40	Lightning strike retest requirements.	6/14/71	D. Arabian	No additional tests believed necessary. Proceed with panel 1 retest.
KL-42	KSC lightning retest requirements (lunar module).	6/16/71	All Analysis Managers	MSC concurs with test plan.
KE-43	Mass spectrometer shipment to University of Texas	6/16/71	R. Giesecke	MSC does not concur with shipment. Further required tests and inspections at KSC Enclosed.
KC-44	Lightning retest requirements (command module)	6/16/71	All Analysis Managers	MSC concurs with retest plan.
KL-45	Retest of modular equipment stowage assembly heaters.	6/17/71	T. Taylor	MSC concurs with retest plan.
KC-46	Alphas and x-ray spectrometers retest requirements.	6/17/71	R. Giesecke	MSC concurs with retest plan.
KC-47	Mass spectrometer retest requirements.	6/17/71	R. Giesecke	MSC concurs with retest plan.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KL-48	Lunar module environmental control system retest requirements.	6/17/71	P. Hurt	MSC concurs with retest plan.
KL-49	Lunar module propulsion systems retest requirements.	6/17/71	H. White	MSC concurs with retest plan.
KL-50	Retest of modular equipment stowage assembly heaters.	-	-	MSC concurs with retest plan.
KC-51	Panel configuration during command and service module checkout	6/17/71	P. D. Smith	MSC concurs with the KSC proposed panel configuration.
KL-52	Panel meter verification plan (Ref LM-10 DR 602)	6/18/71	R. Munford	MSC concurs with KSC meter verification plan.
KC-53	Oscillating signal conditioners	6/21/71	R. Munford	Signal radiation check with quad doors closed. If signal is less than -115 dBm over 290 to 302 MHz, it is acceptable for flight. KSC to select best signal conditioners available.
KL-54	Alteration of one word in abort electronics assembly during loading.	6/24/71	C. Finch	MSC agreed no more troubleshooting required. Abort electronics assembly acceptable for flight.
KC-55	Modifications to reduce lightning effects.	6/29/71	D. Suiter	MSC furnished recommendations on overcurrent protection.
KC-56	Docking probe tension tie assembly thread removal.	6/29/71	P. D. Smith	MSC concurs with thread removal.
KL-57	Ascent fuel low-level sensor.	7/6/71	H. White	MSC recommended verifying location of fault by pulling circuit breakers and cutting appropriate wire.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KL-58	LM overvoltage of spacecraft bus	7/1/71	R. Munford	No latent failure. Failure mode is to fall short and subsequently open internal leads. No additional testing required on LM-10.
KC-59	Random modulation on 1024KC subcarrier.	7/1/71	R. Munford	No corrective action required.
KC-60	Mass spectrometer backup unit fire contamination	7/8/71	R. Giesecke	Unit acceptable for flight.
KC-61	Waste water tank cover was not on vehicle when shipped	7/8/71	P. Hurt	Will not exceed 50°F. Replacement of emissity blanket is not required
KC-62	Pip pin alert.	7/8/71	E. Fields	Pip pins used in the Apollo 15 vehicle meet the requirements of preliminary alert. MSC-71-03
KL-63	Leak at the LMP's water connector from the LCG	7/8/71	P. Hurt	Leak caused by dry surfaces and would not repeat after wetting. Connector acceptable for flight.
KL-64	Lightning retest requirements during TCP-KL-0007	7/9/71	D. Arabian	Confirmation of verbal agreement. Abridged functional tests will be conducted and will be coordinated with MER.
KL-65	LM-10 flight batteries.	7/12/71	H. White	Megger inspection with battery standing on end for 12 hours sufficient to determine battery ready for flight.
KC-66	Hydrogen cryo tanking. Lower fill rate of liquid hydrogen during CDDT than during earlier checkout.	7/15/71	H. White J. Cooper	Flow rate change caused by drop in dewar pressure during servicing. No anomalies found in GSE. MSC concurs with closure of IDR as an explained condition.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KL-67	Lunar module flight batteries. Cell 13 vent valve failed to open with a pressure of 11 psi during cell vent test. Subsequent tests with all cells pressurized at 5 psi showed the vent valve to open at 10.6 and 8.8 psi. Are batteries flightworthy.	7/15/71	H. White	Batteries without cell vent tests are acceptable for flight.
KC-68	Data from troubleshooting of IDR-023.	7/15/71	R. Munford	No answer required.
KC-69	Water/glycol pump operational characteristics. Requested pump characteristics on flow data, magnetically coupling of pump rotor, phase-to-phase short characteristics, drawings, and hook-up current.	7/15/71	P. Hurt	Data provided.
KC-70A	Use of RTV-102 on SIM door	7/16/71	R. Giesecke	MSC concurs with the use of RTV-102 for SIM panel closeout.
KL-71	Abort sensor assembly retest requirements.	7/19/71	C. Finch	MSC concurs with KSC retest plan and requirements.
KC-72	Recharge deficiency of entry batteries.	7/20/71	H. White	Entry batteries properly charged.
KC-73	Mapping camera flight film	7/20/71	R. Giesecke	Flight film had splotches on first 3 feet of roll, considered acceptable for flight.

APOLLO 15 PROBLEM TRACKING LIST - Continued

Request no.	Title	Date of request	Assigned to	Response
KC-74	Oxygen manifold pressure.	7/20/71	H. White	SC0069P exhibited approximately 6 percent noise on powerup on 7/20, SC0038P measurement replaces SC0069P.
KC-75	24 VAC drop on AC-1	7/23/71	R. Munford	Analysis indicates problem caused by inverter. Testing confirms conclusion and inverter replaced.
KL-76	LM GSE contingency power for power supply 8	7/22/71	R. Munford	Alternate GSE power supply probe proposed. Also could use ascent stage batteries.
KC-77	Lightning retest during countdown.	7/22/71	D. Arabian	Lightning retest requirements forwarded to KSC.
KC-78	Suit circuit heat exchanger flow rates.	7/24/71	P. Hurt	Excessive flow rate drop from chamber runs to CDDT to CD. Rationale developed from previous flight history determines system to be acceptable for flight.
KC-79	Water sample request from suit loop.	7/23/71	P. Hurt	Sample clean.
KC-80	Shear pin of left-hand foot strut of couch.	7/23/71	P. Hurt	Initial analysis indicate shear pins understrength for abort modes. Further investigation indicates shear pins acceptable for flight.
KL-81	Abort sensor assembly heater circuit breaker position for launch.	7/24/71	C. Finch	Circuit breaker to be open for launch.
KC-82	Motor switch transfer time twice specification value.	7/24/71	R. Munford	Present motor switch acceptable for flight as it will only be used in the event of an inverter failure.

APOLLO 15 PROBLEM TRACKING LIST - Concluded

Request no.	Title	Date of request	Assigned to	Response
KC-83	Liquid helium tank 2 filled	7/24/71	H. White	Information only.
KC-84	Ascent propulsion system manifold pressure decay.	7/24/71	H. White	Observed leak rate will not result in inadequate margins for flight.
KC-85	Change to command module computer memory.	7/25/71	C. Finch	Information only.
KL-86	Additional crew preference decals for lunar module.	7/24/71	H. Kuehnel	Decals are on satisfactory material, and satisfactory for flight.
KC-87	Battery data request	7/25/71	R. Bragg	Information only.

APPENDIX D

SPAN OPERATIONS PLAN

MSC 03616

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPAN OPERATIONS PLAN

FEBRUARY 1972

REVISION F

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

MSC-03616
Revision F
February, 1972

SPAN OPERATION PLAN

PREFACE

This document will provide Flight Operations Directorate a baseline for the Apollo Spacecraft Program Office real-time support of Apollo spacecraft during mission operations. This document is one of two that describe the implementation of the technical support provided, beginning with the initiation of pad tests at KSC to mission completion, as directed by APD 56. The remaining document is MSC-05284 Apollo 16 Mission Evaluation Plan. The contents of this plan differ from the Apollo 15 plan by the inclusion of the Surface Science and Orbital Science operations.

James A. McDivitt
Brigadier General, USAF
Manager
Apollo Spacecraft Program

TABLE OF CONTENTS

ENCLOSURES

1.0 PURPOSE

The purpose of this document is to outline policy and procedures for the operations of the Spacecraft Analysis (SPAN).

2.0 SCOPE

2.1

This instruction describes the functions of the SPAN room in Mission Control during an Apollo Mission.

2.2

This instruction will outline the interfacing operations provided the Flight Operations Directorate (FOD) and Science and Applications Directorate (S&AD) by the Apollo Spacecraft Program Office (ASPO) in support of real-time mission operations.

3.0 APPLICABILITY

This procedure is applicable to all personnel interfacing with and supporting SPAN operations.

4.0 REFERENCES

The below referenced documents are applicable: An additional list of mission related documents will be issued prior to launch. Copies of the documents related to the current mission will be available at the SPAN, Mission Evaluation Room and at the RASPO KSC.

A. MSC-02538 - Apollo Program Plan
B. Mission Operations Plan
C. MSC 00142 - MSC Support Services Plan for Apollo Manned Missions
D. MSC-05284 - Apollo 16 Mission Evaluation Plan

5.0 DEFINITIONS

The acronyms and abbreviations used in this document are defined below.

ASPO - Apollo Spacecraft Program Office
CSM - Command and Service Module
DOD - Department of Defense

DO - Detailed Objectives
E&D - Engineering and Development Directorate - MSC
FOD - Flight Operations Directorate - MSC
LM - Lunar Module
LRV - Lunar Roving Vehicle
MER - Mission Evaluation Room
MOCR - Mission Operations Control Room - Bldg. 30
S&AD - Science and Applications Directorate
MSC - Manned Spacecraft Center - Houston, Texas
SPAN - Spacecraft Analysis
TLI - Trans-Lunar Insertion

6.0 POLICY

The exchange of information between FOD, S&AD and the MER will be through the SPAN Room. SPAN is the ASPO Manager's official interface with FOD, and is not a problem solving area. Through its services the ASPO will have the capability to:

A. Provide answers to questions asked by FOD prior to and during real-time flight operations.

B. Provide ASPO inputs, as required, relating to, experiment hardware,spacecraft operations and mission requirements.

C. Provide in depth, real-time system performance analysis.

D. Provide a means of drawing upon expert knowledge and the assistance of specialists.

7.0 SPAN OPERATIONS

The SPAN Room is located in Room 312A, Bldg 30, at MSC. It is a mission support room, connected to the MOCR through consoles manned by trained Flight Controllers. Through the use of special telephones and an organized flow of information, the SPAN Operations Manager can quickly and accurately respond to questions presented by the Flight Controllers, concerning the operations and design of the spacecraft on experiments. Also through the SPAN, the Apollo Spacecraft Program Office can receive recommendations from the SPAN/Mission Evaluation Team and relay, if required, major decisions to the Flight Director.

7.1 VISITORS

Only personnel assigned duty stations will be allowed in the SPAN room during mission operations. All visitors must have the specific approval of the SPAN Operations Manager on duty.

7.2 RESPONSIBILITIES

Overall SPAN management is the responsibility of the Apollo Spacecraft Program Office (ASPO) Assistant Program Manager for Flight Safety. The overall Mission Evaluation management is the responsibility of the Chief, ASPO Test Division. The overall science team management is the responsibility of the Chief, Science Mission Support Division.

7.3 DUTIES - ASPO

The duties of the personnel responsive to the SPAN manager during SPAN operations, are listed below:

A. SPAN Operations Manager

Represent the Apollo Spacecraft Program Manager in the operational interface with FOD, manage SPAN Room operations, and advise the Apollo Spacecraft Program Manager of mission status as required. He will name an alternate in his temporary absence or an assistant should the occasion demand; (example: during the simultaneous lunar surface and lunar orbit operations, an assistant operations manager will be appointed). Process mission inquiries and provide the ASPO position on responses. Review and approve periodic status report provided by mission evaluation team prior to distribition to FOD and other Managers. (If the SPAN Operations Manager cannot take the time within 10 minutes of receipt of the status report for the review and approval, because of priority functions, distribution will be made to FOD and MOCR without prior approval). Review recommendations prepared by the Mission Evaluation Team for the ASPO manager on system go no-go prior to major commitment points in the mission. Schedule major meetings to discuss anomalies, plans, etc., and notify appropriate personnel.

B. MPAD Senior Representative

Maintain an awareness of problems being identified or analyses to be provided within the trajectory, data book, performance, or consumables areas of responsibility. Monitor the actions being taken within his support activity and assure optimum use of available resources.

C. MSFC (LRV) Senior Representative

Provide the MSFC recommendation to SPAN Operations Manager for changes to LRV operations. Maintain an awareness of status and problems associated with LRV operations.

Provide interface to the LRV contractors, and MSFC support team at HOSC at MSFC.

D. Mission Staff Engineer

Interpret, coordinate, and assure implementation of any Detailed Objectives (DO's) or flight plan changes. DO modifications must be coordinated with MER Manager in Building 45 and approved by the Apollo Spacecraft Program Manager and the Flight Director.

E. Contractor Senior SPAN Representative (NR/GAC/MIT)

Maintain an awareness of problems being identified with his system. Monitor the action being taken with support activity and assure optimum use of available contractor resources. Be available in SPAN during high activity periods and on call to the SPAN Operations Manager during off-hours. Coordinate at a management level to approve or state position on responses received in answer to mission inquires.

F. CSD Senior Representative

Maintain an awareness of the problems identified with the EMU and associated equipment and advise the SPAN Operations Manager during the EVA activities.

G. Log Manager

Maintain SPAN action log (enclosure 3), post action requests on "open" and "closed" boards, and other duties as assigned by SPAN Operations Manager.

H. Messenger

Hand carry actions and responses to and from Science Rooms, Mission Evaluation Room, and elsewhere as requested by SPAN Operations Manager.

I. Secretary

Answer phones, and perform other clerical/secretarial duties as required by the SPAN Operations Manager.

7.4 DUTIES - FOD

The duties of the personnel responsive to the FOD Senior Representative during the SPAN operations, are listed on the next page:

A. FOD Senior Representative

Represent the Director of Flight Operations in the operational interface with ASPO. Provide the FOD position on mission inquiries. Coordinate FOD Senior Representative activities.

B. FCD Senior CSM Representative

Maintain an awareness of problems identified within his hardware responsibilities. Provide the SPAN/MOCR CSM Systems Engineer interface. Provide team recommendations and status on his areas of responsibility. Represent his area of responsibility in meetings outside the MOCR.

C. FCD Senior LM Representative

Maintain an awareness of problems identified within his hardware responsibilities. Provide the SPAN/MOCR LM Systems Engineer interface. Provide team recommendations and status on his area of responsibility. Represent his area of responsibility in meetings outside the MOCR.

D. FCD Senior Flight Dynamics Representative

Maintain an awareness of problems identified within his hardware/software responsibilities. Provide the SPAN/ MOCR Flight Dynamics interface. Provide recommendations and status on his areas of responsibility.

7.5 DUTIES - S&AD

The Science and Applications Directorate will provide real-time support for surface and orbital science experiments during the mission. A team and team leader will be located in each of the science support rooms. The surface science team will be located in Bldg. 30, Room 314 and the orbital science team will be in Room 210. The teams will monitor the real-time operations of the Apollo Lunar Science Equipment Package (ALSEP), scientific instrumentation module (SIM Bay) and well as other lunar surface experiments i.e. traverse experiments. A system of communications has been provided between each of the science rooms and the SPAN room.

A. S&AD Science Team Leaders

Maintain awareness of the scientific hardware/software status and problems. Provide the science room/SPAN interface. The team leader will approve all action requests (SMEAR's) originating in his area. Represent his area of responsibility in "real-time" meetings outside the MOCR. The science team leader will provide recommendations and status on his areas of responsibility.

7.6 MISSION EVALUATION OPERATIONS

During the mission, the NASA and contractor engineering, as well as other system specialists, who are located on the third floor of Building 45, will provide continuous (24-hour) real-time support to the mission operation through the SPAN. This group will provide the system experience as evolved through qualification programs, acceptance tests, and factory and launch site testing to be used for resolving inflight problems. The detailed responsibilities of the Mission Evaluation Team are outlined in the Apollo 16 Mission Evaluation Plan - MSC-05284.

8.0 PROCEDURES

8.1

A SPAN Room Manning Plan will be published prior to each mission. Eight-hour shifts will be the normal tour of duty. The assigned stations are shown in the SPAN Room Layout and Station (see enclosure 1).

8.2

Access to SPAN will be achieved as noted below under Section 9.0 "Security" in this instruction.

8.3

Station Manning Time (Initiation and Termination) - will be determined by the Assistant Program Manager for Flight Safety, and issued by separate instructions.

8.4

Problem Definition is normally accomplished by specialists monitoring available data. They will then notify the next level of supervision and prepare necessary documentation as required. The actions below may be waived at the discretion of the SPAN Operations Manager if immediate verbal definition and resolution can be obtained; however, a record of these verbal transactions must be entered in the Operation Manager's log and/or the SPAN action log.

8.5

Problem Description will be accomplished on MSC form 1214 (see enclosures 2, 2A, 2B and 2C). The problems originating in Building 30 will be described on forms 1214A, A-1, A-2 and A-3, those originating in Building 45 on form 1214B, and a continuation sheet form 1214C will be used as necessary in all areas.

8.6

Problem Recording will be established and logged with a number taken serially from the SPAN Action Item Log (MSC form 2041) (see instructions on enclosure 3).

9.0 SECURITY

Security will be accomplished through special badging to gain access to the work data, and implemented as shown below.

9.1

Badging for the SPAN Room will be approved by the Assistant Program Manager for Flight Safety, ASPO.

9.2

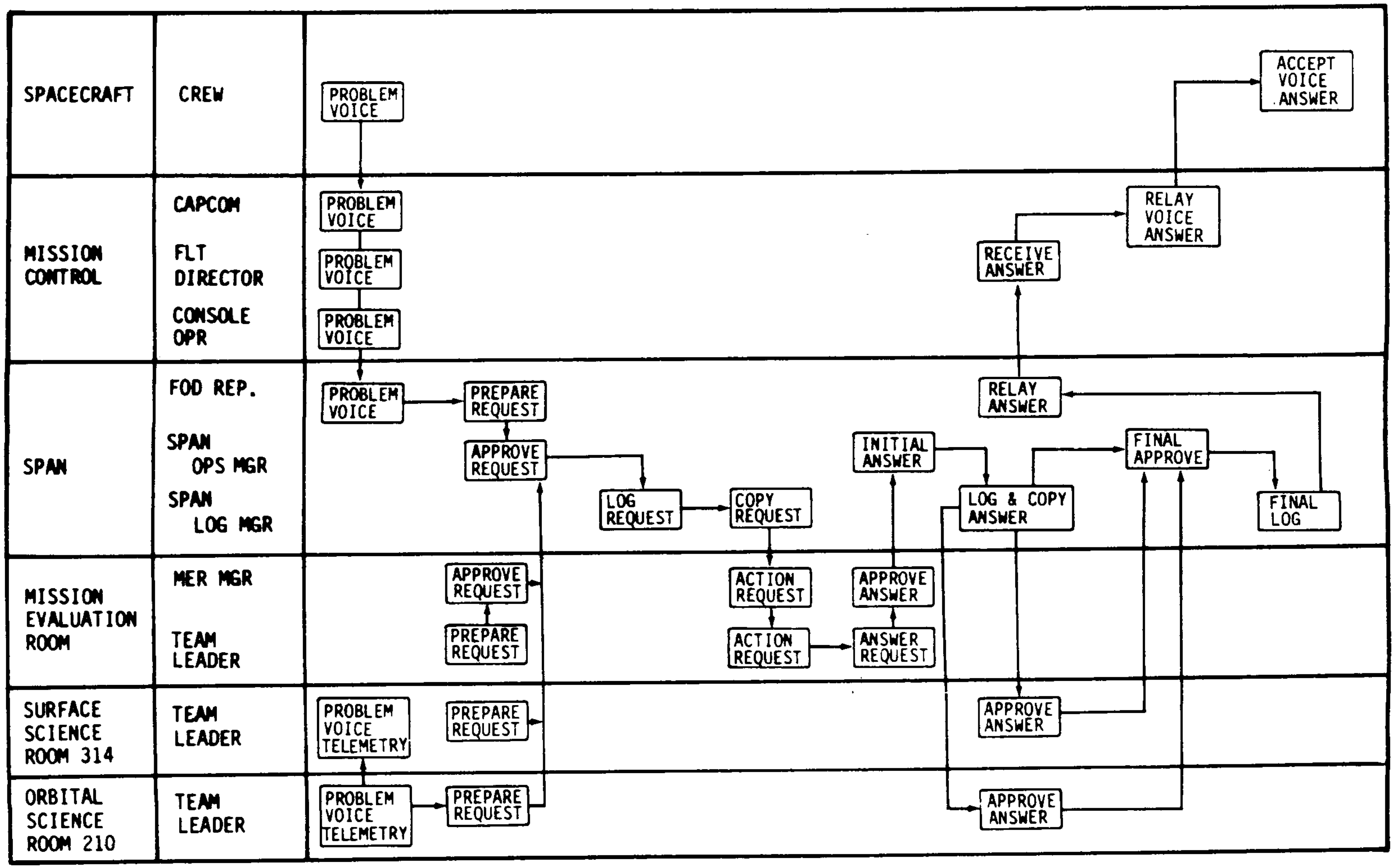
Chief, ASPO Test Division will compile all ASPO badging requirements (including support contractors) and forward to FOD for processing and badge issuance.

10.0 MISSION EVALUATION ROOM PROCEDURE

Mission Evaluation Room, Building 45, Operating Procedures have been prepared and shown in Apollo 16 Mission Evaluation Plan and issued by the Chief, ASPO Test Division.

11.0 ADMINISTRATIVE SUPPORT

The Executive Assistant to the Apollo Spacecraft Program Manager will arrange for, and provide guidance to, the secretarial and messenger support required in SPAN. He will also request equipment changes and furnish office supplies needed to operate the SPAN.



LOGIC DIAGRAM - SPAN

BLDG. 30 SPAN ROOM

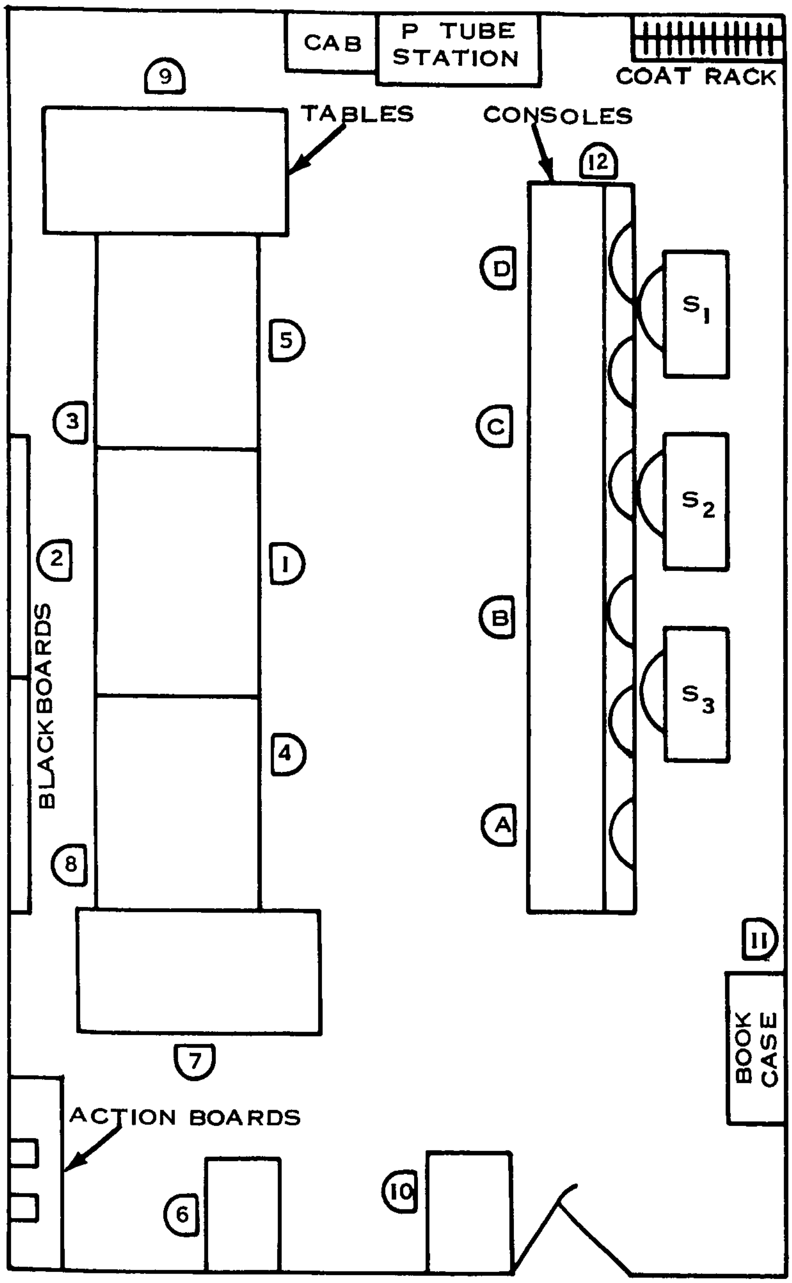


TABLE POSITIONS

1. SPAN OPERATIONS MANAGER
2. ASST SPAN OPS MANAGER
3. MISSION STAFF ENGINEER
4. NR SR REPRESENTATIVE
5. GAC SR REPRESENTATIVE
6. SPAN LOG MANAGER
7. MIT SR REPRESENTATIVE
8. MPAD REPRESENTATIVE
9. LRV (MSFC) REP
10. SECRETARY
11. MESSENGER
12. EMU REP

CONSOLE POSITIONS

A. CSM FCD REPRESENTATIVE
B. FLIGHT DYNAMICS OFFICER
C. FOD SR REPRESENTATIVE
D. LM FCD REPRESENTATIVE

S_1, S_2, S_3 } TV MONITORS

ENCLOSURE 1

USE BLACK BALLPOINT PEN	SPAN / MISSION EVALUATION ACTION REQUEST	USE BLACK BALLPOINT PEN

30 | TIME (T-MINUS/GET) | REQUEST ORGANIZATION | RESPONSE ORGANIZATION | CONTROL NUMBER | 30

ACTION REQD BY (TIME): | REQUESTER

SUBJECT: | APPROVAL

FOD REP

TIME :

SPAN MGR

30 TIME : 30

30 RESPONSE: | CONCUR 30

TEAM LDR

TIME :

CON SR REP

TIME :

ME MGR

TIME :

30 SPAN MGR 30

TIME :

RESPONDER

FOD REP TIME :		SPAN MANAGER TIME :

0 30

MSC Form 1214A (Oct 69) (OT) NASA — MSC

ENCLOSURE 2

USE BLACK BALLPOINT PEN

SPAN / HOSC-LRV ACTION REQUEST

USE BLACK BALLPOINT PEN

30 30

TIME (T-MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER

ACTION REQD BY (TIME):

REQUESTER

SUBJECT:

APPROVAL

FOD REP

TIME :

SPAN MGR

TIME :

30 30

30

RESPONSE:

30

CONCUR

TEAM LDR

TIME :

HOSC MGR

TIME :

SPAN MGR

TIME :

30 30

RESPONDER

30 30

FOD REP TIME :		SPAN MANAGER TIME :

MSC Form 1214A-1 (Jan 72) (OT)

NASA — MSC

LRV/PINK

ENCLOSURE 2A

USE BLACK BALLPOINT PEN	SPAN / MISSION EVALUATION ACTION REQUEST	USE BLACK BALLPOINT PEN

210

TIME (T-MINUS/GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER

210

ACTION REQD BY (TIME):

REQUESTER

SUBJECT:

APPROVAL

FOD REP

TIME :

SPAN MGR

210

TIME : 210

210 RESPONSE:

CONCUR 210

TEAM LDR

TIME :

CON SR REP

TIME :

ME MGR

TIME :

210

SPAN MGR 210

TIME :

RESPONDER

210

FOD REP	CONTR SR. REP/S&AD MGR	SPAN MANAGER
TIME :		TIME :

210

MSC Form 1214A-2 (Jan 72) (OT)

NASA — MSC

SCIENCE/YELLOW

ENCLOSURE 2B

USE BLACK BALLPOINT PEN	SPAN / MISSION EVALUATION ACTION REQUEST	USE BLACK BALLPOINT PEN

314 | TIME (T-MINUS/GET) | REQUEST ORGANIZATION | RESPONSE ORGANIZATION | CONTROL NUMBER | 314

ACTION REQD BY (TIME):	REQUESTER

SUBJECT:

APPROVAL

FOD REP

TIME :

314 SPAN MGR 314

TIME :

314 RESPONSE:

CONCUR 314

TEAM LDR

TIME :

CON SR REP

TIME :

ME MGR

TIME :

314 SPAN MGR 314

TIME :

RESPONDER

FOD REP TIME :	CONTR SR. REP/S&AD MGR	SPAN MANAGER TIME :

314 314

MSC Form 1214A-3 (Jan 72) (OT) NASA -- MSC

SCIENCE/YELLOW

ENCLOSURE 2C

USE BLACK BALLPOINT PEN	SPAN / MISSION EVALUATION ACTION REQUEST	USE BLACK BALLPOINT PEN

45

TIME (T-MINUS / GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER

45

ACTION REQD BY (TIME):	REQUESTER

SUBJECT:	APPROVAL
	TEAM LDR TIME :
	CON SR REP TIME :
	ME MANAGER TIME :
	SPAN MGR TIME :

45 45 45

RESPONSE:	CONCURRENCE
	FOD REP TIME :
	SPAN MGR TIME :
	TEAM LDR TIME :
	CON SR REP TIME :

45 45

RESPONDER

ME MANAGER TIME :		SPAN MANAGER TIME :

45 45

MSC Form 1214B (Jun 69) (OT)

ENCLOSURE 2D

SPAN / MISSION EVALUATION ACTION REQUEST
(CONTINUATION SHEET)

(PLEASE USE BLACK BALLPOINT PEN)

TIME (T- MINUS / GET)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER

ENCLOSURE 2E

MSC Form 1214C (Mar 70) (OT)

NASA — MSC

Preparation of Action Item Log (MSC Form 2041)

The local date (month, day, and year) shall be entered in the date block of each action log sheet. When there is a local date change before the log sheet is completed, the new date (month, day, and year) shall be entered in the log no. column just above where the next serial log number will be entered.

As soon as the copy of the SPAN/Mission Evaluation Request (MSC Form 1214) has been placed on the "open" retainer board and the original and copies have been properly distributed, entries will be made in the Action Item Log as follows:

a. Log No.: - The log number shall be assigned and entered serially, and be prefaced by letters indicating the spacecraft elements affected. (See legend below.)

b. Subject: - The title of the request as shown on the MSC Form 1214 shall be entered.

c. Required by: - The function making the request (FOD, S&AD, SPAN or MER) shall be entered.

d. Time of Req: - The time the request was made, as shown on the MSC form 1241. Prelaunch - "T" minus time showing on countdown clock, postlaunch - GET shall be entered.

e. Assigned to: - The function to which the action was assigned (FOD or 45) as shown on the MSC form 1214 shall be entered.

f. Required Time: - The time by which the response is required, as shown on the MSC form 1214 shall be entered.

g. Time of Completion: - The time entered by the SPAN Operations Manager on the MSC form 1214 when he signs closing the action shall be entered.

h. Notes: - Any comments relative to the subject request or any general comments may be entered.

DESIGNATOR LEGEND:

C = Command and Service Module
E = Extravehicular Mobility Unit (EMU, PLSS, Suit, etc.)
L = Lunar Module
P = Photograph Equipment
R = Lunar Rover Vehicle
T = Television/GCTA
OX = Orbital Experiments - Room 210
SX = Surface Experiments - Room 314

Enclosure 3

ACTION ITEM LOG

DATE

LOG NR.	SUBJECT	REQUESTED BY	TIME OF REQUEST T minus LO-PRELAUNCH GET-INFLIGHT	ASSIGNED TO	REQUIRED TIME	TIME OF COMPLETION	NOTES

ENCLOSURE 3A

APPENDIX E

APOLLO 14 PROBLEM TRACKING LIST

MSC Form 750 (Apr 70) NASA — MSC

APOLLO 14 PROBLEM TRACKING LIST

ITEM NO.	VEHICLE CSM	VEHICLE LM	DESCRIPTION	ACTION IN PROGRESS	ACTION ASSIGNED TO	STATUS	ESTIMATED COMPLETION TIME
1	X		After ingress, Commander's EKG was not working prior to lift-off. After first revolution, EKG was working properly.	Problem has cleared and no further action planned. Spares are available onboard should problem recur.	Zieglschmid		Postflight
2	X		First several attempts at docking were unsuccessful.	Possible causes of problem are: 1. Foreign material jamming latch mechanism 2. Slow response of capture latch to latch 3. Bent shaft Procedures to return probe has been verified and completed.	Arabian Glynn Finch Williams		3/15/71
3	X		Reaction control system quad B oxidizer manifold pressure loss at spacecraft/launch vehicle separation.	Analysis of transducer and associated wiring in progress	Munford		Postflight
4	X		Intermittent loss of high gain antenna pitch measurement on telemetry from 03:22:00 to 06:31:00 hours Apollo elapsed time.	Analysis in progress. No intermittent operation has been noted since 06:31:00 hours.	Irvin		Postflight
5	X		Unexplained venting on left side of S/C with higher than normal oxygen flow.	Either a leaking vent or valves were not configured for waste management system. However, no leakage has been noted since 15:00:00 A.e.t.	Hurt	CLOSED	

MSC Form 750 (Apr 70) NASA — MSC

APOLLO 14 PROBLEM TRACKING LIST

ITEM NO.	VEHICLE CSM	VEHICLE LM	DESCRIPTION	ACTION IN PROGRESS	ACTION ASSIGNED TO	STATUS	ESTIMATED COMPLETION TIME
6	X		Oxygen tank 2 pressure tracking tank 3 during heater cycle.	Check valve leak. Should not have any effect in the event tank 3 should have to assume the oxygen demand.	White		Postflight
7		X	Ascent battery 5 voltage was .3 volt lower than battery 6	Test by crew shows telemetry readings valid. Change in battery 5 voltage indicates some current drain has occurred. Battery has operated normally throughout the flight. Inspection of the .3 V noted initially. A study of all previous cell data is in progress to ascertain if in fact this condition is a result of an internal or external condition.	White		2/28/71
8	X		Between 76:45 and 76:55 proper high gain antenna auto-track could not be achieved.	Performance was nominal until revolution 6 (see item 10) The antenna is working normally in the auto-track mode. However, tests are scheduled on the return trip to attempt to isolate the problem.	Irvin		4/1/71
9	GFE		Hycon camera magazine making clacking type noise GET 89:45	Lunar topographic camera (Hycon) exhibited noisy operation during rev 4 photography. Approximately 195 of 415 frames were obtained without the reported noise. Preliminary testing in Bldg. 4 shows essential duplication of the problem symptoms with 0.4 amp into camera; normal current is 0.6 amp. Hycon is assessing MSC findings. Hycon feels that the camera is probably operating satisfactorily. (concluded next page)	Kuehnel		3/15/71

(concluded next page)

MSC Form 750 (Apr 70) NASA — MSC

APOLLO 14 PROBLEM TRACKING LIST

ITEM NO.	VEHICLE CSM	VEHICLE LM	DESCRIPTION	ACTION IN PROGRESS	ACTION ASSIGNED TO	STATUS	ESTIMATED COMPLETION TIME
9 (continued)				Results of shutter test indicate that shutter is running continuously when no actuation is commanded which renders the camera nonoperational. Camera is being returned.			
10	X		High gain antenna failed to acquire in narrow beam AUTO reacquisition mode during revolution 6 (GET 92:16) following initial acquisition attempt, uplink carrier was cycled off and back on six times without success.	(see item no. 8)			
11		X	LGC abort with 104:22 A.e.t. Descent engine bit set. Bit removed when abort switch depressed. Occurred four times prior to powered descent initiation. Recurred again after ascent phase from lunar surface.	Procedure for software workaround being verified. Switch or contamination high suspect.	Hanaway Munford		3/15/71
12		X	C/B of S-band steerable popped reported by crew - recurred on rev. 14 at 108:20.	Driving into stops with error signal will blow circuit breaker	Irvin		2/28/71
13		X	Water separator speed (GF9999) erratic	Data analysis being compared to previous history which indicates instrumentation was at fault.	Hurt		2/28/71
14		X	Landing radar turned on within low scale instead of high. Recycling breaker cleared problem. Excessive slant range changes were noted during the first 8 sec after initial acquisition.	Possible momentary power interruption of transient on low scale switch signal.	Irvin		2/28/71

MSC Form 750 (Apr 70) NASA — MSC

APOLLO 14 PROBLEM TRACKING LIST

ITEM NO.	VEHICLE CSM	VEHICLE LM	DESCRIPTION	ACTION IN PROGRESS	ACTION ASSIGNED TO	STATUS	ESTIMATED COMPLETION TIME
15		X	PLSS comm. intermittent during initial activation GET 113:45	This is believed to have been a LM configuration problem. Proper communication was established during a re-run of the checklist.	Irvin		Crew debrief.
16	ALSEP		Of the 18 igniters used in the thumper, 5 failed to fire, 13 fired successfully.	Circuits and components analysis and examination of trainer to repeat problem When right hand was pressing actuator, left hand movement may have allowed MODE SELECT dial to move out of detent.	Harris		2/28/71
17	GFE		Color television picture becoming coming fuzzy	Can be associated with temp on transmission to the center.	Irvin		2/28/71
18		X	Problem with acquisition on LM steerable antenna on tenth and fourteenth revolutions.	Flight tests showed the antenna to be normal. System worked properly during ascent.	Irvin		2/28/71
19	ALSEP		Boyd bolts difficult to release on ALSEP/SIDE experiment	Crew debriefing to determine how lunar dust (or soil) caused the problem and successful method used for soil removal.	Langford		2/28/71
20	ALSEP		Stiffness of cable between SIDE and CCGE	Similar problem occurred on Apollo 12. Cable wrap removal for Apollo 14 did not reduce cable torque adequately.	Langford		2/28/71
21	ALSEP		Apparent low transmitter power output on central station	The antenna was realigned at end of EVA 2 resulting in .5 to 1.0 dB improvement in received signal strength. The signal strength level is now considered acceptable and usable data is being received at all stations.	Harris		2/28/71

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22	ALSEP		Noisy data on SIDE	Eliminated by sequence of SIDE CPLEE, and PSE ON/OFF commands SIDE turned to operating mode with high voltages off until first lunar sunset.	Langford		2/28/71
23	GFE		Lunar module pilot right hand EVA glove wrist control cable reported broken and pulling hand toward inside.	The lunar module pilot EVA gloves are to be returned to MSC for examination and postflight analysis	Hurt		2/28/71
24		X	Loss of abort guidance system after braking during rendezvous Computer could not be assessed for self-test. Cycling of circuit breakers and control switch did not return system to normal operation.	Possible 6 V power supply or standby switch problem at that time.	Finch		2/28/71
25		X	Crew comment of something hanging off the ascent stage.	Review of television pictures show nothing.	Glynn		Crew debrief.

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