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

JUL 13 1966

IN REPLY REFER TO: EX22/7-13/L145

TO : See list attached

FROM : Project Officer, ALSEP

SUBJECT: ALSEP Interface Meeting

Enclosed is a copy of the minutes and presentation material of the July 7, 1966, "Interface Meeting on Apollo Lunar Surface Experiments Program" for your review and retention.

James C. Church

Enclosure

Data Bank
ALSEP papers
ESA

MINUTES

INTERFACE MEETING ON APOLLO LUNAR SURFACE EXPERIMENTS PROGRAM

July 7, 1966

The third Apollo Lunar Surface Experiments Program Interface Meeting was held at NASA's Manned Spacecraft Center on Thursday, July 7, 1966. The list of attendees is attached. Following a few introductory remarks by R. O. Piland, chairman of the meeting, and R. E. Vale, the status of ALSEP contracts was presented by J. C. Church. It was stated that all ALSEP contracts which were planned to be initiated during this period have been awarded except for the Lunar Surface Camera and the inter-organizational agreements between MSC and USGS for the services of Dr. E. Shoemaker, Principal Investigator for the Lunar Geological Equipment Experiment. Future planned contracting activity was stated to be (1) a potential hardware contract for the Heat Flow Experiment following the 11-week design-definition study being performed by Bendix Systems Division, which is scheduled for completion during the middle of August, (2) a dual negotiation for the Lunar Drill, which will be conducted with Northrop and Martin beginning August 22, 1966, with the winner of this contract to be recommended for the Phase D contract, and (3) completion of a dual study being performed by the AEC (Y-12) and an inhouse MSC group for the Sample Return Containers. This evaluation is anticipated to begin approximately July 20, 1966, upon receipt of proposals from these two organizations. The chart that was shown dealing with contract status is attached to these minutes.

Dr. Robert Kovach, Principal Investigator of the Active Seismic Experiment, made a presentation on the status of his work being performed under the contract at Stanford University. In the Active Seismic data formating using the 10,600 bits per second transmission rate, Dr. Kovach feels the amount of synchronization presently planned is excessive. He feels that if the synchronization cannot be lessened, a new format relocating portions of the synchronization is desired. An action item was established to analyze this matter (See attached). Dr. Kovach announced that he was incurring a

three-week slip in his breadboard schedule due to the limitations of communication between Bendix and himself. During this presentation, Mr. Piland stressed that the requirements of all Principal Investigators should receive the utmost attention by Bendix in attempting to satisfy them. Mr. Piland also stressed the fact that dual directions being pursued by Dr. Kovach's subcontractor (Develco) and Bendix should be merged as effectively as possible. During Dr. Kovach's presentation, an action item was established between Bendix and MSC on the matter of investigating experiment test data processing (see attachment). Copies of the slides presented by Dr. Kovach are attached to these minutes.

Captain O'Bryant asked Dr. Kovach if he had information pertaining to Bendix planning for his experiment including a copy of their master schedule. Dr. Kovach stated that he did have this data. In response to a question from Mr. Piland regarding the staffing situation at Bendix for the Active Seismic Experiment, Mr. Clayton (BSD) stated that the previous under staffing situation at Bendix has been corrected.

Dr. John Freeman, Rice University, the Principal Investigator for the Suprathermal Ion Detector Experiment, made a presentation in regard to the status of his contract for this GFE experiment. The first portion of this presentation was made by Mr. Thomas of Marshall Labs, the Rice University subcontractor for the experiment. A copy of the slides presented by Mr. Thomas are attached to these minutes. In answer to a question by Mr. Piland, Mr. Thomas stated that he expects the peak labor force at Marshall approximately 43 people, which would occur in the fall of this year. Mr. Thomas stated that the present manning level was at approximately 25 people. In answer to a question regarding EMI which arose at the Second ALSEP Interface Meeting on June 2, 1966, Mr. Wiseman furnished to Dr. Freeman an advance copy of a letter being processed to him pertaining to EMI specifications. This letter contains information regarding waivers being granted to Dr. Freeman's experiment

on this subject. Mr. Wiseman further stated that a letter containing the interpretation of the EMI specifications as applicable to the ALSEP program was being processed and would be forwarded to all Principal Investigators of ALSEP experiments. Dr. Freeman stated that documentation references contained in his contract caused a need for him to obtain these reference documents. An action item was established to provide these documents to Dr. Freeman (see attachment). During Dr. Freeman's presentation an extensive discussion arose in regard to the systems testing and KSC testing planning for the ALSEP as related to the SIDE experiment. Bendix personnel stated that systems test results would be recorded and at any time the resulting tapes could be re-analyzed for any specific piece of data applicable to this or any experiment. An action item was established on this matter (see attachment). Dr. Freeman presented information which he had acquired on the Teledyne latching relay which was being utilized as a circuit breaker switch by Bendix for this experiment. Dr. Freeman stated that there has been a long failure history associated with this part and that apparently quality control practices being applied to this part were questionable. During the Bendix portion of the Meeting, Mr. L. Lewis gave a status in regard to this Teledyne part and stated that earlier this year there had been a history of failure and problems. However, within the past few months, this part has been redesigned and has now been found to be acceptable to the users of this part which include Goddard Space Flight Center, the Navy's Bureau of Ships, and several others. Mr. Lewis referenced Goddard personnel (Mr. Harry Moore and Mr. George Kambros). An action item was established (see attachment). Dr. Freeman also stated that he desired to have redundancy in this circuit breaker switch. During Dr. Freeman's presentation, a question came up regarding the current monitoring being provided by Bendix for each experiment. It was determined that the situation pertaining to whether individual current monitors are being provided on each experiment or at the total experiment load level should form a part of the design review being conducted at Ann Arbor by Bendix during the week of July 11. Dr. Freeman also requested assistance

from J. Clayton in regard to the delivery of Channeltrons from Bendix Research Division. Mr. Clayton stated that he would investigate and assist Dr. Freeman in obtaining these parts. Dr. Freeman questioned Bendix as to whether or not they were using a backup turn-on timer for each experiment. J. Clayton stated that they were against using a turn-on timer for each instrument because of the complexities involved and that they felt the backup command system was enough redundancy for each experiment. Captain O'Bryant asked Dr. Freeman if he had received copies of the Bendix Management Control Plan for his experiment and the Bendix master schedule. Dr. Freeman stated that he has obtained these. At a later point in the meeting, Dr. Freeman confirmed the fact that Bendix intended to attend the SIDE Design Review which has been scheduled for July 25 at Marshall Labs at Torrence, California. Dr. Freeman asked for information in regard to the deployment sequence which would be contained in the ALSEP Mission Operation Plan. It was stated that the details of the deployment were still being evolved and that Dr. Freeman would be furnished information at such time as this information becomes available.

Dr. George Sutton deferred the presentation on the Passive Seismic Experiment to Dr. Gary Latham, who presented the status of the activity at Lamont pertaining to their contract on the Passive Seismic Experiment. Dr. Latham expressed dissatisfaction in regard to the benefits which were derived from the first month of work at Teledyne on the experiment and inquired in regard to the communication link between Bendix Systems Division and Teledyne. Mr. Clayton, BSD, stated that a resident BSD person has been located at Teledyne and that a Teledyne liaison person has been established at BSD in order to assist in the communication link between the two organizations. Dr. Latham asked for a direct copy of the monthly Teledyne Progress Report, to which Mr. Clayton agreed. Dr. Latham asked about the status of the material which is intended to be utilized for the engineering model of the Passive Seismic Experiment. He indicated that Teledyne's planning may be

for the use of aluminum rather than beryllium for this model. Mr. Clayton stated that he believed the requirements placed on Teledyne by BSD were that beryllium be employed but he would investigate. An action item was established on this matter (see attachment). Dr. Latham asked that BSD assist in Teledyne's expediting of the delivery of integrated circuits for the Passive Seismic Experiment model. Dr. Latham stated that there seemed to be some confusion at Teledyne in regard to the governing specifications for the work being performed by Teledyne to which Mr. Clayton stated that there should be no confusion in the mind of Teledyne and that he would investigate the matter and insure that confusion was dispelled on the matter. Dr. Latham asked that a better definition be established for the GSE which will be furnished with the engineering model and prototype models from Teledyne. An action item was established on this matter (see attachment). Dr. Latham asked for details pertaining to the analog data tape which will be delivered to Lamont following the receipt of lunar experiment data. An action item was established on this matter (see attachment). A question arose in regard to the control of heater power on an individual experiment basis. It was determined that this matter would be covered during the design review at Bendix in Ann Arbor during the week of July 11. Copies of the slides presented by Dr. Latham are attached to these minutes.

Mr. James Carroll of the GRCSW made a presentation on behalf of Dr. F. Johnson, the Principal Investigator of the Cold Cathode Gauge Experiment. Copies of the slides utilized by Mr. Carroll are attached to the minutes of this meeting. Mr. Carroll stated that he had not yet received copies of the Bendix master schedule. He was furnished a copy of this schedule at the meeting. Mr. Carroll stated that the major design problem being encountered on the Cold Cathode Gauge Experiment was that for the seal. Dr. Johnson stated that they were currently investigating several different designs for this seal and would present a progress report on this problem at the next interface meeting. Mr. Piland inquired as to the schedule consequences

of this seal problem and Dr. Johnson stated that as a last resort they would fly this experiment with only the protection of a dust cover.

Dr. Conway Snyder presented the status of the Solar Wind Experiment. Dr. Snyder stated that his current status is that the instrument is in the process of being breadboarded and that the preliminary design review for this experiment is scheduled for July 19, 1966. During Dr. Snyder's presentation an action item was established pertaining to the handling of systems test data (see attachment). During Dr. Snyder's presentation an extensive discussion arose in regard to the types and levels of thermal, altitude, and solar tests to be performed by BSD at qualification testing and acceptance testing. Mr. Schorken of BSD attempted to explain the current planning being performed by BSD during these tests. An action item was established in order to furnish to each Principal Investigator copies of the Bendix documents which contain test planning data (see attached). During this presentation, a discussion arose regarding the capability of the systems test set to checkout each experiment. An action item resulted from this discussion (see attachment). Dr. Snyder stated that the current power consumption of the Solar Wind Experiment is a peak of 6 watts with a $4\frac{1}{2}$ watt average consumption. Dr. Snyder also questioned the current planning in regard to the stopping and re-starting of the experiment's clock, when the clock is designed to operate continuously to exceed 500 hours. Mr. L. Lewis of BSD explained that the only stop-start situation which would be applicable is pertinent to heater power and with the Solar Wind Experiment not utilizing any heater power, the clock would not be subject to being turned off. Dr. Snyder asked for additional detail regarding tape data which resulted in an action item (see attachment). Attached to the minutes of this meeting is the test philosophy presented by Dr. Snyder.

On behalf of Dr. Charles Sonett of Ames, Mr. Herb Cross presented the status of the Magnetometer Experiment. The first portion of this presentation was a discussion conducted by Dr. Rose of Philco, whose slides are attached to the minutes of this meeting. Following Dr. Rose's presentation Mr. Cross continued with the discussion of the Magnetometer experiment and requested approval from MSC on the dust coverage assumptions which had been described by ARC as the basis for their thermal calculations. An action item resulted from this discussion (see attachment). Mr. Cross stated that the preliminary design review for the magnetometer experiment was scheduled for July 14, 1966, at Philco in Palo Alto, California. Mr. Cross described the situation whereby he obtained the agenda for this meeting late (July 6). (It should be noted that the agendas were mailed to all Principal Investigators Air Mail June 27, 1966.) Mr. Piland stated that, henceforth, the agendas for subsequent meetings would be attached to the minutes of preceding meetings and that this would constitute a notification for this meeting. Mr. Piland also stated that in the event that any participant of the meeting wished to make an entry for the agenda for the next meeting, that he should contact Mr. J. C. Church by phone (HU 3-5243) at MSC prior to the receipt of meeting minutes with the attached agenda. The test philosophy being employed by ARC on this experiment is an attachment to the minutes of this meeting. During his presentation, Mr. Cross stated that the current estimate for their delivery of the engineering model of the Magnetometer Experiment is approximately two weeks behind schedule. Mr. Cross also entered into a discussion of the various levels and types of tests to be performed as part of Bendix qualification testing and acceptance testing. Previous minutes of other presentations describe the action items pertinent to this subject. Dr. Rose of Philco asked about the sun angles which should be utilized in the design of the Magnetometer Experiment. Mr. Wiseman stated that the current BSD planning is that deployment sun angles are in the range of 7 to 20 degrees and the design limit is 45 degrees. As a result of a discussion on the lunar surface

deployment planning an action item was established (see attachment). During Mr. Cross's presentation, John Driscoll of GAEC stated that vibration level specifications applicable to the ALSEP scientific equipment were in the process of being reduced and that revisions to applicable documents were being forwarded to MSC and Bendix. Ames and Philco personnel expressed great interest in obtaining revisions to the vibration specifications as applicable to the Magnetometer.

Dr. Marcus Langseth presented the status of the Heat Flow Experiment as related to the 11-week design-definition study being performed on this experiment. Dr. Langseth stated that he felt that MSC should implement on an immediate basis conclusive results of this study phase as they evolved during the study phase rather than wait for a final report at the end of this period. Dr. Langseth stated that he was attending the Drill Review Meetings which were to be held with Northrop and Martin during the week of July 11. Dr. Langseth also requested that MSC consider establishing an almost day-to-day liaison between his group at Lamont with BSD with regard to the astronaut interface for his experiment. Mr. Clayton stated Dr. Langseth should feel free in order to establish communication links with BSD personnel for this purpose.

On behalf of Dr. Brian J. O'Brien of Rice University, the Principal Investigator of the Charged Particle Experiment, Dr. John Freeman read a statement from Dr. O'Brien. This statement is attached to the minutes of this meeting.

Following lunch, Mr. Robert Piland described the activities of the two groups that have been established at MSC for the purpose of simulating lunar surface astronaut activities. He described the first group headed by Dr. Ted Foss as a planning group which is responsible for the identification of activities and plans for a simulation program. The

second group, headed by W. E. Feddersen, is responsible for the implementation of the planning group. The responsibility of this group is to determine whether or not the astronauts can in fact perform the tasks as idenified by the planning group and to establish the time line for this activity. Mr. Piland stated that Dr. Foss would be presenting a report at subsequent Lunar Surface Experiment Meetings and the minutes of the two simulation programs meetings would be distributed to BSD and all PI's as they occur.

The presentation on the Lunar Geological Field Experiment was given by Dr. Shoemaker of the U. S. Geological Survey. Dr. Shoemaker stated that the contract status of equipment supporting the experiment had been presented earlier by Mr. Church and that the contracts had not progressed to the point where equipment status is available. Dr. Shoemaker expressed some concern over the continual downgrading of the experiment, mentioning the recent deletion of the scientific stereo camera as an example. He noted that the Field Geological Experiment is the one experiment which utilizes the astronauts scientific skills and that, at present, the experiment has been downgraded to the point that we are collecting about 1/10 of 1% of the data which could be acquired.

Several attendees to the meeting combined in presenting to the group some of the results of the Surveyor Program. Mr. Ed Chandler of JPL represented Dr. D. LeCroissette and introduced Mr. J. Waters of Hughes, who described some of the significant Surveyor mission profile data. Mr. Waters described the flight as nominal with no major problems. A quick-look flight report of Surveyor I was submitted to Mr. Church, which is available upon request. Mr. Church submitted to all PI's Surveyor data as requested in the last Interface Meeting. JPL has published a NASA report SP-126 which is a preliminary five day report discussing the Surveyor I facts. Mr. J. Dragg, MSC, discussed the Surveyor TV data

analysis. His presentation material is enclosed. Mr. B. Vogt's presentation material is also enclosed.

D. Wiseman, MSC Experiments Program Office, presented a summary of the ALSEP interface. He summarized the status of ICD's generated by Grumman, Bendix and North American. In addition, an explanation of outstanding NAA ICD's was given. Mr. Wiseman also presented a summary of Design Review plans and mentioned the agenda for the Preliminary Design Review (PDR) on July 11 and 12, 1966. This agenda is generally as follows:

JULY 11:	9:00 AM	Convene with opening comments by Bendix and MSC regarding objectives and detailed plans for the PDR.
	9:30 AM	Design Review
JULY 12:	9:00 AM	Design Review continues
	12:00 AM	Convene Design Review Board
	5:00 PM	Adjourn

Mr. Wiseman's presentation material is enclosed. Mr. Piland requested that each PI or his representative attend these reviews if at all possible.

Mr. J. F. Clayton, Bendix, presented the status of the Interface Control Specifications on the ALSEP Program. Mr. Clayton introduced Mr. L. Lewis who presented Bendix flat cable test results and their deployment. Mr. Clayton then presented the ALSEP power vs time profile curves which had been prepared by Bendix. The material presented by Mr. Clayton and Mr. Lewis are attached to the minutes of this meeting. In addition, Mr. Lewis distributed to each of the Principal Investigators and other meeting personnel the Bendix flat conductor cable report (ATM 335), which is a preliminary report dated July 5, 1966. Mr. Lewis also discussed the flat conductor cable bobbin design and displayed models of a 30 foot cable bobbin and a 50 foot cable bobbin and discussed some of the sources of both connectors and bobbins.

Mr. Charles Beers, MSC's Flight Control Division, made a presentation on the operational support of ALSEP. The slides utilized by Mr. Beers are contained as attachments to these minutes. Mr. Beers stated that a general plan is in production now and should be completed for distribution by July 11, 1966. Mr. Piland requested that this report be distributed to the Principal Investigators of ALSEP Experiments and BSD. Mr. Beers stressed the importance of looking at the real time recording requirement of the ALSEP during the first 45 days of operation as related to the commitment of full time computer facilities. It was stated that the current requirements of ALSEP are for this 45 day real time recording, however it would be reviewed between now and September 30 which is apparently a critical date for determination of the requirements in order to provide facilities to implement the requirement.

Mr. John Driscoll of GAEC presented the status of LEM/ALSEP interface. The slides presented by Mr. Driscoll are attached to the minutes of this meeting. Mr. Driscoll stated that GAEC would be able to provide a set of struts to BSD by August 15, 1966, provided that GAEC received an authorizing TWX from MSC. Mr. Wiseman stated that the TWX was in the LEM Project Office in process to GAEC. During the presentation GAEC and MSC personnel agreed to a July 22 meeting for the purpose of reviewing and signing off the mechanical ICD for the LEM/ALSEP interface, LID-360-22809. A discussion resulted from this presentation in regard to the need for Grumman to obtain direction and the load which they should utilize in spacecraft testing for the 2400 watt hour connection in the LEM Descent Stage compartment. An action item resulted from this discussion (see attachment). As a result of Mr. Driscoll's presentation showing a number of open action items and approvals which are pending, an action item resulted (see attachment). Mr. Driscoll submitted the following drawings to BSD: LED-280-17710, 17625, 17624, 17739, 17627, 17628, 17607, 17884, 17708, 17887. At the same time the following ICD's were submitted to MSC: LIS-360-22101, -22102, -22102-3, -22301, -22301-1, -22302, -22303, -22303-1, -22304, -22304-1, -22305, -22305-5, -22501,drawing LID-360-22502.

Mr. A. Pitrolo of the General Electric Company made a presentation for Mr. W. Remini on the status of the SNAP-27 RTG. The slides which Mr. Pitrolo utilized are attached to the minutes of this meeting. During this presentation, discussion was entered regarding the relationship of instrumentation of RTG to the available output power. Mr. Wiseman stated that nominal output power should in no way be constrained by the availability of RTG instrumentation. It was pointed out by Mr. Pitrolo that real time advantage can be taken of the available output power by knowledge of the operating status of RTG. In addition, Mr. Pitrolo made mention of the desirability of diagnostic instrumentation for the RTG. These points were recognized by MSC.

Mr. Piland closed the meeting and stated that the next Interface Meeting will be held on August 11, 1966.

Robert O. Piland
Manager, Experiments Program Office

NOTE: It has been determined that rather than attach a tentative agenda to these minutes, a firm agenda will be forwarded to you on or about the 19th of July, 1966.

ACTION ITEMS

M60707-01M	MSC will analyze the total 10,600 bits per second data mode and propose any possible modifications to the format to improve the transmission of the Active Seismic Experiment Data. Dr. Kovach will be advised of the results of this analysis by July 21, 1966. Provider - D. Wiseman
B60707-02B	BSD to provide to MSC investigation report with resulting recommendations for enlarging and improving experiment test data processing by July 19, 1966. Provider - J. Clayton
M60707-03M	MSC to provide documentation to Dr. Freeman according to references contained in Dr. Freeman's contract by July 15, 1966. Provider - J. Church
M60707-04M	MSC will analyze the trade off factors as related to the processing of subsystems test data as it affects each ALSEP Experiment and will provide a report to each PI by July 28. Provider - D. Wiseman
B60707-05M	MSC to investigate the status of the magnetic latching relay (model 42) being utilized as a circuit breaker switch by Bendix as related to the SIDE experiment. Mr. Smith will report to both Bendix and Dr. Freeman in regard to his assessment of the situation as related to this part by July 14, 1966. Provider - E. Smith
B60707-06B	BSD to determine the use of beryllium for the engineering model of the PSE from Teledyne, and to report to Dr. G. Latham in regard to this matter by July 14, 1966. Provider - J. Clayton
B60707-07B	BSD to provide to Dr. Latham a definition of the GSE to be provided by Teledyne to support the engineering model and prototype models deliveries by July 14, 1966. Provider - J. Clayton

M60707-08M — MSC to furnish to Dr. Latham, Lamont, information regarding the details of the analog data tape which will be delivered to Lamont following their receipt of lunar data on the Passive Seismic Experiment by July 21, 1966.
Provider - D. Wiseman

B60707-09B — BSD to initiate a special meeting to be attended by representatives of each PI in order to discuss the handling of systems test data as related to individual experiments and the utilization of a team concept for the analysis of this test data. This meeting is to be based on a report scheduled for completion by BSD on July 18 and the meeting is tentatively scheduled for July 19, 1966.
Provider - J. Clayton

M60707-10M — MSC to furnish to each PI copies of the Bendix functional plan describing the activities to be performed by GSD under their contract. These documents to be furnished by July 29, 1966.
Provider - J. Church

M60707-11M — MSC to furnish to each PI a report regarding the capability of the system test set to check out the applicable experiment and the test plan which is intended to be performed at KSC by July 29, 1966.
Provider - D. Wiseman

J60707-12M — MSC to furnish to Dr. C. Snyder specific data format information on the bulk data which will be furnished to him by July 21, 1966.
Provider - D. Wiseman

S60707-13M — MSC to forward comments to H. Cross of ARC in regard to the dust coverage assumptions made by ARC as the basis of their thermal calculations by July 21, 1966.
Provider - D. Wiseman

S60707-14S — ARC to furnish to MSC the mission operation requirements (lunar surface) by July 14, 1966.
Provider - H. Cross

G60707-15M	MSC to forward TWX to Mr. John Driscoll, GAEC, in regard to the load GAEC should utilize in spacecraft testing for the power terminals of the LEM Descent Stage compartment by July 21, 1966. Provider - D. Wiseman
G60707-16M	MSC to schedule a meeting with J. Driscoll, GAEC, and other GAEC applicable personnel in order to resolve, approve and sign all outstanding documents by August 11, 1966. Provider - D. Wiseman

ATTENDEES

APOLLO LUNAR SURFACE EXPERIMENTS PROGRAM INTERFACE MEETING

July 7, 1966

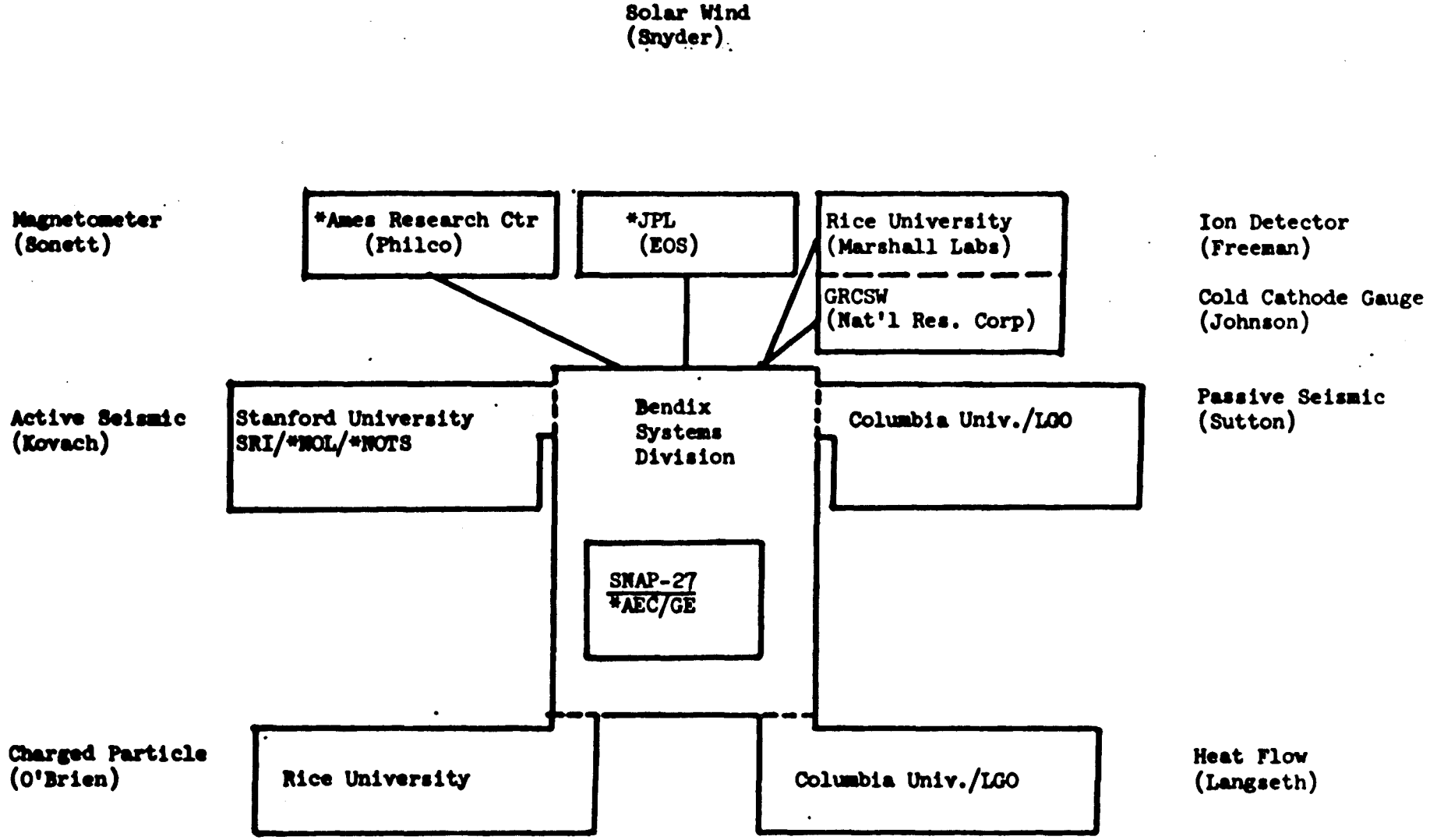
R. L. Kovach	Stanford Univ
J. H. Langford	MSC
W. T. O'Bryant	NASA Hqs
R. J. Green	NASA Hqs
H. W. Hinners	Bellcomm
A. Schwarzkopf	NASA Hqs
J. Driscoll	GAEC
O. Koontz	ARC
W. C. Remini	NASA/AEC
A. Petrilo	GE
G. V. Latham	Columbia Univ
G. H. Sutton	Columbia Univ
H. Cross	ARC
K. Rose	Philco
T. H. Foss	MSC
J. Dragg	MSC
P. E. Lafferty	MSC
C. T. Van Sant	Philco
C. E. Whitsett, Jr.	MSC
B. L. Sharpe	MSC
D. E. Evans	MSC
B. H. Hood	MSC
J. S. Gorman	MSC
J. Overton	MSC
A. B. Carraway	MSC
F. Griffin	MSC
K. J. Langenberg	LEC
B. H. Leach	MSC
F. Pearce	MSC
C. E. McCullough	MSC

W. N. Trahan	MSC
J. L. Cioni	MSC
R. O. Piland	MSC
Z. Eubanks	MSC
R. Longmire	MSC
M. E. Donnelly	Bendix
C. A. Beers	MSC
R. F. Martin	MSC
W. K. Stephenson	MSC
J. M. Sulester	MSC
E. M. Shoemaker	USGS
E. L. Weeks	MSC
C. E. Chandler	JPL
J. L. Waters, Jr.	Hughes
J. J. Thomas	Marshall Labs
J. W. Freeman	Rice Univ
T. J. Graves	MSC
W. E. Zrubek	MSC
E. Smith	MSC
W. A. Smith	Rice Univ
J. W. Small	MSC
R. A. Vogt	MSC
E. B. Hamblett	MSC
W. R. Durrett	KSC
P. E. Maloney	MSC
D. G. Wiseman	MSC
H. R. Greider	MSC
J. J. Fears	MSC
F. S. Johnson	GRCSW
J. M. Carroll	GRCSW
D. L. Purdum	Philco
W. D. Womack	MSC
J. F. Clayton	Bendix

D. Bitondo	Bendix
G. T. Burton	Bendix
J. E. Dye	Bendix
L. Lewis	Bendix
C. A. Schorken	Bendix
C. W. Snyder	JPL
D. Norris	JPL
E. V. LaFevers	MSC
P. D. Gerke	MSC
R. F. Irwin	MSC
A. Dennett	MSC
E. O. Zeitler	MSC
D. B. Cherry	MSC
H. J. Lowery	MSC
J. C. Church	MSC

ENCLOSURE

THE MATERIAL PRESENTED BY DR. KOVACH AND DR. FREEMAN WILL BE SUBMITTED TO ALL ATTENDEES AT A LATER DATE.



ALSEP CONTRACTS

*Inter-Organizational Agreements

LGE (Shoemaker/USGS)

1. Drill {Northrop / Martin}
2. SRC {Y-12* / MSC*}
3. Hand Tools-MSC*
4. Camera -

ALSEP ACTIVE SEISMIC EXPERIMENT

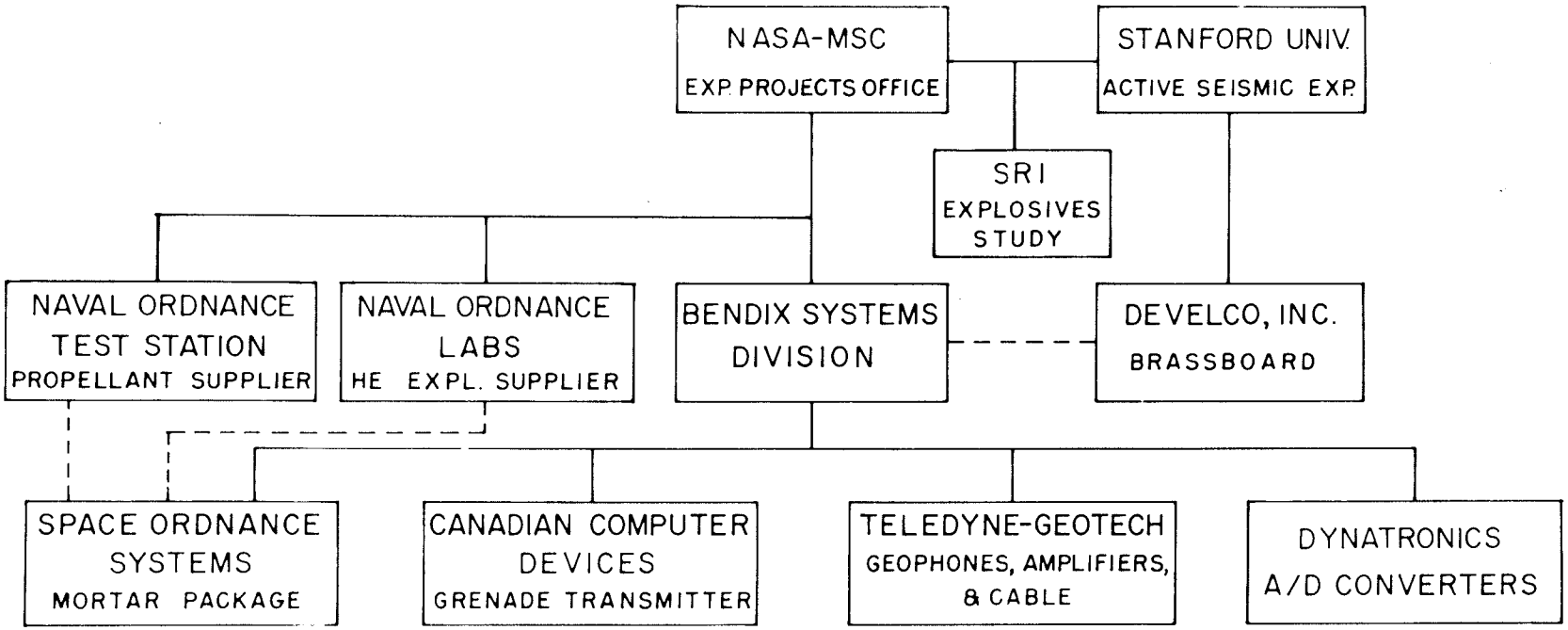
SCIENTIFIC OBJECTIVES

I. MEASURE NEAR-SURFACE ELASTIC PROPERTIES OF MOON

- a. Internal layering
- b. Isostatic compensation of topographic features
- c. Buried primordial lunar surface
- d. Properties of surface fragmental layer (Thumper)
- e. Buried ice layers
- f. Possibility of aseismicity
- g. Aids heat flow interpretation

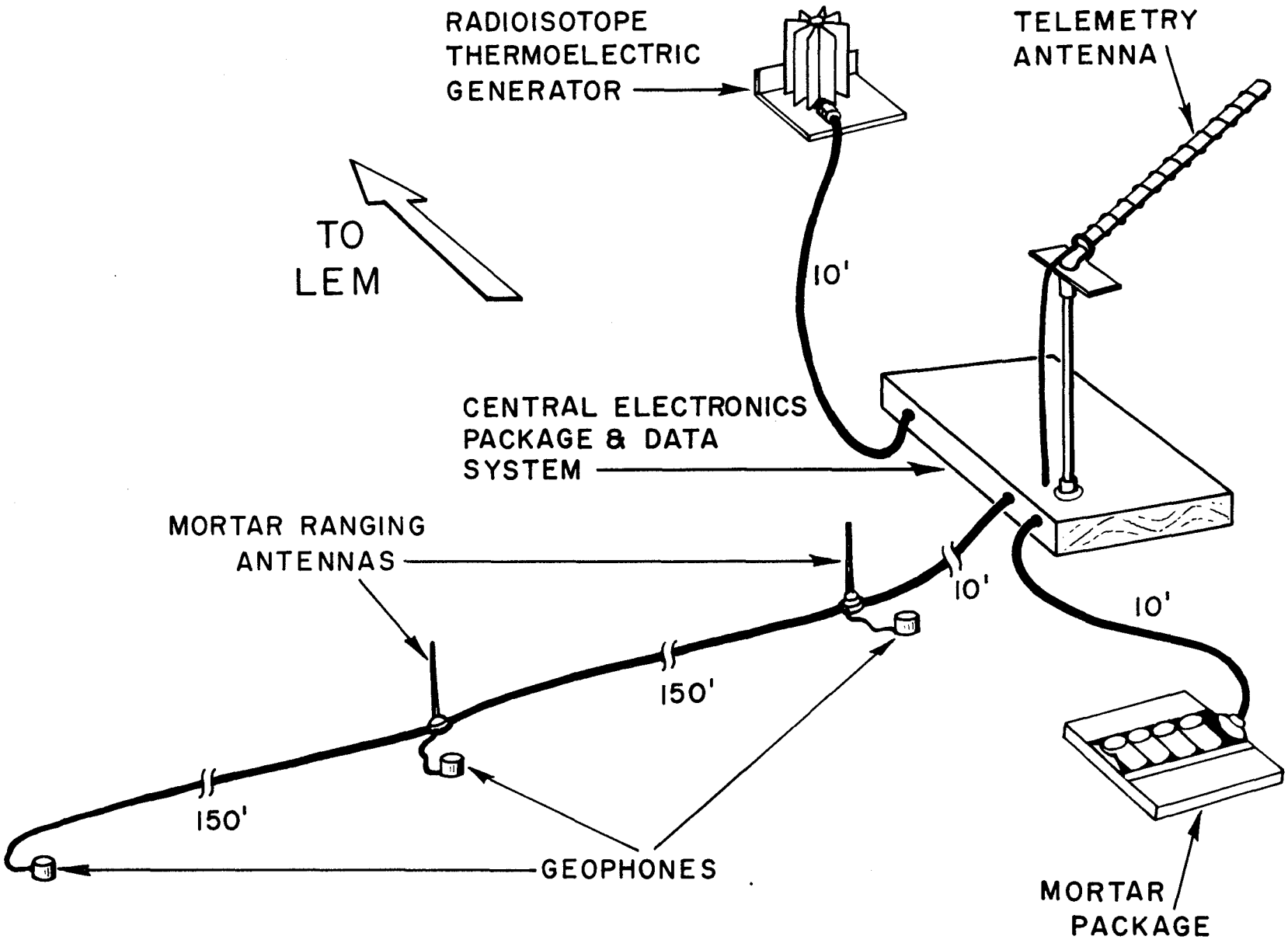
II. PASSIVE SEISMIC MODE

- a. High-frequency quakes
- b. Backup for Apollo passive seismic experiment



ORGANIZATION CHART

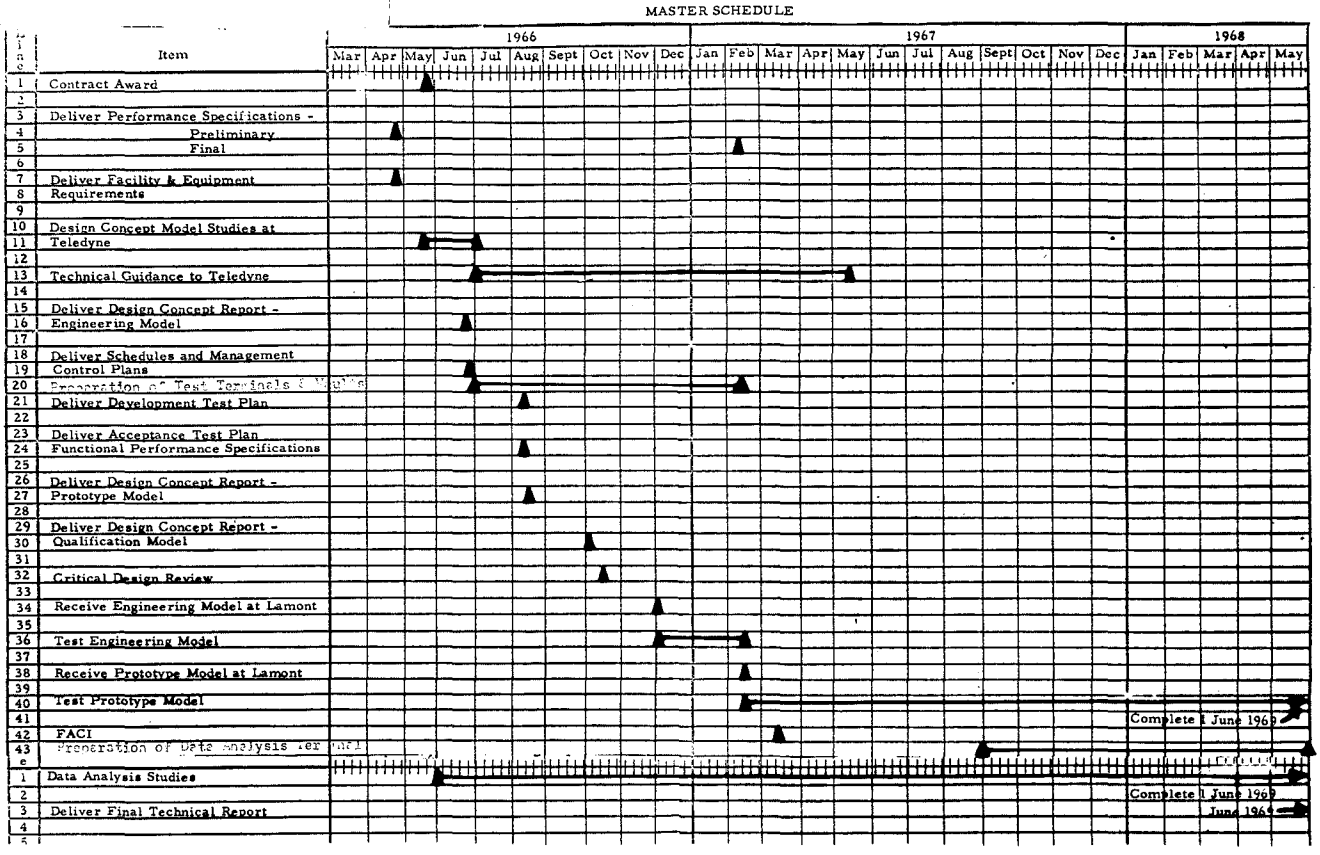
ACTIVE SEISMIC EXPERIMENT SUBSYSTEM



ALSEP ACTIVE SEISMIC EXPERIMENT

MANAGEMENT CONTROL PLAN SCHEDULE

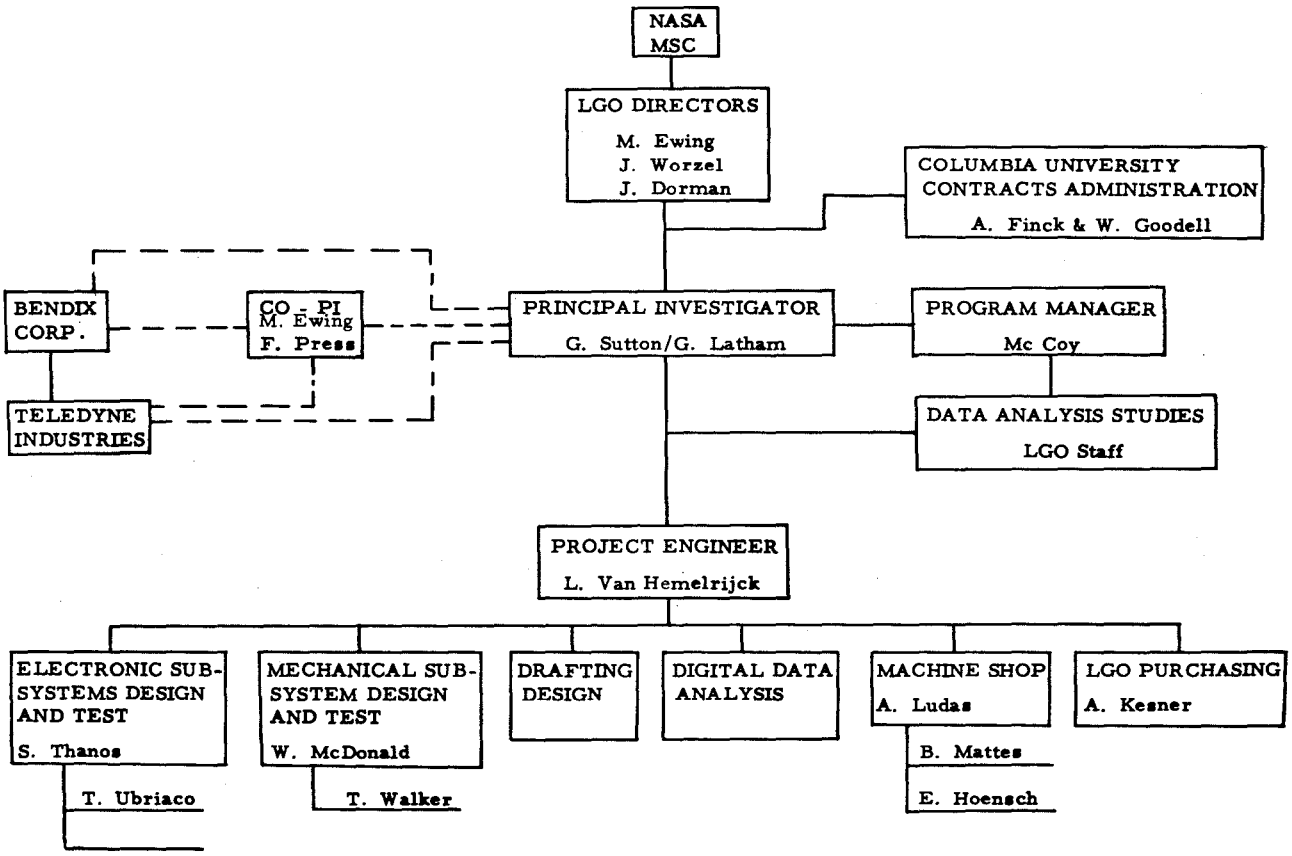
MASTER SCHEDULE



LAMONT GEOLOGICAL OBSERVATORY ORGANIZATIONAL CHART
FOR THE ALSEP PASSIVE SEISMIC EXPERIMENT

CONTRACT NAS 9-5957

JUNE 15, 1966



SUMMARY OF DESIGN CONCEPT SELECTIONS

SUSBYSTEM ELEMENT	SELECTED APPROACH
Level Sensors	Mercury level bubbles
Leveling Motors	Stepping motors
Leveling Mechanism	Gimbal
Short-period vertical component elastic suspension	Triangular cantilever leaf spring plus delta rods.
Long-period vertical component elastic suspension	Triangular cantilever leaf spring.
Long-period seismometer flexure points	Bendix cross-flexure hinges.
Method of calibration in earth g	Long-period components: remove 5/6 of each seismic mass. Short-period component: tilt so that only 1/6 g acts along the free axis.
Timer Mode of operation	Timer will turn on main power and uncage the instruments putting only the short-period component into operation. The second command - type pulse will be used to calibrate the system.
Back-up mode of operation	If fully qualified flight unit cannot be completed in time, the complete instrument will be sent with only the short-period component operational.

CCGE TEST PHILOSOPHY

1. Testing at NRC

A. Prototype, Qualification Model, and all flight units will be individually calibrated against an NRC modulated B-A gauge in the manner of Torny and Feakes.[1]

B. Two models will be calibrated in the NRC extreme high vacuum facility to less than 1×10^{-12} torr.

C. One qualification model will be environmentally tested by NRC.

D.

2. Testing at GRCSW

A. Extensive testing on GRCSW engineering model from 10^{-6} to 10^{-11} torr. This will be a long term test.

B. Spot checks of all calibrated units in GRCSW facility.

C. Operation of gauges and flight electronics to explore possible problem areas.

D. Testing of break-seal device to determine reliability.

3. Testing at Marshall Labs, Rice, Bendix and KSC.

These tests will be complete experiment tests and are incorporated in the SIDE test plan.

CCGE DATA REQUIREMENTS

All data requirements are integrated with SIDE.

Power and Weight Reduction Programs are integrated with SIDE.

1. 10th National Vacuum Symposium (1963), 208.

PRESENTED BY AMES ON THE LUNAR SURFACE MAGNETOMETER

ALSEP Interface Meeting #3

Tests in plant

- Functional Tests
- Solar Simulation Tests
  - Thermal Vac Tests
  - Vibration
  - Shock
  - EMI Curves
- Detailed Exp Tests
- Calibration

Test Requirements at BSD

Assumptions

1. LSM GSE to be paralleled with System Test Set
2. Definition of failure to be agreed upon

Tests

LSM Integration Test
LSM Detailed Exp Test

System Testing

Vibration (stowed in ALSEP compartment)
Shock (stowed in ALSEP compartment)

LSM Solar Sim (after shake and shock tests)
System Thermal Vac Test

Tests at KSC

Detailed Experiment test (with flux tanks) for 2 point calibration

Data Requirements during Test

Dependent upon ARC/WDL support during tests. If no ARC/WDL support, then will need as minimum 1 hour of test data transmitted to ARC.

Information Needs

Thermal Design Constraints, EMI REQUIREMENTS
Sun Elevation Angle
Landing
Deployment
~~Understand ARC to receive MCP's~~
LEM Vibration Levels

Bulk Data Requirements

All data merged
All scientific data as specified in Performance Specs
ALSEP Eng Data

1. Bus voltage
2. LSM bus current
3. Temperatures if limits known or design known
4. Uplink command receiver and decoder status

Astronaut Debriefing or communications link -- the level of the instrument when first placed on surface.

Other Data

Dust detector info
Measure of surface conductivity

Operational Plan

When will it be available

Will PI's be requested to submit requirements

Bendix

Individual current monitors for experiments

Timed commands from ALSEP (Dr. Freeman discussion)

COF — for your to read at V meeting

DEPARTMENT OF SPACE SCIENCE
Rice University
Houston, Texas

MEMORANDUM Date: 6 July, 1966

To: R. Piland, NASA-MSC

From: B. J. O'Brien, Rice BJO'B/fll

Subject: Report on status for ALSEP Interface Meeting July 7, 1966

1. Work on the Charged-Particle Lunar Environment instrumentation is proceeding at Bendix Research Lab and at Rice. The two major milestones achieved during June were

(a) Bendix and NASA reached agreement that a sixth or funnel channeltron be added to each pair of five channeltrons. This agreement took more than two months of time.

(b) Thereupon, the prime Rice contract NAS9-5884 was signed on June 22, 1966. Firm schedules and technical specifications, etc. were then rapidly defined.

2. Bendix Research Lab is gradually beginning to come up to speed after initial severe staffing and other problems. More effective communications were established among Rice and Bendix Research Lab and Bendix Systems Division. A major milestone was the Preliminary Design Review on July 6, 1966 at which time the completed Breadboard-Brassboard Design by Bendix was presented and discussed.

3. With the signing of the Rice prime contract, Rice was able to obtain Contracting Officer's approval to procure major equipment subsystems for the Rice calibration system. No significant schedule change was caused by this delay, and the major design of the system is essentially complete.

4. Rice will continue to develop the more critical electronic subsystems of the experiment in parallel with Bendix until Bendix actually produces significant hardware, probably at the engineering-model level. The two Rice subcontractors for the vital high-voltage switching power supply have both supplied a satisfactory breadboard and now a flight prototype. However, the preferred one failed to

meet the weight specifications of the prototype by about one pound and this is presently a critical area being examined jointly by Rice and Bendix. A parallel approach will be taken for at least two more months on this particular problem. Without significant modification to the present high-voltage supply, the total experiment weight would be eight ounces more than the allocated 4 1/2 lbs. It is believed by Rice that this ten percent overweight condition can be eliminated by careful and detailed attention to the individual parts' designs, without recourse to an untried Bendix design of a high-voltage switching power supply.

5. Preliminary experiment performance specifications will be signed off on schedule before mid-July.

cc: J. Church, NASA-MSC
R. Vale, NASA-MSC
J. Langford, NASA-MSC
Capt. W. O'Bryant, NASA-Hqs.
J. Ballentyne, Rice
J. Musslewhite, Rice

DR. CONWAY SNYDER

TEST PHILOSOPHY: Test in manner and to degree used in JPL projects and proved success in Rangers, Mariners, and Surveyors.

Calibrations

Temp: side-by-side sensors (8)

Current and voltage calibrations

Calibrations in accelerator: response in energy, angle

Qual testing (TA) shake, shock, accel (2 x flight) (Proto)

Acceptance Testing (FA) (1 x flight) (Engr model)

Thermal-vacuum testing: approach not stttled; control ave power

Space sim test to explore temperature gradients and define TA test limits

Mechanical model tests of deployment and leveling

Temperature model tests (Space General) to verify thermal calculations

10% overvoltage test to assure adequate margin in design

Engineering test: GSE operation; monitor calibrations and noise levels

At ALSEP Facility

Checks with GSE as above

System Test

Verify normal data under all operations

At KSC

Weight Reduction: -reduce sensor size; not very significant

-weight not firm yet

Power Reduction

Expect 6 w peak, 4.5 ave, Fairchild int cir, Reduced sensor size might reduce.

No additional power at night.

Some IC's may be run at 9v instead of rated 12v if tests show feasibility, Save $\sim \frac{1}{4}$ w.

Definition of "low-power mode" needed; turn-off not desired.

Data in System Test

SWS data, some housekeeping data, command verif data at all times for computer analysis

Display in block format -- proton, electron, calib.

SURVEYOR TV DATA ANALYSES

A. SURVEYOR SCIENTIFIC EVALUATION ADVISORY TEAM

B. JET PROPULSION LABORATORY

C. USGS

D. APOLLO PROJECT

E. LUNAR ORBITER PROJECT

F. LUNAR SCIENCE COMMUNITY

A. SURVEYOR SCIENTIFIC EVALUATION ADVISORY TEAM

a. PRELIMINARY REPORT 14 DAYS

b. FINAL REPORT 60 DAYS

B. JET PROPULSION LABORATORY

1. PHOTOGRAPHIC DIGITAL ENHANCEMENT

2. PHOTOMETRY STUDIES

3. COLORIMETRY STUDIES

4. TOPO-STATISTICAL ANALYSIS AND COMPUTER CONTOUR MAPPING

C. U. S. GEOLOGICAL SURVEY

1. IMPROVED PHOTO MOSAICS

2. TERRAIN PROFILES AND TOPO-MAPS

3. GEOLOGIC STUDIES

   a. SIZE, DISTRIBUTION, ORIGIN OF CRATERS

   b. SIZE, DISTRIBUTION, ORIGIN OF ROCKS

   c. STRATIGRAPHY

   d. PETROLOGY

   e. IDENTIFICATION AND DELINEATION OF GEOLOGIC UNITS

   f. CORRELATION WITH TERRESTIALLY OBSERVED UNITS

4. TERRAIN ANALYSIS STUDIES

   a. RELATION TO SURVEYOR LANDABILITY

   b. SURFACE ROUGHNESS CLASSIFICATION

   c. MICRO-RELIEF CLASSIFICATION

D. APOLLO PROJECT

1. EVALUATION OF DESIGN OF LM

2. IN CONJUNCTION WITH LUNAR ORBITER DATA, FOR EVALUATION OF POTENTIAL LUNAR LANDING SITES

E. LUNAR ORBITER PROJECT

1. CORRELATION WITH ORBITER PHOTOGRAPHS FOR EXTRAPOLATION OF SURVEYOR DATA TO OTHER AREAS OF THE MOON.

I

THE SURVEYOR I SPACECRAFT LANDED ON A NEARLY LEVEL PLAIN AT 2.4° S LATITUDE; 43.4° W LONGITUDE IN THE VICINITY OF THE CRATER FLAMSTEED.

THIS AREA OF THE MOON IS THERMALLY A BLAND AREA IN THAT NO THERMAL ANOMALIES ARE LOCATED NEARBY.

1) THE THERMAL PARAMETER $[(k\rho c)^{1/2}]$ IN THIS VICINITY BASED ON EARTH OBSERVATIONS IS ABOUT 800 IN CGS UNITS.

2) THE RANGE OF VALUES IN SUCH BLAND AREAS TYPICALLY 700 TO 1000.

3) THE LUNAR SURFACE TEMPERATURE FOLLOWED A COOLING CURVE AFTER SUNSET CONSISTENT WITH A THERMAL PARAMETER OF 1000.

4) EVACUATED POWDERS OF PLAUSIBLE COMPOSITION (E.G., 1 TO 25 MICRON TEKTITE) HAS A THERMAL PARAMETER IN THIS RANGE.

AVERAGE ALBEDO FOR THE REGION ESTIMATED AS 0.052 (AVERAGE FOR VISIBLE SURFACE .07)

II

POSTLANDING OBSERVATIONS OF SPACECRAFT TEMPERATURES INDICATE VALUES WHICH WOULD PREVAIL WITH UNDEGRADED SURFACE COATINGS.

THIS STRONGLY INDICATES ESSENTIALLY NO DUST ON THE SURFACES OF THE SPACECRAFT, AND TV PICTURES SUBSTANTIATE THIS INDICATION.

SOME SPACECRAFT TEMPERATURES ARE DETERMINED PRIMARILY BY HEAT EXCHANGE WITH A LIMITED AREA OF THE LUNAR SURFACE (1000 FT^2) AND WITH DEEP SPACE.

PRELIMINARY ESTIMATES OF LUNAR SURFACE TEMPERATURE BASED ON ONE SUCH VEHICLE SENSOR WITH A 31° SUN ELEVATION INDICATE 180°F COMPARED TO THE 130°F DERIVED FROM A SMOOTH MOON MODEL FOR THIS SUN ANGLE AND LOCATION.

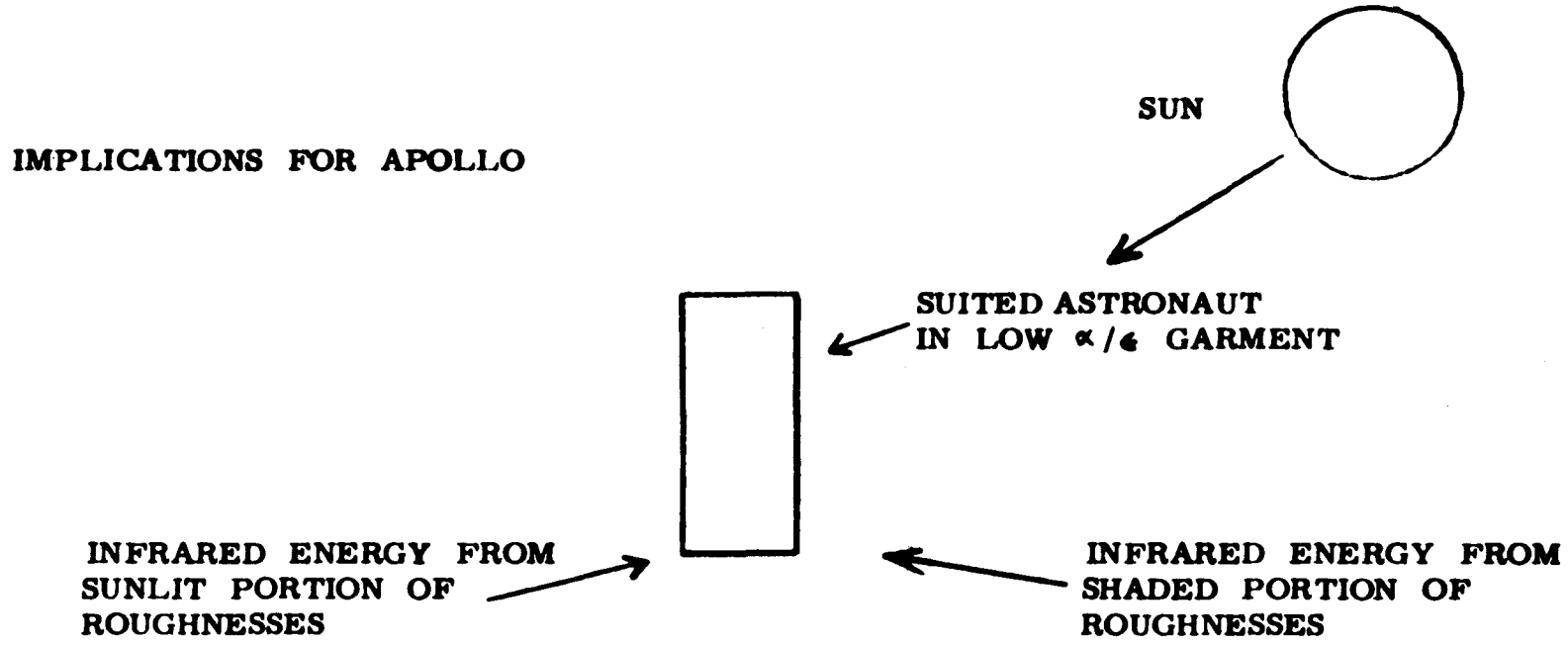
PREDICTIONS OF LUNAR SURFACE TEMPERATURE SHOWED ABOUT THIS VARIATION UNTIL NOON WHEN A 230°F TEMPERATURE (CONSISTENT WITH A SMOOTH MODEL) WAS INDICATED.

EARTH BASED OBSERVATIONS SHOW AS MUCH AS 100°F DIFFERENCE IN APPARENT TEMPERATURE BETWEEN OBSERVATIONS LOOKING ALONG THE SUN DIRECTION AND LOOKING INTO THE SUN.

THIS CAN BE EXPLAINED BY ROUGHNESSES OF CENTIMETER SCALE THE ILLUMINATED SIDE OF WHICH IS HOTTER.

LUNAR SURFACE TEMPERATURES INDICATED FROM NOON TO SUNSET (SENSOR LOOKING INTO THE SUN) AGREED WELL WITH THE SMOOTH MODEL.

IMPLICATIONS FOR APOLLO



DARK SIDE OF ASTRONAUT COULD ACTUALLY BE WARMER.

SNAP 27 MILESTONES

- PREPARED PHASES III AND IV PROGRAM PLAN
- RESOLVED ALL PROBLEMS LEADING TO ALSEP/SNAP 27 ICD
- COMPLETED SNAP 27 GENERATOR SYSTEM REQUIREMENTS FOR QUAL DESIGN FREEZE
- COMPLETED FUEL CAPSULE ASSEMBLY SYSTEM REQUIREMENTS SPECIFICATION
- AERO AND THERMAL TESTING COMPLETED FOR LFC
- BACKWARD STABILITY ELIMINATED FOR LFC
- LFC STAGE III RELEASE ISSUED
- LFC QUAL DESIGN FREEZE DELAYED 6 - 8 WEEKS
- LFC THERMAL DEVELOPMENT TEST EXPANDED TO SYSTEM INTEGRATION TEST
- LFC SUPER ORBITAL CAPABILITY EVALUATED
- THERMAL ANALYSIS COMPLETED FOR 104 COUPLE MODULES
- THERMOPILE CONTROL CIRCUITS AVAILABLE FOR 104 COUPLE MODULES
- PRESENTED SNAP 27 SAFETY PROGRAM TO NASA/AEC/SANDIA
- INTERFACES FOR SAFETY DATA IDENTIFIED
- BeO FOLLOWERS THERMAL PERFORMANCE EVALUATED
- BeO FOLLOWERS ADOPTED FOR GENERATORS
- MOLY FRAME/BN INSERTS ADOPTED FOR GENERATORS
- MOD I THERMAL AND MECHANICAL TESTING COMPLETE
- MOD I HERMETIC CLOSURE EVALUATION COMPLETE
- SHRINK FIT ASSEMBLY FIXTURES (MOD 5 - 8) COMPLETED
- MOD 5 PRACTICE SHRINK FIT
- INITIATED FHT REDESIGN
- SERIES I CAPSULE IMPACT PROGRAM COMPLETED
- SERIES II CAPSULE IMPACT TESTING INITIATED
- SERIES III CAPSULE MATERIAL ORDERED
- CAPSULE DISASSEMBLY PROCEDURES INITIATED
- COATING SPECIFICATIONS PREPARED
- COATING EVALUATION COMPLETED
- ELECTRIC CAPSULES QUAL SHOCKED AND VIBRATED
- DEVELOPMENT PROGRAM ON HEATERS 80% COMPLETE

ICD ACTIVITY AND STATUS

1. IDENTIFIED PROBLEMS AT LAST ALSEP MEETING

2. FORWARDED SNAP 27 ICD DRAWINGS TO BENDIX - JUNE

3. MET IN ANN ARBOR - JUNE 8

   FREE EXCHANGE OF DATA
   EXACT PROBLEMS QUANTIZED
   PROVIDED VERSION OF ICD BASED ON BENDIX FORMAT
   RECEIVED 6 PHASE II ALSEP DOCUMENTS

4. MET IN ANN ARBOR - JUNE 15

   NASA/AEC PARTICIPATION

   PROBLEMS RESOLVED

ENVIRONMENTS	GENERATOR PERFORMANCE
CABLE	FUEL CASK TEMPERATURE LIMITS
THERMAL INTERFACE	RELIABILITY

5. RELIABILITY MEETING - GE/BENDIX - JUNE 22

   EXCHANGED DATA

   EXPLAINED APPROACHES

   ESTABLISHED DOCUMENT EXCHANGE BASIS

6. ICD DATA GENERATED AND/OR SUBMITTED BY GE

   SYSTEM NATURAL FREQUENCIES
   HONEYCOMB CONDUCTANCE ANALYSIS
   PERFORMANCE CURVES FOR ICD
   PERFORMANCE WRITE-UP FOR ICD
   BERYLLIUM MATERIAL PROPERTIES AT TEMPERATURE
   SNAP 27 SYSTEM SPEC
   SNAP 27 ENVIRONMENT AND TEST SPEC
   DERIVATION OF SNAP 27 DYNAMIC ENVIRONMENTS
   TRANSIENT CHARACTERISTICS OF IPJ
   CONDUCTANCE OF PALLET NO. 2

7. ICD PREPARED BY BENDIX

OTHER MEETINGS

- **SAFETY KICK-OFF MEETING** - JUNE 6
  - OUTLINED SNAP 27 SAFETY PROGRAM
  - ESTABLISHED PROCEDURES FOR OBTAINING DATA
  - INTERFACES DELINEATED
  - FORWARDED 5 COPIES OF:

    SNAP 27 COMPONENT CONSTRAINTS

    RADIOLOGICAL PROCEDURES

    NORMAL
    EMERGENCY

    GE IN-HOUSE PROCEDURES
- **SNAP 27 MONTHLY MEETING** - JUNE 21
  - INFORMAL MEETING
  - DETAILED PROGRAM REVIEW
- **BENDIX DESIGN REVIEW** - JUNE 27
  - PCU REVIEW
  - THERMAL INTEGRATION OF LFC
  - EVALUATED FLIGHT HANDLING TOOL PROBLEM

LFC THERMAL TEST

SCHEDULE OF LTA-8
STATUS OF FLT 503
} INCREASES EMPHASIS OF SNAP 27 TEST

RESCHEDULED TEST (DELAYED 8 WEEKS)

SINK DEFINITION	-	JULY 22
INTERFACE DEFINITION	-	JULY 22
TEST PLAN	-	AUGUST 15
HARDWARE AVAILABLE	-	SEPTEMBER 1
TEST START	-	SEPTEMBER 15

PARTICIPANTS

GRUMMAN	GE
BENDIX	NASA

TEST INTEGRATION - NASA - J. CIONI

TEST OBJECTIVES:

PROOF OF DESIGN

EVALUATION OF ALTERNATES

SNAP 27 PROBLEM AREAS

LFC INTEGRATION

- CURRENT DESIGN MARGINS MAY BE NEGATED
  - HIGH INTERNAL TEMPERATURES
  - HIGH DYNAMIC LOADING
- INTEGRATION ANALYSIS AND TRADE-OFFS NOT COMPLETE
- IMPACTS ELECTRIC CAPSULE DESIGN (BEING QUALED NOW)
  - HEATERS FOR QUAL PROGRAM
  - HEATERS FOR M-5
- IMPACTS FUEL CAPSULE ASSEMBLY DESIGN
  - LINER TEMPERATURE
  - LINER STRENGTH
- IMPACTS ON SAFETY PROGRAM
  - REENTRY TEMPERATURE MARGIN
  - FUEL FINES GENERATION (SAFETY TEST CONDUCTED BY MOUND)
- PROGRAM SCHEDULE MARGINS ELIMINATED BY DELAY IN QUAL RELEASE (SEPT 15)
  - UNCOUPLES THERMAL TEST TO DESIGN CHANGE
- REQUIRES THOROUGH INTEGRATION
  - EMPHASIS ON LOW TEMPERATURES AND LOADS
  - DEVELOPMENT OF MAXIMUM KNOWLEDGE OF HEAT SINK LIMITS
  - DESIGN AND TEST OF ALTERNATE SHIELDS

DELIVERABLE HARDWARE

- M-4 FOR LTA-8 REQUIRES RESOLUTION
  - INSTRUMENTATION LIMITS
  - SCHEDULE (AEC/NASA)
- M-5 FOR FLIGHT 503
  - ACTIVE/PASSIVE
  - INTERFACE
  - INSTRUMENTATION

INSTRUMENTATION REQUIREMENTS

ORIGINAL REQUIREMENTS SEP STUDY NASA CONTRACT 9-3901

SNAP 27 SYSTEM SPEC NS0010-02-18

3 HOT FRAME TEMP	1 SEMI-CONDUCTOR HEAT SINK
3 COLD FRAME TEMP	1 GENERATOR OUTPUT VOLTAGE
	1 GENERATOR CURRENT
	1 PCU OUTPUT VOLTAGE
	1 LOAD CURRENT

ALSEP TO PROVIDE TEMP REF, SIGNAL CONDITIONING, ETC.

FIRST REVISION: SNAP 27 INSTRUMENTATION RESTRICTED TO

HOT AND COLD FRAME TEMPERATURES

PCU TO NASA

ALSEP TO PICK-UP DELTA INSTRUMENTATION

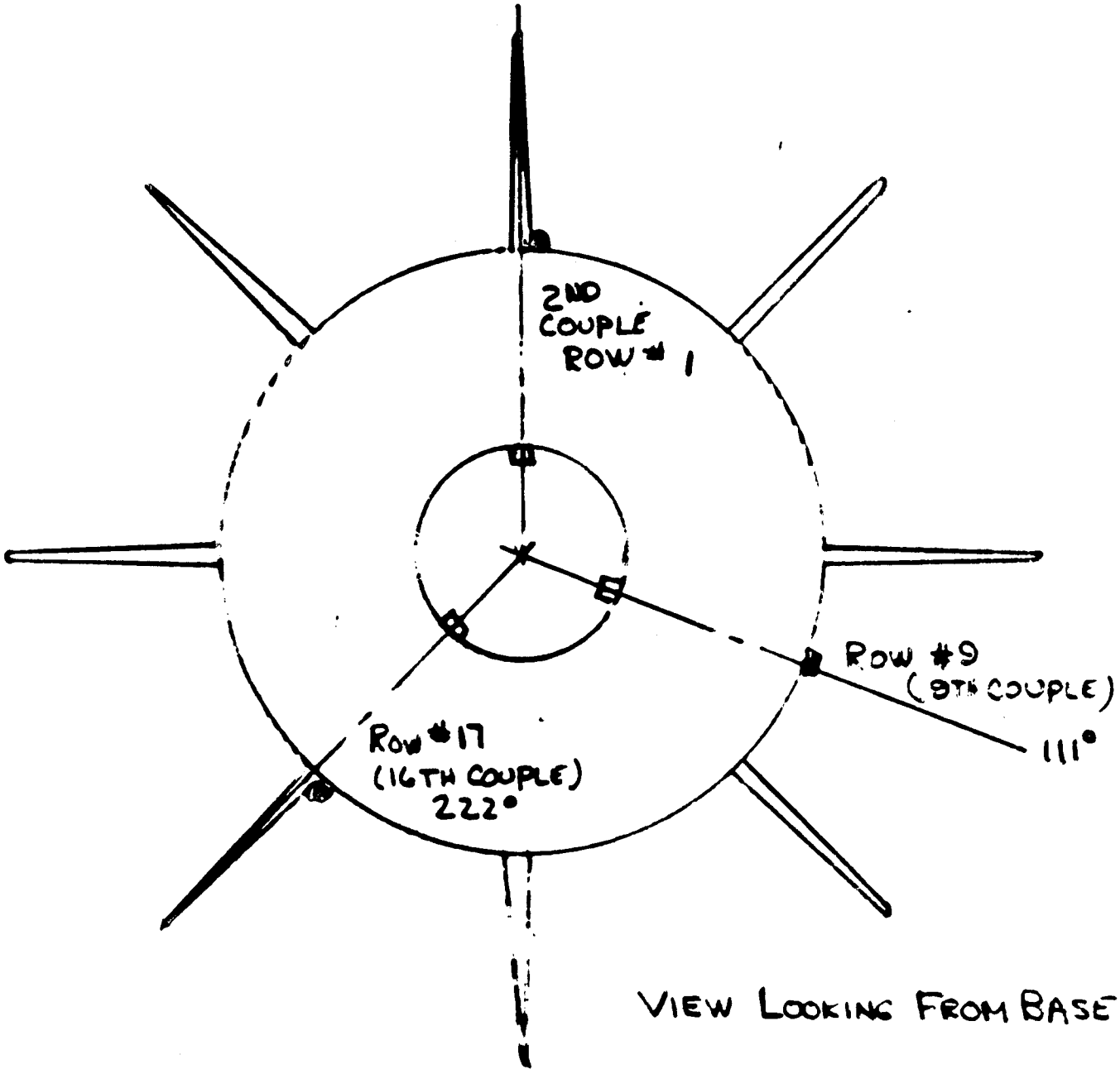
SECOND REVISION: REQUESTED TO EVALUATE PLATINUM RESISTANCE THERM. (RTD)

ELIMINATES: AMPLIFIERS

TEMP REFERENCE

RTD ADOPTED FOR SNAP 27

INSTRUMENTATION - FLIGHT UNITS



PLATINUM RESISTANCE THERMOMETERS (RTD)

SOURCE WINSCO

CONSTRUCTION. .1" x .25" x 3" BACKFILLED WITH He AND O_2

1 MIL DIA PURE PLATINUM WIRE TWO WIRE SYSTEM

SPIRAL WOUND ON CERAMIC MANDREL

PERFORMANCE: REQUIRES 300 TO 400 HOUR BURNIN

NOT LIFE LIMITED

ULTIMATE ACCURACY $\pm$ 1° AFTER ONE YEAR

RANGE: 0 TO 1500°F (1050°F TO 1200°F)

0 TO 600°F (450°F TO 575°F)

USE: WITH SIMPLE VOLTAGE DIVIDER

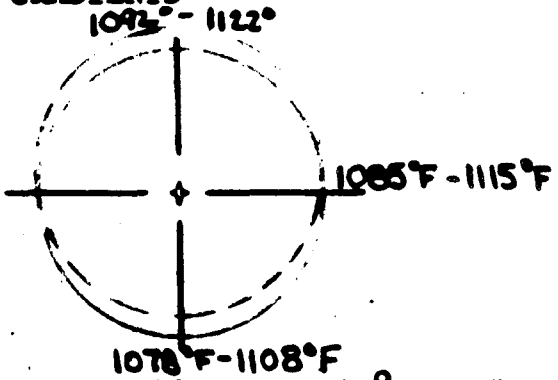
STANDARD BRIDGE

RESOLUTION REQUIREMENTS

GENERATOR PERFORMANCE: RELATED TO TEMPERATURE

PERFORMANCE BASED ON 1100°F EOL

THERMAL MAPPING INCLUDES CIRCUMFERENTIAL AND AXIAL GRADIENTS



RESOLUTION ACCURACY: TEMPERATURE OF HOT JUNCTION ≤ 1130°F AT EOL
SENSOR AND INTERNAL ERRORS ± 3°
SETS SYSTEM ACCURACY TO ≃ ± 5°

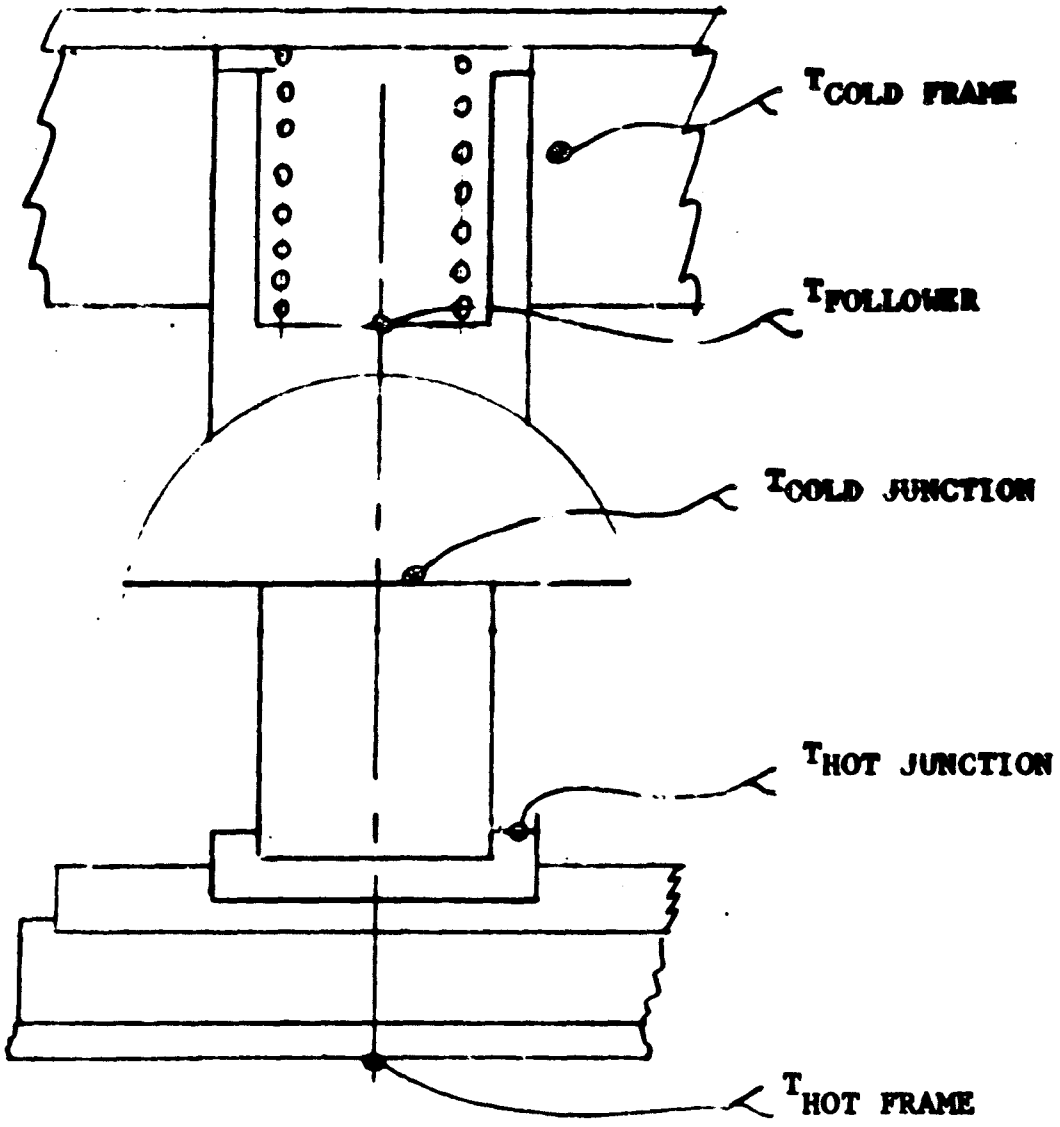
TRADE-OFFS:
SENSOR SIZE (SMALL, LARGE)
LOGIC (BRIDGE, VOLTAGE DIVIDERS)
VOLTAGE TOLERANCE (± 1%)
T/M (WORD SIZE)

RESULTS:
LARGE SENSOR REQUIRED (OBTAIN 1 TO 2 K Ω)
BRIDGE CIRCUIT REQUIRED
VOLTAGE ± 1% MUST PREVAIL
T/M PCM AND 7 BIT WORD OR LARGER

VOLTAGE ERROR (150°)	± 1.5°
T/M ERROR	± .5
	± 2.0°

TOTAL: ± 5°

TYPICAL INSTRUMENTATION



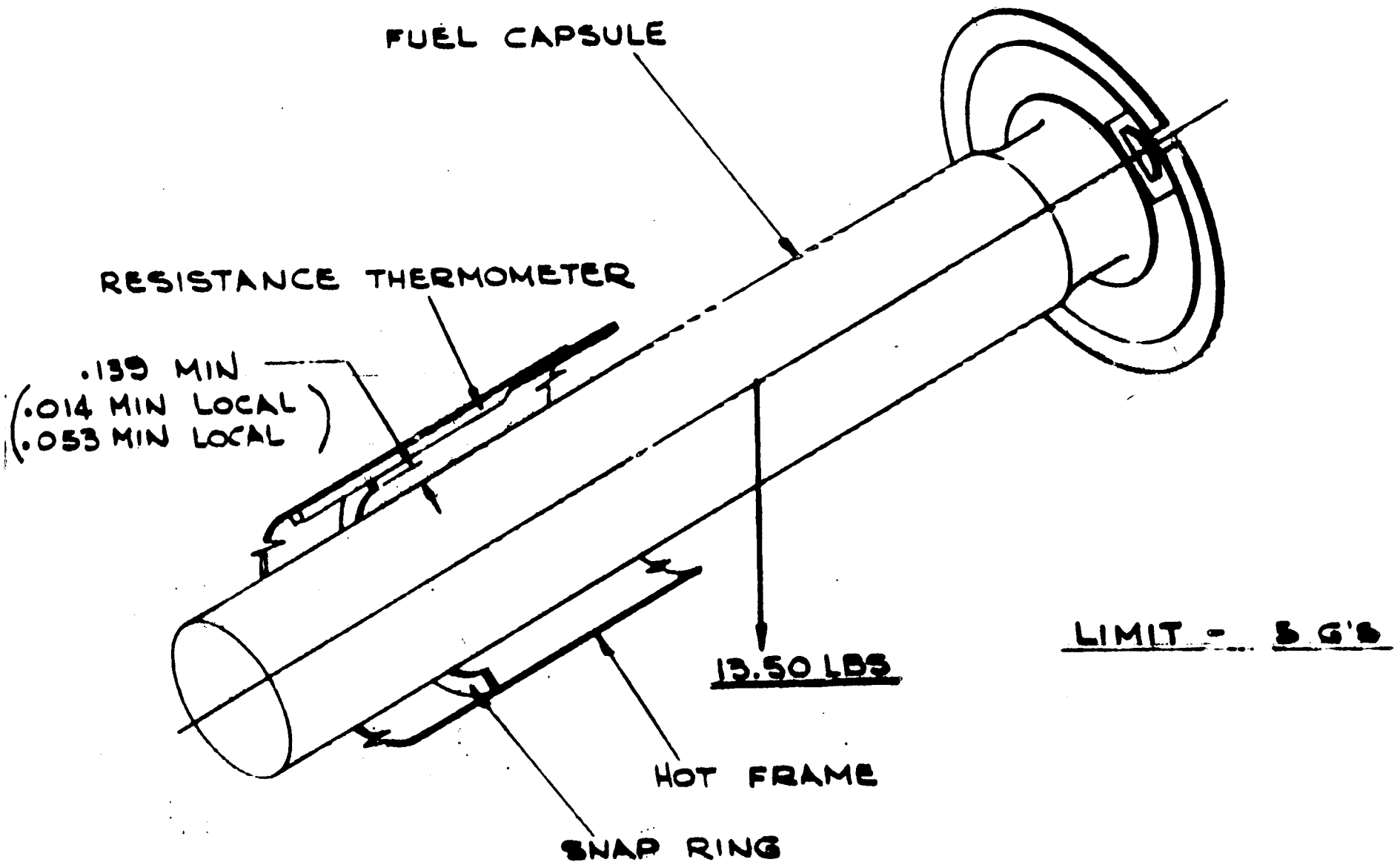
INSTRUMENTATION MODS 5, 6, 7 AND 8

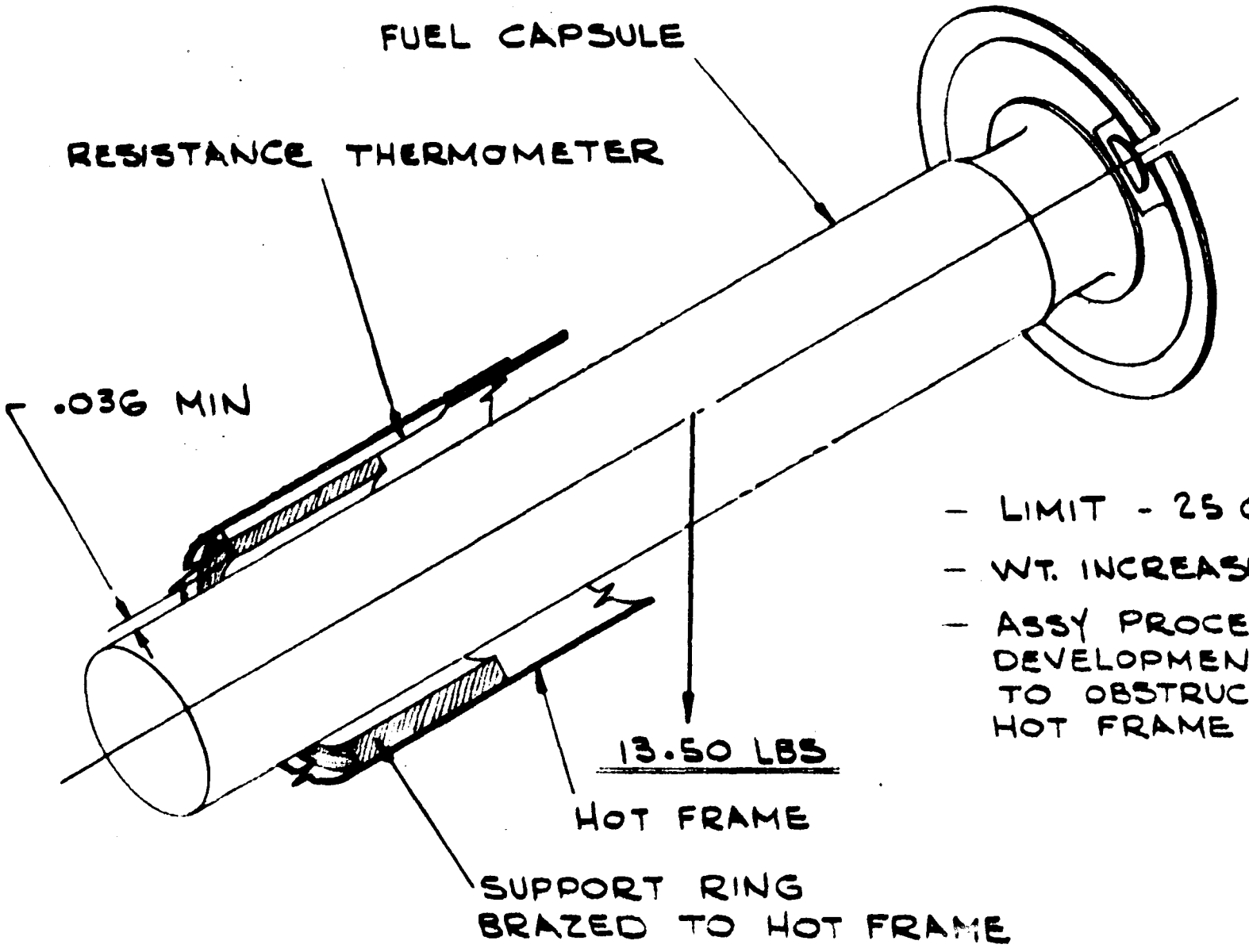
MODS 5, 6 AND 8

EXTERNAL	6 PLATINUM RESISTANCE THERMOMETERS
	6 T/C - HOT FRAME ID, OUTER CASE OD
INTERNAL	10 T/C - 5 HOT JUNCTIONS, 5 COLD JUNCTIONS

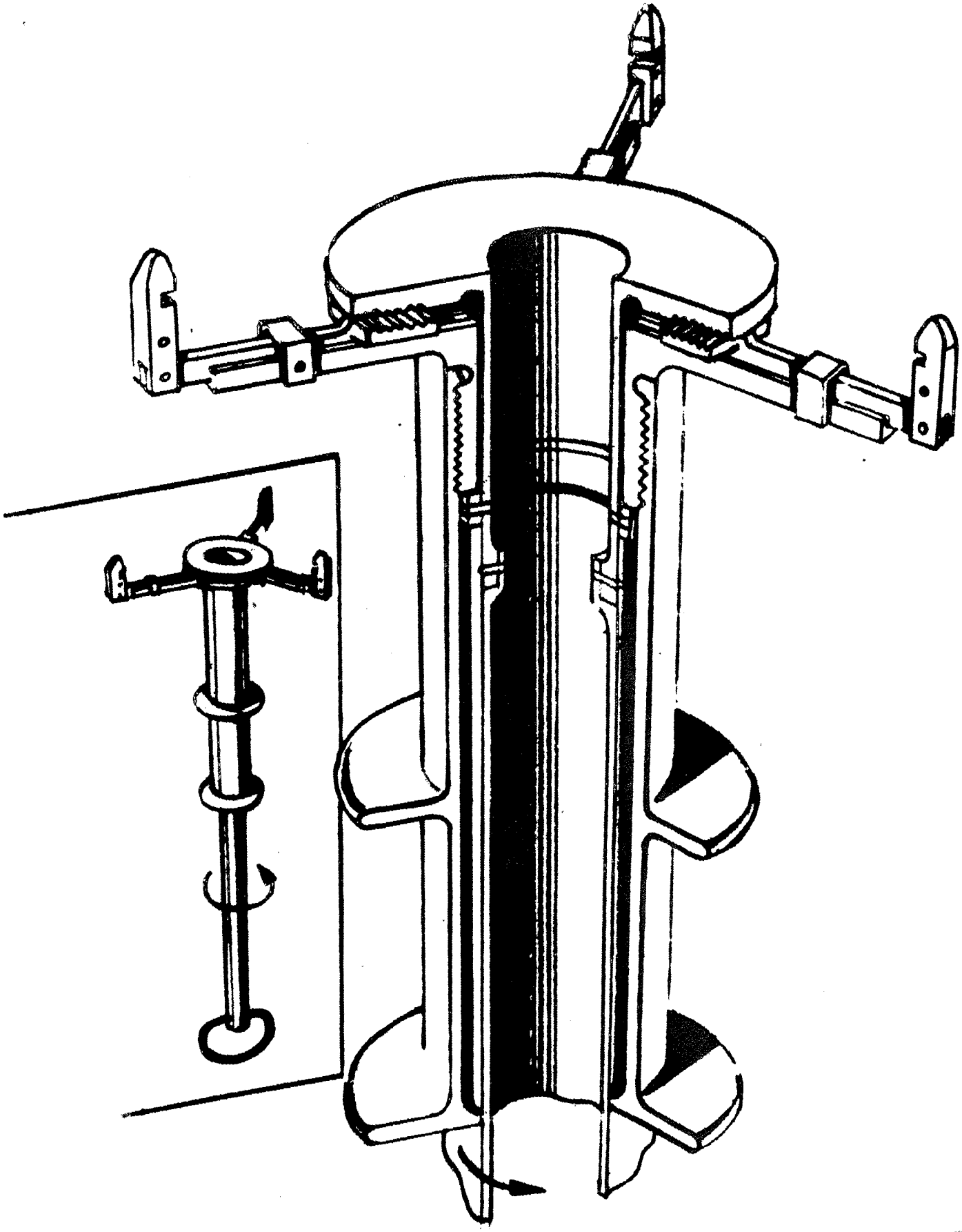
MOD 7

EXTERNAL	FINS (28 T/C PER FIN) FOUR FINS
	6 PLATINUM RESISTANCE THERMOMETERS
	6 T/C HOT FRAME ID, OUTER CASE OD
INTERNAL	48 T/C (AXIAL ROWS 2, 9, 16 - SPACING $\sim 90^{\bullet}$)
	12 HOT JUNCTIONS
	12 COLD JUNCTIONS
	12 FOLLOWERS
	12 COLD FRAME


FUEL CAPSULE
RESISTANCE THERMOMETER
.139 MIN
(.014 MIN LOCAL
.053 MIN LOCAL)
13.50 LBS
HOT FRAME
SNAP RING
LIMIT - 5 G'S



- LIMIT - 25 G'S
- WT. INCREASE - 0.80 LBS
- ASSY PROCEDURE - RTD - DEVELOPMENT REQD DUE TO OBSTRUCTIONS ON HOT FRAME I.D.



A L S E P

I N T E R F A C E

S U M M A R Y

J U L Y 7, 1 9 6 6

INTERFACE CONTROL DOCUMENTS

	SIGNED	SUBMITTED FOR SIGNATURE	PLANNED	TOTAL
BENDIX SYSTEMS DIVISION	8		6	14
GRUMMAN AIRCRAFT	16		6	22
NORTH AMERICAN AVIATION	9		2	11
TOTAL	33	0	14	47

NAA ICD'S OUTSTANDING

MH01 - 12009 - 116 FILM AND TAPE CONTAINER, FRONT INSTALLATION - CM

MH01 - 12010 - 116 FILM AND TAPE CONTAINER, REAR INSTALLATION - CM

- THESE ICD'S ARE TO BE COMBINED TO REFLECT ONE TAPE AND FILM CONTAINER
- TO BE COMPLETED JULY 15, 1966

ALSEP DESIGN REVIEWS

- PRELIMINARY DESIGN REVIEW (PDR)

  SUBSYSTEM PDR'S JUNE - JULY, 1966

  SYSTEM PDR'S JULY 11 - 12, 1966

- CRITICAL DESIGN REVIEW (CDR)

  DECEMBER, 1966

- FIRST ARTICLE CONFIGURATION INSPECTION (FACI)

  JUNE, 1967

PRELIMINARY DESIGN REVIEW

- ESTABLISHED DESIGN BASELINE
- INCLUDES REVIEW OF CONTRACT END ITEM SPECIFICATIONS, EQUIPMENT SPECIFICATIONS, DRAWINGS, AND PLANS

CRITICAL DESIGN REVIEW

- ESTABLISHES FINAL DESIGN OF FLIGHT EQUIPMENT
- INCLUDES REVIEW OF SPECIFICATIONS AND DRAWINGS, ANALYSES, RELIABILITY PREDICTIONS, TEST PLANS, ETC.

FIRST ARTICLE CONFIGURATION INSPECTION

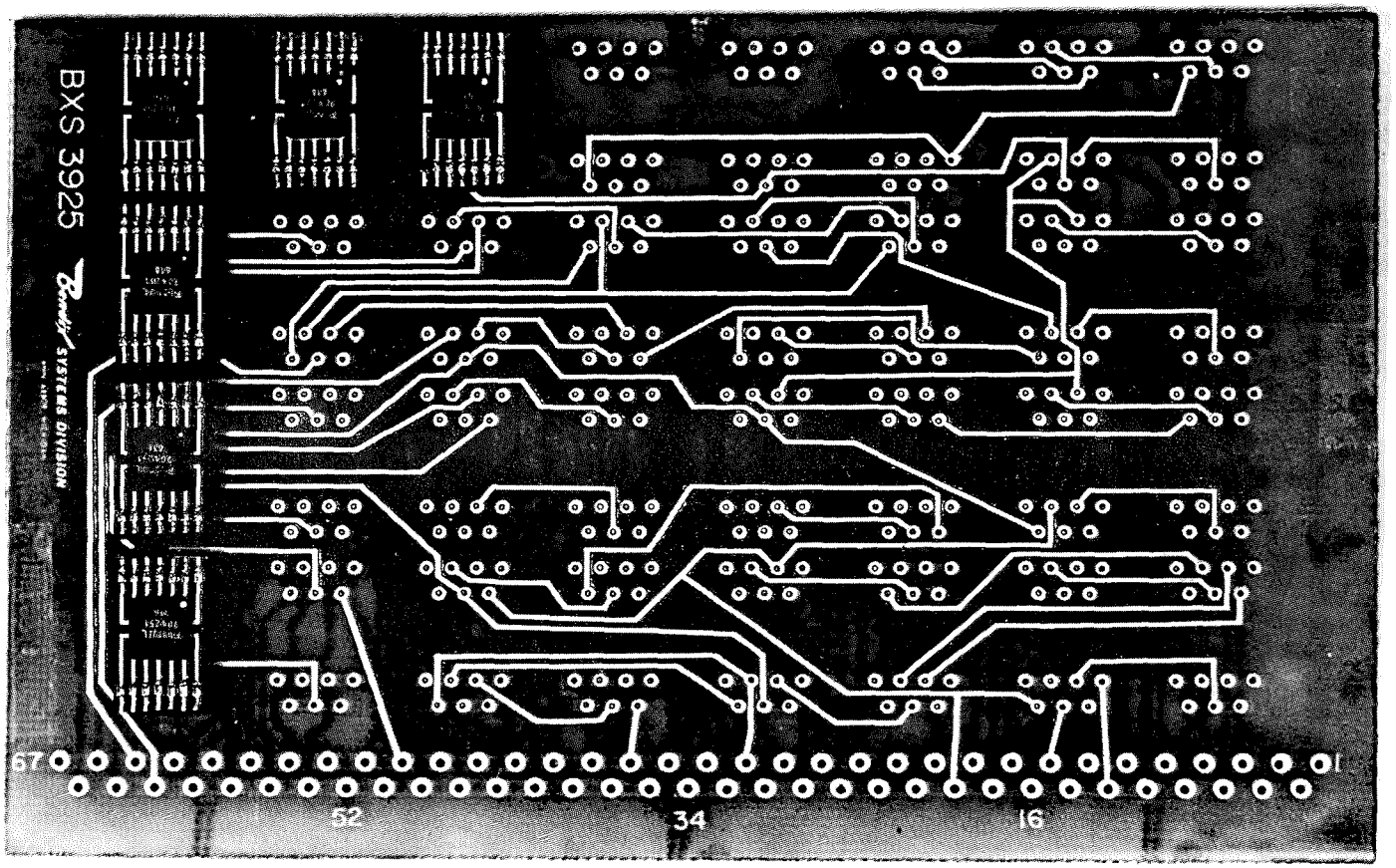
- ESTABLISHES FIRST PRODUCTION HARDWARE CONFIGURATION
- INCLUDES REVIEW OF THE FIRST ARTICLE, DRAWINGS, TEST DATA, SPECIFICATIONS

PROGRAM STATUS
ALSEP MODELS

- Mech Simulator (Model E-1) for LTA-3 - to be delivered - 15 July
- Struct Model (Model I) - in Assy
- Thermal Model (D-1a) - in Fab
- Eng Model (H) - in Design

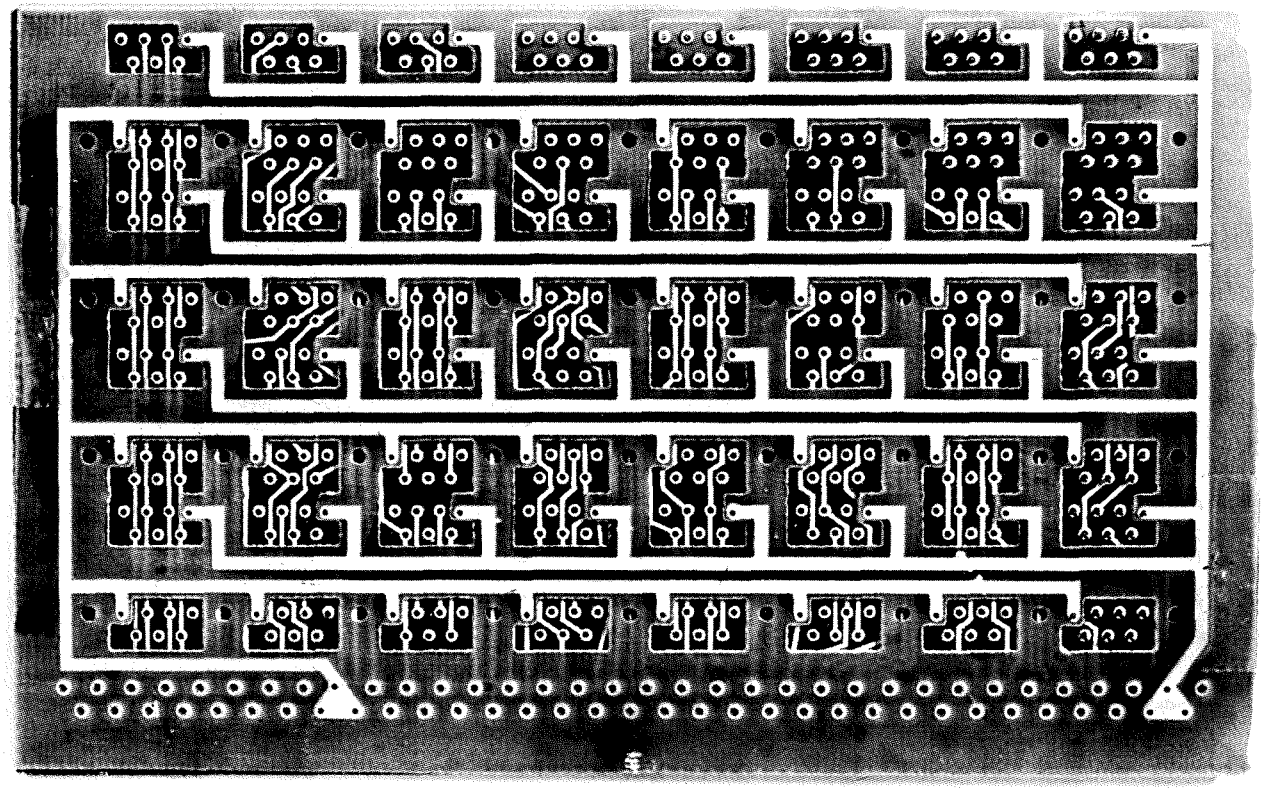
4422-12

TYPICAL BRASSBOARD FLAT PACK P.C. BOARD
PARTIALLY ASSEMBLED COMPONENT SIDE



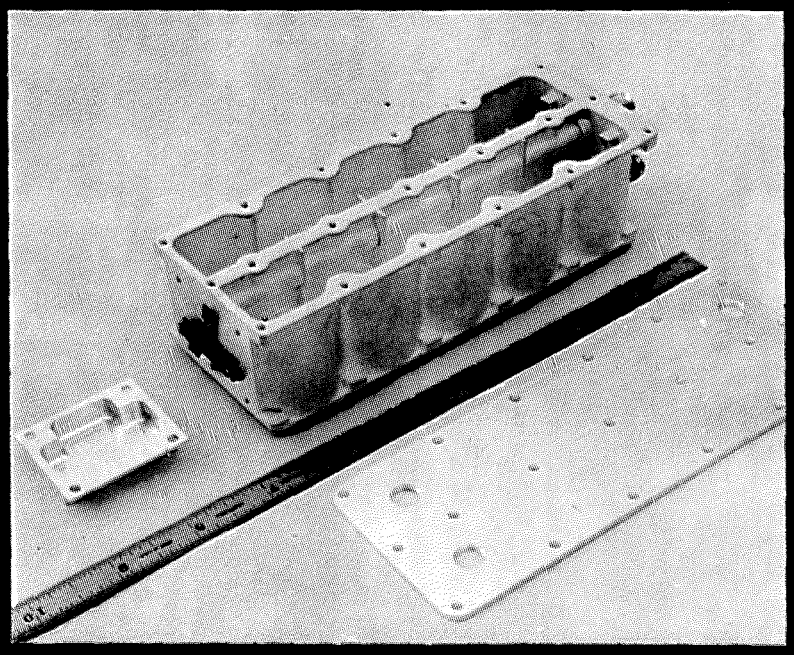
THE Bendix CORPORATION

TYPICAL BRASSBOARD FLAT PACK P.C. BOARD
GROUND & VOLTAGE PLANE SIDE

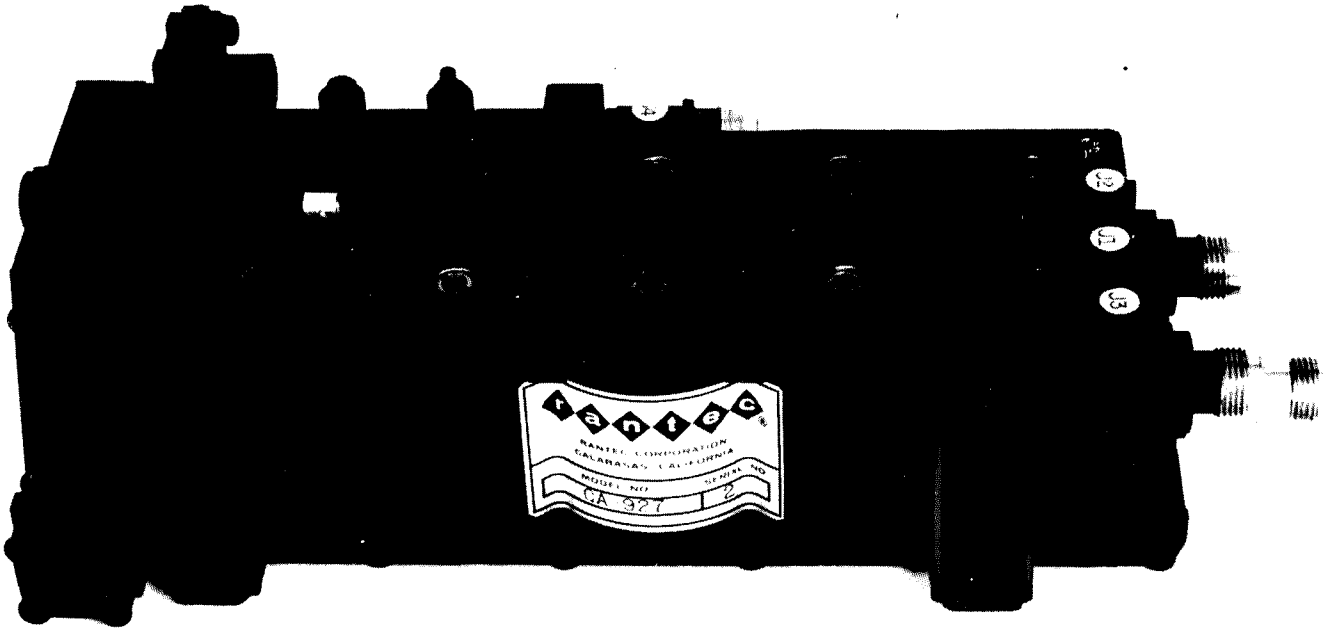


THE Bendix CORPORATION

ALSEP DIPLEXER FILTER SECTION BRASSBOARD



TYPICAL DIPLEXER



STATUS OF I.C.S.

System Level

IC314116	Astronaut	Approval due 6/29
IC314115	MSFN	Resubmitted 6/17
IC314118	MCC-H	In Prep.
IC314117	KSC	Approved 6/13

SNAP-27

IC314119	GFE Power	GE Review

4422-11

ALTERNATIVE FEATURES

	Incorporated	
	Yes	No
Experiment mounting on thermalplate		X
Long legs on central station		X
Multiple voltages to experiments		X
Multiple event turn-on tuner		X
Modularize experiment form factors		X
Unregulated power for thermal control		X
Full-time active seismic listening mode		X

4422–22

STATUS OF I.C.S.

Experiments

IC314103	Magnetometer	*
IC314104	Solar Wind	*
IC314105	STID	*
IC314106	Passive Seismic	*
IC314107	CPLE	*
IC314108	Active Seismic	*
IC314109	Heat Flow	In Prep.

*Approved by PI, disapproved by MSC for deployment environment

IC314114	LGE	Approval due 6/29

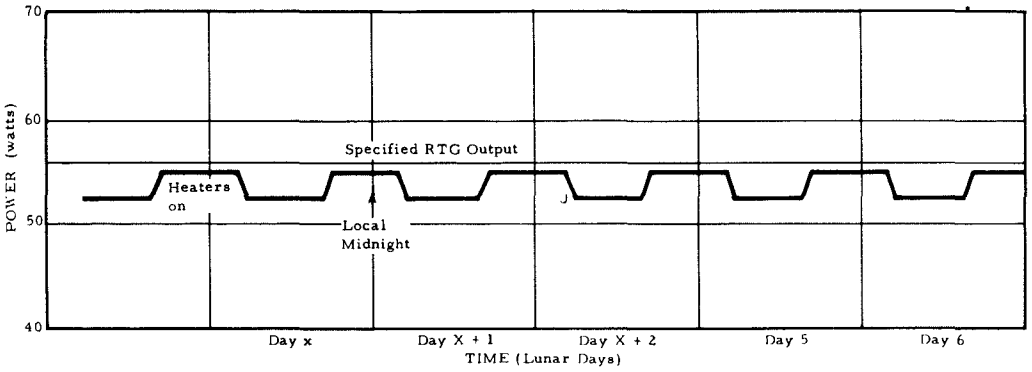
4422-10

ALTERNATIVE FEATURES INVESTIGATED FOR ENG. MODEL (RELATIVE TO PHASE 1 DESIGN)

	Incorporated	
	Yes	No
• Sun shadow antenna sighting to eliminate level and alignment of base	X	
• Increase antenna ground plane	X	
• Multiple use of antenna mast	X	
• Tool carriers as pallet stiffeners	X	
• Provisions to unload if LEM distorts	X	
• Single level circuit protection	X	
• Command decoder normally standby	X	

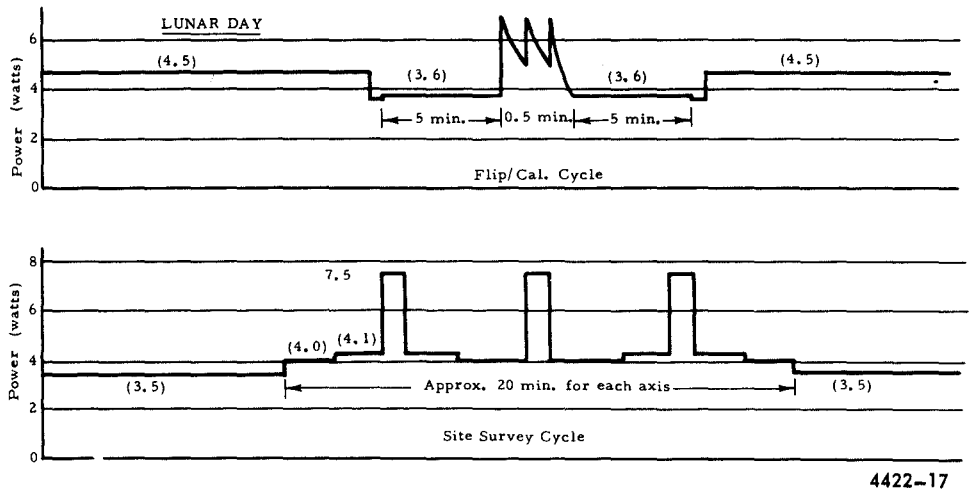
4422-21

SYSTEM FUNCTIONAL POWER PROFILE



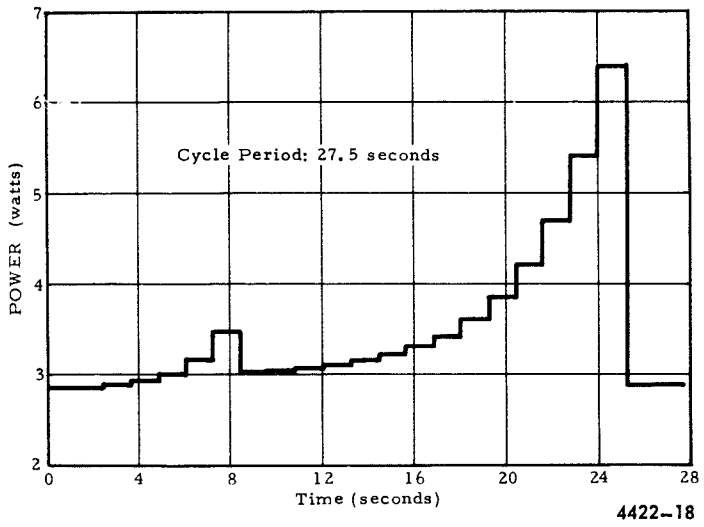
4422–15

POWER PROFILE OF MAGNETOMETER INTERMITTENT COMMANDS



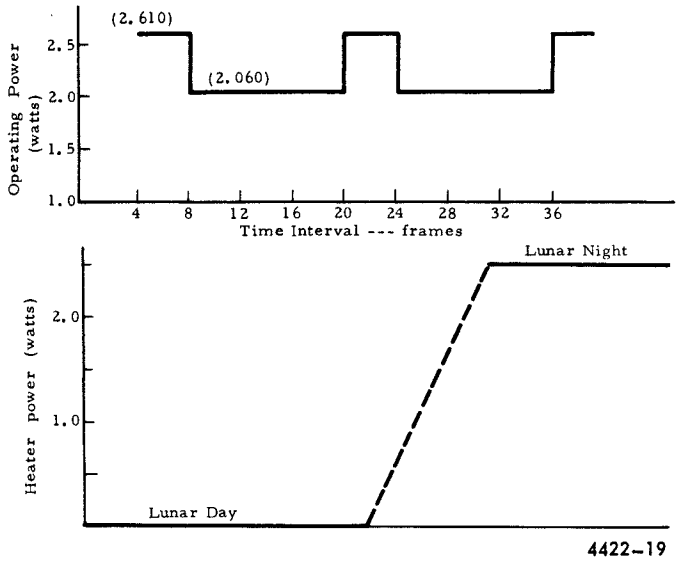
4422-17

POWER PROFILE FOR SOLAR WIND EXPERIMENT



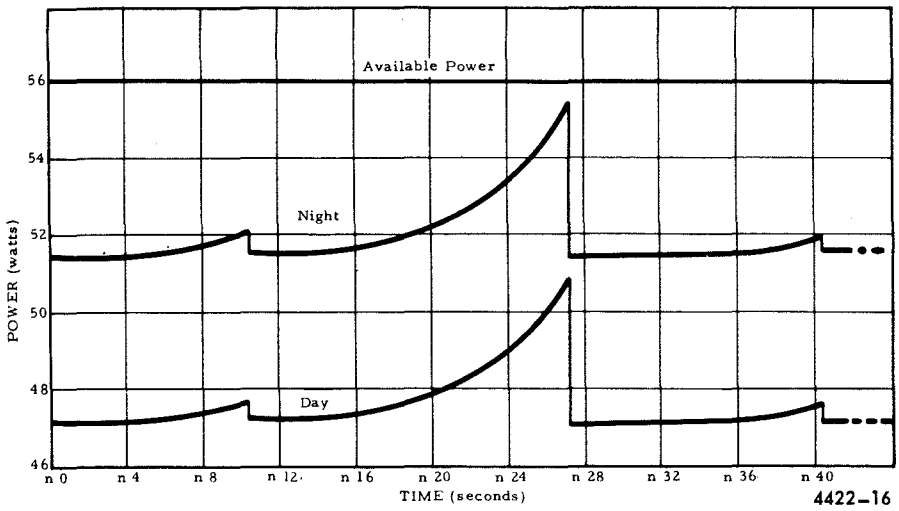
4422-18

POWER PROFILE FOR THE CHARGED PARTICLE EXPERIMENT

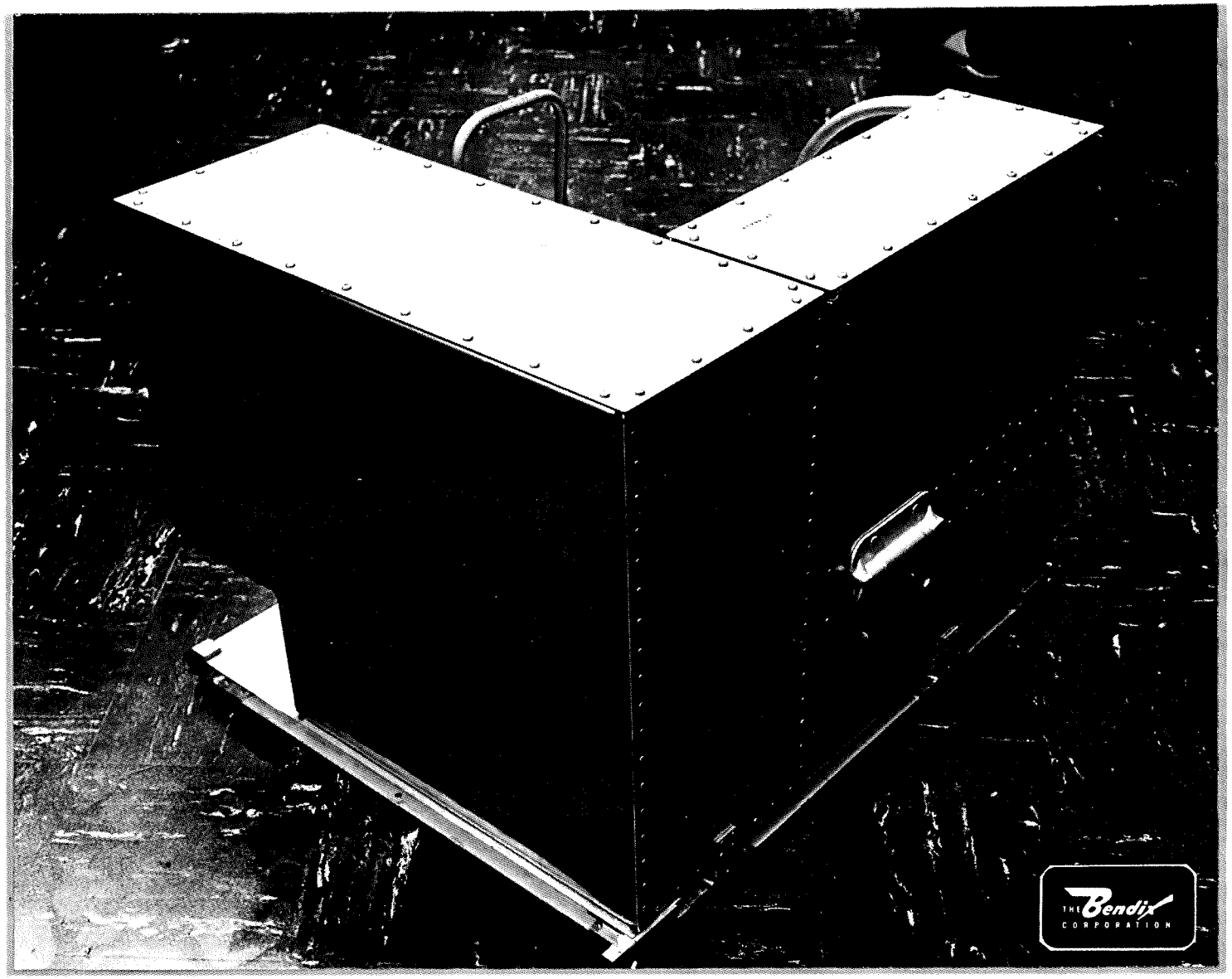


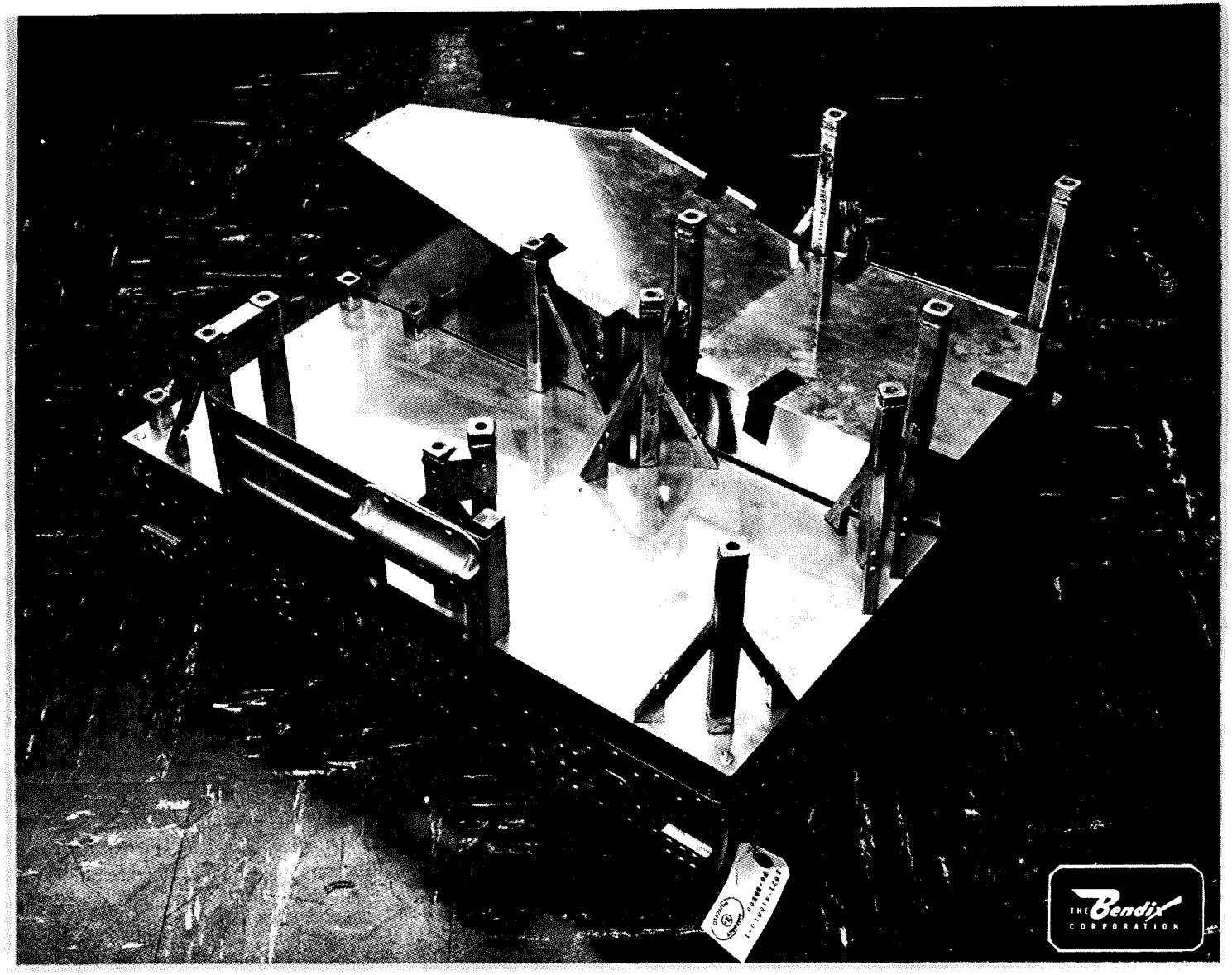
4422-19

DETAILED PROFILE OF OPERATIONAL POWER



4422-16


THE Bendix
CORPORATION


THE Bendix
CORPORATION

START-UP POWER PROFILE

1. Insert RTG Connector
2. PCU Input Energized
3. Transmitter ON

Passive Seismic
4. -ON
5. -Levelling ON
6. -Uncage

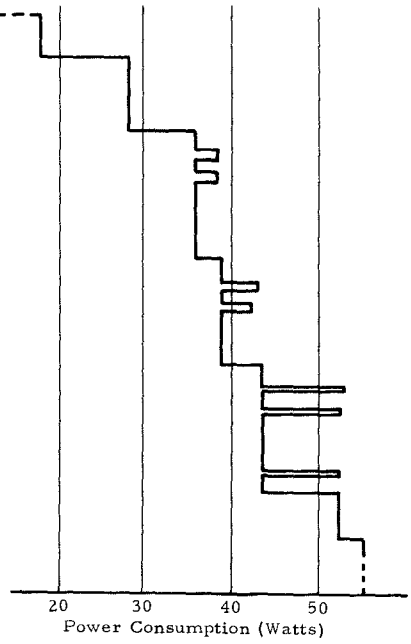
Magnetometer
7. -ON
8. -Site Survey (3)
9. -Flip/Cal

Suprathermal Ion Detector
10. -ON
11. -Remove Dust Cover
12. -Unseal Pressure Gage

Solar Wind
13. -Remove Dust Cover

14. -ON

All Experiment Heaters ON



FLAT CONDUCTOR

CABLE

EVALUATION

MECHANICAL TESTS

Mechanical Tests
- Low Temperature - 196°C
  - Bending
  - Flexing
- High Temperature Tests +200 to +275°C
  - Insulation Resistance
  - Capacitance
- Thermal Calculations
- Welding and Soldering
- Abrasion Resistance

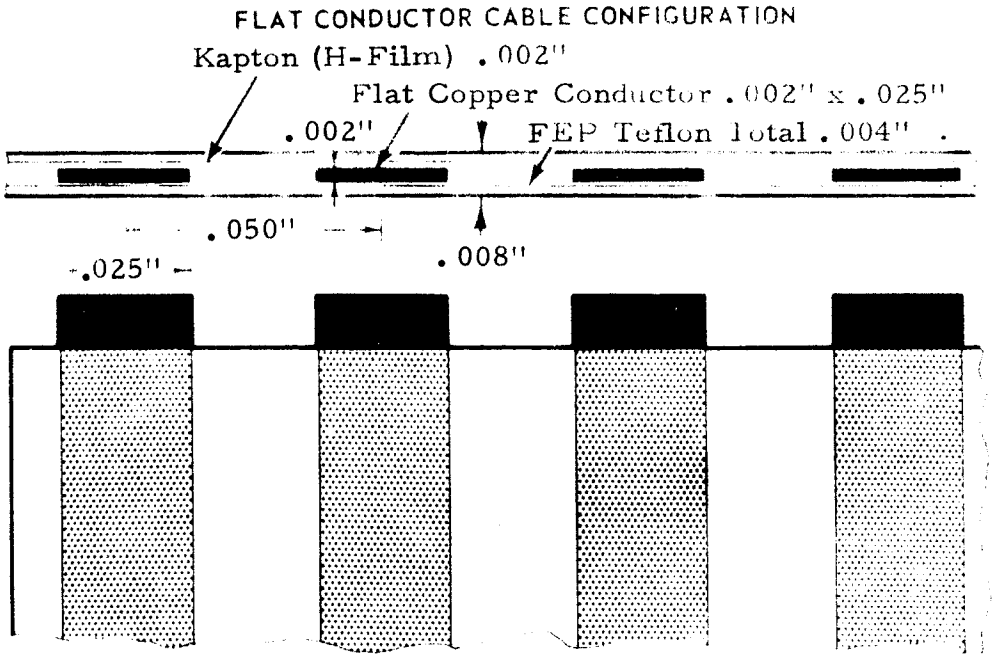
TEST PROGRAM

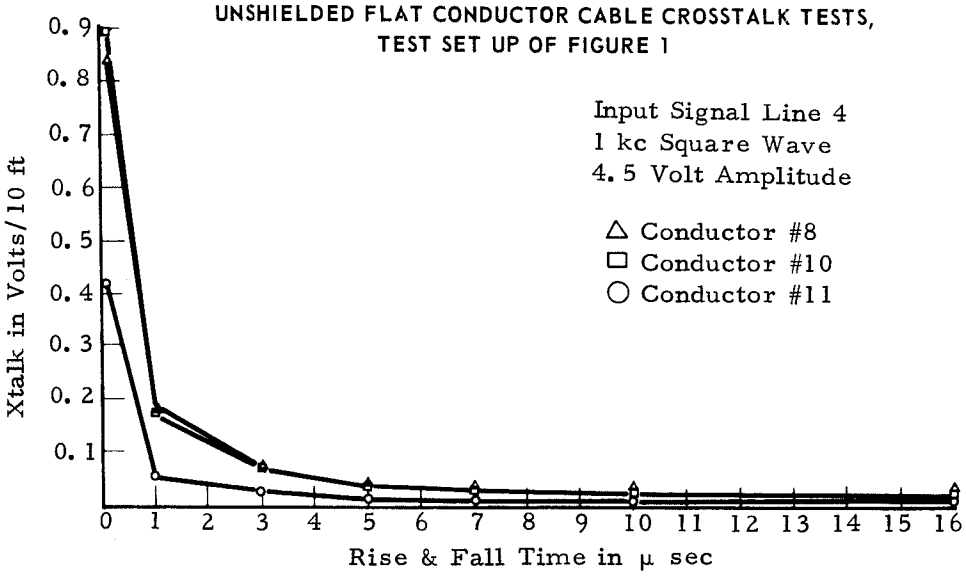
Electrical Properties
- Cross Talk - Resistive Terminations
- Cross Talk - Integrated Circuit Terminations
- EMI - Integrated Circuits Only
- Capacitance
- Leakage Resistance

Mechanical Properties
- Stripping
- Welding & Soldering
- Abrasion Resistance
- Low Temperature Properties
- High Temperature Properties

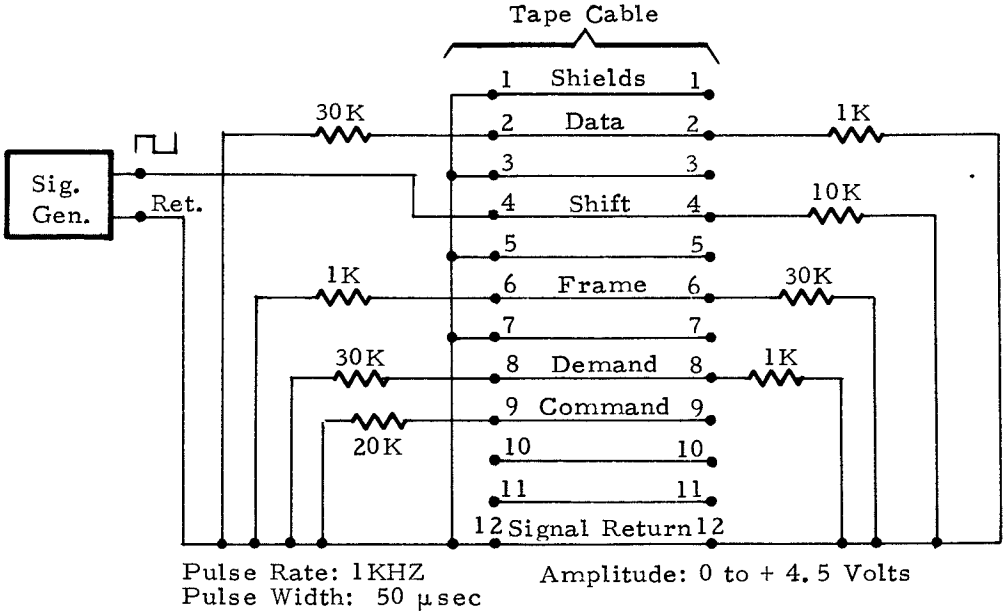
FLAT CONDUCTOR CABLE SELECTIONS

Conductor		
Thickness	.002"	
Width	.025"	
Center-to-Center	.050"	
Insulation		
Kapton	.002"	
FEP Teflon	.002"	
Cable Thickness	.009"	±.001"
Cable Width		
4 Conductors	- .35"	
20	- 1.15"	
30	- 1.59"	
30	- 2.05"	


FLAT CONDUCTOR CABLE CONFIGURATION
Kapton (H-Film) .002"
Flat Copper Conductor .002" x .025"
.002"
FEP Teflon Total .004"
.050"
.008"
.025"


UNSHIELDED FLAT CONDUCTOR CABLE CROSSTALK TESTS,
TEST SET UP OF FIGURE 1
Input Signal Line 4
1 kc Square Wave
4.5 Volt Amplitude
△ Conductor #8
□ Conductor #10
○ Conductor #11
Xtalk in Volts/10 ft
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Rise & Fall Time in μ sec

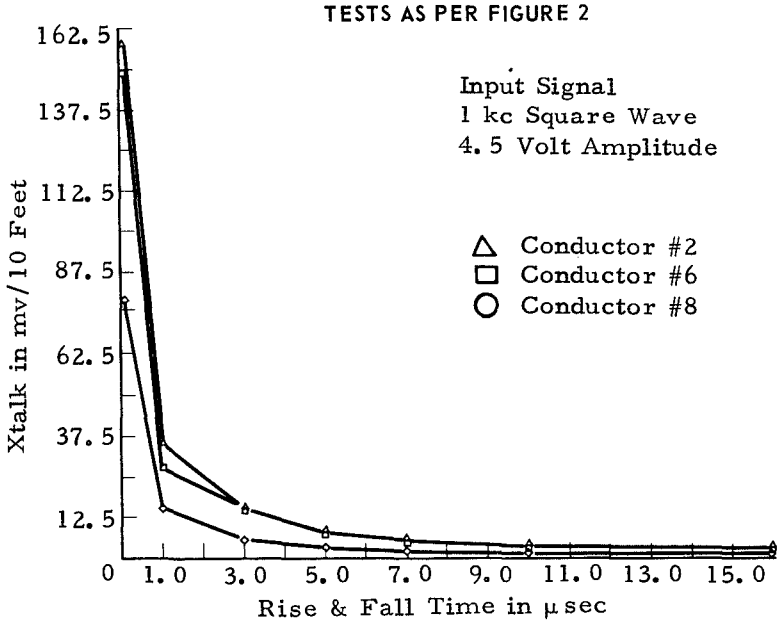
CROSS TALK TEST ARRANGEMENT, CROSS TALK BETWEEN SHIELDED LINES (2,4,6)



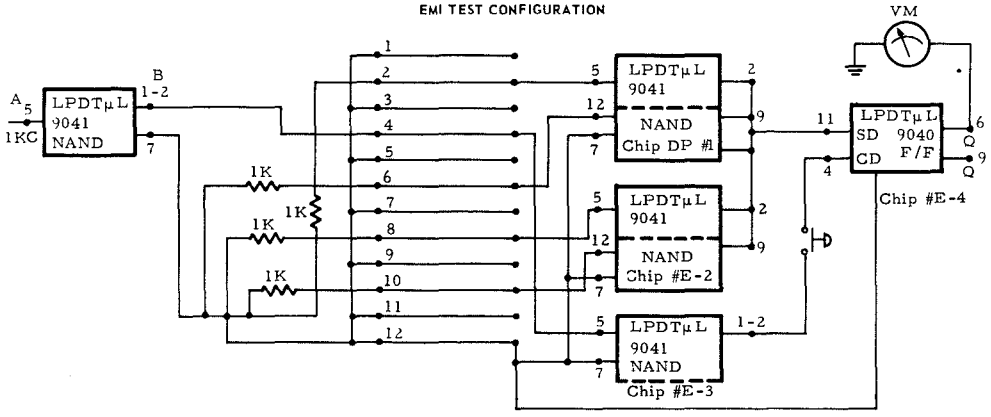
Pulse Rate: 1KHZ
Pulse Width: 50 μsec

Amplitude: 0 to + 4.5 Volts

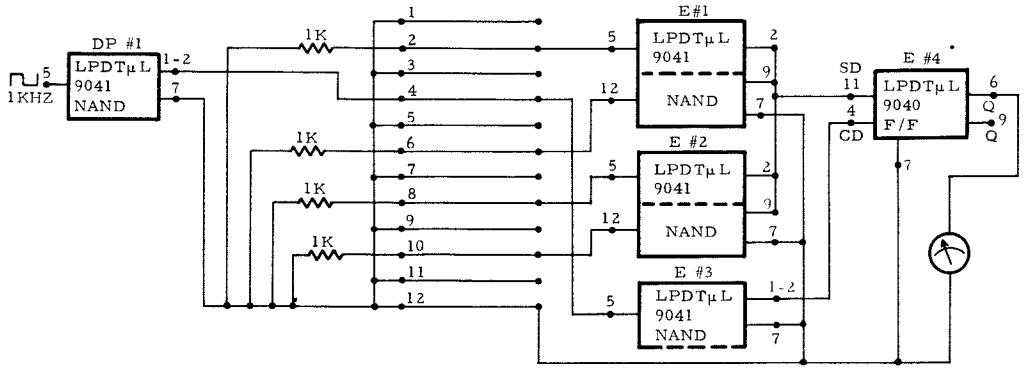
SHIELDED FLAT CONDUCTOR CABLE CROSSTALK,
TESTS AS PER FIGURE 2



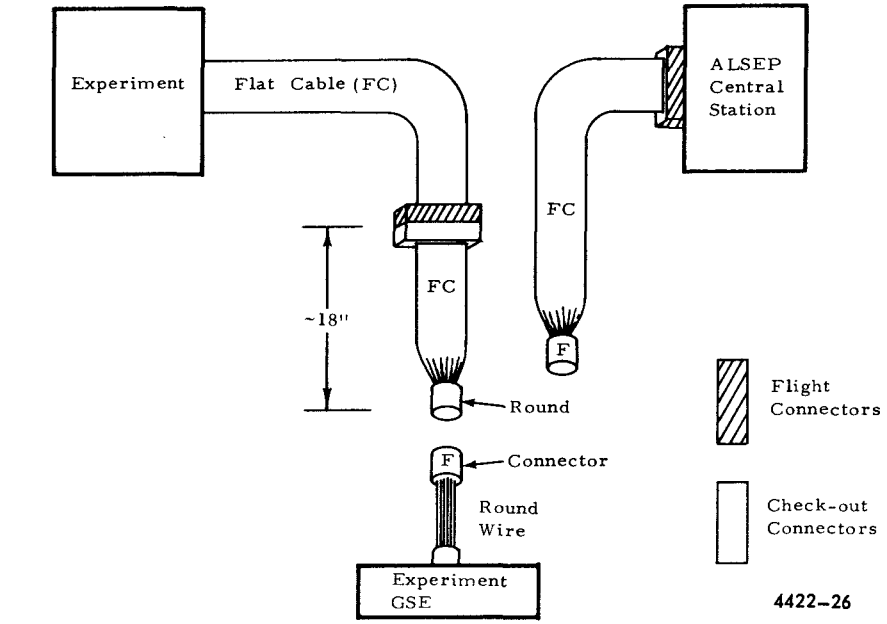
EMI TEST CONFIGURATION



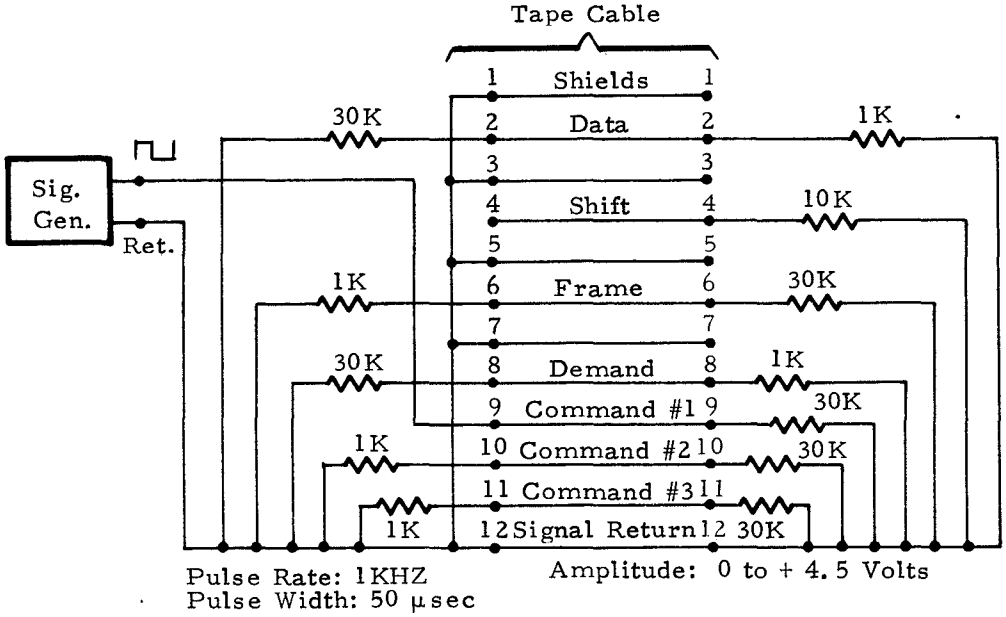
CROSS TALK TESTS WITH INTEGRATED CIRCUITS



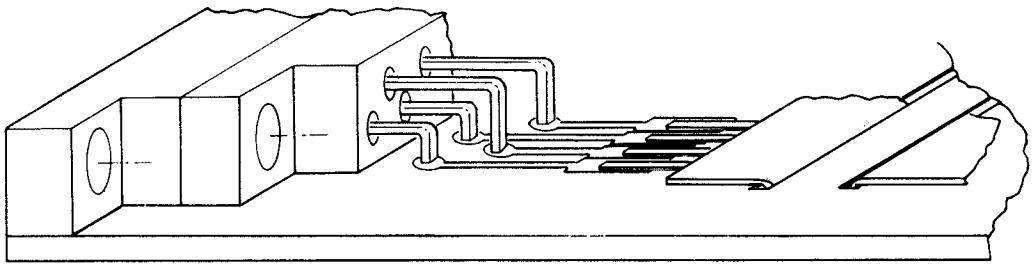
ALSEP CONNECTOR ARRANGEMENT FOR SYSTEM & SUBSYSTEM TESTS



CROSS TALK TEST ARRANGEMENT, CROSS TALK BETWEEN UNSHIELDED LINES (8-11)

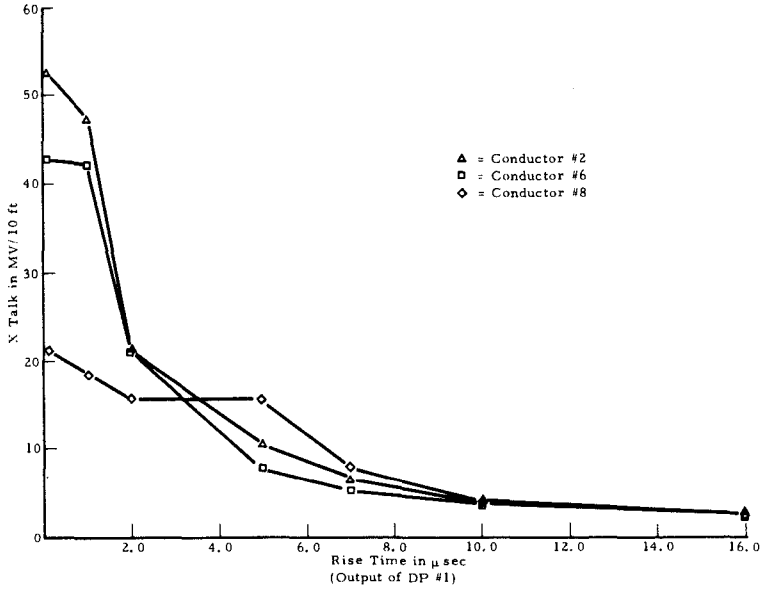


CONNECTOR ARRANGEMENT FOR ENGINEERING MODEL



4422–13

FLAT CONDUCTOR CABLE CROSSTALK WITH INTEGRATED CIRCUITS



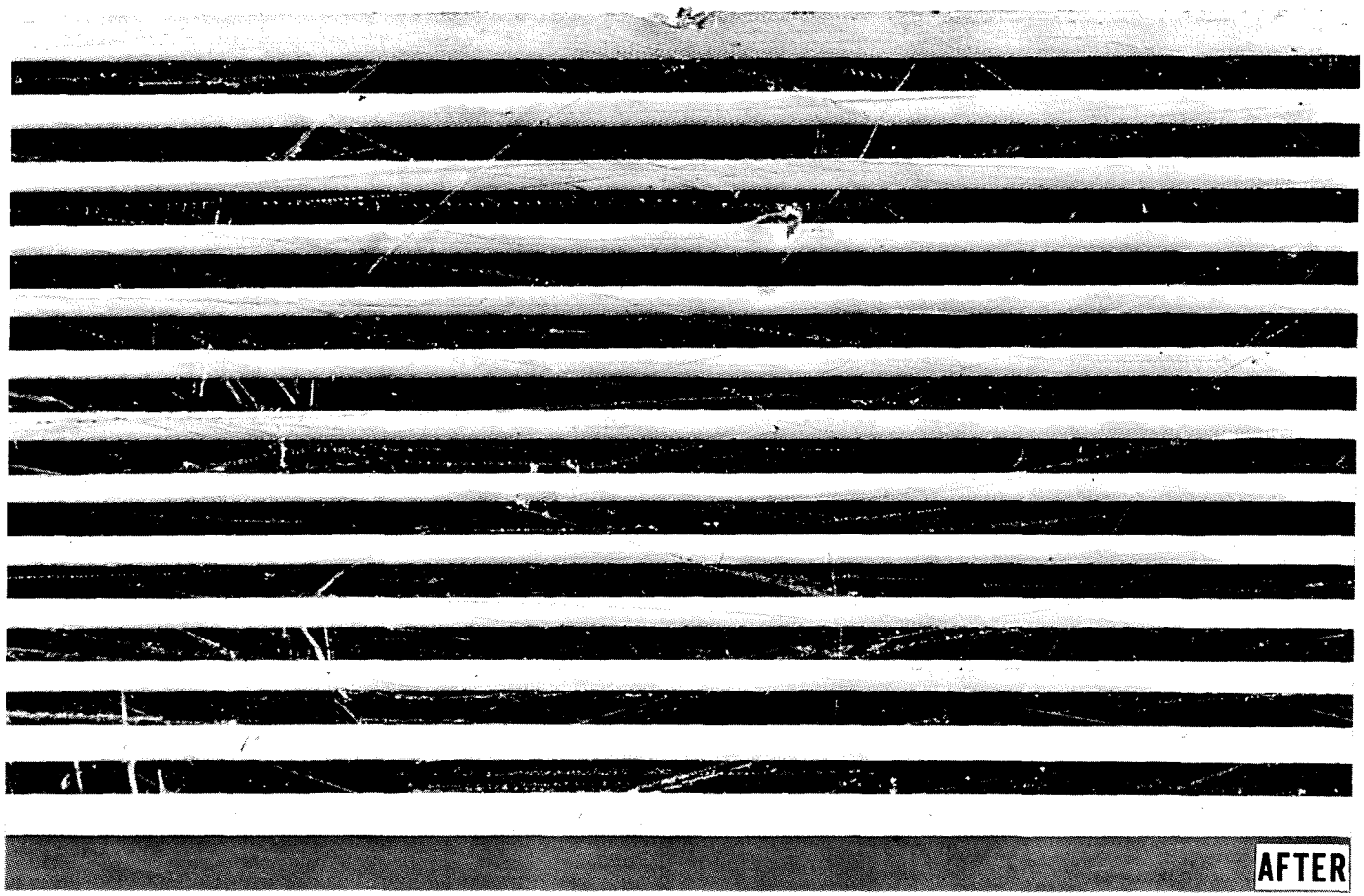
4422-9

FLAT CABLE STATUS

	Excellent Characteristics	Acceptable Properties
Cross Talk	x	
EMI Susceptability	x	
Other Electrical	x	
Low & High Temp	x	
Abrasion	x	
Other Mechanical	x	x
Radiative EMI		x
Connectors	x (after 1/67)	x

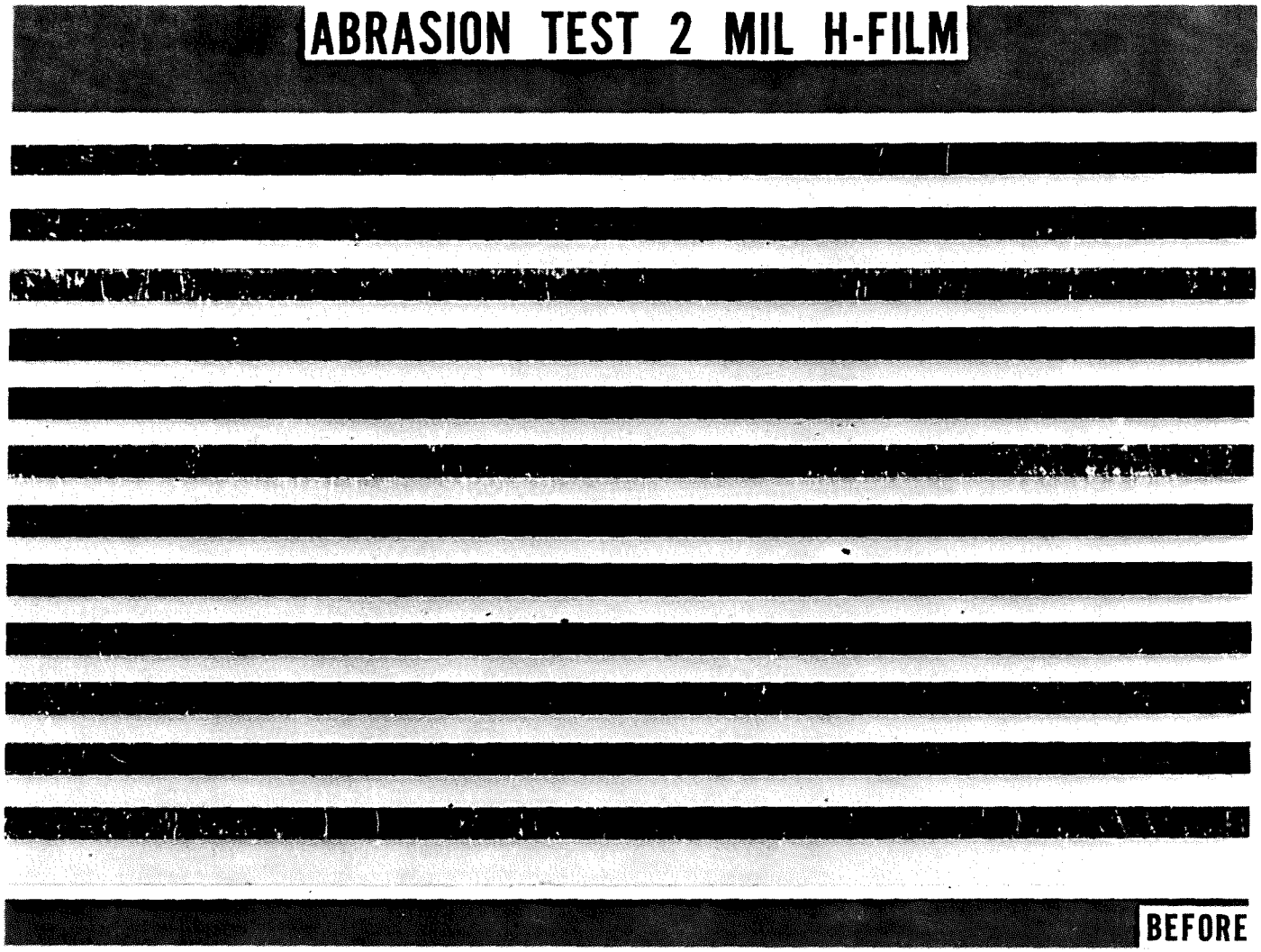
4422-14

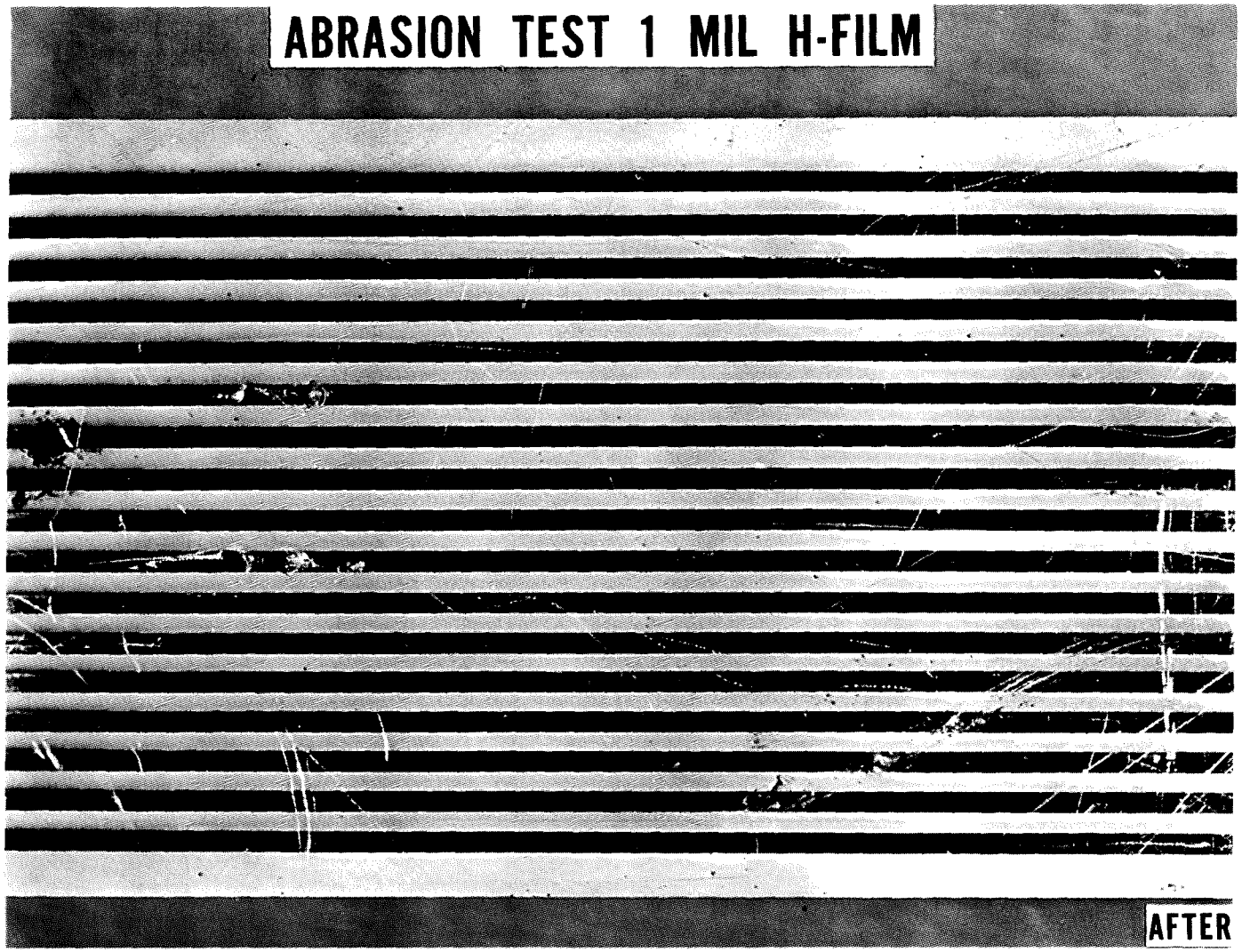
ABRASION TEST 2 MIL H-FILM



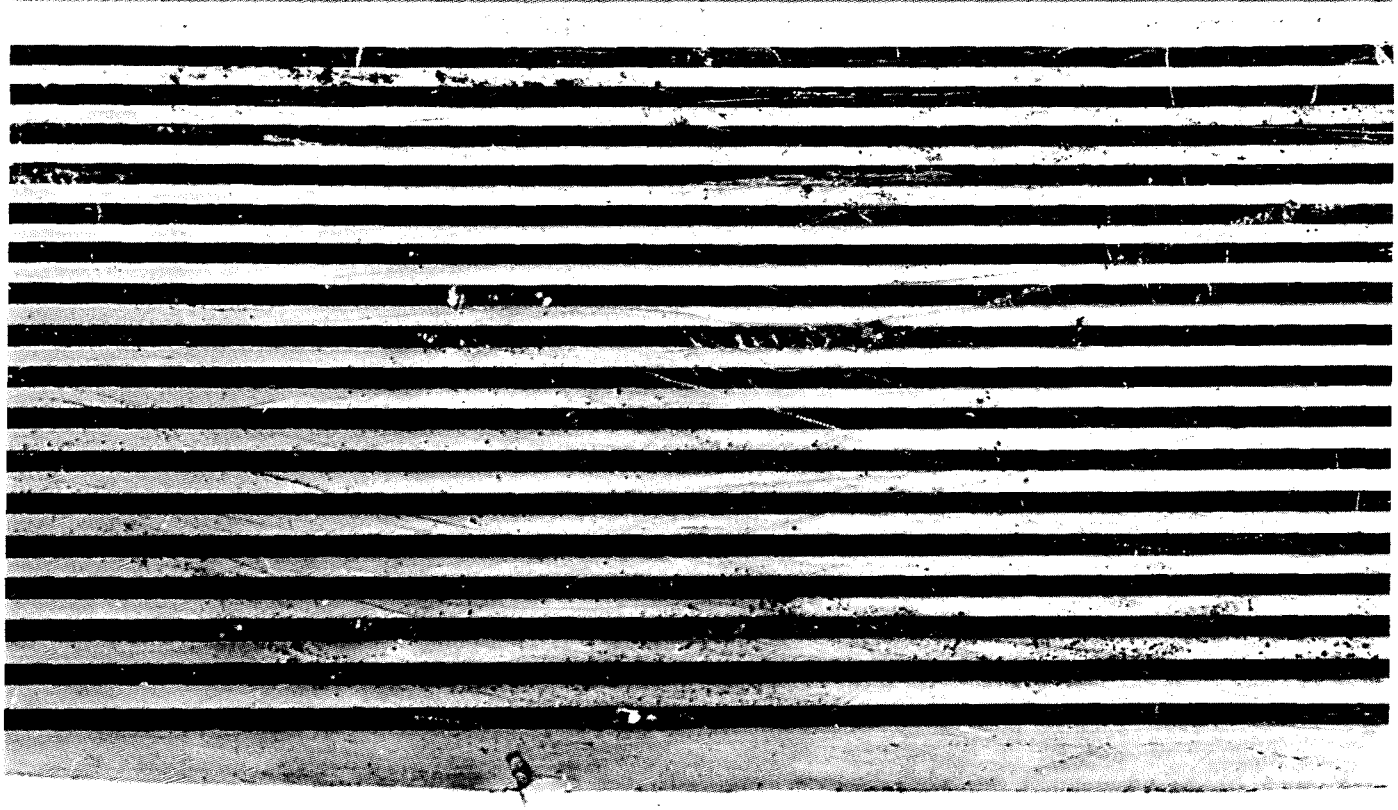
ABRASION TEST 2 MIL H-FILM

AFTER


ABRASION TEST 2 MIL H-FILM
BEFORE

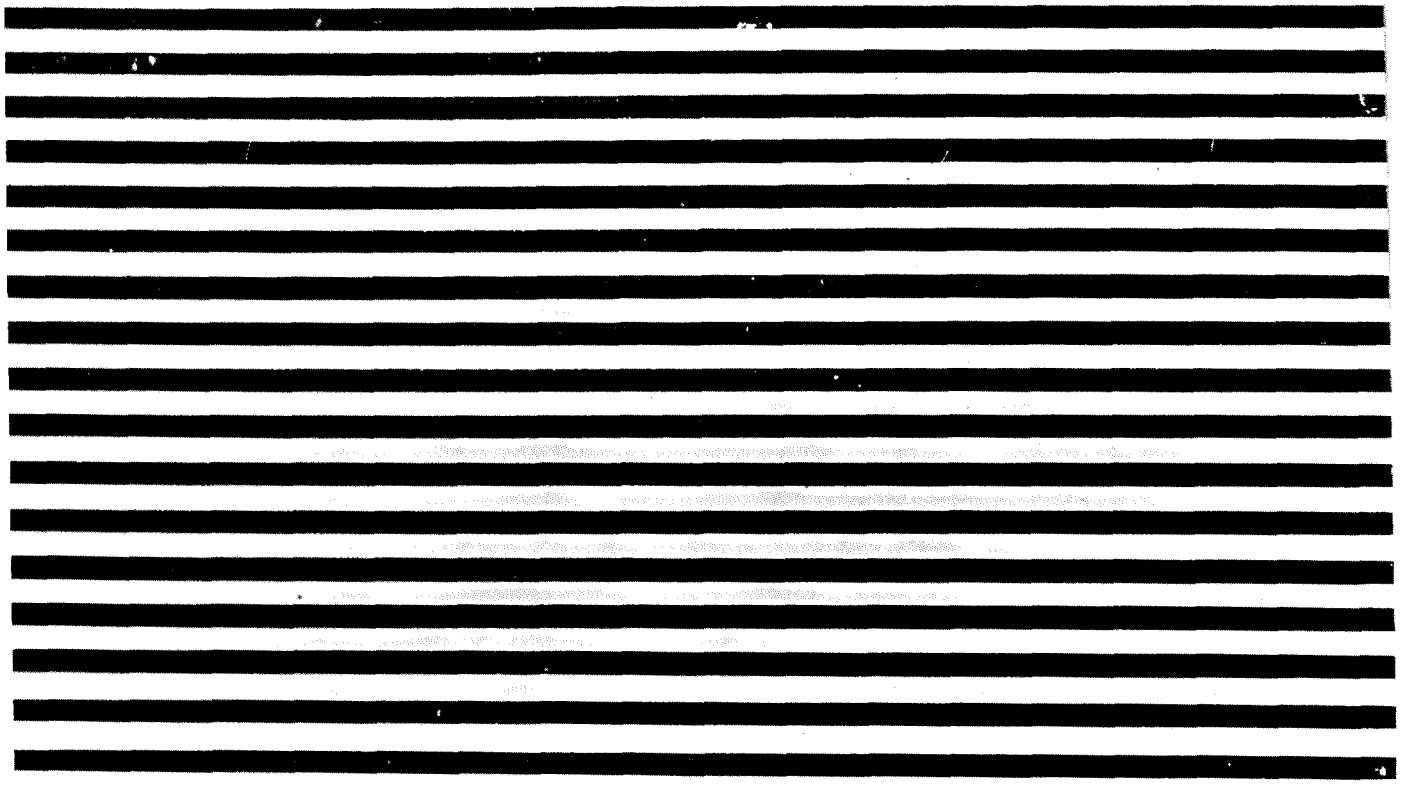

ABRASION TEST 1 MIL H-FILM
AFTER

ABRASION TEST 1 MIL H-FILM



AFTER

ABRASION TEST 1 MIL H-FILM



BEFORE

PRESENTATION

TO

SEQ INTERFACE CONFERENCE

7 JULY 1966

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

- MCR #550 (TEMPERATURE MEASUREMENT FOR LFC THERMAL SHIELD FACING LEM) HAS BEEN APPROVED BY GAEC AND IS AWAITING IMPLEMENTATION BY MSC.

- THE PRELIMINARY RTG/PQGS TEST PLAN TO TEST THE EFFECT OF THE RTG GAMMA SPECTRUM ON THE LEM PROPELLANT QUANTITY GAUGIN SYSTEM WAS RECEIVED ON

CCA #183 - TECHNICAL GROUND RULES, ASSUMPTIONS AND COMMENTS

- THE WEIGHT INCREASE TO LEM RESULTING FROM THE RTG INSTALLATION AND THERMAL/NUCLEAR RADIATION PROVISIONS WILL BE CHARGEABLE TO THE SEQ WEIGHT ALLOCATION AND NOT THE LEM WEIGHT BUDGET. THE SCAR WEIGHT ASSOCIATED WITH LEM'S 7-15 WILL ALSO BE CHARGEABLE TO THE SEQ WEIGHT ALLOCATION.

- LIMITATIONS IN THE RTG/LEM THERMAL INTERFACE AS FOLLOWS:

  A) THE TOTAL HEAT FLUX FROM THE RTG INTO THE LEM WILL BE NOT MORE THAN 100 BTU/HR. AT ANY TIME DURING A MISSION.

  B) THE PRESENCE OF THE RTG WILL NOT CAUSE THE LEM SKIN TEMPERATURE ON THE SIDE OF THE SCIENTIFIC EQUIPMENT BAY TO EXCEED 270°F, NOR ANY OTHER LEM SKIN TEMPERATURE TO EXCEED 160°F.

  BECAUSE OF THE UNCERTAINTIES CURRENTLY ASSOCIATED WITH THE SLA THERMAL DESIGN, LAUNCH PAD STAY TIMES AFTER INSTALLATION OF THE RTG, BOOST HEATING EFFECT ON THE LEM, AND THE ACTUAL CONFIGURATION AND MOUNTING ARRANGEMENT OF THE RTG ON THE LEM, IT IS PROPOSED THAT ACTIVE COOLING AND ADEQUATE RTG THERMAL ISOLATION BE FURNISHED BY MSC.

- THIS CCA DOES NOT INCLUDE EFFORT REQUIRED FOR ALSEP DESIGN ASSISTANCE OR FOR THE ENVIRONMENTAL DEFINITION PROGRAM AS DEFINED IN GAEC LLR-150-1155.

- HARDWARE DELIVERY FOR NUCLEAR INTERFACING OF THE LFC/RCS-PQGS IS NOT INCLUDED IN THIS ESTIMATE.

  THE EFFORT FOR LAUNCH PAD OR FLIGHT SAFETY STUDIES HAS BEEN EXCLUDED. THIS ESTIMATE FURTHER ASSUMES THAT POTENTIAL SAFETY PROBLEMS SUCH AS NUCLEAR RADIATION AND EXPLOSION/FLAMMABILITY PROBLEMS WILL BE INVESTIGATED BY NASA.

- FLIGHT MEASUREMENT #MCR443 (THERMOSTAT) FOR LEM SKINS IS EXCLUDED IN ITS ENTIRETY.

- NUCLEAR RADIATION SENSORS, IF REQUIRED, WILL BE GFE INCLUDING ALL ASSOCIATED EFFORT, SUCH AS WIRING AND DATA REDUCTION AND HANDLING.

- ONLY INFORMAL MEMORANDUMS OR LETTER TYPE REPORTS WILL BE FURNISHED AS REQUIRED FOR DOCUMENTATION OF ANALYSIS OR STUDIES COVERED BY THIS CCA.

- OPERATIONAL RTG CASK ARE TO BE INSTALLED ON LEM'S 4 THROUGH 6 ONLY.

- THE GAEC FEASIBILITY REPORT, LED 360-57 "RTG FEASIBILITY REPORT," ACCEPTED THE CONCEPT OF CARRYING THE RTG POWER SUPPLY ON LEM TO THE MOON. THIS ACCEPTANCE WAS CONTINGENT AT THAT TIME ON SEVERAL GAEC TECHNICAL AND SCHEDULING PROVISIONS, AND THE UNDERSTANDING THAT THE RTG WILL BE CONFIGURED AS DEPICTED IN G.E. FINAL "TECHNICAL RTG REPORT" GR-CR-1201-65. THERE ARE NOW NEW DIMENSIONS AND SHAPE FOR THE CASK. THIS ESTIMATE ASSUMES THAT NAA WILL AGREE TO THE LFC INTRUSION INTO THE LEM WITHDRAWAL ENVELOPE DUE TO THESE CHANGES.

- THE OTHER OUTSTANDING PROVISIONS REQUIRED BY THE FEASIBILITY REPORT BUT EXCLUDED IN THIS ESTIMATE BY REASONS OF NASA DIRECTIONS ARE:

  A) THERMAL SIMULATION OF RTG ON LEM-3

  B) FULL UP ISOTOPE SOURCE FOR LFC/RCS-PQGS TESTS

  C) UTILIZATION OF S-V COOLANT LOOP FOR COOLING RTG FUEL CASK DURING LAUNCH BOOST AND EARTH ORBIT. (THIS RECOMMENDATION WAS REINFORCED BY AGEC IN RESPONSE TO NASA LETTER BC-54-65-443.)

- THIS NEGOTIATION DOES NOT CONSIDER ANY OF THE ABOVE, THE OMISSION OF WHICH GAEC CONSIDERS AS A HIGH RISK FOR A COMPATIBLE LEM/RTG AND LEM/RTG/SLA INTERFACE.

- THE SCHEDULE (TO INTEGRATE THE RTG) SET UP IN LED 360-57 "RTG FEASIBILITY REPORT" TO MAKE RTG/LEM PROGRAM INTEGRATION COMPATIBLE IS IN JEOPARDY, REQUIRING LTA-8 RETRO-FIT AND POSSIBLY LTA-3 RETRO-FIT AT GAEC. RETRO-FIT AT HOUSTON HAS BEEN EXCLUDED IN THIS ESTIMATE.

- THIS ESTIMATE FURTHER ASSUMES THAT NASA WILL PROVIDE A COMPATIBLE SLA ENVIRONMENT. GRUMMAN EFFORT FOR LFC COLD PLATE REQUIREMENTS HAS BEEN EXCLUDED.

- A QUALIFIED ISOTOPE WILL NOT BE REQUIRED FOR SYSTEMS TESTS ON LTA-1 AT GAEC.

- NO REQUIREMENT EXISTS FOR UTILIZATION OF LEM-1, LEM-2, OR LEM-3 IN THIS PROGRAM.

- NO PROVISION FOR ACTIVE HEAT DISSIPATION WILL BE REQUIRED OF LEM.

- THE PRELAUNCH MOUNTING AND TRANSPORTATION ACTIVITIES INVOLVING THE RTG FUEL CAPSULE ARE TO BE ASSUMED BY NASA.

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LID-360-22804 STILL CAMERA PACKAGE - STOWAGE (LEM) REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT. SIGNED OFF BY EPO AND GAEC AT SEQ MEETING NO. 3	10/21/65	10/21/65	
LID-360-22804-1 DEFINES MAX. ALLOWED TOLERANCE IN DISTANCE BETWEEN THE PARALLEL MOUNTING RAILS ON LEM ENGINE COVER FOR CAMERA.	3/4/66		NASA SIGNATURE REQUIRED (IRN TRANSMITTED TO NASA ON 4/27/66)
LID-360-22805 FILM AND TAPE CONTAINER STOWAGE (LEM) REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT SIGNED OFF BY EPO AND GAEC AT SEQ MEETING NO. 4	12/21/65	12/21/65	
LID-360-22805-1 DELETES 4 OF THE 6 CALFAX FASTENERS (SWIP PROGRAM)	3/4/66		NASA SIGNATURE REQUIRED (IRN TRANSMITTED TO NASA ON 4/27/66)

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LID-360-22802 SPECIMEN RETURN CONTAINERS STOWAGE (LEM). REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT. SIGNED OFF BY EPO AND GAEC AT SEQ MEETING NO. 3	10/21/65	10/21/65	
LID-360-22802-1 CHANGE SPECIMEN TO SAMPLE TO AGREE WITH LSP-360-11	9/1/65	10/1/65	NOT STARTED
LID-360-22803 SEQUENCE CAMERA EXTRA FILM CONTAINER STOWAGE (LEM). REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT. SIGNED OFF BY EPO AND GAEC AT SEQ MEETING NO. 4	12/21/65	12/21/65	

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LIS-360-22700 INSTALLATION AND PRE-LAUNCH SERVICING REQUIREMENTS FOR LEM SCIENTIFIC EQUIPMENT. REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT. GSE REQUIREMENTS WILL BE DEFINED AT NEXT SCIENTIFIC EQUIPMENT MEETING.			SEQ REQUIREMENTS NOT YET DEFINED TO GAEC.
LID-360-22704 SCIENTIFIC EQUIPMENT RAY PRELAUNCH ASSESSIBILITY.			SEQ REQUIREMENTS NOT YET DEFINED TO GAEC.

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LID-360-22502 LEM WIRING ELECTRICAL INTERFACE FOR SCIENTIFIC EQUIPMENT	12/21/65	12/21/65	
REMARKS - VEHICLE EFFECTIVITY LTA-1, LTA-8, LEM-4 AND SUB. SIGNED OFF BY EPO AND GAEC AT SEQ MEETING NO. 4			

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR ACTION
LIS-360-22304 ENVIRONMENTAL CONDITIONS INDUCED BY LEM ON THE SEQUENCE CAMERA EXTRA FILM CONTAINER.	12/21/65	12/21/65	
REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT SIGNED OFF BY EPO AND GAEC AT SEQ MEETING NO. 4			
LIS-360-22304-1 DEFINES A TEMPERATURE TIME HISTORY CURVE OF THE LEM CABIN WALLS	4/20/66		
LIS-360-22304-2 DEFINES ENVIRONMENTS FOR LAUNCH AND BOOST AND TRANSLUNAR PHASES BECAUSE SCN 27b REQUIRES CONTAINER TO BE CARRIED IN LEM (VS) CM	9/1/66	10/1/66	NOT STARTED

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR [illegible] ACTION
LIS-360-22303 ENVIRONMENTAL CONDITIONS INDUCED BY LEM ON THE SPECIMEN RETURN CONTAINERS REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT. TEMPERATURE SECTION REQUIRES COMPLETION. LUNAR ASCENT PHASE TEMPERATURES ARE TBD	12/21/65	12/21/65	
LIS-360-22303-1 DEFINES TEMPERATURE TIME HISTORY CURVES OF LEM WALLS AND LEM ASCENT ENGINE COVER	4/20/66		NASA SIGNATURE REQUIRED (IRN TRANSMITTED TO NASA ON [illegible]/27/66)
LIS-360-22303-2 CHANGE SPECIMEN TO SAMPLE TO AGREE WITH LSP-360-11	8/1/66	9/1/66	BEING DRAFTED

ICD AND IRN NUMBER AND TITLE		SIGN OFF GAEC	EPO	CURRENT EFFORT OR NEED FOR ACTION
LIS-360-22301-2	DEFINES ENVIRONMENTS FOR LAUNCH, BOOST AND TRANSLUNAR PHASES BECAUSE SCN 276 REQUIRES CAMERA TO BE CARRIED IN LEM (VS) CM	8/1/66	9/1/66	THIS IRN NOT STARTED
LIS-360-22302	ENVIRONMENTAL CONDITIONS INDUC BY LEM ON THE SCIENTIFIC EQUIP IN THE DESCENT STAGE	10/21/65	10/21/65	
REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT.				
LIS-360-22302-1		7/1/66		UPDATE AND CLARIFY AS PER SEQ MEETING # 9.

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR N ACTIO
LIS-360-22101 LEM SCIENTIFIC EQUIPMENT MATERIALS COMPATIBILITY REQUIREMENTS.	10/21/65	10/21/65	TITANIUM JOINTS AND PIN MAY HAVE TO BE ANODIZED. CURRENT STUDY IN PROGRESS BY GAEC AND BENDIX
REMARKS - VEHICLE EFFECITVITY LEM-4 AND SUBSEQUENT. NEED ESTABLISHED AT SEQ MEETING NO. 1 SIGNED OFF BY EPO AND GAEC AT SEQ. MEETING NO. 3			
LIS-360-22101-1 SPECIAL REQUIREMENTS TO INCORPORATE LFC	NS		NO MATERIALS LISTS SENT TO GAEC AS OF 6/28/66.
LIS-360-22102 SCIENTIFIC EQUIPMENT MASS PROPERTIES.	10/21/65	10/21/65	
REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT NEED ESTABLISHED AT SEQ MEETING NO. 1. SIGNED OFF BY EPO AND GAEC AT SEQ. MEETING NO. 3.			
LIS-360-22102-1 COMBINED FILM CONTS	12/21/65	12/21/65	

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR ACTIO
LIS-360-22102			
22102 - 2. LAUNCHED FILM IN LEM VS CM	7/1/66		NASA SIG REQUIRED FOR IRN's # 2, 3, 4
22102 - 3. INCORPORATED CCA 183	6/7/66		
22102 - 4. LAUNCH STILL CAMERA IN LEM VS CM. INCORPORATE SCN # 27b	7/1/66		
LIS-360-22301 ENVIRONMENTAL CONDITIONS INDUCED BY LEM ON THE STILL CAMERA PACKAGE.	10/21/65	10/21/65	
REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT. SIGNED OFF BY EPO AND GAEC AT SEQ. MEETING NO. 3.			
LIS-360-22301-1 GENERAL UPDATING INCLUDING AN UPDATED CABIN PRESSURE (VS) ELAPSED TIME CURVE.	4/20/66		NASA SIGNATURE REQUIRED (IRN TRANSMITTED TO NASA ON 4/27/66)

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LID-360-22812 LEM DESCENT STAGE SCIENTIFIC EQUIPMENT BAY THERMAL DOOR (FUNCTIONAL) REMARKS - VEHICLE EFFECITVITY LEM-4 AND SUBSEQUENT NEED ESTABLISHED AT SEQ MEETING NO. 3	8/15/66		BEING DRAFTED
LID-360-22813 LEM SCIENTIFIC EQUIPMENT ELECTRICAL INTERFACE CONNECTOR LOCATION REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT	1/28/66	2/7/66	

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LIS-360-22305 ENVIRONMENTAL CONDITIONS INDUCED BY LEM ON THE FILM AND TAPE CONTAINER. REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT TEMPERATURE SECTION REQUIRES COMPLETION. LUNAR ASCENT PHASE TEMPERATURES ARE TBD.	12/21/65	12/21/65	
LIS-360-22305-1 DEFINES TEMPERATURE TIME HISTORY CURVES OF LEM CABIN WALLS AND ASCENT ENGINE COVER	4/20/66		NASA SIGNATURE REQUIRED (IRN TRANSMITTED TO NASA ON 4/27/66)
LIS-360-22305-2 DEFINES ENVIRONMENTS FOR LAUNCH AND BOOST AND TRANSLUNAR PHASES BECAUSE SCN 27b REQUIRES CONTAINER TO BE CARRIED IN LEM (vs) CM.	10/1/66	11/1/66	NOT STARTED

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LIS-360-22402 ENVIRONMENTAL CONSTRAINTS IMPOSED BY LEM ON THE LEM FUEL CASK REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUB.	8/15/66		BEING DRAFTED
LIS-360-22501 LEM ELECTRICAL POWER ALLOCATION AND CONSTRAINTS FOR THE SCIENTIFIC EQUIPMENT (SEQ) REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT. SIGNED-OFF BY EPO AND GAEC AT SEQ MEETING NO. 3	10/21/65	10/21/65	
LIS-360-22501-1 GENERAL UPDATING INCLUDES CHANGE OF LEM NOMINAL VOLTAGE RANGE FROM 24-33VDC TO 25-33VDC, DEFINITION OF 40 AMP SEQ CIRCUIT BREAKER, AND POWER REQUIRED BY INDIVID-			AMPERAGE REQUIREMENT MAY POSSIBLE BE REDUCED

ICD AND IRN NUMBERS AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LID-360-22809 MOUNTING OF RTG. FUEL CASK TO THE LEM.	7/15/66		INCORPORATION OF BENDIX DESIGN AS SHEET 3 OF THE INTERFACE.
LID-360-22810 SCIENTIFIC EQUIPMENT CONTAINERS STOWAGE AND REMOVAL (LEM DESCENT STAGE).	10/21/65	10/21/65	
REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT SIGNED OFF BY EPO AND GAEC AT SEQ MEETING NO. 3			
LID-360-22810-1 DEFINED C.Q.	10/21/65	10/21/65	NASA SIGNATURE REQUIRED FOR INR's 2 AND 3.
LID-360-22810-2 TOLERANCE CHANGE	6/7/66		
LID-360-22810-3 VERTICAL COLUMN CLEARANCE	4/27/66		

ICD AND IRN NUMBER AND TITLE	SIGN OFF GAEC	SIGN OFF EPO	CURRENT EFFORT OR NEED FOR ACTION
LID-360-22814 LEM SCIENTIFIC EQUIPMENT ELECTRICAL CONNECTOR THERMAL DOOR (FUNCTIONAL) REMARKS - VEHICLE EFFECTIVITY LEM-4 AND SUBSEQUENT.	9/1/66	10/1/66	DESIGN OF THERMAL DOOR COMPLETED BUT MUST BE ANALYZED BY STRUCTURES AND THERMAL. ICD HAS NOT BEEN STARTED.

STATUS AS OF 30 JUNE 1966

- THE LFC STRUT SYSTEM DRAWINGS HAVE BEEN RELEASED TO MANUFACTURING ON 28 JUNE 1966. (DVT MODEL FOR SHIPMENT TO BN CR GE WILL BE AVAILABLE BY 15 AUGUST 1966.) STRUT DRAWINGS HAD BEEN SENT TO BN ON 28 JUNE 1966.

- SHEET 1 AND 2 OF LID-360-22809 HAVE BEEN COMPLETED AND WERE SENT TO BN WITH INTERCHANGEABLE STUDY ON 28 JUNE 1966.

- ICD VERIFICATION TESTS FOR LSD SIMULATOR HAVE BEEN COMPLETED WITH NEGATIVE RESULTS. DRILL SIMULATOR DOES NOT QUALIFY AND WAS RETURNED TO MARTIN ON 30 JUNE 1966

- AGREEMENT REACHED ON LEM/GFE DELIVERY REQUIREMENTS FOR ALL TEST AND FLIGHT VEHICLES.

- ALL SEB DRAWINGS HAVE BEEN COMPLETED FOR LTA 3 AND WILL BE SENT TO BENDIX IN 2 WEEKS.

- LIS 360-22302 (ENVIRONMENTAL CONDITIONS INCLUDED BY LEM) WAS REVISED FOR NON-SIMULTANEOUS APPLICATION OF SHOCK AND VIBRATION AND OTHER AGREEMENTS OF GAEC EXPO MEETING #9.

- LOAD ENVIRONMENTS FOR LIS 360-22402 (ENVIRONMENTAL CONSTRAINT IMPOSED BY LEM ON THIS LFC) HAVE BEEN COMPLETED. (NUCLEAR AND THERMAL SECTIONS DUE 15 AUGUST 1966.)

- NEGOTIATIONS FOR INCLUSION OF THE RTG IN THE LEM SEQ PAYLOAD HAVE BEEN COMPLETED, AND THERMAL CRITERIA RECEIVED 9 JUNE 1966.

TABLE I

SEQ/LEM ICD'S

Equipment Name	Structural Stowage	Weight	Materials	SEQ Environmental Constraints	Electrical	FUNCTIONAL Prelaunch Handling and c/o Procedures & Oper. Requirements
Specimen Return Containers (2)	LID-360-22802	LIS-360-22102	LIS-360-22101	LIS-360-22303-1 LIS-360-22303-2		LIS-360-22700 LID-360-22704
Sequence Camera Extra Film Container	LID-360-22803	LIS-360-22102-2	LIS-360-22101	LIS-360-22304-1 LIS-360-22304-2	LIS-360-22501-1	LIS-360-22700 LID-360-22704
Still Camera Package	LID-360-22804-1	LIS-360-22102-4	LIS-360-22101	LIS-360-22301-1 LIS-360-22301-2		LIS-360-22700 LID-360-22704
Film and Tape Container	LID-360-22805-1	LIS-360-22102-1 LIS-360-22102-2	LIS-360-22101	LIS-360-22305-1 LIS-360-22305-2		LIS-360-22700 LID-360-22704
SEQ Containers (Descent Stage)	LID-360-22810-1 LID-360-22810-2 LID-360-22810-3	LIS-360-22102-3	LIS-360-22101	LIS-360-22302-1	LIS-360-22501-1 LIS-360-22502	LID-360-22812 LID-360-22813 LID-360-22814
LEM Fuel Cask (LFC)	LID-360-22809	LIS-360-22102-3	LIS-360-22101-1	LIS-360-22402		LIS-360-22700 LID-360-22704

EF

Data Bank
ALSEP papers

#4

July 21966
Meeting

DB-2010

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EB4/J. Overton
EC5/E. LaFevers
ED14/F. Griffin
ED5/G. H. Leach
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W. Womack
J. Dragg
EP4/E. Weeks
EP5/J. Grayson
ES3/R. Harris
EX/R. Vale
E. Smith
P. Penrod
EX2/J. Small
EX3/F. Pearce
EX32/D. Wiseman
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