

7H3/Dragg  
ALSEP  
Papers

AGENDA

APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE

Interface Meeting

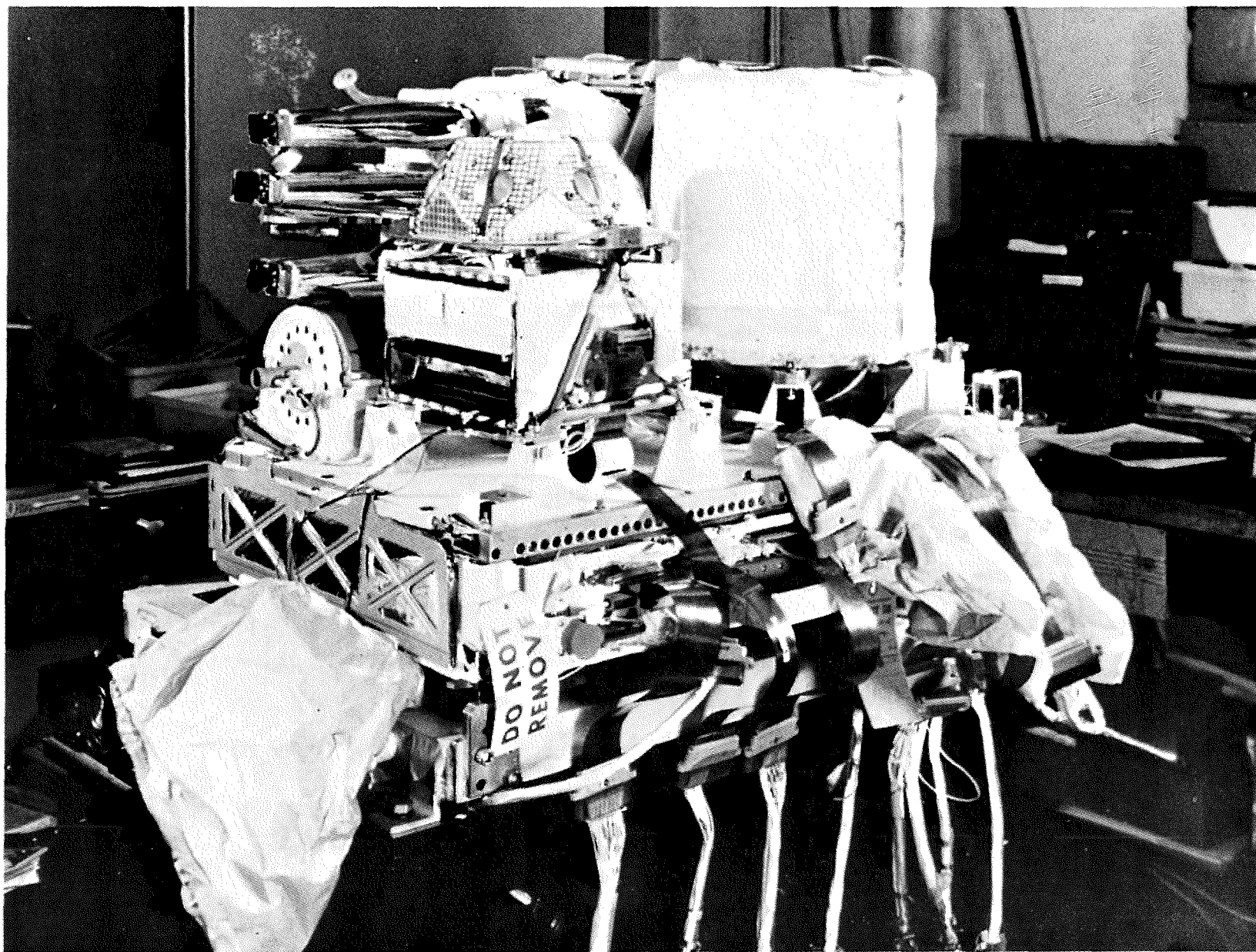
NASA-MSC

Houston, Texas

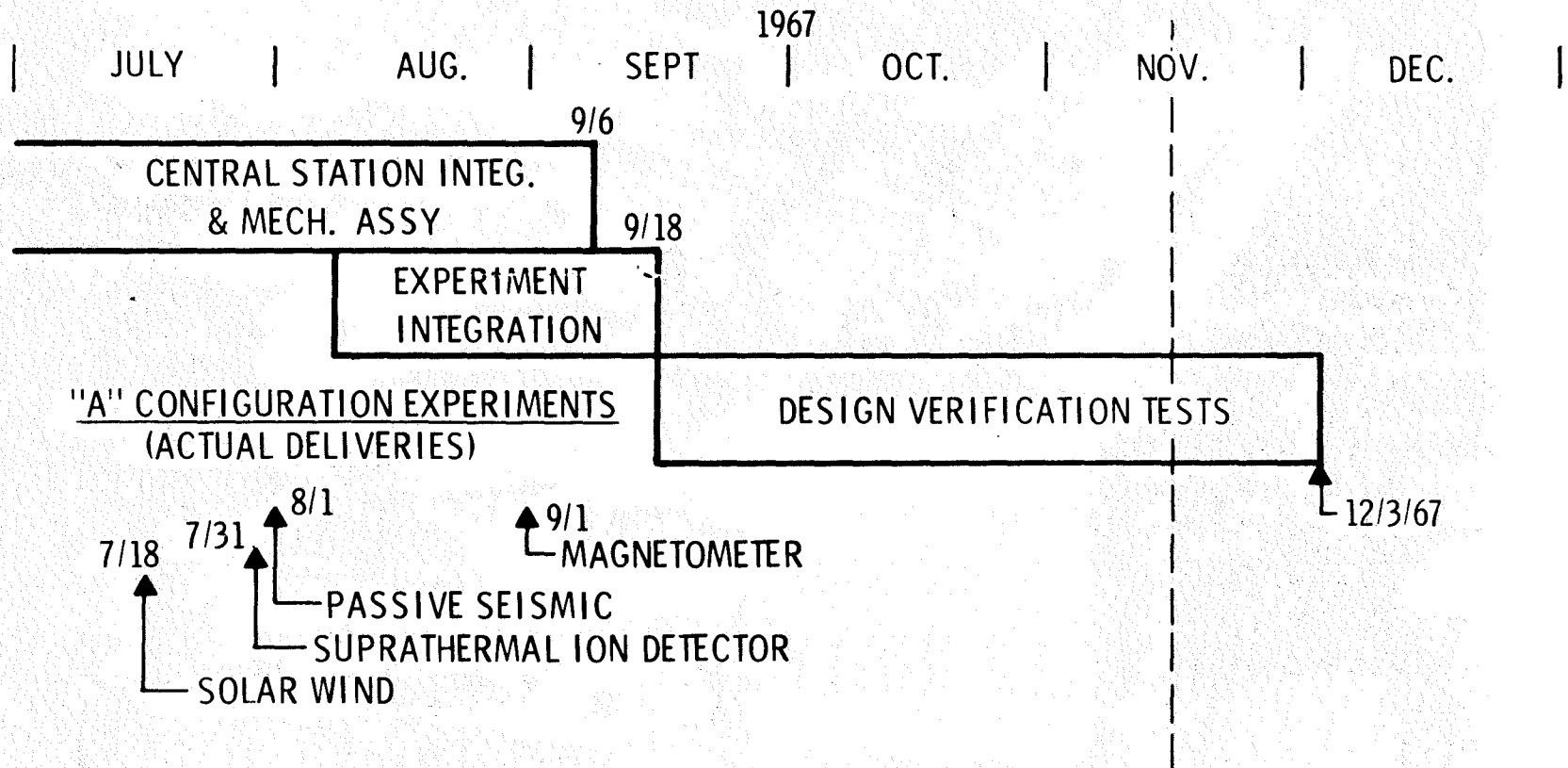
November 16, 1967

|              |                                                                                                                                                                                                                     |                 |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 8:30         | Introduction                                                                                                                                                                                                        | Mr. J. Small    |
| 8:35         | ALSEP Proto A test Set up<br>and Results                                                                                                                                                                            | Mr. J. Clayton  |
| 9:35         | ALSEP Qual Test Status                                                                                                                                                                                              | Mr. A. Schorken |
| 10:00 - 2:15 | Organizational Status<br>Reports: <ul style="list-style-type: none"><li>. Overall Schedule<br/>Status</li><li>. Accomplishments<br/>To Date</li><li>. Forecasted Accom-<br/>plishments</li><li>. Problems</li></ul> |                 |
| 10:00        | ALSEP                                                                                                                                                                                                               | Mr. J. Clayton  |
| 10:30        | SWS                                                                                                                                                                                                                 | Dr. C. Snyder   |
| 10:45        | LSM                                                                                                                                                                                                                 | Dr. C. Sonett   |
| 11:00        | PSE                                                                                                                                                                                                                 | Dr. G. Latham   |
| 11:15        | SIDE                                                                                                                                                                                                                | Dr. J. Freeman  |
| 11:30        | CCGE                                                                                                                                                                                                                | Dr. F. Johnson  |
| 11:45        | CPLEE                                                                                                                                                                                                               | Dr. B. O'Brien  |
| 12:00        | Lunch                                                                                                                                                                                                               |                 |
| 1:00         | ASE                                                                                                                                                                                                                 | Dr. R. Kovach   |

|      |                 |                 |
|------|-----------------|-----------------|
| 1:15 | HFE             | Dr. M. Langseth |
| 1:30 | LRR             | Dr. C. Alley    |
| 1:45 | DRILL           | Mr. M. Goldman  |
| 2:00 | RTG             | Mr. W. Remini   |
| 2:15 | Question Period |                 |
| 2:30 | Adjourn         |                 |



# PROTOTYPE MODEL SCHEDULE "A" CONFIGURATION



# **PROTOTYPE VIBRATION TESTING**

1. INTRODUCTION
2. TESTS PERFORMED
3. FACILITIES
4. TEST AND DATA REDUCTION CONDITIONS
5. QUESTIONS
6. TEST HISTORY
7. CONCLUSIONS AND RECOMMENDATIONS
8. QUESTIONS/DISCUSSION

# PURPOSE OF VIBRATION TESTING

1. VERIFY STRUCTURAL INTEGRITY
2. VERIFY DYNAMIC/STATIC ANALYSIS & SPECIFICATIONS

4422-2904

# TEST SEQUENCE-PROTO #1

## 1. PURPOSE

- A. VERIFY STRUCTURAL INTEGRITY
- B. VERIFY DYNAMIC ANALYSIS

## 2. TESTS

- A. STATIC
  - 1.4 AXIS, INCREMENTALLY TO 115 % OF DESIGN LOAD
- B. DYNAMIC -
  - 1. QUAL LEVEL. 3 AXIS SCAN, SINE & RANDOM VIBRATION

# TEST SEQUENCE (CONT.) LSM PROTO#1

## 1. PURPOSE

- A. TO VERIFY THE INTEGRITY AND DYNAMIC CHARACTERISTICS OF A NEW LSM MOUNTING CONCEPT.
- B. TO DETERMINE THE DYNAMIC ENVELOPE OF THE LSM WITH THE NEW MOUNTING CONCEPT.
- C. TO DETERMINE THE DYNAMIC CHARACTERISTICS AND THE IMPACT ON OTHER EXPERIMENTS UTILIZING THE NEW MOUNTING CONCEPT AND A 0° MOUNTING.

## 2. TESTS

- A. 3 AXIS SCAN, SINE & RANDOM
- B. HIGH SPEED MOVIES

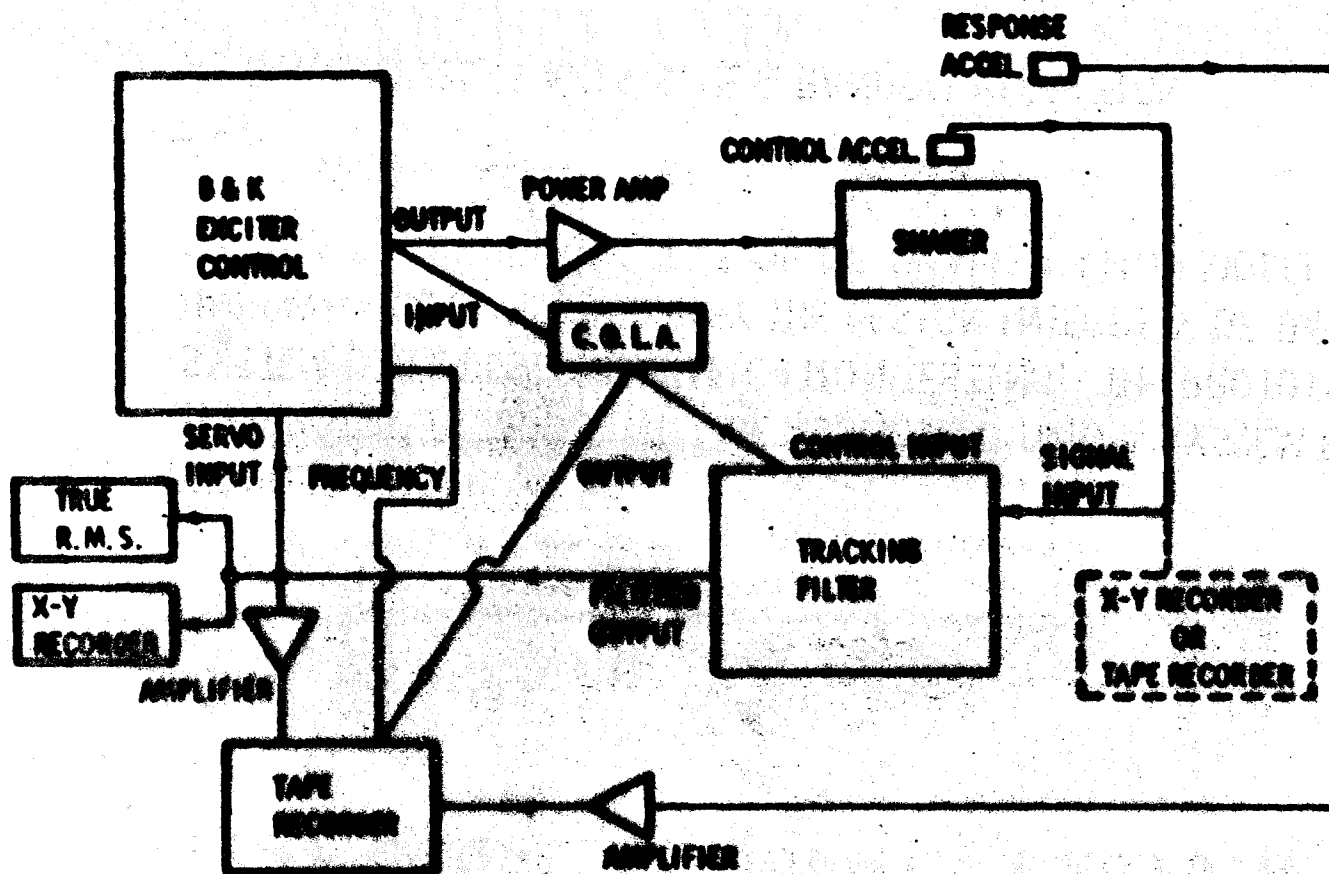
## TEST SEQUENCE (CONT.) PROTO A

### 1. PURPOSE

THE PROTOTYPE MODEL WILL BE ASSEMBLED INTO A SYSTEM FOR SYSTEM LEVEL DESIGN VERIFICATION TESTING. THE PROTOTYPE UNIT WILL BE USED TO VERIFY THE DESIGN INTEGRITY OF THE SYSTEM TO ASSURE SUCCESS OF THE QUALIFICATION MODEL.

### 2. TESTS

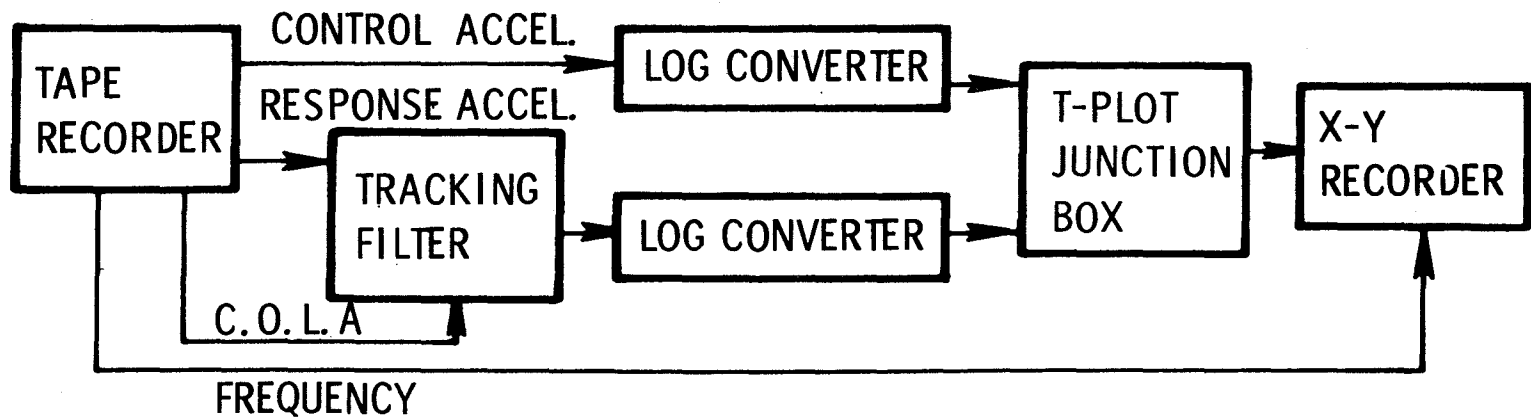
A. QUAL. LEVEL, 3 AXIS SINE & RANDOM VIBRATION



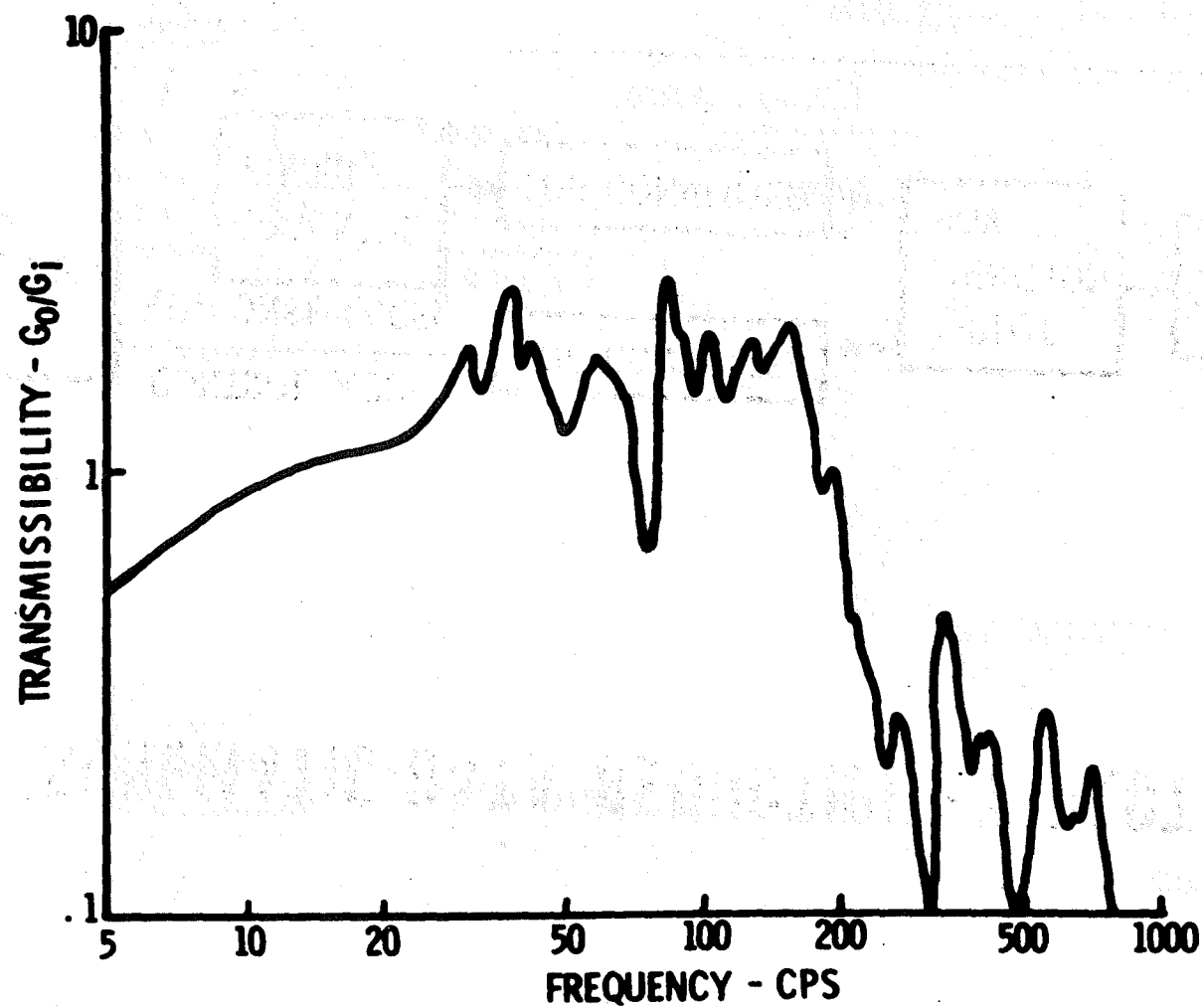
2-6 Fenske

2898  
4422-2000

## SCHEMATIC-DATA REDUCTION - T PLOT

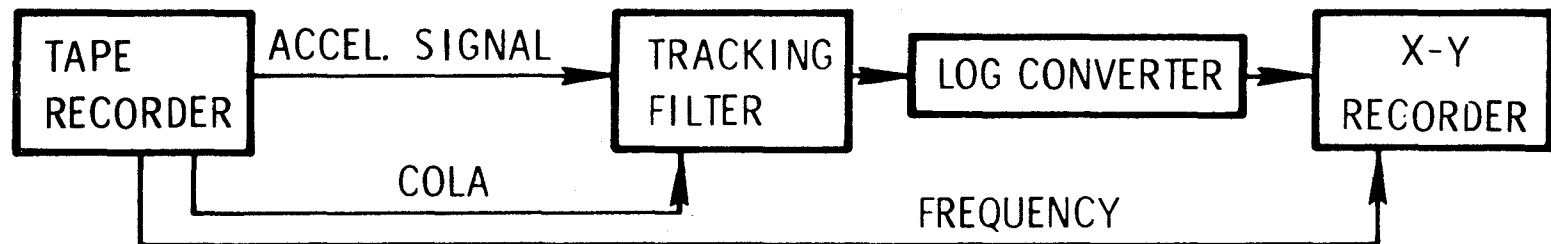


# TYPICAL T PLOT

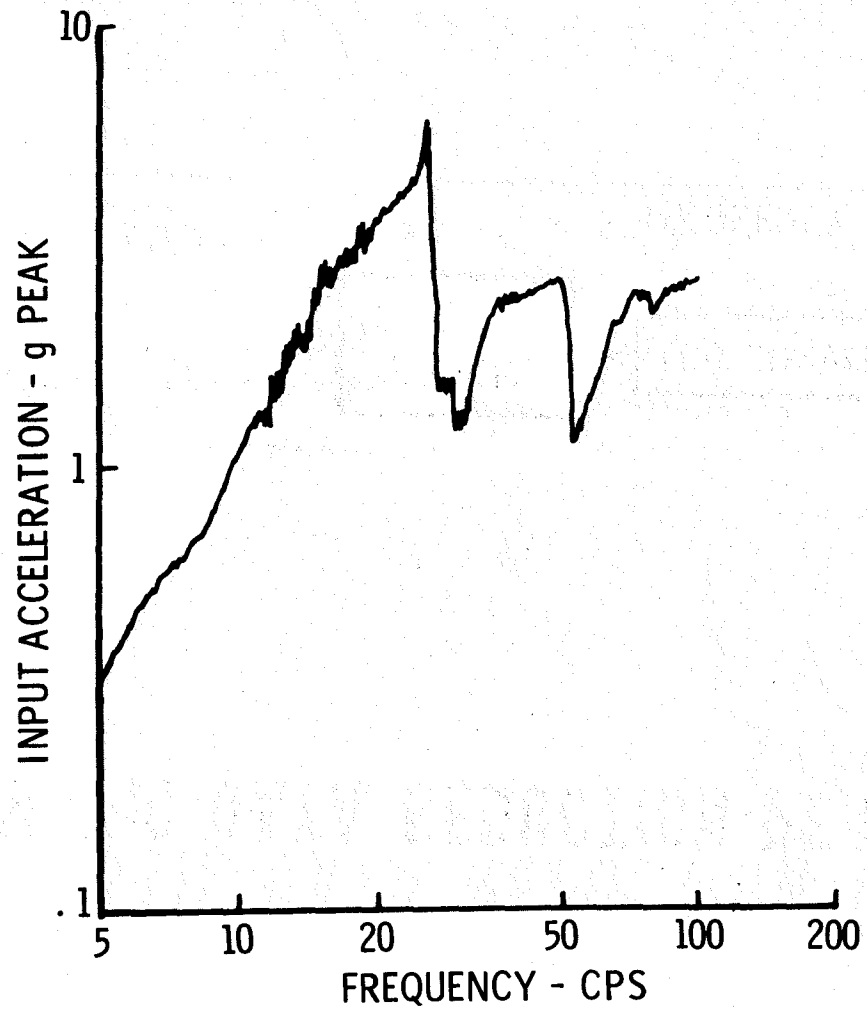


4422-2932

## SCHEMATIC-DATA REDUCTION-PEAK G PLOT

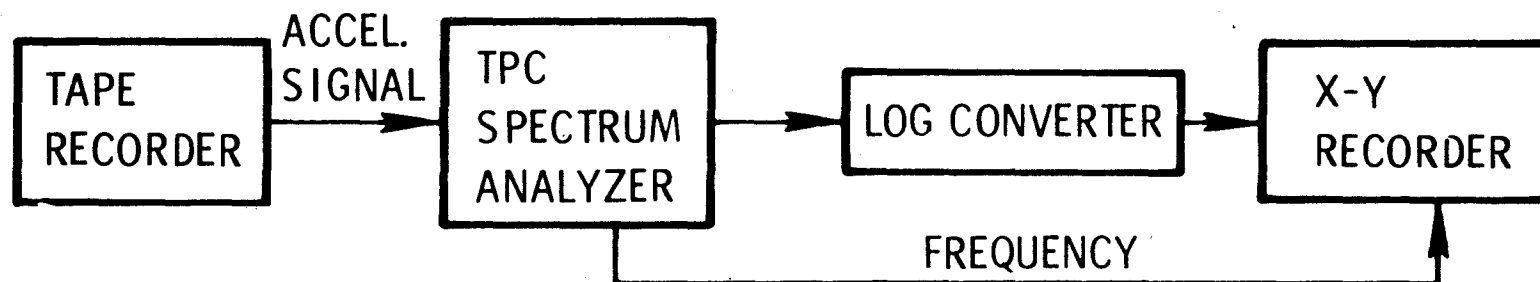


# TYPICAL PEAK G PLOT

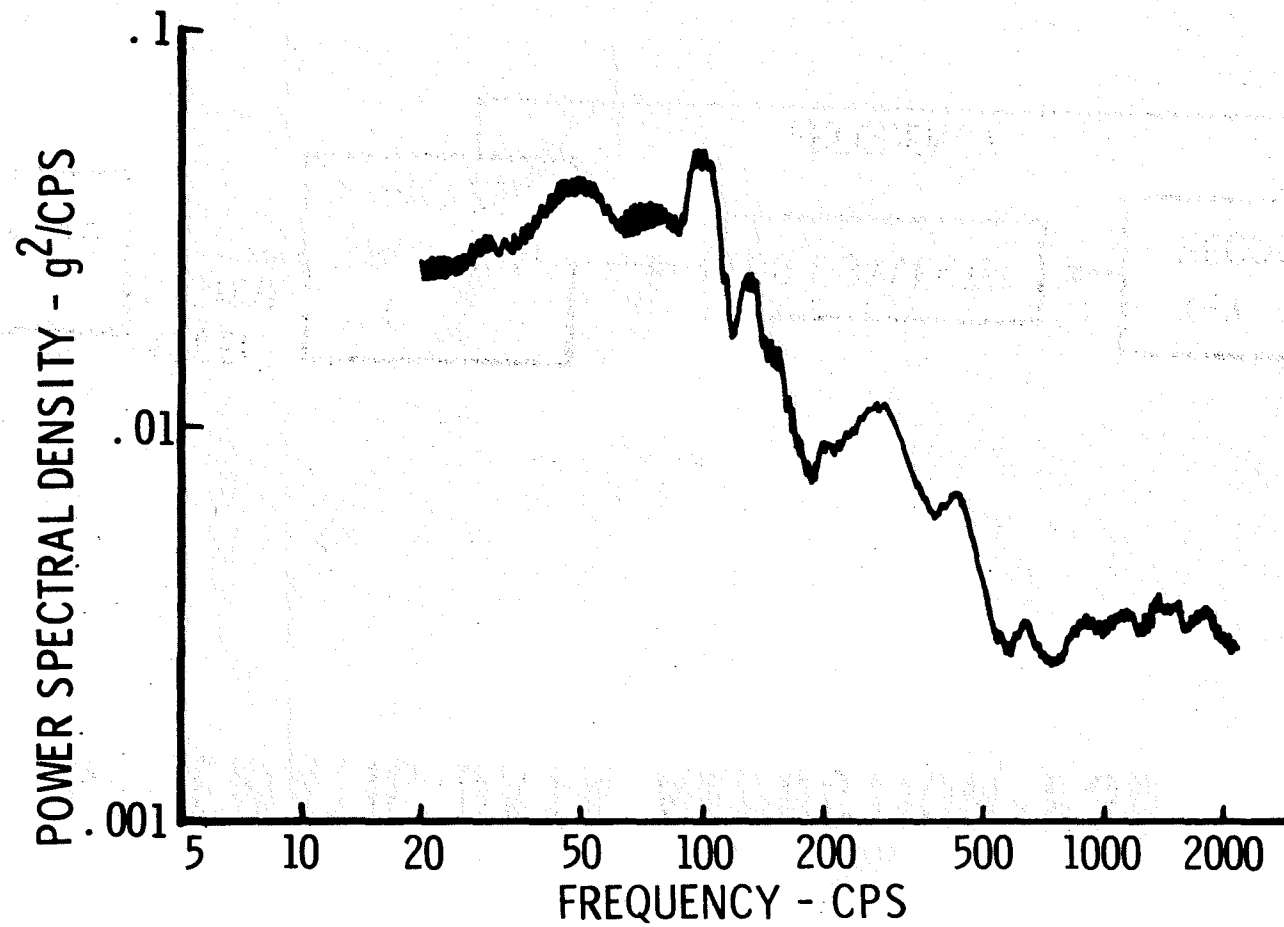


4422-2931

# SCHEMATIC-DATA REDUCTION-PSD



# TYPICAL PSD PLOT



# TEST EQUIPMENT

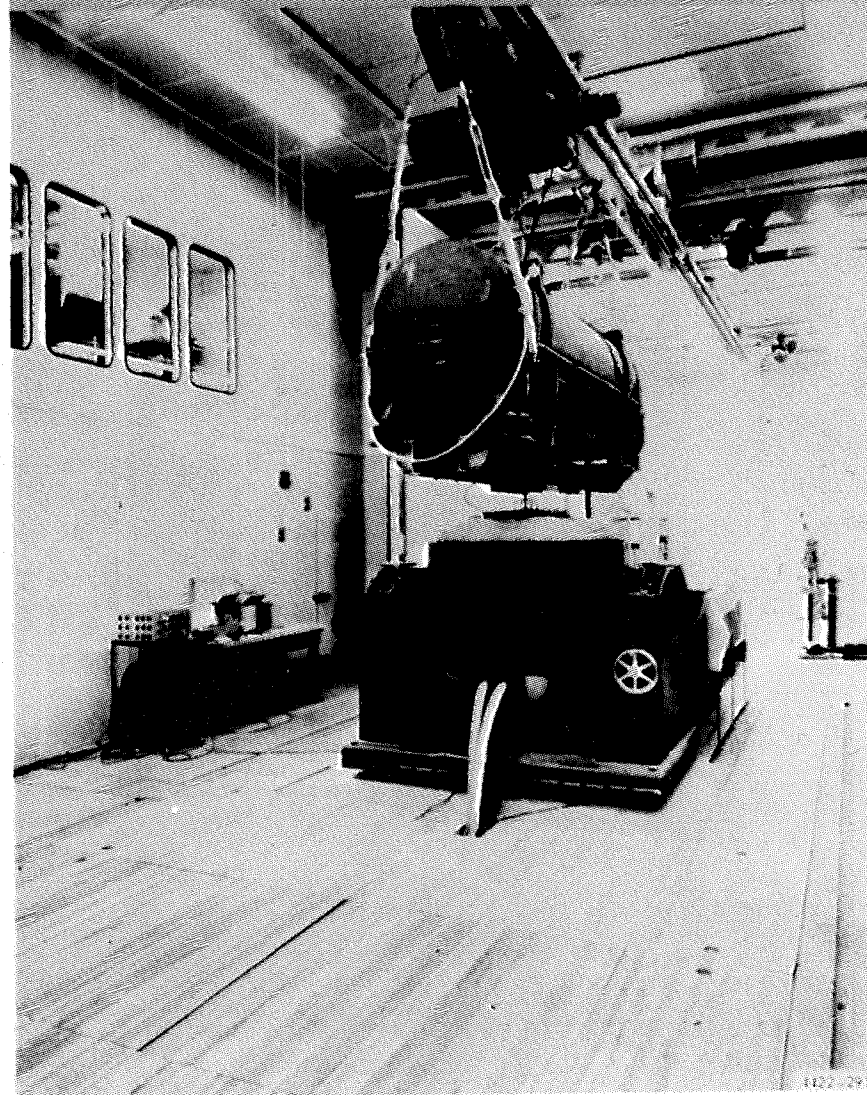
| ITEM                | MANUFACTURER      | SERIAL NO.     | MODEL NO.      |
|---------------------|-------------------|----------------|----------------|
| EXCITER CONTROL     | BRUEL & KJAER     | 1018           | 70666          |
| VIBRATION SYSTEM    | LING ELECTRONICS  | PP175/240-249  | 13, 30         |
| DYNAMIC ANALYZER    | SPECTRAL DYNAMICS | SD 101A        |                |
| COLA                | SPECTRAL DYNAMICS | SD 11          | 332            |
| X-Y RECORDER        | F. L. MOSELY      | 2 DR-20 AND 2D | 610-00711, 110 |
| TRUE RMS VOLT METER | BRUEL & KJAER     | 2409           | 48650          |

# TEST EQUIPMENT

(CONT.)

| ITEM              | MANUFACTURER           | MODEL NO.   | SERIAL NO. |
|-------------------|------------------------|-------------|------------|
| TAPE RECORDER     | AMPEX                  | FR 1100 B   | 156        |
| TAPE RECORDER     | SANBORN                | 3907-06A    | 640-00463  |
| TAPE RECORDER     | SANGAMO                | 471 RB      | 129        |
| LOG CONVERTER     | F. L. MOSELY           | 7561 A      | 548-00267  |
|                   |                        | 60 B        | 840        |
|                   |                        | 60 D        | 101        |
| SPECTRAL ANALYZER | TECHNICAL PRODUCTS CO. | TP 625      | 308        |
| ACCELEROMETER     | ENDEVCO CORP.          | 2221 C OR D | VARIED     |
| DYNAMONITOR       | ENDEVCO CORP.          | 2702 C      | VARIED     |

# VIBRATION EQUIPMENT SHAKER-VERTICAL AXIS



1422-2911

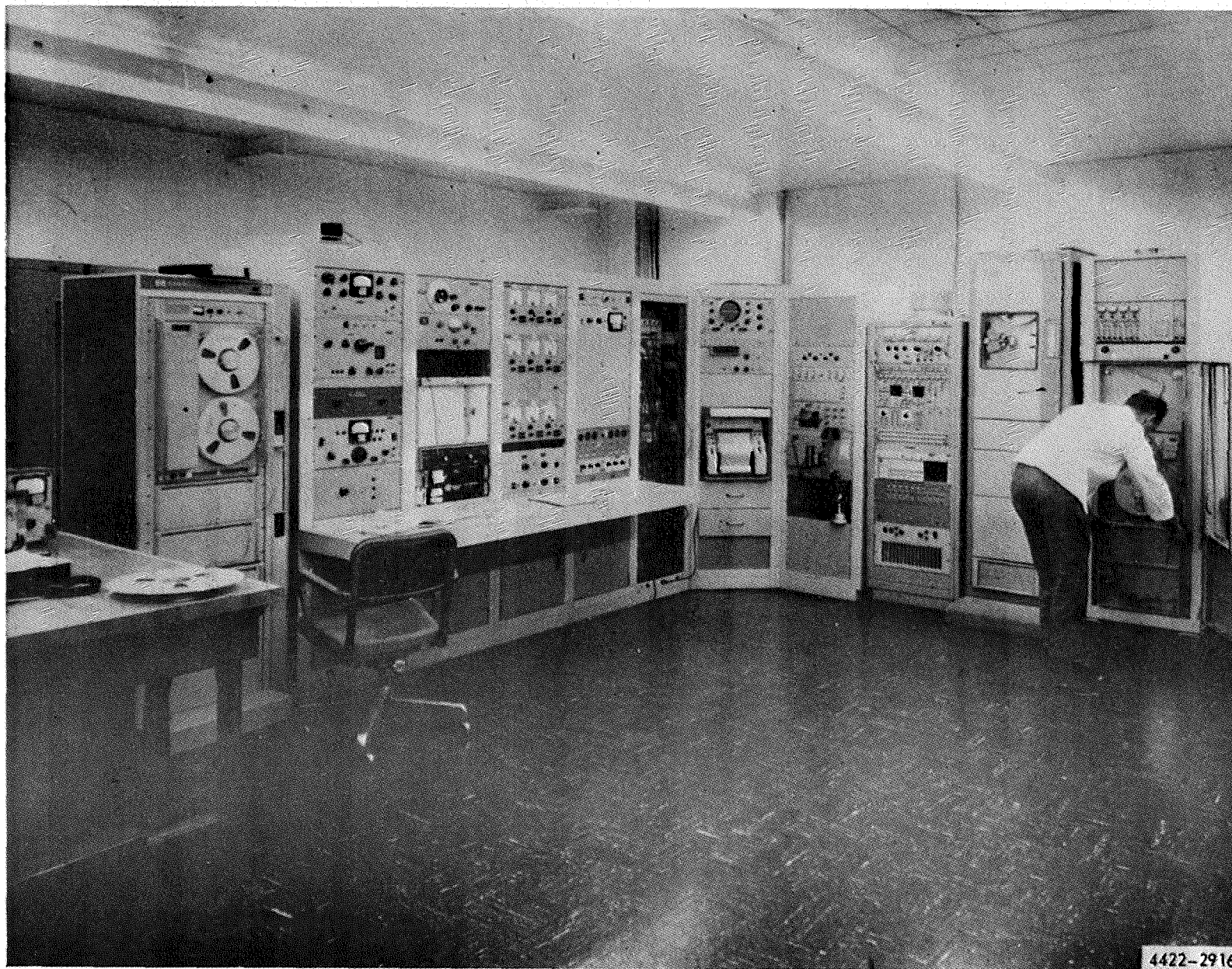
# VIBRATION EQUIPMENT-SHAKER CROSS-AXIS



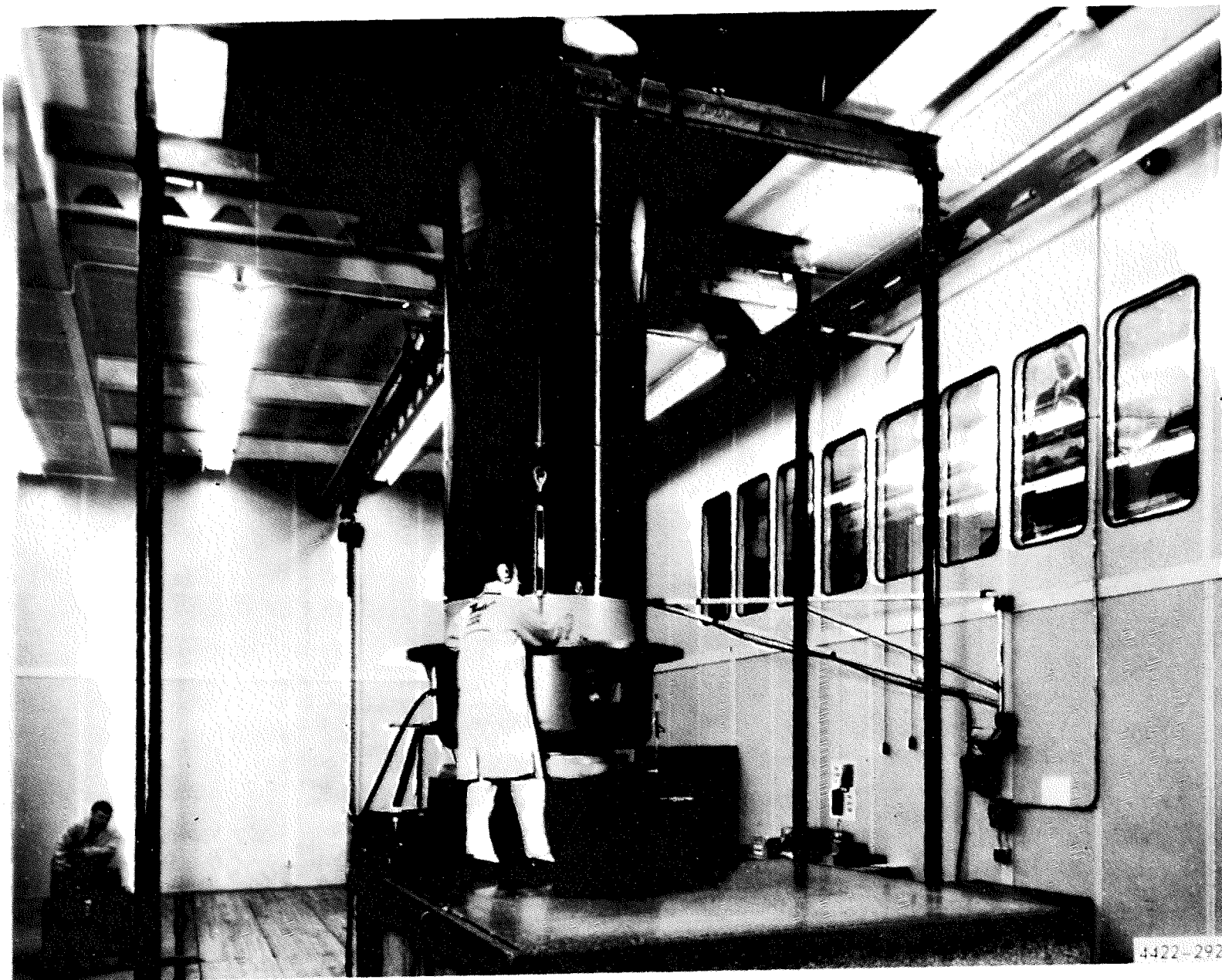
## VIBRATION EQUIPMENT-CONTROL SYSTEM



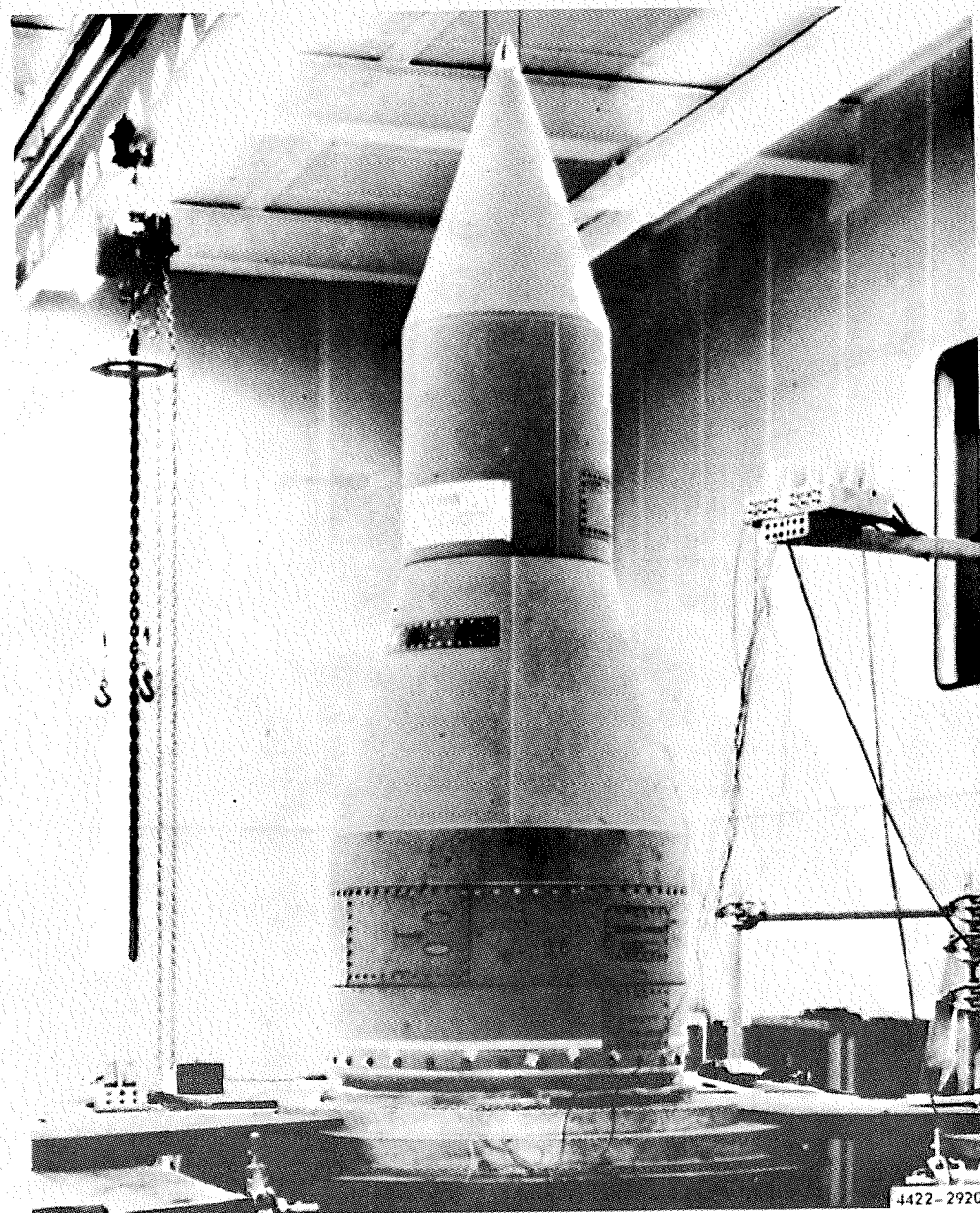
4422-2915



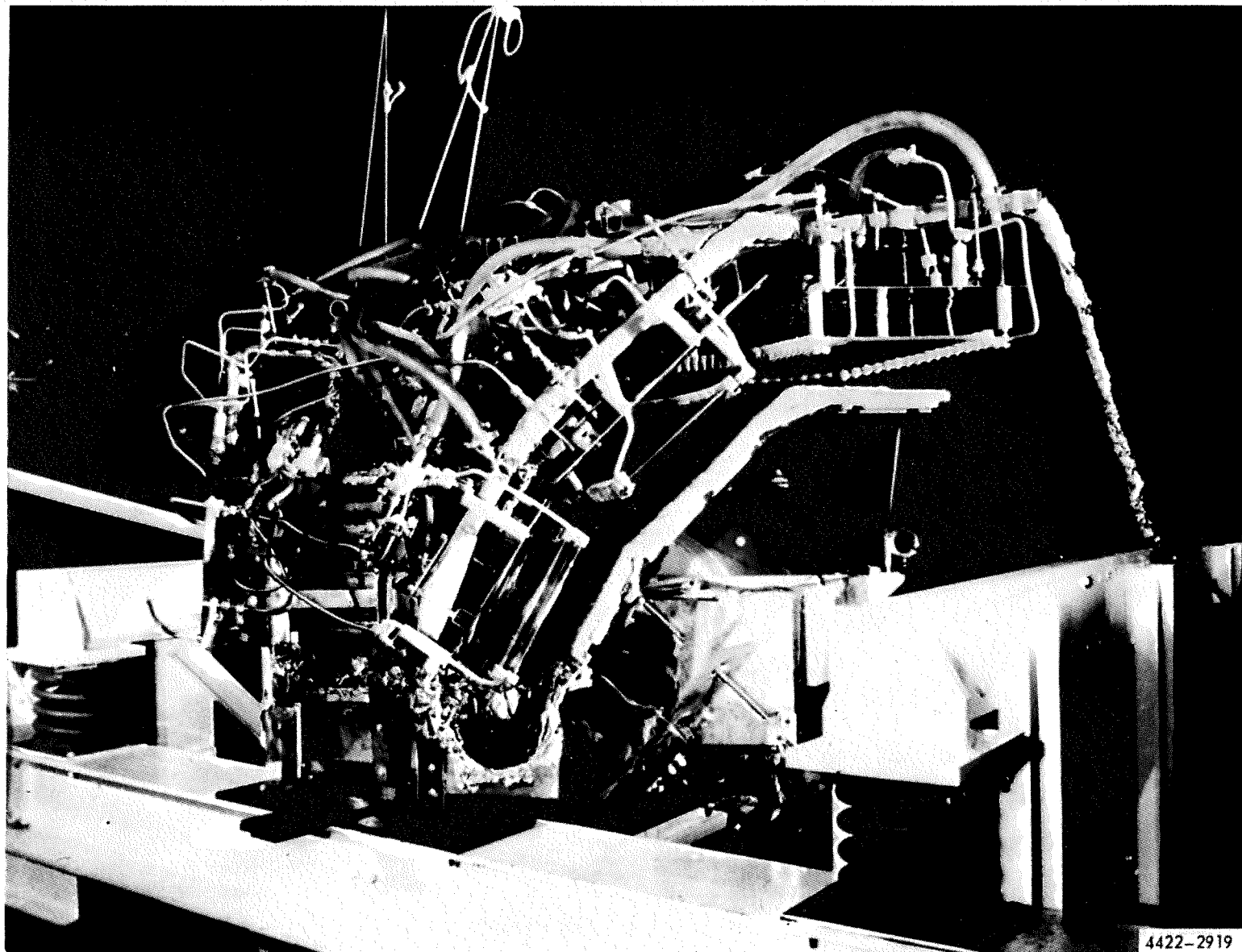
4422-2916



4422-2921

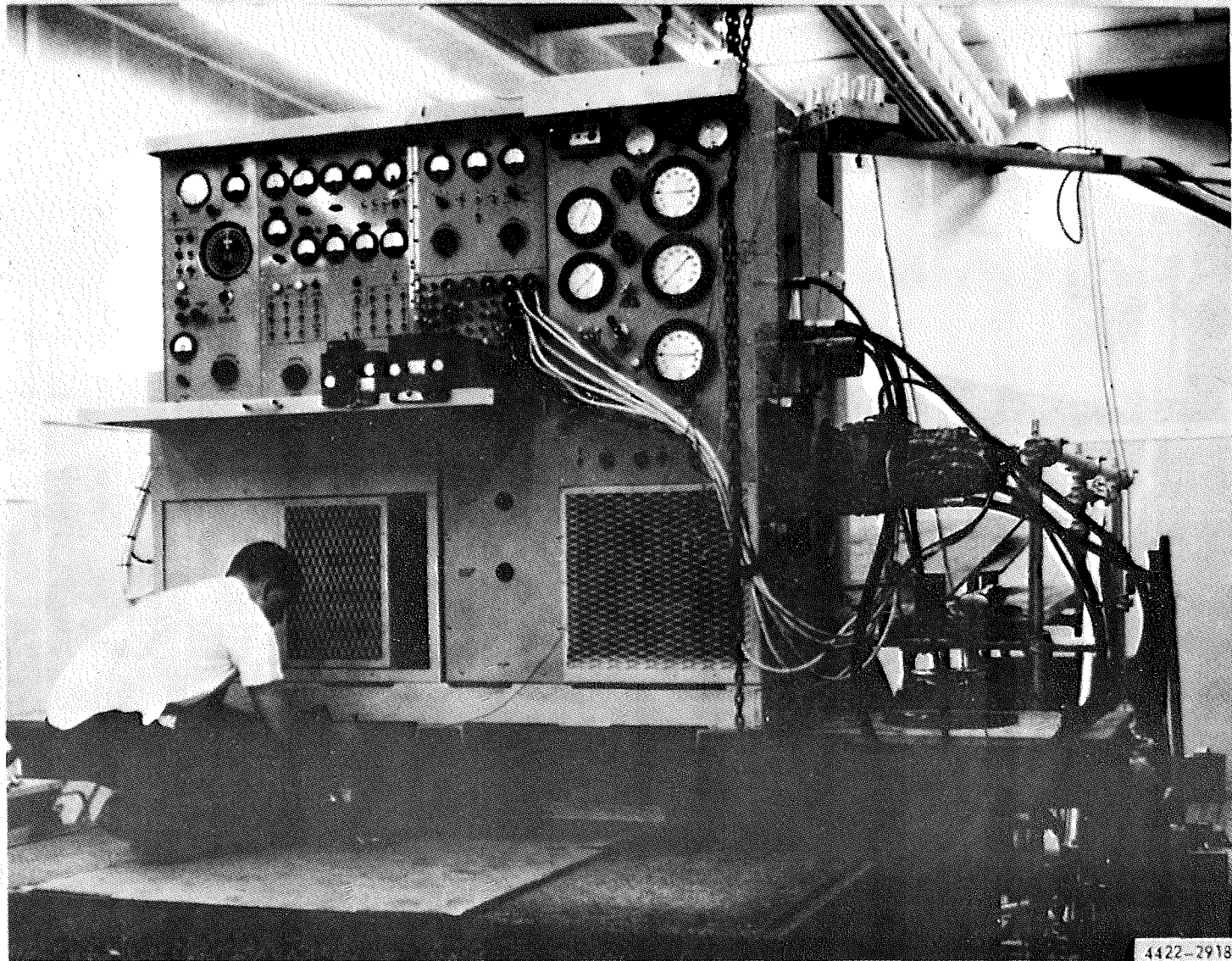


4422-2920

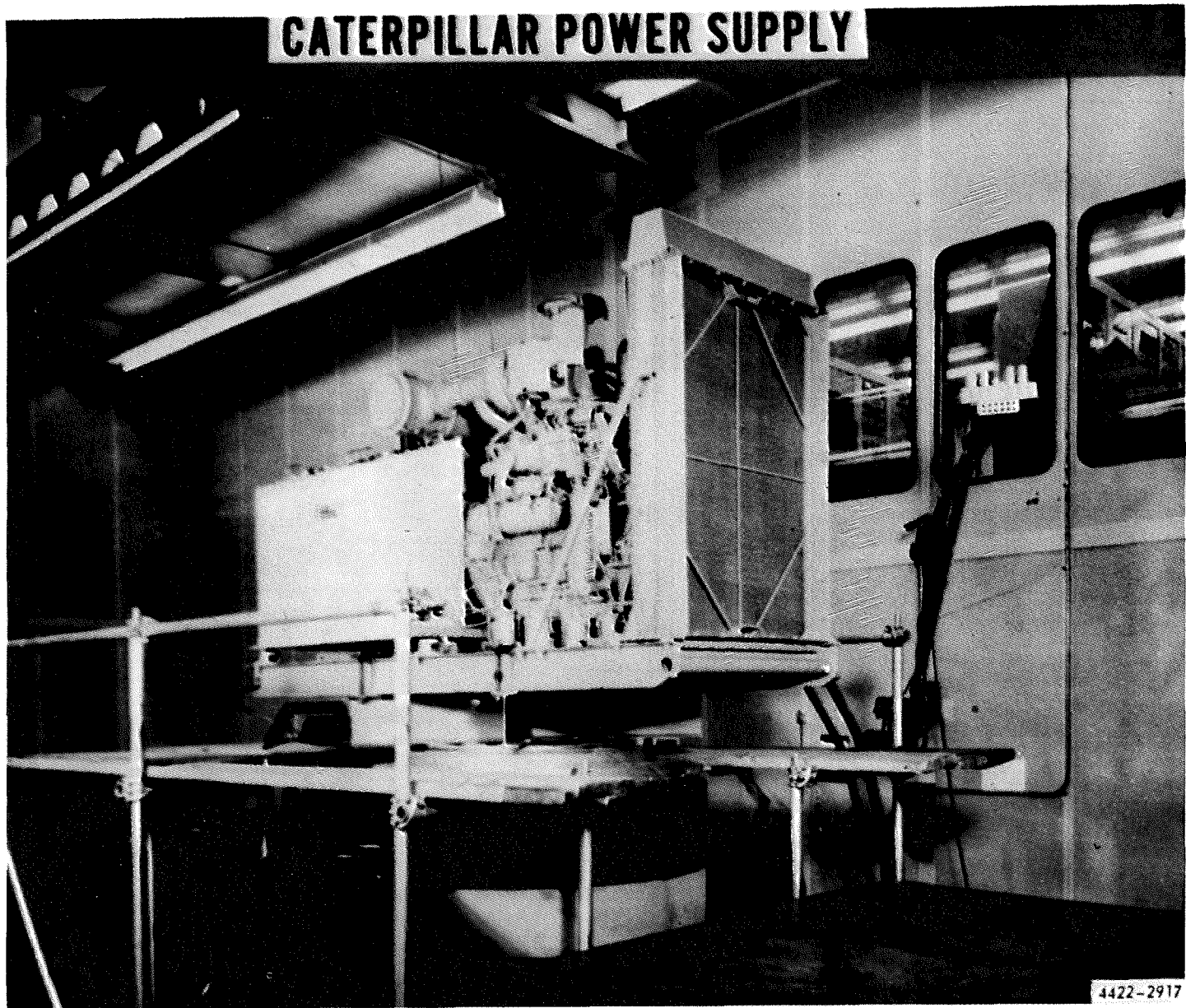


4422-2919

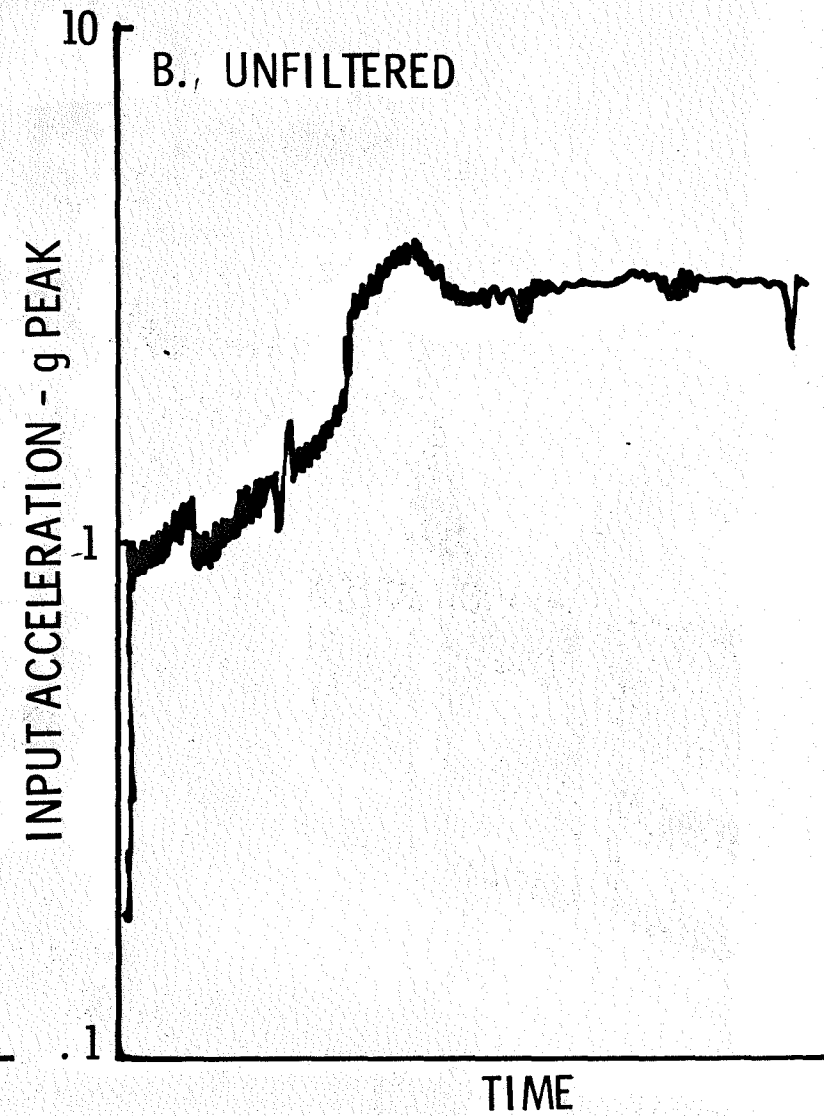
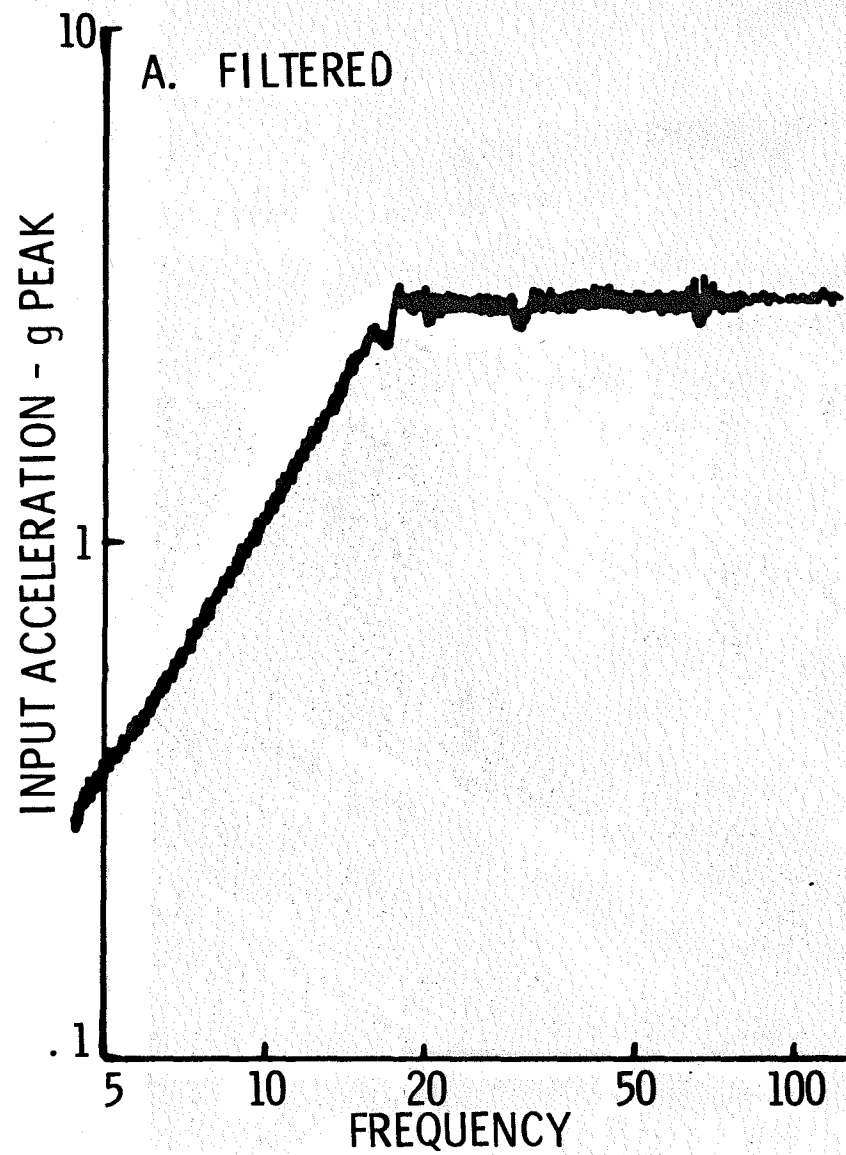
# WESTINGHOUSE SHIPBOARD TEST STAND



# CATERPILLAR POWER SUPPLY

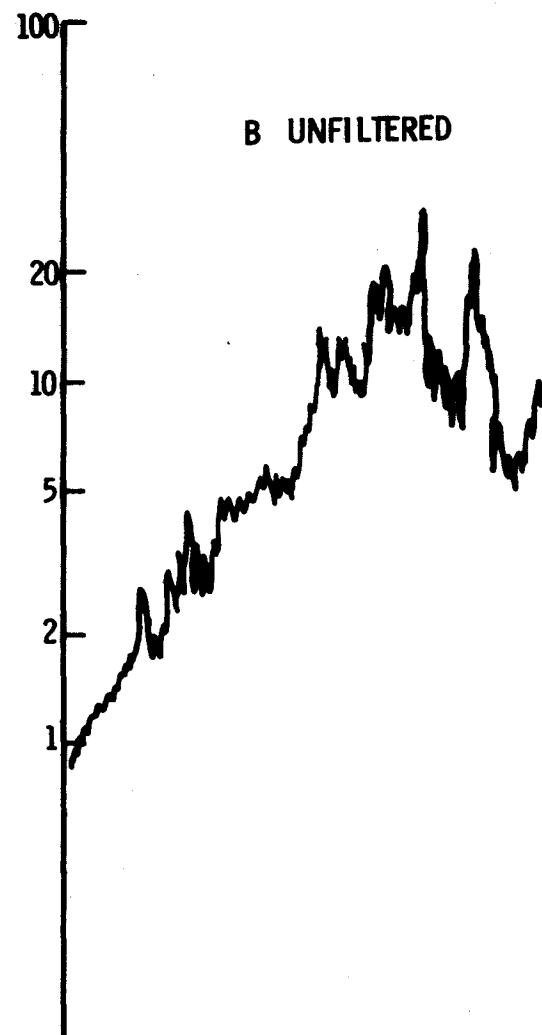
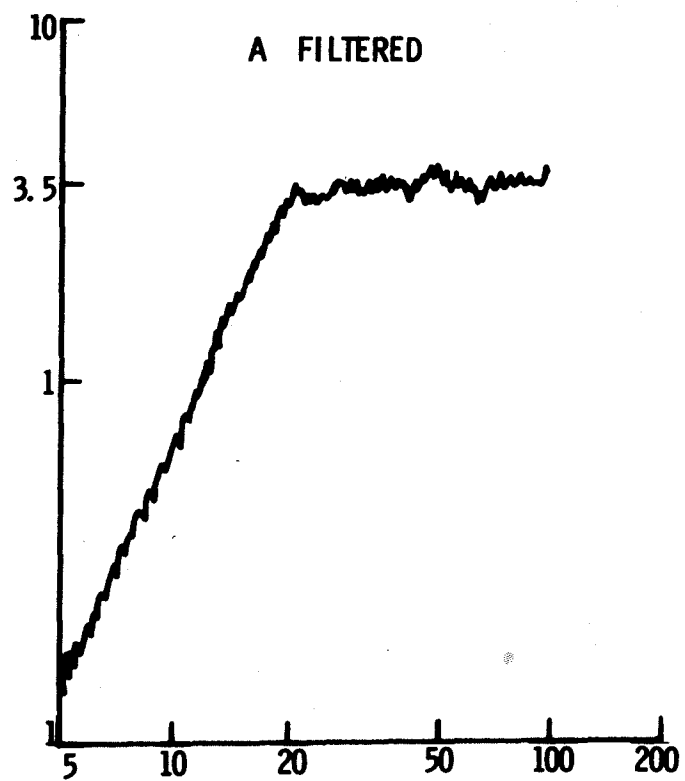


4422-2917

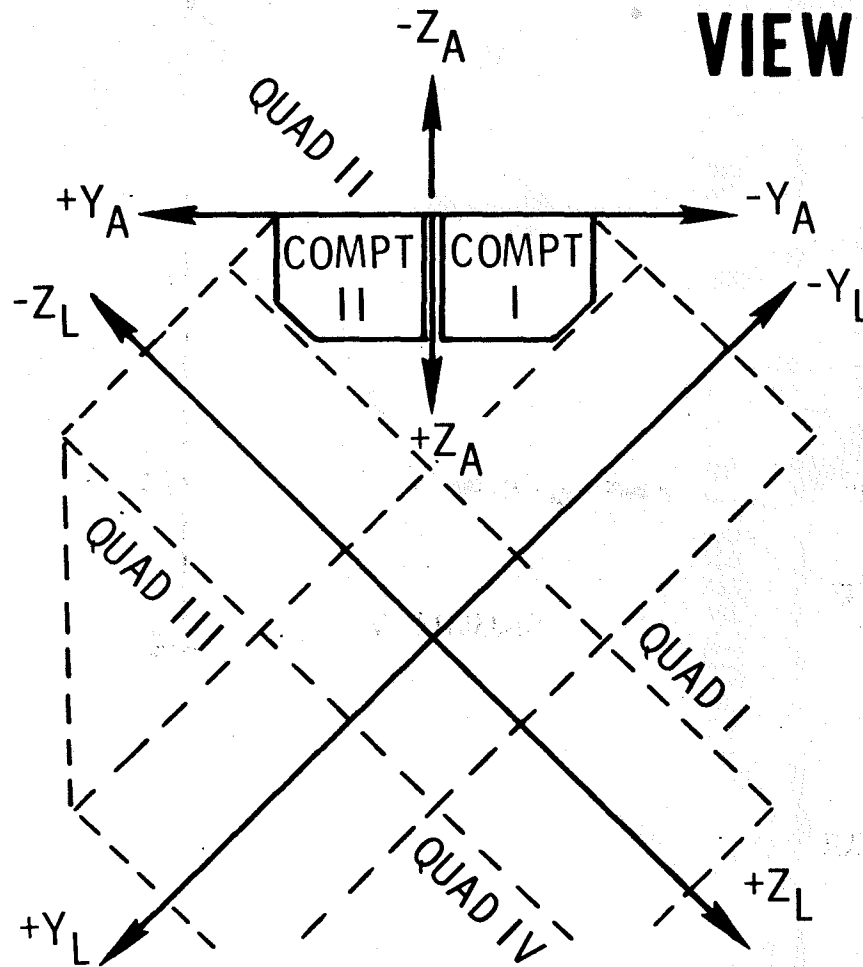


4422-2942

NASA  
S-67-51128

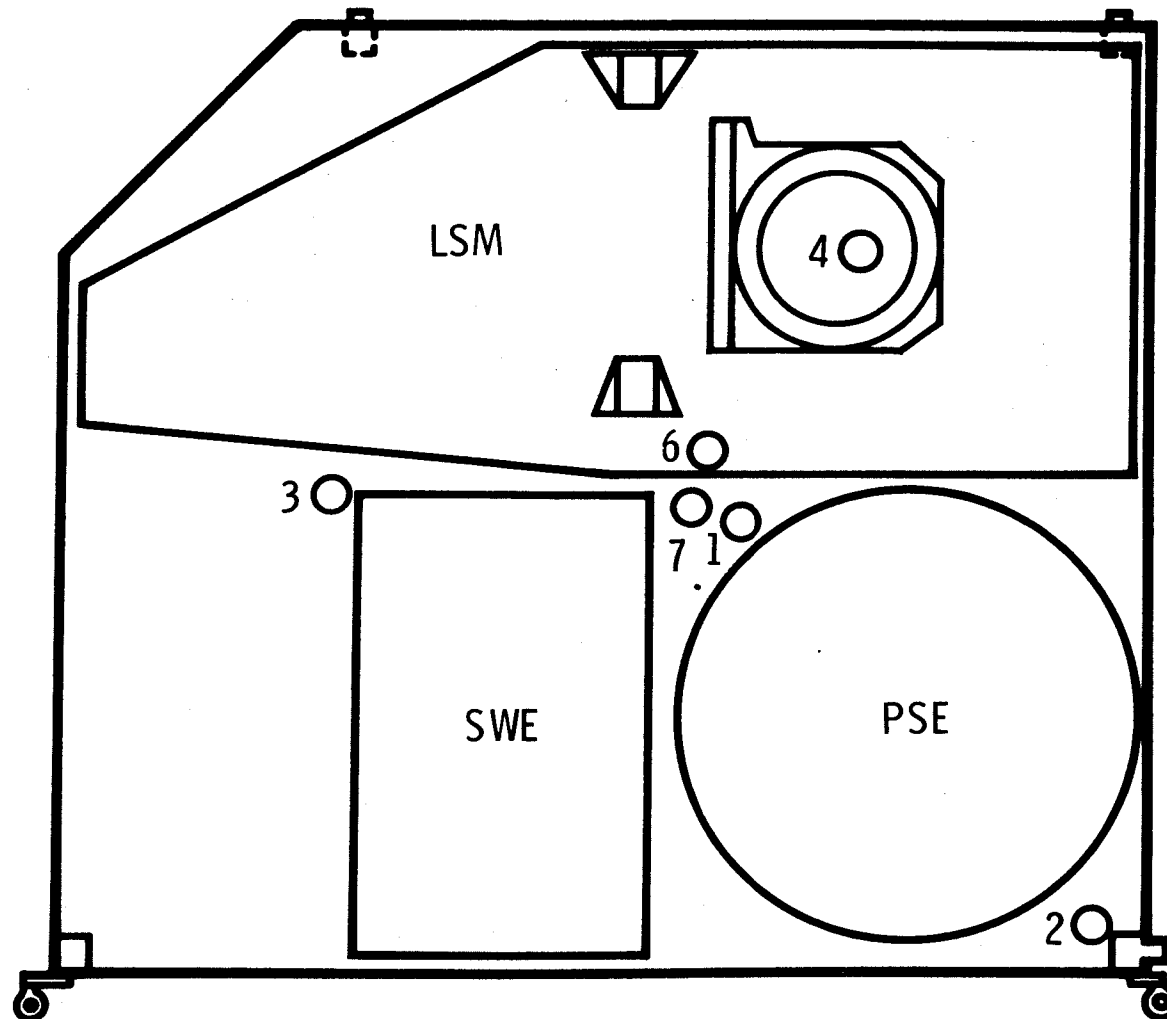


# ALSEP-LM AXIS DEFINITION DESCENT STAGE VIEW LOOKING DOWN

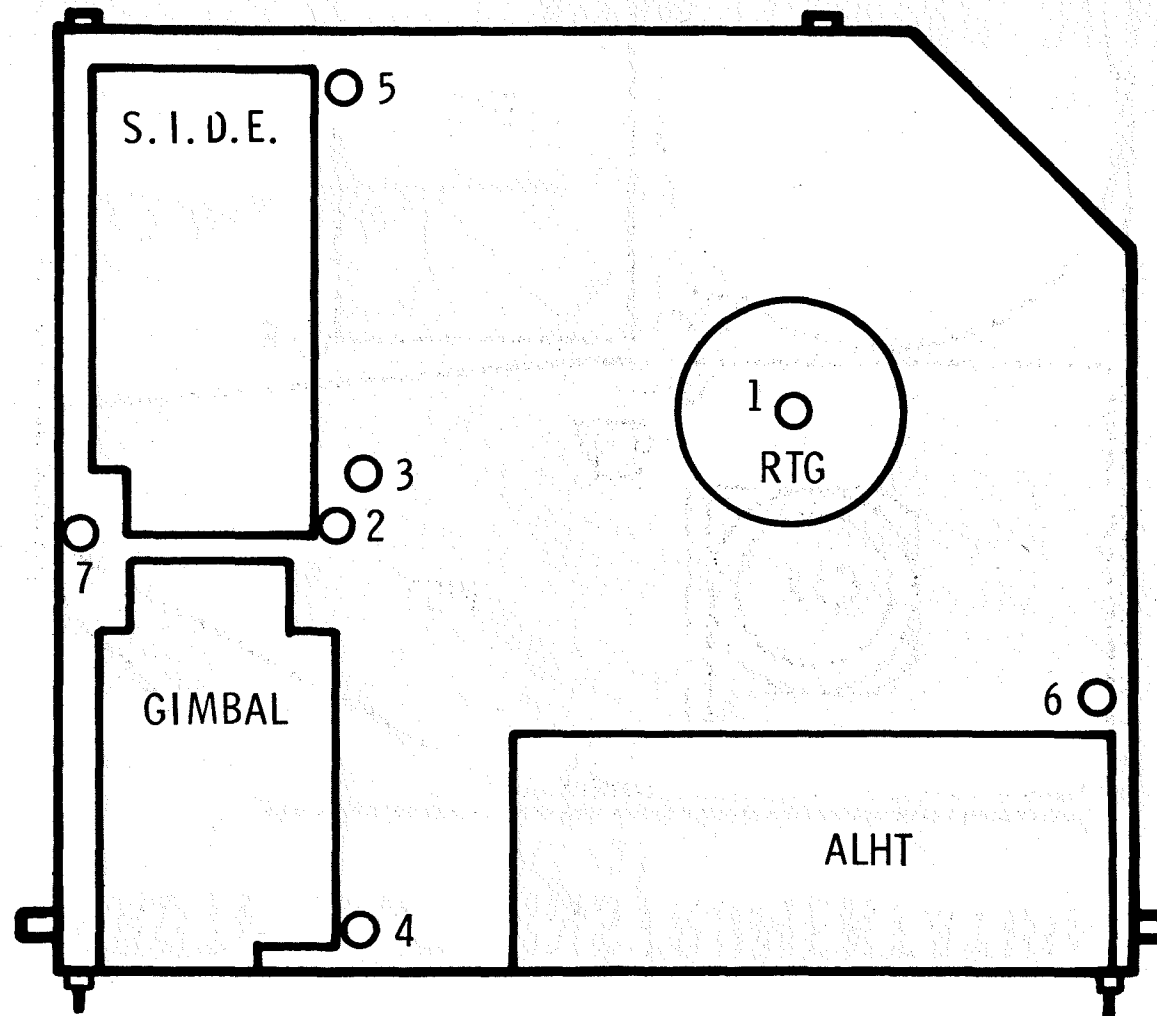


ALSEP PLANE  $X=0$   
EQUIVALENT TO  
LEM PLANE  $X=130.797$

## PROTO A-SP1 INSTRUMENTATION

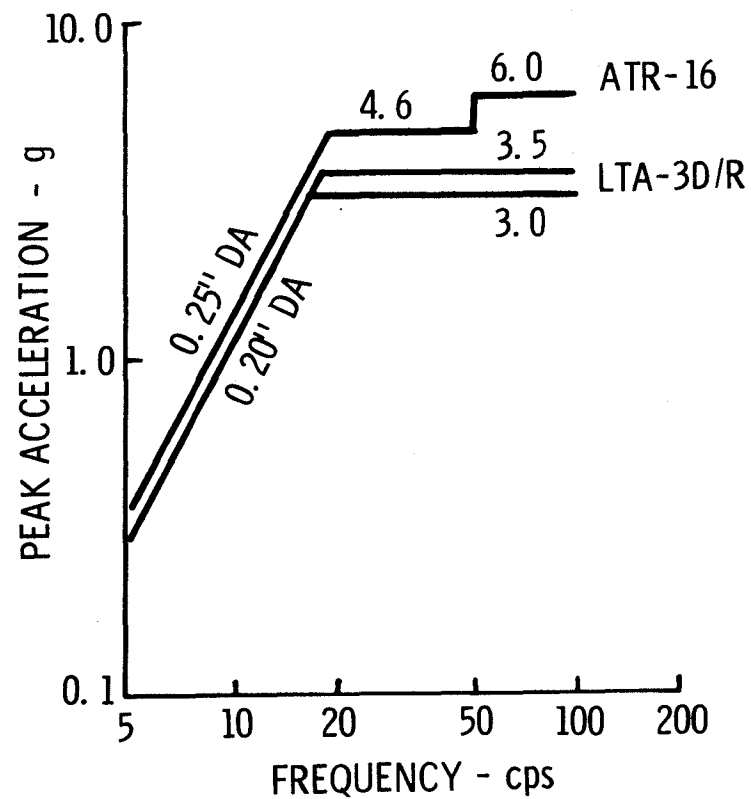


# PROTO A-SP2 INSTRUMENTATION

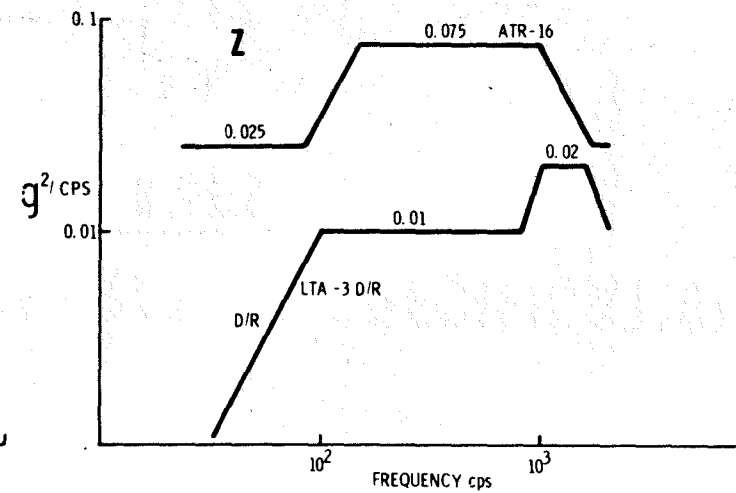
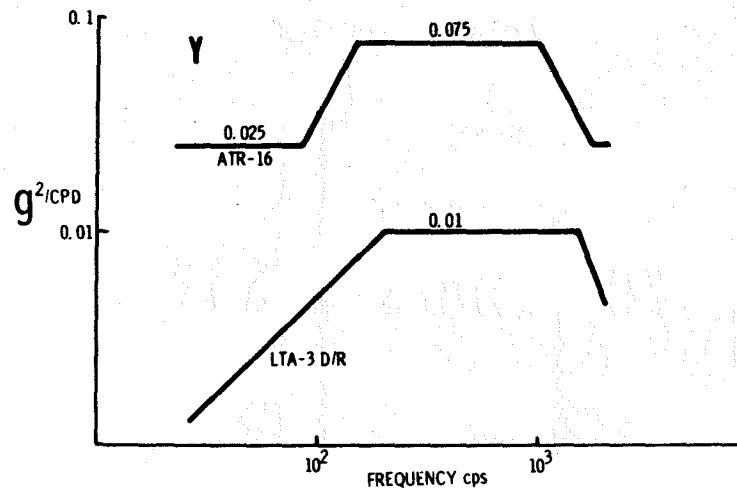
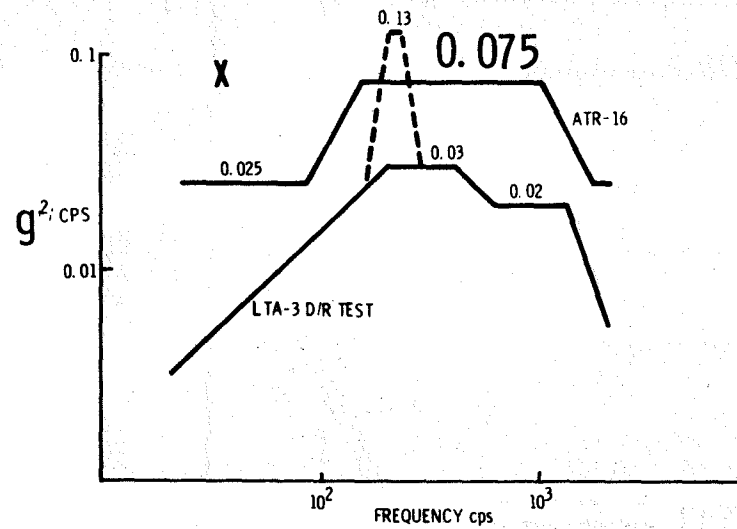


4422-2940

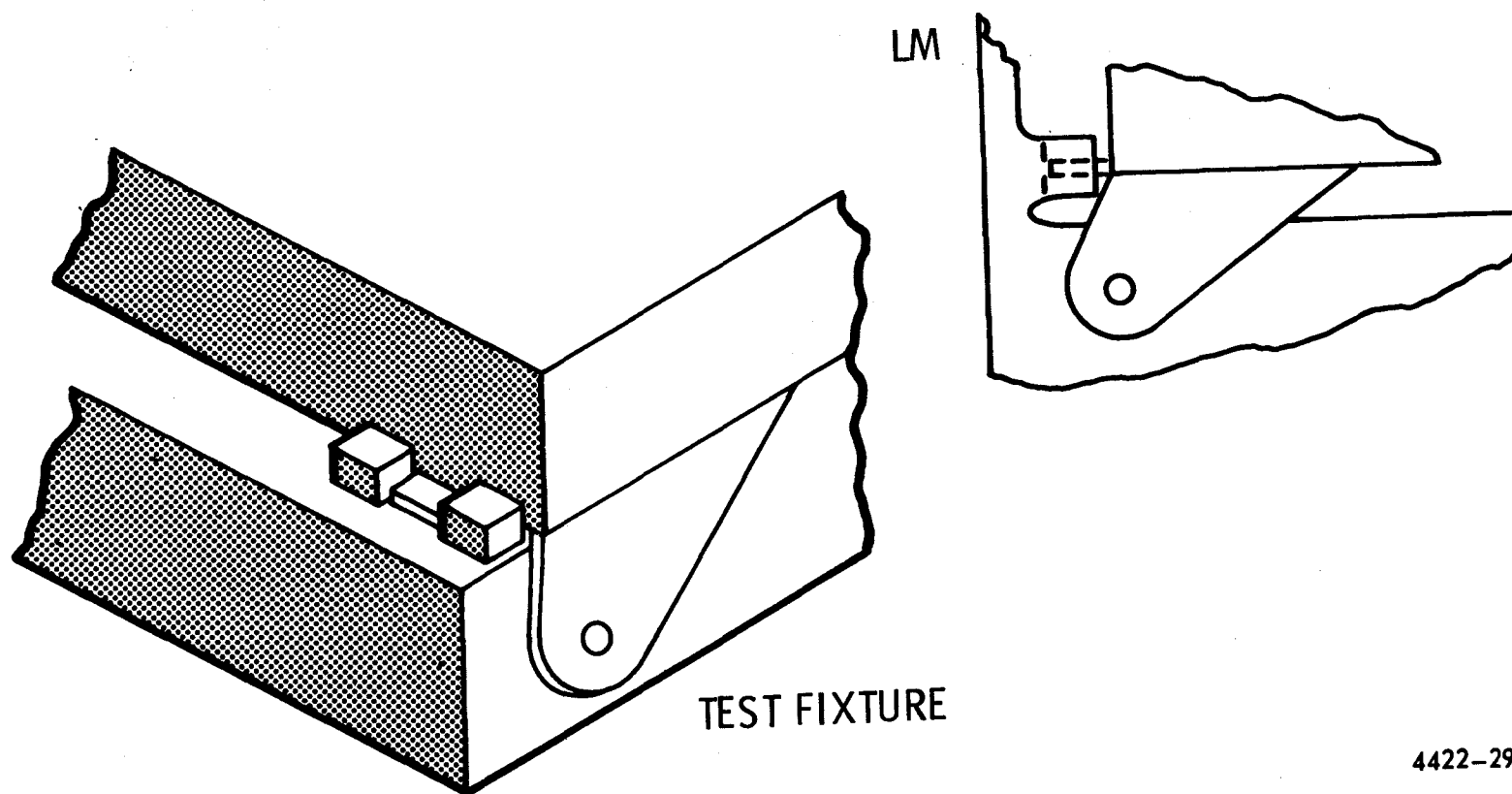
# ALSEP SINUSOIDAL VIBRATION SPECIFICATION X Y Z AXES



# SPECIFICATIONS - RANDOM

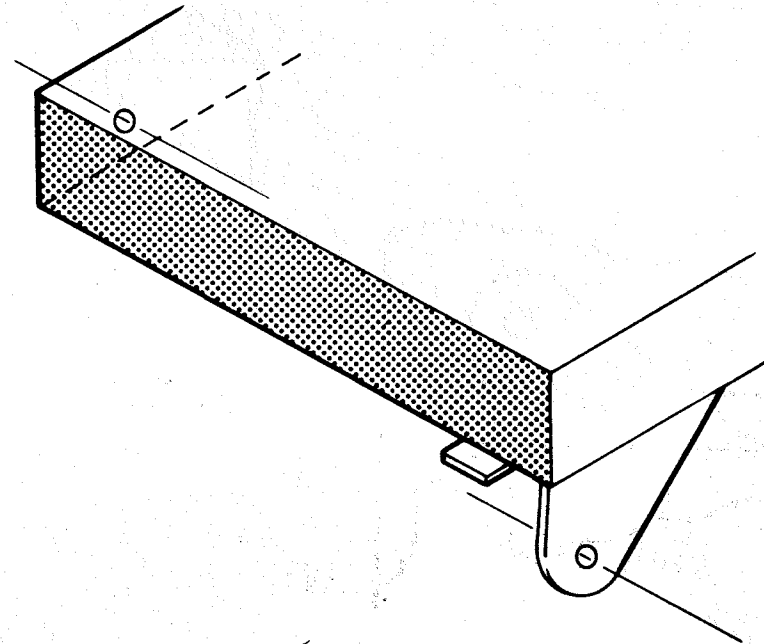


# ALSEP INTERFACE

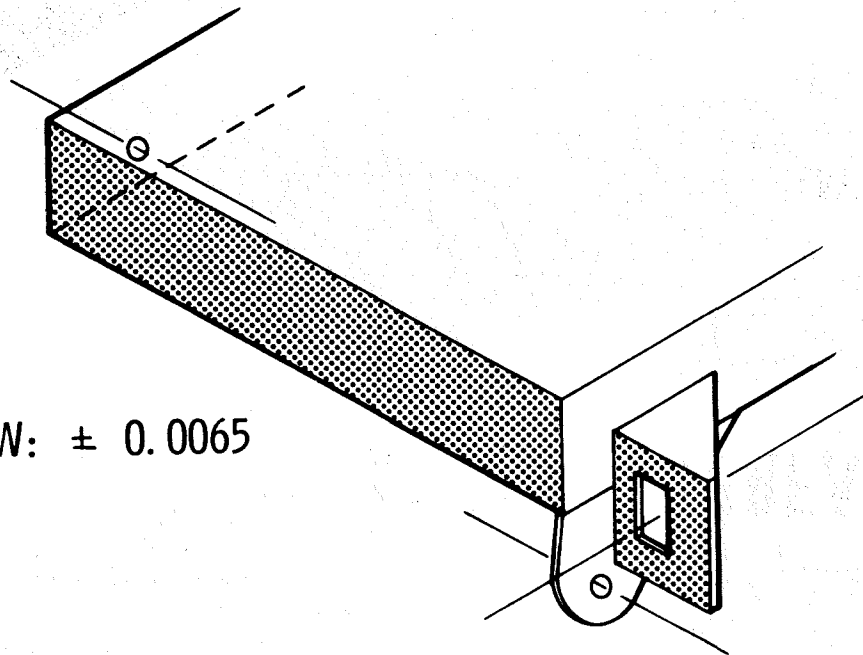


# ALSEP INTERFACE

OLD:  $\pm 0.018$

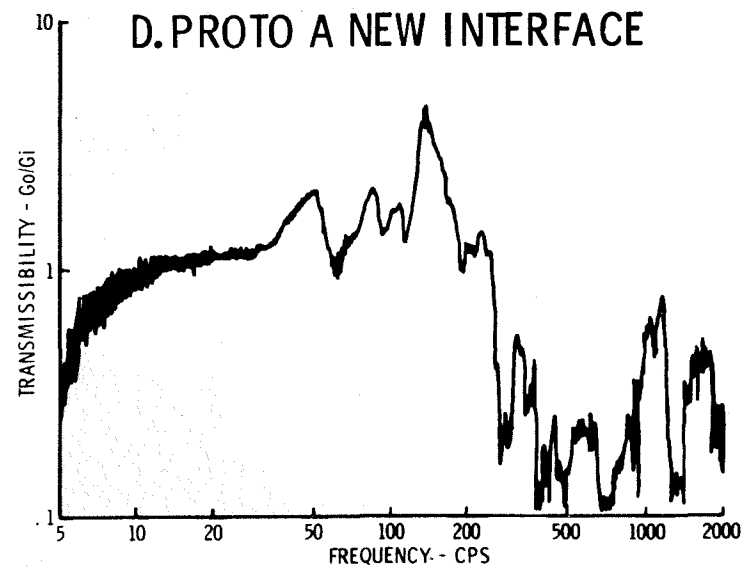
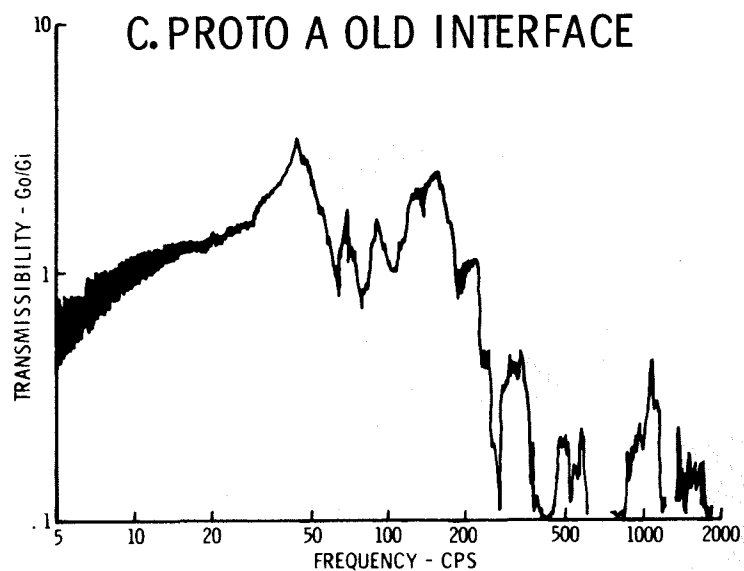
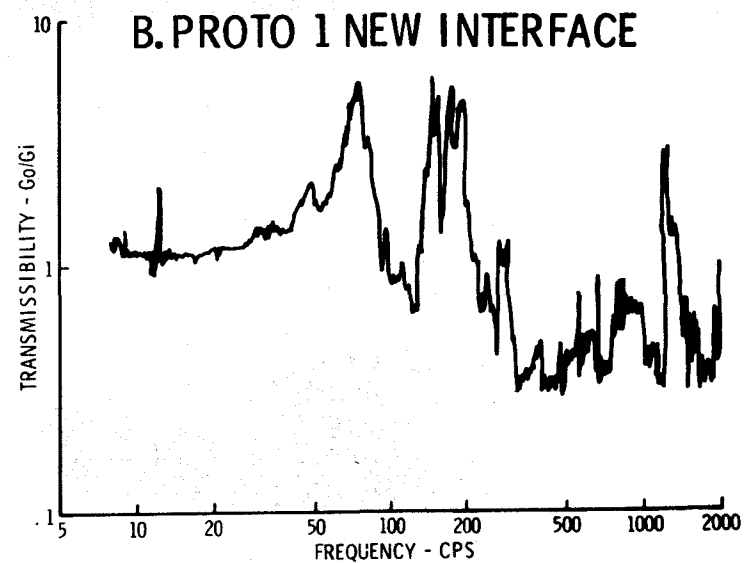
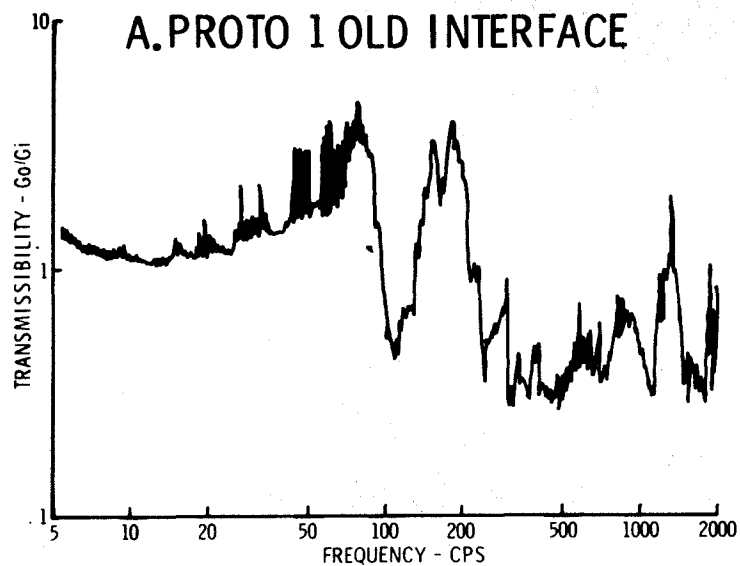


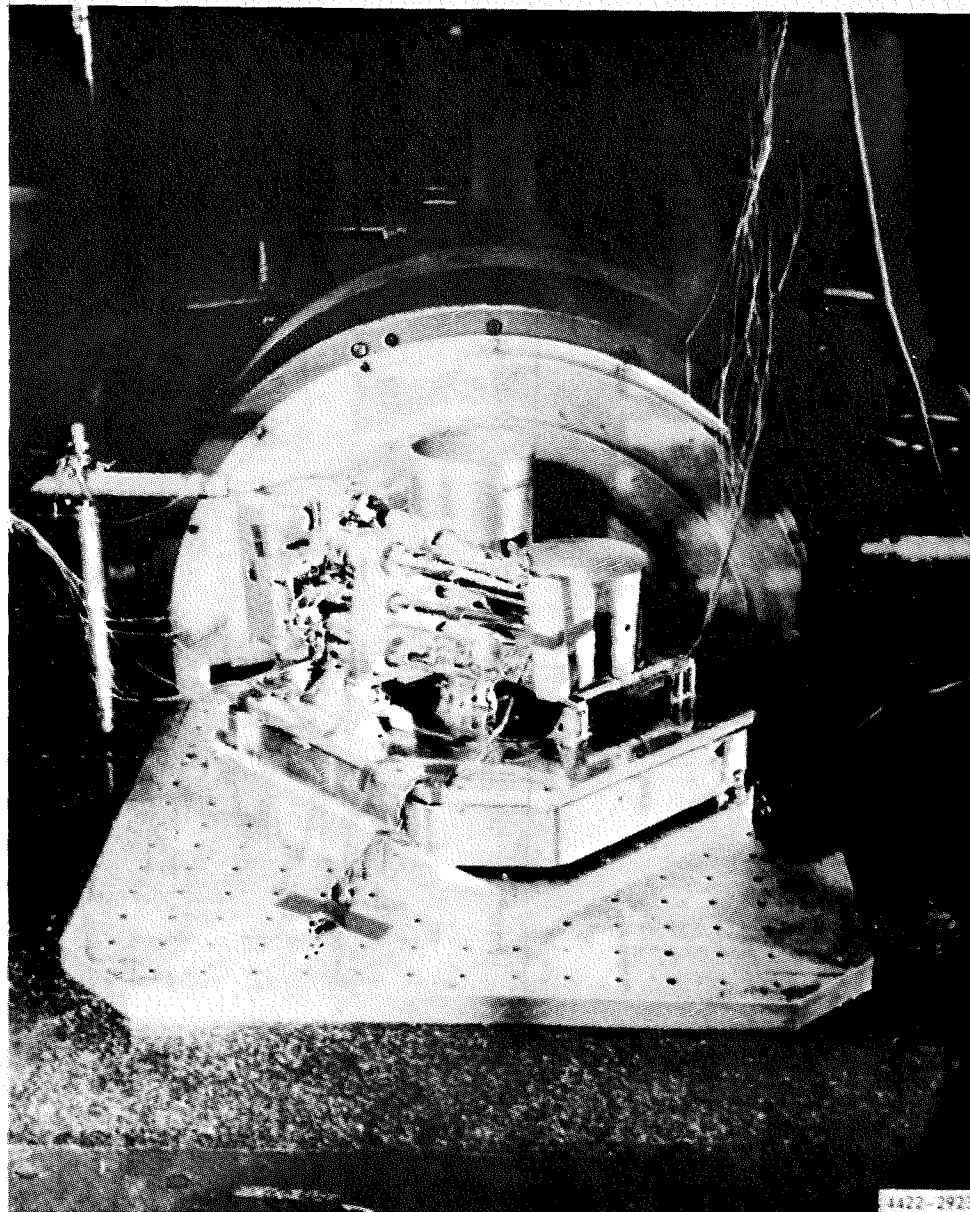
NEW:  $\pm 0.0065$

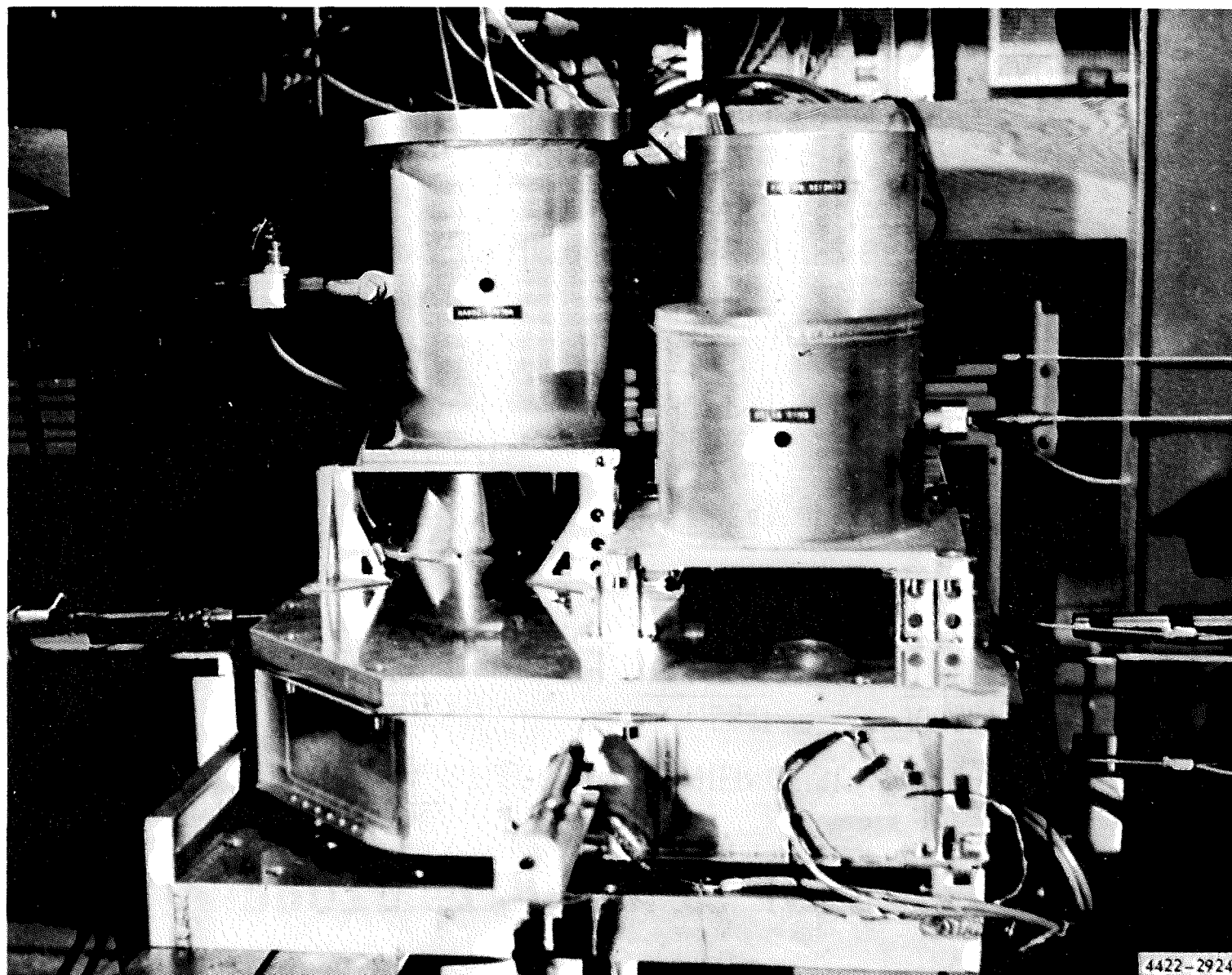


4422-2922

NASA  
S-67-51052







# PROTO#1 RESULTS (REF. ATM-671)

## 1. STATIC

### A. DEFLECTION - CENTER OF SUNSHIELD

| <u>+ x (TEST)</u> | <u>x (TEST)</u> | <u>ANALYSIS</u> |
|-------------------|-----------------|-----------------|
| 0.0965 IN.        |                 | 0.0858 IN.      |
| 0.0970 IN.        | 0.059 IN.       | 0.0922 IN.      |
| 0.0885 IN.        | 0.061 IN.       | 0.0787 IN.      |

### B. STRESS - FRONT BEAM

| <u>+ x (TEST)</u> | <u>- x (TEST)</u> | <u>ANALYSIS</u> |
|-------------------|-------------------|-----------------|
| +5800 PSI         | -6300 PSI         | ± 5215 PSI      |
| -4800 PSI         | +3790 PSI         | ± 4435 PSI      |

## 2. DYNAMIC

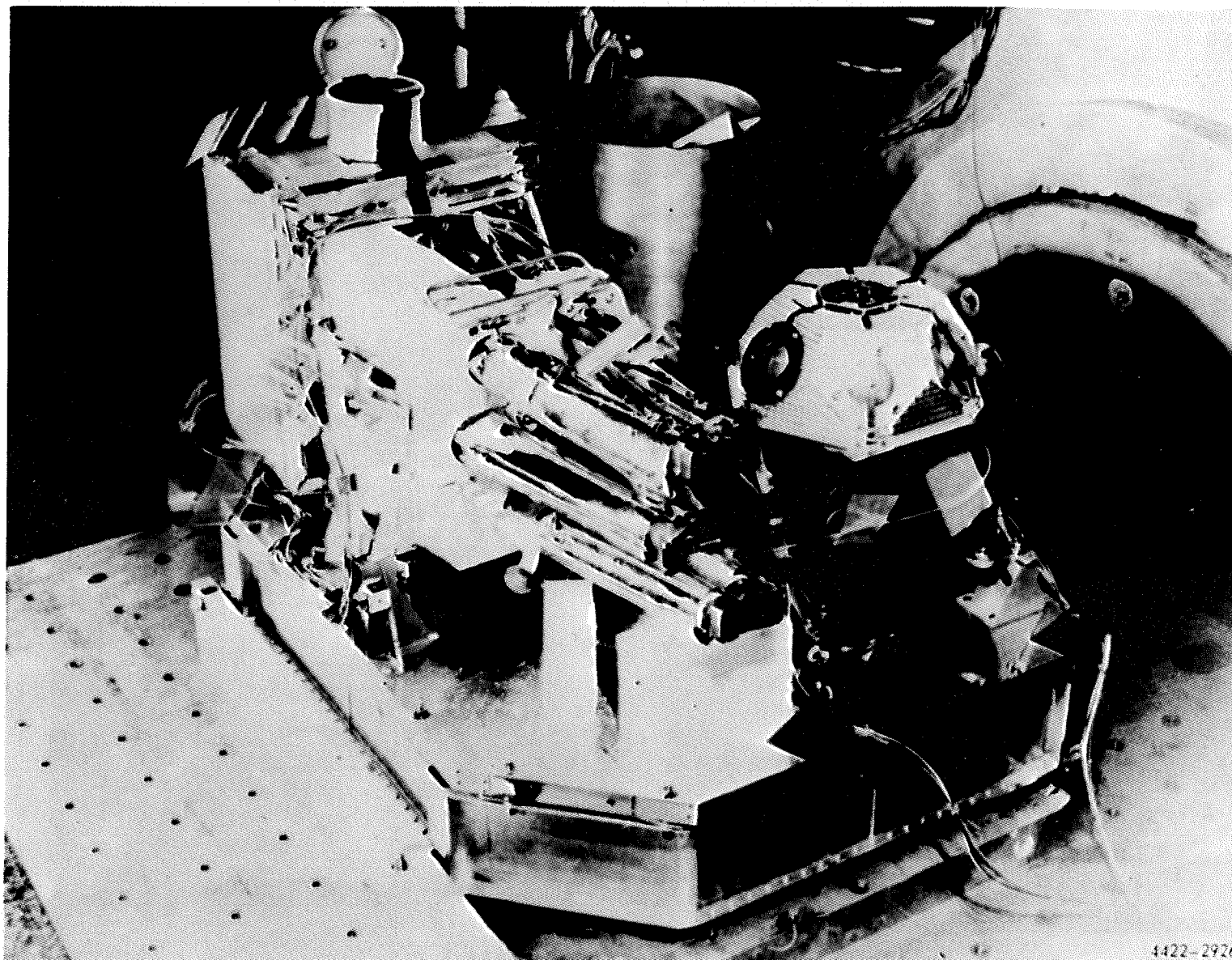
### A. NATURAL FREQUENCY (CENTER OF SUNSHIELD)

| <u>TEST</u> | <u>ANALYSIS</u> |
|-------------|-----------------|
| 80 CPS      | 97 CPS          |

### B. EXPERIMENTS (REF ATM-671)

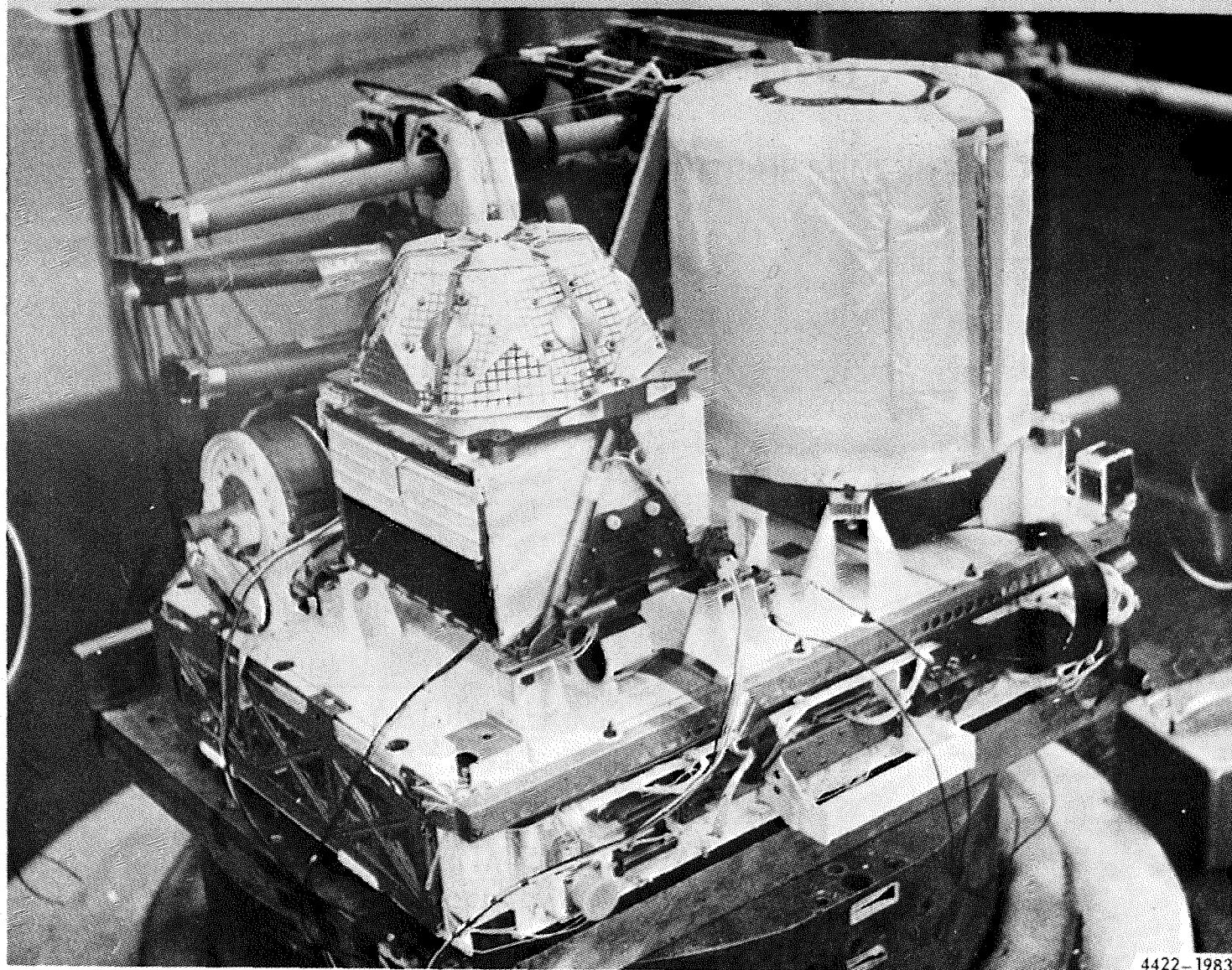
GENERAL CORRELATION BETWEEN ANALYSIS & TEST

4422-2925



4422-2926

# PROTO A-SPI X-AXIS



4422-1983

# TEST CHRONOLOGY

| DATE    | TEST ARTICLE | PINS  | VIBRATION TESTS PERFORMED |        |                  |
|---------|--------------|-------|---------------------------|--------|------------------|
|         |              |       | INPUT AXIS                | LEVEL  |                  |
| OCT. 16 | SP-1         | LOOSE | X                         | SINE   | TR SWEEP (1.0 g) |
|         |              |       | X                         | SINE   | L/B (3.5 g)      |
| OCT. 17 | SP-2         | LOOSE | X                         | SINE   | TR SWEEP (1.0 g) |
|         |              |       | X                         | SINE   | L/B (3.5 g)      |
|         |              |       | X                         | RANDOM | L/B (2.5 min)    |
|         |              |       | Y                         | SINE   | TR SWEEP (1.0 g) |
|         |              |       | Y                         | SINE   | L/B (3.5 g)      |
| OCT. 20 | SP-1         | LOOSE | X                         | SINE   | TR SWEEP (1.0 g) |
|         |              |       | X                         | SINE   | L/B (3.5 g)      |
|         |              |       | X                         | RANDOM | L/B (2.5 min)    |

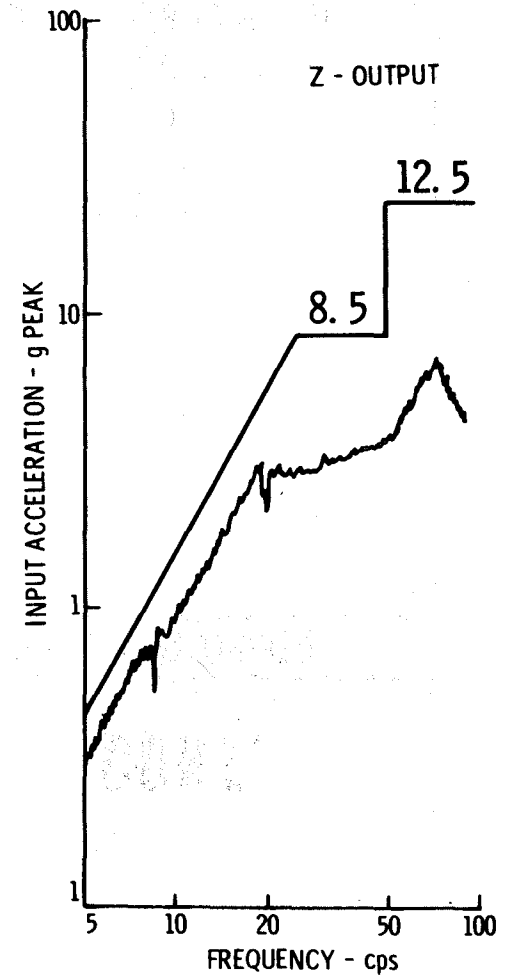
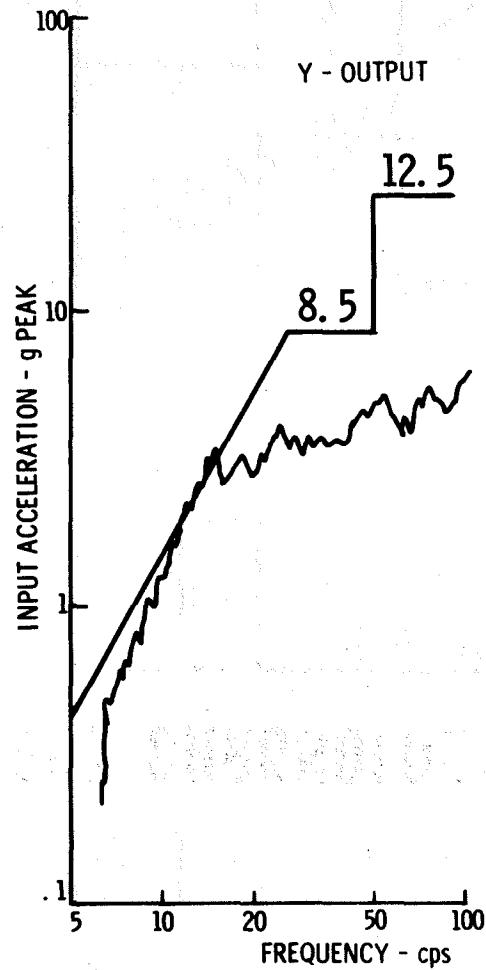
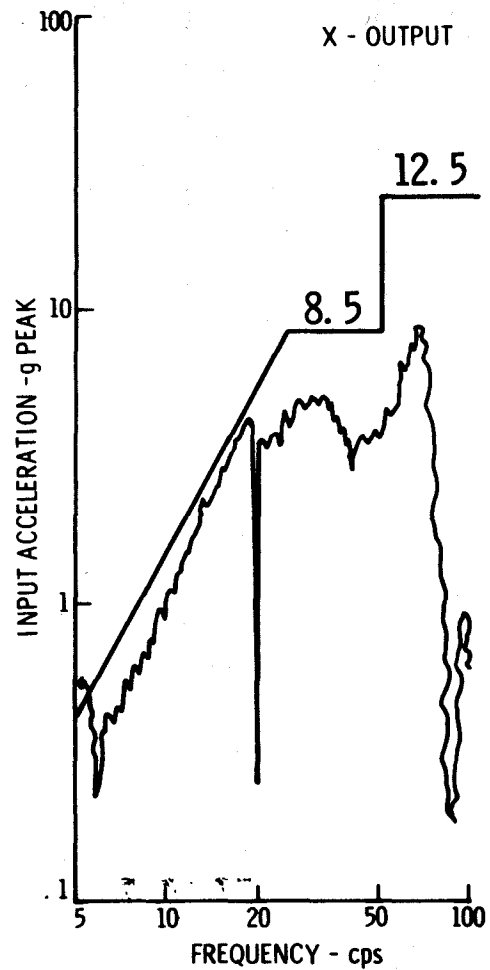
# TEST CHRONOLOGY CONT.

| DATE    | TEST ARTICLE | PINS  | VIBRATION TESTS PERFORMED |                       |
|---------|--------------|-------|---------------------------|-----------------------|
|         |              |       | INPUT AXIS                | LEVEL                 |
| OCT. 24 | SP-1         | TIGHT | Z                         | SINE TR SWEEP (1.0 g) |
|         |              |       | Z                         | SINE L/B (3.0 g)      |
|         |              |       | Z                         | RANDOM L/B (2.5 min)  |
| OCT. 25 | SP-1         | TIGHT | Y                         | SINE L/D (1.4 g)      |
|         |              |       | Y                         | SINE L/B (3.0 g)      |
|         |              |       | Y                         | RANDOM L/B (2.5 min)  |
|         |              |       | Y                         | RANDOM L/D (12.5 min) |
| OCT. 26 | SP-1         | TIGHT | X                         | SINE TR SWEEP (1.0 g) |
|         |              |       | X                         | SINE L/B (3.0 g)      |

## TEST CHRONOLOGY CONT.

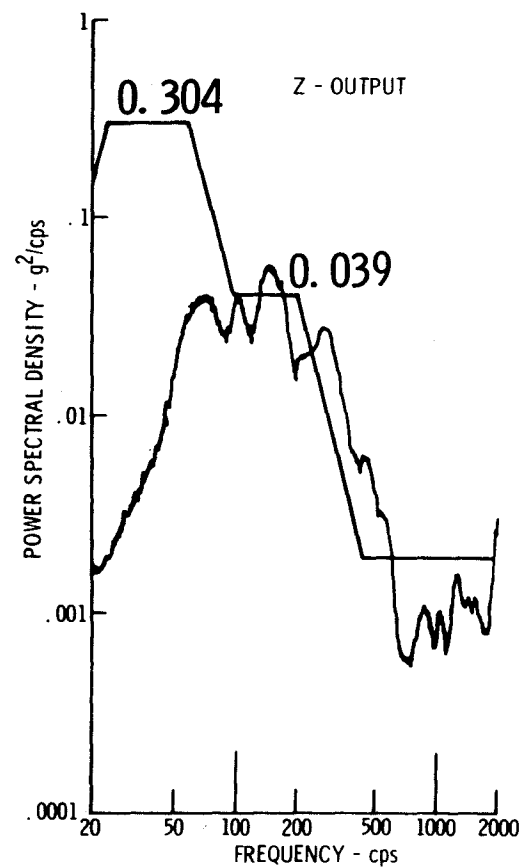
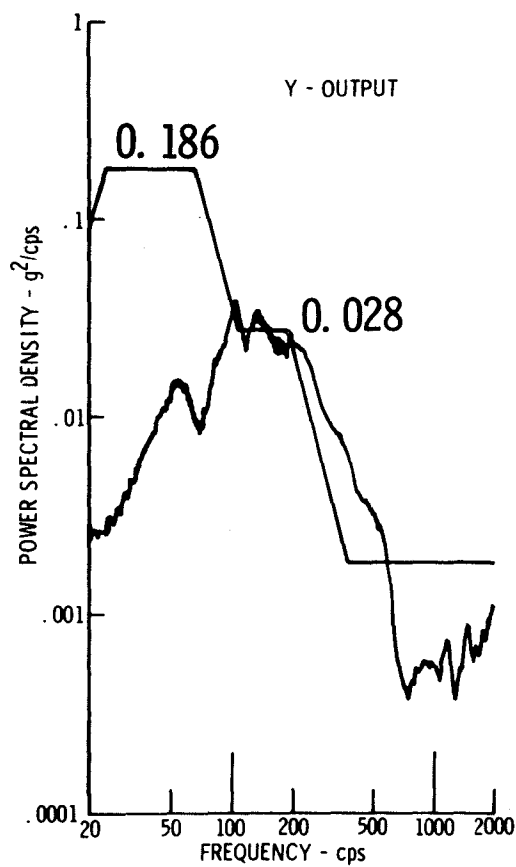
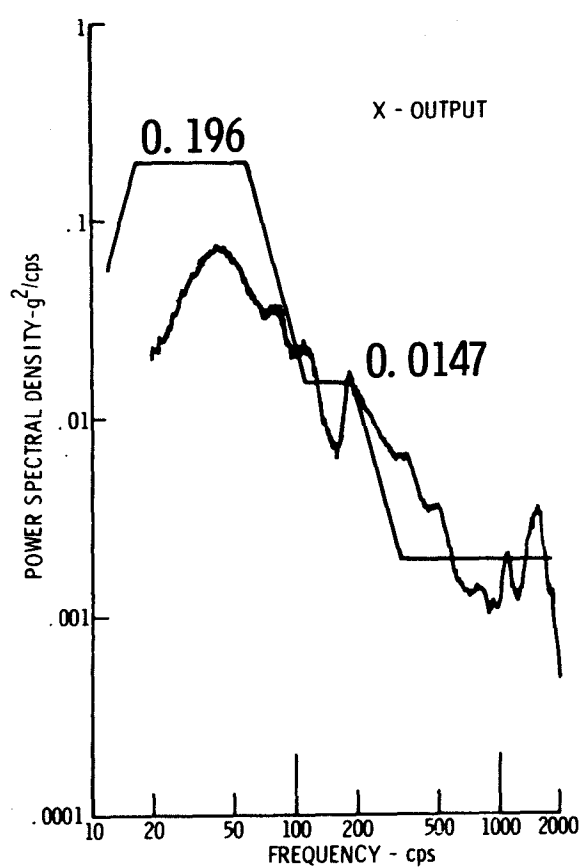
| DATE    | TEST ARTICLE | PINS  | VIBRATION TESTS PERFORMED |                       |
|---------|--------------|-------|---------------------------|-----------------------|
|         |              |       | INPUT AXIS                | LEVEL                 |
| OCT. 27 | SP-2         | TIGHT | Z                         | SINE TR SWEEP (1.0 g) |
|         |              |       | Z                         | SINE L/D (1.4 g)      |
|         |              |       | Z                         | SINE L/B (3.0 g)      |
|         |              |       | Z                         | RANDOM L/D (12.5 min) |
|         |              |       | Z                         | RANDOM L/B (2.5 min)  |
| OCT. 28 | SP-2         | TIGHT | Y                         | SINE TR SWEEP (1 g)   |
|         |              |       | Y                         | SINE L/D (1.4 g)      |
|         |              |       | Y                         | SINE L/B (3.0 g)      |
|         |              |       | Y                         | RANDOM L/D (12.5 min) |
|         |              |       | Y                         | RANDOM L/B (2.5 min)  |
| OCT. 31 | SP-2         | TIGHT | X                         | SINE TR SWEEP (1 g)   |

# PSE g-PLOTS

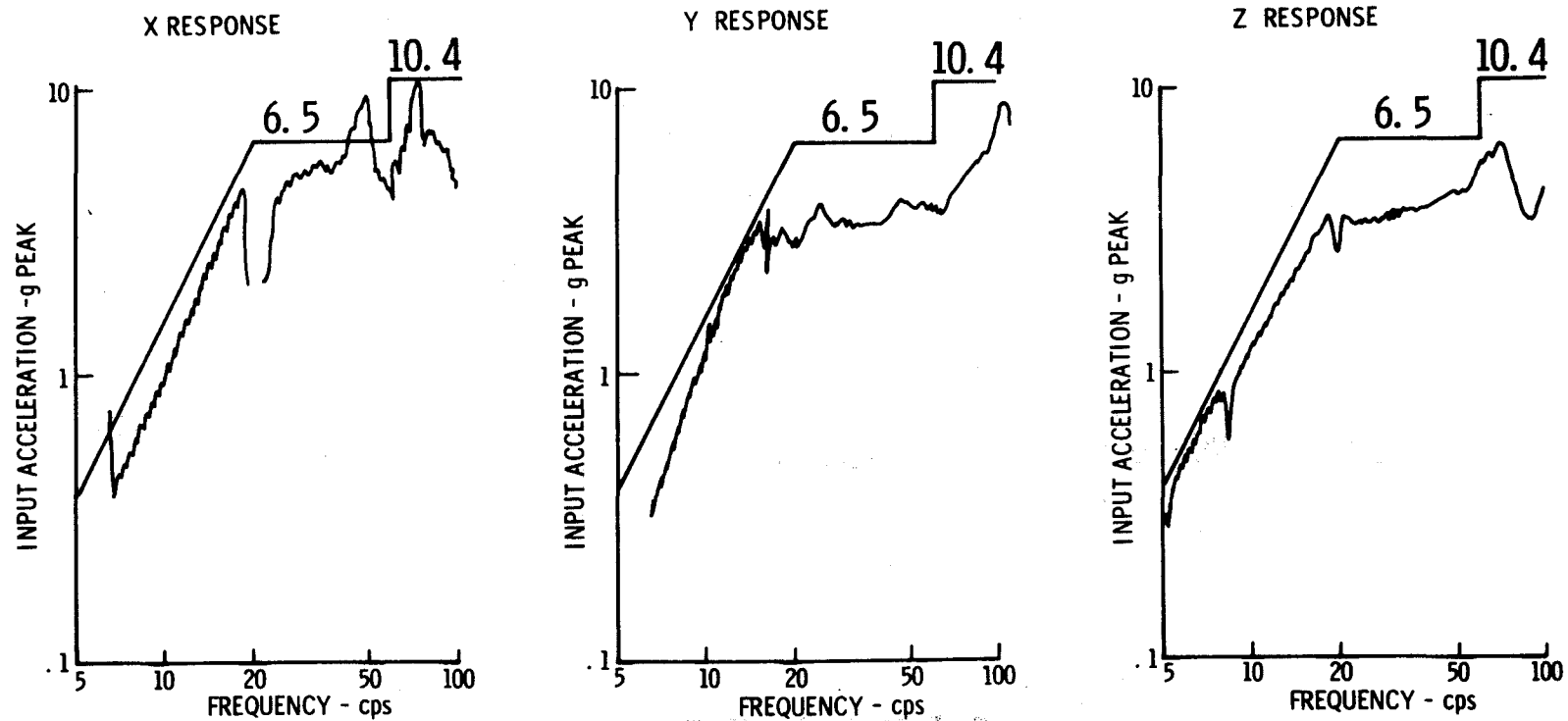


4422-2985

# PSE PSD-PLOTS

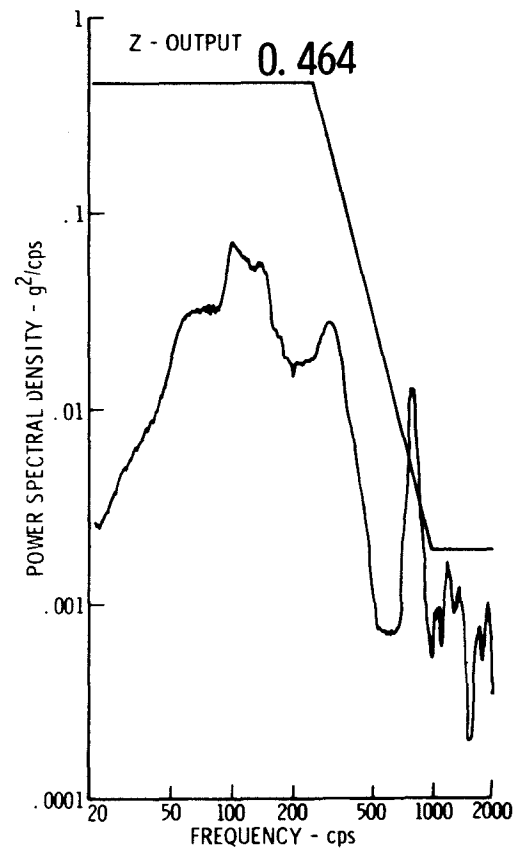
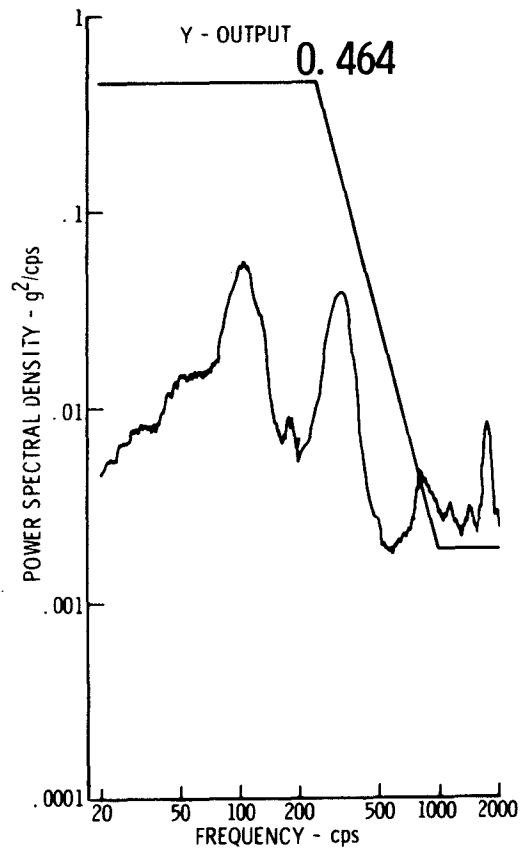
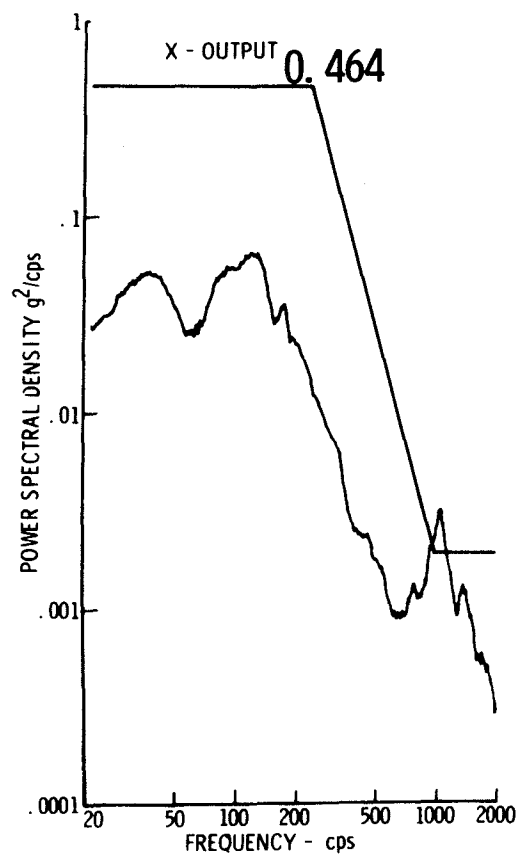


# SOLAR WIND EXPERIMENT

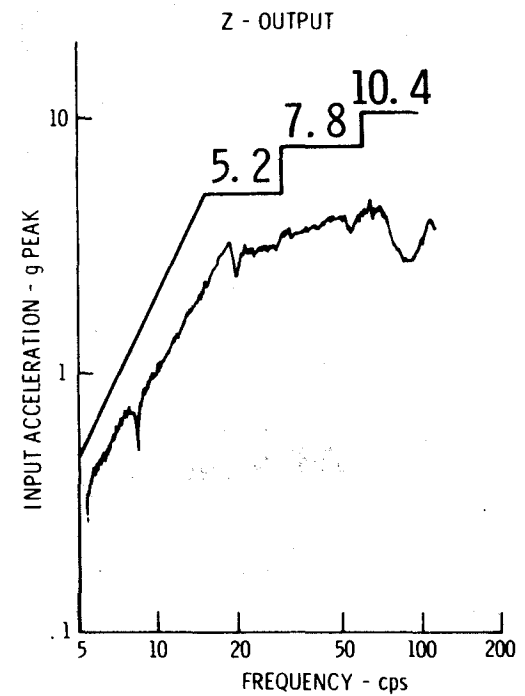
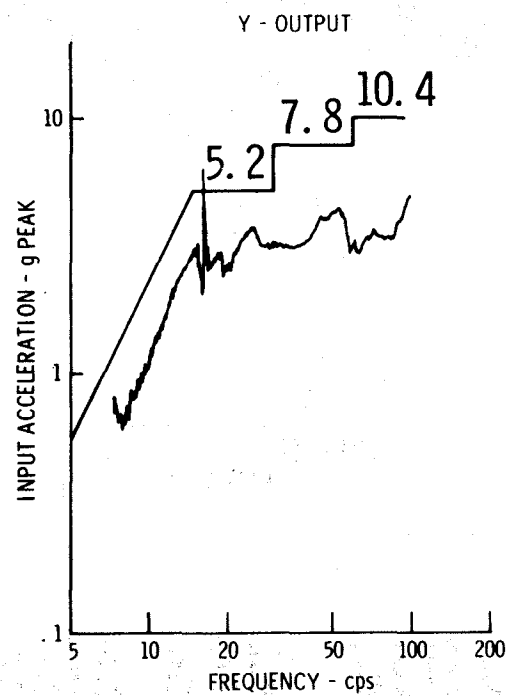
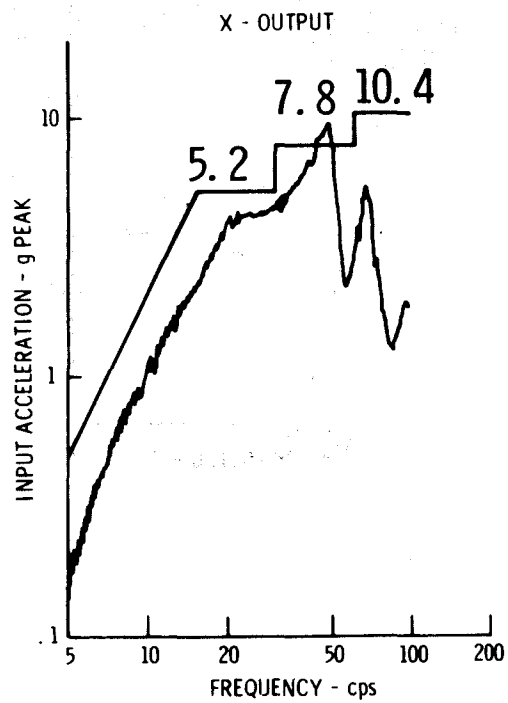


4422-2943

## SWE PSD- PLOTS



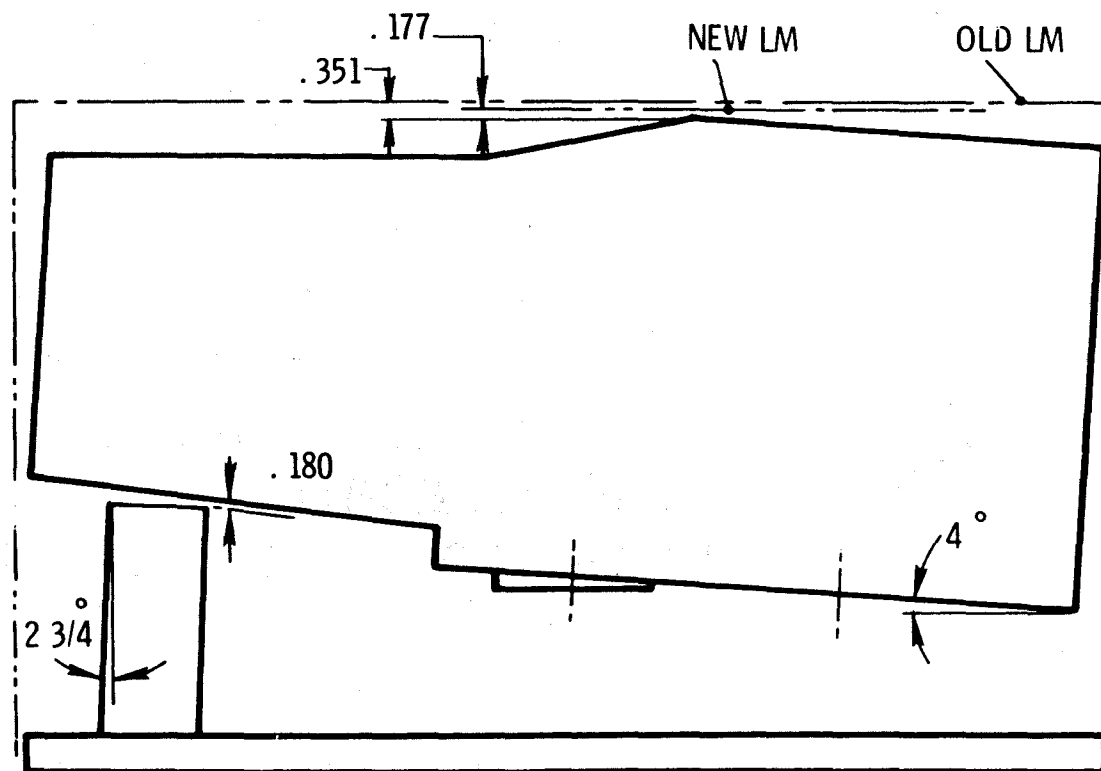
# LSM g-PLOTS



# LSM PROTO#1 RESULTS

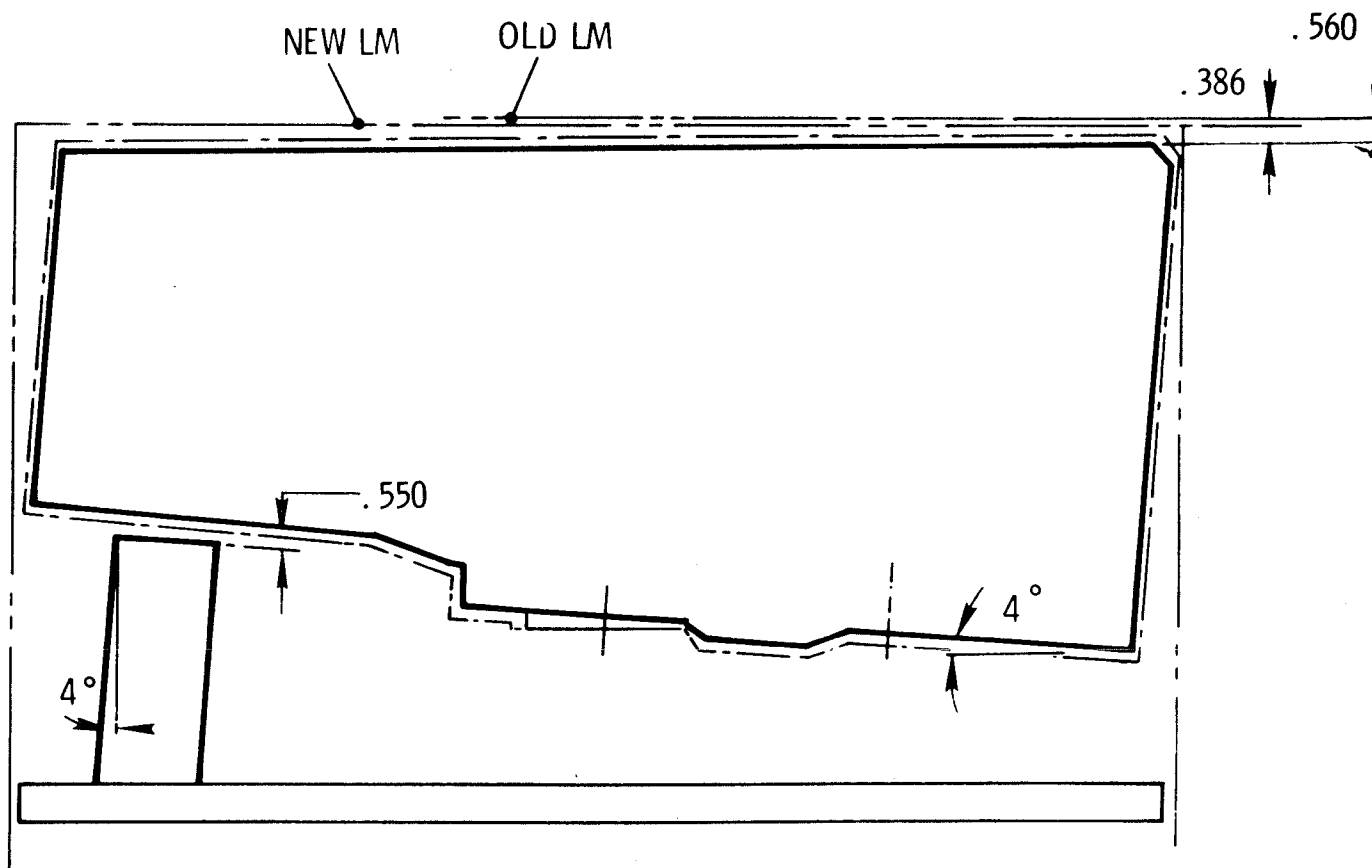
1. DYNAMIC INTEGRITY & CHARACTERISTICS
  - A. EXCELLANT TEST RESULTS
  - B. DYNAMIC CHARACTERISTICS BEING REDUCED
2. DYNAMIC ENVELOPE
  - A. ANALYSIS OF HIGH SPEED MOVIES
  - B. DEFINITIONS OF ENVELOPE
  - C. MODIFICATION OF ICD
3. IMPACT ON EXPERIMENT LOCATIONS
  - A. MOVEMENT OF PSE
  - B. LSM ICD MODIFICATIONS
  - C. SUNSHIELD MODIFICATIONS
4.  $0^{\circ}$  VS  $4^{\circ}$  MOUNTING
  - A.  $4^{\circ}$  MOUNTING SELECTED.

# OLD LSM CONFIGURATION (ICD 2-14-67)

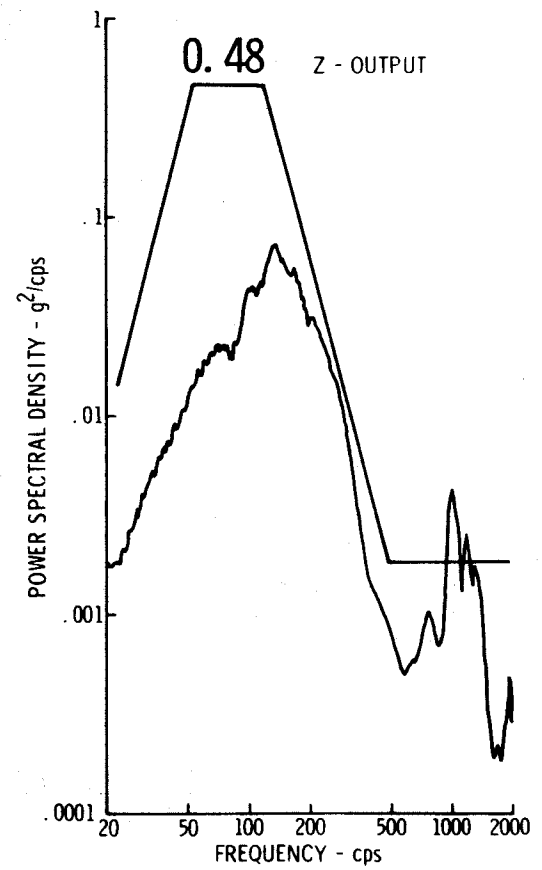
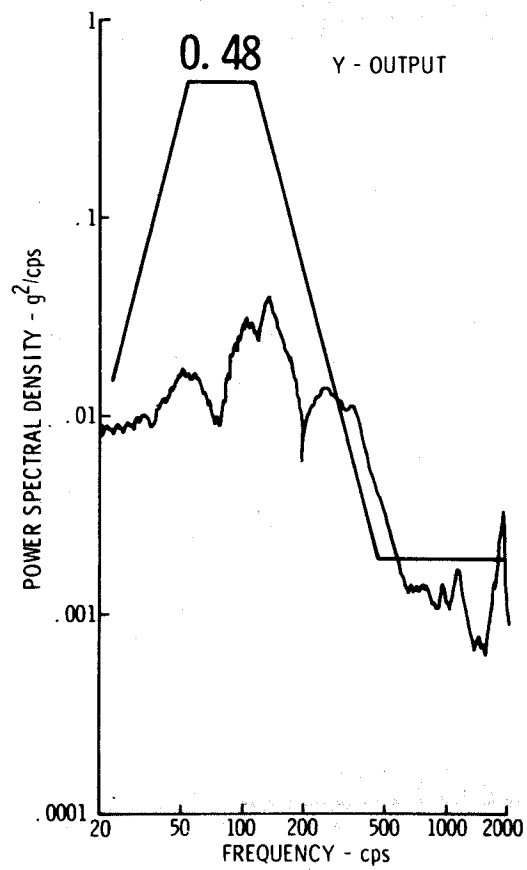
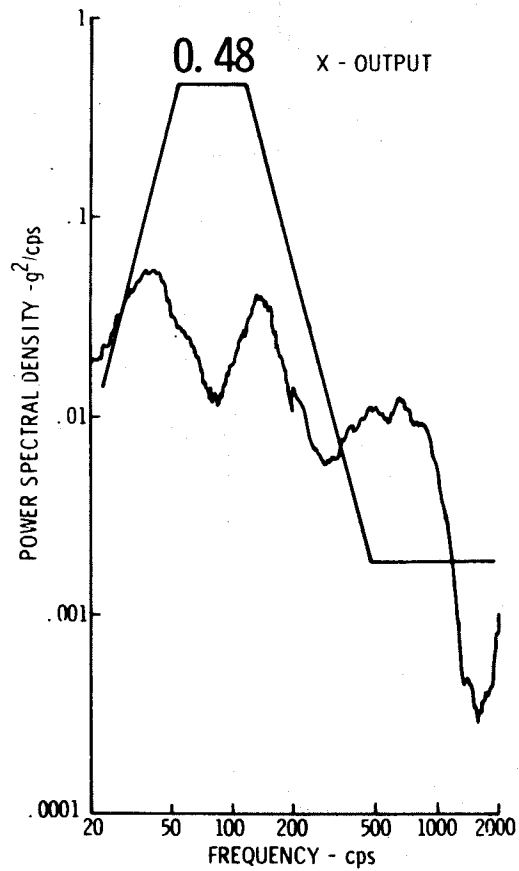


4422-2934

## PRESENT LSM CONFIGURATION

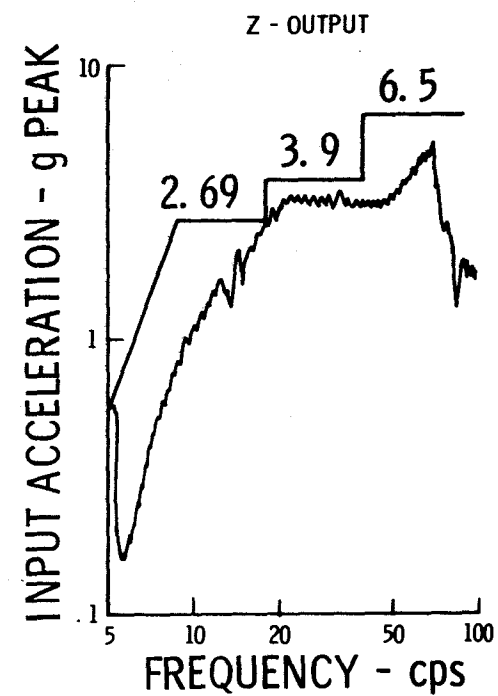
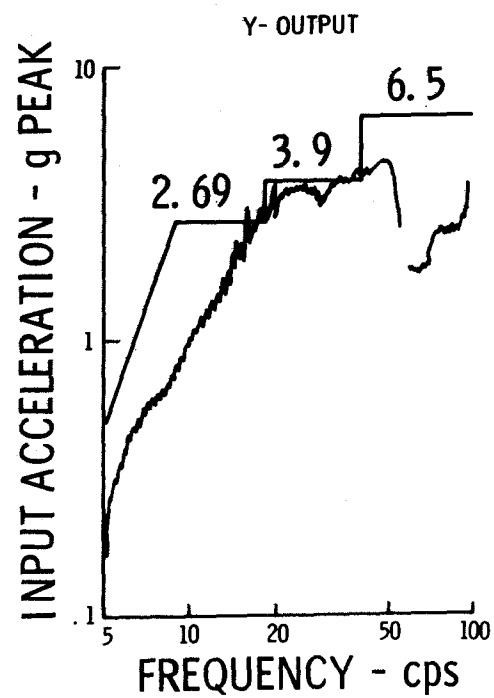
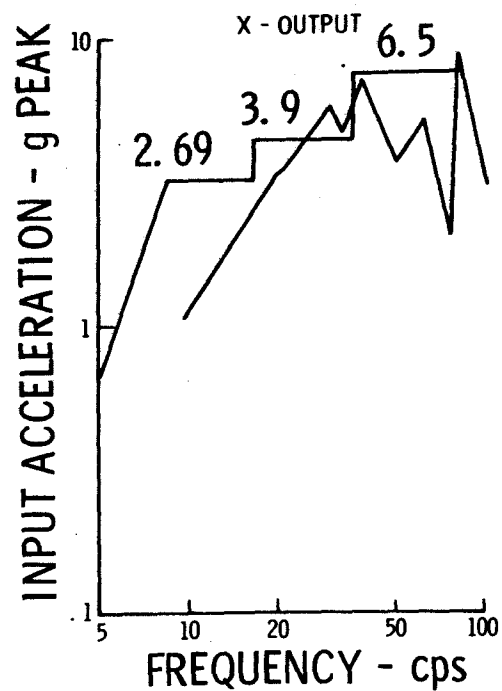


# LSM PSD-PLOTS

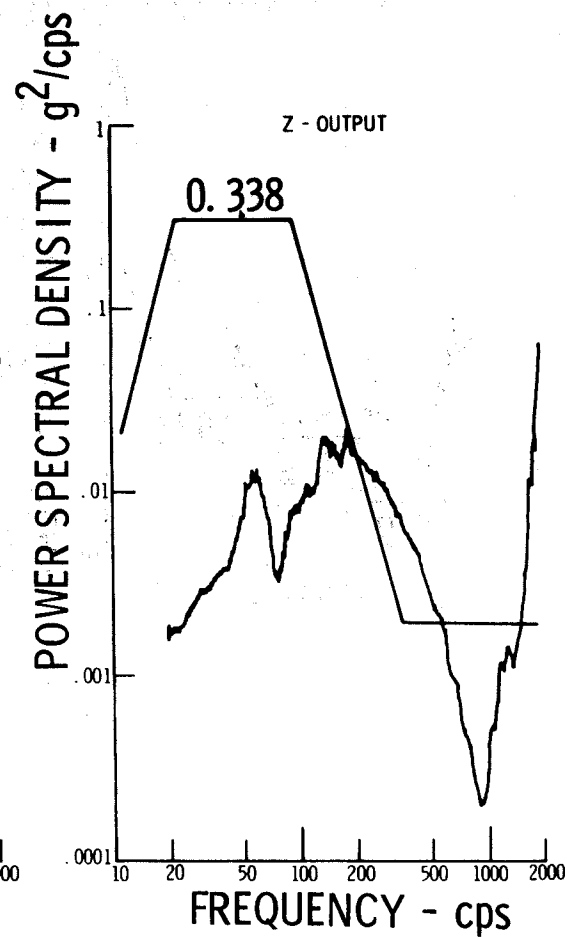
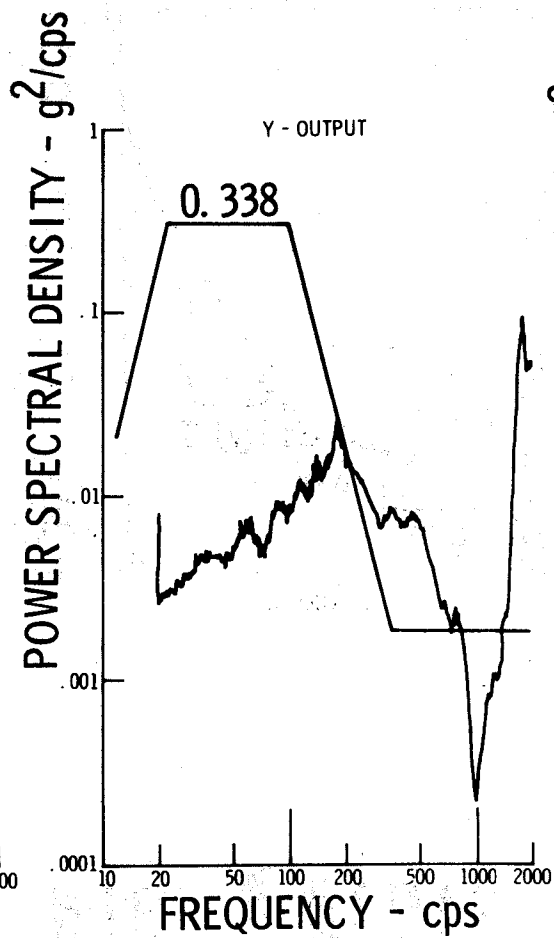
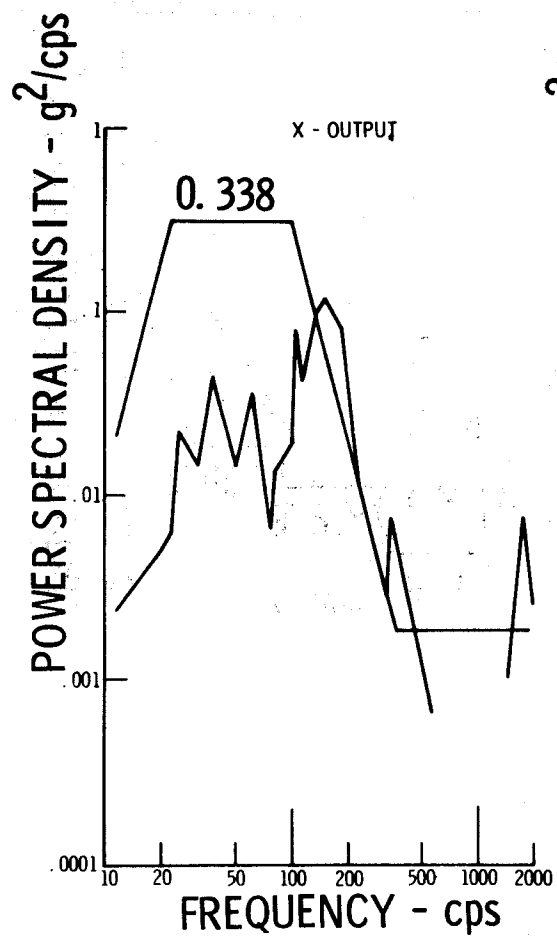


4422-2990

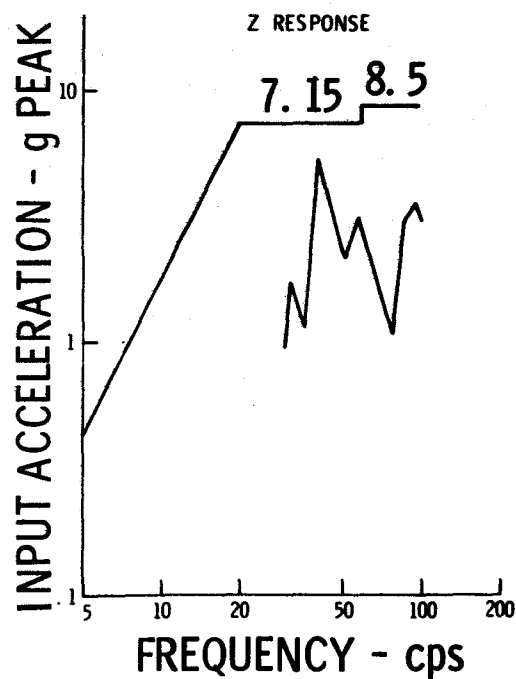
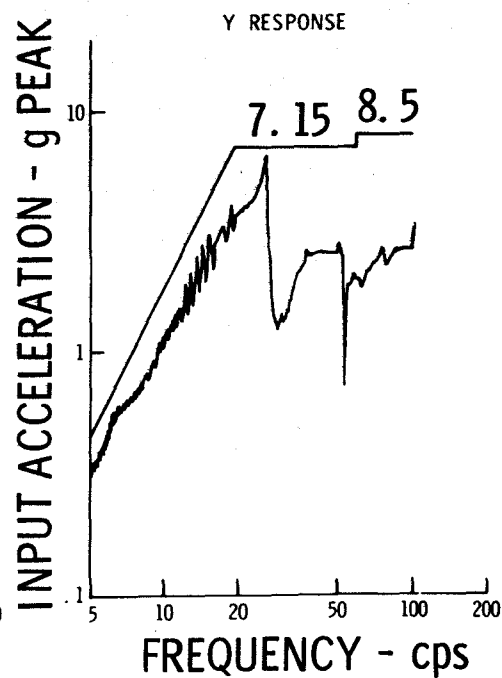
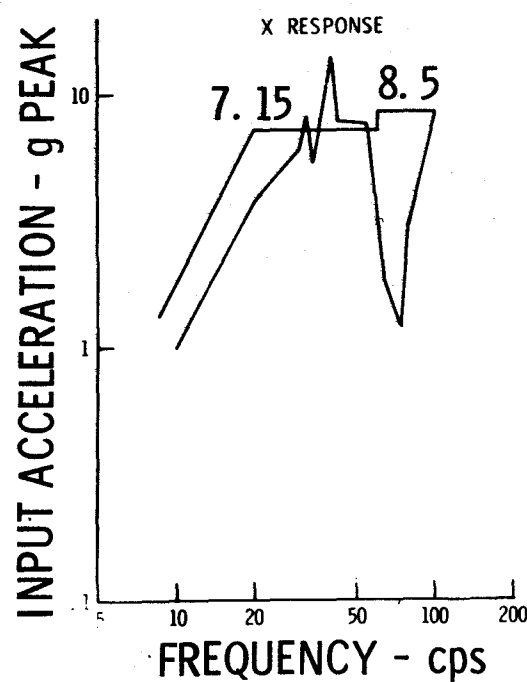
## RTG g-PLOTS



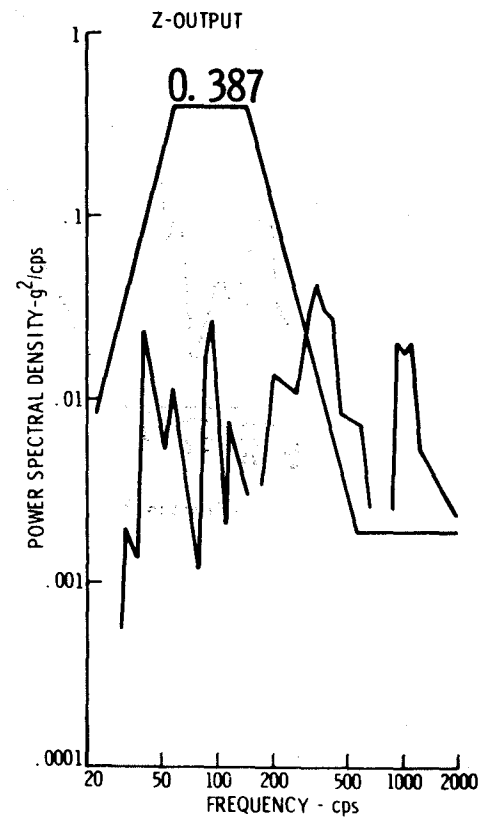
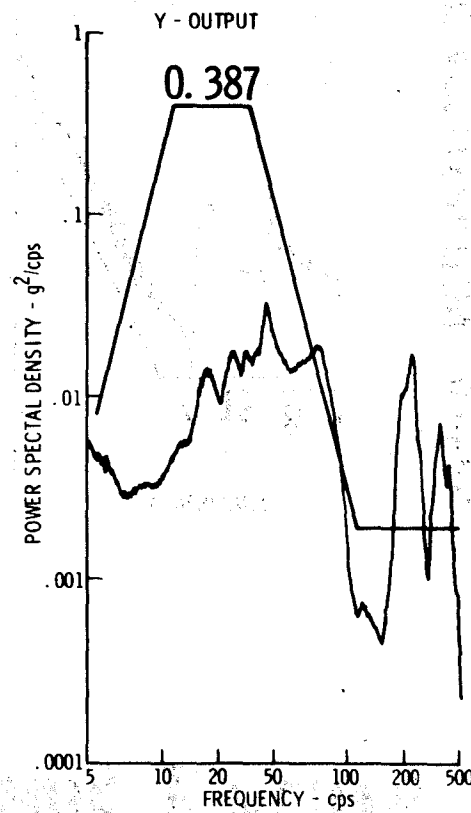
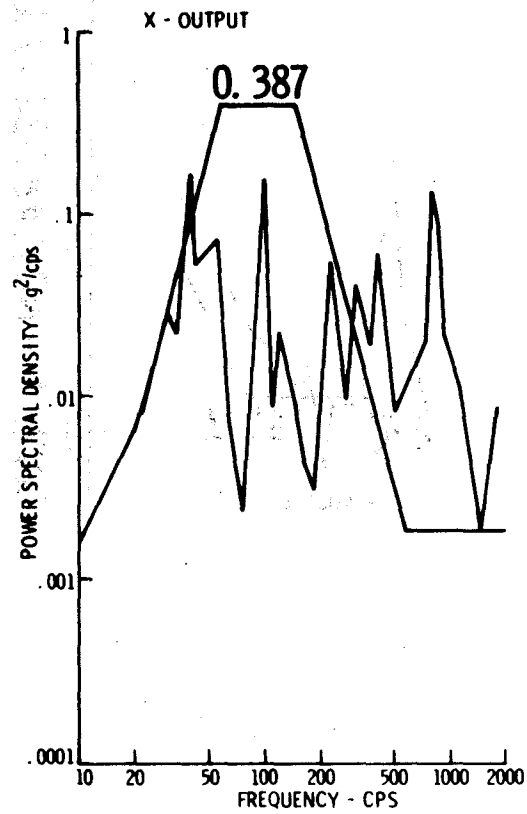
# RTG PSD-PLOTS



## SIDE g-PLOTS



# SIDE PSD - PLOTS



## CONCLUSIONS

1. SINUSOIDAL TEST IS MUCH MORE SEVER STRUCTURALLY THAN RANDOM TEST.
2. WITH THE EXCEPTION OF LSM AND ALHT, ALL EXPERIMENTS SURVIVED PROTO A TESTING DESPITE ADDITIONAL TESTING AS REQUIRED BY MSC (i. e. LUNAR/DESCENT SINE AND RANDOM TESTS).
3. QUAL. A WILL BE PER MSC APPROVED PLAN.
  - A. NO INSTRUMENTATION (EXCEPT CONTROL)
  - B. LAUNCH/BOOST SINE AND RANDOM TESTS

## CONCLUSIONS (CONT.)

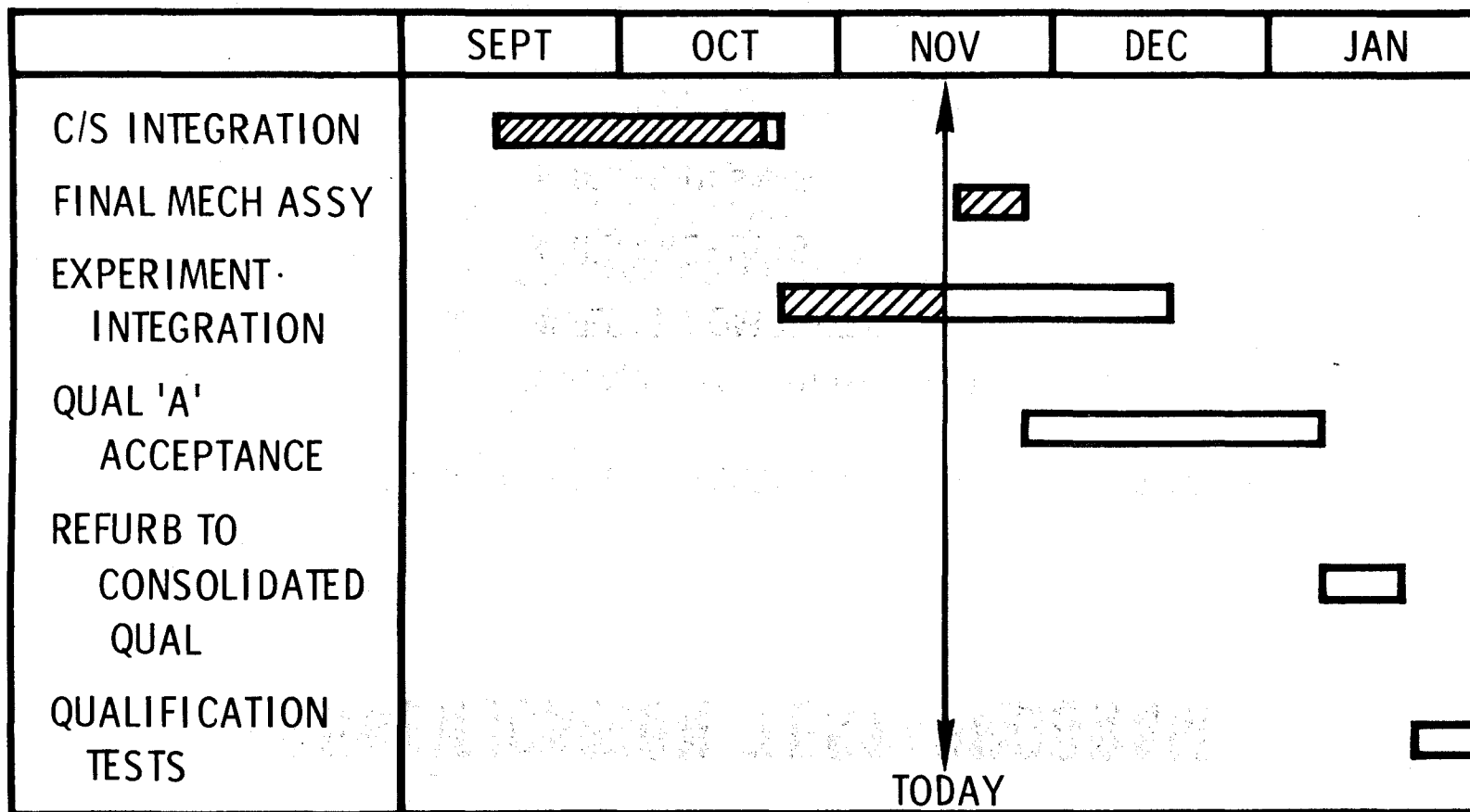
4. BK 1018 CONTROLLER WILL BE REFURBISHED AND IMPLEMENTATION OF ADDITIONAL OPERATING PROCEDURES WILL MINIMIZE HUMAN ERROR.
5. POTENTIAL HARDWARE MODIFICATION - STIFFEN PALLET IN VICINITY OF SIDE.
6.  
ATR-16 ANALYSIS ASSUMED RIGID EXPERIMENTS BUT MODIFICATIONS MAY REQUIRED DUE TO EXPERIMENT FLEXIBILITIES.

NASA  
S-67-51060

# QUALIFICATION TEST PROGRAM

- TESTS COMPLETED
- TEST RESULTS
- TESTS PLANNED
- TEST PROCEDURE STATUS

# QUAL PROGRAM STATUS



# QUAL TESTING COMPLETED

ALL COMPONENT IN-PROCESS & P. I. A. TESTS COMPLETE.

1. CENTROL STATION HARNESS
2. POWER DISTRIBUTION UNIT
3. COMMAND RECEIVER
4. DIPLEXER FILTER
5. COMMAND DECODER
6. TRANSMITTERS (2)
7. DIPLEXER SWITCH
8. DATA PROCESSOR
9. MULTIPLEXER
10. POWER CONDITIONING UNIT

# QUAL TESTING COMPLETED

- CENTRAL STATION INTEGRATION

- CENTRAL STATION/STS INTERFACE TESTS

## SWS EMI TEST DATA (MIL-I-26600)

| TEST                                               | RESULTS                               |
|----------------------------------------------------|---------------------------------------|
| 1. SUSCEPTABILITY<br>(A) RADIATED<br>(B) CONDUCTED | NO PROBLEMS                           |
| 2. CONDUCTED                                       | 15 db (OUT OF SPEC)<br>.64 - 6.9 MCPS |
| 3. RADIATED                                        | 6 db (OUT OF SPEC)<br>155 kcps        |

# QUAL TESTING COMPLETED

## EXPERIMENT TESTING.

### I SOLAR WIND EXP.

- A. P.I.A. - COMPLETE
- B. MASS PROPS - COMP.
- C. E.M.I. - COMP.
- D. INTEGRATION INTO CENTROL STATION -  
COMPLETE.

### II PASSIVE SEISMIC EXP.

- A. P.I.A. - COMP \*
- B. MASS. PROPS-COMP.
- C. E.M.I. - COMP.

\* FAILURE IN P.S.E. REQUIRES A RETEST OF P.I.A.

# CENTRAL STATION INTEGRATION

## 9-15 TO 10-20

### PROBLEMS

### SOLUTIONS

---

- |                                 |                                           |
|---------------------------------|-------------------------------------------|
| 1. PDU - OP-AMP DEFECTIVE       | REPLACE                                   |
| 2. MULTIPLEXER SERIAL #7 FAILED | RETURN TO VENDOR-REPLACE<br>WITH SERIAL 8 |
| 3. OUT OF TOLERANCE CONDITIONS  | PROCEDURE CHANGES                         |
| 4. PDU - NO FLIGHT TYPE C. B.   | RETROFIT WITH QUAL BACKUP                 |
| 5. PCU - SWITCHING PROBLEM      | RETROFIT WITH QUAL BACKUP                 |

## QUAL SUBSYSTEM TESTS PLANNED

| TEST                       | START DATE | COMP. DATE |
|----------------------------|------------|------------|
| PSE PIA                    | 11-15-67   | 11-15-67   |
| PSE INTEGRATION            | 11-16-67   | 11-17-67   |
| RTG PIA                    | 11-14-67   | 11-15-67   |
| SIDE PIA                   | 11-21-67   | 11-22-67   |
| SIDE INTEGRATION           | 11-28-67   | 11-28-67   |
| SIDE EMI AND<br>MASS PROPS | 11-23-67   | 11-26-67   |
| RTG INT                    | 11-24-67   | 11-24-67   |
| CENTRAL STATION<br>EMI     | 11-25-67   | 11-27-67   |

## QUAL ACCEPTANCE TESTS PLANNED

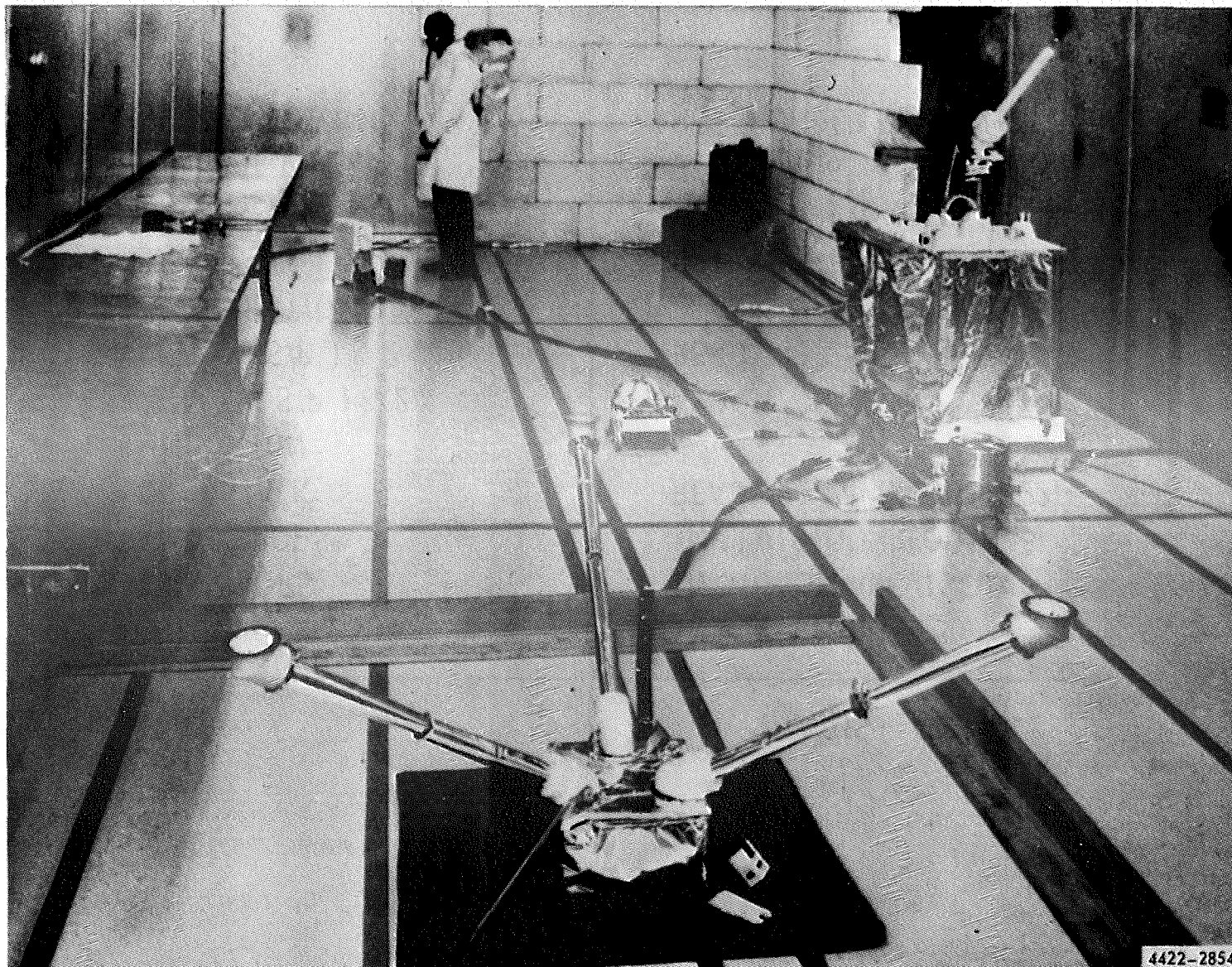
| TEST                  | START DATE | COMP. DATE |
|-----------------------|------------|------------|
| I. S. T.              | 11-29-67   | 12-1-67    |
| TEMP. STORAGE         | 12-3-67    | 12-6-67    |
| MASS PROPS. SUB PAC 1 | 12-10-67   | 12-10-67   |
| MASS PROPS SUB PAC2   | 12-7-67    | 12-7-67    |
| VIBRATION SUB PAC 1   | 12-7-67    | 12-9-67    |
| VIBRATION SUB PAC 2   | 12-11-67   | 12-13-67   |
| C/S I. S. T           | 12-15-67   | 12-15-67   |
| RTG LEAK PIA          | 12-15-67   | 12-16-67   |
| LSM PIA, EMI, MASS P. | 12-1-67    | 12-7-67    |
| LSM INT.              | 12-16-67   | 12-18-67   |
| IST                   | 12-19-67   | 12-21-67   |
| CROSSTALK             | 12-22-67   | 12-22-67   |
| POWER PROFILE         | 12-23-67   | 12-23-67   |
| THERMAL VACUUM        | 12-27-67   | 1-2-68     |
| SYSTEM EMI            | 1-3-68     | 1-5-68     |

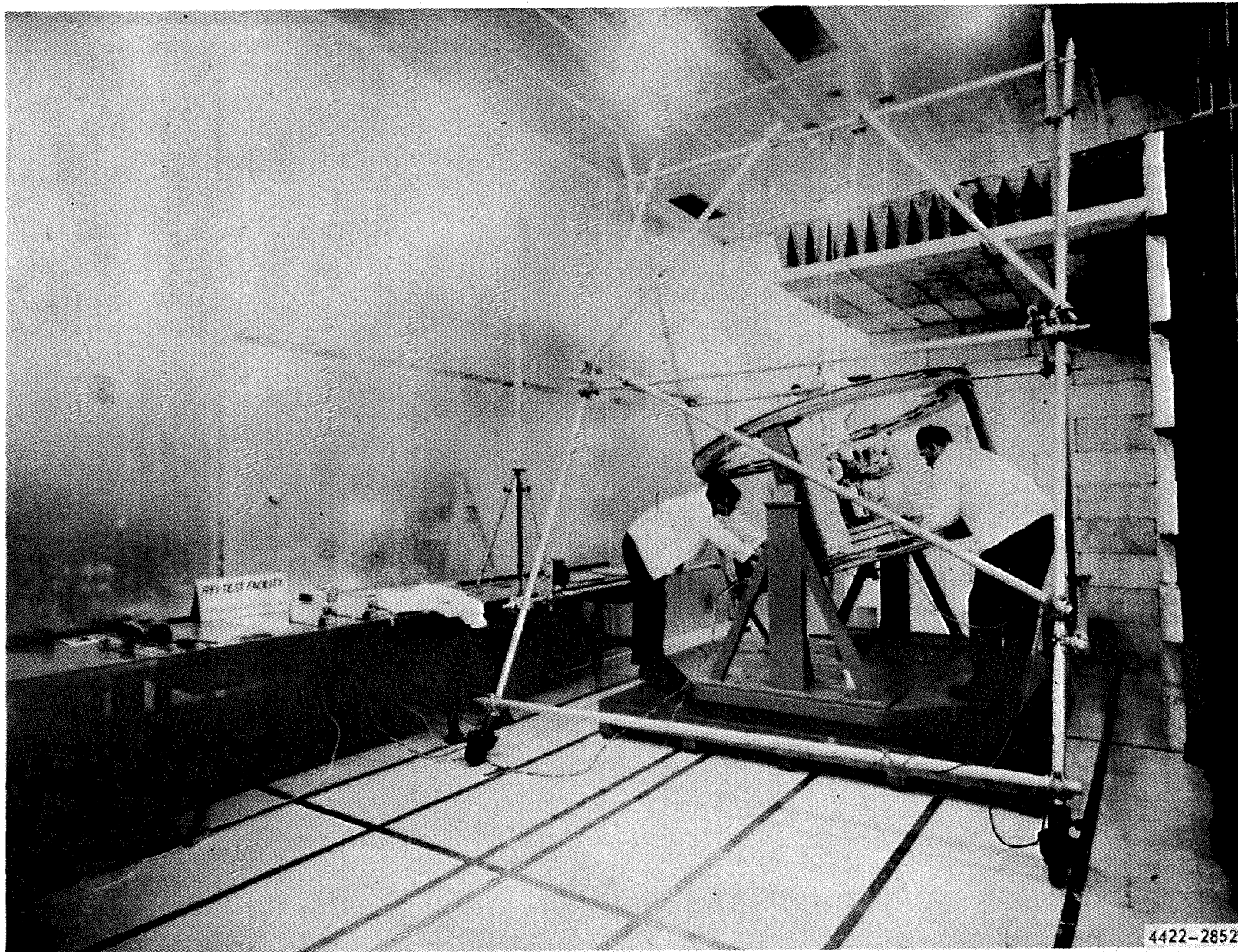
# QUAL MODEL - SYSTEM QUAL TESTS

| TEST           | START DATE | COMP. DATE |
|----------------|------------|------------|
| I. S. T.       | 1-22-68    | 1-23-68    |
| ACCELERATION   | 1-22-68    | 1-27-68    |
| I. S. T.       | 1-29-68    | 1-31-68    |
| SHOCK          | 2-1-68     | 2-5-68     |
| I. S. T.       | 2-5-68     | 2-7-68     |
| VIBRATION - X  | 2-8-68     | 2-9-68     |
| I. S. T.       | 2-9-68     | 2-13-68    |
| VIBRATION-Y    | 2-14-68    | 2-15-68    |
| I. S. T.       | 2-15-68    | 2-19-68    |
| VIBRATION - Z  | 2-20-68    | 2-21-68    |
| I. S. T.       | 2-22-68    | 2-23-68    |
| MAGNETIC PROPS | 2-27-68    | 3-8-68     |
| THERMAL/VAC    | 3-9-68     | 3-14-68    |
| MISSION SIM    | 3-15-68    | 4-19-68    |

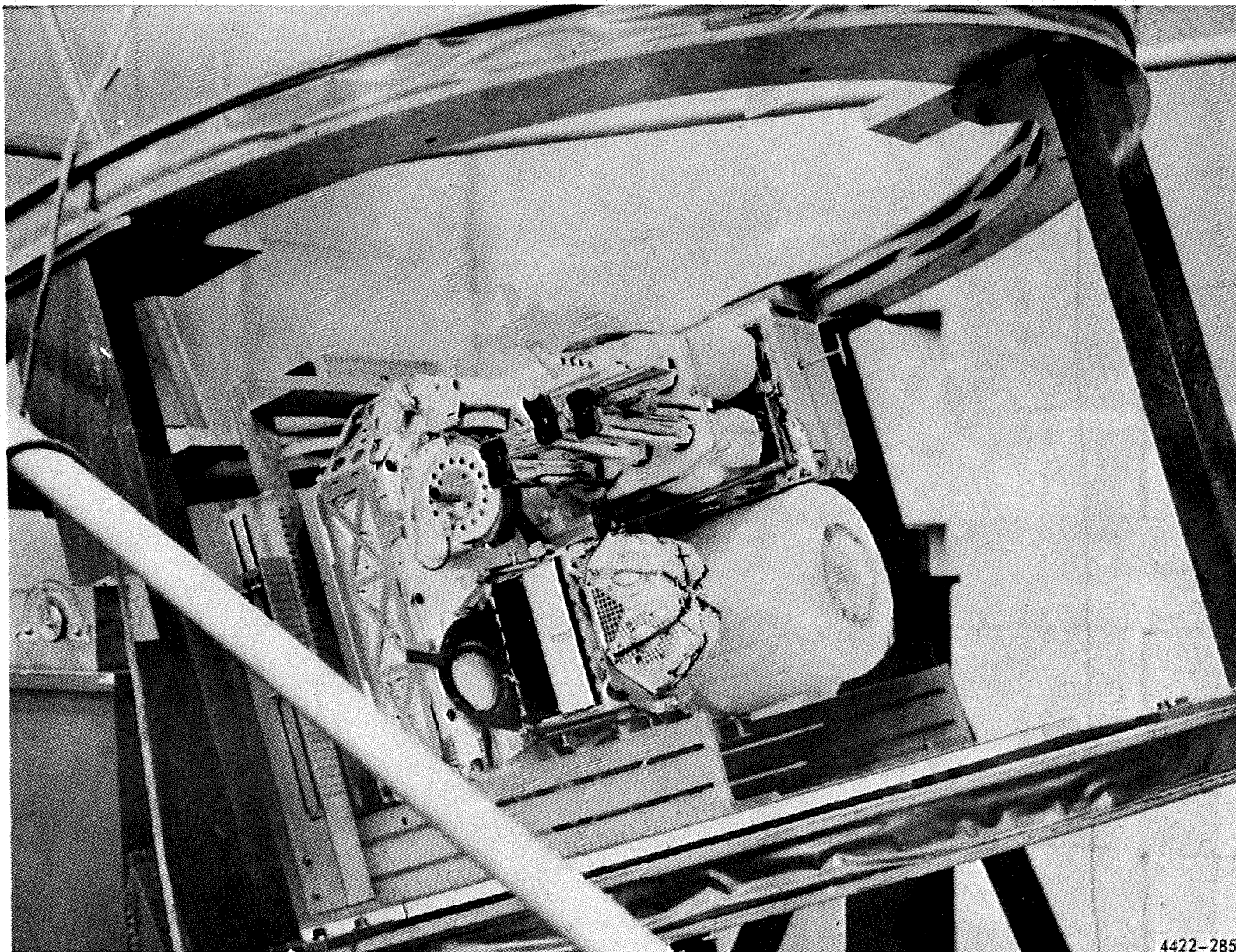
# TEST PROCEDURES

| TITLE                  | STATUS                         |
|------------------------|--------------------------------|
| IST                    | IN REVISION (11-30)            |
| MAS PROPS.             | IN SIGNOFF (REVISED)           |
| MAG. PROPS             | IN REVISION (REQD 1-15)        |
| CROSSTALK              | READY 11-24 (REQD 12-22)       |
| VIBRATION              |                                |
| ACC - S/P 1 & 2        | AT MSC                         |
| QUAL S/P 1 & 2         | READY 11-27                    |
| ACCELERATION S/P 1 & 2 | READY 12-8                     |
| SHOCK S/P 1 & 2        | READY 12-4                     |
| STORAGE                | IN HOUSE SIGNOFF               |
| THERMAL VAC.           | READY 1-16                     |
| EXPERIMENT INT.        | REV B UNDER REVIEW BY SECTIONS |

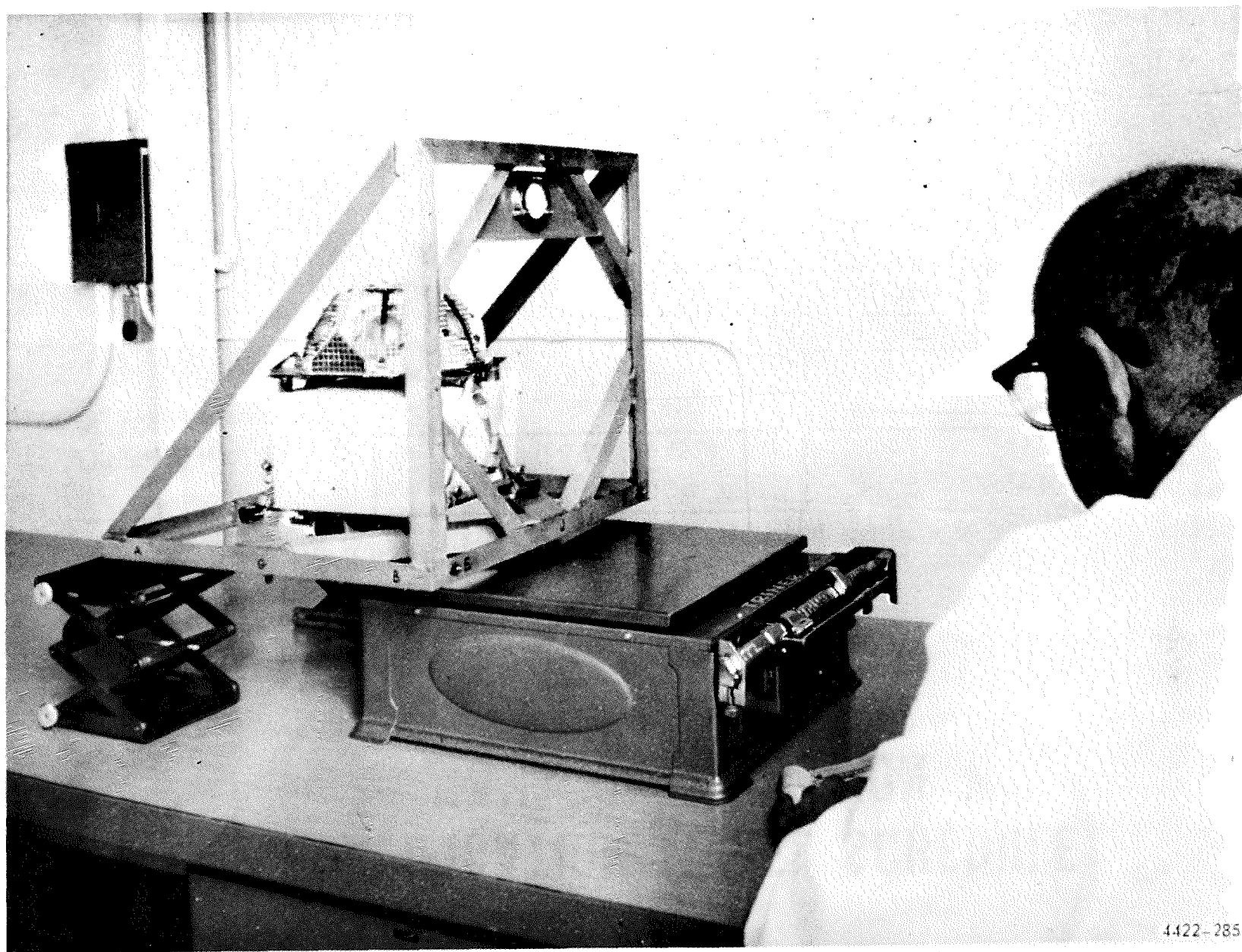




4422-2852

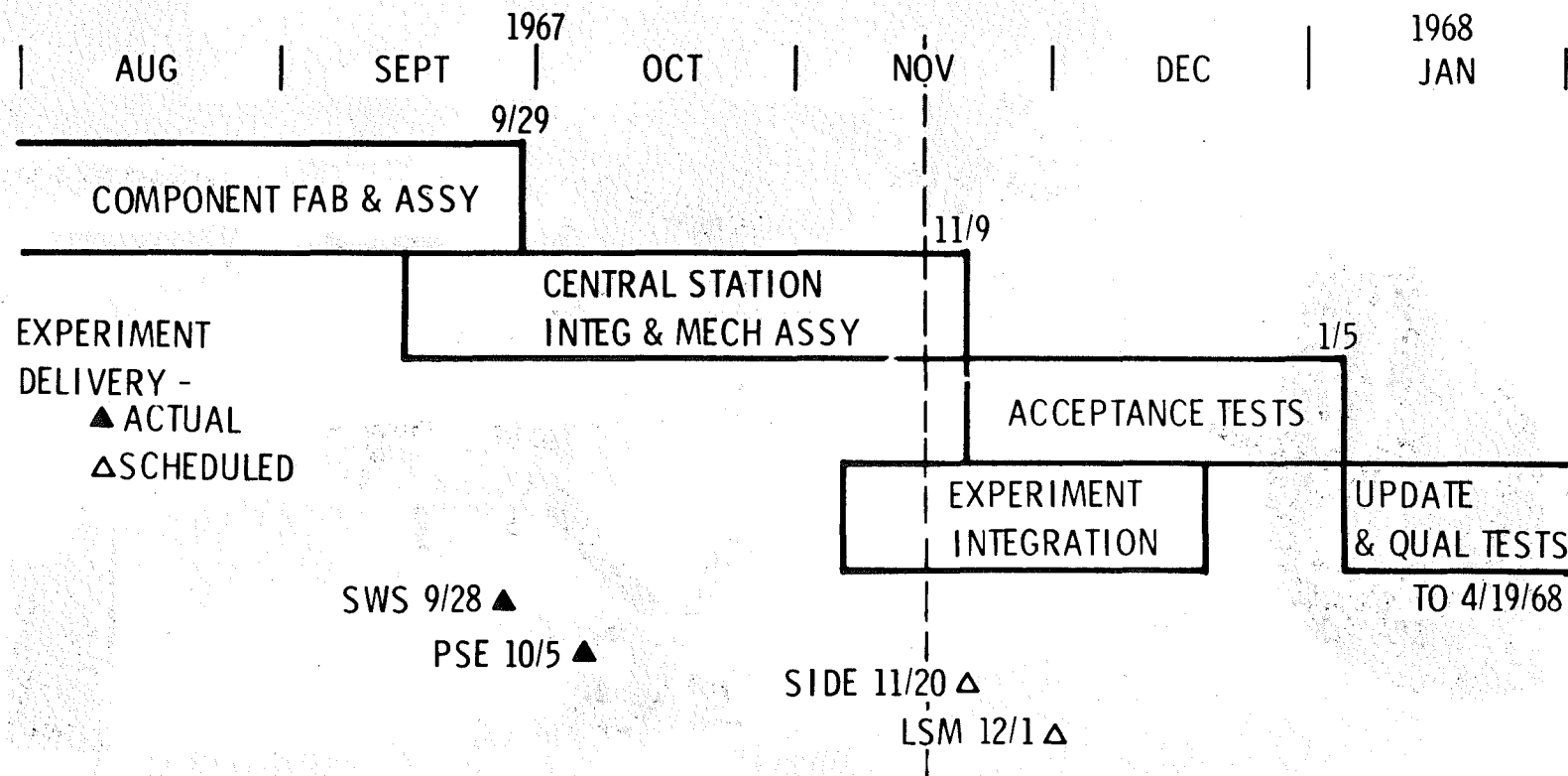


4422-2851

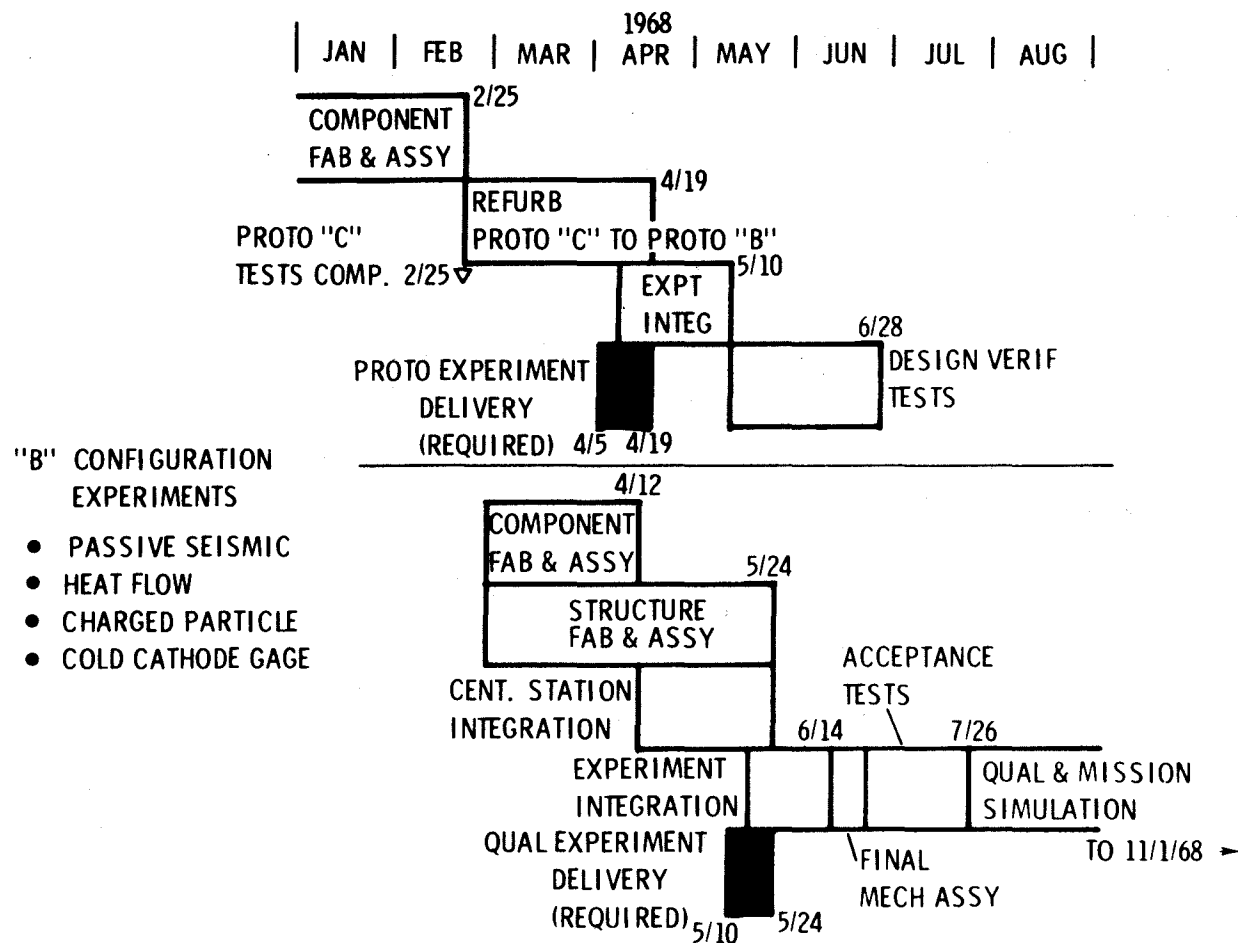


4422-2855

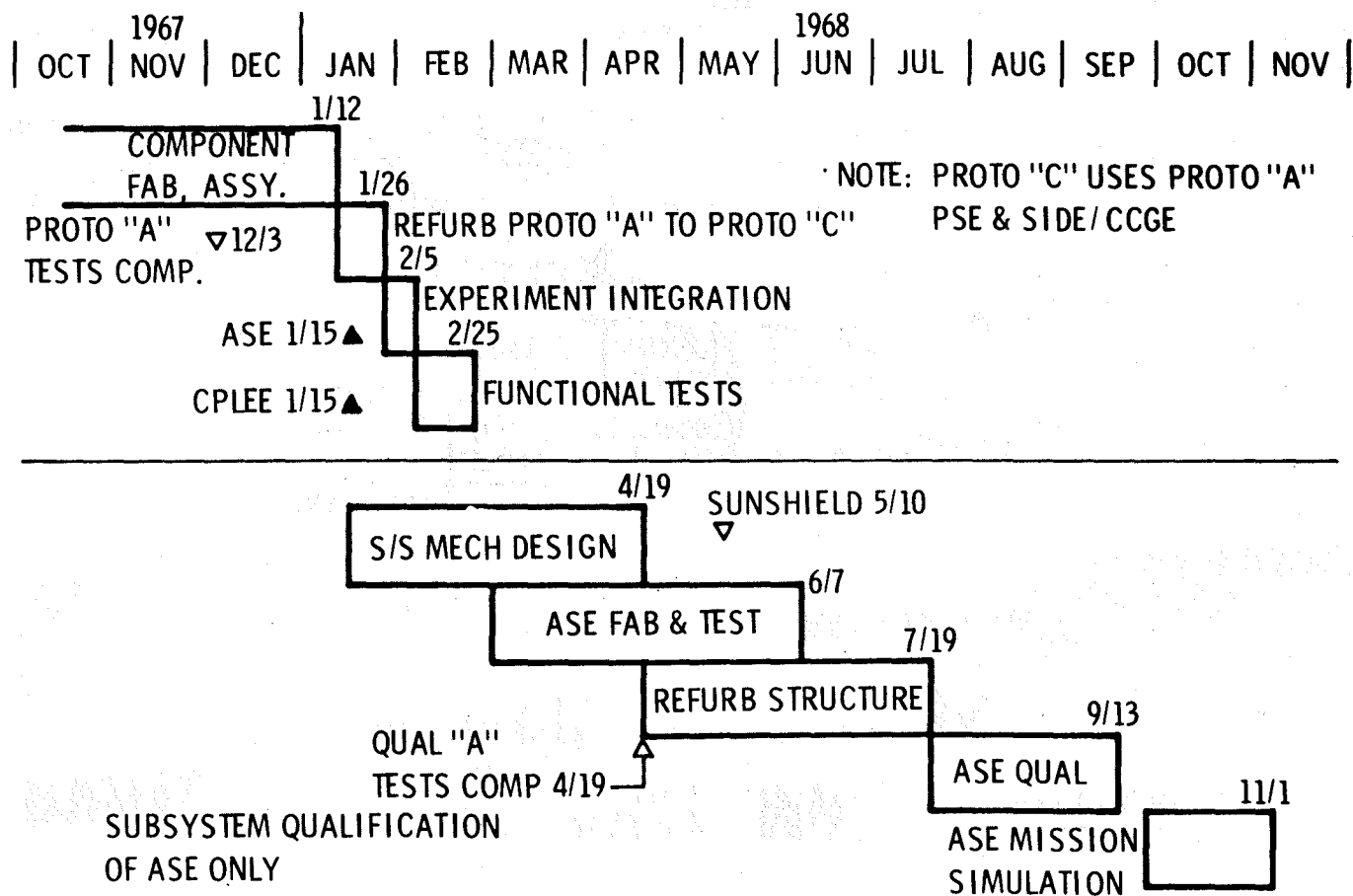
# QUALIFICATION MODEL SCHEDULE "A" CONFIGURATION

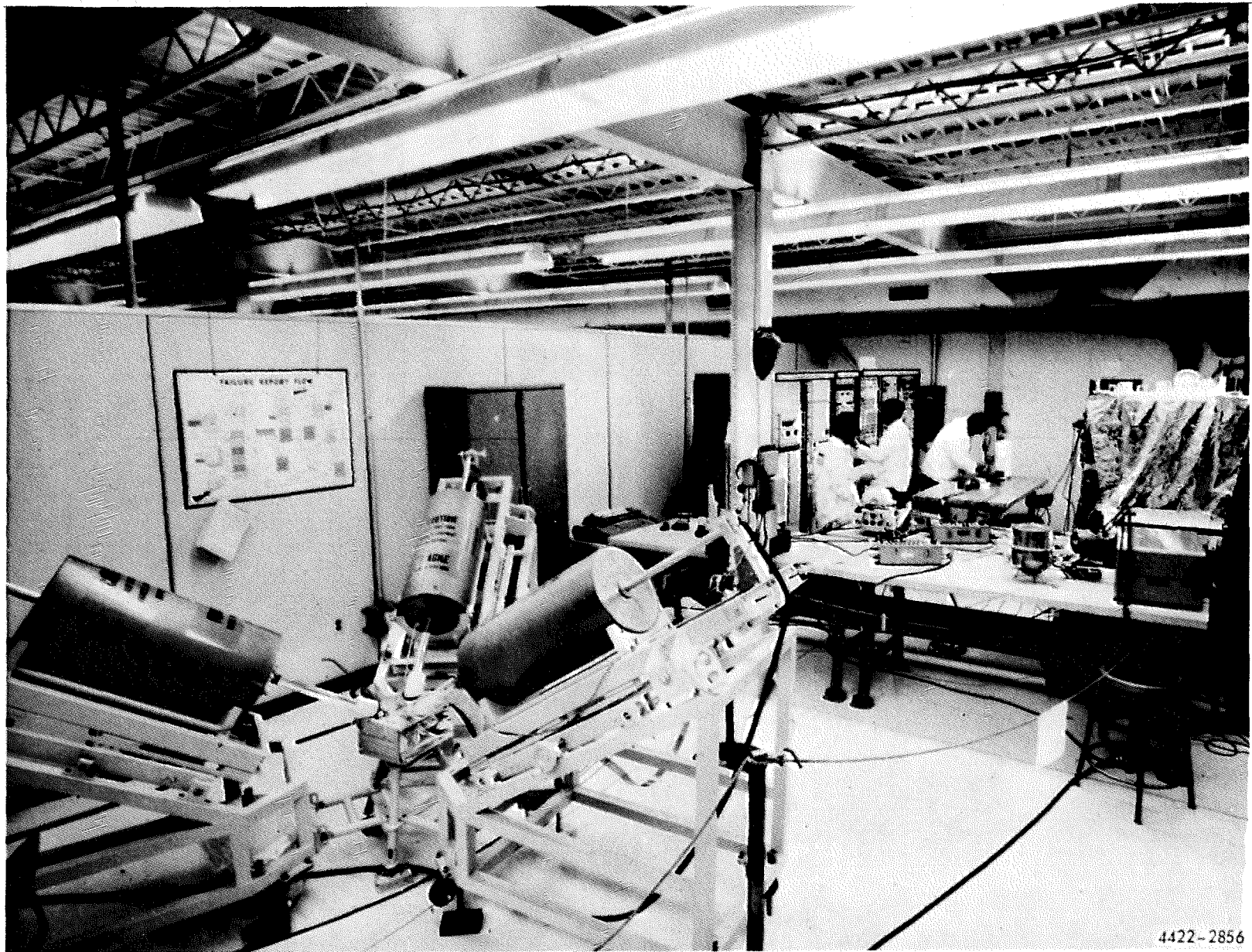


# PROTOTYPE AND QUAL MODEL SCHEDULE "B" CONFIGURATION

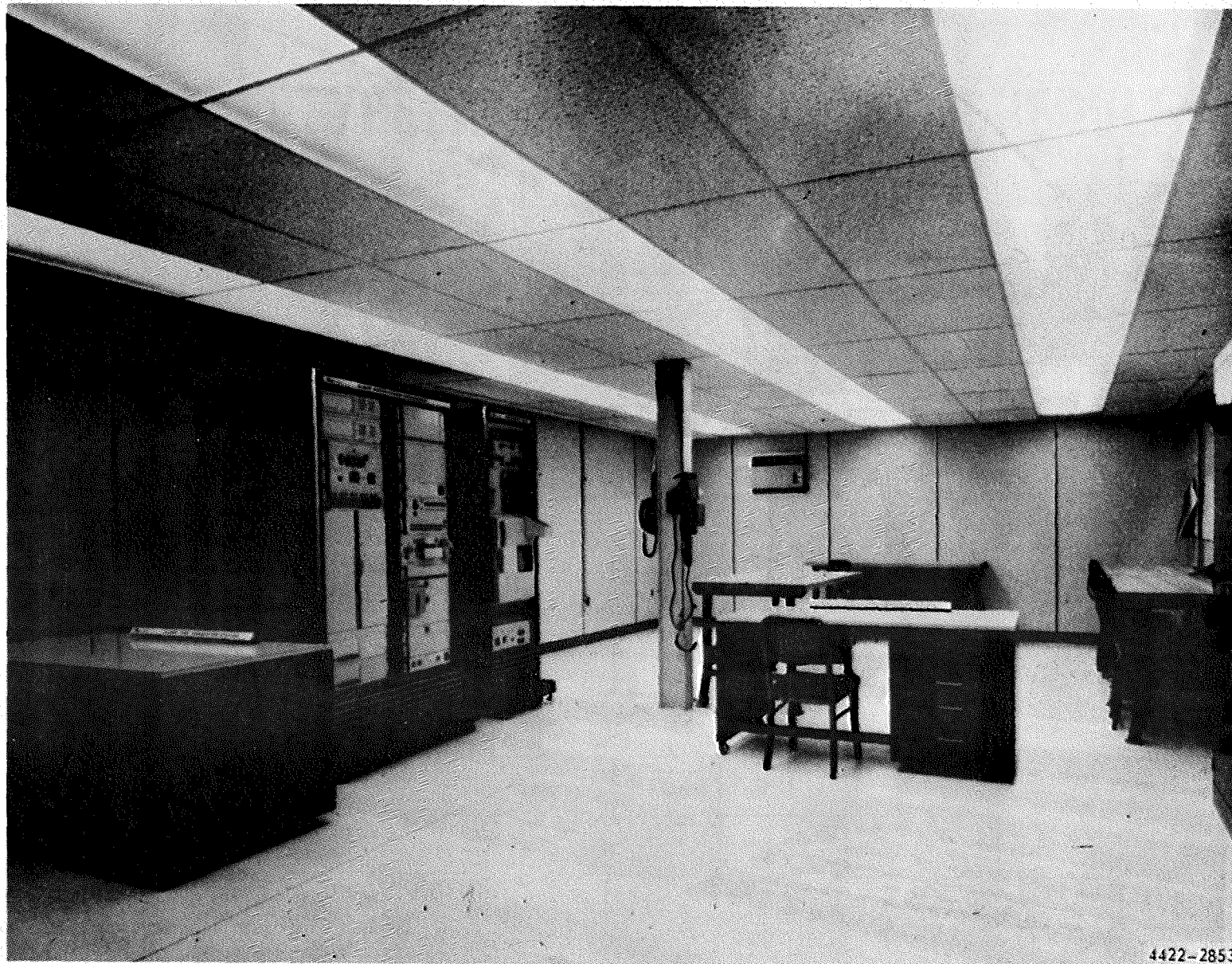


# PROTOTYPE AND QUAL MODEL SCHEDULE "C" CONFIGURATION

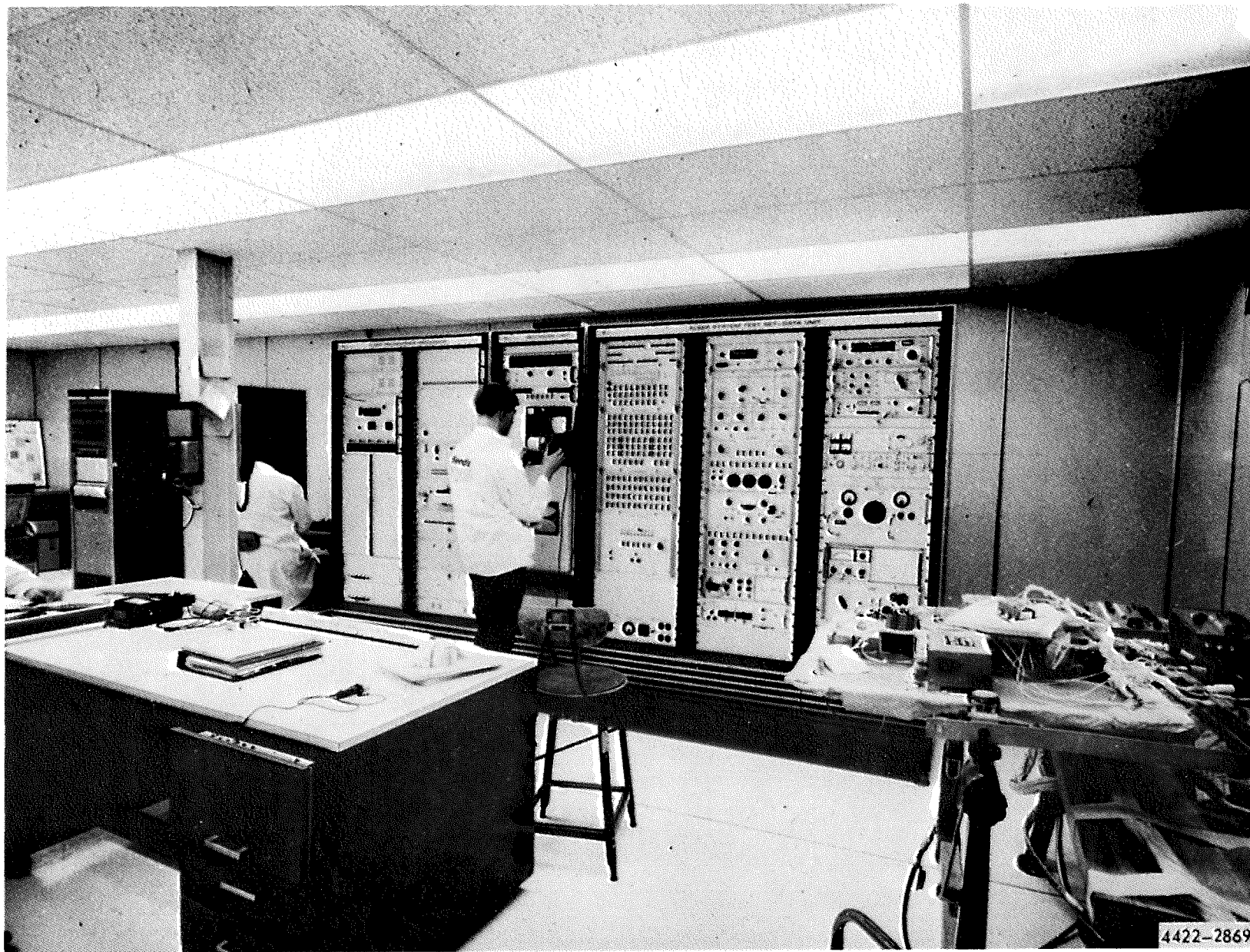




4422-2856



4422-2853



4422-2869

6-1 Snyder

SWS ACCOMPLISHMENTS (11/15/67)

SWS-11 AND SWS-12 DELETED FROM PROGRAM.

SWS-5 (QUAL) DELIVERED TO BxA.

26 SEPTEMBER AND 24 OCTOBER.

SWS-5 COMPLETED BxA SYSTEM INTEGRATION.

SWS-6 (QUAL SPARE) DELIVERED TO JPL 8 NOV.

DYNAMIC MODEL PASSED BxA PROTO-1 TESTS.

SENSOR REDESIGN, REWORK, AND RETROFIT  
COMPLETED.

NEW POWER TRANSFORMERS FABRICATED

AND INSTALLED (UNITS 5 TO 10).

ALL ELECTRONICS FABRICATED FOR UNITS 7,8,9,10.

6-2 Snyder

SWS PROBLEMS (11/15/67)

VIBRATION TEST LEVELS STILL BEING REVISED.  
SHORTAGE OF SPARE I.C. MODULES.  
SENSOR HAS NOT PASSED QUAL SHAKE.  
EXCESSIVE PICKUP IN SWS-5 AND SWS-6 SENSORS.  
SHAKE FIXTURE REJECTED. NEW FIXTURE MUST  
BE QUALIFIED.  
PROBLEM OF INSTRUMENT MOUNTING:  
WILL MOUNTING PLATE WARP?  
WILL ALSEP PALLET WARP?  
WHAT DURATION OF STRESSED STORAGE?  
IMPLICATIONS OF CALFAX REPLACEMENT?  
PROBLEMS WITH SCREENING OF PARTICULAR PARTS.  
QUALIFICATION OF HIGH VOLTAGE RESISTORS.  
CONCERN ABOUT ASTRONAUT HANDLING.

6-3 Snyder

SWS FORECAST TO 12/31/67

1. Resolve sensor pickup problem.
2. Resolve instrument mounting problems.
3. Deliver all flight units to JPL.
4. Complete of SWS qual testing.
5. Completely calibrate one flight unit.
6. Devise plan for total calibration effort.
7. Generate integrated plan for retrofit and test of all units.

6-4 Snyder

SWS DELIVERY SCHEDULE

DELIVERIES TO JPL FROM EOS

SWS-7 22 NOV

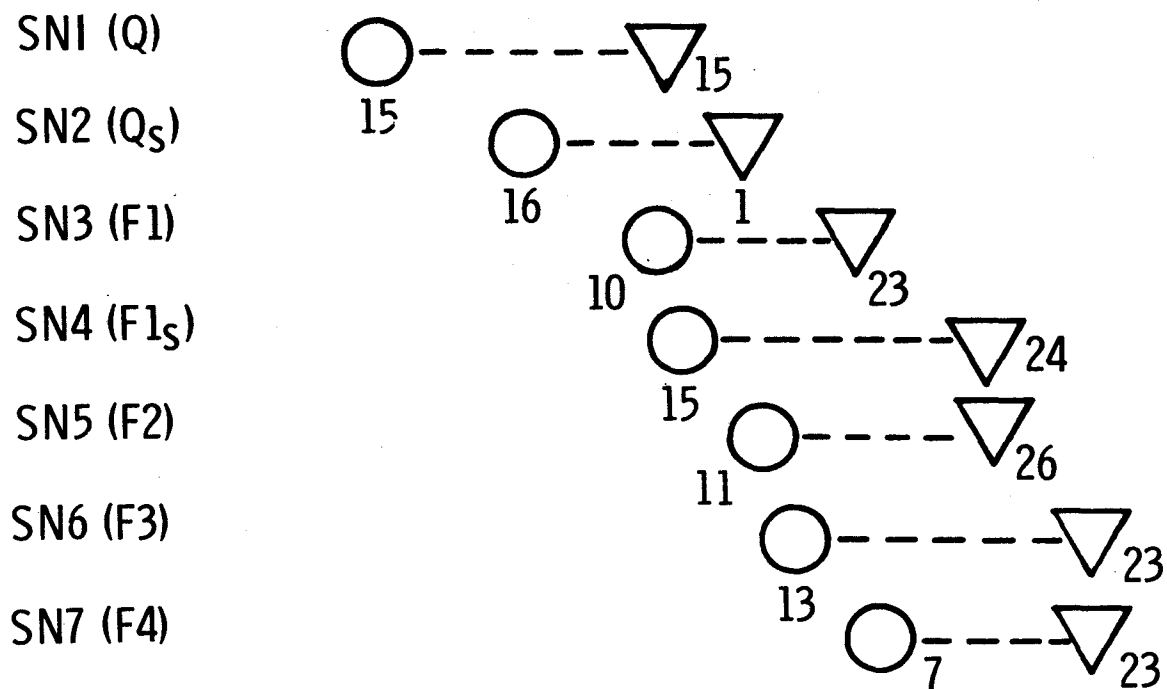
SWS-8 8 DEC

SWS-9 10 DEC

SWS-10 31 DEC

# OVERALL PSE SCHEDULE

| SEPT. | OCT. | NOV. | DEC. | JAN. | FEB. | MAR. |
|-------|------|------|------|------|------|------|
|-------|------|------|------|------|------|------|



○ PREVIOUSLY ANNOUNCED

▽ CURRENT

# ACCOMPLISHMENTS DVT MODEL

- COMPLETED QUAL LEVEL VIBRATION TESTS.

DAMAGE TO PSE.

BROKEN WIRES TO X & Y AXIS MOTORS

BROKEN LITZ WIRES Y & Z BOOM END.

OPEN CIRCUIT - MOTOR DRIVE (WIRE PROBLEM)

LOWER LPZ SPRING SUSPENSION WIRE BROKEN

- POST VIBRATION ACTIVITY

PARTIAL REPAIR OF BROKEN WIRES

LEVEL PSE USING EXTERNAL ELECTRONIC'S

CHECKED X & Y PERIODS (GENERALLY GOOD)

CHECKED Z PERIOD AFTER SPRING REPAIR.

RAN FUNCTIONAL TEST

## ACCOMPLISHMENT DVT-CONTINUED.

- ACCELERATION AND SHOCK TESTS.

TEST TO CONTINUE - OPEN CKT., MTR DRIVE NOT REPAIRED

COMPLETE INVESTIGATION OF SEISMOMETER SYSTEM AFTER  
ACCELERATION & SHOCK.

- REMAINING DVT SCHEDULE - 7 WEEKS

ALL TESTS TO BE COMPLETED 12/27/67

# ACCOMPLISHMENTS PROTOTYPE

- COMPLETION OF PROTO QUAL LEVEL VIBRATION TESTS, X AXIS.

PHYSICAL INSPECTION OF SENSOR AFTER X AXIS TEST  
WIRE BROKEN - Z AXIS PREAMP BOARD  
CHANGED ONE SUSPECT WIRE AT GROUND LUG  
STRAIGHTENED LITZ WIRES.

- Y AND Z AXIS VIBRATION TESTS

PHYSICAL INSPECTION OF SENSOR AFTER Y & Z AXIS TEST.  
NO DAMAGE NOTICED

- SUMMARY

SHORTEN WIRE HARNESS = SELECTIVELY  
INSTRUMENT PASSED VIBRATION  
PROTO CONTINUING IN TEST CYCLE.

## ACCOMPLISHMENTS SNOI - QUAL MODEL

- SHIPPED TO BxA      5 OCT 67.  
PIA STARTED - UNSUCCESSFUL  
RETURNED SNO1 TO VENDOR 10 OCT 67
- SHIPPED TO BxA    12 OCT 67  
INSTALLED UPDATED LOGIC DRAWER INTO E. T. S.  
RAN PIA, EMI TEST AND MASS PROPERTIES TEST  
SNO1 STARTED TO LOOSE CAGING PRESSURE 10 LBS/DAY  
RETURNED SNO1 TO VENDOR    29 OCT 67
- VENDOR CORRECTED LEAK - UPPER MANIFOLD ASSY.  
CAUSE OF PROBLEM ... SILICONE GREASE  
PIA TEST STARTED - STOPPED DUE TO LOGIC PROBLEM.

# FORECASTED ACCOMPLISHMENTS,

- POST VIBRATION THERMAL SHROUD TEST
- SECOND THERMAL TEST OF SNO2 SHROUD
- INSTALLATION OF NEW LACOSTE SPRINGS INTO FOLLOWING PSE MODELS DVT, SN2, SN3 & SN4.
- THERMAL COMPENSATION OF REMAINING PSE SENSORS.

ADDITIONAL SPRINGS ARE ON ORDER

SCHEDULE - UNDER EVALUATION

- RESOLUTION OF CAGE/UNCAGING SYSTEM PRESSURIZATION PROBLEMS.
- RESOLUTION OF LOGIC TIMING PROBLEMS ON PSE.
- INCORPORATE SENSOR CONTROLLER MODIFICATION INTO ETS.
- UPGRADE VENDOR B. B. ETS TO SUPPORT DELIVERY SCHEDULE.
- CONSIDER INCREASING STABILITY OF LEVELING STOOL

## **SIDE/CCGE PROBLEM AREAS**

### **I. CCIG H.V. TRANSIENTS**

#### **REMEDIES:**

- CONTINUED TROUBLESHOOTING
- INCORPORATION OF PROTECTIVE CIRCUITS
- CLEANING OF CCIG
- REROUTING OF GROUNDS AND H.V. LINES

### **II. PROTECTION TO REST OF SIDE/CCGE.**

#### **REMEDIES:**

- INCORPORATION OF PROTECTIVE CIRCUITS

### **III. LOW CONFIDENCE IN THIS SPECIFIC UNIT, QUAL. MODEL, (S/N 3) DUE TO REPEATED ELECTRICAL STRESS UNIT HAS BEEN SUBJECTED TO.**

#### **REMEDY?**

- SUBSTITUTE S/N 4 FOR S/N 3 AS THE QUAL. MODEL AND RETAIN S/N 3 AT RICE FOR ION BEAM TESTS AND/OR REFURBISH FOR QUAL. SPARE

# **SIDE/CCGE ACCOMPLISHMENTS**

**I. COMPLETED PROTOTYPE VIBRATION TEST AT BENDIX**

**II. COMPLETED PRELIMINARY PHYSICS DESIGN  
VERIFICATION TESTS ON THE SIDE USING S/N 3**

**SIDE/CCGE**  
**QUAL. MODEL (S/N 3 ) STATUS**

**I. VIBRATION TEST – COMPLETE**

**II. THERMAL VACUUM TEST – INCOMPLETE**

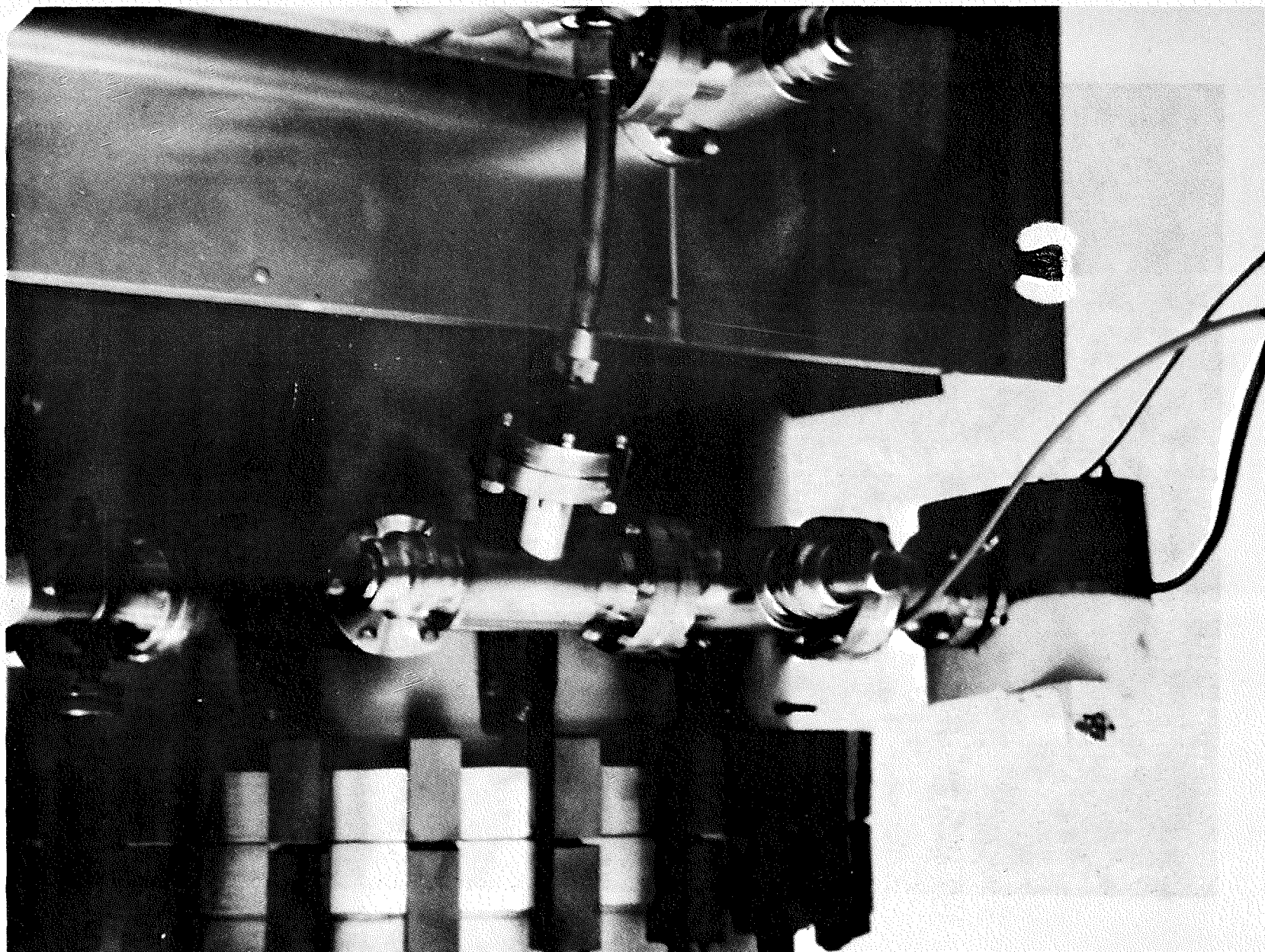
- **A THERMAL VACUUM AND/OR VACUUM TEST HAS BEEN ATTEMPTED 4 TIMES OVER THE PAST MONTH**
- **ON EACH OCCASION TROUBLE HAS BEEN ENCOUNTERED WITH THE CCIG H.V.**
- **ELECTRICAL TRANSIENTS ASSOCIATED WITH GCIG H.V. HAVE CAUSED SUBSTANTIAL DAMAGE TO OTHER PARTS OF THE SIDE/CCGE PACKAGE**

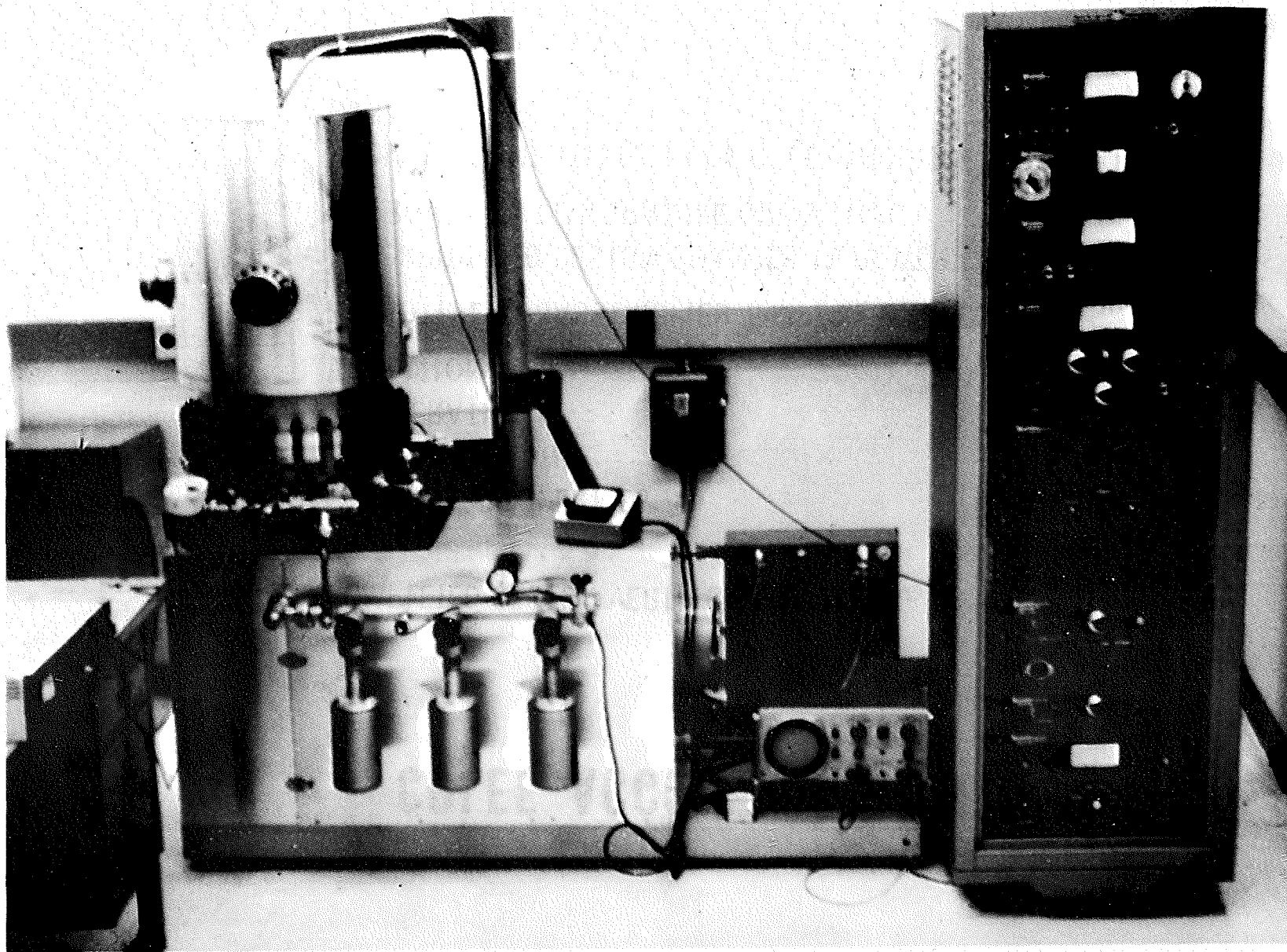
# CCGE DELIVERY STATUS

8 UNITS DELIVERED  
INCLUDING FLIGHT #1

5 FLIGHT UNITS COMPLETED AT NRC  
WAITING FOR PARTS FROM MARSHALL LABS

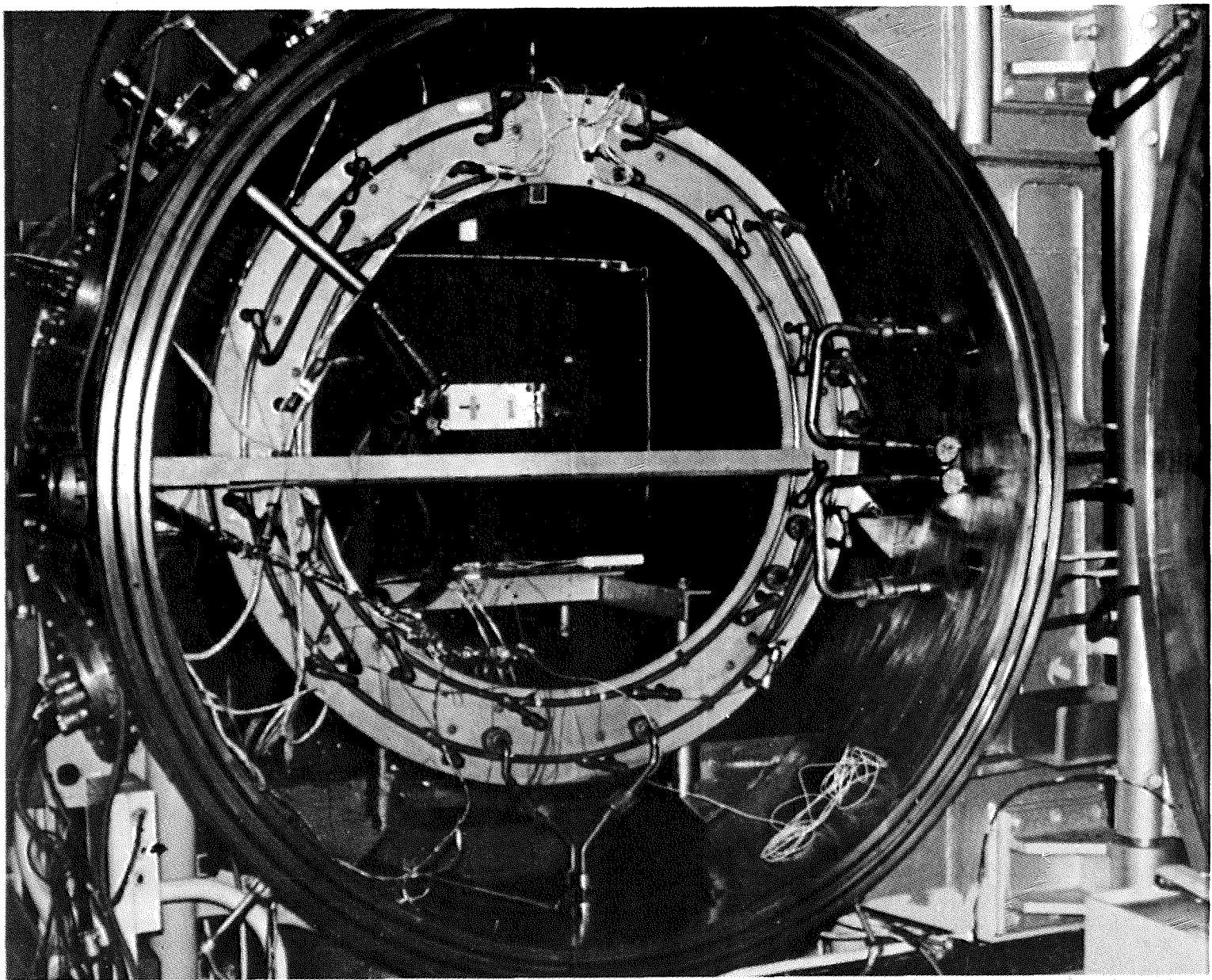
FLIGHT #1 WAS RETURNED TO NRC  
FOR MODIFICATION TO MOUNTING. UNIT  
HAD EXTENSIVE DAMAGE DUE TO POOR  
HANDLING

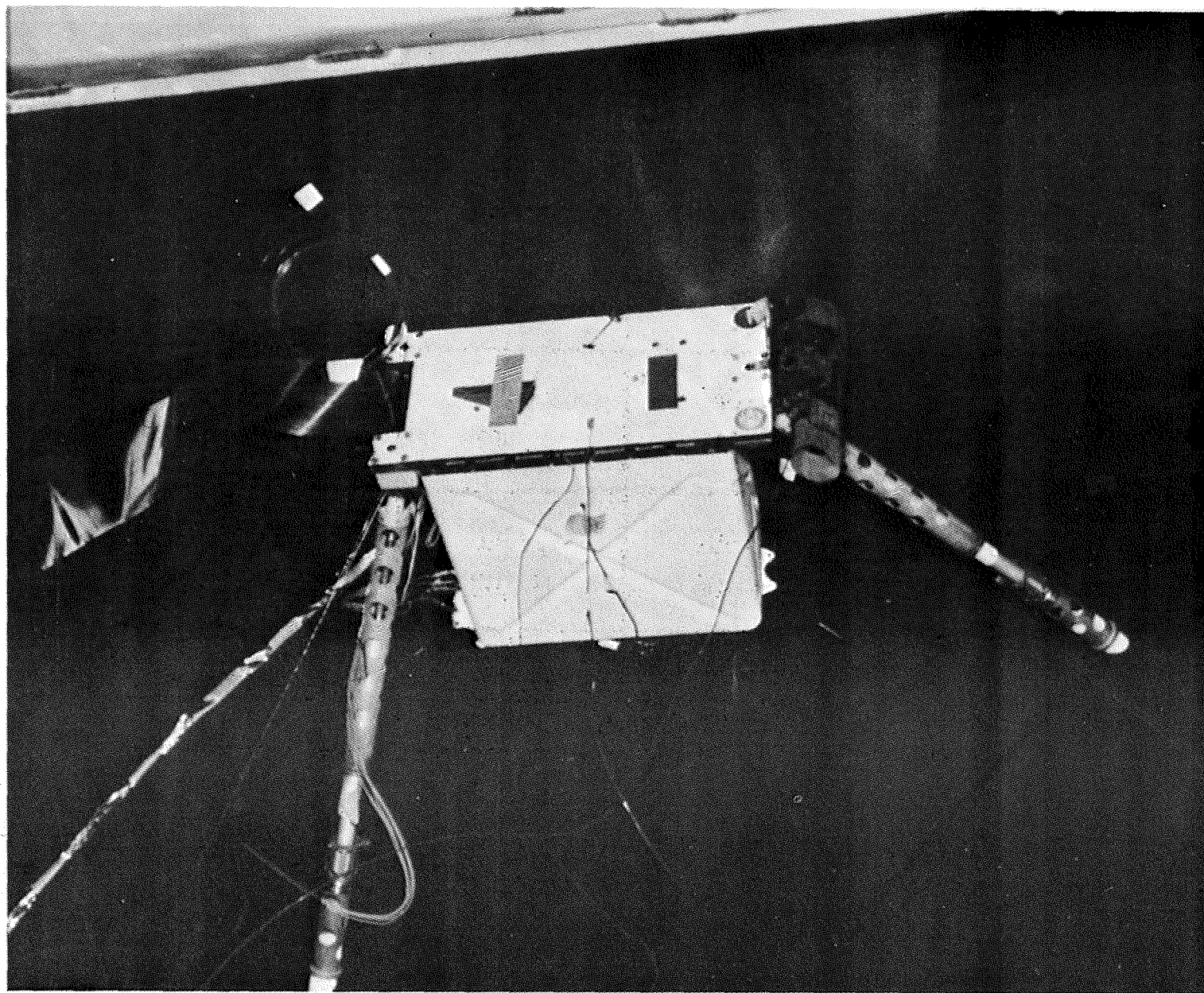




# CPLLE ACCOMPLISHMENTS

1. COMPLETED DESIGN VERIFICATION TESTS:  
EMI  
MAGNETIC PROPERTIES  
THERMAL-VACUUM  
ACCELERATION  
VIBRATION
2. PROTOTYPE SUBASSEMBLIES TEMPERATURE TESTED
3. INCORPORATED DESIGN CHANGES IN POWER SUPPLIES TO  
IMPROVE LOW TEMPERATURE OPERATION.
4. VERIFIED COMPATIBILITY OF CPLLE AND RICE CALIBRATION  
SYSTEM.

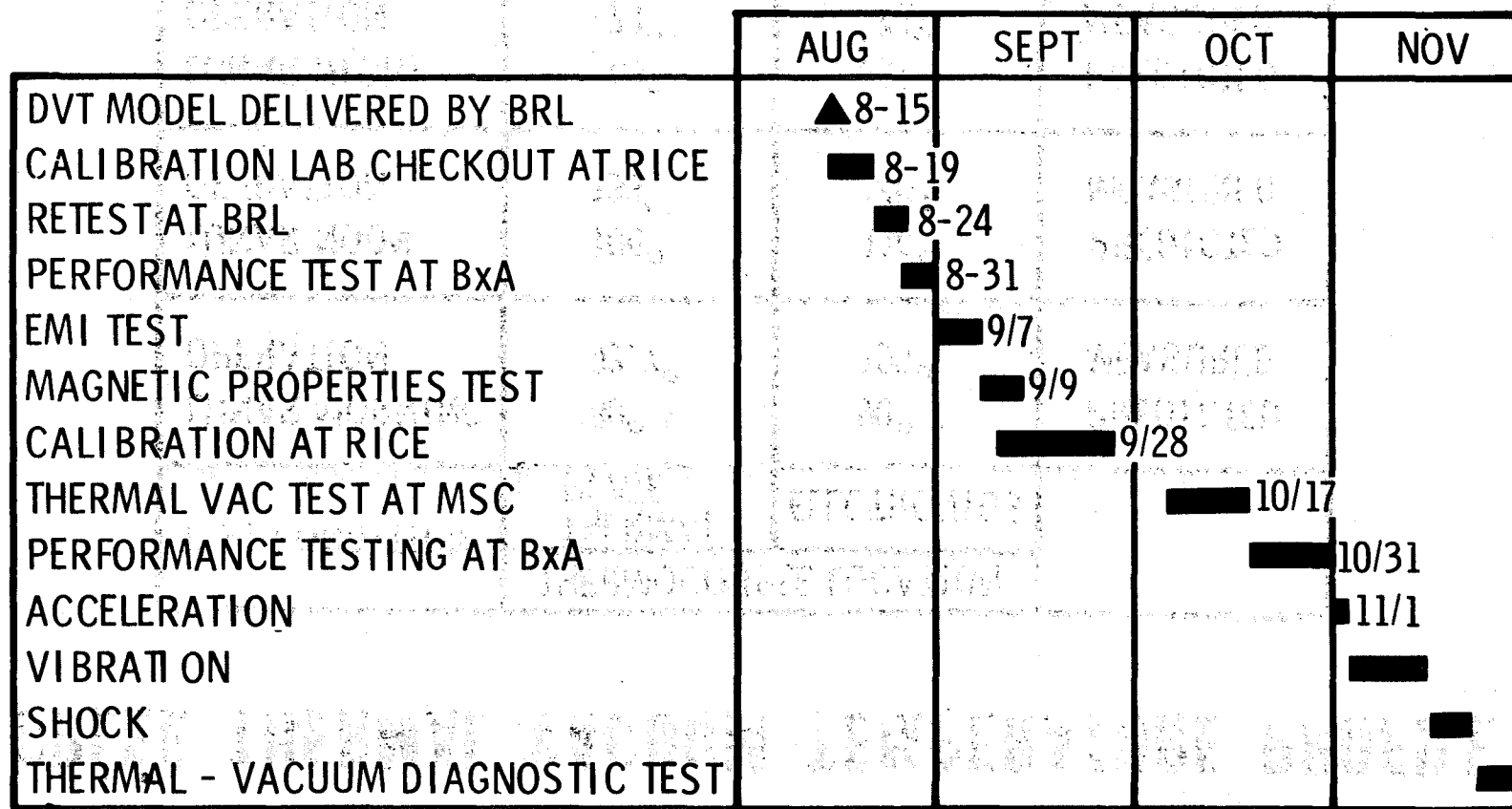




# CPLÉE THERMAL VACUUM TEMPERATURE PROFILE

| TEST CONDITION          | THERMOCOUPLE LOCATION |                |                       |
|-------------------------|-----------------------|----------------|-----------------------|
|                         | THERMAL PLATE         | ELECTRONICS    |                       |
| LUNAR MORNING OPERATION | 80° F<br>93.7°        | 90° F<br>105°  | PREDICTED<br>MEASURED |
| LUNAR NOON OPERATION    | 106°<br>133°          | 116°<br>140°   | PREDICTED<br>MEASURED |
| LUNAR NIGHT OPERATION   | -63°<br>-71°          | -32°<br>-41°   | PREDICTED<br>MEASURED |
| LUNAR NIGHT SURVIVAL    | -65°<br>-71°          | -52°<br>-50.8° | PREDICTED<br>MEASURED |

# CPLEE DESIGN VERIFICATION TEST MODEL



# CPLÉE THERMAL VACUUM TEMPERATURE PROFILE

| TEST CONDITION          | THERMOCOUPLE LOCATION |                |                       |
|-------------------------|-----------------------|----------------|-----------------------|
|                         | THERMAL PLATE         | ELECTRONICS    |                       |
| LUNAR MORNING OPERATION | 80° F<br>93.7°        | 90° F<br>105°  | PREDICTED<br>MEASURED |
| LUNAR NOON OPERATION    | 106°<br>133°          | 116°<br>140°   | PREDICTED<br>MEASURED |
| LUNAR NIGHT OPERATION   | -63°<br>-71°          | -32°<br>-41°   | PREDICTED<br>MEASURED |
| LUNAR NIGHT SURVIVAL    | -65°<br>-71°          | -52°<br>-50.8° | PREDICTED<br>MEASURED |

# CPLEE DESIGN VERIFICATION TEST MODEL

|                                  | AUG    | SEPT   | OCT     | NOV    |
|----------------------------------|--------|--------|---------|--------|
| DVT MODEL DELIVERED BY BRL       | ▲ 8-15 |        |         |        |
| CALIBRATION LAB CHECKOUT AT RICE | ■ 8-19 |        |         |        |
| RETEST AT BRL                    | ■ 8-24 |        |         |        |
| PERFORMANCE TEST AT BxA          | ■ 8-31 |        |         |        |
| EMI TEST                         |        | ■ 9/7  |         |        |
| MAGNETIC PROPERTIES TEST         |        | ■ 9/9  |         |        |
| CALIBRATION AT RICE              |        | ■ 9/28 |         |        |
| THERMAL VAC TEST AT MSC          |        |        | ■ 10/17 |        |
| PERFORMANCE TESTING AT BxA       |        |        | ■ 10/31 |        |
| ACCELERATION                     |        |        |         | ■ 11/1 |
| VIBRATION                        |        |        |         | ■      |
| SHOCK                            |        |        |         | ■      |
| THERMAL - VACUUM DIAGNOSTIC TEST |        |        |         | ■      |

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**S-67-51079**

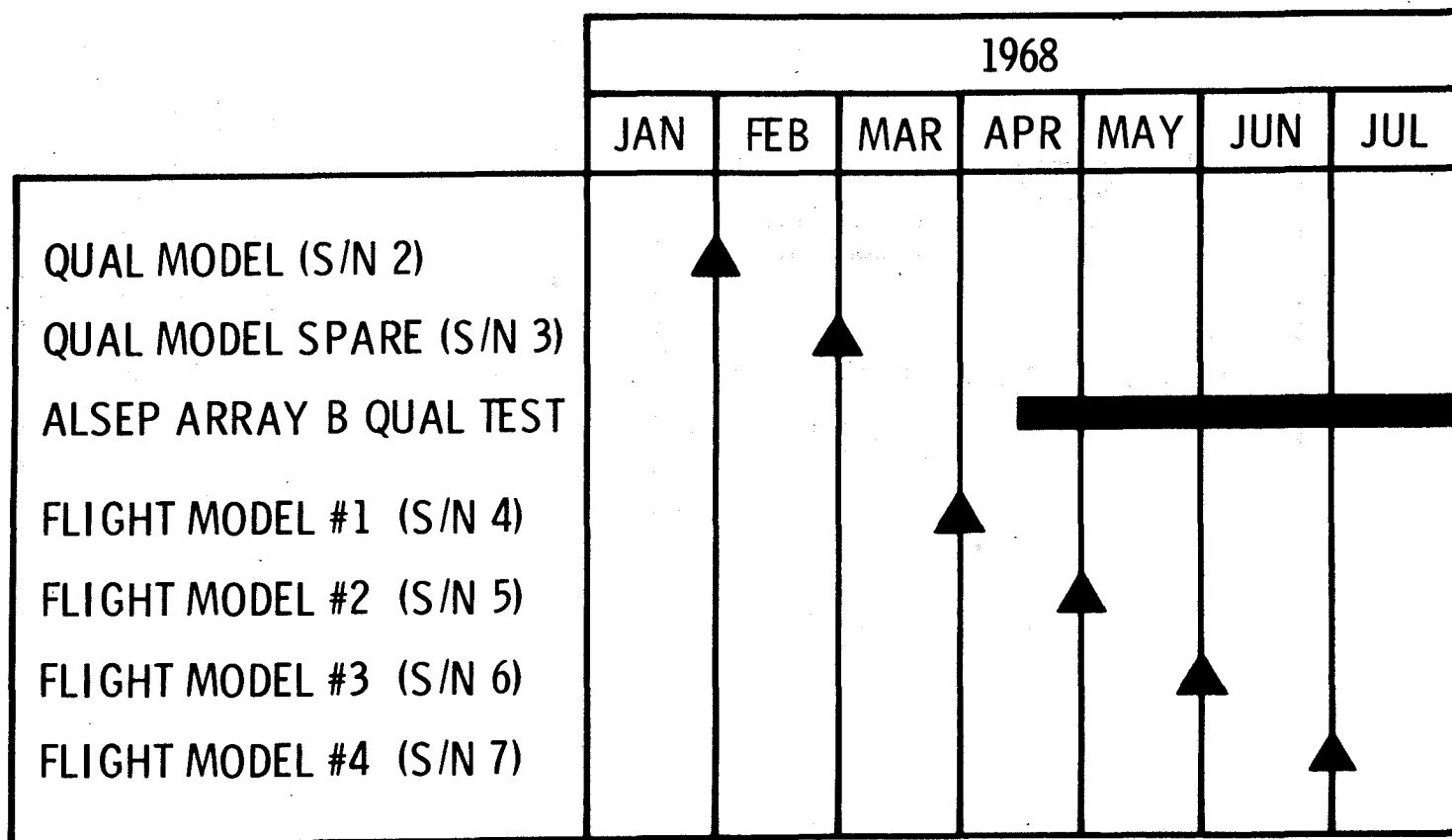
# **CPLER PROBLEMS**

1. CHANNELTRON POWER SUPPLY VOLTAGE MULTIPLIER
2. PHYSICAL ANALYZER NOISE
3. CROSSTALK

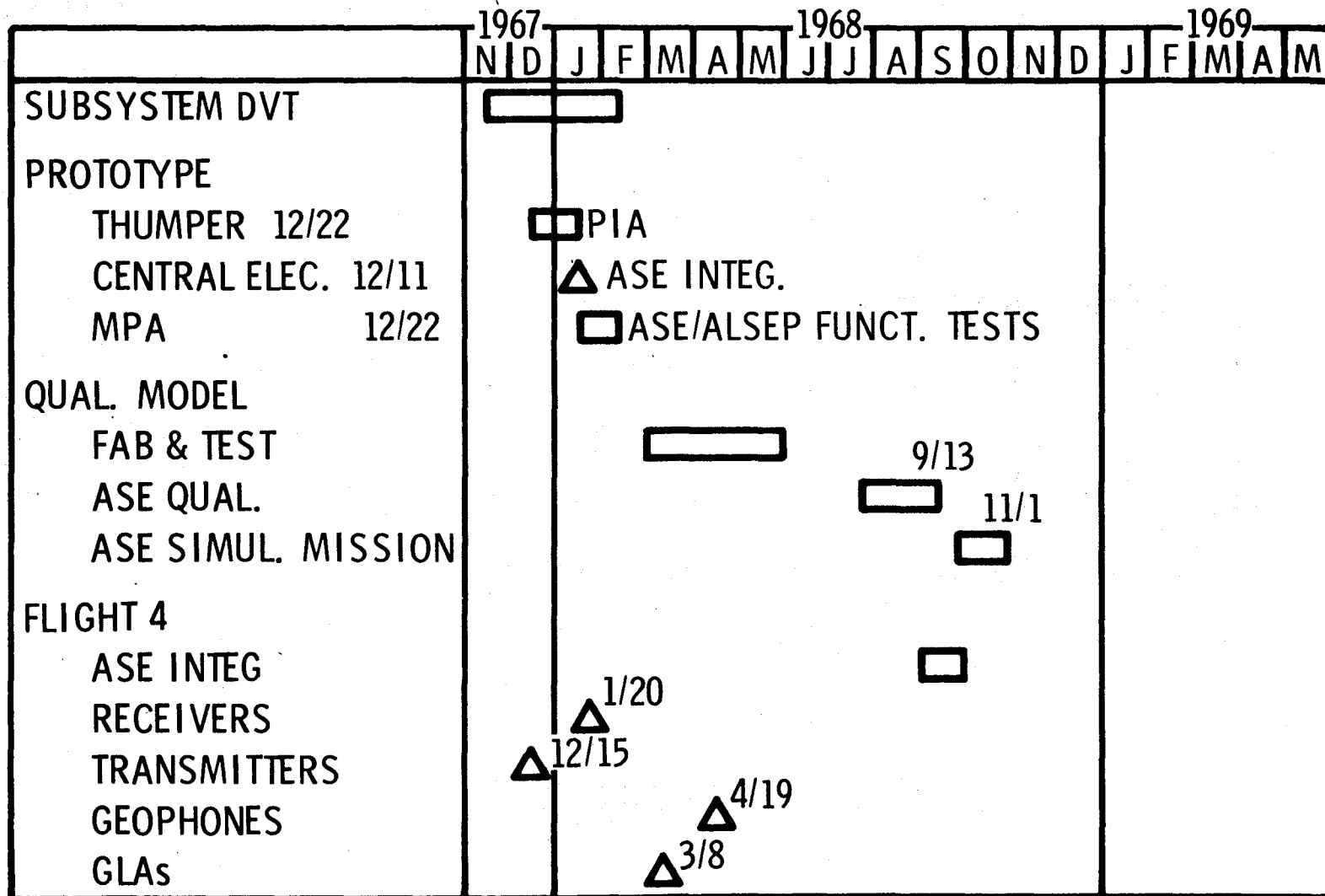
# CPLEE PROTOTYPE SCHEDULE

|                                | 1967 |     | 1968 |     |     |     |     |
|--------------------------------|------|-----|------|-----|-----|-----|-----|
|                                | NOV  | DEC | JAN  | FEB | MAR | APR | MAY |
| ASSEMBLY AND FUNCTIONAL TEST   | ■    | ■   |      |     |     |     |     |
| ACCEPTANCE TESTS               |      | ■   |      |     |     |     |     |
| CALIBRATION                    |      |     | ■    |     |     |     |     |
| FUNCTIONAL TEST WITH ARRAY C   |      |     |      | ■   |     |     |     |
| PROTOTYPE ARRAY B SYSTEM TESTS |      |     |      | ■   |     |     |     |
| EXPERIMENT INTEGRATION         |      |     |      |     |     | ■   |     |
| PROTOTYPE DVT                  |      |     |      |     |     | ■   | ■   |

# CPLEE QUALIFICATION AND FLIGHT MODEL SCHEDULE



# ASE SCHEDULE



# ASE DVT

|                          | NOV.   | DEC. | JAN. | FEB. |
|--------------------------|--------|------|------|------|
| THUMPER                  | △11/14 |      |      |      |
| CENTRAL ELECT.           | △11/15 |      |      |      |
| MPA                      | △12/2  |      |      |      |
| ASSY C/O & THERMAL COAT. | ▬      |      |      |      |
| ASE PIA                  |        | ▬    |      |      |
| VIBRATION                |        | □*   |      |      |
| ACCELERATION             |        | □*   |      |      |
| THERMAL CYCLING          |        |      | □*   |      |
| THERMAL VAC. (WITH HFE)  |        |      | ▬*   |      |
| EMI/MAG. PROP.           |        |      |      | ▬    |
| SHOCK                    |        |      |      | □*   |

\* TEST FOLLOWED BY 3 DAY FUNCTIONAL

# ACTIVE SEISMIC EXPERIMENT

## ACCOMPLISHMENTS

- TRANSMITTER

FREQUENCY DRIFT RESOLVED

CDR COMPLETED

PROCEEDING WITH FLIGHT HARDWARE

- WSTF PROGRAM

ASE SUBSYSTEM TESTING COMPLETED AT BxA

GLA TESTING COMPLETED AT SOS

TRR MEETING AT MSC

WSTF TESTING COMPLETED 5 OCTOBER

# WSTF PROGRAM

## ACCOMPLISHMENTS

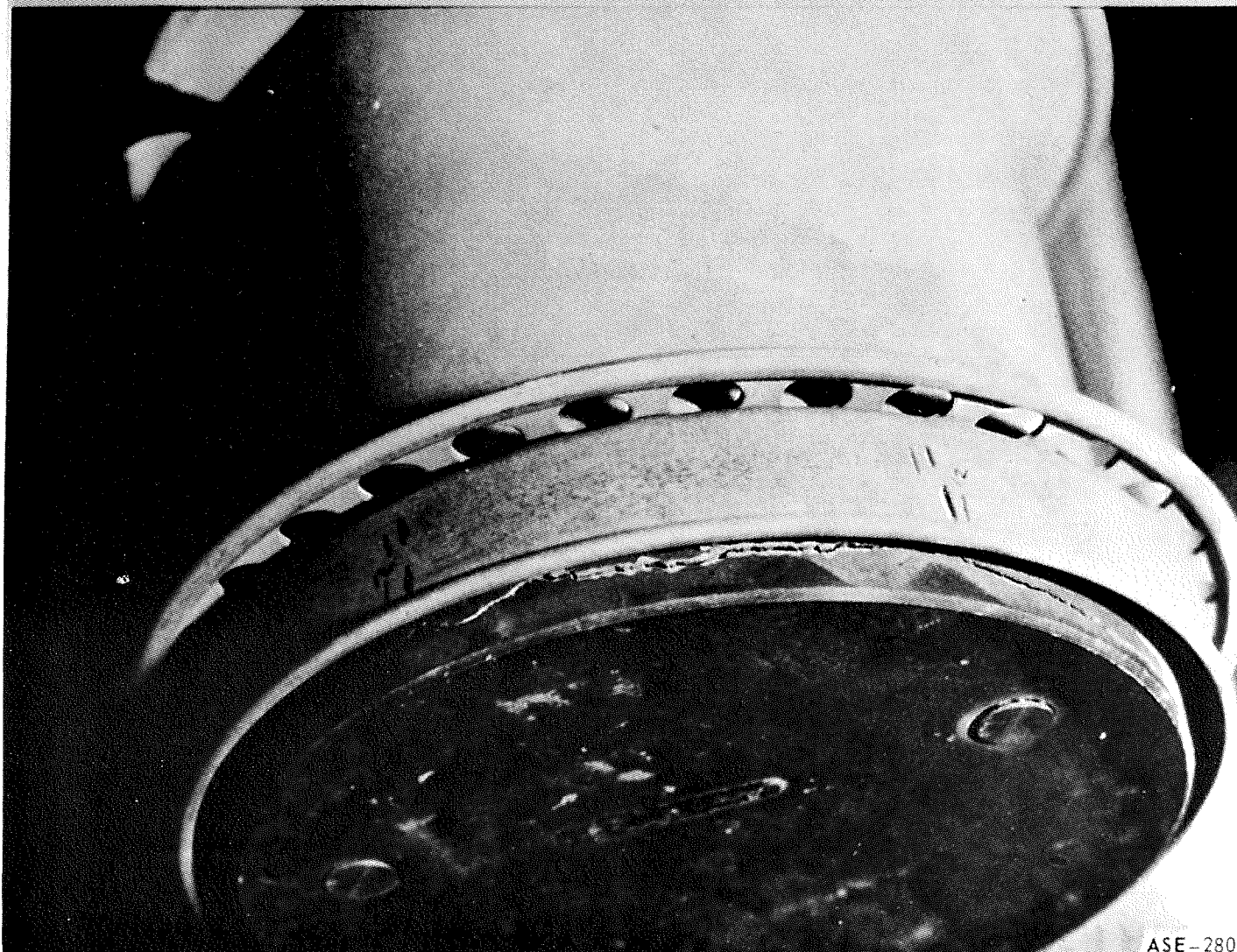
- 4 TEST CATEGORIES
  - EXTRA CHARGE FIRINGS (1000, 3000 FT)
  - THUMPER FIRINGS
  - MORTAR FIRINGS
  - SPECIAL GEOPHONE TESTS
- THUMPER DESIGN INTEGRITY AND PERFORMANCE VERIFIED
- MPA STABILITY VERIFIED
- OVERALL GLA PERFORMANCE VERIFIED
- RF LINK OPERATION VERIFIED
- CENTRAL ELECTRONICS VERIFIED
- INTRODUCTION, DETECTION AND CONDITIONING OF SEISMIC ENERGY VERIFIED.

# WSTF PROGRAM

## PROBLEMS

- THUMPER
  - 21 ASIs FIRED
  - PRESSURE SWITCH CONNECTION, #1 & #2
  - SHIM PLATE FRACTURE ON # 11
- MORTAR PACKAGE
  - 6 GRENADES LAUNCHED
  - 1 FAILURE, MISPLACED SHORTING CONNECTOR
  - 2 FAILURES, THERMAL BATTERY
- GEOPHONES
- RTE
  - RANGE LINE BREAKWIRE

## THUMPER BASE DURING WSTF FIRINGS



ASE-2801

# FRACTURED THUMPER SHIM PLATE DETAIL



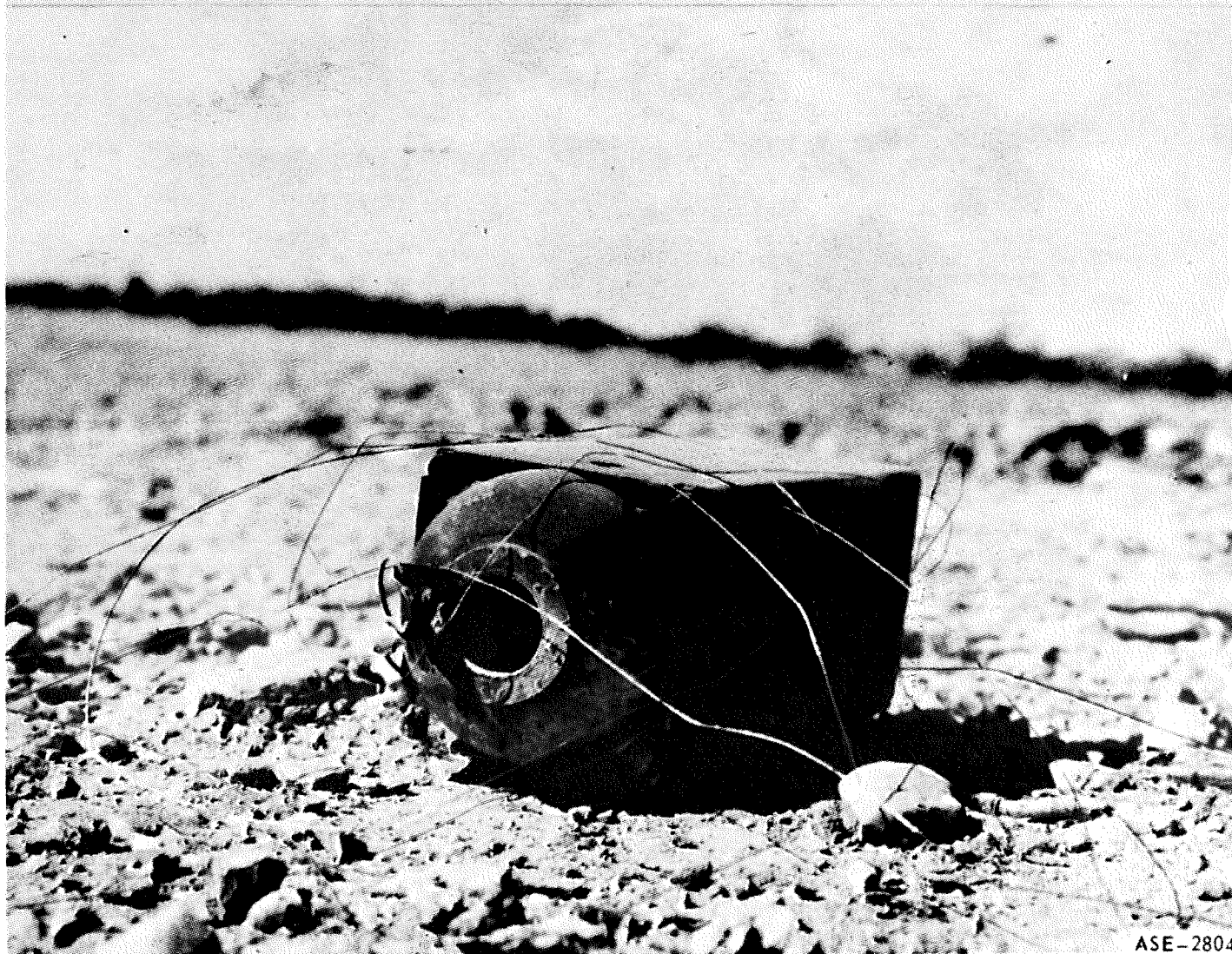
ASE-2800

## WSTF GRENADE 4B AFTER IMPACT



ASE-2805

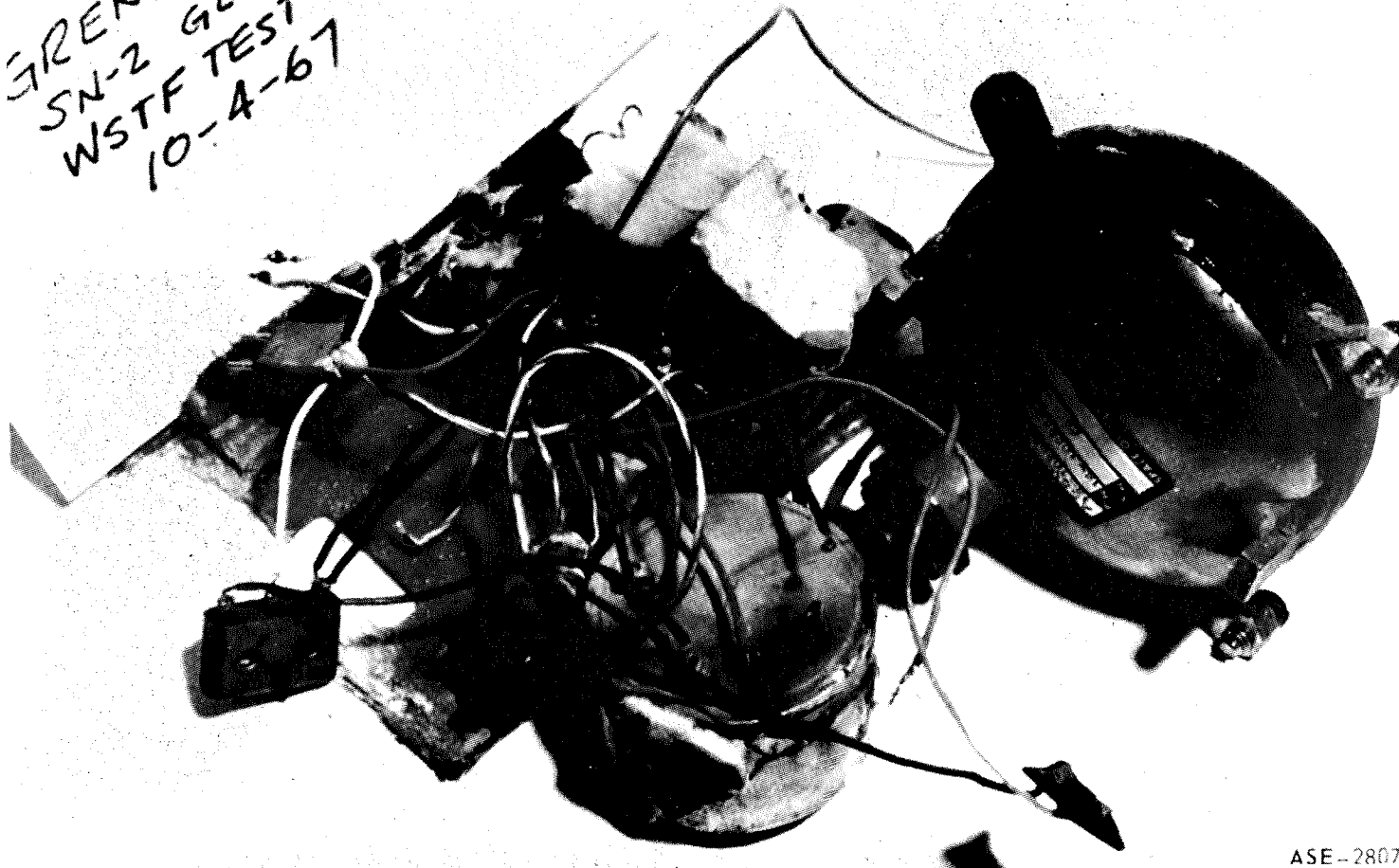
# WSTF GRENADE 1A AFTER IMPACT



ASE-2804

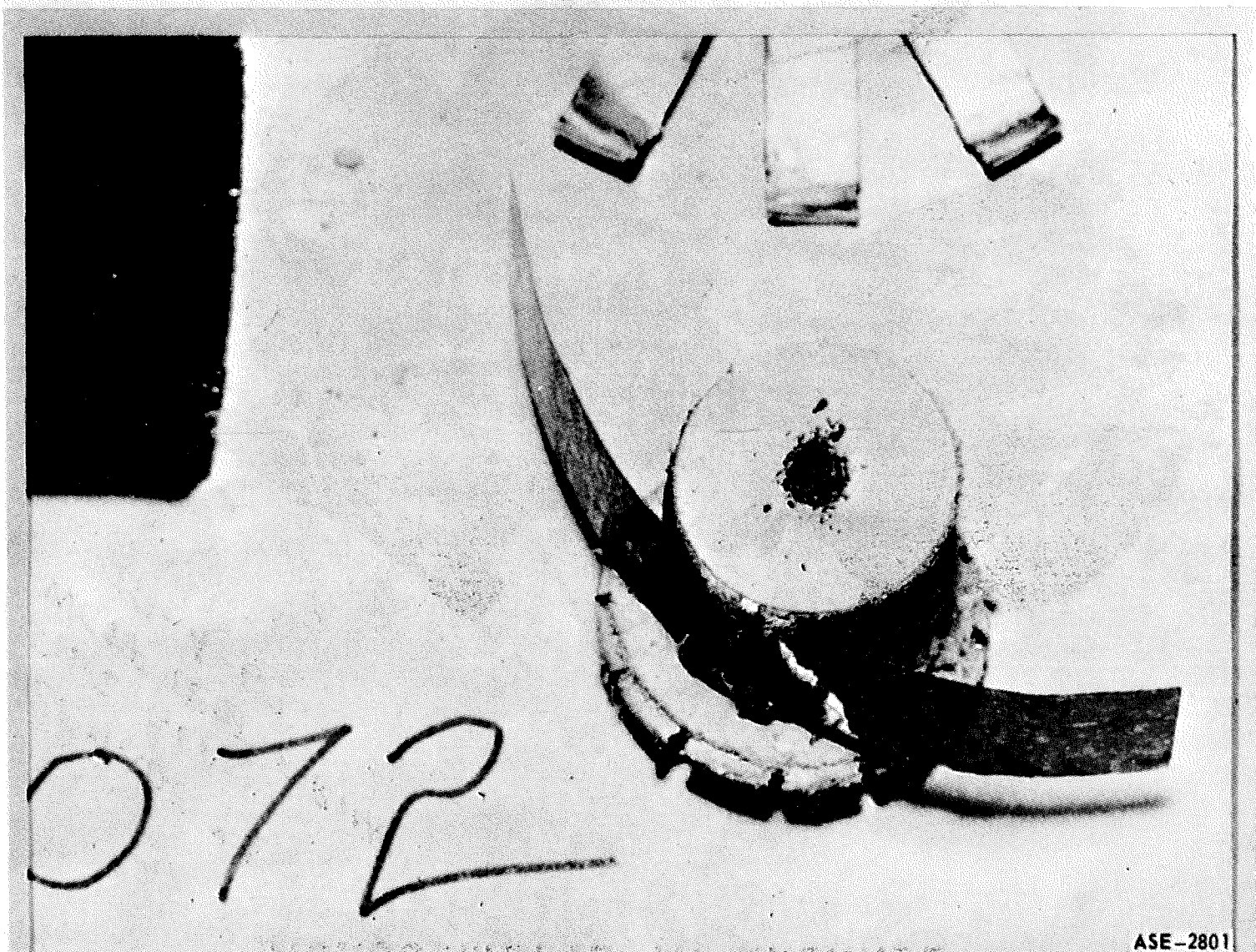
# DISASSEMBLED 1A GRENADE

GRENADE #1  
SN-2 GLA  
WSTF TEST FIRING  
10-4-67



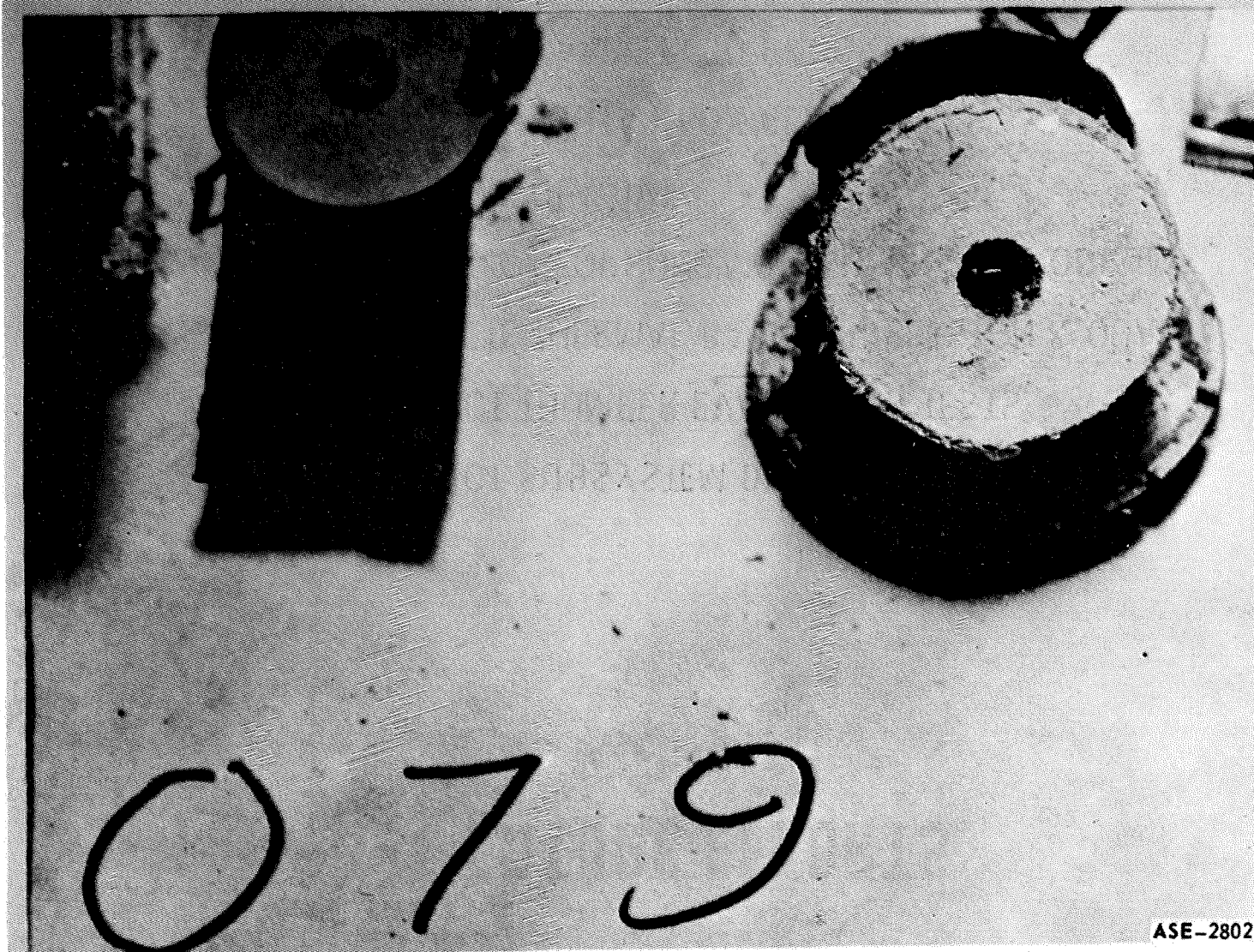
ASE-2807

# SHATTERED MATCH IN WSTF GRENADE 4B BATTERY



UNRECORDED IN GRENAD

# CRUMBLEED MATCH IN WSTF GRENADE 1A BATTERY



ASE-2802

# ASE FUTURE EFFORTS

CONDUCT SUBSYSTEM DVT

CONDUCT THUMPER EVALUATION TESTS

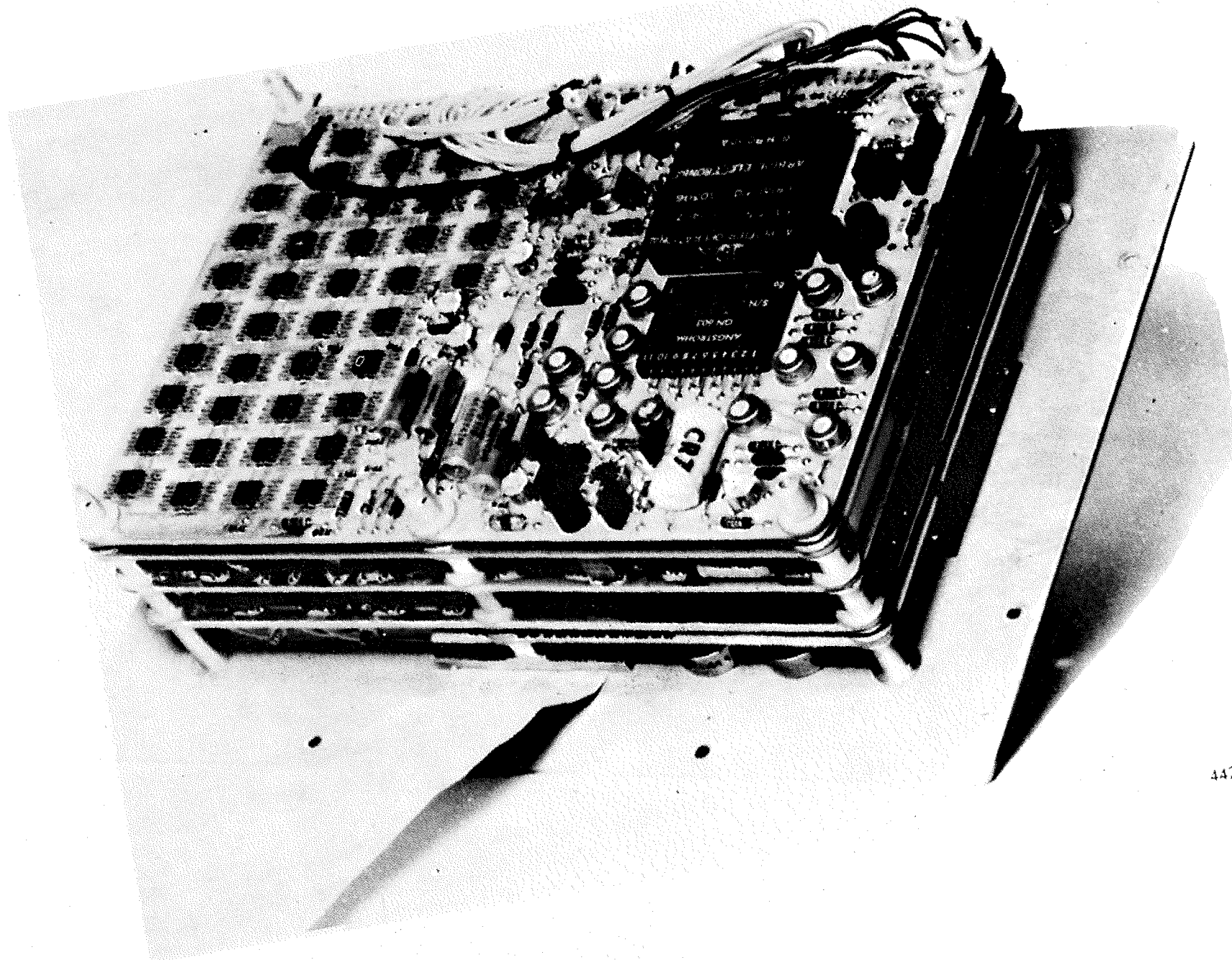
COMPLETE THERMAL BATTERY REDESIGN & QUAL

COMPLETE GEOPHONE MODIFICATION PROGRAM

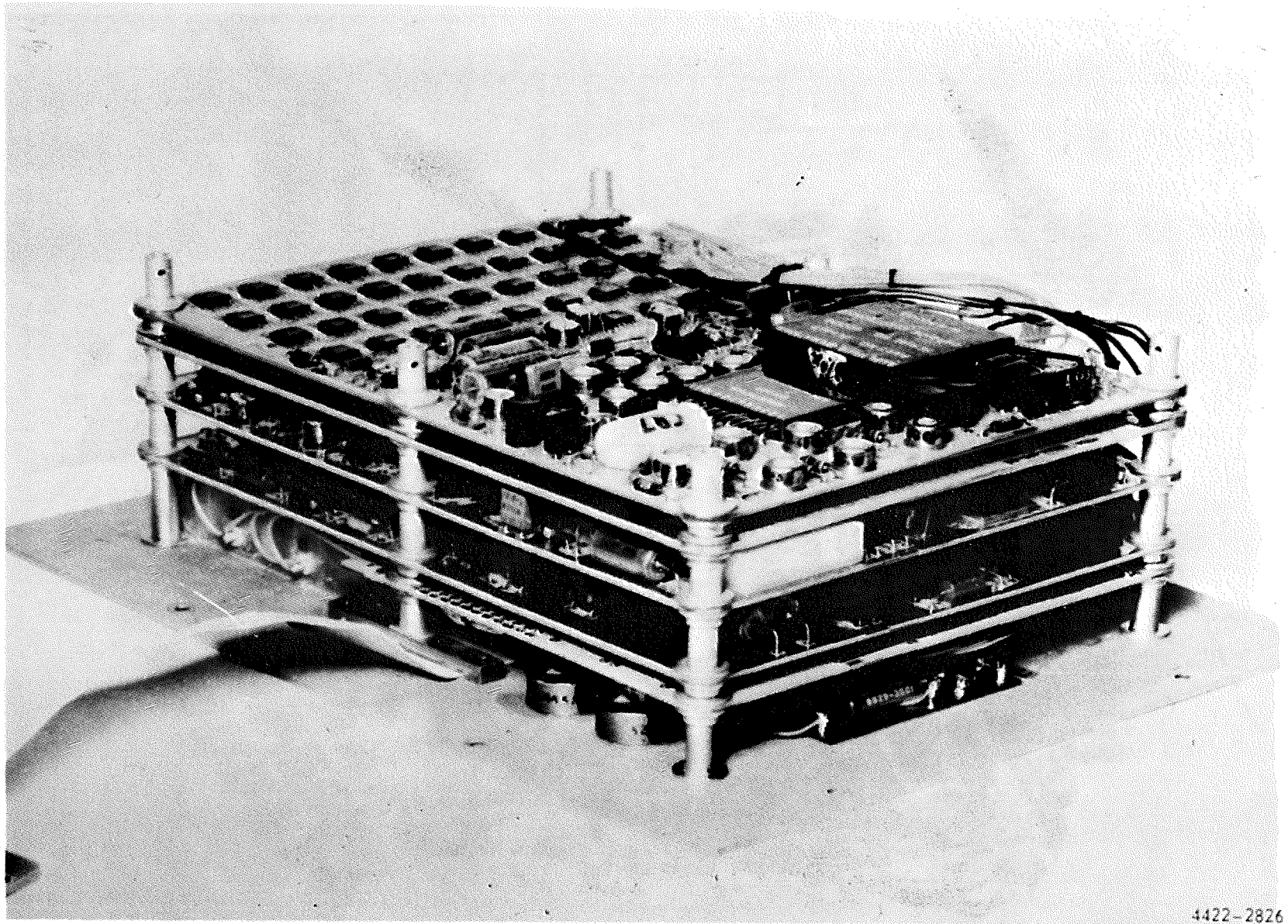
COMPLETE GLA DVT

CONDUCT MORTAR BOX/GLA FIRINGS

IMPLEMENT ASE PROTO PROGRAM

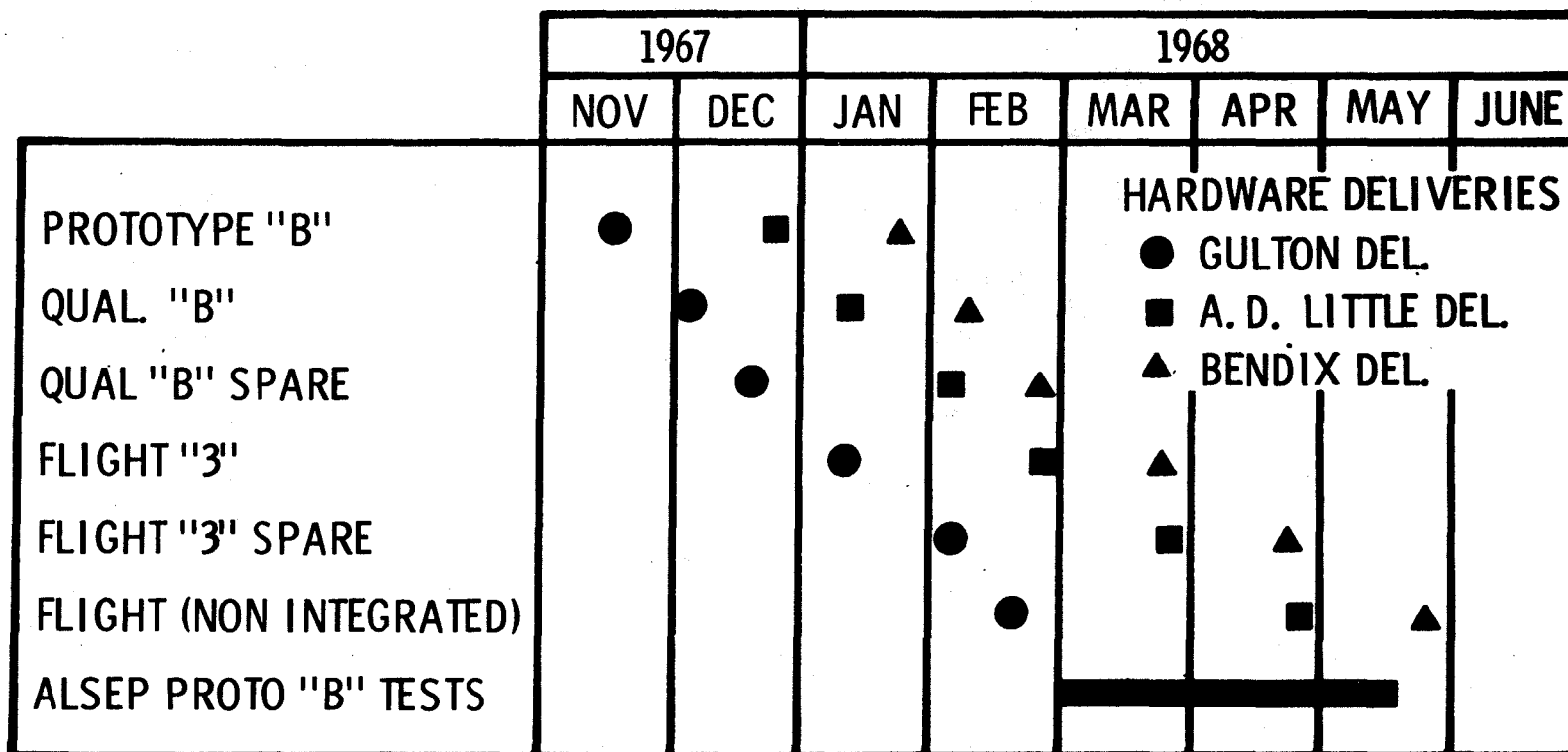


4422-2825

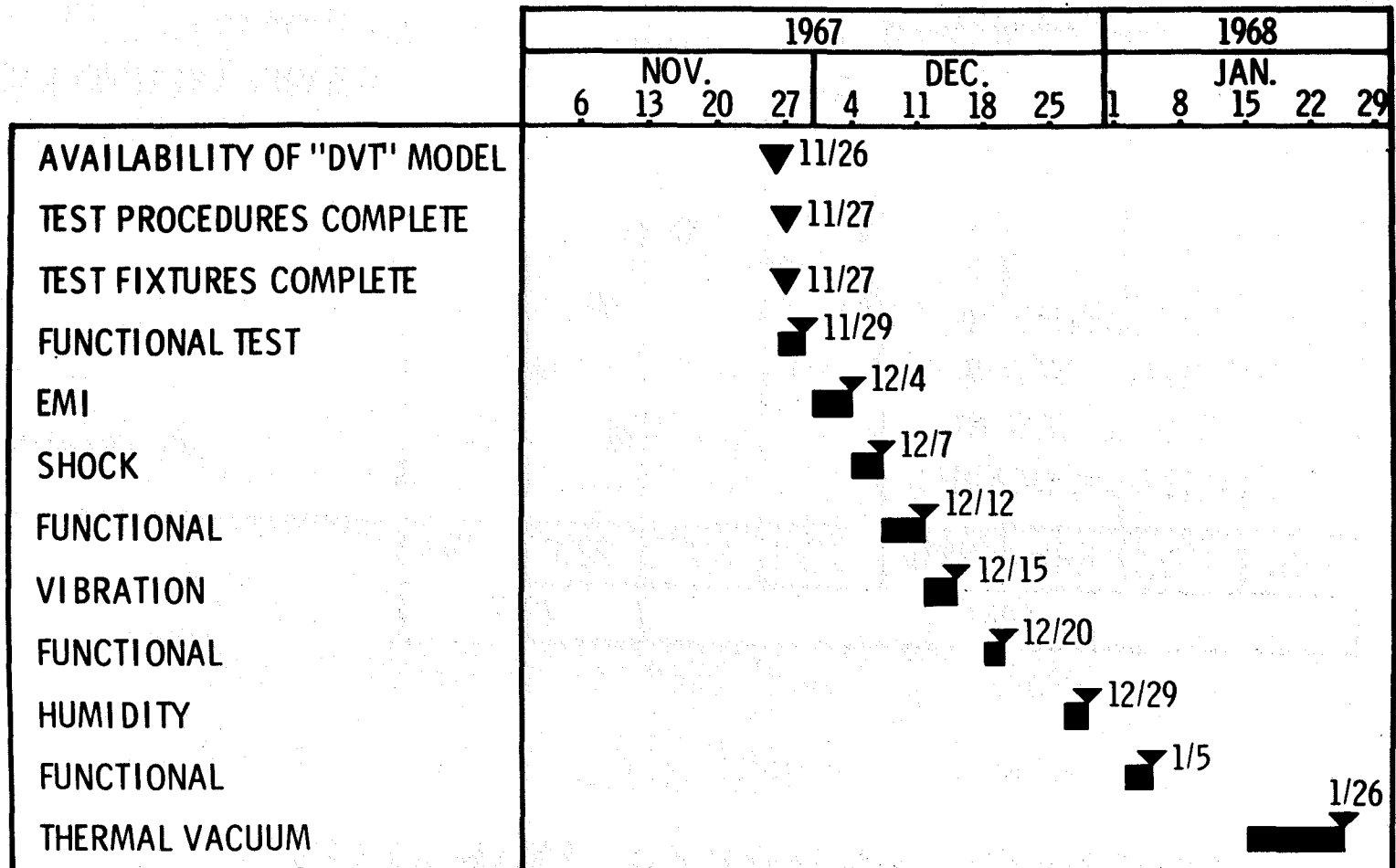


4422-2826

# H.F.E. DELIVERABLE HARDWARE SCHEDULE



# H.F.E. DESIGN VERIFICATION TEST SCHEDULE



## **HEAT FLOW EXPERIMENT STATUS AND ACCOMPLISHMENTS TO DATE**

1. AFTER INTEGRATION OF THE DVT MODEL PROBES AT A. D. LITTLE WITH THE ELECTRONICS, ANOMALIES IN THE DATA DICTATED THE RETURN OF THE "DVT" ELECTRONICS TO GULTON FOR RETEST.
2. GULTON RETESTED THE ELECTRONICS (INCLUDING A THERMAL VACUUM TEST) ON A AROUND THE CLOCK BASIS RESULTING IN THE RETURN OF THE ELECTRONICS TO A. D. LITTLE IN APPROXIMATELY ONE WEEK. THE ELECTRONICS TEST INDICATED NORMAL OPERATION.
3. THE PROBES WERE RE-CONNECTED AND THAT ANOMALY NO LONGER EXISTED. IT WAS ATTRIBUTED TO A COLD SOLDER JOINT ON ONE OF THE EXCITATION LEADS (ONE OUT OF THE SEVENTY INTERFACE CONNECTIONS).

## HEAT FLOW EXPERIMENT STATUS AND ACCOMPLISHMENTS TO DATE

4. ADDITIONAL PROBLEMS (INADEQUATE ACCURACY ON THE GRADIENT DATA) WERE ENCOUNTERED DURING THE GRADIENT CHAMBER TESTING AT A. D. LITTLE ON THE "DVT" MODEL. SEVERAL DAYS OF TROUBLE SHOOTING AT A. D. LITTLE BY THE GULTON AND BENDIX ENGINEERING PERSONNEL ISOLATED THE CAUSE OF THE DIFFCULTY. A WORK AROUND PLAN WAS DEVELOPED TO CONTINUE THE TESTING. THE PROBLEM WAS ASSOCIATED WITH THE POWER GATING CIRCUITRY. A CHANGE IS BEING INCORPORATED IN THE SUBSEQUENT MODELS TO CORRECT FOR THIS PROBLEM.

## **HEAT FLOW EXPERIMENT STATUS AND ACCOMPLISHMENTS TO DATE**

5. PROTOTYPE "B" ELECTRONICS AT GULTON HAS COMPLETED THE ACCEPTANCE TEST. A HOLD IS ON THE UNIT. SEE PROBLEM SLIDE FOR MORE DETAIL.
6. THE PROTOTYPE "B" PROBES HAVE COMPLETED THEIR TESTS AND ARE READY FOR INTEGRATION WITH THE ELECTRONICS.
7. THE QUAL "B" ELECTRONICS ELECTRICAL CHECKOUT IS IN PROGRESS AT GULTON.
8. THE QUAL "B" PROBES HAVE COMPLETED THEIR TESTS AND ARE READY FOR INTEGRATION WITH THE ELECTRONICS.

# HEAT FLOW EXPERIMENT STATUS AND ACCOMPLISHMENTS TO DATE

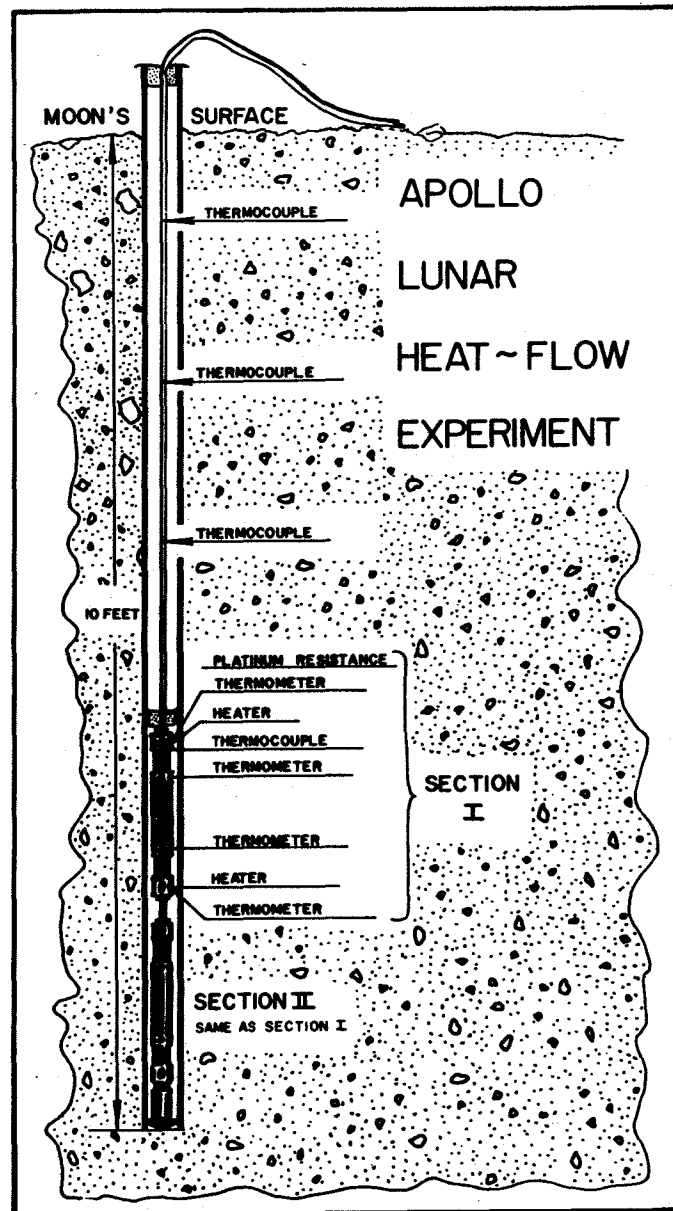
9. THE QUAL "B" SPARE PRINTED CIRCUIT BOARDS HAVE BEEN COMPLETELY ASSEMBLED AND BOARD LEVEL TESTS ARE COMPLETE.
10. FLIGHT 3 AND FLIGHT 3 SPARE PROBES HAVE BEEN ASSEMBLED.
11. THE FIRST LABORATORY SIMULATOR IS UNDER GOING FUNCTIONAL TESTING AT A. D. LITTLE. THE SECOND AND THIRD LABORATORY SIMULATOR HAVE ALL DETAILS FABRICATED AND BOTH UNITS ARE BEING ASSEMBLED.
12. THE THERMAL VACUUM SIMULATOR HAS BEEN ASSEMBLED AND FUNCTIONAL VACUUM TESTS ARE SCHEDULED FOR WEEK ENDING 19-NOV-67.
13. THE KLIXON THERMAL SWITCH TEST HAVE BEEN COMPLETED. THE TEST RESULTS INDICATE THAT THE TYPE "M2" IS SATISFACTORY.

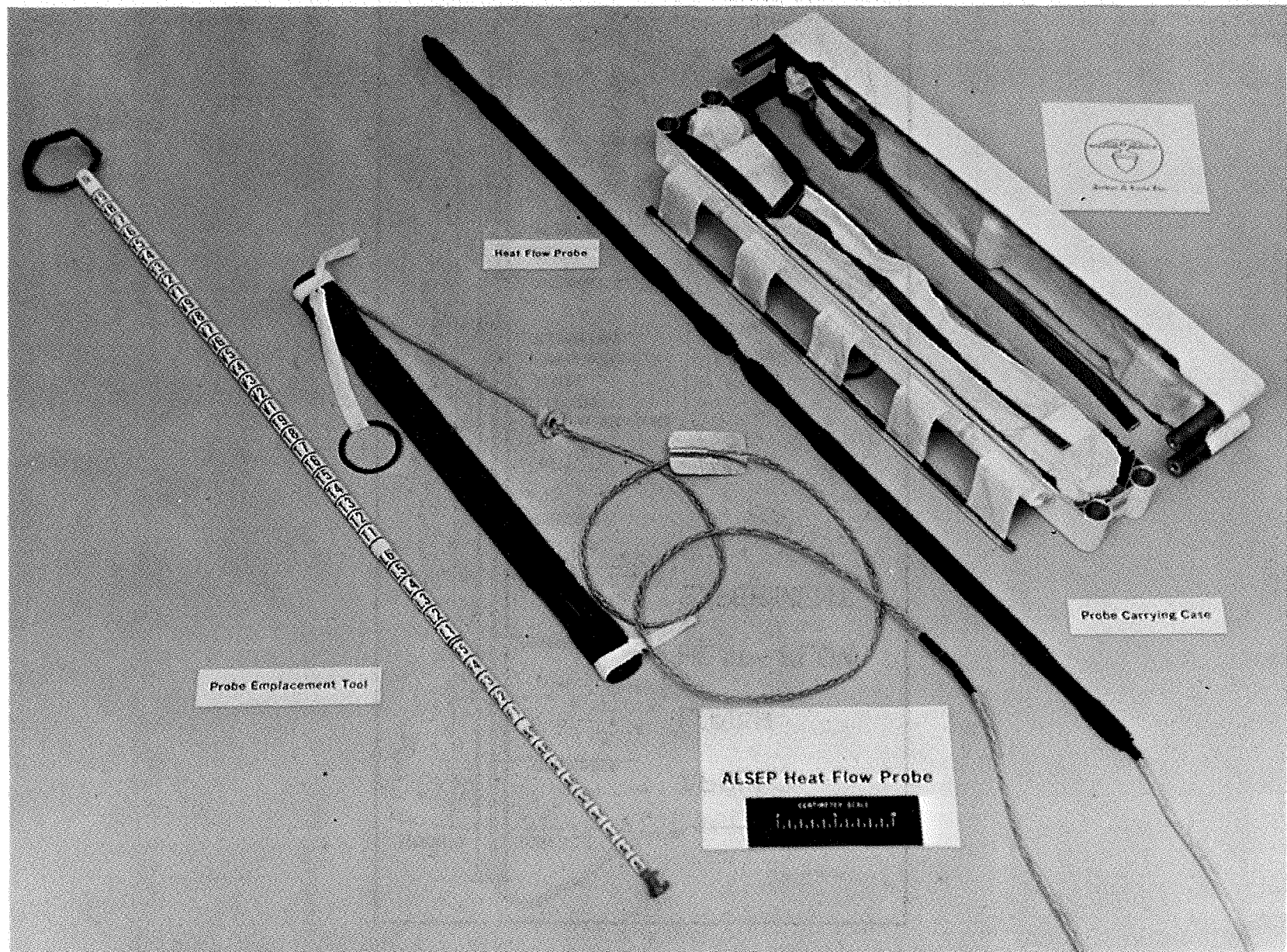
# HEAT FLOW EXPERIMENT MAJOR FORECASTED ACCOMPLISHMENTS

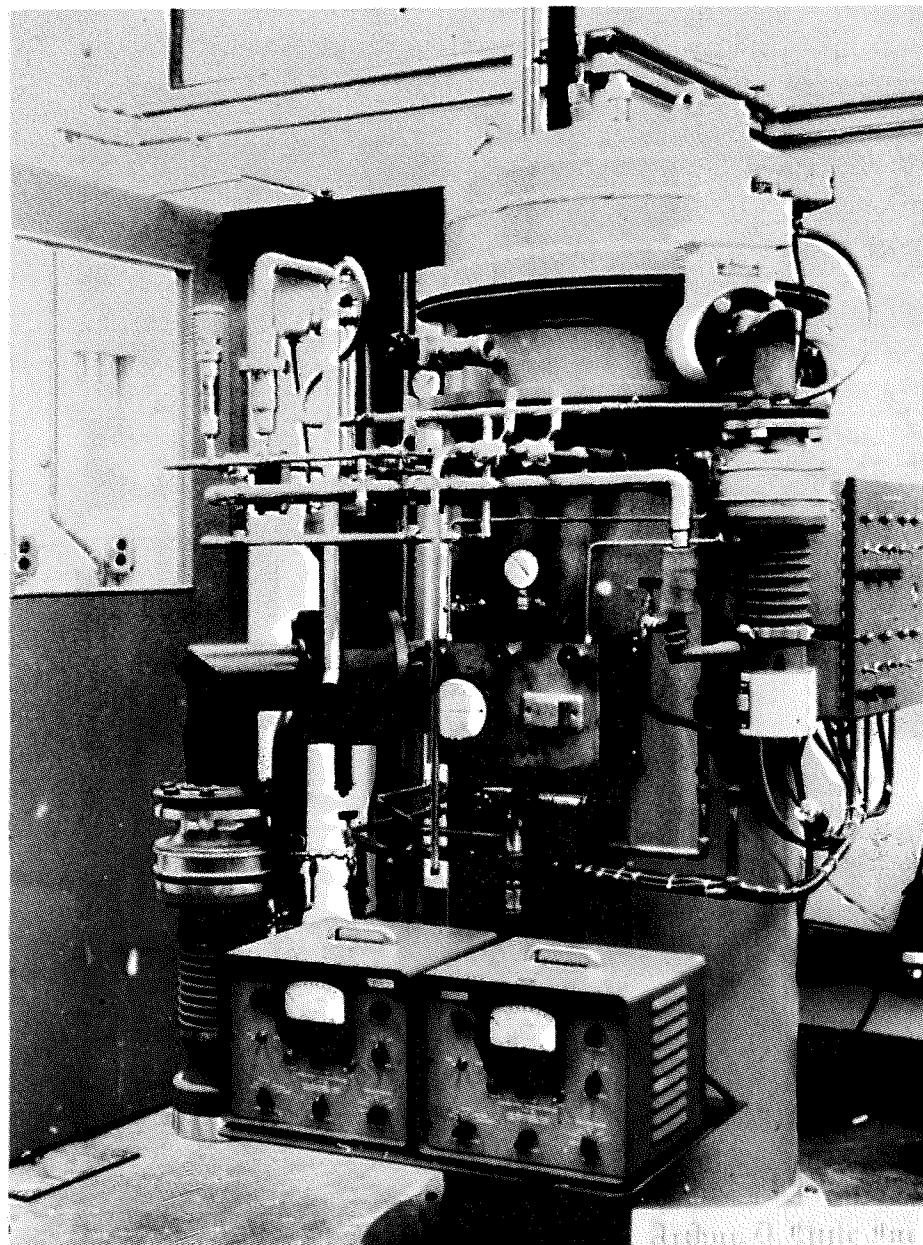
1. ACCEPTANCE TESTING OF THE THERMAL SIMULATORS TO BE COMPLETED.
2. "DVT" TESTS TO BE PERFORMED AT BENDIX.
3. PROTO "B" AND QUAL "B" HARDWARE TO BE AVAILABLE FOR INTEGRATION AT BENDIX.

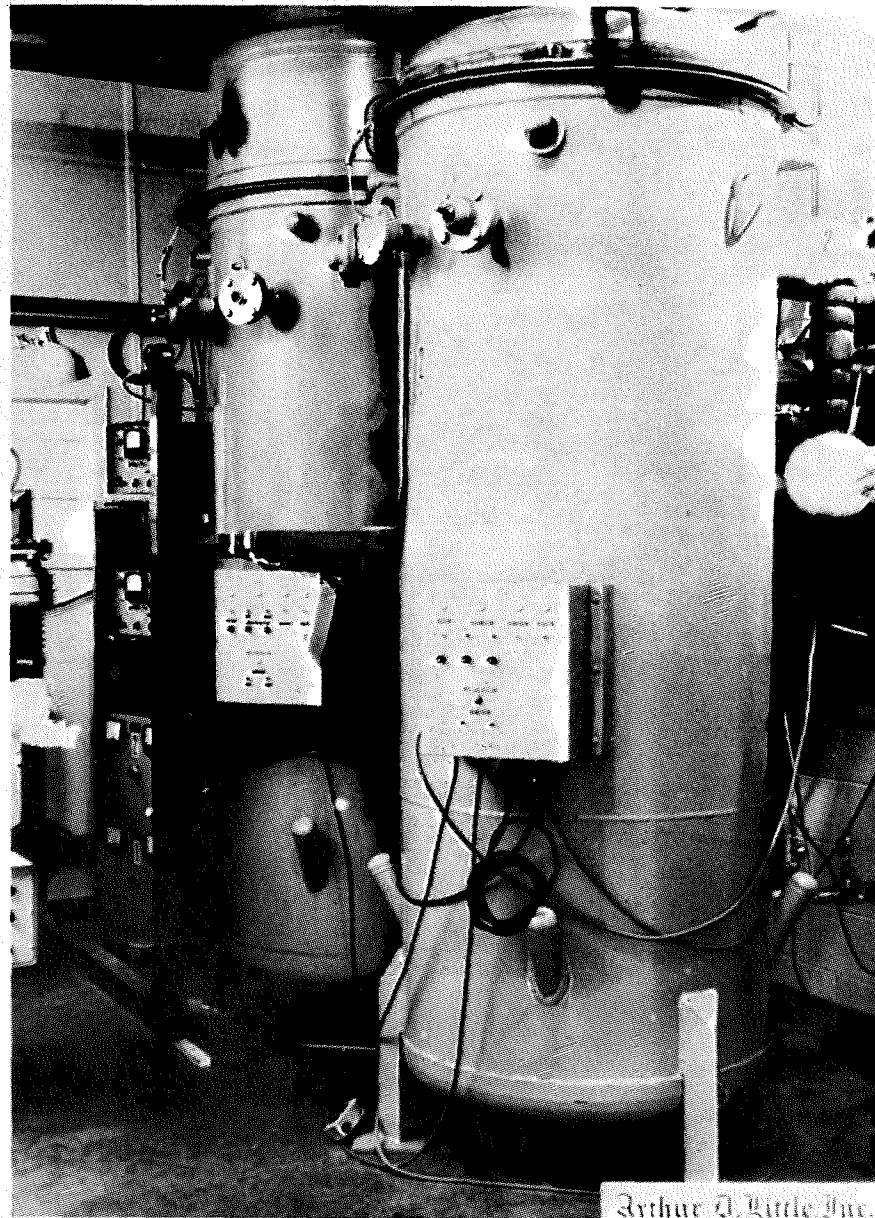
# HEAT FLOW EXPERIMENT MAJOR PROBLEMS

1. THE PROTOTYPE "B" ELECTRONICS AT GULTON DOES NOT MEET THE SPECIFICATION REQUIREMENTS ON THE THERMOCOUPLE INPUT CHANNEL. THE EXACT CAUSE IS BEING INVESTIGATED AT GULTON.
2. THE LABORATORY THERMAL SIMULATOR AT A. D. LITTLE HAS A VACUUM SEAL PROBLEM AT THE FLAT CABLE ENTRY. A NEW SEAL MATERIAL IS EXPECTED DURING THE WEEK ENDING 19 -NOV - 67. THIS IS EXPECTED TO RESOLVE THE PROBLEM.



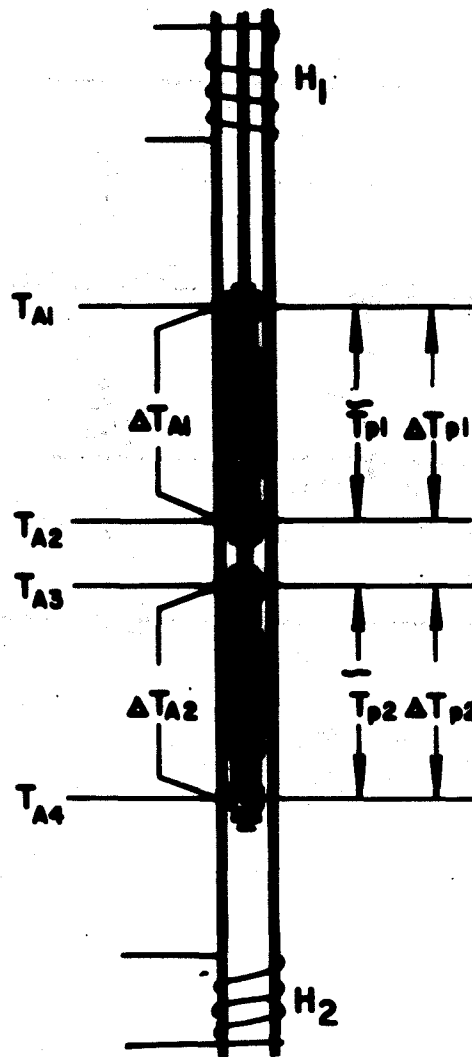


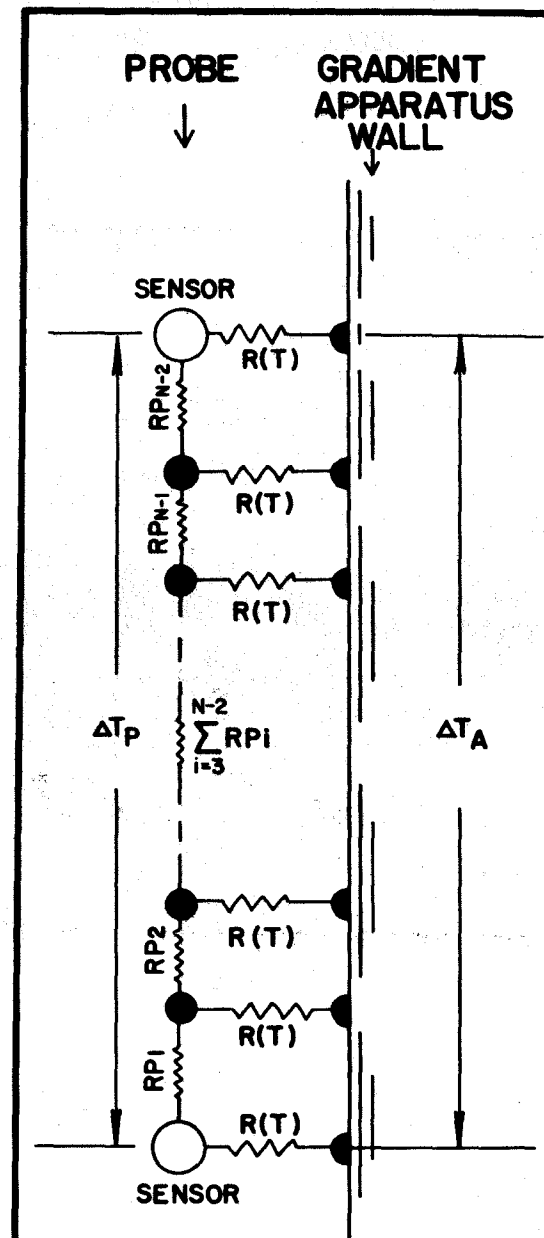




Arthur D. Little Inc.

# GRADIENT TEST APPARATUS





PROTOTYPE MODEL #1

|           |                       | Upper   |            | Lower   |            |            |
|-----------|-----------------------|---------|------------|---------|------------|------------|
|           |                       | T       | $\Delta T$ | T       | $\Delta T$ |            |
| Test #10A | Apparatus             | 240.281 | 1.906      | 242.465 | 1.875      | w/o Elect. |
|           | Probe                 | 240.285 | 1.808      | 242.497 | 1.785      | Pre-       |
|           | Offset T              | 0.003   |            | 0.032   |            | vibration  |
|           | $\Delta TP/\Delta TA$ |         | 0.948      |         | 0.952      |            |
| Test #10B | Apparatus             | 205.791 | -1.934     | 203.466 | -1.985     | w/o Elect. |
|           | Probe                 | 205.765 | -1.814     | 203.488 | -1.868     | Pre-       |
|           | Offset T              | -0.026  |            | 0.022   |            | vibration  |
|           | $\Delta TP/\Delta TA$ |         | .938       |         | .941       |            |
| Test #10C | Apparatus             | 224.680 | -0.008     | 224.642 | -0.047     | w/o Elect. |
|           | Probe                 | 224.726 | -0.011     | 224.686 | -0.045     | Pre-       |
|           | Offset T              | 0.046   |            | 0.044   |            | vibration  |
|           | $\Delta TP/\Delta TA$ |         | --         |         | --         |            |
| Test #14A | Apparatus             | 206.292 | -1.952     | 204.009 | -1.998     | w/o Elect. |
|           | Probe                 | 206.321 | -1.829     | 204.027 | -1.883     | Post       |
|           | Offset T              | 0.029   |            | 0.018   |            | Vibration  |
|           | $\Delta TP/\Delta TA$ |         | 0.937      |         | 0.943      |            |
| Test #14B | Apparatus             | 224.746 | 0.051      | 224.797 | 0.021      | w/o Elect. |
|           | Probe                 | 224.783 | 0.049      | 224.829 | 0.020      | Post       |
|           | Offset T              | 0.038   |            | 0.032   |            | Vibration  |
|           | $\Delta TP/\Delta TA$ |         | --         |         | --         |            |
| Test #14C | Apparatus             | 244.051 | 1.871      | 246.212 | 1.841      | w/o Elect. |
|           | Probe                 | 244.048 | 1.777      | 246.223 | 1.759      | Post       |
|           | Offset T              | -0.002  |            | 0.011   |            | Vibration  |
|           | $\Delta TP/\Delta TA$ |         | 0.950      |         | 0.956      |            |

# PROTOTYPE ACCEPTANCE TEST T-27 A1

## Probe 1 With Electronics

|                  | UPPER       |           | LOWER       |           |
|------------------|-------------|-----------|-------------|-----------|
|                  | TEMPERATURE | DELTA T   | TEMPERATURE | DELTA T   |
| PROBE TEST POINT | 214.50086   | 16.69965  | 234.93134   | 16.49496  |
| TEST APPARATUS   | 214.36354   | 17.74477  | 234.68763   | 17.34152  |
| AVERAGE TEMP.    |             |           |             |           |
| DIFFERENCE       | 0.13731 ✓   |           | 0.24370 ✓   |           |
| SHORTING RATIOS  |             | 0.94110 ✓ |             | 0.95118 ✓ |

All Temperatures in °K

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S-87-51059

# PROTOTYPE ACCEPTANCE TEST T-30 A3

## Probe 2 With Electronics

|                             | UPPER       |         | LOWER       |         |
|-----------------------------|-------------|---------|-------------|---------|
|                             | TEMPERATURE | DELTA T | TEMPERATURE | DELTA T |
| PROBE TEST POINT            | 244.09164   | 1.76945 | 246.24398   | 1.73608 |
| TEST APPARATUS              | 244.02427   | 1.84445 | 245.18102   | 1.81153 |
| AVERAGE TEMP.<br>DIFFERENCE | 0.06736     |         | 0.06295     |         |
| SHORTING RATIOS             |             | 0.95933 |             | 0.95834 |

All Temperatures in °K

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# GRADIENT BRIDGE ZERO OFFSETS

## LEGEND:

|        |                      |
|--------|----------------------|
| DTG 11 | Probe 1 Upper Bridge |
| DTG 12 | Probe 1 Lower Bridge |
| DTG 21 | Probe 2 Upper Bridge |
| DTG 22 | Probe 2 Lower Bridge |

| <u>Prototype Probe Bridge</u> | <u>Offset (°C)</u> |
|-------------------------------|--------------------|
| DTG 11                        | -.001              |
| DTG 12                        | .000               |
| DTG 21                        | .001               |
| DTG 22                        | .000               |

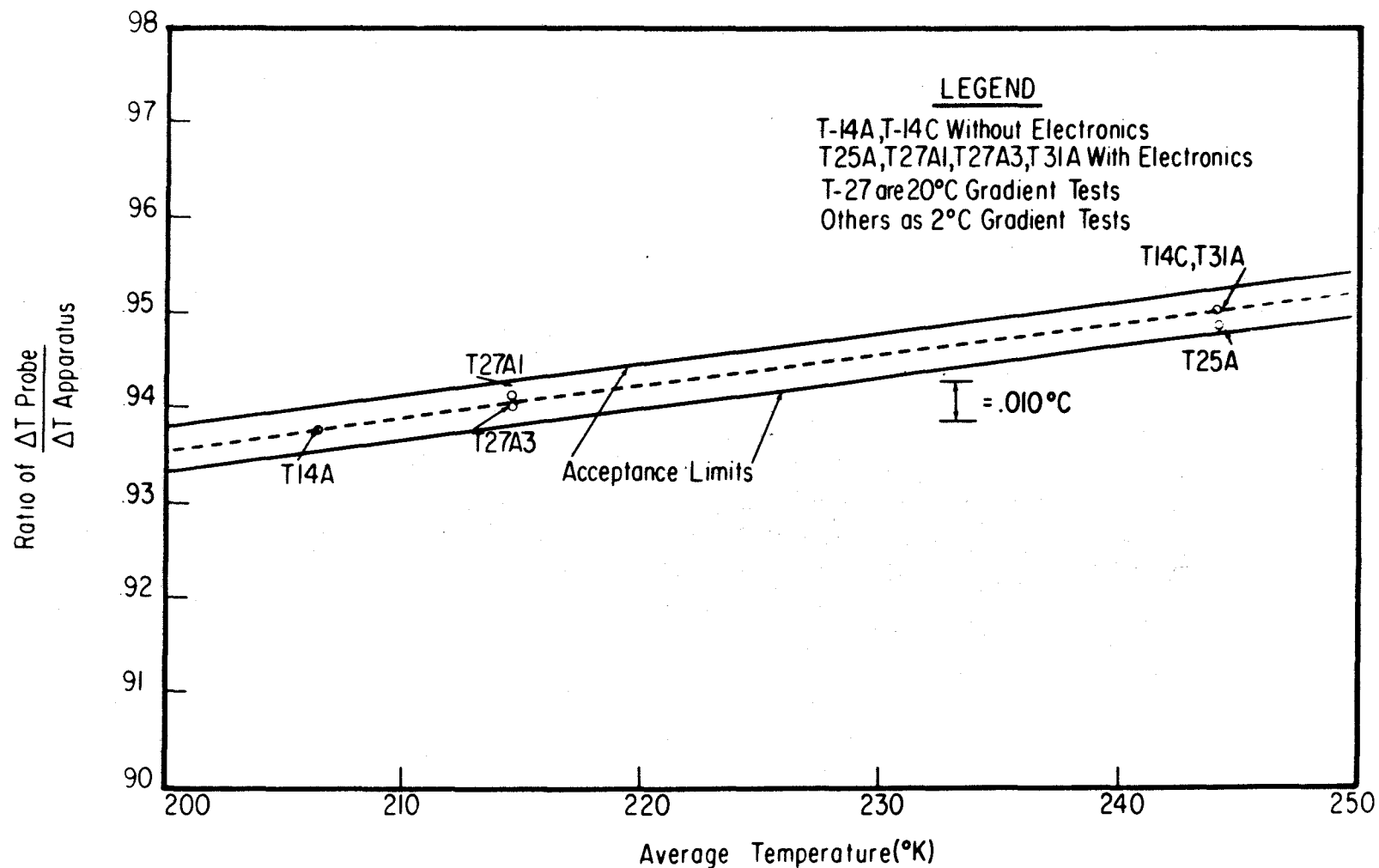
## System Qualification Probe

|        |      |
|--------|------|
| DTG 11 | .001 |
| DTG 12 | .002 |
| DTG 21 | .001 |
| DTG 22 | .001 |

## System Qualification Spare Probe

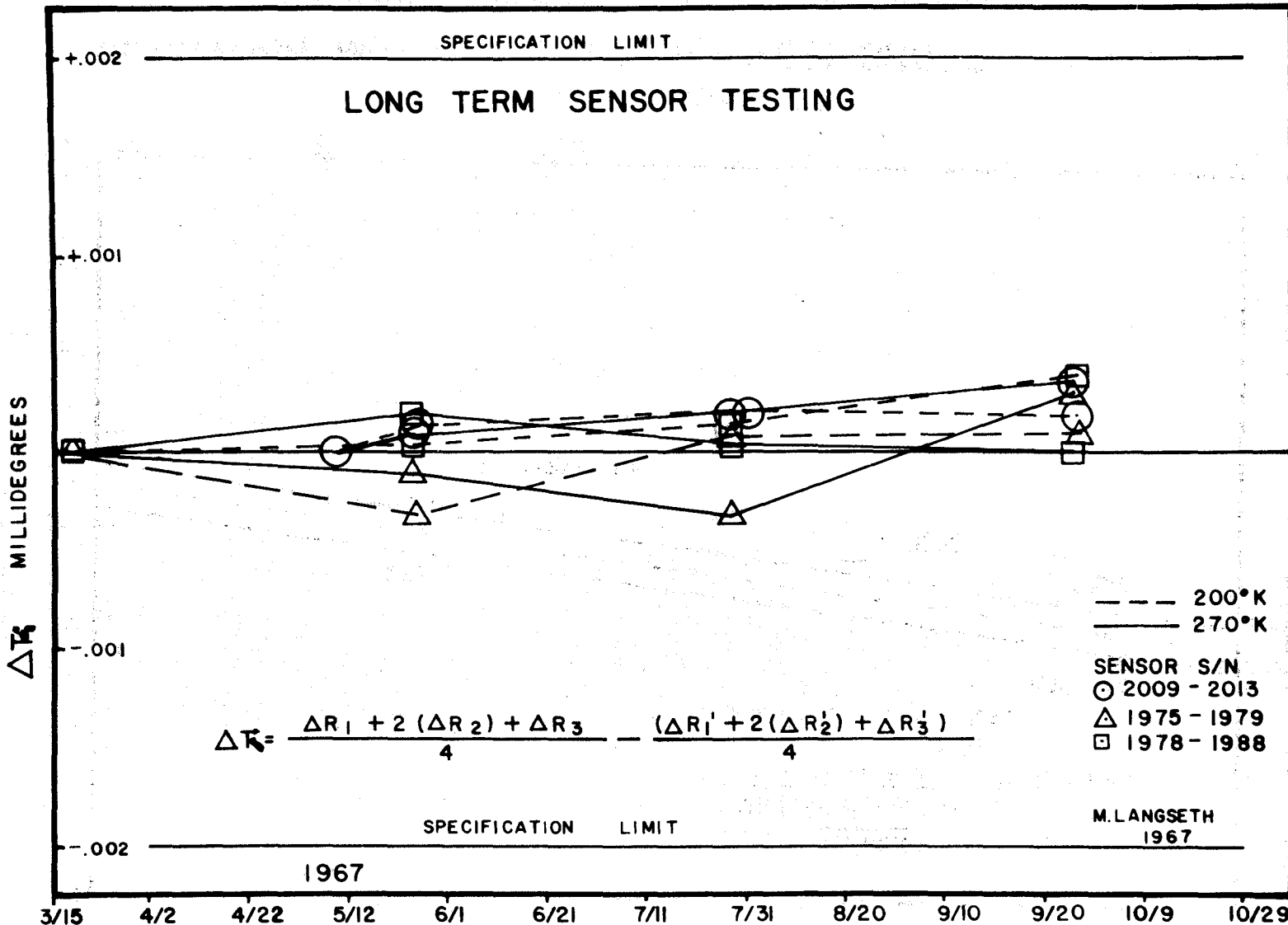
|        |      |
|--------|------|
| DTG 11 | .002 |
| DTG 12 | .001 |
| DTG 21 | .001 |
| DTG 22 | .001 |

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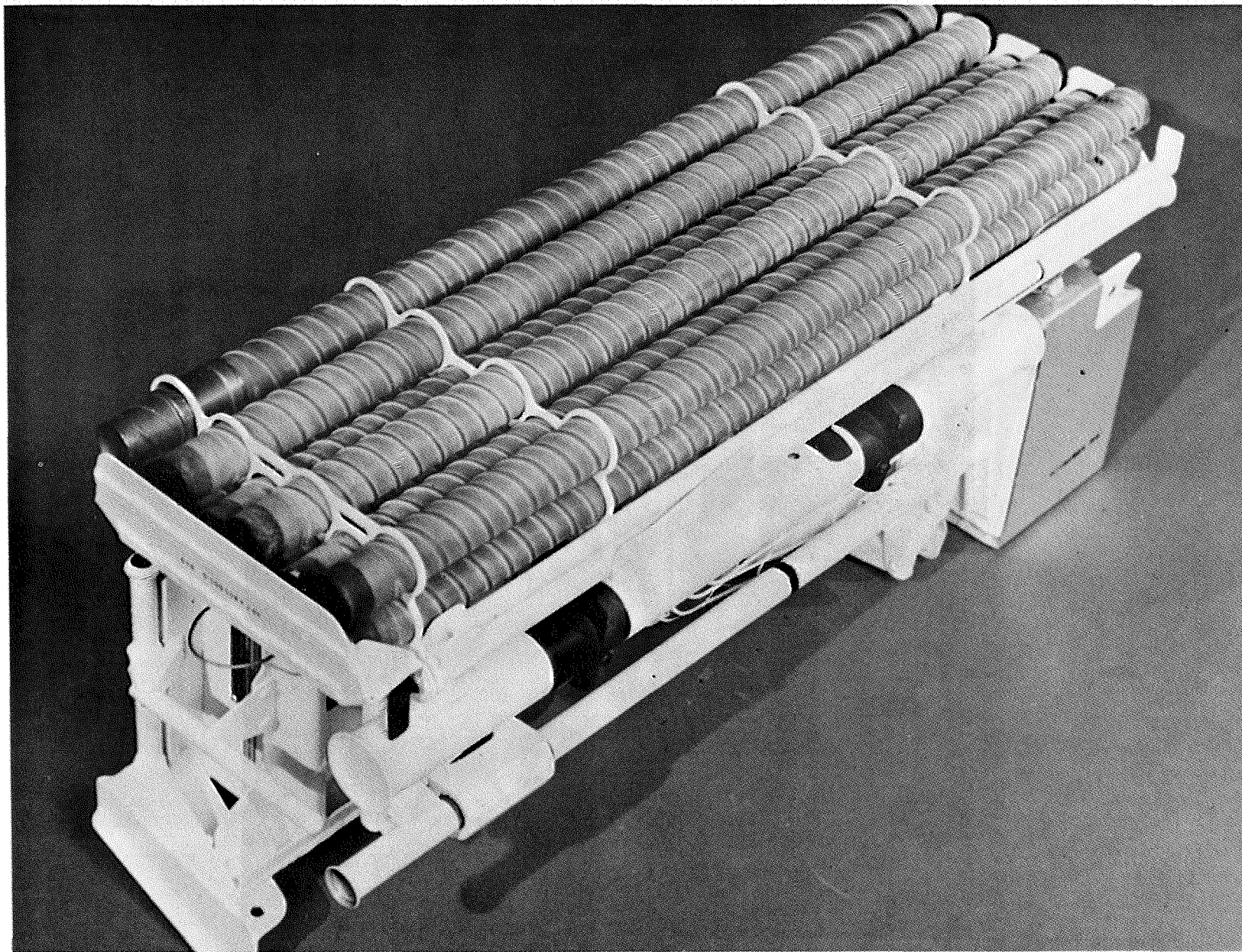


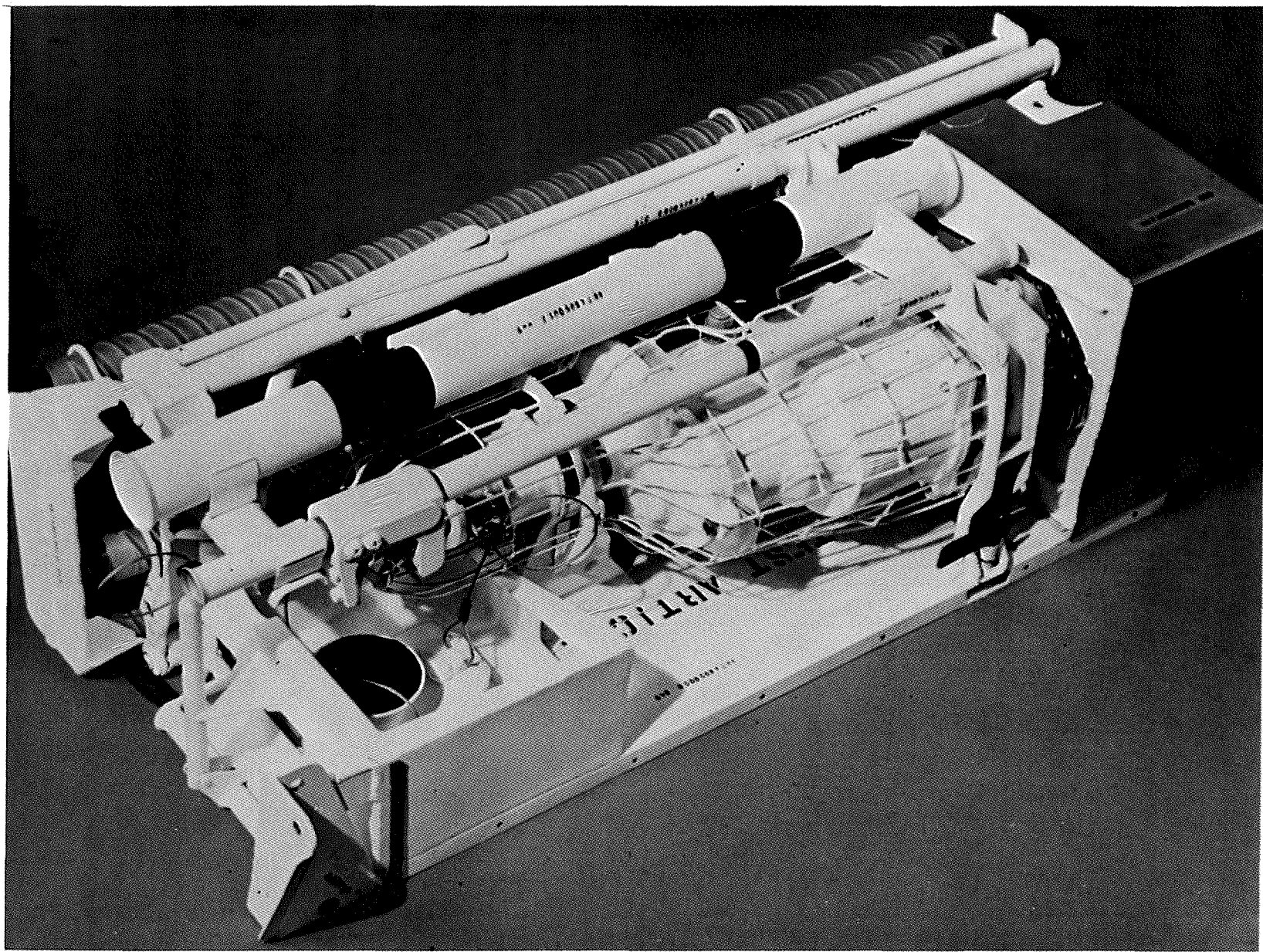
## PROTOTYPE MODEL ACCEPTANCE TEST SHORTING RATIOS

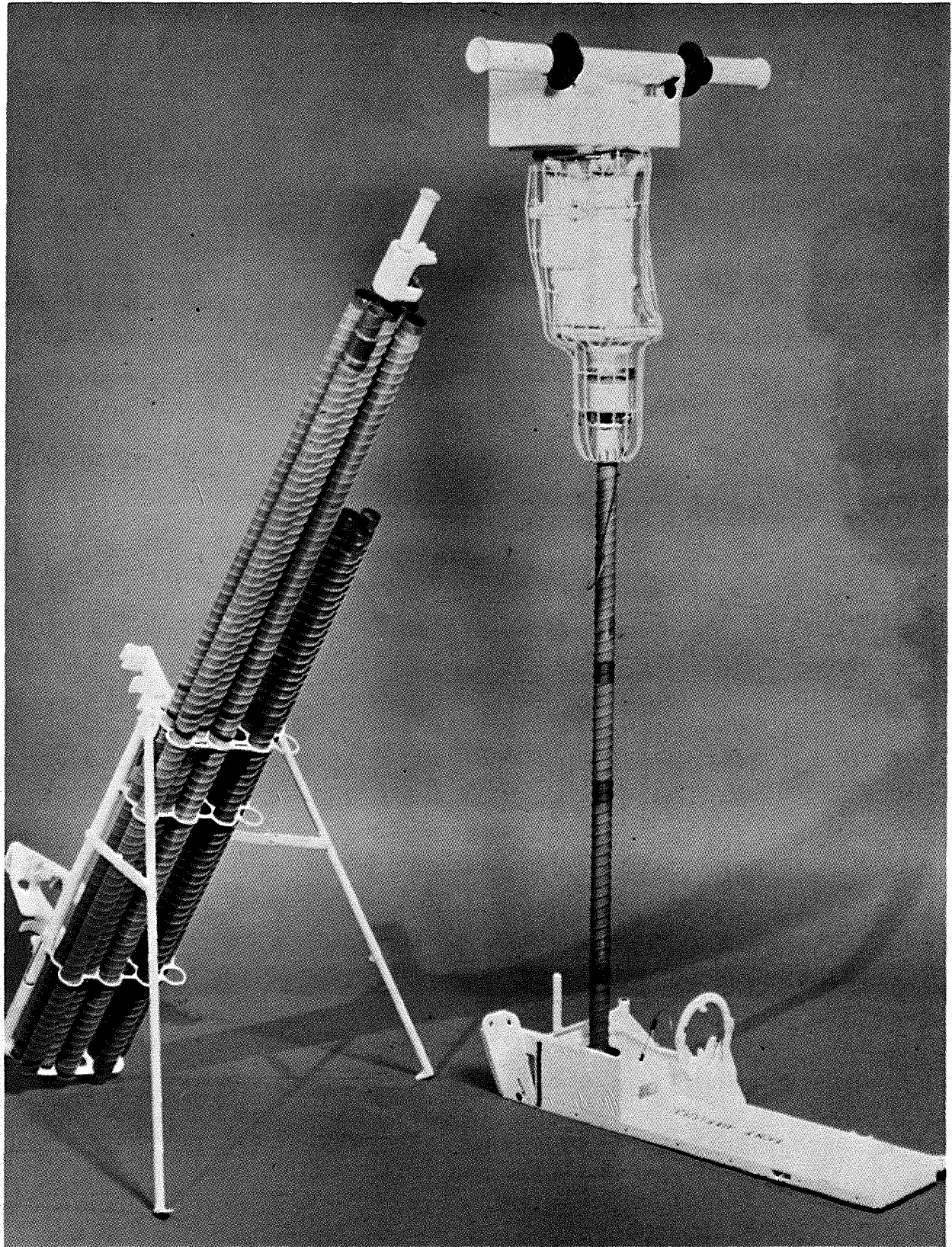
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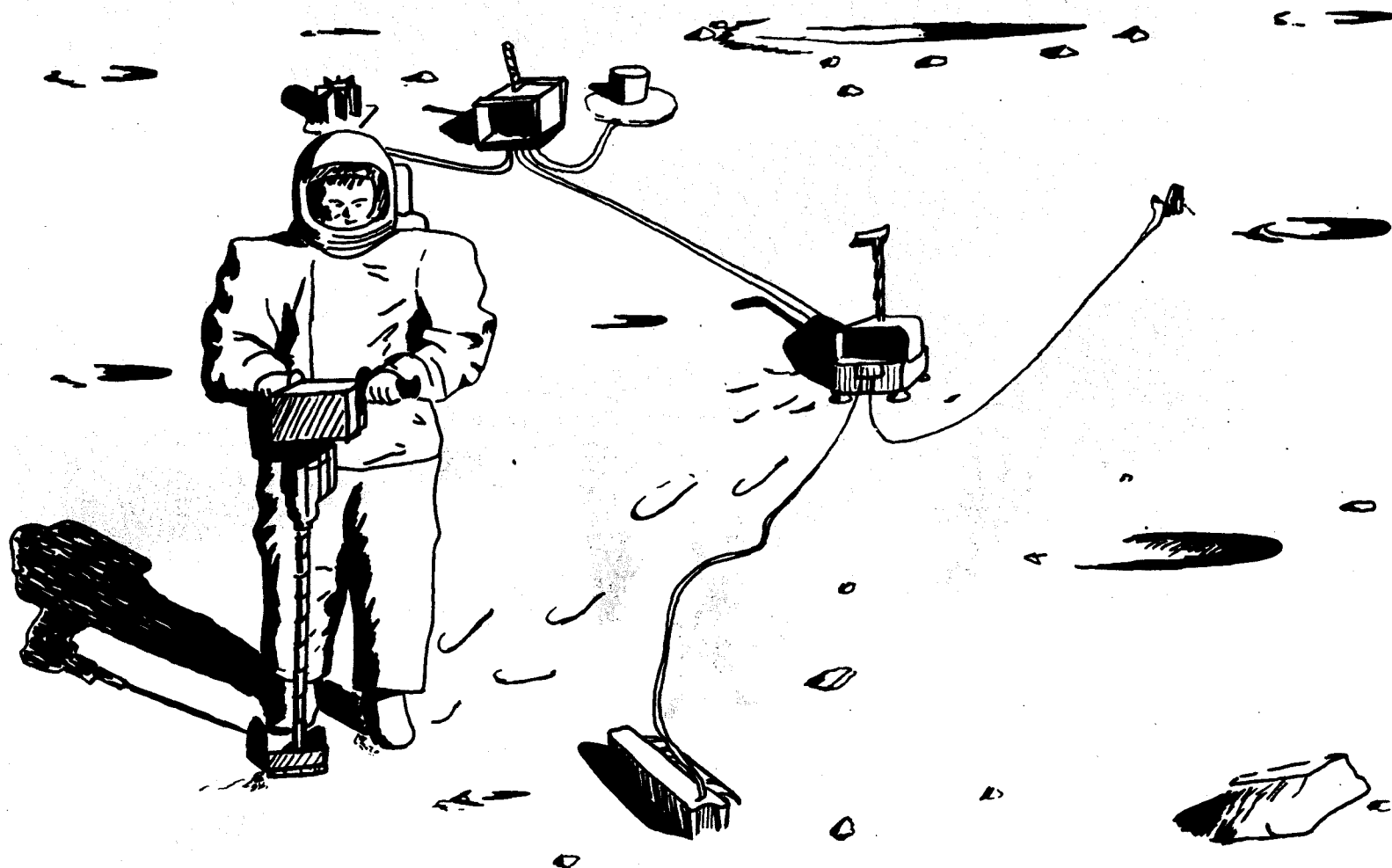








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S-67-51051



89-1491 35A



GENERATOR OUTPUT POWER COMPARISON @ 16 VOLTS

|               |           | INPUT POWER - WATTS |       |      |      |       |      |       |
|---------------|-----------|---------------------|-------|------|------|-------|------|-------|
|               |           | 1415                |       | 1455 |      |       | 1505 |       |
|               | GENERATOR | DAY                 | NIGHT | AIR* | DAY  | NIGHT | DAY  | NIGHT |
| ENGINEERING   | MOD 5     | 64.8                | 64.5  | 68.4 | 67.0 | 67.9  | 69.2 | 71.1  |
| PROTOTYPE     | MOD 14    |                     |       | 66.4 |      |       |      |       |
| QUALIFICATION | MOD 8B    | 63.9                | 64.6  | 68.1 | 67.4 | 68.8  | 70.9 | 72.6  |
|               | MOD 10    | 64.0                | 64.0  | 69.0 | 66.6 | 67.8  | 71.1 | 73.4  |
| PRIME         | MOD 15    |                     |       |      |      |       | 73.1 | 75.2  |
|               | MOD 13    | 64.3                | 65.3  | 65.3 | 67.1 | 68.8  | 69.8 | 72.5  |
|               | MOD 19    | 64.7                | 65.3  | 69.7 | 67.5 | 68.8  | 69.1 | 72.9  |
|               | MOD 21    |                     |       | 67.9 |      |       |      |       |
|               | MOD 22    |                     |       | 69.1 |      |       |      |       |
|               | MOD 23    |                     |       |      |      |       |      |       |

\* 4.7  $\Omega$  LOAD CONDITIONS

OV. 67

PCU TESTING AT GE

1. INCOMING INSPECTION TEST, PCU TEST CHASSIS
  - A. VISUAL INSPECTION - COMPLETE
  - B. ELECTRICAL BENCH TEST WITH SIMULATED PCU - COMPLETE
  - C. ELECTRICAL BENCH TEST WITH BENDIX PCU - COMPLETE
2. ELECTRICAL CHECKOUT, PCU TEST CHASSIS WITH IPU TEST CONSOLE - COMPLETE
3. RTG-PCU INTEGRATION TEST
  - A. IPU (MOD 8B) CHARACTERISTICS - RESISTANCE LOAD - COMPLETE
    - o HIGH, NOMINAL AND LOW OUTPUTS
  - B. INTEGRATION OF PCU WITH IPU AT ROOM TEMPERATURE - COMPLETE
    - o HIGH, NOMINAL AND LOW INPUT POWER
    - o CHANNELS 1 AND 2
    - o HIGH, NOMINAL AND LOW ALSEP LOADS
  - C. PCU/IPU STARTUP AND SHUTDOWN - COMPLETE
  - D. RERUN OF B ABOVE WITH PCU IN VACUUM CHAMBER
    - o HIGH TEMPERATURE - COMPLETE
    - o LOW TEMPERATURE - IN PROCESS

PCU/IPU TEST RESULTS TO DATE

A. AIR OPERATION - AMBIENT

- ⊙ NO EFFECT ON RTG TEMPERATURES
- RANGE OF REGULATOR CONTROL AT RTG (38.4 WATT SPEC)
 

|           |          |
|-----------|----------|
| CHANNEL 1 | 32 WATTS |
| CHANNEL 2 | 33 WATTS |
- ALL PCU OUTPUT VOLTAGES DROP WHEN LOAD IS INCREASED - RISE WHEN LOAD IS REDUCED
- LOAD MONITORING REQUIRED TO MAINTAIN VOLTAGE CONTROL
- RTG VOLTAGE VARIES FROM 16.0 TO 16.5 VOLT WHEN PCU'S IS IN REGULATION
- RTG LINE NOISE - 20 SEC SPIKES, 20 K Hz, 1-3/4 V PEAK TO PEAK.  
NO DETERMINATION OF LONG TERM EFFECT ON RTG.
- STARTUP IMPOSES LOW RTG VOLTAGE DIRECTLY ON + 29 V OUTPUT LINE UNTIL INVERTER TURNS ON AT + 22 VOLTS. COULD INDUCE FAILURE MODE IN EXPERIMENTS THROUGH UNDERVOLTAGE OR ON PCU THROUGH POWER DRAIN DURING STARTUP, HENCE MASKING OPEN CIRCUIT TRIGGER VOLTAGE.
- GRADUAL SHUT DOWN OF RTG FAILED TO CAUSE PCU TO SWITCH FROM CHANNEL 1 TO CHANNEL 2. THIS INDICATES A POSSIBLE TIME DEPENDENT FAILURE MODE BEATING THE BUILT-IN REDUNDANCY.
- PCU TRANSFERS FROM CHANNEL 1 TO CHANNEL 2 EVERYTIME RTG IS OPEN CIRCUITED. COULD PRESENT PROBLEMS DURING CABLE HOOPUP ON LUNAR SURFACE IF RTG IS UP TO POWER AT THE TIME.

PCU-IPU TEST RESULTS TO DATE (CONTINUED)**B. VACUUM OPERATION (10<sup>-7</sup> TORR)****HOT (+ 158°F MOUNTING PLATE)**

- ESSENTIALLY DUPLICATED AIR OPERATION RESULTS ABOVE

**COLD (- 22°F MOUNTING PLATE)**

- INSTABILITY NOTED AT OR BELOW 0°F
- INSTABILITY OCCURS AFTER STARTUP WHILE APPLYING ALSEP LOADS
- NOISE ON OUTPUT LINES INCREASES ABRUPTLY, EFFICIENCY DROPS
- PCU FAILED WHILE EXPLORING UNSTABLE REGIONS

**REGULATION CHARACTERISTICS  
OF ALSEP PCU  
AS DETERMINED FROM  
ROOM TEMPERATURE TESTS**

