Data Bank
ALSEP papers
#7

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

IN REPLY REFER TO: EX23/L141

SEP 29 1966

TO : See list attached

FROM : Manager, Lunar Surface Program Office

SUBJECT: ALSEP Interface Meeting

Enclosed is a copy of the minutes and presentation material of the September 15, 1966, "Interface Meeting on Apollo Lunar Surface Experiments Program" for your review and retention.

John W. Small

Enclosure

Addressees:
NASA Hqs, L. Reiffel, MA
NASA Hqs, W. O'Bryant, SL
NASA Hqs, E. Davin, SL
NASA Hqs, R. Green, SL
NASA Hqs, A. Schwarzkopf
NASA Hqs, V. Wilmarth
KSC/W. Durrett
BN7/Z. Eubanks
R. Longmire
BG721/D. Cherry
J. Goldstein
CB/H.H. Schmitt
EB2/B. Hood
EB4/J. Overton
EC5/E. LaFevers
ED14/F. Griffin
ED5/G. H. Leach
EE2/W. Zrubek
R. Armstrong
EF/D. Evans
T. Foss
P. Lafferty
C. Warren
J. Modisette
W. Le Croix
R. Manka
W. Womack
J. Dragg
EP4/E. Weeks
EP5/J. Grayson
ES3/R Harris
EX/R. O. Piland
R. E. Vale
E. Smith
EX12/P. Penrod
EX14/R. R. Clemence
EX2/J. Small
J. Church
EX3/F. Pearce
EX22/R. Moke
R. McComb
J. Sanders
C. McClenney
J. Langford
A. Carraway
EX23/D. Wiseman
R. Irwin
G. Kenney
P. Gerke
H. Greider
J. Lowery

EX4/W. Stephenson
E. Zeitler
FC/R. Martin
C. Beers
C. E. Whitsett
J. M. Sulester
J. J. Fears
P. M. Joyce
D. B. Pendley
M. A. Lowe
PD2/E. B. Hamblett
PS6/W. Lee
ZS5/W. Remini
EX2/P. Maloney

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MANNED SPACECRAFT CENTER

INTERFACE MEETING ON APOLLO LUNAR SURFACE EXPERIMENTS PROGRAM

September 15, 1966

The fifth Apollo Lunar Surface Experiments Interface Meeting was held at the Manned Spacecraft Center, Houston, Texas, on September 15, 1966. The 80 attendees to the meeting are listed on Enclosure 1. The agenda for the meeting is included as Enclosure 2.

1. Introduction: Robert O. Piland - In the introductory remarks, Mr. Piland expressed the desire that the PI's for the lunar surface experiments endeavor to assume a more active role in the Gemini and other current NASA scientific experiment efforts because of the personal benefits they would derive from such participation in preparing for the lunar surface Apollo mission experiment. Mr. Piland presented a summary of the Gemini 11 scientific experiments and results.

2. Program Status and Plans: John W. Small - Mr. Small discussed the overall ALSEP schedule and presented a milestones chart (Enclosure 4). Several of Mr. Small's specific comments regarding this chart follow.

a. The apparent negative learning curve indicated by the times required to produce ALSEP Flight Systems 1, 2, and 3 is not in fact a negative learning curve--the schedule merely reflects the fact that major components of Flight Systems 2 and 3 are produced at the same time as System 1, but assembled later in time.

b. Difficulties encountered in integration of the RTG fuel cask resulted in a delay of approximately one month until the environmental ICD's could be defined and approved. Concentrated effort is continuing to complete these.

c. The central station ICD's are generally on schedule although some effort is required concerning the LGE tool and drill carriers.

d. Vibration data from the LTA-3 testing at GAEC is currently being reviewed. No conclusions are available at this time, but it is significant to note that nothing shook apart during the test.

Because of interest of several people in the LTA-3 test results, action items M60915-10 , M60915-11B, and M60915-12M were created to disseminate this information to the interested parties.

In response to a question from Dr. Latham, J. Clayton stated that it was anticipated that the LTA-3 and LTA-8 test results would confirm rather than change the ALSEP design.

3. Bendix Status: James A. Burns - (Charts referred to by J. Burns during his presentation are included as enclosure 5.)

In discussing the integrated testing to be conducted at Bendix, the underlying philosophy is to add system components one at a time to test interaction. The same pertains to the experiments integration testing as well as the central station testing.

Answering a question from Dr. Freeman, J. Burns stated that the Data Subsystem Test Set would stimulate the ALSEP during the category 1, 2, and 3 tests, and that these tests would verify the electrical interfaces only. Category 4 tests will utilize the Experiment Test Sets for the first time.

D. Moke questioned the logic of showing the Test Procedures availability date the same as the start test date. This was answered by stating that the dates reflected availibility of the last procedure and start of the first test.

J. Burns showed several pictures concerning suited subject deployment of a thermal blanket and the Lunar Surface Magnetometer (LSM) Experiment. Results of the tests indicated desirability of the blanket to be self-deploying and a time of 8-10 minutes required for deploying the LSM.

J. Burns discussed pictures of brassboard hardware and testing concerning the command decoder using the Fairchild logic circuits, data processor (which operated satisfactorily the first attempt), the multiplexer encoder, the three units preceeding interconnected with the command simulator for testing the data subsystem (during the coming week the data subsystem test set will be used with these items), the RF diplexer switch, the RF transmitter, and the command receiver now in integrated RF testing). Late next week, it is intended to integrate the RF components with the data subsystem for testing.

In response to a question from R. Piland on ICD status, J. Dye (Bendix) stated that Bendix was confident of having, within the next few weeks, approved working ICD's complete to the final level of detail.

4. Test Program Status: D. Wiseman - (Charts referred to by D. Wiseman during his presentation are included in enclosure 6.)

D. Wiseman presented the recently compiled listing of test measurement requirements from the ALSEP experiments. The findings and conclusions are shown in enclosure 6. Dr. Langseth explained the apparently high number of measurements on the Heat Flow Experiment on the basis of the number of parameters and number of measurements per parameter on his experiment.

D. Wiseman stated that the data would be reviewed and a decision made on new facility requirements as shown in the attachment. Mr. Wiseman stated that he hoped all required information was in hand to make the required decisions, but all PI's would be contacted should it become necessary to compromise their requirements. Mr. Piland emphasized that MSC and Bendix would continue to work with the PI's to define a test program which will be satisfactory.

Mr. Wiseman told H. Cross that the omission of the dataphone required for the LSM was an oversight by NASA and did not indicate that the requirement had been deleted.

B. Remini was told that acceptance testing of the RTG at Capė Kennedy would be discussed in the September 16 meeting at GAEC.

5. The Lunar Geological Experiment (LGE): Dr. E. M. Shoemaker - The Lunar Geological Investigator has the following Co-investigators: Aaron Waters, University of California, Santa Barbara; Hoover Macken, University of Texas; Ed Goddard, University of Micigan; Jack Schmitt, NASA/MSC. Recently, the following were added: Ted Foss, NASA/MSC; Melvin Calvin (bioscience); and John McGonigle, USGS, (geological tools).

Dr. Shoemaker stated the Lunar Geological Investigators to consist essentially of first correlating lunar surface observations of the astronaut with early photographic observations (orbital and surface landing such as Surveyor whose TV system is comparable with an astronaut's eye both in position and acuity) and then obtaining and then obtaining and appropriately identifying a number of lunar specimen for return to Earth.

Dr. Shoemaker presented a number of pictures showing U. S. Geological Survey developed tools taken during field investigations of the tools. These efforts led to the definition of the LGE tools. Such tools now in final design inhouse at MSC were discussed individually. Developmental models of the tools prepared for 1/6 g simulation tests in the KC-135 aircraft were displayed.

A motion picture of the KC-135 tests was shown. The test suited subject was Jack Slight. Results from the tests indicate that the geological tools with 60 pounds of rock samples are easily carried in the 1/6 g environment. In the pressurized suit, the relaxed position of the astronaut's arm carrying the tool carrier is extended almost outright.

Several comments provided as a result of a brief question and answer session follows:

a. Retaining clips on the tool carrier will be designed for removal of tools by one hand.

b. The tools will be available for use by the astronaut when deploying ALSEP if required.

c. Most LGE photographs will be with black and white film. It is hoped that several hundred stereo pairs (photographs) can be taken on the lunar surface.

d. The camera will be abandoned on the lunar surface.

e. The location of obtained samples will be determined by the hand-held surveying instrument. The accuracy by this means is the absolute minimum acceptable for the LG Investigators. Primary method of recording this data will be tape recording of the astronaut's voice in the MCC-H with backup recording in the LM.

f. It is hoped to be able to return up to 50 but at least 40# of samples.

6. Apollo Lunar Surface Scientific Simulation Program: Dr. T. H. Foss - Dr. Foss stated that he had received simulation requirements from all PI's and that he will provide copies of simulation test plans to the PI's as soon as they are available.

Recent activities have included tests on tools (reference previously mentioned film), thermal tests which indicated a problem for suited subject to hold objects at temperatures greater than 250° for extended periods, tests of the LM ladder which showed this ladder may be useful in removing the ALSEP with the scientific equipment compartments elevated, and evaluation of the LM forward platform used as an observation deck on the lunar surface - it was found not advisable to use it for this purpose without a tether and none is available. Conclusions from tests of instrument leveling devices indicate the desirability of standardizing on one type of leveling device.

During the coming period activities will include: complete suit subject indoctrination and training, investigation of torquing capability wearing the thermal glove, support to the Bendix Category 3 and 4 tests, and investigation of the metabolic rate requirements for geological tasks in a 1/6 g environment.

Dr. Foss stated that they have not yet attempted to determine the metabolic rate requirements during ALSEP deployment.

Mr. E. LaFevers stated that the heat removal capability of the Apollo suit is high compared to that of the Gemini. Dr. Foss stressed that removing heat from the suit is not the only problem associated with metabolic requirements.

7. <u>Presentations by PI's (other than Dr. Shoemaker)</u>

a. Suprathermal Ion Detector Experiment (SIDE): Presentation by Wayne Smith.

The following activities or significant details were reported:

(1) An EMI signature test is currently being conducted on the Experiment Test Set.

(2) The electronic circuitry is 70% fabricated

(3) Of 100 modules for the Engineering Model 3 are complete.

(4) Marshall Labs now is on an extended work week and has 52 people working on the SIDE in hopes of making up their schedule slippage.

(5) Documentation is on schedule.

(6) Several activities related to data processing were completed. This will be further discussed with MSC.

(7) The Experiment Test Set is being data phone checked between Marshall Labs and Rice University.

(8) Environmental Test Plans and detailed procedures are in preparation.

(9) Tests of the breadboard detector revealed outgassing - this problem is being corrected.

(10) Due to the late delivery of the Engineering Model it will be shipped directly from Marshall Labs to Bendix.

Dr. Freeman stated that Rice now has capacity to compute on two sets of test data simultaneously and propose to have one data phone input direct from Ann Arbor with immediate access to the computer during conduction of the ALSEP Integrated Tests. He further stated that he felt concern over the expense of data phone useage was unwarranted since installation is only $100.00 and typical unit rents for $80.00 per month plus charges from long distance lines which could be WATS lines.

A question of Dr. Freeman's was answered by the statement that the astronaut will carry a radiation survey meter which could be used to avoid setting any ALSEP experiment in a hot radiation area.

Mr. Piland expressed concern over the two weeks slippage at Marshall Labs and Dr. Freeman said they would continue trying to make it up.

b. Cold Cathode Ion Gauge Experiment (CCIGE): Presentation by Jim Carrol

Mr. Carol reported the following:

(1) National Research Corporation (NRC) will provide shielding, packaging, and wiring of the gauge.

(2) Marshall Labs will integrate the gauge into the SIDE.

(3) Marshall Labs prepared an ICD for the gauge. This necessitated rework of the engineering models which will now be delivered by October 15, 1966, with the prototype delivered by October 30, 1966.

(4) The NRC magnetic shielding provides limits within those required for the LSM in both the stowed and deployed configurations.

(5) Forecast: The engineering models will be completed within the next month or $1\frac{1}{2}$ months.

(6) The prototype will undergo extensive testing at NRC and Marshall Labs.

(7) Further definition may allow reduction in the weight of the cable between the CCIGE and the SIDE.

(8) Documentation is up to date. Development Test plans and procedures are being updated to reflect the change in schedule.

Herb Cross asked for information on the level of magnetic contamination. Jim Carrol stated that levels as follows were measured with a fluxgate magnetometer and a Hall effect gauge:

.15 gauss at 1 foot in the stowed configuration

12 gamma in the deployed configuration

c. At this point the presentation from the PI's was interrupted to allow Mr. B. Calderon from Teledyne Industries, Inc. to summarize activities related to a Teledyne Mag-Latch relay used in ALSEP.

A 7 page report on the Teledyne Model 421 Mag-latch Relay is included as Enclosure 7.

The problems associated with the Teledyne Model 421 Mag-Latch Relay and corrective actions taken were summarized by Mr. Calderon. These are presented in more detail in the report.

Mr. B. Calderon stated that more than 20,000 units have been shipped to the field since the design corrections were made without recurrence of a failure of the original type.

Mr. Calderon stated that answers to specific questions asked by Mr. Earl Smith and Mr. Bill Zrubek are included in the report.

The meeting was adjourned for lunch at 12:30 pm and resumed at 1:15 pm.

d. Active Seismic: Dr. Robert Kovach (The six charts presented by Dr. Kovach are included in Enclosure 8)

Dr. Kovach's charts are comprehensive and will not be discussed in detail. The following additional comments were offered:

(1) The major difference between the Develco component weights and those of the Bendix System is in the mortar box Dr. Kovach is preparing a memo which details the mortar box design and he urged that Bendix review it in detail.

(2) Preliminary conclusions from current work in energy coupling of explosives detonated in a vacuum reveal that approximately 50% amplitude is lost in coupling energy by raising the charge one charge diameter above the surface. 10^{-3} torr has proven an unacceptable level of vacuum for these tests - a minimum of 10^{-5} is necessary.

e. Charged Particle Lunar Environment Experiments (CPLEE): Dr. B. O'Brien

Dr. O'Brien briefly mentioned one of his papers on Lunik 10 findings which are pertinent to his experiment. This is included in Enclosure 9. The potential influence on ALSEP environment is depicted in Enclosure 10.

The following points were reported by Dr. O'Brien:

(1) The data processor is on schedule.

(2) Delivery of their vacuum system has slid to November 1, 1966. It is not felt this is a problem.

(3) A few points on ICD's will be negotiated in the next few days.

(4) Dr. O'Brien suggested that Bendix use magnesium rather than stainless steel on the brassboard hardware.

Dr. O'Brien then introduced Mr. Wiley from Bendix to discuss progress on the CFE CPLEE.

Mr. Wiley stated that the Engineering Model will be delivered to the Systems Division by November 1, 1966. The schedule is tight but realizable. Mr. Wiley showed 11 pictures which included 6 of breadboard circuitry utilizing TI flat pack microcircuit modules and 5 of channeltron detector circuit modules.

Mr. Wiley stated that detailed design information is now in the mail to MSC for MSC review prior to the Design Review.

f. Passive Seismic Experiment: Dr. G. Latham

Dr. Latham reported the following activities:

(1) Assistance was provided Teledyne during the period.

(2) A concreted vault supported on bed rock was prepared for testing the engineering model in late November.

(3) Test Documentation has progressed on schedule.

(4) In conjunction with Don Gault at Ames a meteoroid study was initiated in hopes of determining energy coupling efficiency.

Dr. Latham expressed his appreciation to Bendix for their cooperation in improving the Teledyne fabrication and quality control problems.

He further expressed concern over the Bendix (Teledyne) proposed thermal design for the experiment and declared that the intent for the September 16, 1966, meeting at Bendix is to achieve an acceptable thermal design and he was optimistic regarding that end.

g. Heat Flow Experiment: Dr. Mark Langseth

Dr. Langseth reported there was significant activity on his experiment for the period.

The design definition phase was completed with a preliminary design established and a contract established.

The design provides means to measure lunar subsurface temperature and temperature gradient in two bore holes - a concession from the originally planned three. The exact position of the boreholes from the LM is not critical; however, it is necessary to stay out of the ALSEP elongated shadows.

The probe design which provides 8 absolute temperature and two temperature gradient measurements per borehole is shown in Enclosure 11. The sensitivity of the probe will be sufficient to measure a gradient equivalent to 1/10 the earth heat flow rate (1/5 is anticipated). High and low conductivity modes of operating may be commanded for the probes.

The probe electronics proved a severe design problem. The drift problem was solved by making all measurements with one amplifier switched between bridges within one millisecond.

Predicted weight of the HFE is 9.3 # and power consumption is 6 watts. The borehole drill will weigh 22-25 pounds.

A sleeve will be implanted in the top 1 meter of the borehole if necessary. Temperature measurements can be made thru the sleeve with the thermocouples.

The flight design hardware will be compatible with serving as a backup experiment for the second mission. The engineering model will be delivered late to Bendix, however, in order to perform extensive calibration testing at A. D. Little Co. A meeting is scheduled for September 27, 1966, with Bendix to resolve the HFE - ALSEP integrated schedule.

It is hoped that documentation will be completed within two weeks on the thermocouple detailed design.

Dr. Langseth stated that it was desirable for the HFE to bring back the total core from both boreholes; however, the original HFE proposal submitted to NASA Hqs. did not include this requirement. A proposal submitted by Gene Simmons (with Langseth as Co-Investigator) on Chemical and Physical properties does include this requirement. A decision on this proposed is pending.

Dr. Langseth mentioned that interfaces between the borehole cores and special containers for visual inspection of the cores are yet to be fully defined.

Dr. Latham asked if investigations had included consideration of thermal shocks such as those possibly generated by the LM Ascent Stage and Descent Stage and their influence on the HFE. Dr. Langseth said that those particular thermal shocks had not been investigated but he had investigated the thermal shock introduced to the borehole during the drilling operation.

h. Solar Wind Spectrometer (SWS): Presentation by Doug Clay

Doug Clay reported that the SWS was on schedule barely and expressed minor concern over the ability to meet the Nov. 1, 1966, date on delivery of their engineering model.

They were experiencing some problems from voltage transients in stepping the voltage on the high voltage power supply. The transients were affecting the Fairchild low-level circuitry and they foresaw no immediate solution to this problem.

They hope to analyze their data handling and analysis capabilities within two weeks - first look appears encouraging.

Power consumption appears to be 6.25 watts and the weight is 11.8 #. Considerable effort had to be applied toward weight reduction to achieve this figure and drastic departures on mechanical configuration will have to be considered if there is any hope of achieving the target weight of 10 #.

Their Experiment Test Set looks on schedule. Some unqualified squibs are being considered but the schedule should permit their utilization.

Mr. Clay commented that more work in the area of common handles & leveling system between the experiments appeared in order. Further, that the g level shock loading specified in the mechanical environment specification could stand review. Further, that they would like to see a complete frequency spectrum analysis for potential sources of cross interference undertaken. Mr. J. Clayton stated that this was planned as part of the engineering model testing.

At Mr. Piland's suggestion Mr. J. Small accepted an itemized list of the preceding comments from Doug Clay and stated that they would be given full consideration.

i. Lunar Surface Magnetometer (LSM): Presentation by Herb Cross (two charts presented by Mr. Cross are included as Enclosure 12)

Mr. Cross indicated that the Interface Control Specification should be completed in the next few days.

A meeting with Bill Stevenson on September 16, 1966, is scheduled to define data processing requirements.

Present weight of the LSM is 14.1 #.

The Engineering Model is on schedule in fabrication with all parts on hand.

Electrical GSE design is complete.

A five minute film of a suited subject at Bendix deploying the LSM was shown. Narration was provided by Dr. Dyal. It was pointed out that the tests showed the experiment could be deployed within the allocated time of 10 minutes and that it appeared advisable to alter the design of the sunshade to a manually deploying type.

8. Closing Remarks: Robert O. Piland

In his closing remarks Mr. Piland asked that inspection channels be exercised due to imminence of ALSEP hardware shipments. He stated that it appeared in order for experimenters and Bendix to talk freely with one another regarding sunshades and dust covers to achieve maximum commonality of design.

It is intended with the cooperation of NASA Hqs. to substitute a technical review symposium for the October Interface Review Meeting. The symposium will probably last several days and will include a systems design review.

This will be more fully defined within a week and the Principal Investigators advised of their participation expected in this meeting. This schedule would provide them 4 weeks for preparation.

The meeting was adjourned at 3:00 p.m.

Robert O. Piland, Manager
Experiments Program Office

List of Enclosures

1. List of Attendees
2. Agenda
3. List of Action Items
4. ALSEP Milestones Chart (1 Chart Presentation by John Small)
5. Bendix Status Report (3 charts from presentation by J. Burns)
6. Test Program Status Report (12 charts from presentation by Donald Wiseman)
7. Report on Teledyne Model 421 Mag-Latch Relay
8. Active Seismic Experiment status (6 charts from presentation by Dr. R. Kovach)
9. Preliminary Findings from Lunik 10 Experiments (Paper by Dr. B. O'Brien)
10. Potential Influence of Solar Wind on ALSEP Environment (Pictorial display from presentation by Dr. B. O'Brien)
11. Heat Flow Experiment Status Report (4 charts and 4 design drawings from presentation by Dr. M. Langseth)
12. Lunar Surface Magnetometer Status Report (Two charts from presentation by Herb Cross)

Enclosure 1

LIST OF ATTENDEES

Name	Organization
R. A. McComb	MSC
H. R. Greider	MSC
J. R. Skidworth	LEC
B. J. O'Brien	Rice Univ
J. A. Adams	Rice Univ
John Musslewhite	Rice Univ
G. P. Kenney	MSC
P. R. Maloney	MSC
D. G. Wiseman	MSC
A. Pitrolo	GE
Caroline Clark	Philco
W. C. Remini	AEC/MSC
R. A. Moke	MSC
J. M. Sanders	MSC
J. C. Church	MSC
W. K. Stephenson	MSC
J. D. Harris	MSC
W. E. Zrubek	MSC
Z. K. Eubanks	MSC
R. R. Clemence	MSC
R. B. Hill	MSC
W. D. Womack	MSC
Earl Smith	MSC
C. E. Whitsett, Jr.	MSC
P. M. Joyce	MSC
G. M. Ferguson	MSC
E. V. LaFevers	MSC
J. L. Modisette	MSC
John W. Freeman, Jr.	Rice Univ
R. Piland	MSC
D. B. Pendley	MSC

Name	Organization
M. A. Lowe	MSC
R. F. Martin	MSC
T. K. Sulmeisters	MSC
A. Schwarzkopf	NASA Hqs
B. Wilkinson	Bellcomm
P. Hickson	Bellcomm
E. M. Shoemaker	USGS
J. W. McGonigle	USGS
V. Wilmarth	NASA Hqs
J. M. Carroll	GRCSW
D. E. Evans	MSC
O. K. Stafford	MSC
G. W. Crum	MSC
B. H. Hood	MSC
F. M. Lucas	Off. of Naval Res.
T. H. Foss	MSC
R. L. Kovach	Stanford Univ
R. F. Irwin	MSC
H. V. Cross	NASA Ames
Palmer Dyal	NASA Ames
C. O. McClenny	MSC
K. L. Rose	Philco
J. F. Clayton	Bendix
B. Calderon	Teledyne
J. E. Dye	Bendix
R. J. Green	NASA Hqs
W. T. O'Bryant	NASA Hqs
E. M. Davin	NASA Hqs
G. V. Latham	Columbia Univ
J. C. Driscoll	Grumman
W. A. Smith	Rice Univ

Name	Organization
P. H. Bailey	Rice Univ
J. A. Burns	Bendix
J. H. Langford	MSC
W. P. LeCroix	MSC
J. W. Small	MSC
D. R. Clay	JPL
D. Lind	MSC
D. Gerke	MSC
A. Carraway	MSC
A. B. Olsen	MSC
J. S. Watkins	MIT
E. B. Hamblett	MSC
H. H. Schmitt	MSC
J. H. Carney	MSC
E. S. Bills	MSC
J. M. Sulester	MSC
R. D. Berkley	MSC
C. S. Warren	MSC

ENCLOSURE 2

INTERFACE MEETING ON APOLLO LUNAR SURFACE EXPERIMENTS PROGRAM

Manned Spacecraft Center, Building 2, Room 661

September 15, 1966 Chairman: Robert O. Piland

Time		Participants
9:00 - 9:15	Introduction News Releases	Robert O. Piland
9:15 - 9:30	Program Status and Plans	John W. Small
9:30 - 9:45	Bendix Status	James A. Burns
9:45 - 10:00	Test Program Status	Donald G. Wiseman
10:00 - 11:00	Lunar Geological Experiment	Eugene M. Shoemaker
11:00 - 11:15	Apollo Lunar Surface Scientific Simulation Program	Ted H. Foss
11:15 - 4:00	Principal Investigator Presentations	

Topics	Participants	Time
Overall Milestone Status	J. Freeman/F. Johnson	11:15 - 12:00
Accomplishments to Date	(LUNCH)	12:00 - 1:00
Forecasted Accomplishments	B. O'Brien	1:00 - 1:30
Interface Documentation Status	R. Kovach	1:30 - 2:00
Electrical/Mechanical/Data	G. Latham	2:00 - 2:30
Data and Information Needs	M. Langseth	2:30 - 3:00
	C. Snyder	3:00 - 3:30
	C. Sonett	3:30 - 4:00

4:00 Adjourn

Enclosure 3

LIST OF ACTION ITEMS

M60915-01X - Dr. Kovach will provide a brief description of the Active Seismic Experiment to R. O. Piland.
-Not Time Critical-

M60915-02J - Dr. Snyder will provide a brief description of the Solar Wind Spectrometer Experiment to R. O. Piland.
-Not Time Critical-

M60915-03W - Dr. Johnson will provide a brief description of the Cold Cathode Ion Gauge Experiment to R. O. Piland.
-Not Time Critical-

M60915-04S - Dr. Sonett will provide a brief description of the Lunar Surface Magnetometer Experiment to R. O. Piland.
-Not Time Critical-

M60915-05O - Dr. O'Brien will provide a brief description of the Charged-Particle Lunar Environment Experiment to Piland.
-Not Time Critical-

M60915-06F - Dr. Freeman will provide a brief description of the Suprathermal Ion Detector Experiment to R. O. Piland.
-Not Time Critical-

M60915-07L - Dr. Langseth will provide a brief description of the Heat Flow Experiment to R. O. Piland.
-Not Time Critical-

M60915-08P - Dr. Latham will provide a brief description of the Passive Seismic Experiment to R. O. Piland.
-Not Time Critical-

M60915-09U - Dr. Shoemaker will provide a brief description of the Lunar Geological Experiment to R. O. Piland.
-Not Time Critical-

M60915-10G - John Driscoll will provide data on the ascent and descent stages of the LM LTA-3 testing to J. Clayton.
-September 23, 1966-

M60915-11B - J. Clayton will send an information letter to each of the PI's on interpretation of the LTA-3 test data and its affects on ALSEP.
-October 7, 1966-
(Two weeks after receipt of the data from GAEC)

M60915-12M - D. Wiseman will provide a copy of the acoustical test plan for testing the LTA-3 vehicle at MSC to A. Pitrolo.
-September 30, 1966-

3 YEAR

MANNED SPACE FLIGHT SCHEDULE

LEVEL

SCHEDULE RESPONSIBILITY ______

STATUS RESPONSIBILITY ______

CONTRACTOR:

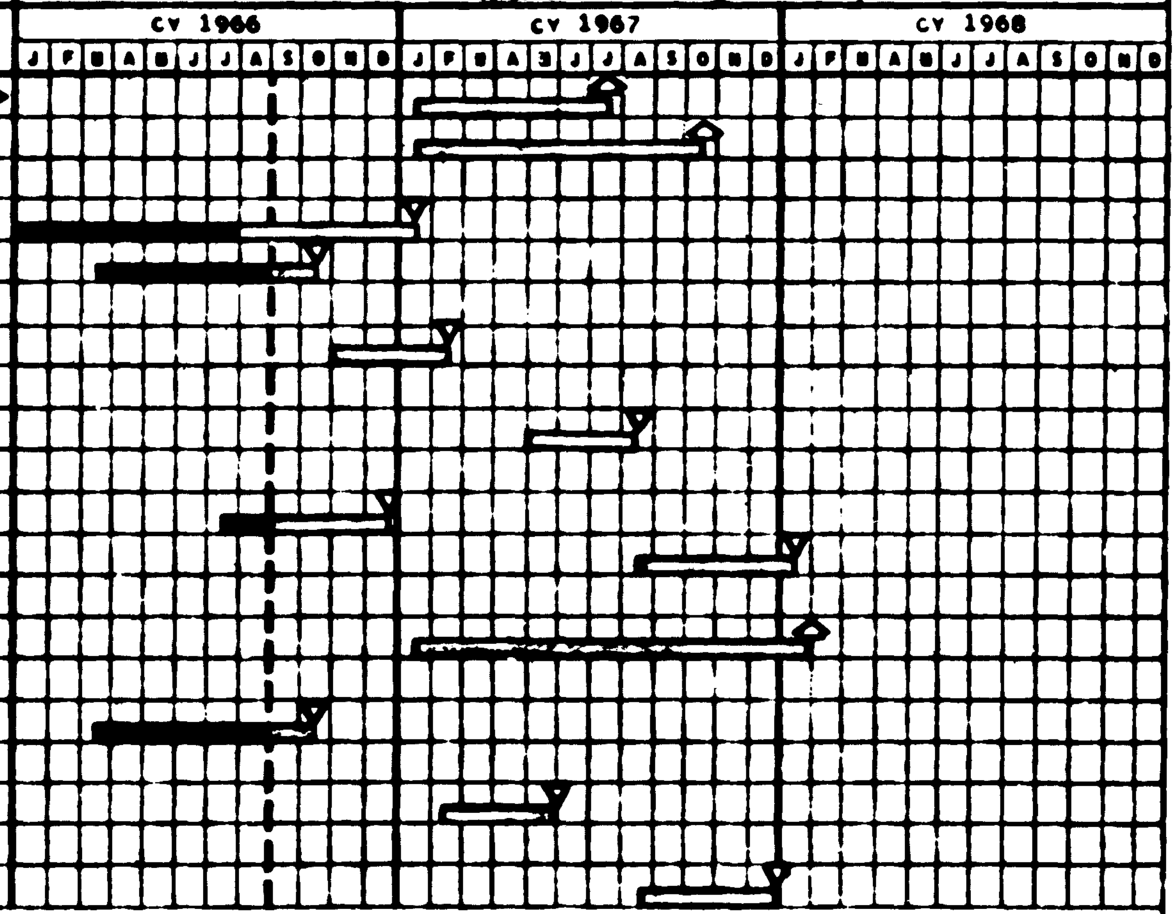
PROJECT SCHD. NO.

ORIGINAL SCHEDULE APPROVAL ______ (DATE)

LAST SCHEDULE CHANGE ______ (DATE) (NO.) (INITIALS)

STATUS AS OF AUG 31, 1966 (DATE) (INITIALS)

	MILESTONES
1	FLT SYS NO. 1
2	FLT SYS NO. 2
3	
4	ICD COMPLETE (LM)
5	ICD COMPLETE (CS)
6	
7	ENGR TEST - ARRAY A
8	
9	QUAL TEST - ARRAY A
10	
11	LTA-3 MECH SIM TEST
12	LTA-8 MECH SIM TEST
13	
14	FLT SYS NO. 3
15	
16	ICD COMPLETE (CS)
17	
18	ENGR TEST - ARRAY B
19	
20	QUAL TEST - ARRAY B



NOTES

NASA FORM 796 REV. SEP. 63

Attachment 4

BENDIX STATUS REPORT

1. Engineering Model Tests

2. Experiment Deployment Checks

3. Data Subsystem Brassboard

ENGINEERING MODEL TEST APPROACH

FOUR TEST CATEGORIES

TC #1 - Central Station Integration

Checks integrated operation of PCU, PDU, Data Subsystem using Data Subsystem Test Set and Experiment Simulator.

TC #2 - Individual Experiments Integration

Introduces each experiment, checking it with Data Subsystem.

TC #3 - Experiment Interaction

All experiments operating, checking interaction, interference.

TC #4 - Data Verification and Subsystem Interactions

All experiments operating, using STS.

ENGINEERING MODEL TEST APPROACH

ENGINEERING MODEL TEST MILESTONES

	Cat I, II, III	Cat IV
1. Prepare general test plan	19 September	12 August (ATM-399A)
2. Prepare preliminary detailed test plan	19 September	15 Oct
3. Prepare final detailed test plan and test procedures	15 October	15 Nov*
4. Complete STS programming	------	15 Dec
5. Begin tests	TC #1 15 Oct TC #2 15 Nov TC #3 15 Dec	1 Jan

*Prerequisites:

(1) Format freeze	9 Sept	
(2) Meetings (Bx/PI) to define test details and STS program requirements	SWS - Essentially complete LSM - Essentially complete SIDE - 14 Sept Meeting PSE - 20 Sept Meeting	ASE - 21 Sept Meeting CPLE - 27 Sept Meeting HFE - 22 Sept Meeting

ALSEP EXPERIMENTER

TEST REQUIREMENTS

- PROGRAM DEFINITION

  - ESTABLISH EXACT REQUIREMENTS OF EACH PI AND OF THE AEC/GE FOR EACH FORMAL PRIMARY ALSEP TEST LEVEL.
  - REVIEW THE REQUIREMENTS IN RELATION TO PRESENTLY PLANNED TEST EQUIPMENT AND PROCEDURES.
  - ESTABLISH PROGRAM "TRADE-OFF" POSSIBILITIES.
  - MAKE A PROGRAM DECISION AND ORIENT TEST EQUIPMENT PROVISION AND TEST PLANNING ACCORDINGLY.

- PURPOSE

  - DEFINE MEASUREMENT REQUIREMENTS FOR THE FOLLOWING TEST LEVELS:

    - INSTRUMENT ACCEPTANCE TESTS
    - INSTRUMENT QUALIFICATION TESTS
    - SYSTEMS INTEGRATION TESTS
    - SYSTEMS QUALIFICATION TESTS
    - SYSTEMS ACCEPTANCE TESTS
    - SYSTEMS PRELAUNCH TESTS

  - DEFINE UNIQUE TEST REQUIREMENTS
  - DEFINE UNIQUE HARDWARE REQUIREMENTS
  - DEFINE UNIQUE DATA REQUIREMENTS

SCHEDULE OF MEETINGS

EXPERIMENT	DATE
SUPRATHERMAL ION DETECTOR EXPERIMENT	AUGUST 30, 1966
COLD CATHODE GAUGE EXPERIMENT	SEPTEMBER 13, 1966
LUNAR SURFACE MAGNETOMETER	AUGUST 31, 1966
SOLAR WIND SPECTROMETER	SEPTEMBER 1, 1966
PASSIVE SEISMIC EXPERIMENT	SEPTEMBER 2, 1966
ACTIVE SEISMIC EXPERIMENT	SEPTEMBER 6, 1966
CHARGED PARTICLE LUNAR ENVIRONMENT EXPERIMENT	SEPTEMBER 8, 1966
HEAT FLOW EXPERIMENT	SEPTEMBER 9, 1966
RADIOISOTOPE THERMAL GENERATOR	SEPTEMBER 16, 1966

PI MEASUREMENT REQUIREMENTS SUMMARY

- ALL MEASUREMENTS FROM THE NORMAL DATA STREAM
- ALL INTERFACE PARAMETERS PRIOR TO INTEGRATION INTO THE ALSEP
- ALL INTERFACE PARAMETERS IN THE EVENT OF A FAILURE
- ALL INTERFACE PARAMETERS WITH THE EXPERIMENT LOADING THE CENTRAL STATION (SIDE ONLY)
- ALL MEASUREMENTS FROM THE TEST CONNECTORS ON THE EXPERIMENTS IN THE EVENT OF A FAILURE AT ALL TEST LEVELS (SIDE, LSM, & CPLEE ONLY)
- ALSEP CENTRAL STATION HOUSEKEEPING DATA

PI TEST MEASUREMENT SUMMARY

	TEST LEVEL					
	IA	IQ	SI	SQ	SA	PL
TOTAL MEASUREMENTS IN NORMAL ALSEP OUTPUT	513	665	513	539	490	513
TOTAL MEASUREMENTS NOT IN NORMAL ALSEP OUTPUT	234	291	191	196	190	211
TOTAL	747	956	704	735	680	724

DEFINITIONS:

IA - INSTRUMENT ACCEPTANCE

IQ - INSTRUMENT QUALIFICATION

SI - SYSTEM INTEGRATION

SQ - SYSTEM QUALIFICATION

SA - SYSTEM ACCEPTANCE

PL - PRE-LAUNCH

	TEST LEVELS					
	IA	IQ	SI	SQ	SA	PL
SIDE						
NORMAL DATA STREAM	53	205	53	79	30	53
OTHER (TEST CONNECTOR & INTERFACE)	44	101	33	35	9	29
TOTAL	97	306	86	114	39	82
LSM						
NORMAL DATA STREAM	19	19	19	19	19	19
OTHER	54	54	54	54	54	54
TOTAL	73	73	73	73	73	73
SWS						
NORMAL DATA STREAM	259	259	259	259	259	259
OTHER	14	14	14	14	14	14
TOTAL	273	273	273	273	273	273

2

	TEST LEVEL					
	IA	IQ	SI	SQ	SA	PL
PSE						
NORMAL DATA STREAM	29	29	29	29	29	29
OTHER	33	33	28	28	28	28
TOTAL	62	62	57	57	57	57
ASE						
NORMAL DATA STREAM	28	28	28	28	28	28
OTHER	51	51	28	31	51	48
TOTAL	79	79	56	59	79	76
CPLEE						
NORMAL DATA STREAM	36	36	36	36	36	36
OTHER	24	24	20	20	20	24
TOTAL	60	60	56	56	56	60
HFE						
NORMAL DATA STREAM	89	89	89	89	89	89
OTHER	14	14	14	14	14	14

PI TEST DATA HANDLING REQUIREMENTS SUMMARY

- REAL TIME ANALYSIS OF TOTAL EXPERIMENT TEST DATA
- DATA FROM EACH EXPERIMENT PRESENTED INDEPENDENTLY
- DECIMAL DISPLAY
- REAL TIME DATA REDUCTION
- COMPARATOR, "GO/NO-GO" ANALYSIS INADEQUATE

PI TEST CONFIGURATION AND EQUIPMENT REQUIREMENTS

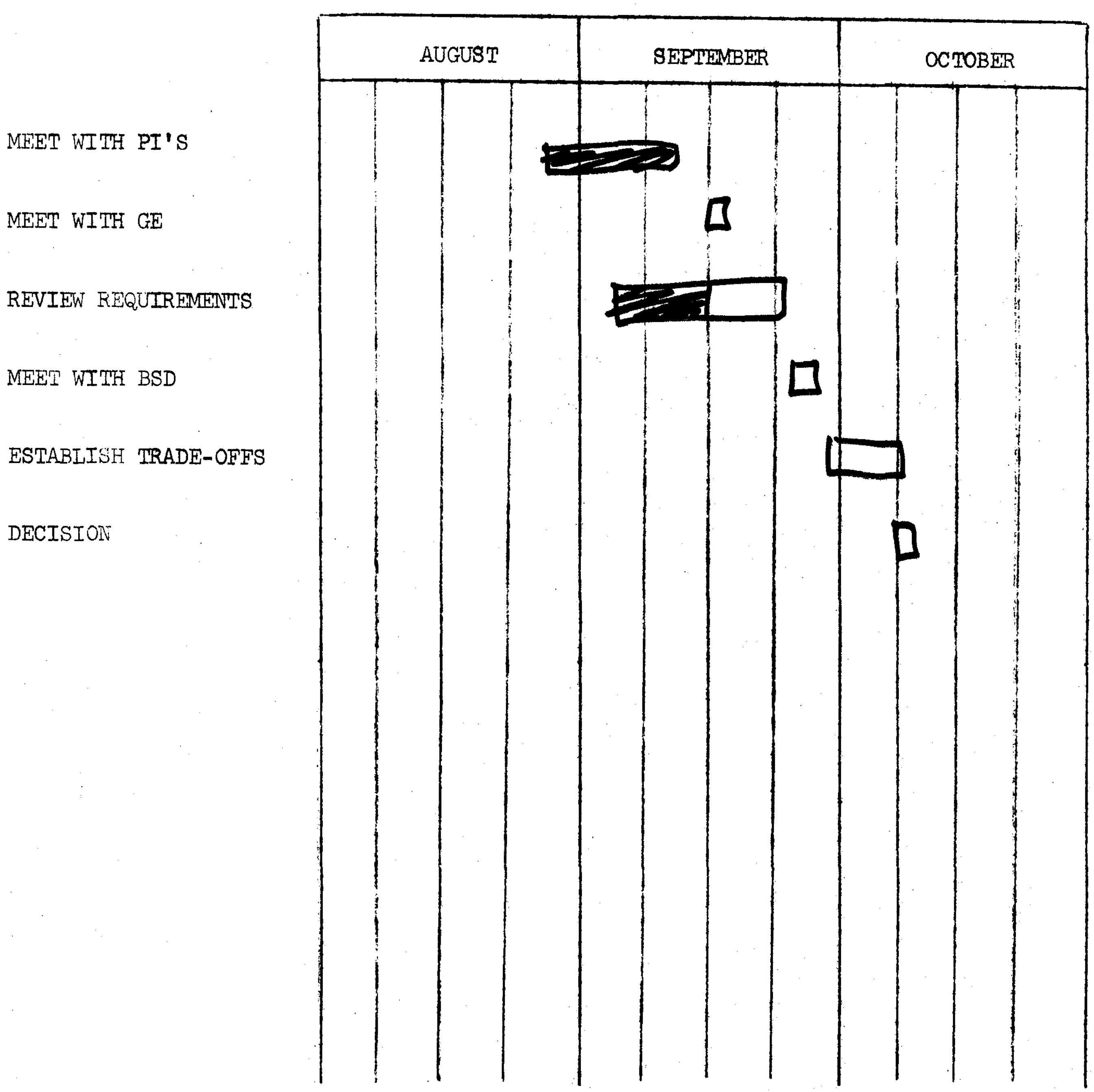
- SENSOR SIMULATORS FOR ALL TEST CATEGORIES
- VACUUM FACILITIES FOR ALL TEST CATEGORIES FOR USE WITH PARTICLE AND FIELD EXPERIMENTS
- ANALOG READOUT DEVICES FOR DISPLAY OF INTERFACE PARAMETERS FOR ALL TEST CATEGORIES
- EXPERIMENT TEST SET (ETS) TO BE AVAILABLE FOR ALL TEST CATEGORIES IN EVENT OF EXPERIMENT FAILURE (SIDE, LSM, SWS, CPLEE, PSE)
- EXPERIMENT COMPATIBILITY TESTS TO BE RUN ON ALL MODELS
- PORTIONS OF SYSTEM TESTS BE PERFORMED WITH ETS CONNECTED (SIDE & LSM)
- DATA PHONE AND ASSOCIATED EQUIPMENT FOR ALL TEST CATEGORIES (SIDE)
- FLUX TANKS FOR ALL TEST CATEGORIES FOR USE WITH THE LUNAR SURFACE MAGNETOMETER

BASIC MODIFICATIONS TO PRESENT CAPABILITY

- DISPLAY OF EXPERIMENT/CENTRAL STATION INTERFACE PARAMETERS FOR ALL TEST CATEGORIES
- UTILIZATION OF EXPERIMENT TEST CONNECTORS FOR ALL TEST CATEGORIES
- VACUUM FACILITY AND FLUX TANKS FOR ALL TEST CATEGORIES (SWS, SIDE, CPLEE, & LSM)
- REAL TIME TEST DATA REDUCTION FOR ALL EXPERIMENTS
- DECIMAL DISPLAY OF EXPERIMENT DATA SIMULTANEOUSLY
- PRESENTATION OF EACH EXPERIMENT TEST DATA UNIQUELY
- ETS FOR ALL TEST CATEGORIES (SIDE, LSM, CPLEE & SWS)

SCHEDULE FOR COMPLETION OF

TEST PROGRAM DEFINITION



Summary of Teledyne Precision Inc.

Model 421 MAG-LATCH Relay

1. During Stepember 1965, Teledyne Precision Inc. (T.P.I.) advised by Mr. H. Moore of Goddard Space Flight Center (phone 301-982-4713) that TPI's Series 421 Relay was withstanding NASA tests adequately and he intended to use these units for spacecraft applications.

2. TPI received a copy of NASA report on tests (1. above) in February 1966. Test Report No. PACER 601-002.

3. On November 1965, TPI received a contract for 100 pieces of Model 421 for use by Mr. H. Moore. These units were shipped approximately January 1966.

4. In March 1966, TPI was advised by Mr. Moore of NASA that he was having trouble with the relays. Failure analysis on these units definitely indicated a problem area in the method of hinging the armature to the permanent magnet pivot resulting in the relay assuming intermediate positions or failure to operate. A change was made in the method of locating and holding the armature in proper relation to the permanent magnet pivot and was reviewed by Mr. Moore. This change, while minor in nature, solved the problem as proven by Mr. Moore's tests on replacement units provided him during June and July 1966. Complete qualification tests have been performed under contract to General Dynamics (Pomona Division, Mr. Ernie Head, Reliability Engineer - phone 714/NA 3-5333 Ext. 381) on units incorporating the improvements within the last two months, further demonstrating the suitability of the solution. Report available on request.

5. On March 28, 1966, TPI was surveyed by Mr. Cooke of GSFC, Quality Assurance. This report which was received on May 23, 1966, indicated areas of improvement principally in material control, housekeeping outside of production area and traceability of parts. The necessary improvements have been made and a request for resurvey was made on July 19, 1966. No word has yet been received from GSFC, Quality Assurance on their intent to resurvey.

6. On July 15, 1966, Mr. Earl Smith, Quality Manager at NASA-Houston, visited TPI's facility. He was aware of the GSFC QA report and was shown the areas where improvements were made and explained what improvements were in process. He stated that he was pleased with TPI's cooperative and helpful attitude and felt that TPI was complying to Quality Assurance requests.

7. On September 7, 1966, Mr. S. Ellison, Bendix Reliability, visited TPI's facility.

Mr. M. Blitz's letter to Mr. S. Ellison on September 12, 1966, outlined the discrepant areas and the correction action. These areas were as follows:

(a) Parts Handling - The shipping department has been notified not to accept parts for shipment that are not in containers. This method of handling parts will be added to our shipping procedure.

(b) Inspection Criteria - Procedures have been written for inspection of headers and motors, and are awaiting approval and typing.

(c) Shelf Life Materials - Epoxies not properly identified with date of manufacture have been discarded. Procedures outlining control of cure type materials have been reviewed with the personnel involved.

(d) Hair Protection - Caps and gloves have been ordered for use by personnel in the relay cleaning room. These are expected shortly and will be in use before September 16, 1966.

(e) Items yet to be corrected are Gram Gauge Control and Careful Review of Calibration Equipment Card File. Effort has begun on both these items and corrective action will be complete prior to September 23, 1966.

Corrective Action of Teledyne Precision Inc.

Model 421 TO-5 Can Size Relays

Problem: Approximately February 1966, multiple failures were experienced under a wide variety of environments, during inspection. Failure analysis revealed the presence of metallic particles created by a knife edge of the pivot arm, grooving the adjacent case surface. The particles were lodging under the armature and preventing it from mating with fixed contacts.

Corrective Action:

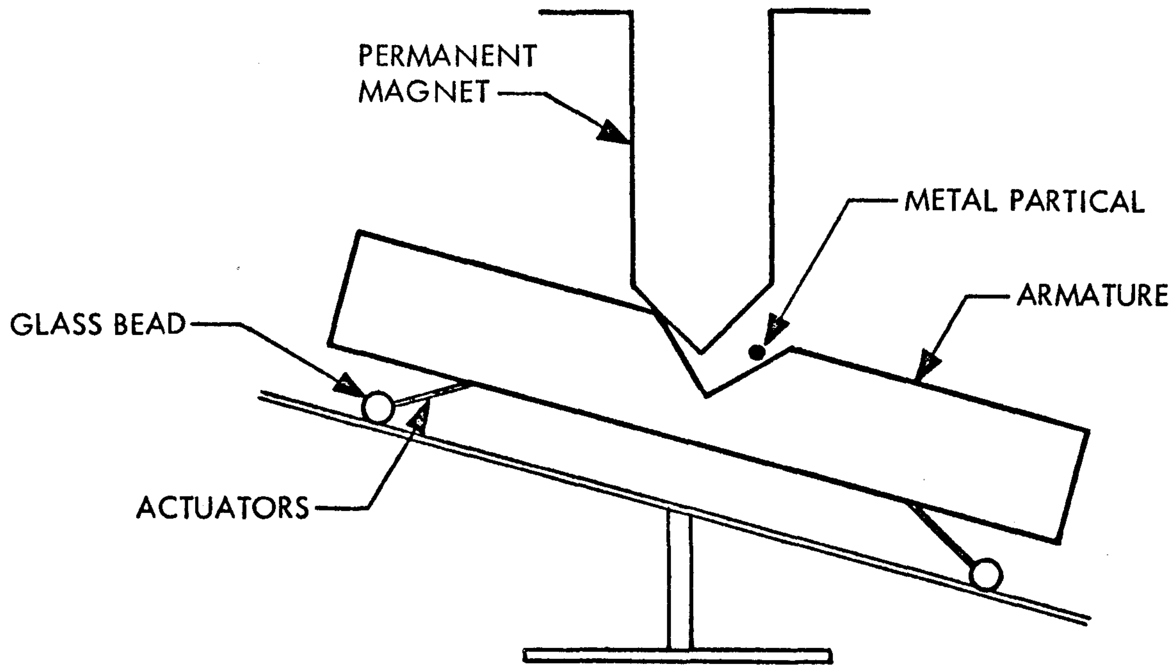
(1) The pivot arm system was redesigned so as to prevent any further contact with adjacent surfaces, and the armature shimmed up to prevent jamming by "particle contamination." The redesign, basically added a pin and a hole to a clip which ties the permanent magnet and the armature together.

(2) All parts are now deburred before assembly.

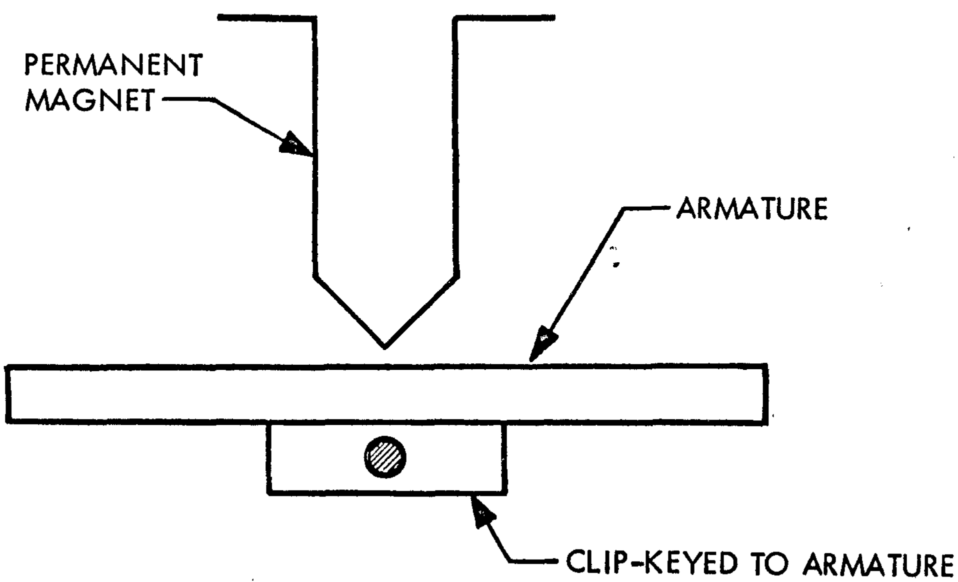
(3) The permanent magnet is now demagnetized after every welding operation to prevent possible ferrous particle accumulation.

(4) All stages of assembly are now performed in an air-conditioned and filtered clean room.

OLD DESIGN

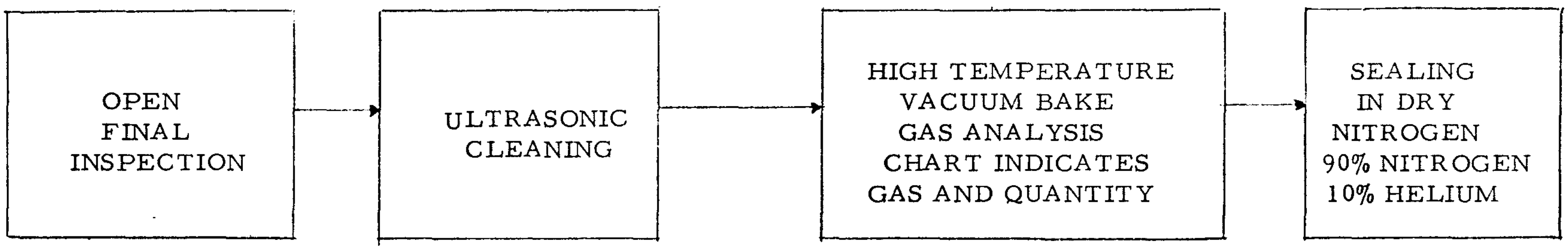


NEW DESIGN



TELEDYNE PRECISION INC.

CONTROL OF CONTAIMINATION IN SEALED RELAYS



TELEDYNE PRECISION MODEL 421 TO-5 RELAY

COMPARISION OF ENVIRONMENTS

Environment	ALSEP Environment	Tested Environment GD Qual Test	No Parts Tested	No Parts Passed
High Temperature Storage	+85°C	+125°C	26	26
High Temperature Operation	+85°C	+125°C	4	4
Low Temperature Storage	-20°C	-65°C	26	26
Low Temperature Operation	-20°C	-65°C	4	4
Vibration Sinusoidal	6.5G 10 to 50 hz at 3 octaves 13G 50 to 100 hz per minute	.2 inch with cross-over to 30G 10 to 3000 hz in 22 minutes	4	4
Shock	32 ± 2G for 5 ± 1 millisecond in any axis	100G for 11 milliseconds	4	4
Humidity	Up to 100 percent	Not performed, see Note I	-	-
Acceleration	5G - any axis	0-100G's - three axis	4	4
Life	Not specified	100,000 cycles + an additional 100,000 cycles	4	3 See Note III
Pressure	10-12mm Hg I0-6mm Hg	Not performed, see Note II	-	-
Random Vibration	.048G²/hz from 20 to 250 hz	Not performed	-	
Salt Atmosphere	No requirement	10,000-50,000 MGM/M²/day	4	4

Note I: Parts were tested by Teledyne Precision and results of test are reported in Report No. 5657. Test conditions 90-98 percent RH; temperature varied between 25 and 65°C. Four parts tested, all passed.

Note II: All relays are sealed in a TO-5 can and are subjected to and pass 10^{-8} mm/helium.

Note III: Note 3 of test report states:

"During test one sample malfunctioned after 98,200 operations. (Because of previous Group B testing total operations of this unit were 103,200 at time of failure. Analysis indicated this to be a random failure and not representative of the design. To further prove this analysis the three samples which operated satisfactorily during life test were subjected to an additional 100,000 cycles after being tested for electrical characteristics. Operation was satisfactory throughout the test."

ACTIVE SEISMIC EXPERIMENT

OVERALL MILESTONE STATUS AS OF 8 SEPTEMBER 1966

- PI's Breadboard Model system tests completed.
- PI's Brassboard Model design completed and fabrication 80% completed.
- PI's Brassboard Model testing at component level beginning.
- Brassboard Model drawings and BOM to NASA.
- Development Test Plan completed.
- PI Measurements Requirements List to NASA.

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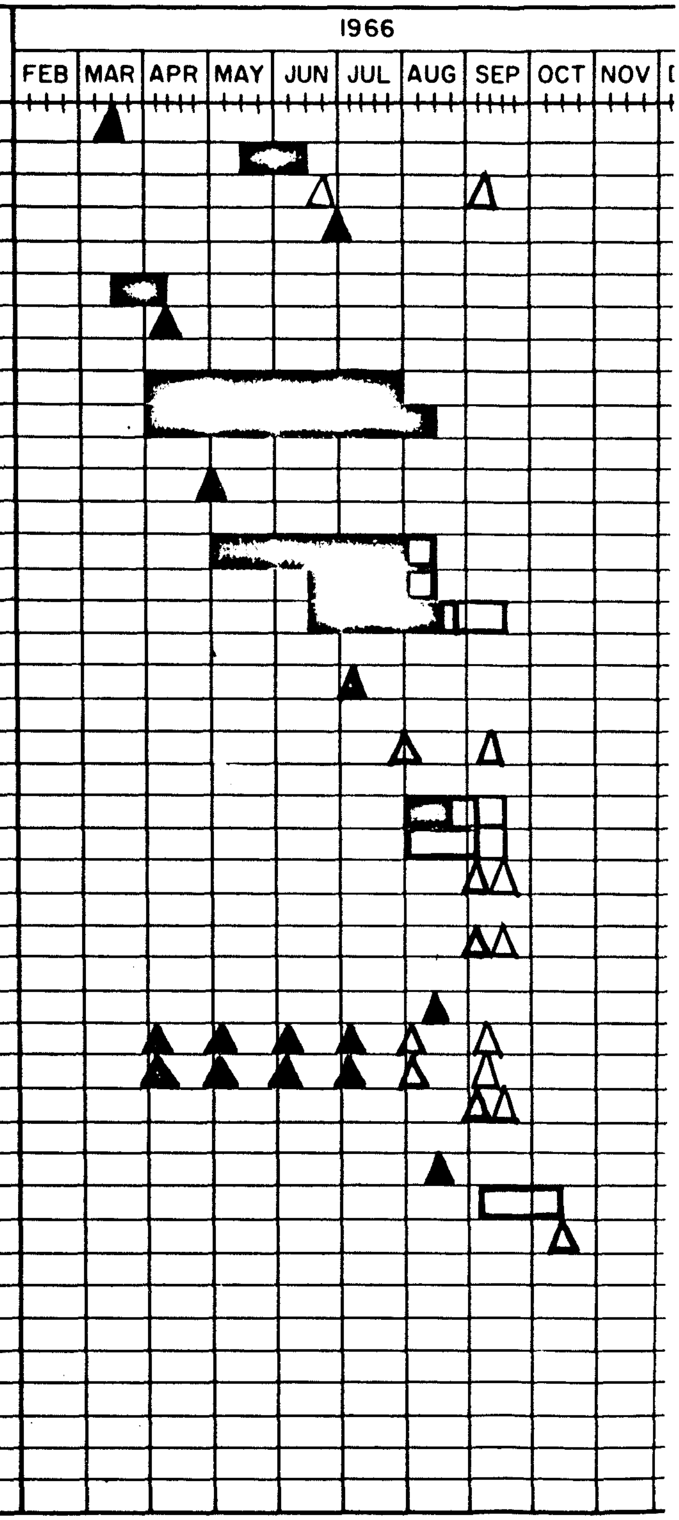
STANFORD UNIVERSITY
DEPARTMENT OF GEOPHYSICS

ACTIVE SEISMIC EXPERIME

Line	ITEM P.I. BRASSBOARD PROGRAM
1	Subcontract Award
2	Negotiate Thumper Interface
3	Let Thumper Subcontract
4	Freeze Thumper Interface
5	
6	Preliminary Design Analysis
7	Preliminary Design Review
8	
9	Breadboard Design
10	Breadboard Fab. and Test
11	
12	Critical Design Review
13	
14	Brassboard Design
15	Brassboard Design Review
16	Brassboard Fabrication
17	
18	Development Test Plan Completed
19	
20	Thumper Brassboard Completed
21	
22	Subcontractor's Brassboard Tests
23	P.I. Test Participation
24	Acceptance Tests Complete
25	
26	Brassboard Model Delivered to P.I.
27	
28	Drawings and BOM to P.I.
29	Subcontractor Cost Reports Due
30	Subcontractor Progress Reports Due
31	Subcontractor, Final Report & Doc.
32	
33	Drawings and BOM to NASA
34	PI Evaluation of Brassboard Model
35	Deliver Brassboard Model to NASA
36	
37	Deliver Final Exp. Performance Specs.
38	
39	
40	
41	
42	
43	



Remarks: Blocked in portions of the bars and triangles above mark progress as of the dates of re been drawn, or open portions of the bars extended, to indicate new target dates for co

ACTIVE SEISMIC EXPERIMENT

FORECASTED ACCOMPLISHMENTS

- Complete Brassboard Model fabrication by 17 September 1966.
- Complete Acceptance Tests and take delivery of Brassboard Model by 23 September 1966.
- Complete PI evaluation of model and deliver it to NASA-MSC on 15 October 1966.
- Deliver final experiment performance specifications on 15 December 1966.

ACTIVE SEISMIC EXPERIMENT

INTERFACE DOCUMENT STATUS

- IC 31408 Interface Control Specification for the ASE - Signed by PI with exception not yet resolved.
  Magnetic cleanliness spec for ASE needed.
- CP 215000 Performance/Design Specification for the ASE - Not signed by PI due to disagreement over amplifier performance specifications.
- IC 314118 MSFN/MCC-H/ALSEP Operations - Not signed by PI pending resolution of data format and passive mode consideration.

ACTIVE SEISMIC EXPERIMENT - (Major Problems)

- Bendix current weight 25.36 lb
- Minimum expected weight with current design - 22.54 lb
- Incentive - 0 points at 14.4 lb

  max points at 12.4 lb

ACTIVE SEISMIC EXPERIMENT

WEIGHT AND SIZE COMPARISONS

WEIGHT

	Bendix	PI
Mortar Box	15.2 lbs.	2.3 lbs.
Grenades (4)		6.5 lbs.
Geophones and Cable	2.9 lbs.	2.0 lbs.
Central Electronics	3.2 lbs.	3.0 lbs.
TOTALS	21.3 lbs.	13.8 lbs.

SIZE

Mortar Box (Stowed)	15.6 x 4 x 10.5	17 x 6.3 x 6.8
Central Electronics	4 x 6.5 x 2.5	4 x 6.5 x 2.6

ENCLOSURE 9

DEPARTMENT OF SPACE SCIENCE
Rice University
Houston, Texas

MEMORANDUM Date: 13 September 1966

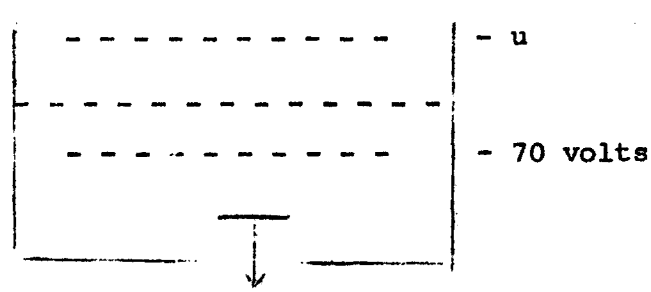
TO: Distribution

FROM: B. J. O'Brien

SUBJECT: Preliminary findings from Lunik 10 Experiments

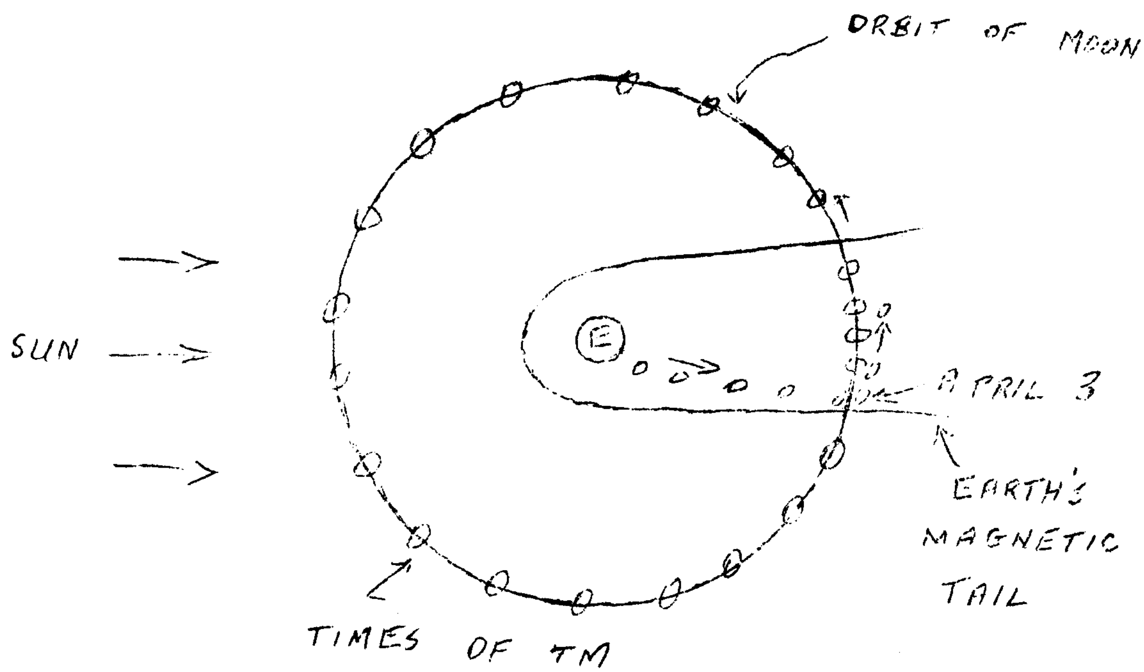
The first International Symposium on Solar-Terrestrial Relations was held at Belgrade August 29 - September 2, 1966. I was able to attend (courtesy of the National Science Foundation!) and engage in informal verbal discussions with several Russians about Lunik 10 results. Most complete were the discussions with Gringauz and Vernov about particle fluxes while Pushkov gave a few more details on the magnetic field. Insofar as there were no written documents, the following notes should be taken as preliminary, but they appear of sufficient relevance to ALSEP to warrant their transmittal to you.

Gringauz told of measurements with two of his four three-electrode traps (similar to his earlier Lunik devices), located on opposite sides of the spacecraft.



where u has a 50-volt square wave of a long period applied

Data were transmitted intermittently for about 35 days. The trajectory was as sketched below:



The orbit in inertial space was essentially a maximum-sunlit orbit, i.e. at dawn and dusk, and not eclipsed by the moon, and was at some 400 to 1000 km altitude.

For five days centered around full moon, one of the traps measured negative current. For the other times, both ion traps registered positive fluxes. Gringauz concludes:

1. that "outside" the magnetospheric tail the payload encountered a thermalized plasma of positive ions with energy above ~50 ev rather than the streaming of solar wind of interplanetary space.

2. that the magnetospheric tail envelopes the moon for ~5 days, However, he is unable to conclude whether the negative current is due to

a. magnetospheric electrons with energy above ~100 ev, or

b. photoelectric effects combined with the exclusion by the tail of the elsewhere dominant positive-ion flux.

Pushkov gave a few results on the magnetic field measurements. My interpretation of his comments is that the magnetic field was variable between some 10 and 20 gammas, but that he was unable to distinguish clearly the magnetospheric tail.

Vernov et al. gave a preprint on the penetrating-radiation data from Lunik 9, approaching and on the lunar surface. The geiger was 6 mm diameter and 10 mm length. The shielding was about 1 g/cm^2. The mean count rate on the flight to the moon was (3.272 ± 0.004) counts/sec, while that on the moon was (2.064 ± 0.004)/sec. Since the moon shielded 2π sterads of cosmic rays, there was an <u>excess</u> of lunar-associated radiation of 0.43 counts/sec. Vernov et al. conclude that a dominant part of this could be cosmic-ray lunar albedo, with a relatively small contribution from lunar radioactivity. Since the geiger is shielded effectively from protons below 10 Mev and electrons of ~1 Mev, while Vernov's results are of interest, they are not immediately very relevant to current ALSEP experiments.

To summarize, ALSEP may be expected to encounter the following domains:

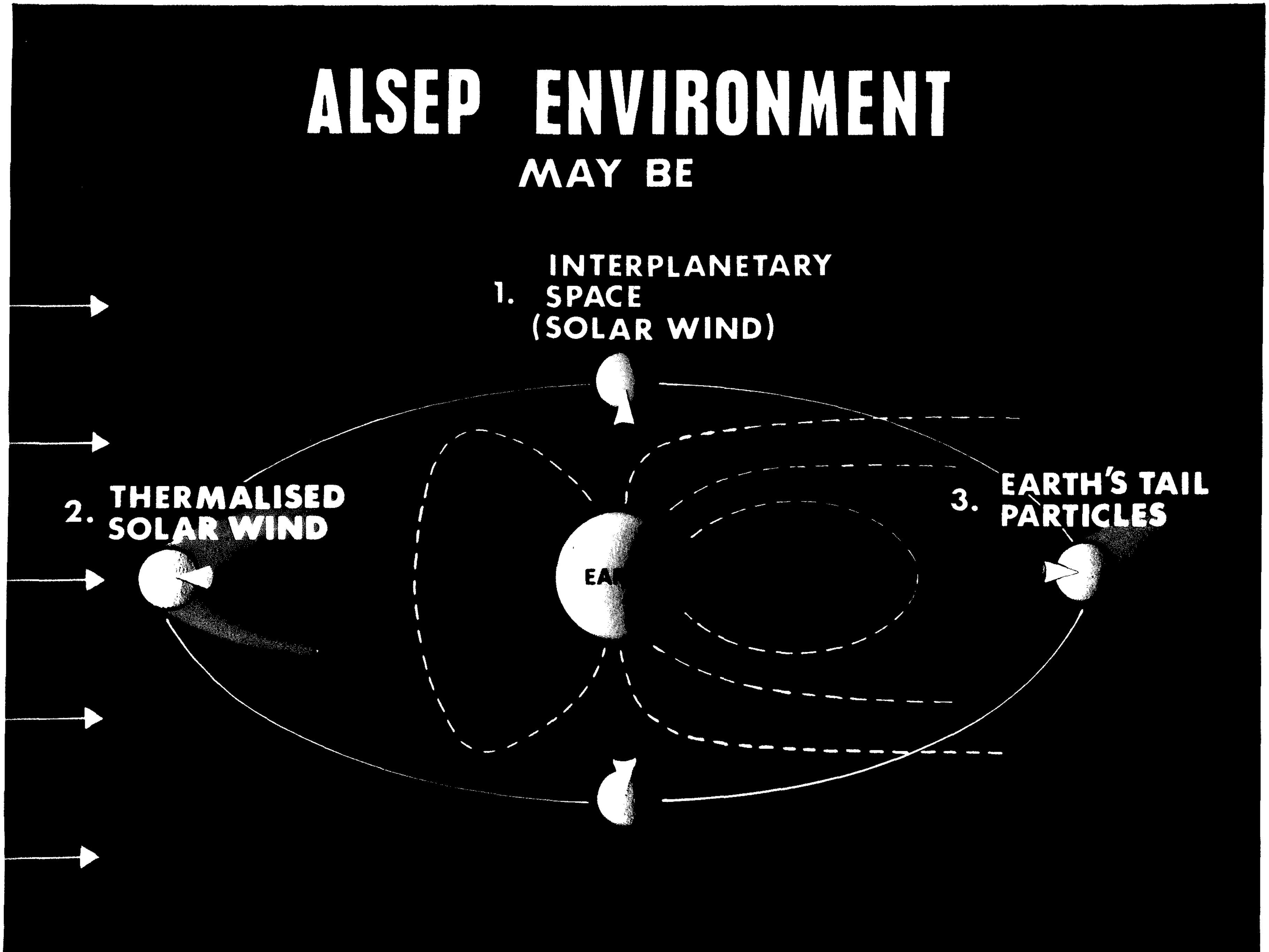
1. the magnetospheric tail of the earth for about five days centered around full moon

2. thermalized solar wind at least at dawn and dusk for 23 days of the lunar month.

Lunik 10 did not encounter pure interplanetary solar wind.

The valid comment has been made that planning ALSEP scientific experiments without consideration of the Soviet data is akin to planning trans-Atlantic crossings while ignoring the fact that Columbus has done it already. But the details discussed above are of such preliminary form that I suggest they should be treated as analogous simply to Columbus reporting "there is land there!"

Gringauz mentioned there may be preliminary reports in Doklady in September and more detailed reports in the USSR Space Research perhaps in December.


ALSEP ENVIRONMENT
MAY BE
1. INTERPLANETARY SPACE (SOLAR WIND)
2. THERMALISED SOLAR WIND
3. EARTH'S TAIL PARTICLES

ACCOMPLISHMENTS TO DATE

1. Test data establishes that the platinum resistance elements will withstand the environmental condition without affecting their long term calibration accuracy.

2. Bi polar excitation of platinum sensors and ratio measurements to cancel long term drifts in the electronics.

3. Proven feasibility of low level commutation to reduce electronic complexity.

4. Heat Flow measurement technique defined.

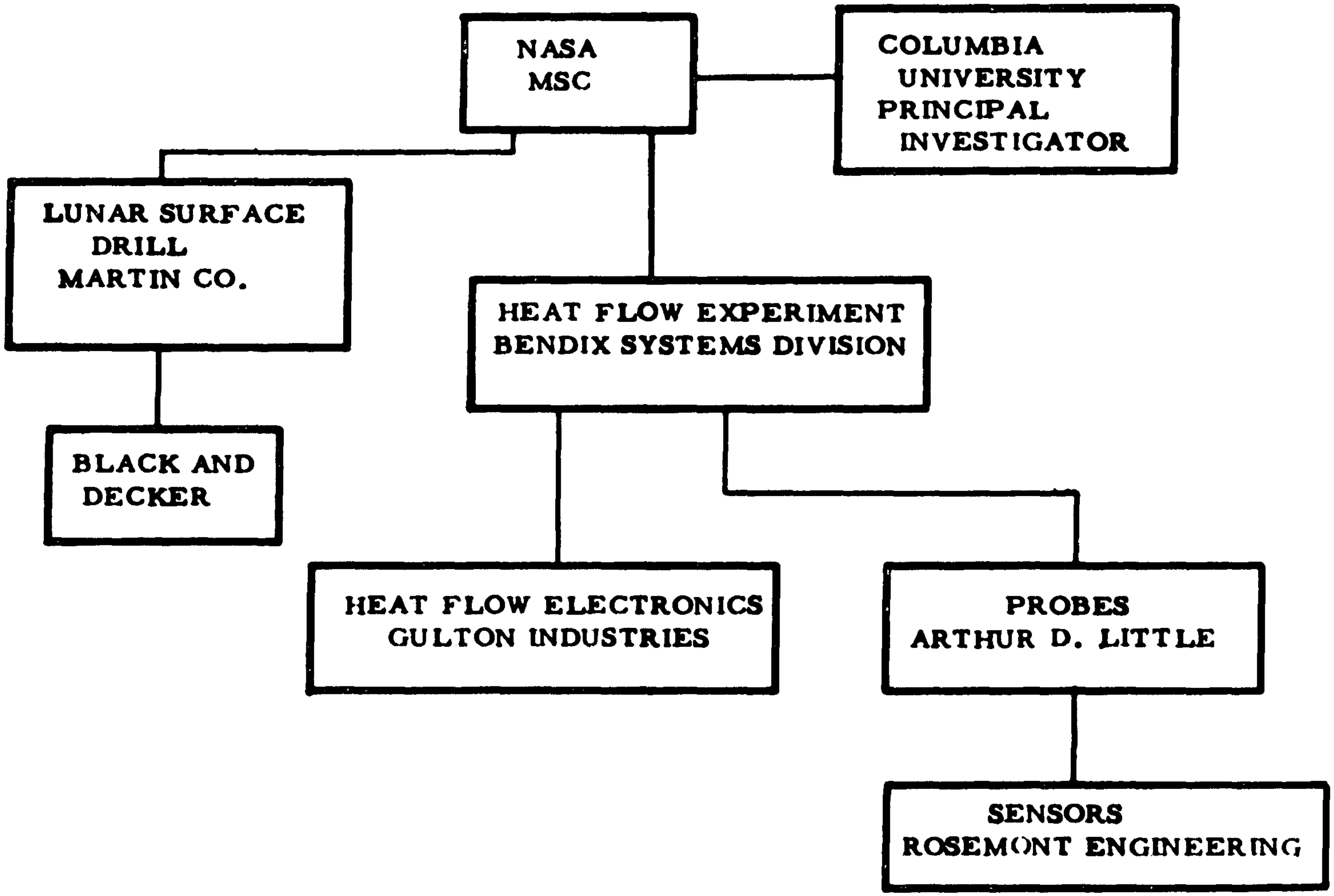
   (a) Two boreholes

   (b) Two intervals of gradient measurements in each borehole

   (c) Absolute temperatures measured at eight points in each hole

   (d) Thermal conductivity measured at four points in each hole.

Attachment 11
p1



HEAT FLOW EXPERIMENT ORGANIZATION

Attachment II
p2

The Bendix Corporation — Systems Division, Ann Arbor, Michigan

MANAGEMENT CONTROL PLAN SCHEDULE

HEAT FLOW EXPERIMENT MASTER SCHEDULE

No:	Revision	Group
Issued On:	Revised On	P/C Check

CY 1966: Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec — CY 1967: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec — CY 1968: Jan, Feb, Mar, Apr, May

Line	Item	Schedule notes
1	H. F. Structural Thermal Model	
2	Design	
3	Fab & Test	
4		
5	H. F. I Model	
6	Fabricate	
7		
8	H. F. Brassboard Model	
9	Rec H. F. Brassboard Elec at BxS	
10	Test Elec at BxS	Ship to ADL
11	Integrate & Test Brsbd Elec & Probe at ADL	Ship to BxS
12		
13		
14	H. F. Engineering Model	
15	Rec Eng Model Elec at ADL	
16	Design Eng Model Cable & Reel	
17	Design Eng Model H. F. Elec Box	
18	Fab Eng Model Box, Cable & Reels (Support)	Ship to ADL
19	Assemble & Integrate Eng Model	
20	Design Verification Test	Ship to BxS (1 Probe, 1 Container)
21		
22	H. F. Prototype Model	
23	Design Proto Elec Box, Cable Reel, etc	
24	Rec H. F. Proto Elec at BxS	
25	Integrate & Test Elec & Box at BxS	Ship to ADL
26	Assemble & Test Proto at ADL	Ship to BxS
27		
28	H. F. System Qual Models	
29	Design Qual Elec Box, Cable Reel, etc	
30	Rec H. F. Qual Elec at BxS (1st Set)	
31	Integrate & Test Elec & Box at BxS	Ship to ADL No. 1
32	Assemble & Test Qual Model at ADL	Ship to BxS No. 1
33	Rec H. F. Qual Elec at BxS (2nd Set)	
34	Integrate & Test Elec & Box at BxS	Complete Elec Qual at Gulton; Ship to ADL No. 2
35	Assemble & Test Qual #2 at ADL	Ship to BxS No. 2
36		
37	H. F. Flt Model #2	
38	Rec Elec at BxS	
39	Integrate & Test Elec & Box at BxS	Ship to ADL
40	Assemble & Test Flt Model #2 at ADL	Ship to BxS
41	Ship Spare H. F. Exp to BxS	Ship to BxS
42		Rec Elec at BxS; Ship Elec to ADL
43		

Approvals

Project Engineer Resp. for PWO	Program Control	Supervision	MCP SCHEDULE ____ Page ____ of ____	WBS Level 1 2 3 4 5 / PWO No. / PWO Title

970-15C

11-3

Bendix Corporation Systems Division, Ann Arbor, Michigan

MANAGEMENT CONTROL PLAN SCHEDULE

No:	Revision	Group
Issued On:	Revised On	P/C Check

CY 1966: Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec — CY 1967: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec — CY 1968: Jan, Feb, Mar, Apr, May

Line	Item	Schedule annotations
1		
2	H. F. Flt Model #3	
3	Rec Elec at BxS	
4	Integrate & Test Elec & Box at BxS	Ship to ADL
5	Assemble & Test Flt Model #3 at ADL	Ship to BxS
6		
7		
8	H. F. Flt Model #4	
9	Rec Elec at BxS	
10	Integrate & Test Elec & Box at BxS	Ship to ADL
11	Assemble & Test Flt Model #4 at ADL	Ship to BxS
12		
13	Probes Cables Del to BxS (3)	
14		
15	Probes Mechanical Mockup Del to BxS (3)	
16		BxS Design
17	Probes Training Simulator Del to BxS (4)	
18		
19	Design Reviews With PI	
20	Brassboard, D-1a and I Model	
21	Eng Model	
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Approvals			
Project Engineer Resp. for PWO	Program Control	Supervision	MCP SCHEDULE ____ Page ____ of ____

WBS Level	1	2		3	4	5	
PWO No.							
PWO Title							

970-15C

Attachment II
135

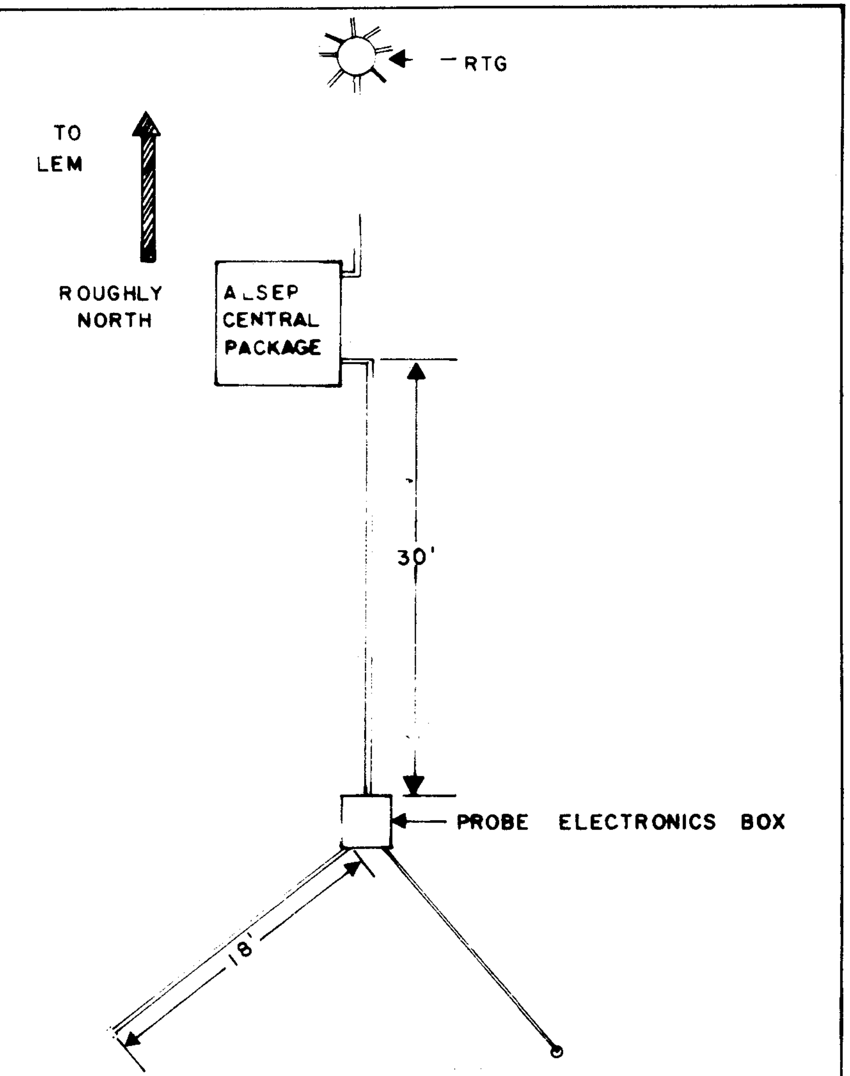

FIGURE 3. PLAN VIEW OF PROPOSED HEAT-FLOW EXPERIMENT DEPLOYMENT.

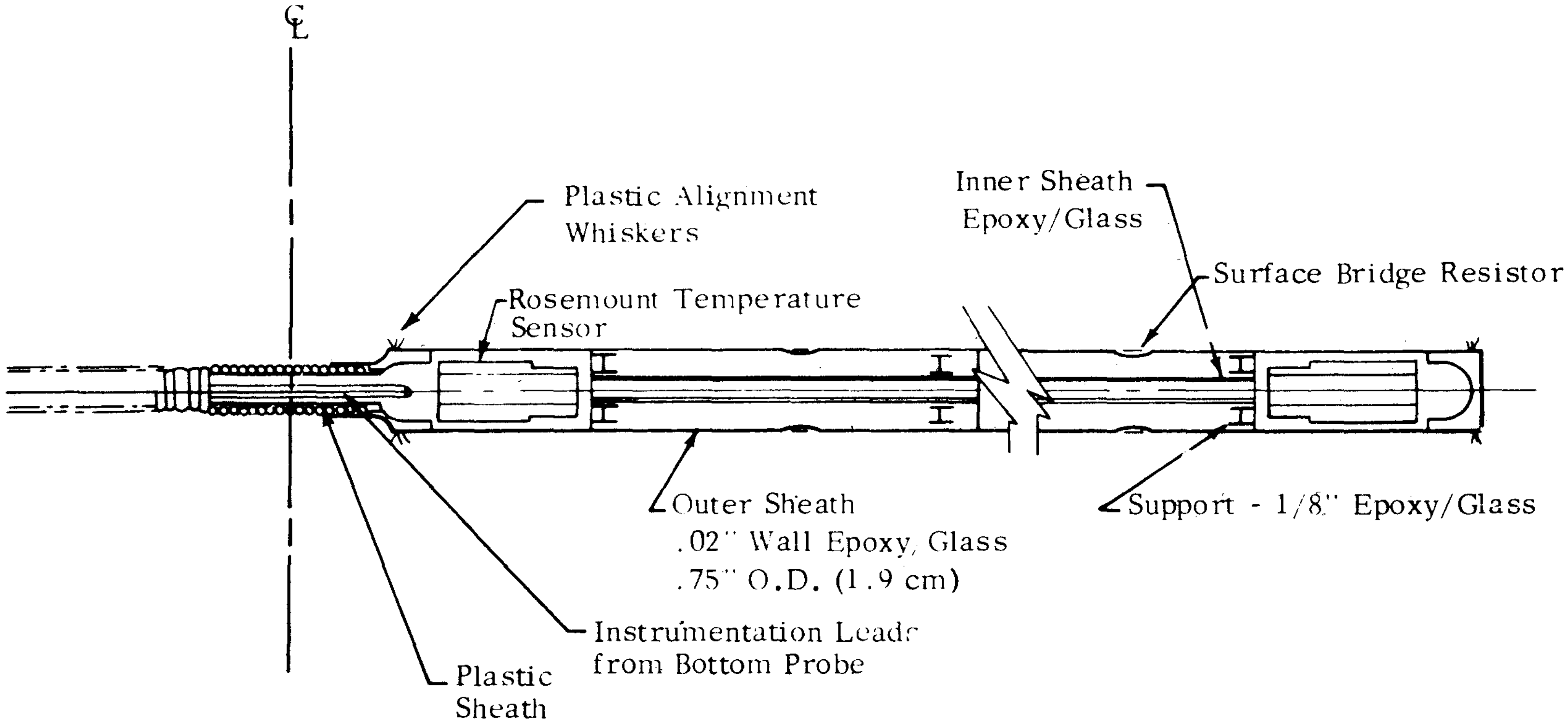

FIGURE 1 DUAL STATIC PROBE ASSEMBLY

Attachment 11
P6

Attachment 11
p7

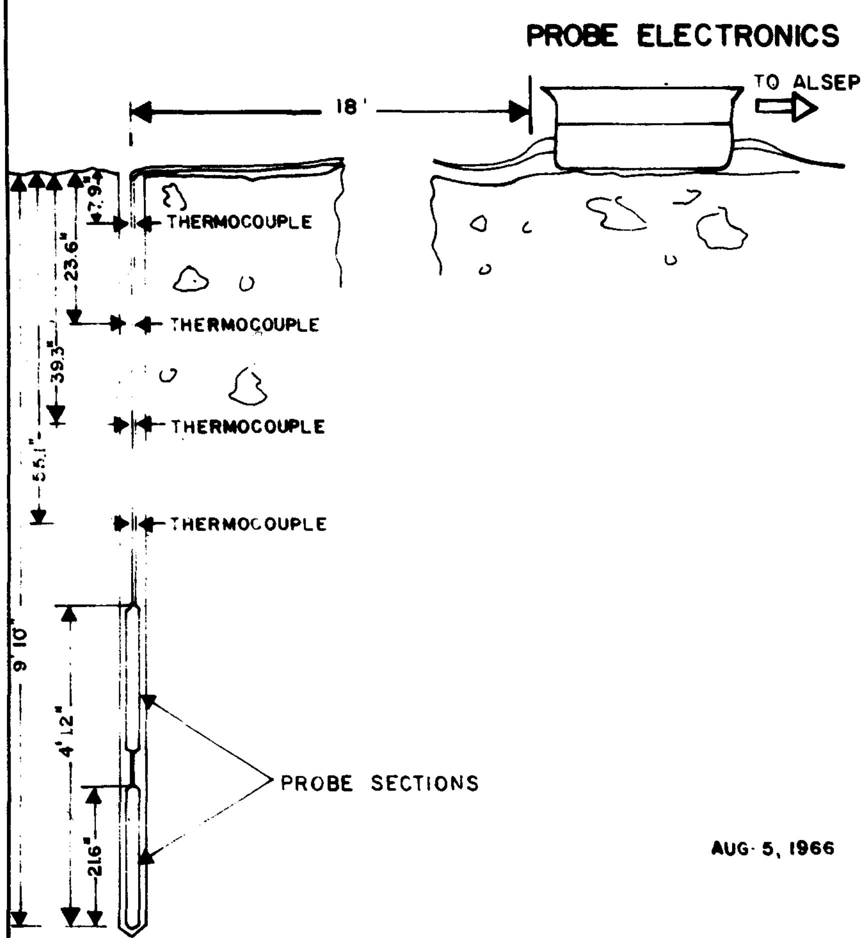

FIG. 2 HEAT-FLOW PROBE IN PLACE IN BOTTOM OF THREE METER HOLE: APPROXIMATE DISTANCES ARE SHOWN

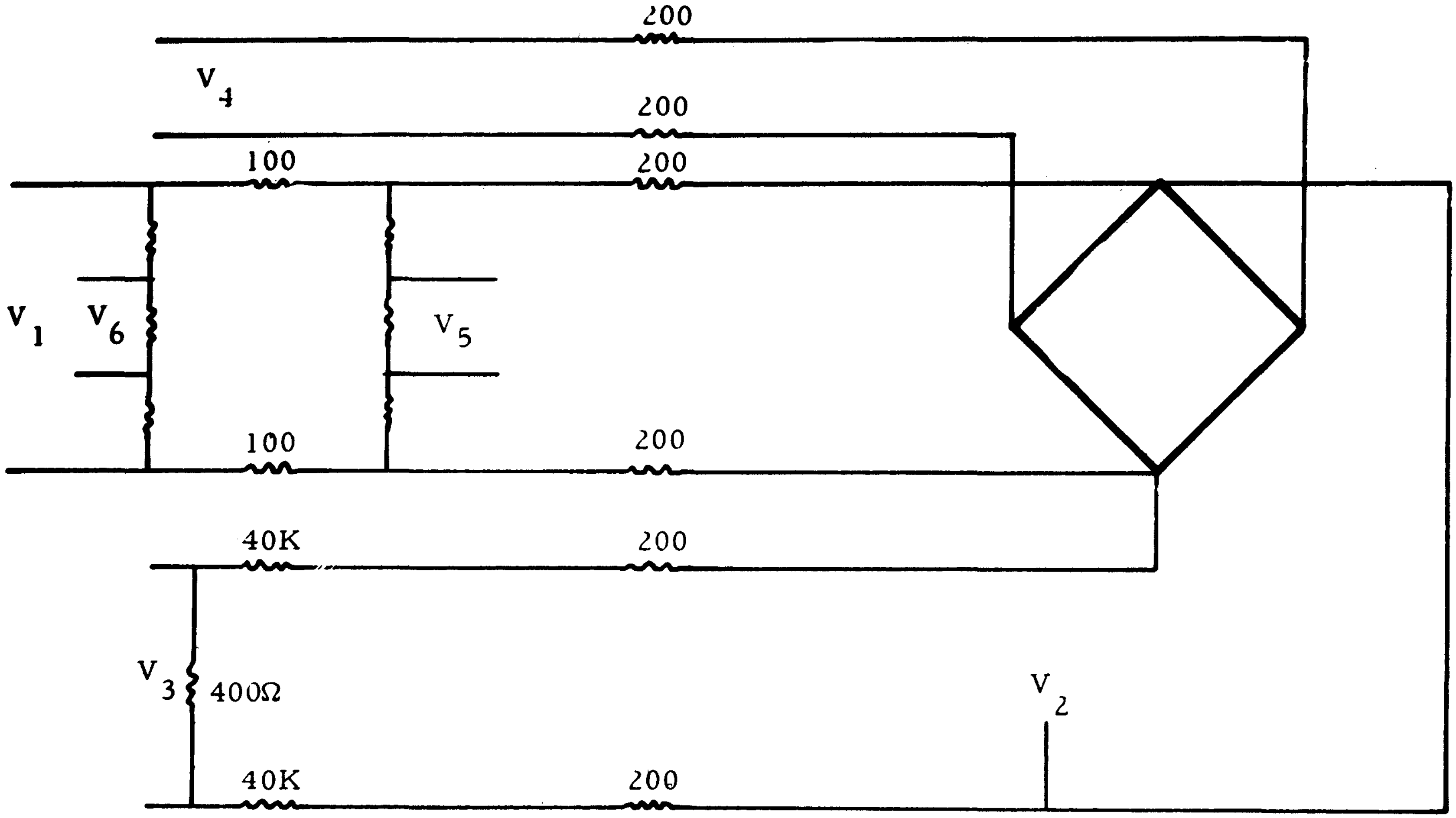

Figure 19 Proposed Bridge Circuit

Attach 11 P 8

MILESTONES - PAST 5 WEEKS

1. BRASSBOARD FABRICATION, TEST, AND DELIVERY
2. BREADBOARD TESTING IN PROCESS
3. ENGINEERING MODEL FABRICATION IN PROCESS
4. ELECTRICAL GSE DESIGN COMPLETE; FABRICATION IN PROCESS
5. MECHANICAL GSE DESIGN COMPLETE EXCEPT FOR HARD POINT MOUNTING DEFINITION; FABRICATION IN PROCESS
6. THERMAL DEVELOPMENT TESTS UNDERWAY
7. PRELIMINARY ASTRONAUT/FLIGHT SUIT TESTS COMPLETE

Attachment 12
page 1

MILESTONES EXPECTED - NEXT 5 WEEKS

1. ALSEP/LSM BRASSBOARD TESTS COMPLETE
2. BREADBOARD TESTING AT AMBIENT TEMPERATURE
3. ENGINEERING MODEL DEBUGGING IN PROCESS
4. PROTOTYPE FABRICATION START
5. THERMAL DEVELOPMENT TEST COMPLETE
6. GSE #1 COMPLETE
7. GSE #2 FABRICATION COMPLETE; TESTING IN PROCESS

Attachment 12
page 2