



**Aerospace  
Systems Division**

Noisy SIDE Data Investigation,  
ALSEP 4

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ATM-991	
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This ATM provides the results of an investigation of the Noisy SIDE Data anomaly which occurred during the ALSEP 4 Lunar Mission.

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## 1.0 INTRODUCTION

During ALSEP 4 experiments turn on, transmission of SIDE/CCGE Operate Select Command caused noisy or incoherent data in the SIDE, PSE and CPLEE data. ALSEP word 33 containing the Central Station and experiment housekeeping values, remained normal. After SIDE/CCGE was commanded to the Standby Mode, the experiment data printouts returned to normal. Next, with CPLEE in the Power Standby Mode, the SIDE/CCGE Power Turn On was repeated again with the same results as above; that is, the PSE analog data was erratic while the housekeeping printout remained normal.

Subsequently, after alternate Transmitter and Data Processor switching, the PSE was commanded to the Standby Mode and SIDE/CCGE was commanded on again. The SIDE/CCGE experiment data remained noisy until the SIDE Load 7 Command was transmitted. Upon execution of this command, normal experiment data was received and evaluation of this data revealed the SIDE dust cover blown, and the CCGE dust seal removed.

Subsequent operation of ALSEP was normal, with the experiments either in Power On or Power Standby Mode and after repeated power switching of the experiments.

## 2.0 POTENTIAL CAUSES OF THE ANOMALY

The following causes for the anomaly have been suggested and evaluated:

- I. ALSEP System Related Causes
  - a. Intermittent breaking and mating of SIDE ASTRO Connector
  - b. EMI in the SIDE cable due to crossing of the RTG cable
  - c. Transients in experiment power lines due to SIDE/CCGE arcing
  - d. Noise susceptibility due to SIDE/CCGE arcing
  - e. Extraneous commands to ALSEP.



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## II. MSFN Software Related Causes

- a. Site-to-MSD Transmission Link problems
- b. Computer program problems.

### 3.0 EVALUATION OF CAUSES

Evaluation of the anomaly history as described in Section 1.0 tends to eliminate causes I(a) and I(b) as possibilities, since the downlink became normal after transmission of the Load 7 Command to SIDE and without other changes to ALSEP.

Evaluation of ALSEP Word 5 (CV) during the anomaly period does not contain any extraneous commands to ALSEP. When this is coupled to the fact that the problem disappeared after execution of SIDE Load 7 Command, cause I(e) can be discarded.

Software related causes of the anomaly can also be eliminated for the reasons discussed above: that the problem cleared itself without recourse to a software re-configuration or a change in the method of Link Transmission. In addition, evaluation of data obtained from replaying MSFN Site magnetic tapes indicates correlation with the real time data and thus further eliminates the Ground Link Transmission System as a potential cause.

The most probable cause for the anomaly was arcing or noisy output in the SIDE/CCGE prior to the dust cover removals. This type of arcing has been previously observed during Thermal/Vacuum Tests, with the usual result that synchronization of the SIDE/CCGE experiment data could not be maintained. In the present anomaly, however, PSE and CPLEE data were also reported as improper and erratic. This provided a different experience from what has been previously observed with SIDE/CCGE arcing and created doubt as to whether SIDE/CCGE arcing caused the problem.



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The ALSEP FRAME DELOG for the period 036/19:01:59 to 036/19:06:57 GMT has been extensively evaluated. In addition, a Strip Chart recording of the 64 ALSEP Words obtained from replay of SITE data for portions of this period has been briefly investigated. The SIDE/CCGE was in the ON mode from 036/19:02:00 to 036/19:07:20 GMT. The following observations resulted from analysis of this data:

- a. ALSEP Words 1 thru 3 (control words), Word 5 (CV) and Word 33 (the housekeeping channels) remained normal during the anomaly.
- b. The SIDE data during the anomaly showed that SIDE remained in the 0 SIDE Frame and did not sequence through the 0-127 frames that is normal after turn-on. An explanation of this is not readily apparent.
- c. PSE words representing Long Period Seismic, Tidal and Temperature data were clearly distinguishable in the FRAME DELOG. Prior to SIDE turn on, these words appeared in the proper locations and were stable values over long time periods. After SIDE turn on, the locations of these words shifted erratically in the ALSEP frame; the relative position of Long Period Seismic Data occurred at alternate word intervals except that they were shifted one or two words from the proper location in the ALSEP frame. The effect of this resulted in the erratic response indicated on the analog strip chart in MCC. After SIDE was returned to STANDBY, the PSE data returned to normal.

This shifting of data words within the PSE data format was probably caused by noise in power and/or signal timing lines which in turn advanced the PSE Data Multiplexer erratically. The origin of the noise is presumed to be the arcing within the SIDE Experiment.

- d. It was reported that CPLEE data was also erratic during the initial periods in which SIDE was operating. An evaluation of the FRAME DELOG of the CPLEE words for a complete CPLEE cycle (32 frames), however, showed that CPLEE was operating normally, with the CPLEE deflection voltages sequencing normally, the -0V CAL Detector levels having the right counts of about 390,000 and all other detectors having low counts. From the results of this manual data reduction, it appears that the computer should have printed out the proper CPLEE data.



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#### 4.0 CONCLUSION

From the above described evaluations of the limited data available, it appears that prior to the Dust Seal removal, the SIDE/CCGE was arcing, causing faulty operation of the SIDE/CCGE Experiment and generating noise. The generated noise in turn effected proper operation of the PSE Electronics Multiplexer by shifting or intermixing the various PSE Short Period, Long Period and Tidal data.