APOLLO PROGRAM

LUNAR SURFACE EQUIPMENT STATUS

18 SEPTEMBER 1973

NOTE: Discussions of closed problems will be deleted from subsequent issues.

Italics indicate change from previous issue.

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Experiments Manager

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APOLLO LUNAR SURFACE EQUIPMENT STATUS
1.0 INTRODUCTION

Scientific data gathering equipment and related communications and power equipment were deployed on the lunar surface by the crew on each of the six Apollo lunar landing missions from July 20, 1969, (Apollo 11 mission) through December 11, 1972, (Apollo 17 mission). This report covers the performance of the deployed equipment which was designed to continue to provide data after the return of the crew to earth.

The report is divided into four sections, section one being the Introduction. The second section is an overall summary in the form of a graphic presentation of the time history of the percent of full capability of the instruments from the time of deployment on the lunar surface, with a gross indication of when changes occurred. The third section includes a brief word status of each instrument in a listing which is grouped by experiment, so that the status for each of the experiments on each applicable mission can be seen at a glance. The fourth section discusses each problem encountered. Problems are arranged in chronological order, and a listing of all problems by subject and number is included.

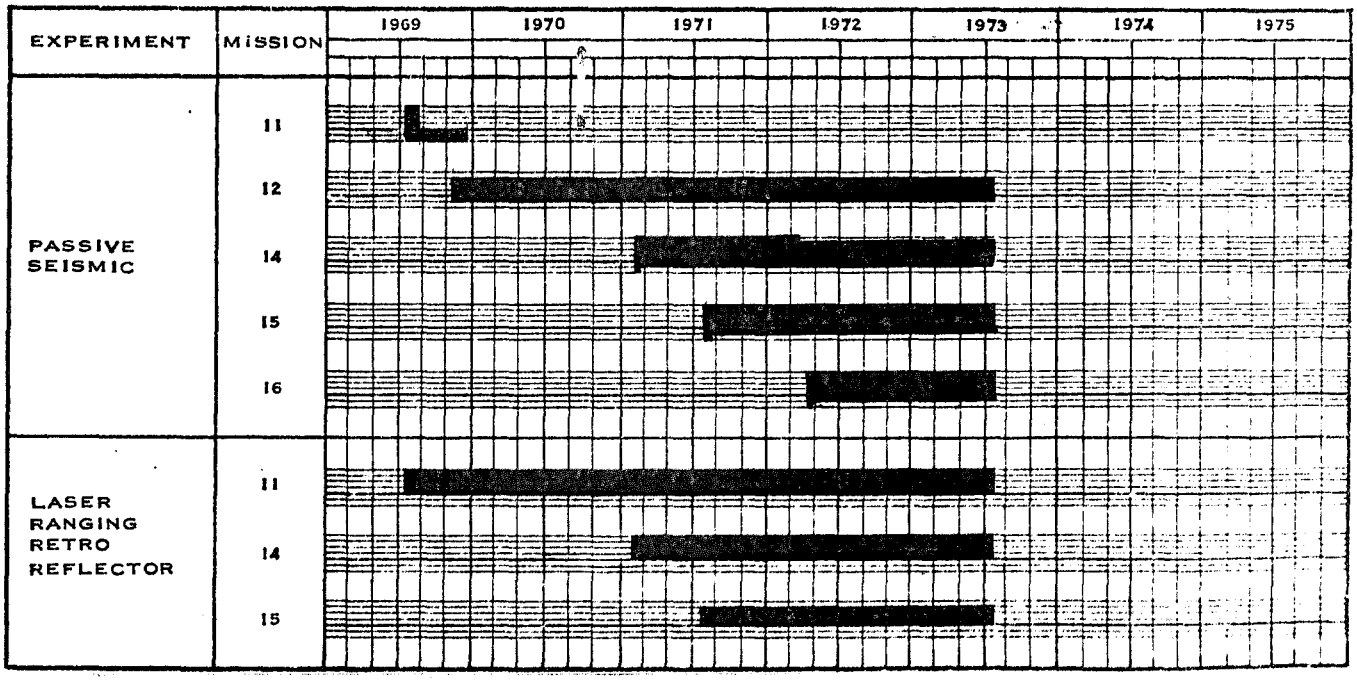
This issue of the Apollo Lunar Surface Equipment Status Report updates previous issues of the report. Problems which have been closed out in previous issues of the report are not included in the discussion portion of Section 4.0. However, the date of the issue in which the closed out discussion last appeared is so indicated in the Chronological Listing of Problems at the end of Section 4.1.

APOLLO LUNAR SURFACE EQUIPMENT STATUS

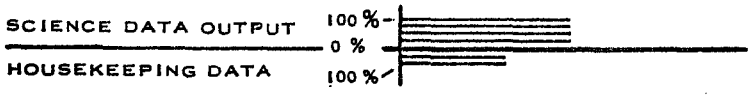
2.0 OVERALL SUMMARY

MISSION	LAUNCH DATE	LUNAR SURFACE DATA		
		START	END	
			UPLINK	DOWNLINK
11	Jul. 16, 1969	Jul. 21, 1969	Aug. 25, 1969	Dec. 14, 1969
12	Nov. 14, 1969	Nov. 19, 1969		
14	Jan. 31, 1971	Feb. 5, 1971		
15	Jul. 26, 1971	Jul. 31, 1971		
16	Apr. 16, 1972	Apr. 21, 1972		
17	Dec. 7, 1972	Dec. 12, 1972		

TIME – HISTORY PROPORTION OF FULL CAPABILITY OF INSTRUMENT

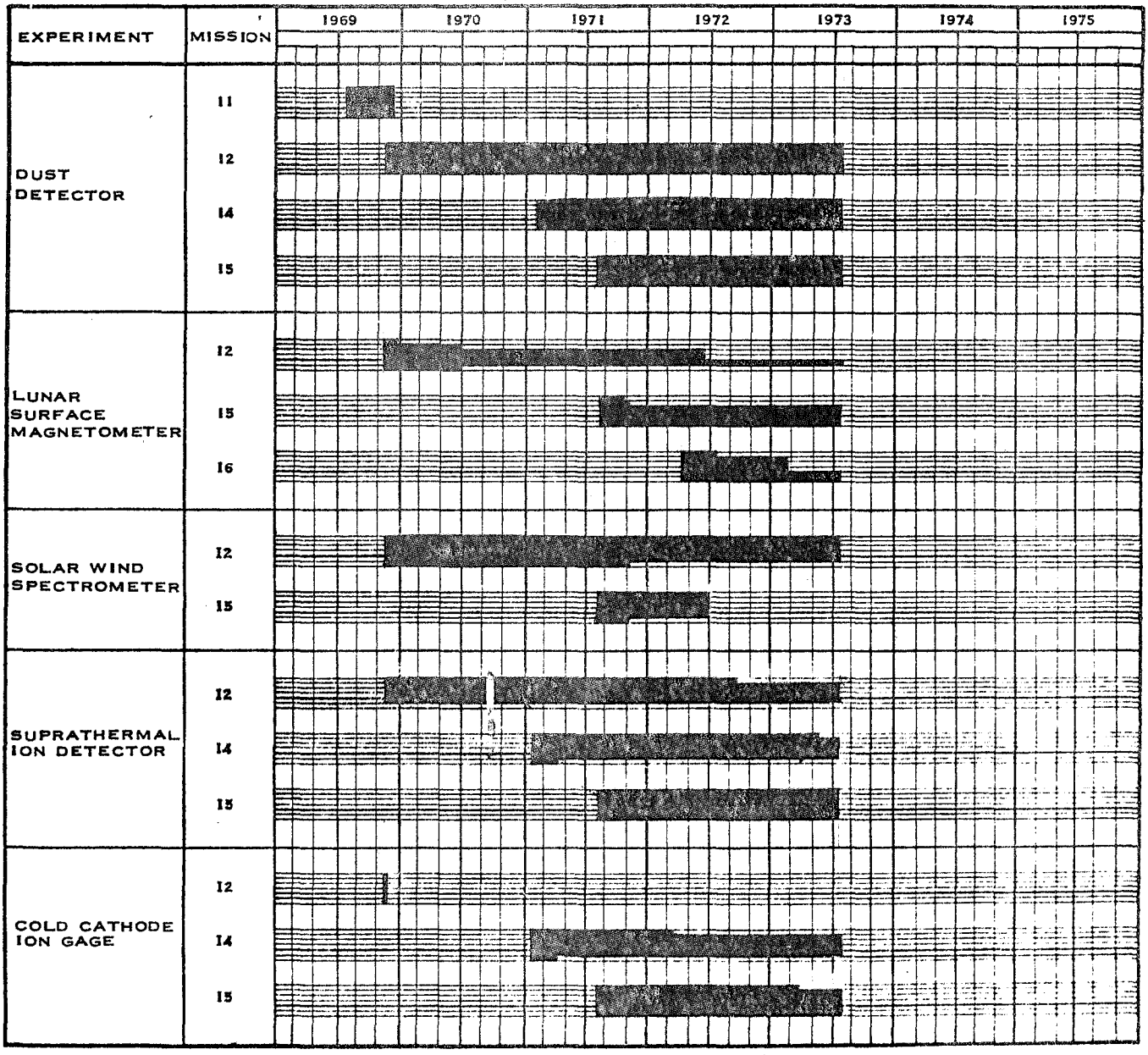


LEGEND :



APOLLO LUNAR SURFACE EQUIPMENT STATUS

2.0 OVERALL SUMMARY



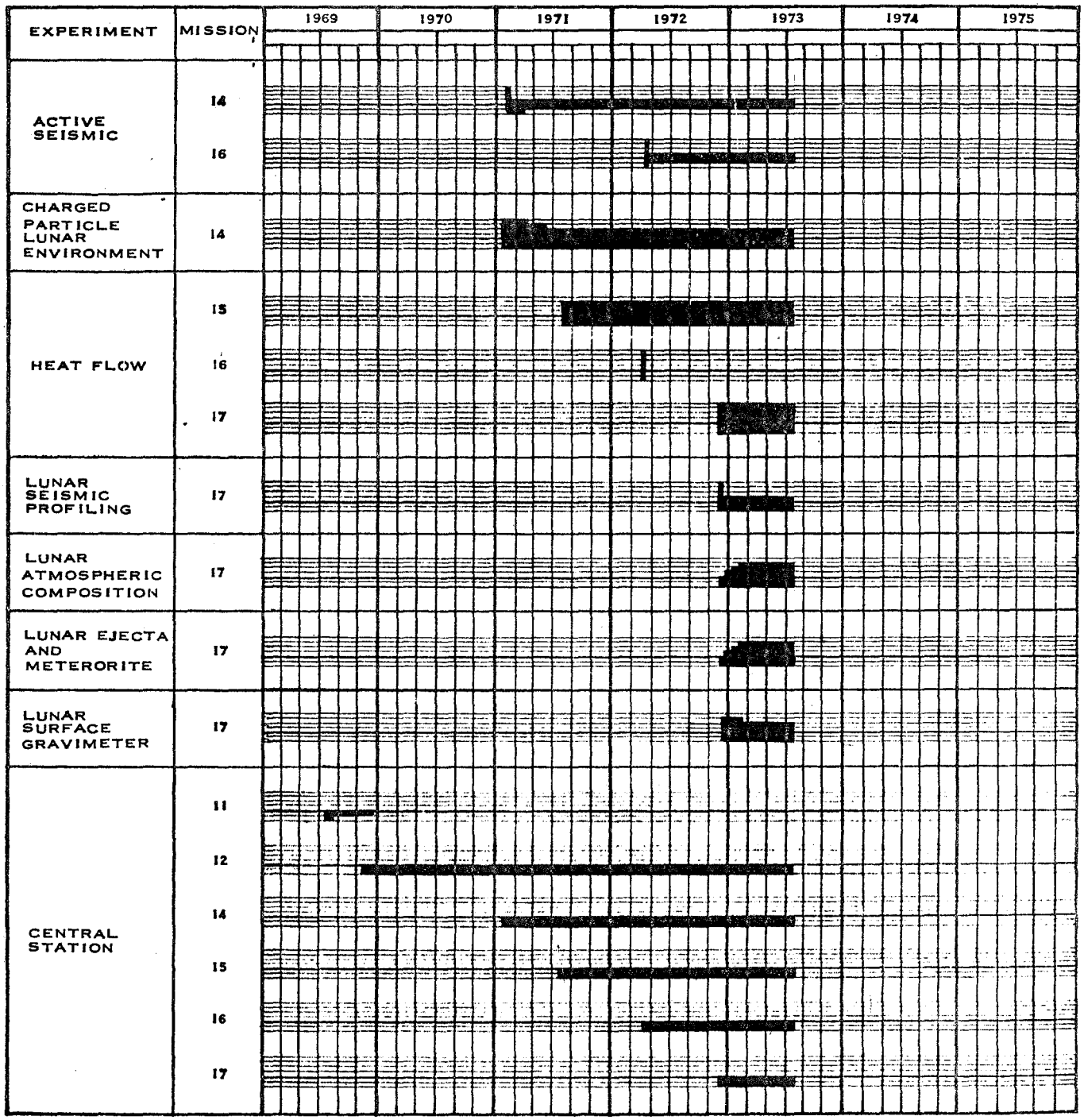
LEGEND :

SCIENCE DATA OUTPUT — 100 % – 0 %

HOUSEKEEPING DATA — 100 %

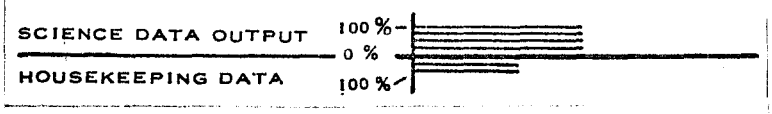
APOLLO LUNAR SURFACE EQUIPMENT STATUS

2.0 OVERALL SUMMARY



Note: All central station data is considered housekeeping rather than science data.

LEGEND :



APOLLO LUNAR SURFACE EQUIPMENT STATUS

3.0 INSTRUMENT STATUS

	APOLLO 12 ALSEP	APOLLO 14 ALSEP	APOLLO 15 ALSEP	APOLLO 16 ALSEP	APOLLO 17 ALSEP
PSE	SPZ AXIS MALFUNCTIONED SINCE DEPLOYMENT. Z DRIVE MOTOR REQUIRED @ NIGHT FOR THERMAL CONTROL SINCE 2/1/70.	LPY AXIS OCCASIONALLY DIFFICULT TO LEVEL. LPZ AXIS INOPERATIVE SINCE 11/17/72.	FULL OPERATION	LPX, LPY, & LPZ AXES OCCASIONALLY DIFFICULT TO LEVEL.	N/A
ASE	N/A	MORTARS NOT FIRED. HBR FOR 30 MIN/WK ABOVE -60°C. #3 GEOPHONE NOISY SINCE 3/26/71, DATA RECOVERABLE.	N/A	LAUNCHED 3 MORTARS. HBR 30 MIN/WK. PITCH SENSOR AND ROLL SENSOR FAILED SINCE 5/23/72.	N/A
LSM	DATA INTERMITTENT STARTING 12/11/69. DATA STATIC SINCE 6/4/72. FLIP CAL CMD WAS DISCONTINUED 6/14/72.	N/A	NO FLIP CAL CMD ABOVE 62°C. Y-AXIS FLIP CAL FAILED 8/30/71. Y-AXIS DATA STATIC SINCE 9/20/72.	SCIENCE DATA INTERMITTENT SINCE 2/15/73.	N/A
SWS	INTERMITTENT MODULATION DROP IN PROTON ENERGY LEVELS 13 AND 14 SINCE 11/5/71.	N/A	IN STANDBY SINCE 6/30/72, TM OUT OF SYNC & EXCESSIVE POWER DRAIN. PERIODIC CHECKING FOR POSSIBLE RECOVERY.	N/A	N/A

APOLLO LUNAR SURFACE EQUIPMENT STATUS

3.0 INSTRUMENT STATUS
(CONTINUED)

	APOLLO 12 ALSEP	APOLLO 14 ALSEP	APOLLO 15 ALSEP	APOLLO 16 ALSEP	APOLLO 17 ALSEP
SIDE	CYCLIC COMMANDING REQUIRED BECAUSE OF HIGH VOLTAGE ARCING ABOVE 55°C. *INTERMITTENT DIGITAL DATA (SCIENCE AND ENGINEERING) SINCE 9/9/72.*	LOSS OF SOME ENGINEERING DATA BECAUSE OF FAILURE OF POSITIVE PART OF A/D CONVERTER ON 4/5/71. LUNAR NIGHT OPERATION ONLY BECAUSE OF ANOMALOUS STANDBY OPERATIONS OF SIDE SINCE 4/15/73.	FULL OPERATION	N/A	N/A
HFE	N/A	N/A	TEMP REF 2 OFFSCALE HIGH SINCE 8/7/71. USING TEMP REF 1. PROBES NOT TO FULL DEPTH INTENDED.	INOPERATIVE: ELECTRICAL CABLE BROKEN DURING DEPLOYEMNT.	FULL OPERATION THERMAL ACCURACY BEING EVALUATED.
CCIG	FAILED 14 HRS AFTER TURN ON, 11/20/69.	*INTERMITTENT NIGHT TIME SCIENCE DATA SINCE 2/19/72. FULL OPERATION UNTIL SIDE ANOMALY (4/15/73).* LUNAR NIGHT OPERATION SINCE THEN AS DICTATED BY SIDE.	*ERRATIC NIGHT TIME SCIENCE DATA SINCE 2/22/73. AUTOMATIC ZERO AND CALIBRATION FUNCTIONS NOT OPERATING.*	N/A	N/A

APOLLO LUNAR SURFACE EQUIPMENT STATUS
3.0 INSTRUMENT STATUS
(CONTINUED)

	APOLLO 12 ALSEP	APOLLO 14 ALSEP	APOLLO 15 ALSEP	APOLLO 16 ALSEP	APOLLO 17 ALSEP
LEAM	N/A	N/A	N/A	N/A	THERMAL PROBLEM: INCREASING TEMPERATURE 5°F INCREMENTS EACH LUNATION. FULL OPERATION ABOUT 70% OF LUNATION.
LSPE	N/A	N/A	N/A	N/A	HBR 30 MIN/WK
LACE	N/A	N/A	N/A	N/A	THERMAL PROBLEM, 125°F TURN OFF. NOISE ON ALL MASS DATA CHANNELS, DATA RECOVERABLE. EXPERIENCED MODE CHANGES BEING CONTROLLED BY PROCEDURES.
LSG	N/A	N/A	N/A	N/A	SENSOR BEAM CANNOT BE STABILIZED IN THE NULL POSITION. SEISMIC HIGH GAIN, POST AMPLIFIER GAIN STEP 11, INTEGRATOR SHORTED MODE, BIAS OUT.

APOLLO LUNAR SURFACE EQUIPMENT STATUS
3.0 INSTRUMENT STATUS
(CONCLUDED)

	APOLLO 12 ALSEP	APOLLO 14 ALSEP	APOLLO 15 ALSEP	APOLLO 16 ALSEP	APOLLO 17 ALSEP
CPLEE	N/A	ANALYZER B FAILED 4/8/71. ANALYZER A INTERMITTENT OPERATIONS SINCE 6/6/71.	N/A	N/A	N/A
C/S	FULL OPERATION WITH XMTR B & PROCESSOR Y. (12-HOUR TIMER FAILED ON 2/16/70.)	FULL OPERATION WITH XMTR A & PROCESSOR Y. (12-HOUR TIMER FAILED ON 2/17/71.) ANTENNA SEATING PROBLEMS DURING DEPLOYMENT AFFECTS SIGNAL STRENGTH.	FULL OPERATION	FULL OPERATION WITH XMTR B & PROCESSOR Y.	FULL OPERATION
DTREM	FULL OPERATION	FULL OPERATION	FULL OPERATION	N/A	N/A

	APOLLO 11 ALSEP	APOLLO 12 ALSEP	APOLLO 14 ALSEP	APOLLO 15 ALSEP	APOLLO 16 ALSEP	APOLLO 17 ALSEP
LR^3	FULL OPERATION	N/A	FULL OPERATION	FULL OPERATION	N/A	N/A

The signal strength fluctuations that are observed in the downlink signal of each of the five ALSEP's is of no consequence as no system telemetry is lost due to this phenomenon. These signal strength phenomenon are most probably caused by variations in the tracking stations characteristics, the Earth-Moon libration pattern, and associated atmospheric phenomenon.

Power output of the various ALSEP Radioisotope Thermoelectric Generators (RTG) continues to be more than adequate. There is no question as to the expected and progressive gradual degradation of the ALSEP RTGs. The RTG's characteristics are such that continuous changing of thermoelectric material properties exist. These changes in characteristics can be caused by a large number of variables, i.e., thermal coating degradation, metallurgical aging, thermal shocks, and decrease of inert gas pressure. Based on the current RTG data no catastrophic failure should occur through normal system operations.

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS

This section provides a chronological listing of problems encountered with the ALSEP stations. Although the original design requirement for ALSEP was a one year life, much longer useful lifetimes are being realized. Problems in this section, therefore, cover the period from deployment of Apollo 11 ALSEP (21 July 1969).

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
1	11	PSE	Level Indicator Not Stable	21 Jul 69	Apollo 11 Mission, 5-Day Report, Jul 69
2	11	PSE & C/S	Leveling Motor Inadvertently Triggered	21 Jul 69	Apollo 11 Mission, 5-Day Report, Jul 69
3	11	PSE & C/S	Thermal Control	21 Jul-3 Aug 69	Apollo Experience Report Thermal Design of ALSEP, Dec 71, NASA TN D-6738
4	11	C/S	Data Processor X Selected	23 Aug 69	EASEP 30-Day Report, Sep 69
5	11	C/S	Command Capability Loss	25 Aug 69	Apollo 11 Mission Report, Nov 69, Section 11.4.4
6	11	PSE	PSE STANDBY Mode	27 Aug 69	EASEP 30-Day Report, Sep 69
7	11	C/S	Power Dissipation Module Failure	16 Sep 69	Daily Science Report, 17 Sep 69
8	12	RTG	Fuel Element Difficult to Remove From Cask	EVA (19 Nov 69)	Apollo 12 Mission Report, Mar 70, Section 14.3.3

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
9	12	C/S	Shorting Plug Ammeter Did Not Indicate RTG Current During Deployment	EVA (19 Nov 69)	Apollo 12 P & D List, 16 Dec 69, Item GFE-7
10	12	PSE	Deployment Difficulties	EVA (19 Nov 69)	Apollo 12 Mission Report, Mar 70, Section 14.3.4
11	12	SIDE	Dust Covers Deployed Prematurely	EVA (19 Nov 69)	Apollo 12 P & D List, 16 Dec 69, Item GFE-15
12	12	SIDE/ CCIG	Deployment Difficulties	EVA (19 Nov 69)	Apollo 12 Mission Report, Mar 70, Section 14.3.5
13	12	PSE	SPZ Displaying Reduced Sensivity at Low Signal Levels	19 Nov 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-9
14	12	PSE	Negative Square Wave Like Pulses Appeared on SPZ Data Channel	19 Nov 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-10
15	12	SIDE/ CCIG	High Voltage Arcing Problems *(CCIG Failure)*	20 Nov 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-5
16	12	PSE	LPZ Displaying Unstable Period & a Long Time Constant After Releveling	22 Nov 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-4

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
17	12	LSM	Loss of Data above 50°C (Digital Filter Problem)	22 Nov 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-6
18	12	C/S	Failure Timer Functions	4 Dec 69	Apollo 12 P & D List, 26 Mar 70, Item ALSEP-2
19	12	LSM	X, Y, & Z Sensor Data Dropped Offscale Unexpectedly & Science Data was Lost	11 Dec 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-7
20	11	C/S	Loss of Downlink	14 Dec 69	Apollo 12 SMEAR, ALSEP 16
21	12	SIDE	High Voltage Power Supply Arcing	22 Dec 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-5
22	12	LSM	Science Data Offset Y-axis	22 Dec 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-8
23	12	LSM	Temperature Range Exceeded Predictions	23 Dec 69	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-14
24	12	C/S	Systematic Spurious CVW's	27 Dec 69	Apollo 12 P & D List, 26 Mar 70, Item ALSEP-3
25	12	PSE	Temperature Range Exceeded	25 Jan 70	Apollo 15 P & D List, 13 Sep 71, Item ALSEP-4

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
26	12	C/S	Transmitter A Switched Out of Service	30 Jan 70	Apollo P & D List, 20 Aug 70, Item ALSEP-11
27	12	SIDE	Limited Operating Time During Lunar Noon (55°C Maximum)	18 Mar 70	Apollo 12 SMEARS, ALSEP 42, 66 & 73
28	12	PSE	LPX & LPY Shroud Noise	14 Jun 70	Apollo 12 SMEAR, ALSEP 46
29	12	LSM	Flip Cal Data Undefinable	14 Jun 70	Apollo 12 P & D List, 8 Oct 70, Item ALSEP-13
30	12	LSM	Y-axis Sensor Head Failure	29 Jun 70	Apollo 12 P & D List, 8 Oct 70, Item ALSEP-13
31	12	PSE	Thermal Effect of Lunar Seasonal Cycle	29 Jun 70	Apollo 12 P & D List, 20 Aug 70, Item ALSEP-12
32	12	LSM	Science & Engineering Data Static & Invalid	30 Jun 70	Apollo 12 P & D List, 8 Oct 70, Item ALSEP-13
33	12	C/S	Transmitter Switch from B to A	1 Sep 70	Apollo 12 P & D List, 8 Oct 70, Item ALSEP-15
34	12	C/S	Transmitter A Intermittent	13 Dec 70	Apollo 12 P & D List, 8 Oct 70, Item ALSEP-15

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
35	14	RTG Cask	Difficult to Latch RTG Dome Removal Tool in Cask Dome	EVA (5 Feb 71)	Apollo 14 P & D List, 12 Apr 71, Item ALSEP-13
36	14	SIDE	SIDE Boyd Bolt Blocked due to Compacted Lunar Dirt	EVA (5 Feb 71)	Apollo 14 P & D List, 12 Apr 71, Item ALSEP-2
37	14	SIDE/ CCIG	Difficult to Deploy	EVA (5 Feb 71)	Apollo 14 P & D List, 26 Mar 71, Item ALSEP-3
38	14	ASE	Geophone and Flag Easy to Knock Over	EVA (5 Feb 71)	Apollo 14 P & D List, 12 Mar 71, Item ALSEP-11
39	14	C/S	Sunshield Sags	EVA (5 Feb 71)	Apollo 14 P & D List, 26 Mar 71, Item ALSEP-10
40	14	ASE	Thumper Misfired Five of Eighteen Times	EVA (5 Feb 71)	Apollo 14 Mission Report, May 71, Section 14.4.1
41	14	C/S	Received Signal Strength Lower Than Expected	EVA (5 Feb 71)	Apollo 14 P & D List, 26 Mar 71, Item ALSEP-6

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
42	14	SIDE	Exhibited Noisy Data During Initial Turn ON	6 Feb 71	Apollo 14 Mission Report, May 71, Section 14.4.2
43	14	C/S	12-hour Timer Pulses Did Not Occur	7 Feb 71	Apollo 14 Mission Report, May 71, Section 14.4.4
44	14	PSE	Y-axis Levelling Intermittent & Sluggish	9 Feb 71	Apollo 14 Mission Report, May 71, Section 14.4.5
45	14	PSE	Thermal Control Problem	12 Feb 71	Apollo 14 P & D List, 26 Mar 71, Item ALSEP-15
46	14	C/S	Systematic Spurious CVW's	16 Feb 71	Apollo 12 P & D List, 26 Mar 70, Item ALSEP-3
47	14	PSE	Long Period Vertical Feedback Filter Not Operating	2 Mar 71	Apollo 14 Mission Report, May 71, Section 14.4.6
48	14	ASE	Geophone 3 Data Noisy	26 Mar 71	Apollo 14 P & D List, 15 Jul 71, Item ALSEP-18 Apollo 14 Mission Anomaly Report No. 6, Dec 72

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
49	14	SIDE/ CCIG	Analog to Digital Converter Positive Section Data Loss	5 Apr 71	Apollo 14 Mission Report, May 71, Section 14.4.8
50	14	CPLEE	Analyzer B Data Loss	8 Apr 71	Apollo 14 Mission Report, May 71, Section 14.4.9
51	14	CPLEE	Analyzer A Data Decay and Undervoltage Condition	6 Jun 71	Apollo 14 P & D List, 15 Jul 71, Item ALSEP-21
52	15	C/S	Rear Curtain Retainer Removal Lanyard Broke	EVA (31 Jul 71)	Apollo 15 Mission Report, Dec 71, Section 14.4.2
53	15	SIDE/ CCIG	Experiment Connector was Difficult to Mate	EVA (31 Jul 71)	Apollo 15 P & D List, 13 Sep 71, Item ALSEP-17
54	15	C/S	Shorting Switch Actuated Early	EVA (31 Jul 71)	Apollo 15 P & D List, 8 Oct 71, Item ALSEP-18
55	15	SIDE/ CCIG	Intermittent Lock of UHT in Fitting of SIDE/CCIG Experiment	EVA (31 Jul 71)	Apollo 15 Mission Report, Dec 71, Section 14.4.3
56	15	*HFE*	*Subpallet Boyd Bolts Did Not Release Immediately*	EVA (31 Jul 71)	Apollo 15 P & D List, 13 Sep 71, Item ALSEP-13

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
57	15	PSE	LPZ Axis Leveling Difficulties	1 Aug 71	Apollo 15 SMEAR, SX-194
58	15	C/S	Systematic Spurious CVW's	5 Aug 71	Apollo 12 P & D List, 26 Mar 70, Item ALSEP-3
59	15	HFE	Probe 2 Reference Temperature Measurement Intermittent	7 Aug 71	Apollo 15 P & D List, 30 Nov 71, Item ALSEP-25
60	15	PSE	Thermal Control Degradation	13 Aug 71	Apollo 15 P & D List, 13 Sep 71, Item ALSEP-4
61	15	C/S	Loss of Science Data Due to Experiment Ripple Off	19 Aug 71	Apollo 15 SMEAR, ALSEP 16
62	15	LSM	Y-axis Sensor Head Failure to Flip On Command	30 Aug 71	Apollo 15 P & D List, 23 Feb 72, Item ALSEP-26
63	14	SIDE/ CCIG	Lunar Noon & Arcing Constraints	20 Oct 71	Apollo 14 SMEAR, ALSEP 58
64	15	LSM	Y-axis Sensor Data Loss	2 Nov 71	Apollo 15 P & D List, 14 Jan 72, Item ALSEP-27
65	12 15	SWS SWS	Intermittent Modulation Drop in Proton Energy Levels 13 and 14	5 Nov 71	Apollo 15 P & D List, 14 Jan 72, Item ALSEP-28

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
66	15	SIDE/ CCIG	Limited Operating Time During Lunar Noon (85°C Maximum)	16 Dec 71	Apollo 15 SMEAR, ALSEP 36
67	14	ASE	-60°C Minimum Operating Temperature	10 Feb 72	Apollo 14 SMEAR, ALSEP 67
68	15	C/S	Lunar Night Operating Temperature Limits	18 Feb 72	Apollo 15 SMEAR, ALSEP 40
69	14	PSE	LPZ Axis Inoperative	20 Mar 72	Apollo 14 SMEAR, ALSEP 72
70	16	Subpackage 2	Fell OFF Carry Bar	EVA (21 Apr 72)	Apollo 16 P & D List, 26 Jun 72, Item ALSEP-1
71	16	HFE	Electrical Cable Broke	EVA (21 Apr 72)	Apollo 16 Mission Report, Aug 72, Section 14.4.1
72	16	ASE	Number 3 Spike on Mortar Package Did Not Deploy	EVA (21 Apr 72)	Apollo 16 Mission Report, Aug 72, Section 14.4.2
73	16	ASE	Thumper Cables Stiff to Deploy	EVA (21 Apr 72)	Apollo 16 P & D List, 16 May 72, Item ALSEP-6

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
74	16	ASE	Mortar Box Roll Angle Telemetry Offscale HIGH	23 Apr 72	Apollo 16 Mission Report, Aug 72, Section 14.4.3
75	16	PSE	Temperature HIGH During Lunar Day	24 Apr 72	Apollo 16 P & D List, 16 May 72, Item ALSEP-11
76	16	ASE	Pitch Sensor Offscale HIGH After Launching 3rd Grenade	23 May 72	Apollo 16 Mission Report, Aug 72, Section 14.4.12
77	16	ASE	Mortar Package Pitched Down 9 Degrees as a Result of Launching Grenade 2	23 May 72	Apollo 16 P & D List, 13 Jun 72, Item ALSEP-17
78	12	LSM	Flip Cal Suspension	14 Jun 72	Apollo 12 SMEAR, ALSEP 76
79	12	SWS	AC Calibrate Measurements LOW (Sequence 15)	20 Jun 72	Apollo 12 SMEAR, ALSEP 77
80	16	C/S	Systematic Spurious CVW's	29 Jun 72	Apollo 12 P & D List, 26 Mar 70, Item ALSEP-3
81	15	SWS	Loss of Experiment, Science and Engineering	30 Jun 72	Apollo 15 SMEAR, ALSEP 42
82	16	LSM	Failure of all 3 Axes to Flip	24 Jul 72	Apollo 16 SMEAR, ALSEP 23
83	12	SIDE/ CCIG	Intermittent Failure of Digital Electronics to Process Data	9 Sep 72	Apollo 12 SMEAR, ALSEP 80

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
84	12	PSE	LPX Axis Leveling in Auto Mode Balky	4 Dec 72	Apollo 12 SMEAR, ALSEP 81
85	16	PSE	LPY Axis Leveling in Forced and Auto Mode Balky	4 Dec 72	Apollo 16 SMEAR, ALSEP 24
86	17	RTG	Cask Dome Removal was Difficult	EVA (12 Dec 72)	Apollo 17 Mission Report, Mar 73, Section 15.4.4
87	17	C/S	Downlink Signal Strength Fluctuations	EVA (12 Dec 72)	Apollo 17 P & D List, 12 Jan 73, Item SX-1
88	17	LSG	Sensor Beam Cannot be Stabilized in the Null Position	EVA (12 Dec 72)	Lunar Surface Equipment Status Report, *18 Sep 73*, Section 4/2 Apollo 17 Mission Report, Mar 73, Section 15.4.1
89	17	C/S	Power Dissipation Module HIGH Temperature	EVA (13 Dec 72)	ALSEP Status Report, 14 Dec 72
90	17	LEAM	Excessive Temperature	17 Dec 72	Lunar Surface Equipment Status Report, *18 Sep 73*, Section 4.4 Apollo 17 Mission Report, Mar 73, Section 15.4.3

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONTINUED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INIITAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
91	17	LACE	Excessive Temperature with Covers ON	17 Dec 72	Lunar Surface Equipment Status Report, *18 Sep 73*, Section 4.3
92	17	LACE	Zero Offset in Data Output of Mass Channels	18 Dec 72	Lunar Surface Equipment Status Report, *18 Sep 73*, Section 4.5 Apollo 17 Mission Report, Mar 73, Section 15.4.5
93	17	LACE	Mode Change - Sweep Lock	8 Jan 73	ALSEP Status Report, 9 Jan 73
94	16	LSM	Loss of Science Data	15 Feb 73	Apollo 16 SMEAR, ALSEP 25
95	16	C/S	Transmitter B and Processor Y Selected	26 Mar 73	ALSEP Status Report, 30 Mar 73
96	14	SIDE/ CCIG	Anomalous STANDBY Operations	*15 Apr 73*	Apollo 14 SMEAR, ALSEP *71*
97	17	LACE	Limited Operation During Lunar Day (125°F Maximum)	5 Jun 73	Lunar Surface Equipment Status Report, *18 Sep 73*, Section 4.3
98	*14*	*CCIG*	*Intermittent Night Time Science Data Since 2/19/72.*	*1 Jul 73*	*Lunar Surface Equipment Status Report, 18 Sep 73, Section 4.6*

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.1 CHRONOLOGICAL LISTING OF PROBLEMS
(CONCLUDED)

SEQUENCE NUMBER	APOLLO MISSION	EXPERIMENT OR SYSTEM	PROBLEM	INITIAL DATE OF OCCURRENCE	DISCUSSION REFERENCE
99	*15*	*CCIG*	*Intermittent Night Time Science Data Since 2/22/73.*	*1 Jul 73*	*Lunar Surface Equipment Status Report, 18 Sep 73, Section 4.7*

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.2 LUNAR SURFACE GRAVIMETER SENSOR BEAM

Problem Date	Problem
Initial: 12 December 1972 (1st lunar day)	Lunar Surface Gravimeter Experiment
Presence throughout lunar cycle	Lunar surface gravimeter sensor beam cannot be stabilized in the null position.
	Sensor beam could not be center balanced in normal configuration because 1/6-g weights were too light. Weights were too light because of an error in calculations converting from 1-g to 1/6-g requirements.

Remarks:

Cause: Following the initial experiment turn-on, the set-up procedure of nulling the sensor beam in the proper stable position between capacitor plates could not be accomplished.

When the command was given to add any or all of the nulling masses to the sensor beam assembly, the data indicated that the beam would not move away from the upper capacitor plate. The only way to bring the beam down was by caging it against the lower capacitor plate.

During the second and third extravehicular activities, the Lunar Module Pilot rapped the exposed top plate on the gimbal; rocked the experiment in all directions; releveled the instrument, working the base well against the surface; and verified the sunshade tilt. This was done in an attempt to free a mass/weight assembly or sensor beam thought to have been caught or bound. No apparent change or improvement was detected.

Review of sensor development test records revealed that an error in arithmetic resulted in the sensor mass weights being about 2 percent lighter than the proper nominal weight for 1/6-g operation of the flight unit. The sensor mechanism allows ground command adjustment of up to ± 1.5 percent from nominal to compensate for possible inaccuracies. Unfortunately, the 2 percent error in weight made in initial conversion calculations from 1-g to 1/6-g mass exceeded this for the qualification unit and was also passed on to the flight unit final calculations.

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.2 LUNAR SURFACE GRAVIMETER SENSOR BEAM
(CONTINUED)

Initial: 12 December 1972 (1st lunar day) — Lunar Surface Gravimeter Experiment

Activity: The 45-day real-time monitoring period for the LSG showed a lack of seismic signals which was unusual for a site going through the thermal excursions associated with a lunation, yet the seismic channel indicated a low seismic background noise which was consistent with what had been determined for other lunar locations by the PSE (Passive Seismic Experiment). The LSG free mode channel appeared to be providing usable data and the frequency response was as expected.

During the 6 April 1973 7-hour special test it was determined that the seismic channel had been operated in a saturated condition during the first 45 days and by reducing the post amplifier from gain step 15 to gain step 10, the instrument could be operated in seismic high gain mode without saturation of the data channel by instrument noise. Calibration of LSG was attempted by use of integrator and bias control commands. At the lower gain settings significant beam response was obtained that requires further analysis. The instrument was subsequently operated in the reconfigured condition in an attempt to detect seismic signals associated with the thermal effects of terminator crossing. Seismic events associated with thermal effects which occur during this period as had been previously detected by PSE and ASE (Active Seismic Experiment) at other lunar sites. Terminator crossing occurred on 8 April and repetitive seismic events, approximately 50% higher than noise, were detected by the LSG.

The second special test to exercise the flight LSG was held on 19 April 1973, to lower the beam resonant frequency to better detect lunar seismic signals known to have predominant frequencies in the 1 Hz region. Beam resonances for the operational configuration previously used were determined by calculations to be in the order of 30-40 Hz which was too high for useful monitoring of lunar seismic acitivity.

The method to lower frequency was to drive the coarse screw to its lower stop position thereby lessening tension on both the LaCoste spring and mass support spring. While driving the screw to its lower position data were taken to attempt to verify the beam resonant frequency. Data taken during the first

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.2 LUNAR SURFACE GRAVIMETER SENSOR BEAM
(CONTINUED)

Initial: 12 December 1972 (1st lunar day) Lunar Surface Gravimeter Experiment

Activity: half of the coarse screw drive implied instrument resonant frequencies were 20 - 40 Hz. Beam position was changed during the last half of the coarse screw drive to the all masses ON condition. This was done to observe if the beam would center freely and had not been attempted since the last astronaut EVA. The beam did not center. Ultimately, both coarse and fine screws were driven to the lower stop and the beam was centered using the mass change uncaging system. In this condition, the beam movement vs screw drive was significantly more sensitive. Employing the integration normal and bias commands an electrical calibration input excited the beam which oscillated at approximately 1.5 hertz which also gave an indication of increased sensitivity over all previous operations. The LSG was left in the beam centered condition to gather seismic data for the lunation of April 22 through lunar sunset. Seismic activity was noted on LSG with amplitudes approximately twice that previously noted, however repetitious seismic signals were not present and good calibration versus LSP (Lunar Seismic Profiling Experiment) was not obtained.

Consequently, comparative tests between the LSG and the LSP were accomplished during lunar sunrise on May 7. The LSG was operated thru terminator crossing to obtain the expected sequence of repetitive events and then the LSP listening mode was accomplished to obtain comparative data. Event correlation between instruments indicated that signal-to-noise detection capability of the LSP was approximately an order of magnitude better than that of the LSG. Accordingly, it seems unlikely the LSG would detect the low amplitude signals typically associated with small magnitude lunar events such as distant moonquakes and meteoroid impacts. A question still remains about the instrument's capability to detect gravity waves events. Real-time correlation will be performed on LSG data tapes to attempt to uncover this type of event.

A planned reconfiguration of the flight LSG is tentatively set for 26 September 1973, when 10 hours of real-time computer support have been scheduled. This third special test will be made to determine the absolute sensitivity of the LSG at its natural frequency of 1.5 Hz. During the test the instrument's closed loop (feedback) mode of operation will be employed in an effort to detect lunar tidal variation and improve the quality of the free modes data. It is understood that this third special test will complete the implementation of the flight LSG design modes of operation.

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.2 LUNAR SURFACE GRAVIMETER SENSOR BEAM
(CONCLUDED)

Initial: 12 December 1972 (1st lunar day) — Lunar Surface Gravimeter Experiment

Result: The beam has been centered by applying a load on the beam through the mass support springs by partial caging of the mass weight assembly. Signals being received are being processed and analyzed for seismic, free mode, and gravity wave information. Comparison with the LSP indicates the LSG is not adequate for detecting typical low level moonquake signals, although further processing of data needs to be done. Further analysis of data channels is also in process to determine if free mode oscillations and gravity waves are being detected. *No reconfiguration of the LSG has been attempted since 19 April 1973.*

APOLLO LUNAR SURFACE EQUIPMENT STATUS

4.3 LUNAR ATMOSPHERIC COMPOSITION EXPERIMENT EXCESSIVE TEMPERATURE

Problem Date

Initial: 17 December 1973
(1st lunar day)

Repeats each lunar day

Problem

Lunar Atmospheric Composition Experiment

Thermal control does not maintain operating temperature below qual test maximum level during the lunar day at the Apollo 17 site.

LACE is commanded OFF each lunar day until the temperature cools down again within limits.

Remarks:

Cause: Difference in thermal condition at the Apollo 17 site from design site (level plain at equator), and error in calculating thermal control configuration capability and effectivity.

Activity: Component part, used in both the emission control assembly and the sweep high voltage power supply, is thermally sensitive at 158°F. Component is a photo transistor (Monsanto part number MCT-1). Although temperature rating for the part is 185°F, the gain decreases with increasing temperature above 158°F. No further thermal analysis in progress.

Operational restrictions required for sensor outgassing contamination have required the instrument to be operated only at temperatures below 125°F. As expected, the contamination level (from analysis of the science data) in the sensor has been lower with each lunar day; and use of the instrument during the lunar day will be extended as low levels of sensor contamination are confirmed.

However, the ion source has a limited operational lifetime (from self-contamination). As a result, only spot operation at selected times are planned, rather than full-time continuous operation. Consequently, these selected short-time data-gathering periods may be accomplished during the lunar days, whereas the inadequate thermal control might prevent continuous operation through a complete lunar day.

Result: Operating the experiment during the selected times for the sensor operation may restrict operation within a temperature range acceptable for the sensitive component. It may be necessary to restrict operation within the selected time periods to temperatures below 158°F, or accept some degradation of the data.

APOLLO LUNAR SURFACE EQUIPMENT STATUS

4.4 LUNAR EJECTA AND METEORITE EXPERIMENT EXCESSIVE TEMPERATURE

Problem Date

Initial: 17 December 1973
(1st lunar day)

Repeats each lunar day

CLOSED

Problem

Lunar Ejecta and Meteorite Experiment

Thermal control does not maintain operating temperature below qual test maximum level during the lunar day at the Apollo 17 site.

LEAM is commanded OFF each lunar day until the temperature cools down again within limits.

Remarks:

Cause: Difference in thermal conditions at the Apollo 17 site from design site (level plain at equator), and error in calculating thermal control configuration capability and effectivity.

Activity: Components are rated higher (200° - 212°F) than maximum qual test temperature (167°F). Have been increasing allowable maximum temperature of operations in controlled increments with each lunar day per *Apollo 17 SMEAR, ALSEP 49 R-2.* No further thermal analysis in progress.

Result: Experiment monitored the Apollo 17 lunar site for lunar ejecta and meteorite activity for 59.2% of the lunar cycle on day 2, 67.4% of the time on day 7, *71.0% of the time on day 8 and 9 and it is estimated to monitor about 80 - 85% of the time on day 11, based on thermal profiles observed so far. This anomaly is considered closed.*

APOLLO LUNAR SURFACE EQUIPMENT STATUS

4.5 LUNAR ATMOSPHERIC COMPOSITION EXPERIMENT ZERO OFFSET

Problem Date

Initial: 18 December 1972
(1st lunar day)

Presence throughout lunar cycle

CLOSED

Problem

Lunar Atmospheric Composition Experiment

A zero offset is noted in part of the LACE data on each of the mass channels. The condition has caused no loss of data, but requires additional processing during data reduction.

Remarks:

Cause: As the result of analysis of the data from some periods of trouble-shooting with selected command sequences the presence of the offset noise originally appeared to be the result of cross-coupling of the high voltage wires to the unshielded collectors in the sensor package. The characteristics appeared to be similar to some preflight bench test experience. This no longer appears to be the source of the background offset noise.

Subsequent data from the flight instrument indicates some relationship to whether the ion source is on or off, and perhaps also to the temperature of the ion source. However, the cause of the background offset noise is not yet known.

Activity: Laboratory testing with the prototype and qualification models have failed to duplicate the data characteristics. No further ground tests are planned.

Result: The data are usable with additional processing during data reduction. *This anomaly is considered closed.*

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.6 APOLLO 14 ALSEP COLD CATHODE ION GAUGE EXPERIMENT INTERMITTENT SCIENCE DATA

Problem Date	Problem
Initial: 19 February 1972 (13th lunar night)	Cold Cathode Ion Gauge Experiment
Repeats each lunar night	Intermittent night time science data since 19 February 1972. Initially reported in the Investigator's 1 July 1973 monthly progress report.

CLOSED

Remarks:

Cause: The Cold Cathode Ion Gauge Experiment (CCIG) is no longer able to continually measure the Moon's low atmospheric pressure during lunar night. This inability to continuously measure low pressure amounts to effective loss of sensitivity of the instrument's lowest measurement range.

Activity: This intermittent loss of night time science data as noted in the Investigator's progress report was first encountered during lunar night operations of the CCIG on 19 February 1972. Analyzed experiment data indicates that this problem occurred intermittently throughout lunar night operations until late November 1972 at which time all night time data were lost. This total loss of lunar night science data lasted until 10 May 1973. Since May 1973 the instrument's data continues to be intermittent. Analysis of the data indicates the most probable cause is some combination of the following two items:

a. Low atmospheric pressure during lunar night operation.

b. Drifting of the CCIG electrometer amplifier gain, possibly attributable to component aging.

Processed range data tapes have currently been analyzed through 14 June 1973, with the instrument's science data continuing to be intermittent.

Results: Scientific data are useable when obtained. Currently no plans are anticipated for continued investigation of the above lunar night time problem. This anomaly is considered closed.

APOLLO LUNAR SURFACE EQUIPMENT STATUS
4.7 APOLLO 15 ALSEP COLD CATHODE ION GAUGE EXPERIMENT NOISY DATA AND INTERMITTENT AUTOMATIC ZERO AND CALIBRATION FUNCTIONS

Problem Date	Problem
Initial: 22 February 1973 (20th lunar night) Repeats each lunar night	Cold Cathode Ion Gauge Experiment Erratic night time science data since 22 February 1973, consisting of an increase in data noise and loss of the automatic zero and calibration functions. Initially reported in the Investigator's 1 July 1973 monthly progress report.

CLOSED

Remarks:

Cause: Initial examination of the CCIG (Cold Cathode Ion Gauge Experiment) circuits indicates that the erratic performance can be the result of a degraded electronics component.

Activity: The Investigator noted in the CCIG progress report that this problem has persisted during night operations from 22 February 1973 through 14 June 1973 with only occasional periods of proper operations. Scientific range data tapes have not been received and processed past 14 June 1973. Cursory analysis indicates that the most probable source is associated with one of the instrument's 15 relays. These reed relays perform functions that control the gauge's calibration currents, ranging and gain change functions, and grounding the instrument during calibration.

Results: Currently no plans exist for continued investigation of this anomaly, as the scientific data are useable when obtained. This anomaly is considered closed.

APOLLO LUNAR SURFACE EQUIPMENT STATUS
APPENDIX A - LOSS OF ALSEP DOWNLINK DATA HISTORY

A.1 INTRODUCTION

Prior to 15 April 1973, the participating Spaceflight Tracking and Data Network ground stations receive/record equipment capability was restricted to receiving and recording of up to four ALSEP downlink data streams simultaneously. This limitation was resolved by the acquisition and implementation of additional receive/record equipments, enabling the primary supporting stations (those with 30-foot antennas) to receive and record up to six downlink data streams simultaneously. In addition, to assure uninterrupted ALSEP receive/record coverage during Skylab missions supplemental support stations were utilized.

A.2 ALSEP DATA LOSS HISTORY

Spaceflight Tracking and Data Network ground station coverage for receiving and recording of the ALSEP downlink data stream was not available at the following times due to either programmatic or equipment constraints.

APOLLO LUNAR SURFACE EQUIPMENT STATUS
A.2 ALSEP DATA LOSS HISTORY
(continued)

DATE	GROUND STATION	TIME (G.m.t.)	ALSEP SYSTEM	DATA TIME LOSS
1973				
12 Feb	GWM	LOS 12/1513	15-16-17	18^{m}
	ACN	AOS 12/1531		
25 Feb	GWM	LOS 25/0139	12	21^{m}
	CYI	AOS 25/0200		
25 Feb	GWM	LOS 25/0100	14	$1^{h}00^{m}$
	CYI	AOS 25/0200		
26 Feb	GWM	LOS 26/0228	12	22^{m}
	CYI	AOS 26/0250		
28 Feb	HAW	LOS 28/0006	12	$04^{h}21^{m}$
	CYI	AOS 28/0427		
02 Mar	MAD	LOS 02/0951	12	31^{m}
	MIL	AOS 02/1021		
03 Mar	ACN	LOS 03/0918	16	$01^{h}04^{m}$
	ACN	AOS 03/1022		
04 Mar	HSK	LOS 04/0642	12	17^{m}
	CYI	AOS 04/0659		
04 Mar	ACN	LOS 04/0926	15	19^{m}
	CYI	AOS 04/0945		
05 Mar	CYI	LOS 05/0942	12	$02^{h}12^{m}$
	MIL	AOS 05/1154		
06 Mar	CYI	LOS 06/0955	12	$02^{h}32^{m}$
	MIL	AOS 06/1227		
07 Mar	CRO	LOS 07/1203	12	25^{m}
	CYI	AOS 07/1228		
09 Mar	ACN	LOS 09/1500	12	50^{m}
	ACN	AOS 09/1550		

APOLLO LUNAR SURFACE EQUIPMENT STATUS
A.2 ALSEP DATA LOSS HISTORY
(continued)

DATE	GROUND STATION	TIME (G.m.t.)	ALSEP SYSTEM	DATA TIME LOSS
1973				
14 Mar	HSK ACN	LOS 14/1315 AOS 14/1350	12	35^{m}
24 May	ORR TAN	LOS 24/2105 AOS 24/2125	14-17	20^{m}
27 May	TAN ACN	LOS 27/0718 AOS 27/0730	12-14-15-16-17	12^{m}
30 May	CRO TAN	LOS 30/0721 AOS 30/0755	12-14-15-16-17	34^{m}
11 Jun	BUR ACN	LOS 11/1455 AOS 11/1547	12	52^{m}
12 Jun	GWM TAN	LOS 12/1115 AOS 12/1207	12	52^{m}
14 Jun	MAD MAD	LOS 14/2228 AOS 14/2250	14	22^{m}
15 Jun	VAN VAN	LOS 15/0720 AOS 15/0856	14	$1^{h}36^{m}$
19 Jun	VAN VAN	LOS 19/0930 AOS 19/1054	12	$1^{h}24^{m}$
20 Jun	VAN VAN	LOS 20/0712 AOS 20/1000	12	$2^{h}48^{m}$
02 Jul	ORR GWM	LOS 02/0435 AOS 02/0730	12	$2^{h}55^{m}$
08 Jul	TEX ORR	LOS 08/0336 AOS 08/0530	12	$1^{h}54^{m}$

APPENDIX B - ABBREVIATIONS AND ACRONYMS

ACN	*Ascension Island, United Kingdom (30')*
A/D	Analog-to-Digital
AGO	*Santiago, Chile (40')*
ALSEP	Apollo Lunar Surface Experiments Package
ANG	*Antigua, United Kingdom (30')*
AOS	*Acquisition of Signal*
ASE	Active Seismic Experiment
BDA	*Bermuda, United Kingdom (30')*
BUR	*Johannesburg, South Africa (40')*
CCIG	Cold Cathode Ion Gauge
CMD	Octal Command Number
CPLEE	Charged Particle Lunar Environment Experiment
CRO	*Carnarvon, Australia (30')*
C/S	Central Station
CVW	Command Verification Word
CYI	*Canary Islands, Spain (30')*
EVA	Extravehicular Activity
GBM	*Grand Bahamas, United Kingdom (30')*
GDS	*Goldstone, California, U.S.A. (85')*
GWM	*Guam, U.S.A. (30')*
GYM	*Guaymas, Mexico (30')*
HAW	*Kokee Park, Hawaii, U.S.A. (30')*
HBR	High Bit Rate
HFE	Heat Flow Experiment
HSK	*Honeysuckle Creek, Australia (85')*
LACE	Lunar Atmospheric Composition Experiment
LEAM	Lunar Ejecta and Meteorite Experiment
LM	Lunar Module
LOS	*Loss of Signal*
LP	Long Period (PSE sensors)
LSG	Lunar Surface Gravimeter
LSM	Lunar Surface Magnetometer
LSPE	Lunar Seismic Profiling Experiment
MAD	*Madrid, Spain (85')*
MIL	*Merritt Island, Florida, U.S.A. (30')*
ORR	*Orroral Valley, Australia (85')*

APPENDIX B - ABBREVIATIONS AND ACRONYMS (concluded)

P & D	Problem and Discrepancy List
PI	Principal Investigator
PSE	Passive Seismic Experiment
QUI	*Quito, Ecquador (40')*
ROS	*Rosman, North Carolina, U.S.A. (85')*
RTG	Radioisotope Thermoelectric Generator
SIDE	Suprathermal Ion Detector Experiment
SMEAR	Span/Mission Evaluation Action Request
SP	Short Period (PSE sensor)
SWS	Solar Wind Spectrometer
TAN	*Tannanarive, Malagasy Republic (40')*
TEX	*Corpus Christi, Texas, U.S.A. (30')*
TM	Telemetry
UHT	Universal Handling Tool
ULA	*Fairbanks, Alaska, U.S.A. (85' & 40')*
VAN	*Vanguard, Tracking Ship, U.S.A. (30')*
XMTR	Transmitter

APOLLO PROGRAM-LUNAR SURFACE EQUIPMENT STATUS

AC/G. Abbey
TA/T. Calio
TN/L. Haskin
TN3/W. Eichelman (6)
TN3/R. Baldwin
TN3/J. Bates
PA/G. Lunney
WA/D. Arabian
WA2/J. Lobb
WA2/R. Blount
WT4/J. Dodson
EA/M. Faget
EA3/R. Gardiner
EA3/D. Gerke
ED1/V. Melliff
ED1/J. Lowery
NB5/E. Smith
PHO F222/E. Carr
C30/C. E. Hutchinson
FS/J. Stokes
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