Bendix

Aerospace Systems Division

Gross Hazard Analysis Report, LEAM	NO. ATM 1016	REV. NO.
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	DATE 11 June 1971	

This ATM documents the Gross Hazard Analysis of the LEAM experiment.

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1.0 INTRODUCTION

This report presents the results of a Gross Hazard Analysis conducted to evaluate the Lunar Ejecta and Micrometeoroid Experiment (LEAM) for potential hazards.

This report also includes subsystem evaluation for LEAM. Of primary significance are items in Figure 1.1.

2.0 Subsystem Description

The Lunar Ejecta and Meteorite Experiment consists of a set of three particle sensors and their associated electronics. Two of the sensors have front and rear assemblies while the third has only a rear film assembly. The film assenblies consist of film strips and grid strips.

A cosmic dust particle impact upon one of the films causes the metal to be ionized. This record allows isolation of the one square inch area in which the impact occurred.

Signals from each collector and film strip in both the front and rear assemblies are threshold detected. When a signal exceeds the threshold, this fact is recorded in a storage register location for that respective film or collector grid strip. The signal amplitude is measured and recorded. The time interval between impacts on the front and rear films is measured and recorded in the storage register.

The particle impact on the rear film assembly is also detected by a crystal microphone attached to the center of the assembly. The amplitude of the microphone signal, considered proportional to particle momentum, is analyzed and stored in the register.

A second noise microphone is mechanically isolated from the active microphone in one segment of the film-grid matrix of the rear film assembly of the single film sensor. Detectable signals from impacts or noise are accumulated in the storage register.

3.0 DISCUSSION

The design of the LEAM was analyzed to ensure that abrasive surface and sharp edges, corners, and protuberances are avoided. Temperatures on the external surface are nominally local ambient and are not hazardous to personnel. There are no flammable or combustible materials used in the experiment.

3.1 Figure 1.1 Hazard Analysis Sheet Array E

This figure depicts the typical format used in the LEAM Hazard Analysis. All hazard potential items were researched and noted in the current design. The Analysis identified the two safety items referenced "System Safety Record Sheets".

3.2 Figure 1.2 LEAM Functional Schematic

A functional Block Diagram of the electronics in the LEAM experiment was used to determine whether hazardous voltages exist in the experiment and whether functions are performed by central logic that can cause hazardous events.

3.3 Figure 1.3 LEAM Life Cycle

This chart depicts the typical flow of LEAM interface from Subcontractor BxA on through to Lunar Deployment. The flow was used to determine whether at any of the blocks referenced, a hazard could exist. Hazardous events that could occur are limited to the Spring or Leg Assembly inadvertently being released. This analysis is referenced in Safety Record Sheet.

4.0 CONCLUSION

There are no significant potential hazards in the LEAM Experiment.

HAZARD ANALYSIS SHEET

ALSEP ARRAY E

SYSTEM LEAM BY M. Calares

DETAIL/ASSEMBLY/OPERATION DATE 6-11-71

HAZARD \ PHASE	MANUF & TEST	FIELD TEST	KSC	LAUNCH & LANDING	LUNAR SURFACE	REMARKS
ACCELERATION	No	No	No	No	No	
CHEMICAL	No	No	No	No	No	
CONTAMINATION	No	No	No	No	No	
CORROSION	No	No	No	No	No	
DEBRIS	No	No	No	No	No	
ELECTRICAL-INADVERTENT ACTIVATION	No	No	No	No	No	
ELECTRICAL-POWER SOURCE FAILURE	No	No	No	No	No	
ELECTRICAL SHOCK	No	No	No	No	No	
ENDURANCE LIMIT EXCEEDED	No	No	No	No	No	
ENVIRONMENTAL STRESS	No	No	No	No	No	
EQUIPMENT FAILURE	No	No	No	No	No	
EXPLOSION	No	No	No	No	No	
FIRE	No	No	No	No	No	
FRAGMENTATION	No	No	No	No	No	
HEAT & TEMPERATURE	No	No	No	No	No	
IMPACT	No	No	No	No	No	
LEAKAGE	No	No	No	No	No	
MOISTURE	No	No	No	No	No	
OXIDATION	No	No	No	No	No	
PERSONNEL ERROR	No	No	No	No	No	
PERSONNEL ILLNESS	No	No	No	No	No	
PRESSURE	No	No	No	No	No	
RADIATION	No	No	No	No	No	
SHOCK	No	No	No	No	No	
EXPLOSIVE DEVICES	Yes	Yes	Yes	No	No	See Reefing Line Cutter
STRESS CONCENTRATIONS	Yes	Yes	Yes	No	No	-See Spring & Leg Assy. Safety Sheet
STRUCTURAL FAILURE	No	No	No	No	No	
TOXICITY	No	No	No	No	No	
VIBRATION AND NOISE	No	No	No	No	No	
WEATHER	No	No	No	No	No	

Bendix Aerospace Systems Division

SYSTEM SAFETY RECORD SHEET

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Program ALSEP ARRAY E
System LEAM
Phase G, H, A,

SUBSYSTEM/TASK	SAFETY CONSIDERATION	HAZARD POTENTIAL	TECHNICAL APPROACH OR SOLUTION	CONTROL POINTS
Reefing Line Cutter Assy. Atlas Chemical Ind. P/N ISE 166 Formulation: Lead Aside 100% Net Explosive Weight - 25 mg. Max. No Fire 0.10 Current Watts - 5 min. time Min. All Fire Current 0.55 amps. Resistance 4.5 ± .5 ohms	Inadvertent Firing of Cutter	Negligible	1. Design of the component provides for complete self-containment of evolved gases and cutter. 2. Premature release of dust covers would not compromise astronaut safety or experiment performance.	1. Specification Control Drawing 2346220 2. ARD-463-Rev. D
Spring & Leg Assy.	Leg Assy. may inadvertently spring open on ground personnel or astronaut.	Negligible	Spring forces too low to cause injury or damage.	Dwg. 2347796

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LEAM Functional Schematic

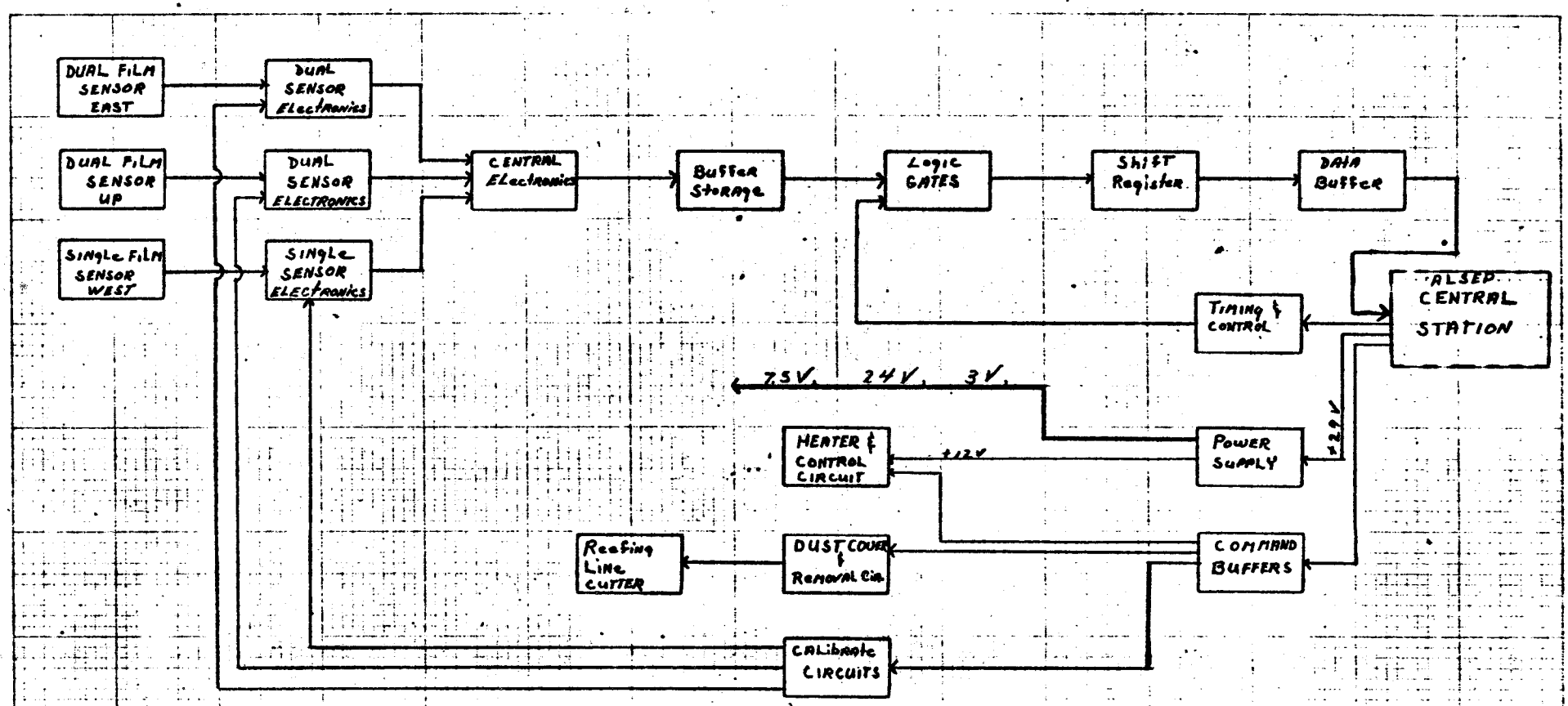

Figure 1.2

LEAM Life Cycle

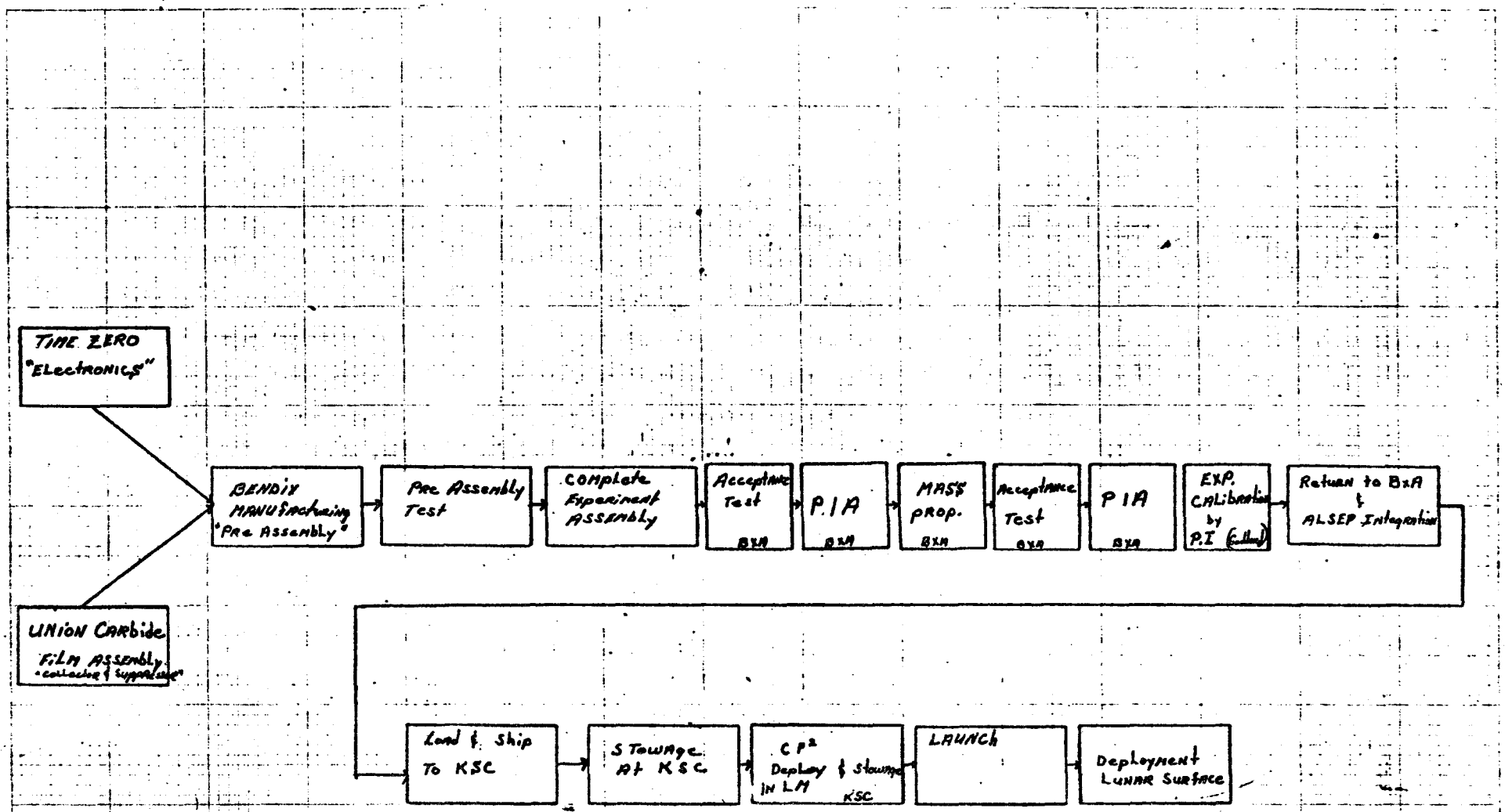

Figure 1.3