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

IN REPLY REFER TO: TD/5-24/M043

JUN 5 1967

TO : See list attached

FROM : Manager, Lunar Surface Project Office

SUBJECT: Minutes of the Eighth Apollo Lunar Surface Experiments Program Interface Meeting

Enclosed are the minutes of the Eighth Apollo Lunar Surface Experiments Program Interface meeting held at NASA-Manned Spacecraft Center, Houston, Texas, May 11, 1967.

John W. Small

Enclosure

Data Bank
ALSEP papers

MINUTES

EIGHTH APOLLO LUNAR SURFACE PROGRAM INTERFACE MEETING

May 11, 1967

The eighth of a series of Apollo Lunar Surface Program Interface meetings was held at NASA, MSC, Houston, Texas, May 11, 1967. Each organization (PIs, contractors, etc.) gave a status report which included the following: (a) overall schedule status, (b) accomplishment to date, (c) forecasted accomplishments, (d) problems, and (e) data and information needs. The enclosed agenda shows the organizational elements and subject material presented. Presentation material used is attached.

In general, all elements of the program will support an ALSEP flight system delivery within 1 month of scheduled date, except for the LSM and SIDE. Both the LSM and SIDE are at least 6 months behind schedule.

The following action items were established:

M70511-01J — JPL will request waiver or experiment ripple specification by June 1, 1967.
Dr. Snyder to Moke

M70511-02M — MSC will provide Bendix with available information on Apollo experience with stainless steel bellows, leaks, and soldering by June 10, 1967.
Moke to Clayton

M70511-03M — MSC will provide ARC with a definition of a reasonable simulation of the astronaut thermal glove by June 15, 1967.

Dr. Foss to Dr. Sonett

M70511-04B Bendix Aerospace Systems Division will arrange meeting between Bendix Research Laboratory Division and Marshall Labs to discuss thermal control design of CPLEE and how it may be applicable to SIDE by June 15, 1967.

Dye to Norris

AGENDA

APOLLO LUNAR SURFACE EXPERIMENT PACKAGE

Interface Meeting

NASA - MSC Houston, Texas

May 11, 1967

9:00 a.m.	Introduction	Mr. J. Small
9:15 - 12:00 p.m.	Organizational Status Reports:	
	a. Overall Schedule Status	
	b. Accomplishments to date	
	c. Forecasted Accomplishments	
	d. Problems	
	e. Data and Information needs	
9:15	Solar Wind Spectrometer	Dr. C. Snyder
9:30	LS Magnetometer	Dr. C. Sonett
9:45	Passive Seismic	Dr. G. Latham
10:00	SIDE/CCGE	Dr. J. Freeman
		Dr. F. Johnson
10:30	CPLEE	Dr. B. O'Brien
10:45	Active Seismic	Dr. R. Kovach
11:00	Heat Flow	Dr. M. Langseth
11:15	Drill	Mr. M. Goldman
11:30	RTG	Mr. B. Remini
12:00 p.m.	ALSEP	Mr. J. Clayton
12:30	Lunch	

(Continued)

1:30 p.m.	Factory and KSC Test Procedure	Mr. P. Maloney
2:00	Summary of AS-204 Accident and Implications for ALSEP	Mr. D. Wiseman
	ALSEP Weight Status	
2:45	ALSSSP Activities	Dr. T. Foss
3:00	LGE Description	Mr. A. Carraway
3:30	Question Period	
4:00	Adjourn	

Data Bank
ALSEP papers
#16

ATTENDEES

NAME	AGENCY
Mr. L. Blackwell	Rice University
Mr. J. Burns	The Bendix Corporation
Mr. J. Carroll	Graduate Research Center of the Southwest
Mr. J. Clayton	The Bendix Corporation
Mr. H. Cross	Ames Research Center
Mr. D. Crouch	Martin-Marietta Corporation
Mr. E. Davin	NASA Hqs. - SL
Mr. M. Donnelly	The Bendix Corporation
Mr. J. Driscoll	Grumman Aircraft Engineering Corporation
Mr. W. Durrett	NASA-KSC - JH
Mr. P. Dyan	Ames Research Center
Mr. J. Dye	The Bendix Corporation
Major V. Ettredge	MSC - TD2
Mr. Z. Eubanks	MSC - BN7
Mr. J. Grayson	MSC - EP5
Mr. J. Harris	MSC - BN7
Dr. W. Hess	MSC - TA
Mr. P. Hickson	Bellcomm, Incorporated
Mr. R. Hill	MSC - BN7
Dr. F. Johnson	Graduate Research Center of the Southwest
Mr. W. Johnson	The Bendix Corporation
Mr. P. Joyce	MSC - FC
Mr. G. Kenney	MSC - TD3
Mr. G. Kepler	Marshall Laboratories

Dr. R. Kovach	Stanford University
Mr. J. Langford	MSC - TD
Dr. M. Langseth	Columbia University
Dr. G. Latham	Columbia University
Mr. W. LeCroix	MSC - TH3
Mr. D. Lehr	MSC - FC32
Mr. R. Lyon	NASA-KSC - DJ
Mr. C. McClenny	MSC - TD2
Mr. J. McDowell	The Bendix Corporation
Mr. P. Maloney	MSC - TD
Mr. B. Miley	MSC - FC
Mr. H. Miller	The Bendix Corporation
Mr. J. Modisette	MSC - TG
Mr. R. Moke	MSC - TD2
Mr. D. Mueholland	Ames Research Center
Mr. C. Murtaugh	MSC - FC
Mr. J. Musslewhite	Rice University
Mr. B. Myers	Grumman Aircraft Engineering Corporation
Mr. D. Norris	Marshall Laboratories
Dr. B. O'Brien	Rice University
Capt. W. O'Bryant	NASA Hqs., - SL
Mr. A. Olsen	MSC - EE4
Mr. J. Redd	MSC - RMD
Mr. W. Remini	MSC - ZS5
Mr. A. Robinson	The Bendix Corporation

Mr. J. Sanders	MSC - TD2
Mr. R. Schmidt	The Bendix Corporation
Mr. A. Schorken	The Bendix Corporation
Mr. A. Schwarzkopf	NASA Hqs., - MAP
Mr. B. Sharpe	MSC - FC
Mr. J. Slight	MSC - EC2
Mr. J. Small	MSC - TD
Mr. E. Smith	MSC - TA3
Mr. W. Smith	Rice University
Dr. C. Snyder	Jet Propulsion Laboratory
Dr. C. Sonett	Ames Research Center
Mr. O. Stafford	The Bendix Corporation (NASA-MSC Rep.)
Mr. H. Starnes	MSC - TA3
Mr. W. Stephenson	MSC - TF2
Mr. R. Swain	Teledyne, Incorporated
Mr. C. Sykes	MSC - FC
Mr. D. Tormohlen	The Bendix Corporation
Mr. E. Van Valkenburg	The Bendix Corporation
Mr. C. Vaughn	NASA-KSC - HS
Mr. E. Weeks	MSC - TD2
Mr. D. Wiseman	MSC - TD3
Mr. W. Womack	MSC - TG2
Mr. J. Zill	MSC - TD2

SWS FORECAST

SN03 BACK TO BASD 5/15

SN04 QUAL TESTS BEGIN 5/12

SN05 COMPLETED TO FLIGHT QUALITY

TRAINING UNIT DELIVERY 6/5

Q.A. PLAN REVISION AND APPROVAL

COMPLETE QUALITY IMPROVEMENT

COMPLETE PARTS PROCUREMENT

LAST W.M. PART 5/15

LAST ITEM (H.V. RELAY) 6/10

DOCUMENTATION CLEANUP

FIRST COMPLETE CALIBRATION

MAG TAPE HANDLING PROGRAM

APPROVE ICS REVISION

SWS PROBLEMS

HIGH VOLTAGE TRANSFORMER

HIGH VOLTAGE ARCKING

WELDED MODULE HEADERS

F. E. T. FAILURES

HIGH VOLTAGE RESISTORS

PARTS PROCUREMENT

TURN-OFF TRANSIENT

RIPPLE FED INTO POWER LINE

WEIGHT 12.3 POUNDS

SWS ACCOMPLISHMENTS

CRITICAL DESIGN REVIEW (4/25-26)

- 2 CHITS ON INSTRUMENT DESIGN

QUALITY IMPROVEMENT PROGRAM

- STRICT FAB AND REWORK CONTROL
- Q.A. PERSONNEL CHANGES
- IMPROVED PARTS HANDLING
- NEW M.O. SYSTEM ON MECH PARTS
- FAILURE REPORTING SYSTEM
- HIGH LEVEL ATTENTION AT EOS

PROTO-1 (SN03) UPDATED

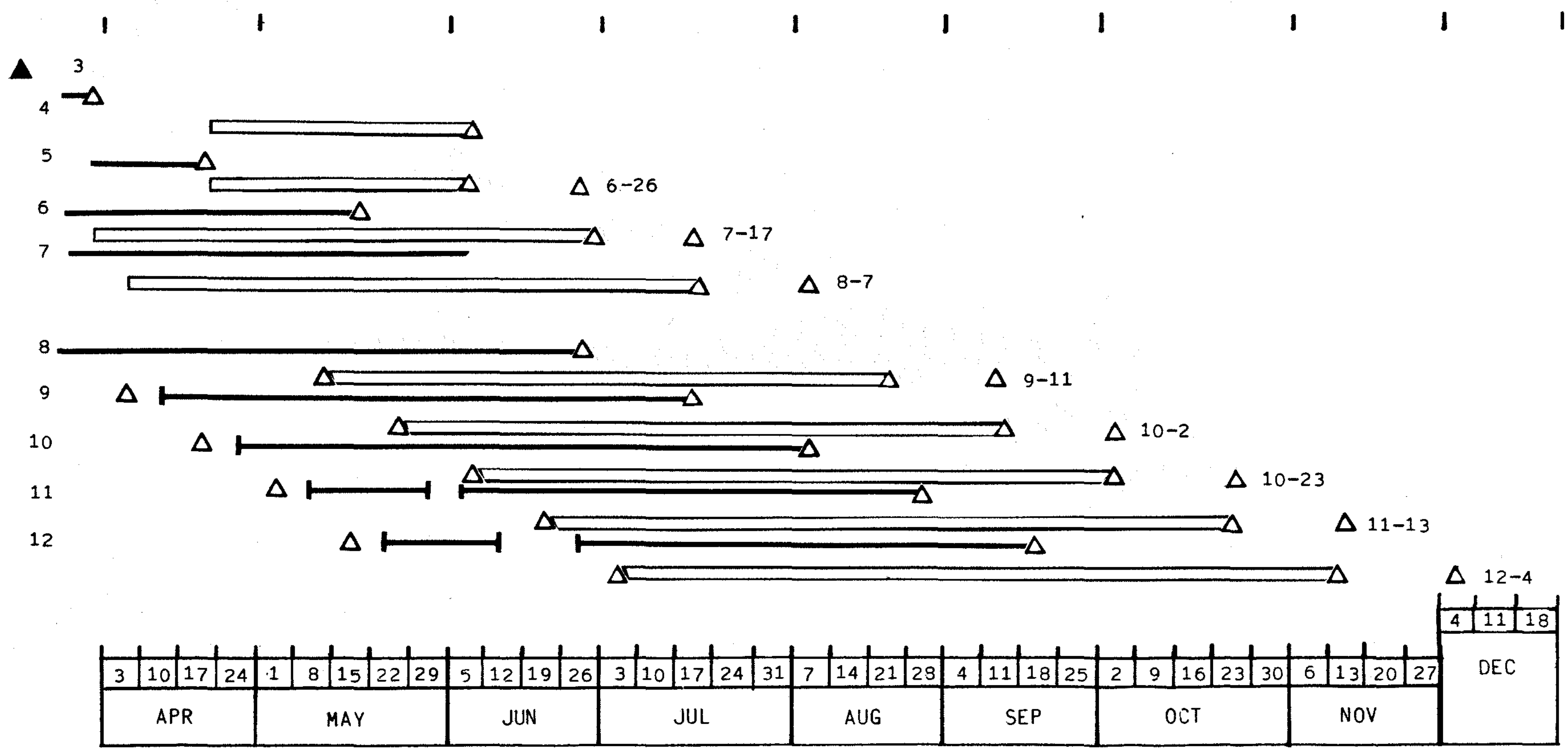
QUALITY AUDIT OF SN05

FIT TEST OF EXP. HANDLING TOOL

NEGOTIATION OF MODS 4 AND 4

SWS SCHEDULE

BEFORE AND AFTER REAPPRAISAL



SUMMARY OF DESIGN DEFICIENCIES IN PASSIVE SEISMIC SUBSYSTEM

MODEL EM-2

Component / Assembly	Description of Problem
1. Caging System:	
a) L. P. Horizontals	When releasing caging pressure, the coupling pins at the rear end of the booms are not guided into their proper seats. This results in non-operating components.
b) LPZ Spring Caging	When uncaged, there is insufficient clearance between the spring and the caging sleeve. This results in rubbing between these elements.
c) Caging tubes	Leaks were present after vibration. Unsupported tubes are resonating, reducing reliability of soldered joints.
d) Caging bellows	The caging bellows show significant hysteresis, i.e., they do not return to original zero positions when caging pressure is removed.
2. Leveling drives:	Occasional locking of the gimbal motor drives has occurred. In operation, this would lead to the loss of all LP components. b) The resonance at 75 cps excited during vibration tests is attributed to insufficient stiffness in the motor drive bracket. Correction is mandatory. c) Dry lubricant is applied to the leveling drive screw in layers of uncontrolled thickness. This may lead to drift in the leveling mechanism and loss of tidal data.

	d) The present assembly does not provide 5° leveling capability. This is required for successful deployment.
	e) Positive stops at the limit of travel are required to prevent jamming if the gimbal drive is accidentally overdriven.
	f) Coarse level switches have been found to be improperly adjusted. This leads to an increase in required leveling time.
3. LP Magnet Supports	The damping magnets must be more securely clamped to the frame. One magnet assembly slipped during vibration test. This results in a non-operating component.
4. Gimbal Ring	Brazed assembly of gimbal ring elements is unsatisfactory. Return to solid gimbal ring has been requested.
5. LPZ Component	Lateral resonance due to use of weak hinges (3 to 5 Hz) is present in the LPZ component.
6. SPZ Component	ALNICO V-7 magnet material was originally selected. Magnet materials with lower energy products have been substituted with a resulting loss in sensitivity.
7. LP Boom Take-Off Wires	Location and stiffness of signal wires affect the periods and linearity of the LP components. This can drastically affect instrument response.
8. LP Calibration Test Points	Require excessive driving voltages which would destroy components of the calibration and feedback network. Relocation of these test points to a lower voltage level is required.

9.	Post Amplifiers (CSE)	a) Intermittent oscillation ($\approx$ 1 Hz) during noise test of EM-2 was observed. b) High frequency oscillation of post amplifiers is observed when they are saturated with a negative signal.
10.	Analog Data Channels	a) Voltage swings should be limited to 5V $^{+2}_{-0}$. b) High frequency noise, 500 Kc (1 volt p-p), is present in EM-2 on all lines examined.
11.	SPZ Frequency Response	Deviates from specified response around 100 sec due to an additional high-pass filter (EM-2 only).
12.	SPZ Noise	The SPZ amplifier does not meet its noise figure requirements by 10 to 20 db. This increases the minimum detectable signal for this component.
13.	Commands	a) Y Leveling Power ON command requires multiple tries to turn on. Z leveling ON and the Leveling OFF commands are occasionally not executed. b) Occasionally cross-talk actuates more than one command (leveling +, gain)
14.	ETS	No provision has been made to measure power drain transients.
15.	Test Procedure	In order to perform required tests on the short-period seismometer sensor and electronics, it is necessary to solder and unsolder two jumper wires on the gimbal ring. This is an unsatisfactory procedure from the reliability standpoint.

NASA
S-67-30851

PSE ACCOMPLISHMENTS - I

EM-2 SCHEDULED DELIVERY TO LGO 10 MAY 1967

- TESTS
  - IN - PROCESS ADJUSTMENTS
  - VIBRATION
  - ELECTRONIC FUNCTIONS
  - SEISMOMETER PERFORMANCE
  - TEMPERATURE EXTREMES AND CYCLE

NASA
S-67-30848

PSE ACCOMPLISHMENTS - II

- PROTOTYPE SCHEDULED DELIVERY TO BxA 12 MAY 1967
  - ENGINEERING INTEGRATION TESTS AT BxA 15 - 26 APRIL 1967
    - SUBSYSTEM CHECKOUT
    - SYSTEM INTEGRATION
      - PSE + SWS + LSM
      - BREADBOARD SENSOR EXCITER USED.
    - PERFORMANCE "A- OK"
- ACCEPTANCE TESTS (IN PROCESS 11 MAY 1967)
  - VIBRATION
  - ELECTRICAL/SEISMOMETER PERFORMANCE

NASA
S-67-30849

PSE ACCOMPLISHMENTS - III

QUALIFICATION MODEL NO. 1

- DELIVERY SCHEDULED 23 MAY 1967
- INTEGRATION TESTS PERFORMED
- ACCEPTANCE TESTS IN PROCESS 11 MAY 1967
  - VIBRATION
  - ELECTRONIC FUNCTIONS
  - SEISMOMETER PERFORMANCE
  - TEMPERATURE
- IMPROVEMENTS BASED ON EM-2 TESTING
  - SOLID GIMBAL RING, NEW BRACKET

NASA
S-67-30839

PSE ACCOMPLISHMENTS - IV

FLIGHT MODEL NO. 1

- DELIVERY SCHEDULED 2 JUNE 1967
- PRE-ACCEPTANCE TESTS IN PROCESS 11 MAY 1967
  - VIBRATION
  - ELECTRONIC FUNCTIONS
  - SEISMOMETER PERFORMANCE
  - TEMPERATURE

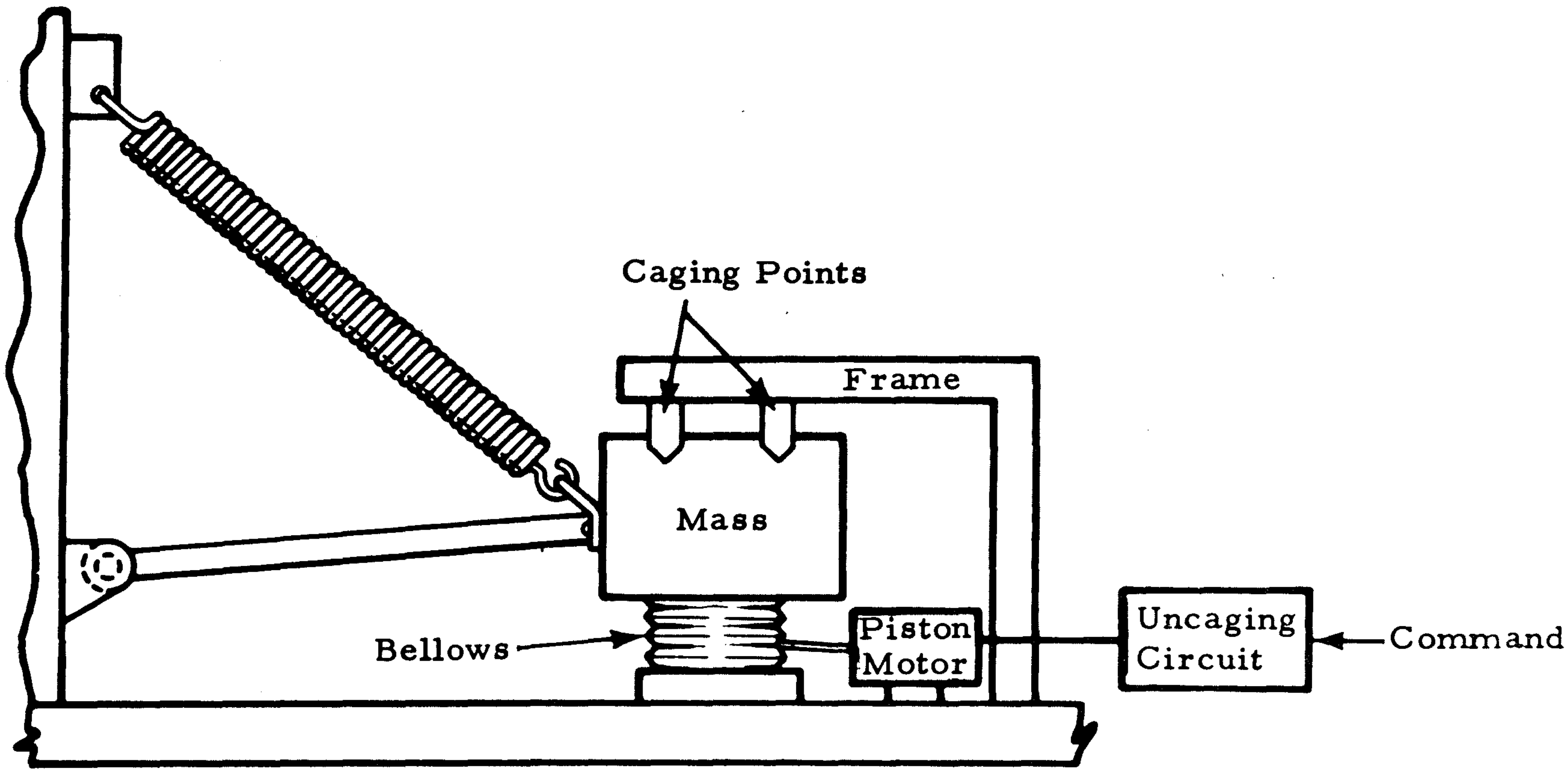
NASA
S-67-30847

PSE ACCOMPLISHMENTS - V

- EM-3 (DESIGN VERIFICATION TEST MODEL)
  - COMPLETION SCHEDULED 2 JUNE 1967
    - CHECKOUT COMPLETE - 6 JUNE 1967
  - DVT PROCEDURE PREPARED
    - LGO, BxA, ESC COMMENTS ADDED
  - DVT TEST SUPPORT FACILITIES CONTRACTED

NASA
S-67-30852

DIAGRAMMATIC SKETCH PSE UNCAGING MECHANISM



NASA
S-67-30840

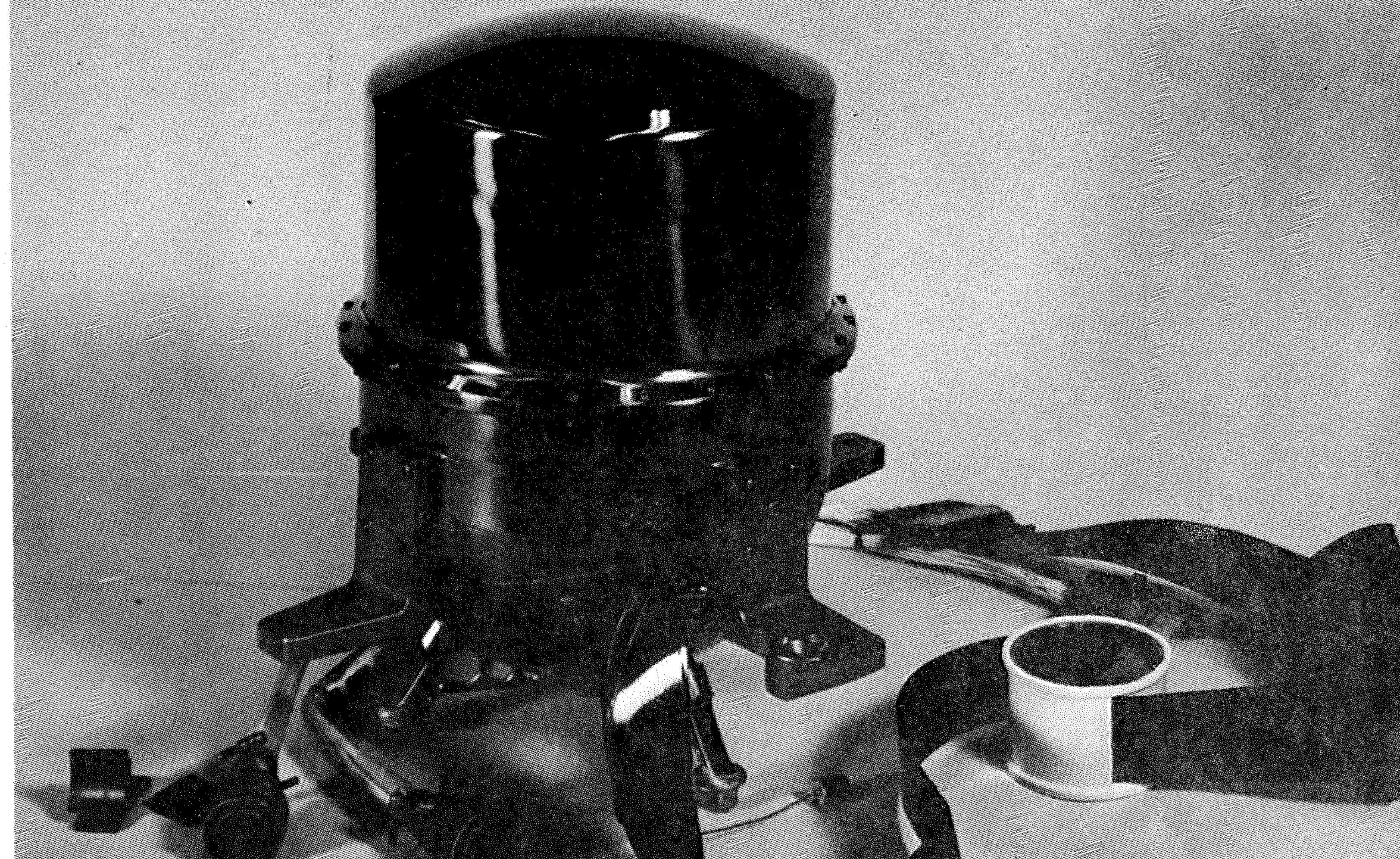
PSE PROBLEM AREA

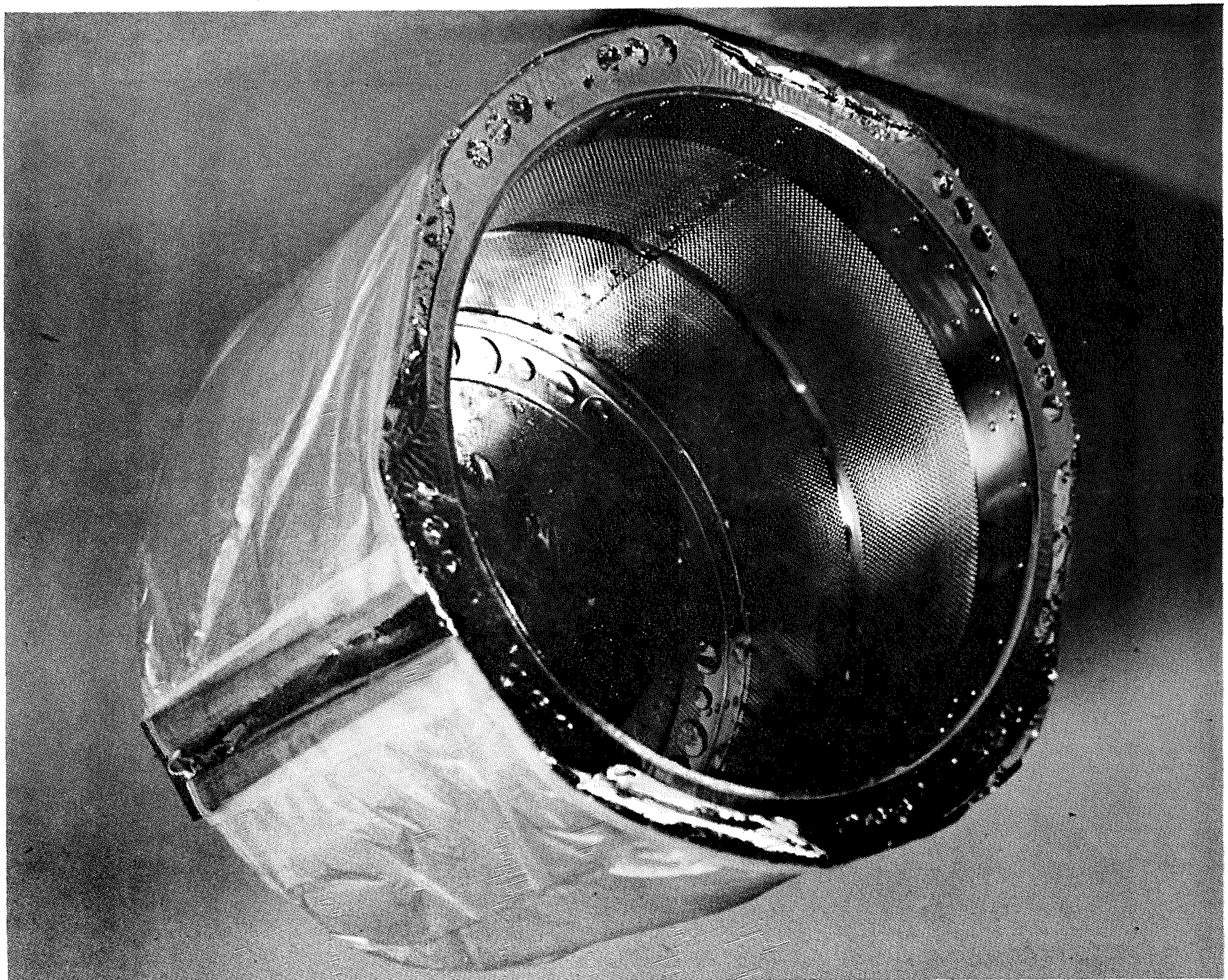
- CAGING MECHANISM
  - LEAKS IN PNEUMATIC BELLOWS ASSEMBLY
  - SOLUTION
    - EM-2, PROTOTYPE &, Q-1

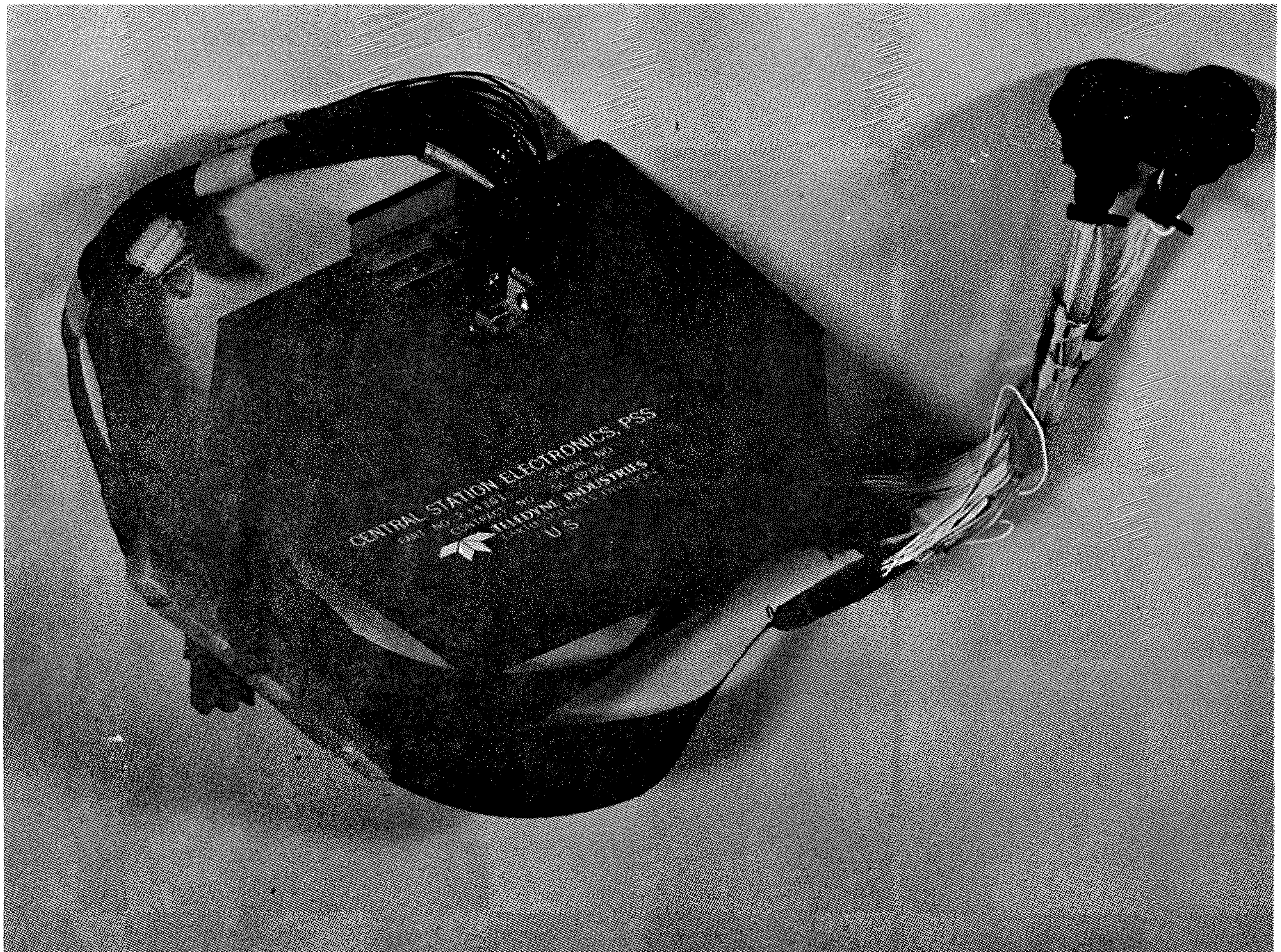
      RESOLDER AND RE-CHECK FOR ACCEPTABLE LEAK RATES
    - Q-2 & SUBSEQUENT

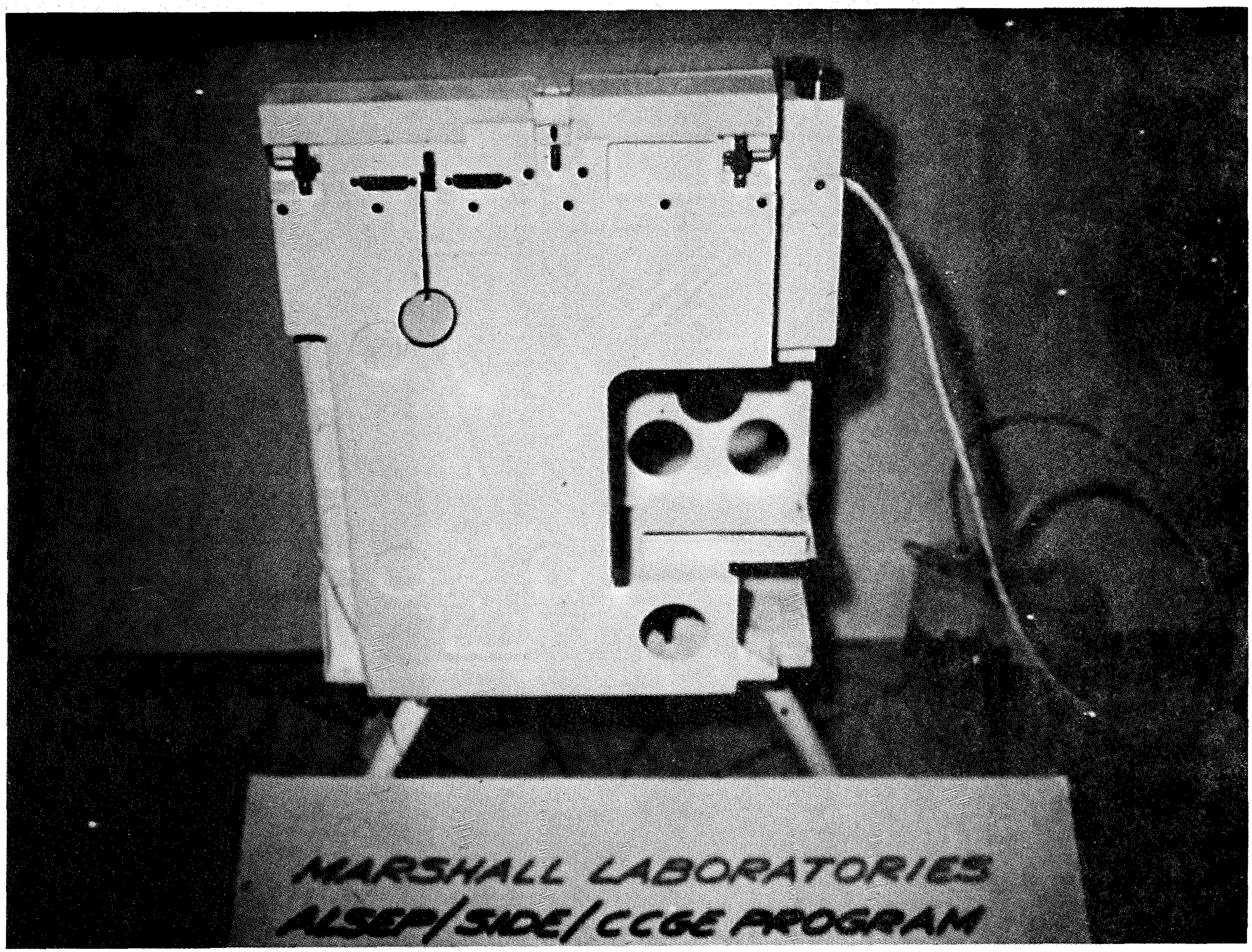
      STAINLESS STEEL BELLOWS

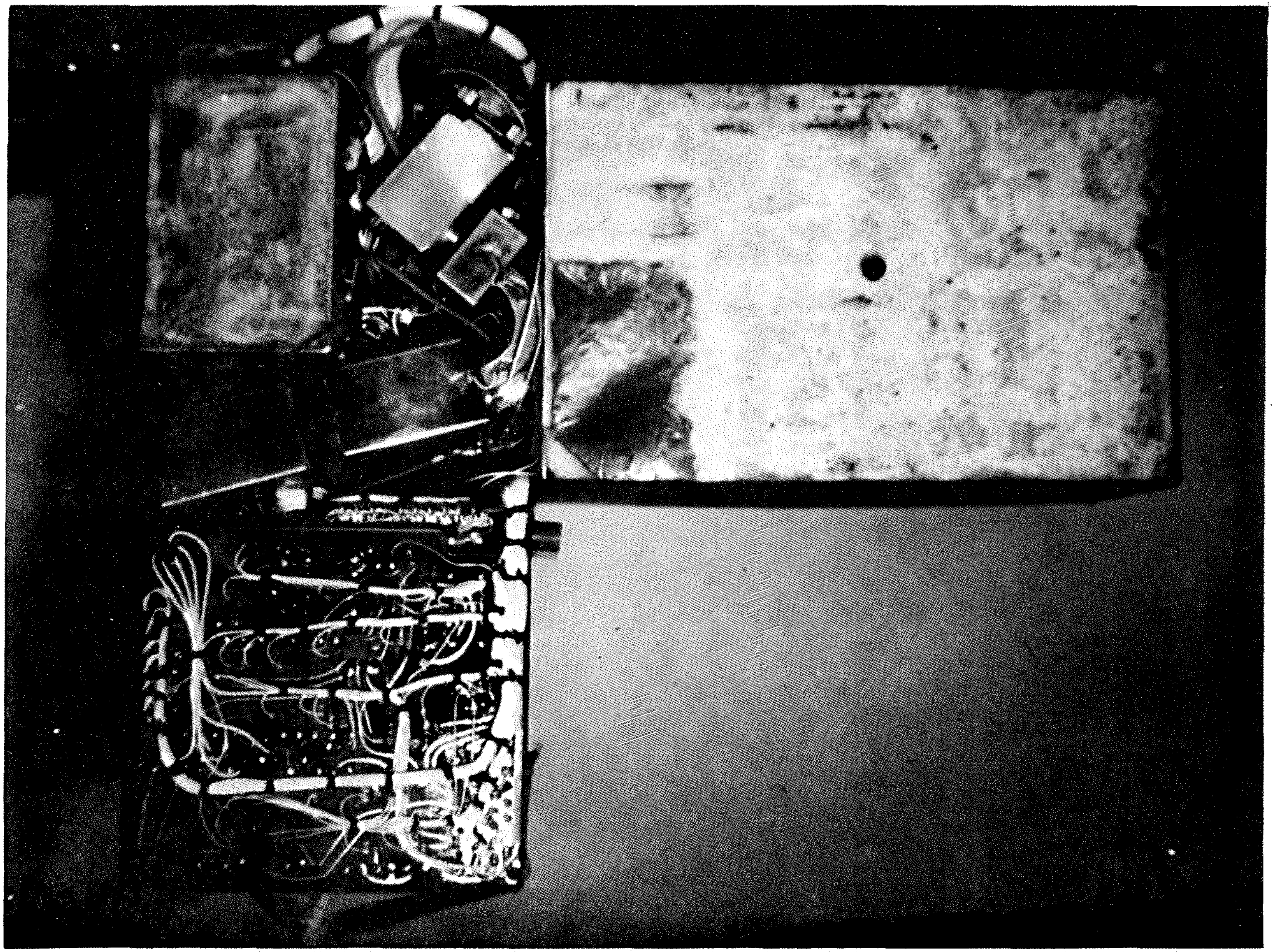
      INDUCTION SOLDERING CONNECTIONS

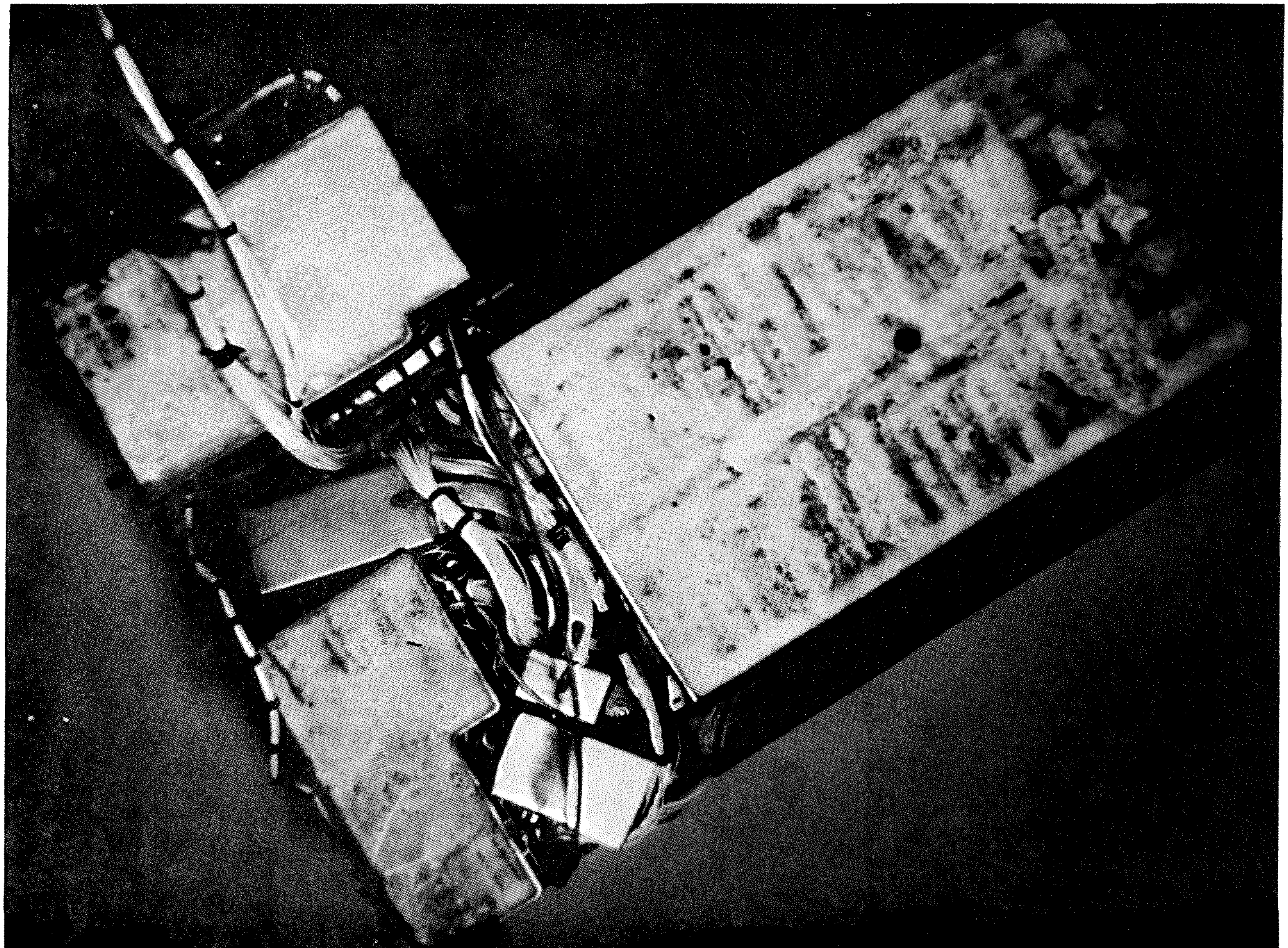


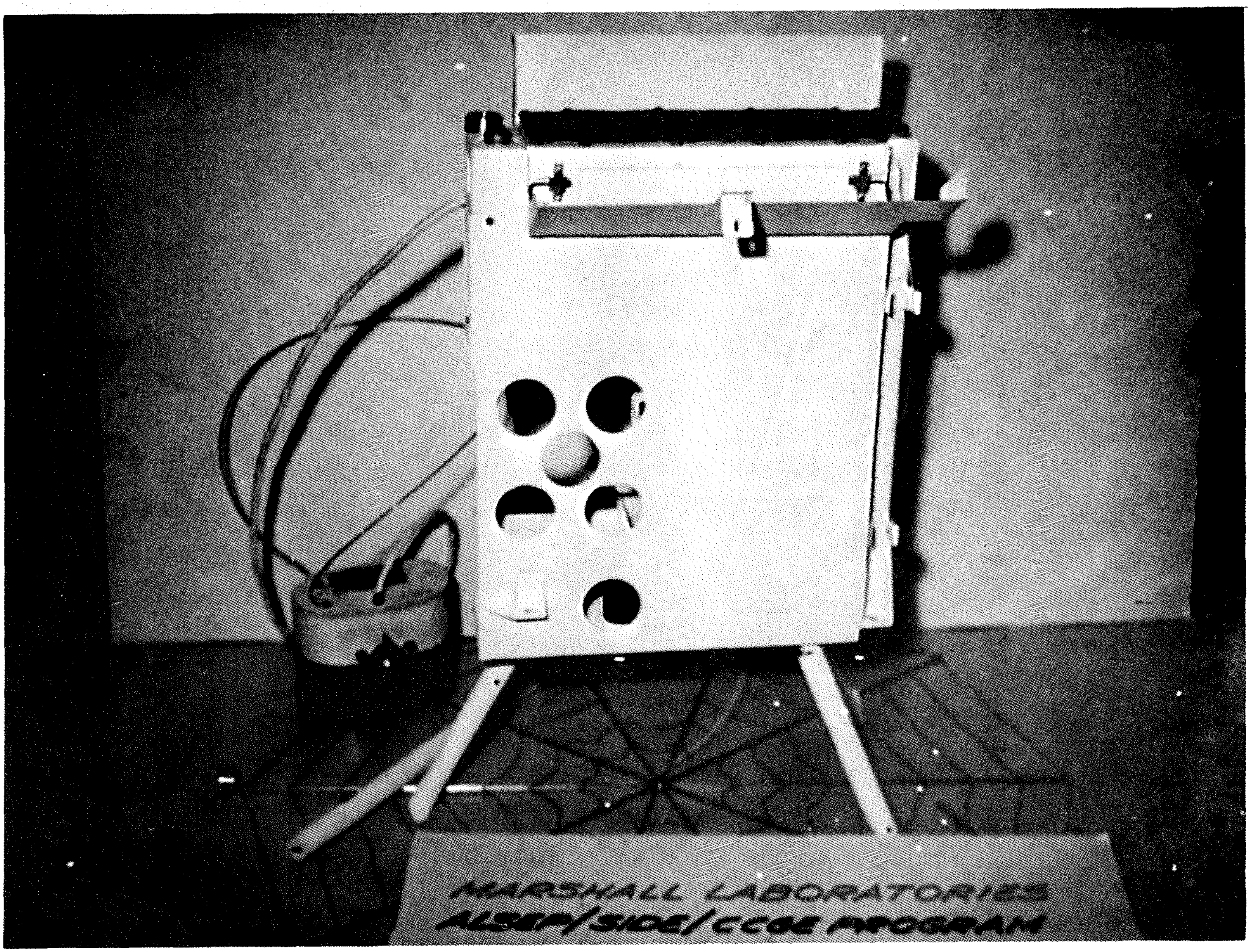


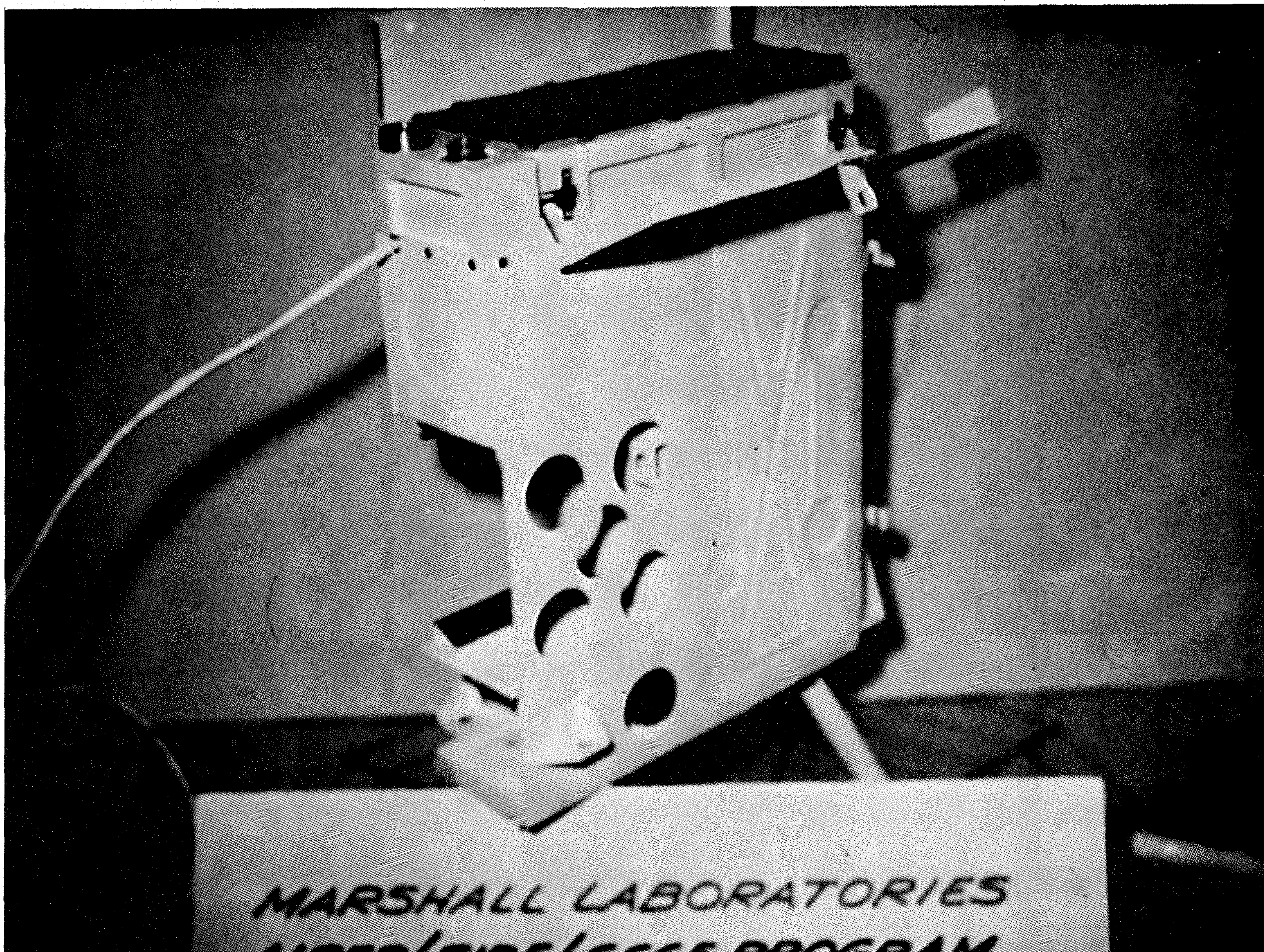

CENTRAL STATION ELECTRONICS, PSS
TELEDYNE INDUSTRIES
U S

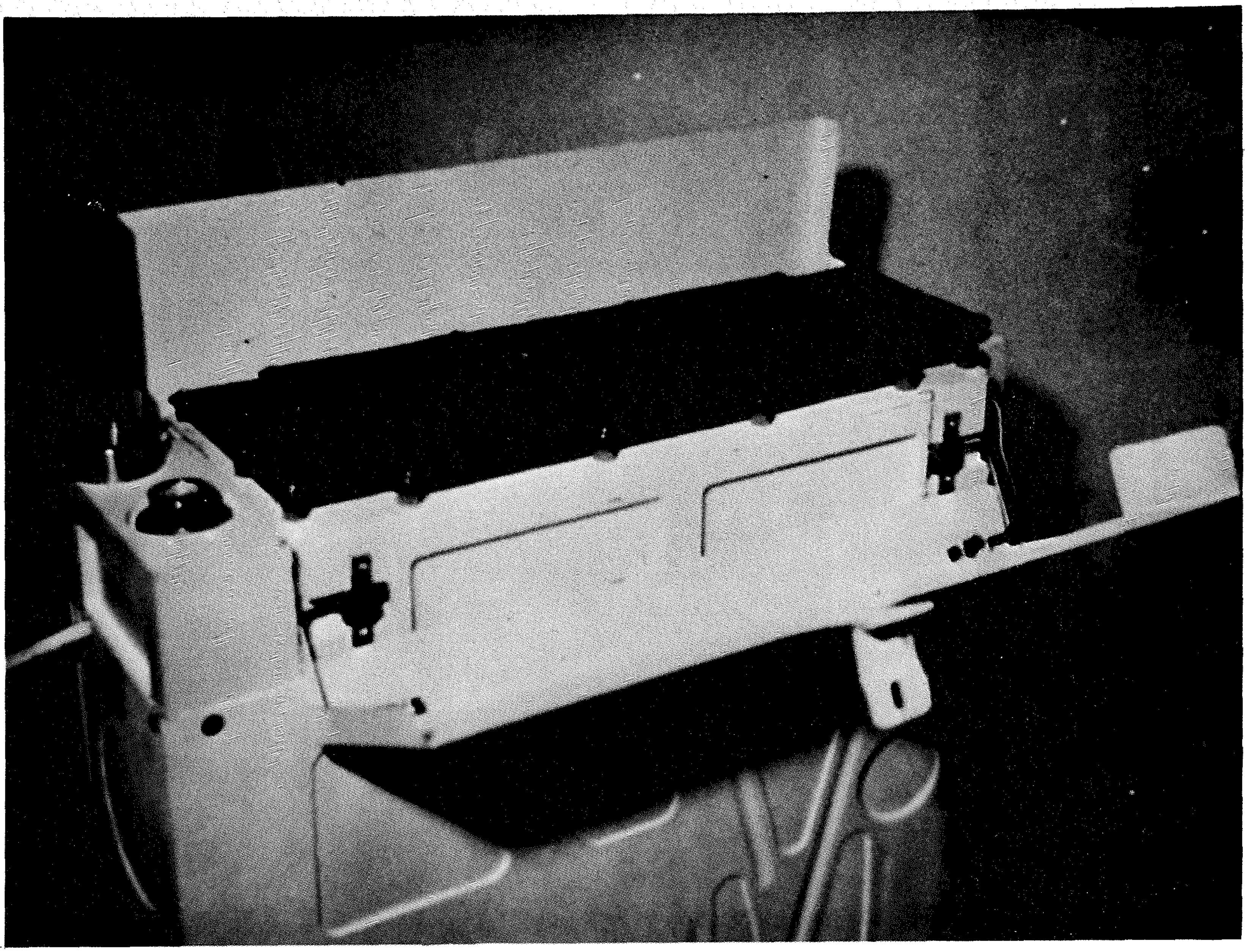

MARSHALL LABORATORIES
ALSEP/SIDE/CCGE PROGRAM

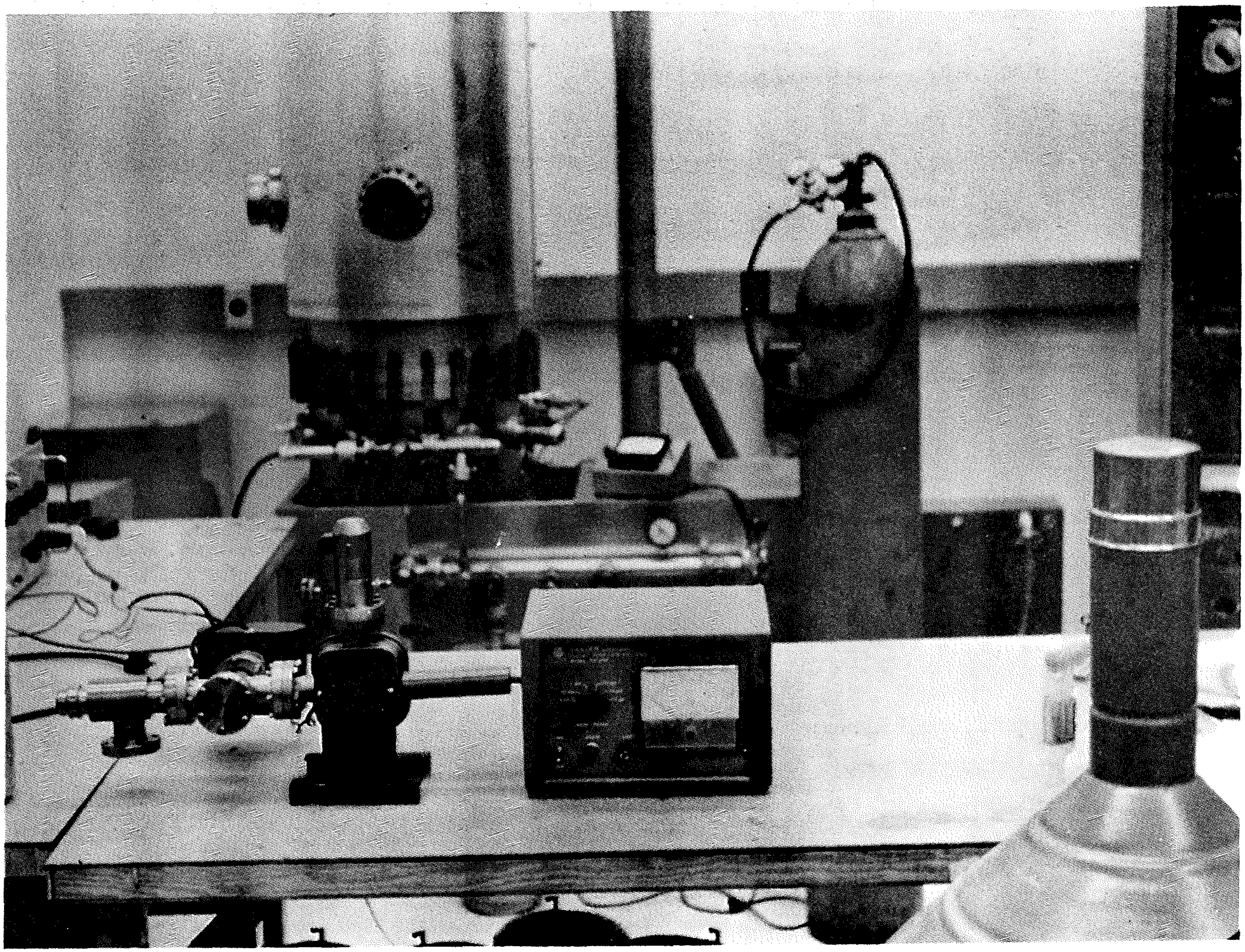


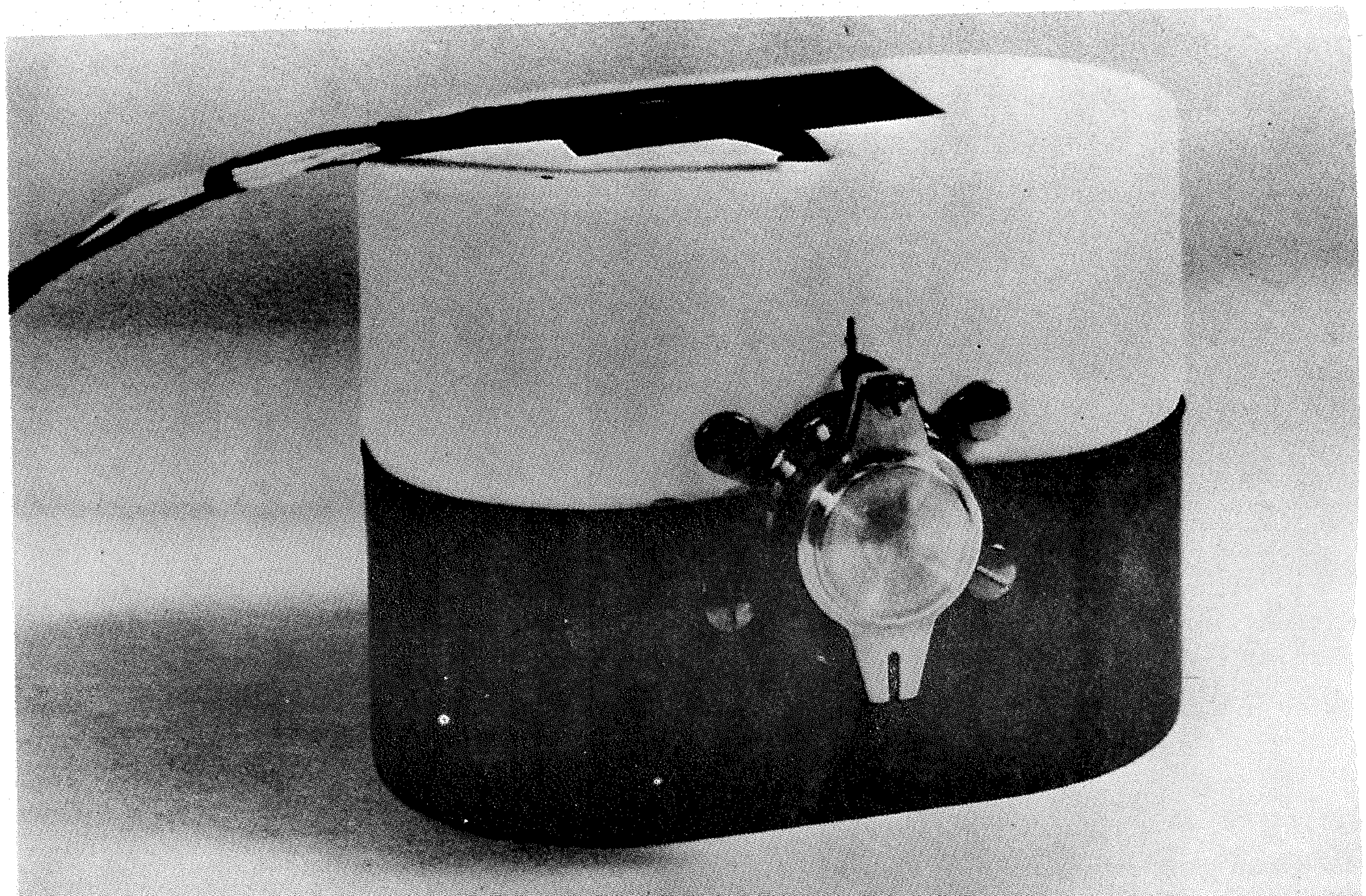



MARSHALL LABORATORIES
ALSEP/SIDE/CCGE PROGRAM

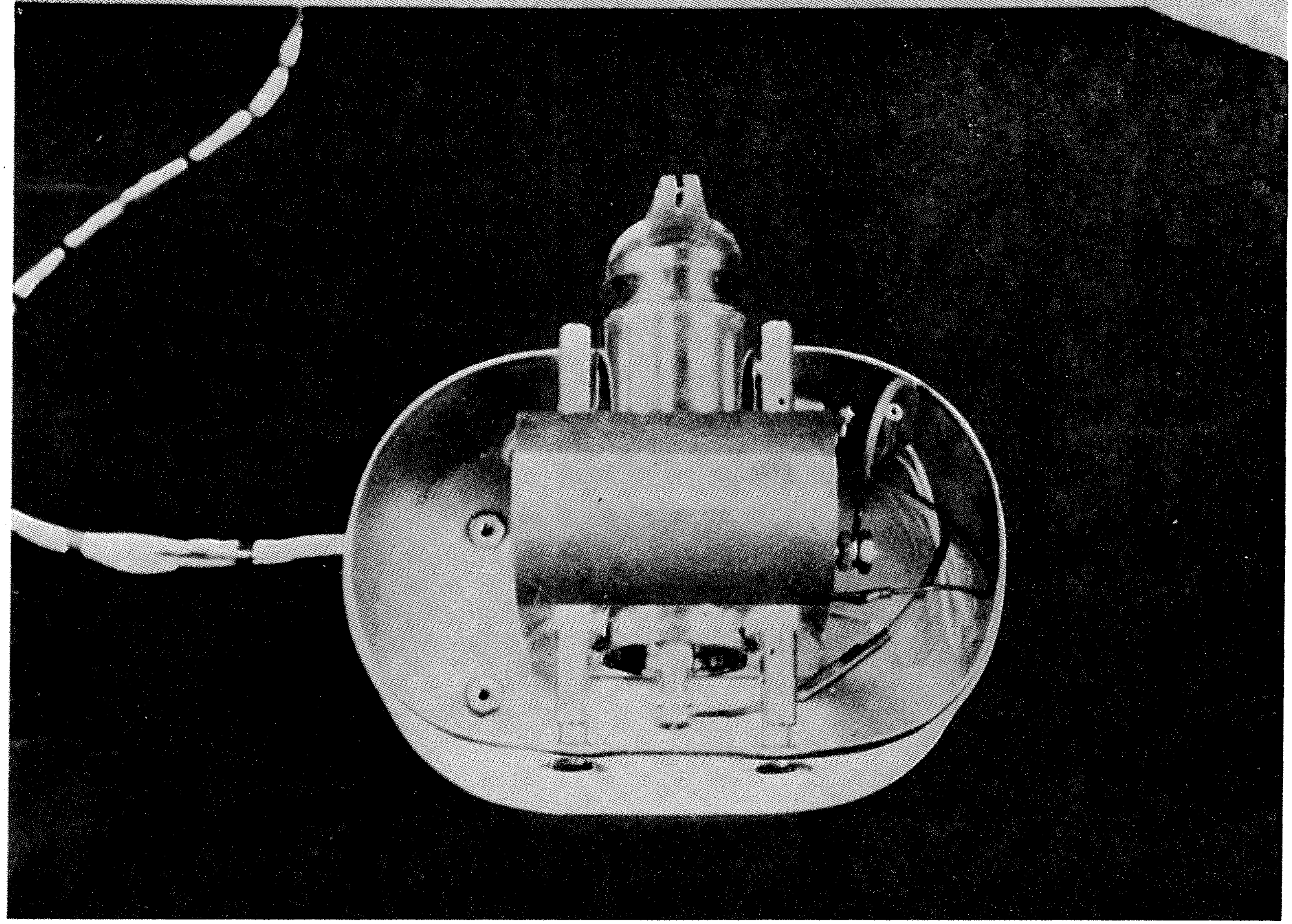

MARSHALL LABORATORIES
ALSEP/SIDE/CCGE PROGRAM

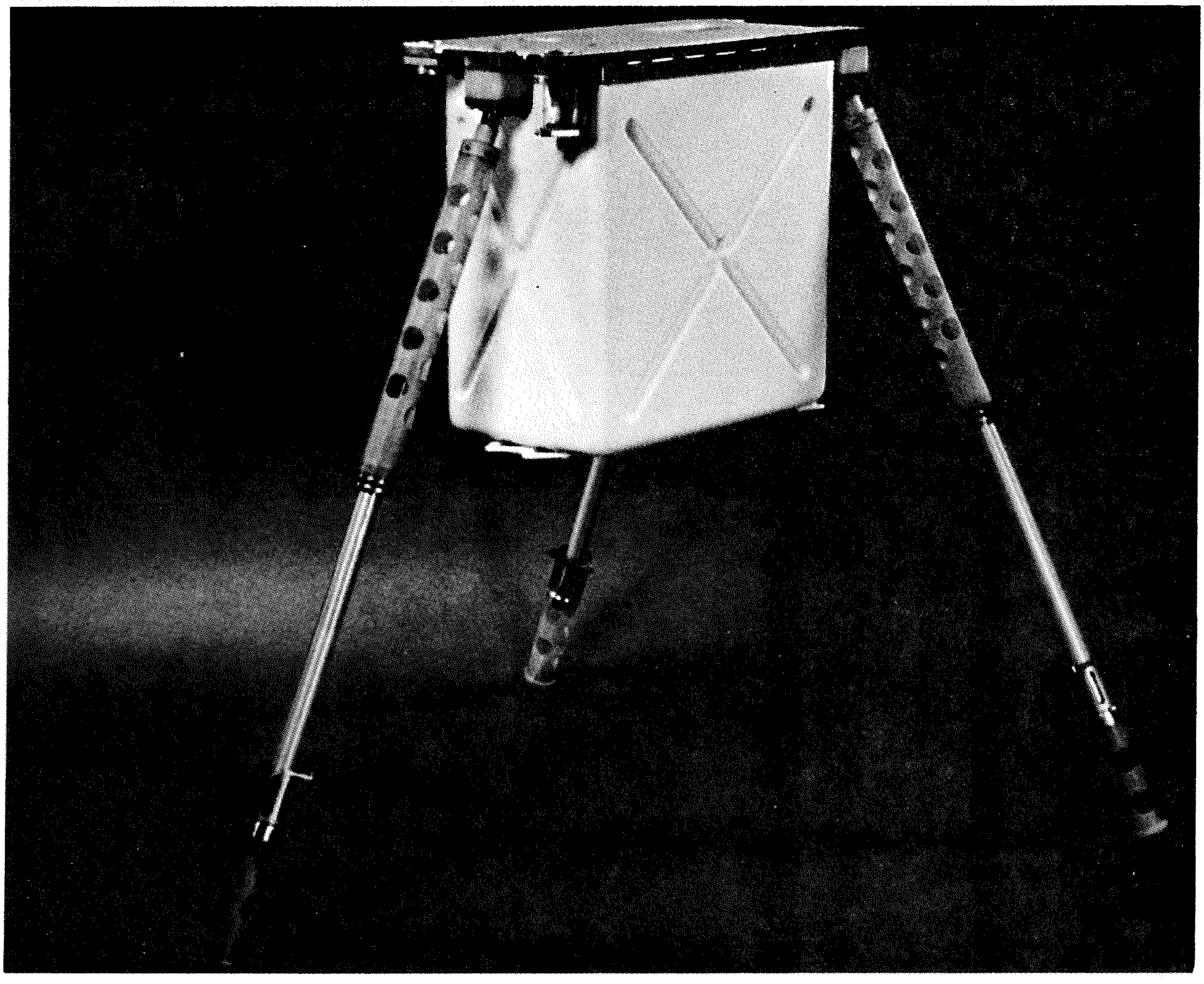






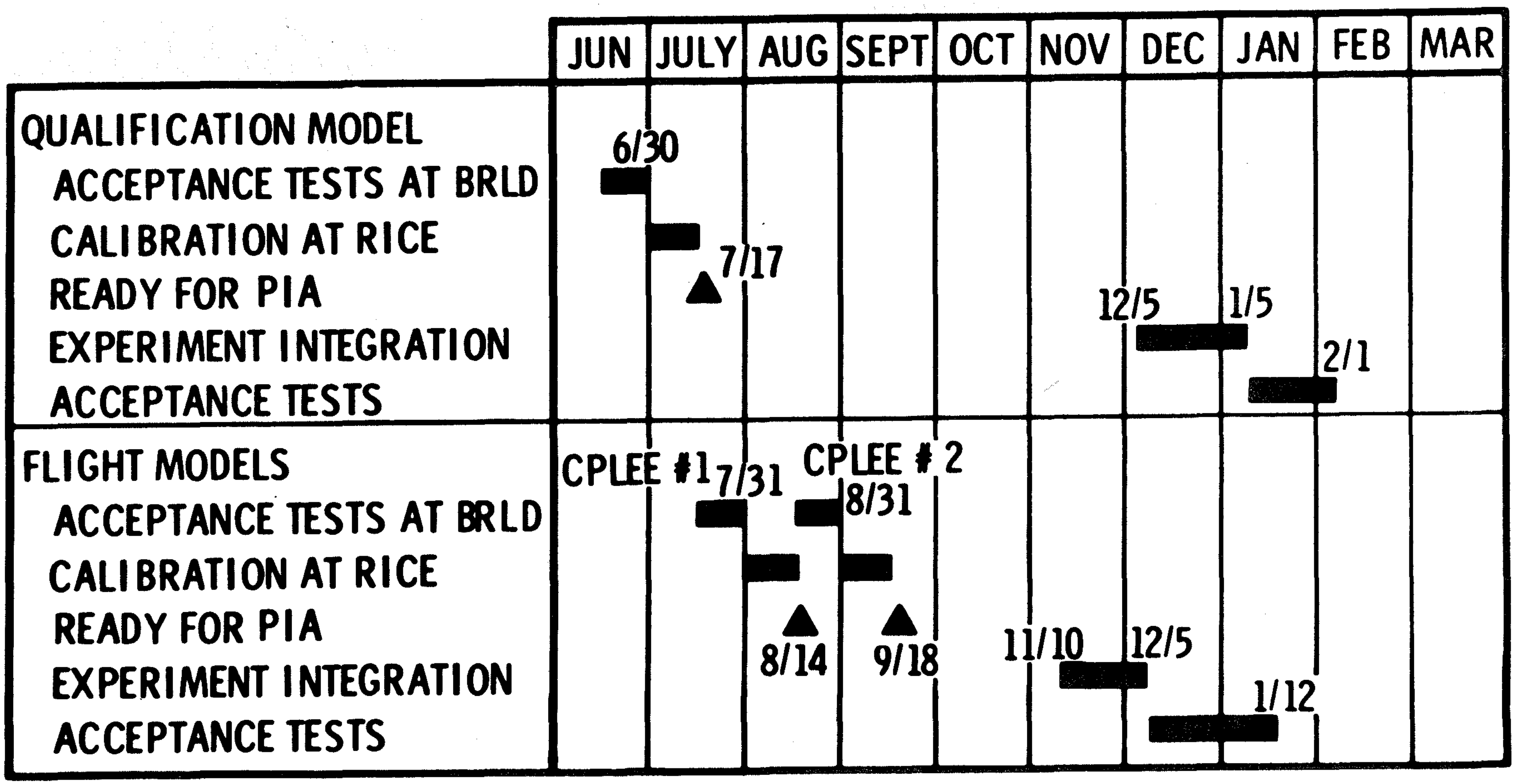
Qual Model 1 - CCIG Installation In Cover





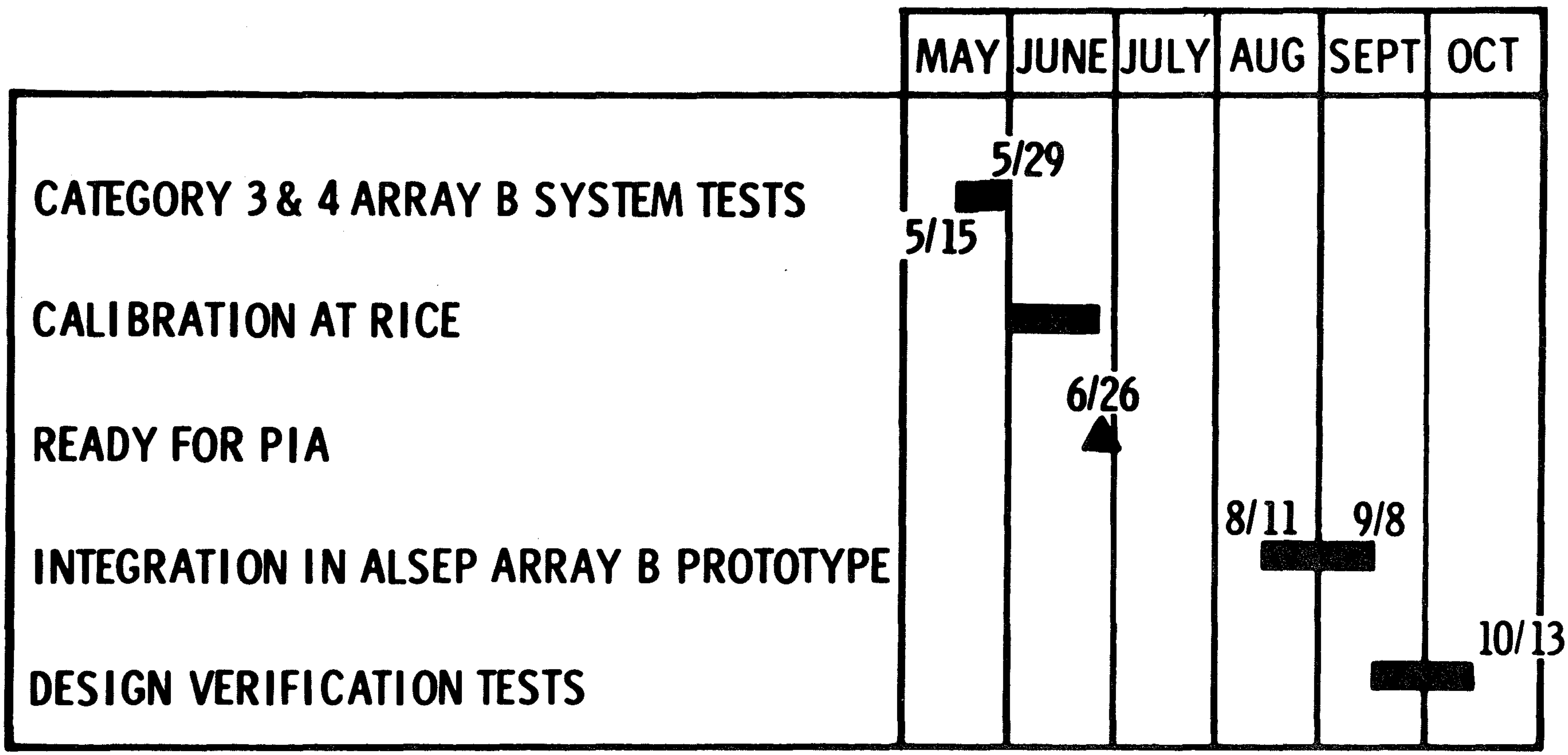
NASA
S-67-30841

CPLEE QUALIFICATION AND FLIGHT MODEL SCHEDULE



NASA
S-67-30842

CPLEE PROTOTYPE SCHEDULE



NASA
S-67-30838

CHARGED PARTICLE EXPERIMENT

PROTOTYPE UNIT FABRICATION AND ASSEMBLY COMPLETED

UV NOISE SUPPRESSION DESIGN IMPROVEMENTS COMPLETED

TRAINING SIMULATOR E-2 MODEL COMPLETED

STATUS OF QUALIFICATION MODEL

- ELECTRONIC MODULES TO BE COMPLETED BY MAY 22
- MECHANICAL COMPONENTS TO BE COMPLETED BY JUNE 1
- ASSEMBLY AND TEST TO BE COMPLETED BY JUNE 30

ASE PROGRAM STATUS

1. BENDIX-STANFORD COMMUNICATIONS - GOOD

2. ACTIVE SEISMIC DETECTION SYSTEM

   a. PROTOTYPE ACCEPTED

   b. FREQUENCY RESPONSE PROBLEM

   c. SYSTEM NOISE LEVEL PROBLEM

3. MORTAR BOX TESTS

   a. DESIGN PROBLEMS CORRECTED

   b. RANGE LINE CALIBRATION NEEDED

NASA
S-67-30872

ASE PROBLEM STATUS CONTINUED

4. GEOPHONE, CABLE, AND MORTAR BOX DEPLOYMENT TESTS

5. ANALOG DATA DISPLAY AND S/SYSTEM TESTS

6. THUMPER

   a. THUMPER CABLE DEPLOYMENT

   b. SUIT EFFECTS

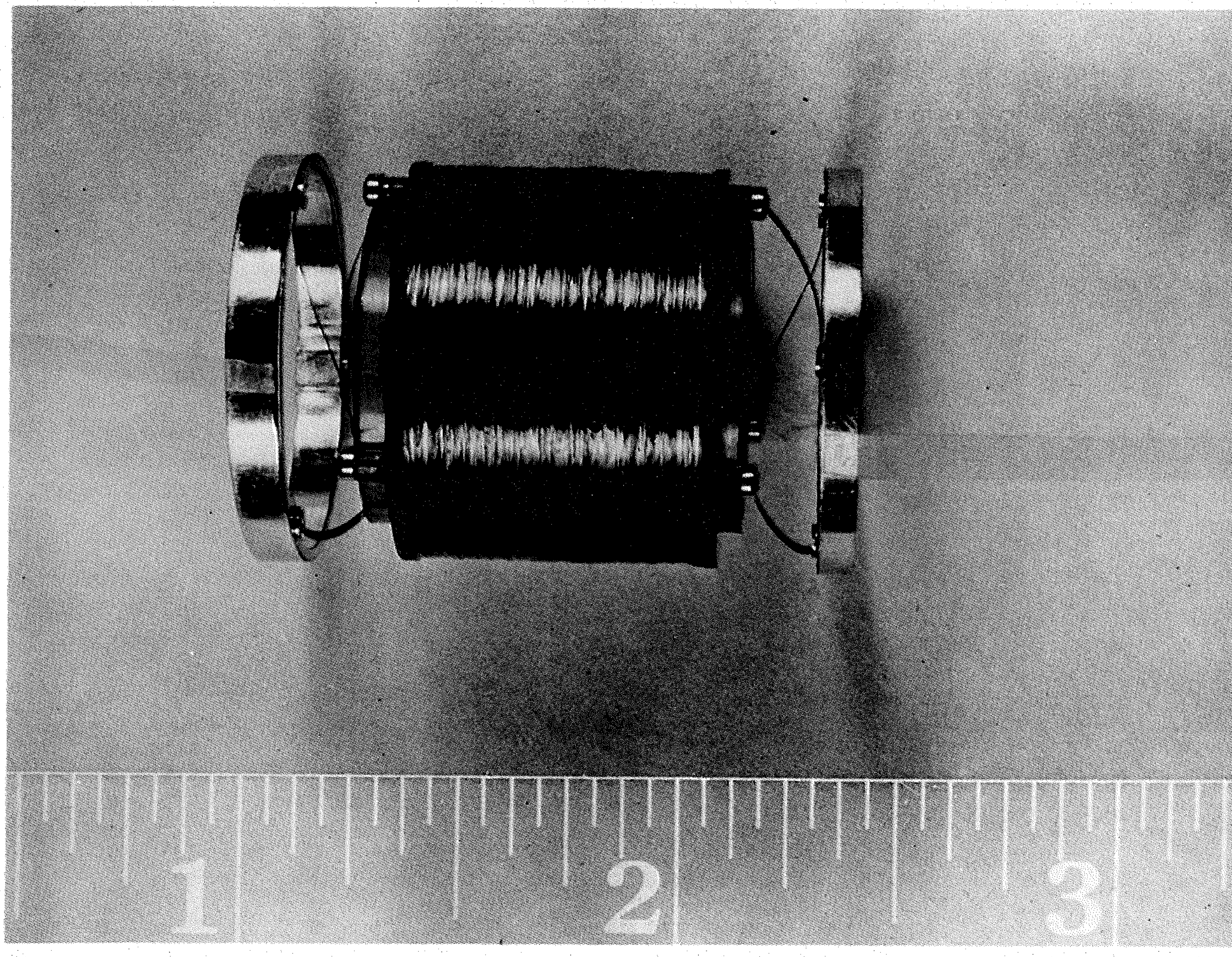
7. ANTENNA/RANGE LINE DOUBLE FAILURE MODE

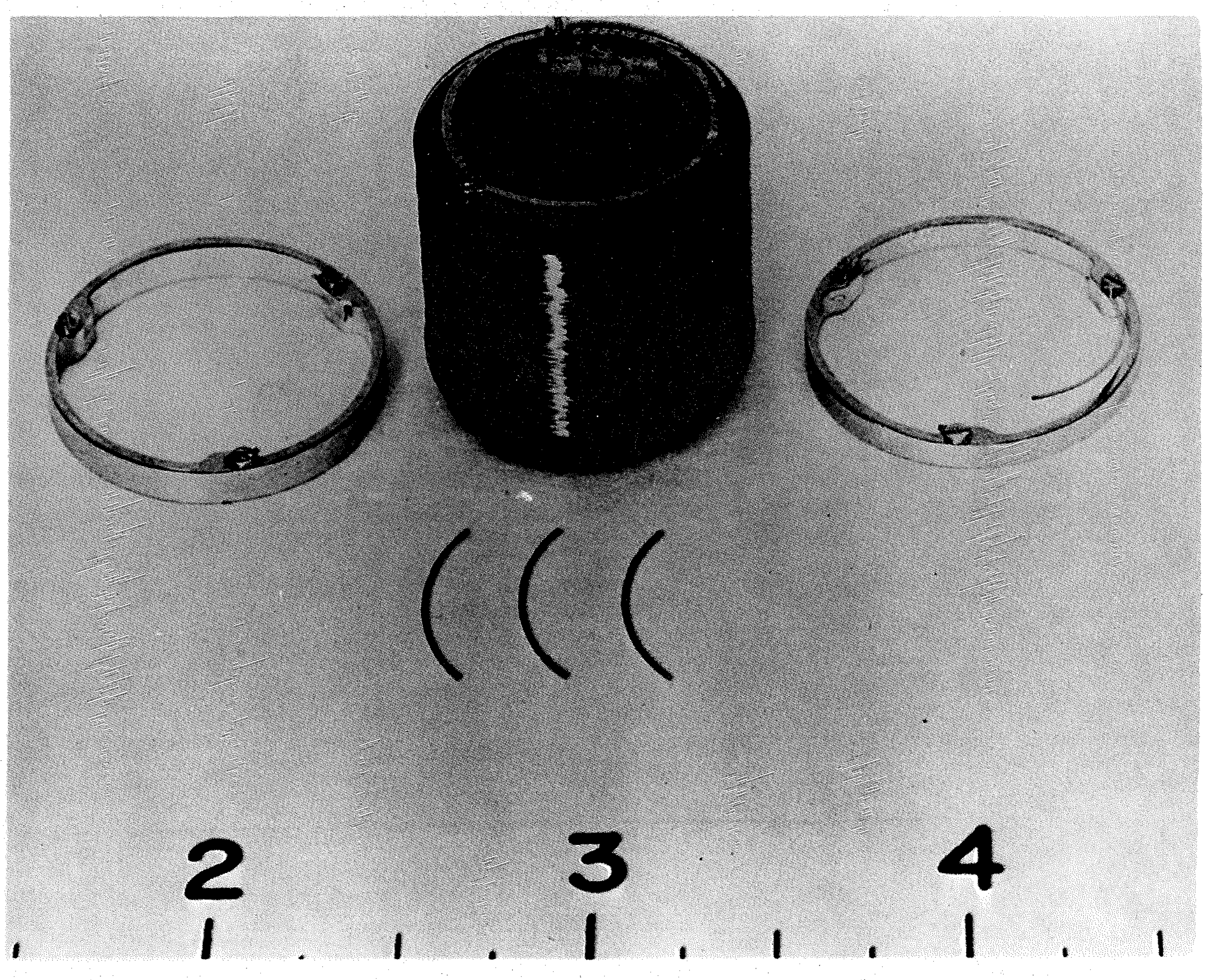
8. OTHER

   a. PROTOTYPE RECEIVER ACCEPTED

   b. THERMAL BATTERIES - QUALIFIED AND DELIVERED

   c. GRENADE TRANSMITTER - OUTPUT PROBLEM


1
2
3


2
3
4

DETECTION SYSTEM SPECIFICATIONS

1. Sensitivity: 18 db SNR for 5 mμ displacement at 10 Hz minimum

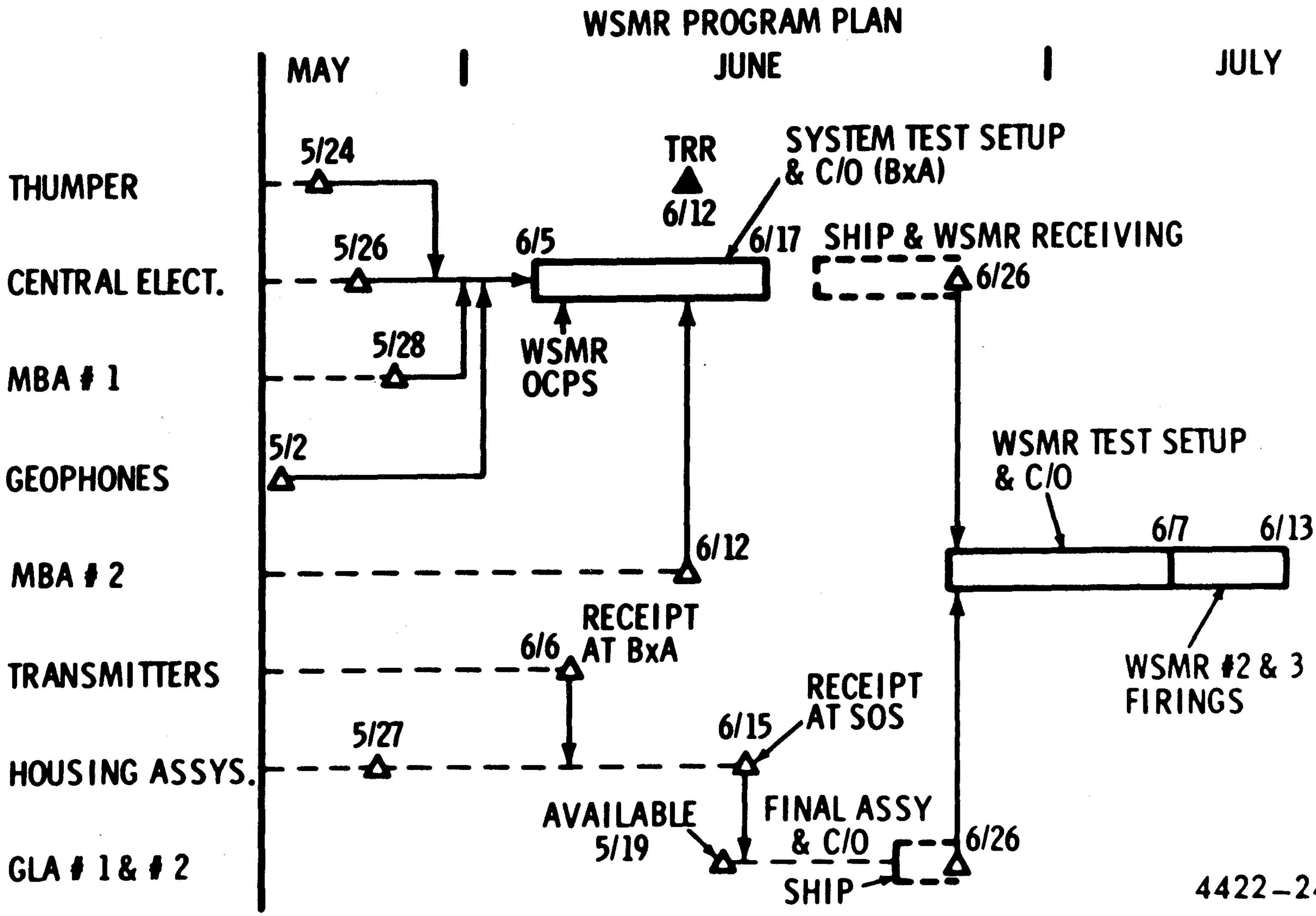
2. Frequency Response (Design Goal):
   3 - 10 Hz: +1 db to -3 db
   10 - 100 Hz: +1 db to -1 db
   100 - 250 Hz: +6 db to -6 db
   250 - 450 Hz: Less than +1 db
   Above 450 Hz: Less than -38 db

3. Dynamic Range: 80 db at input log
   Compressed to 5 bits at output (7 bits Array A)

4. Time Resolution ±1 msec (Sampling Frequency $\leq$ 500 Hz)

NASA
S-67-30854

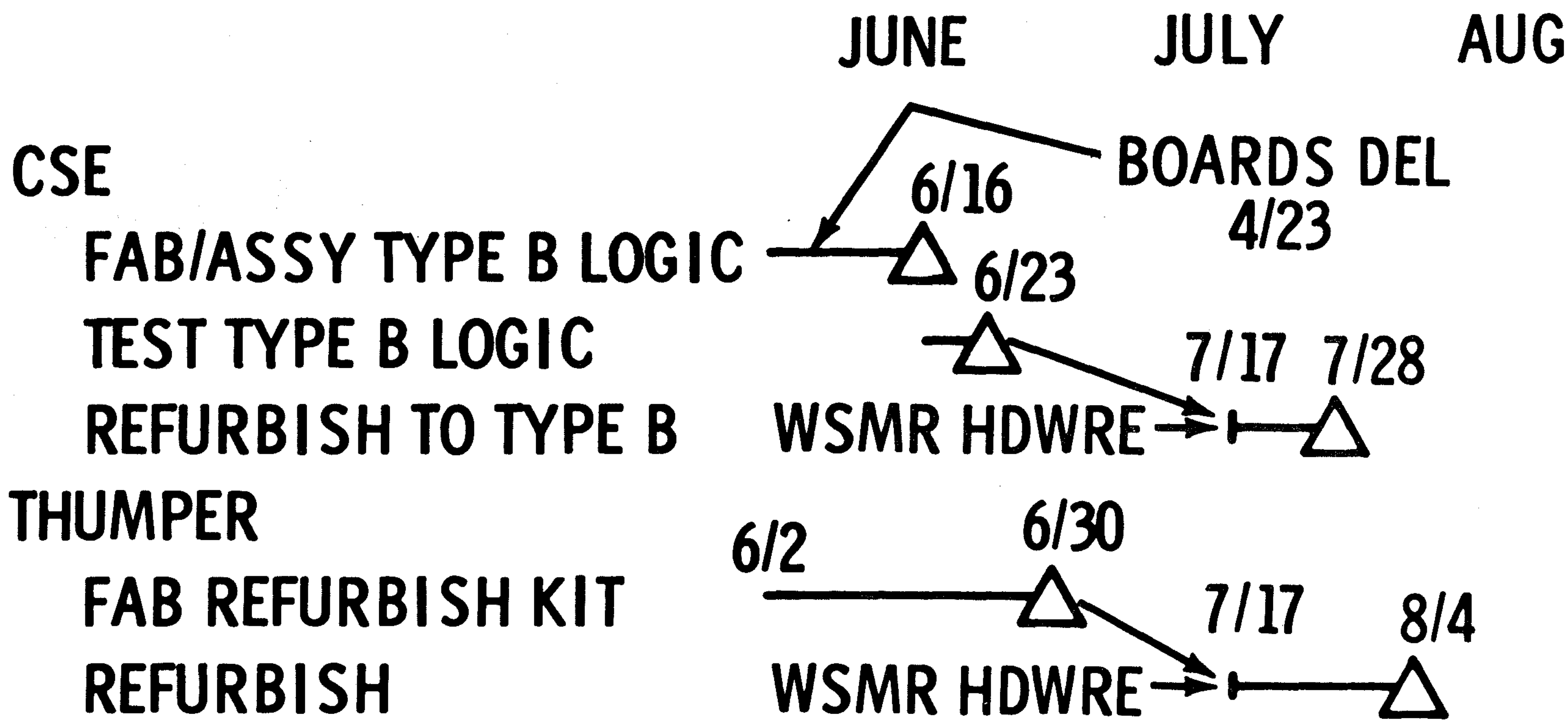
ACTIVE SEISMIC EXPERIMENT



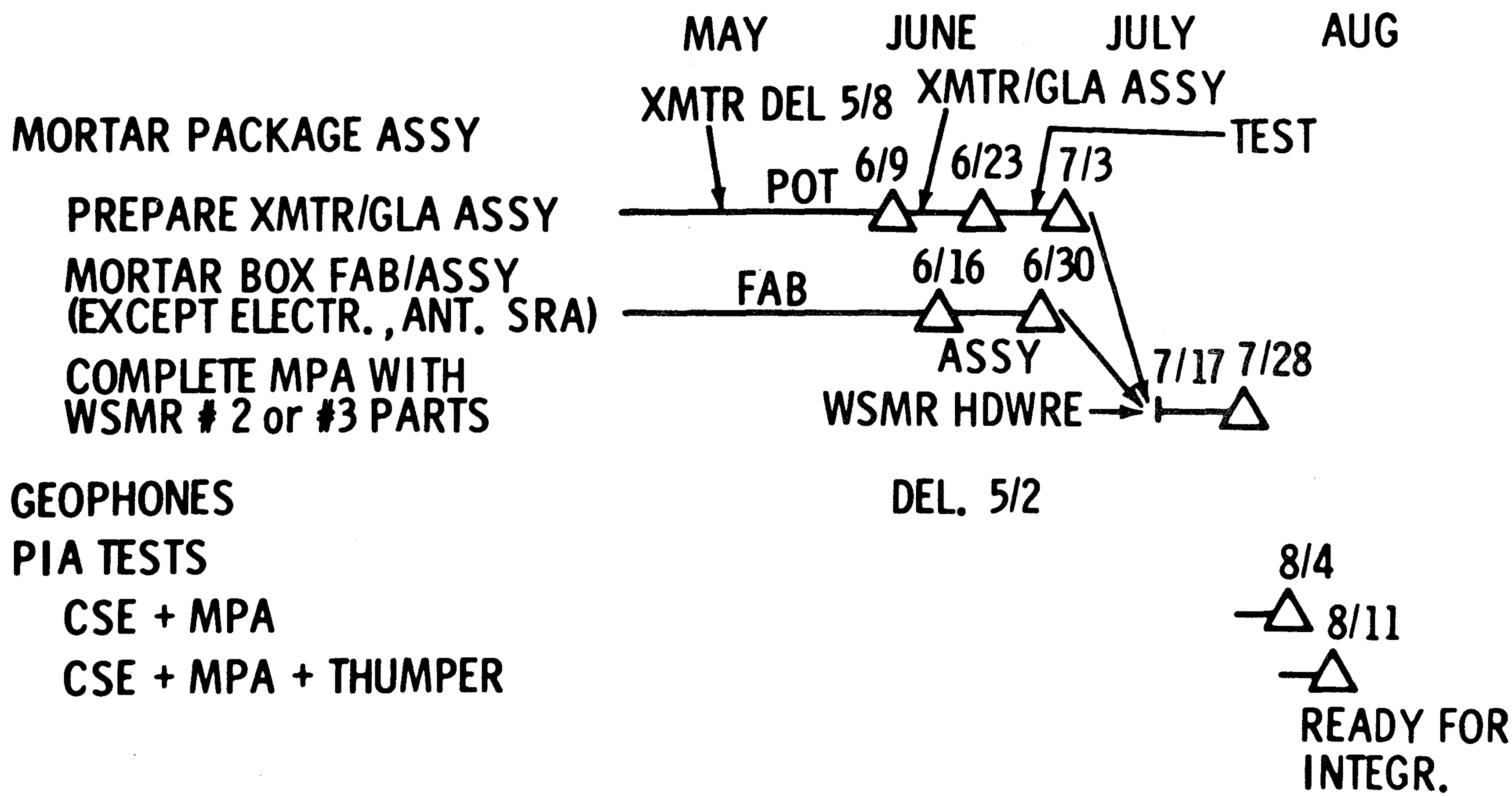
4422–2479

NASA
S-67-30843

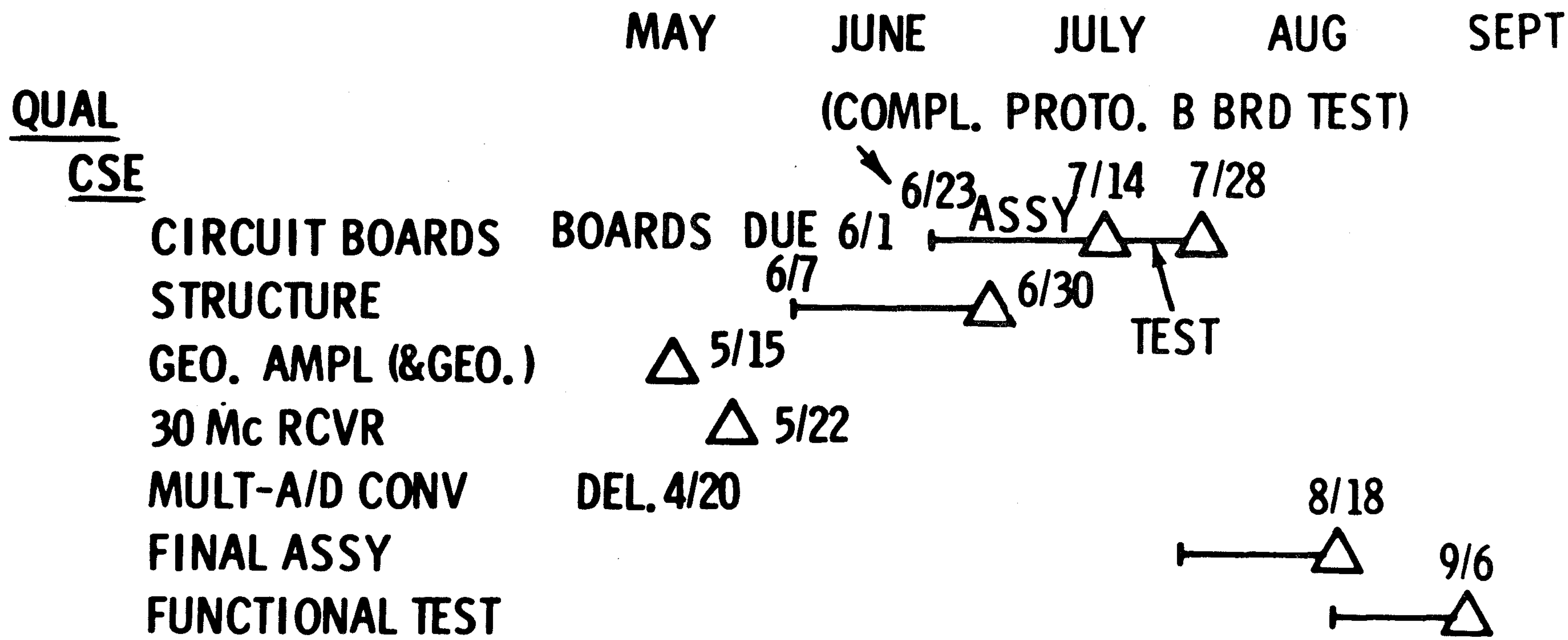
ASE PROTOTYPE SCHEDULE



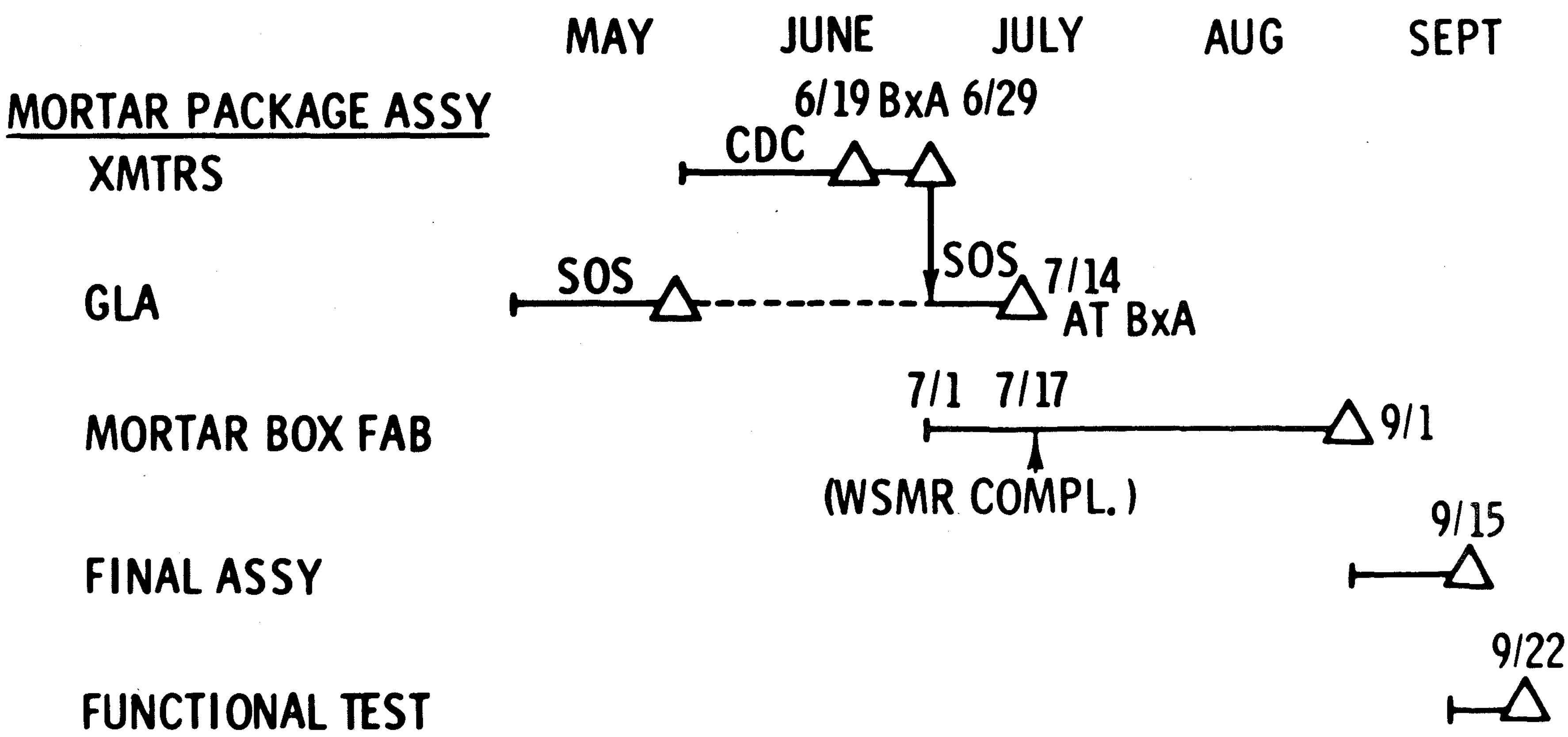
ASE PROTOTYPE SCHEDULE (CONT'D)



ASE QUAL & FLIGHT SCHEDULE

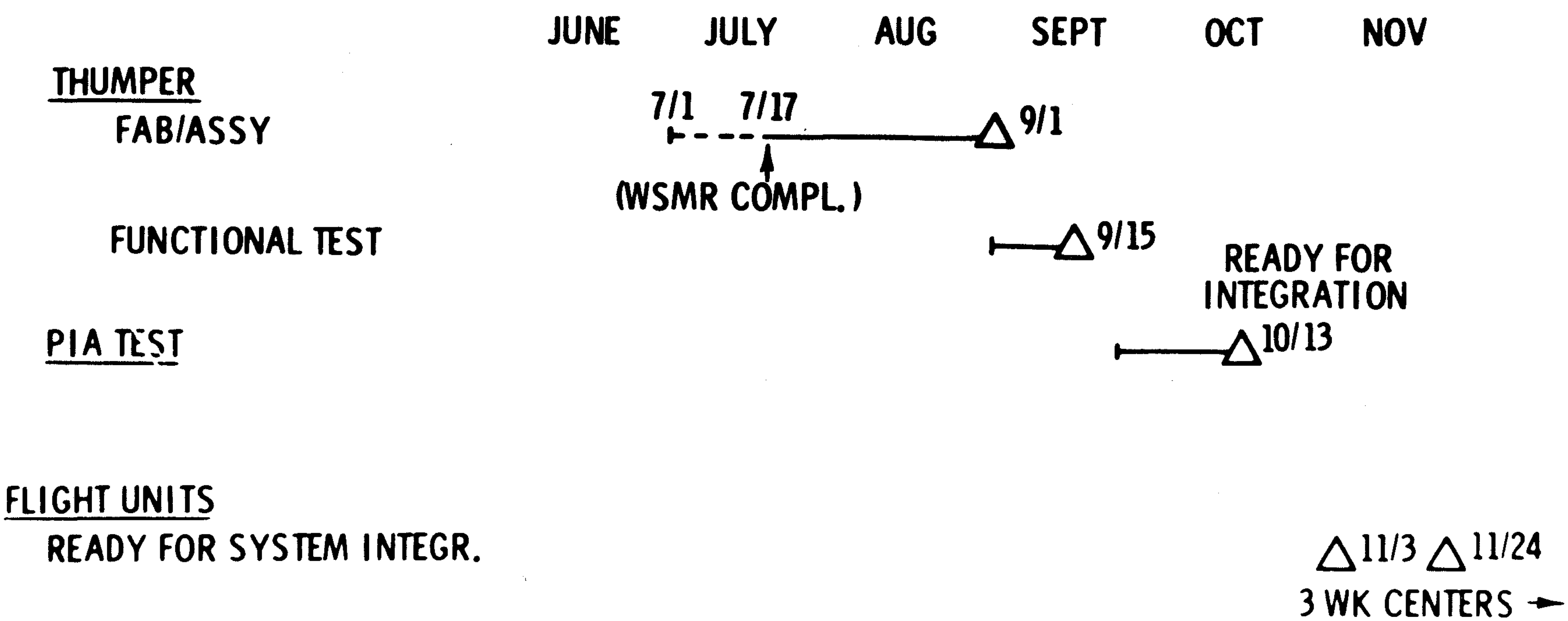


ASE QUAL & FLIGHT SCHEDULE (CONT'D)



NASA
S-67-30844

ASE QUAL & FLIGHT SCHEDULE (CONT'D)



NASA
S-67-30850

HEAT FLOW EXPERIMENT STATUS

ELECTRONICS (GULTON IND.)

ENG. MOD # 1

A. REPAIRED ELECTRONICS.

B. COMPLETED CAT # 2 AND CAT # 3 TESTING.

C. CAT # 4 TESTING IN PROGRESS.

ENG. MOD # 2

A. UNIT ASSY COMPLETE.

B. IN UNIT CHECKOUT WITH ETS.

C. ACCEPTANCE TESTING TO START 5-15-67.

PROTOTYPE

A. ALL PC BOARDS ASSEMBLED.

B. BOARD ELECTRICAL CHECKOUT IN PROGRESS.

C. UNIT ASSEMBLY SCHEDULED FOR 5/13/67.

D. UNIT CHECKOUT SCHEDULED FOR 5/17/67.

E. ACCEPTANCE TESTING SCHEDULED FOR 5/22/67.

NASA
S-67-30836

HEAT FLOW EXPERIMENT STATUS (CONT'D)

PROBES (ADL)

A. ENG MODEL & BRASS BOARD PROBE UNDERGOING CONTINUOUS ENG. TESTING.

B. PROTOTYPE PROBES IN GRADIENT & CONDUCTIVITY TEST CYCLE.

C. FIRST QUAL PROBE ASSEMBLY COMPLETED, STARTING ASSEMBLY OF SECOND PROBE.

THERMAL DESIGN (BxA)

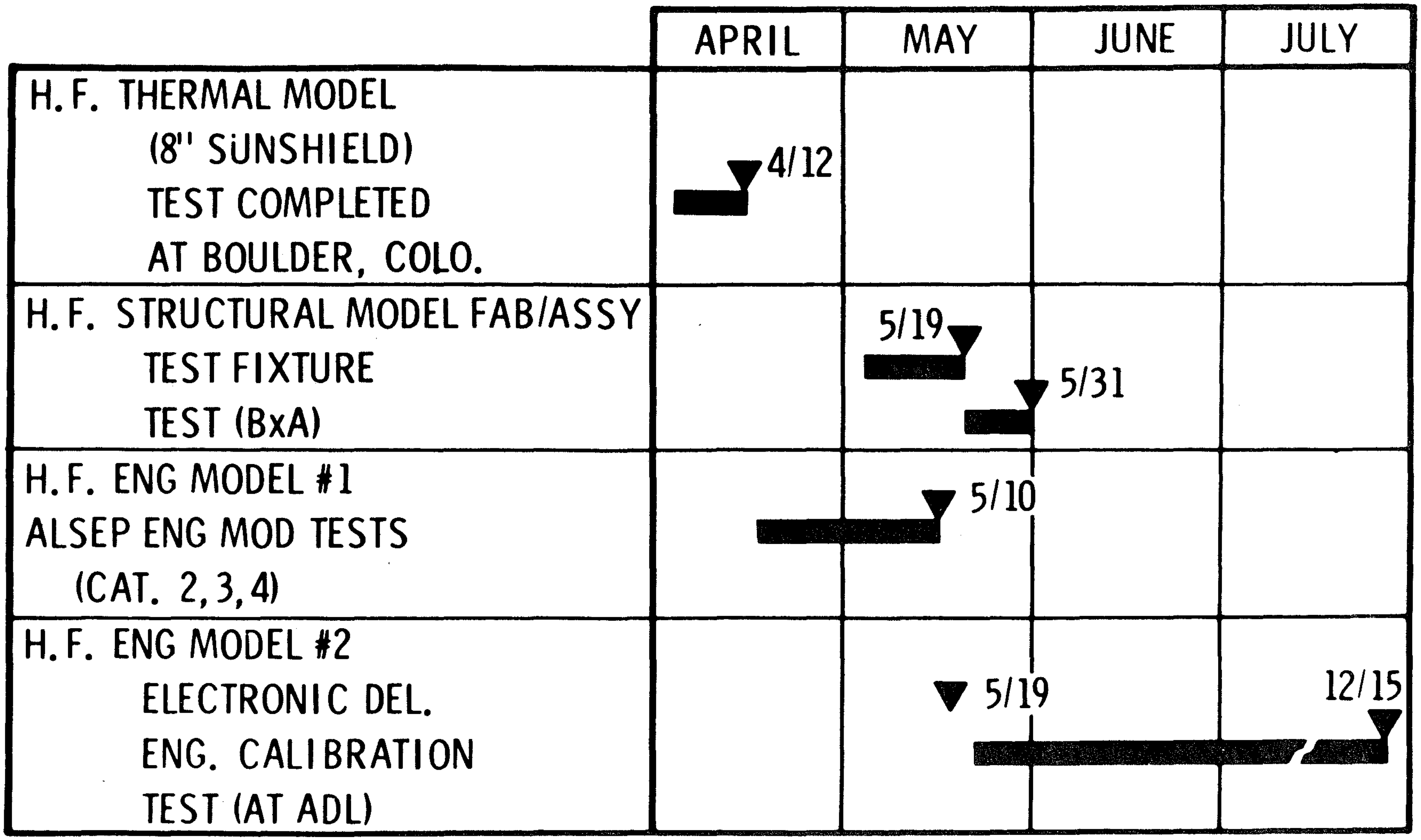
A. THREE SUNSHIELD HAVE BEEN ANALYSED.

B. THERMAL TESTS COMPLETED ON THERMAL MODEL.

C. SECOND THERMAL TEST TO BE SCHEDULED MID-JUNE.

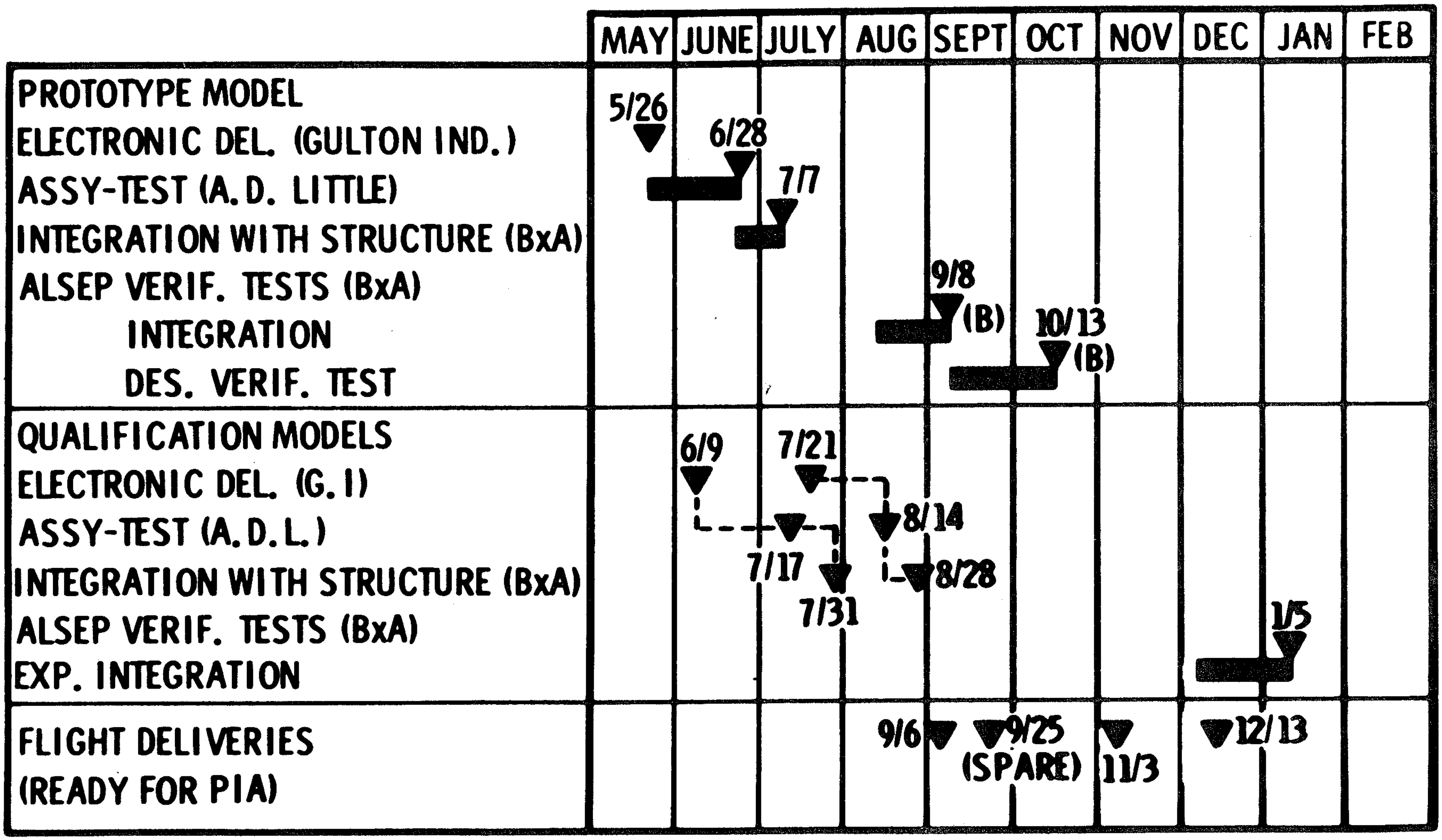
NASA
S-67-30837

H.F.E. DEVELOPMENT SCHEDULE

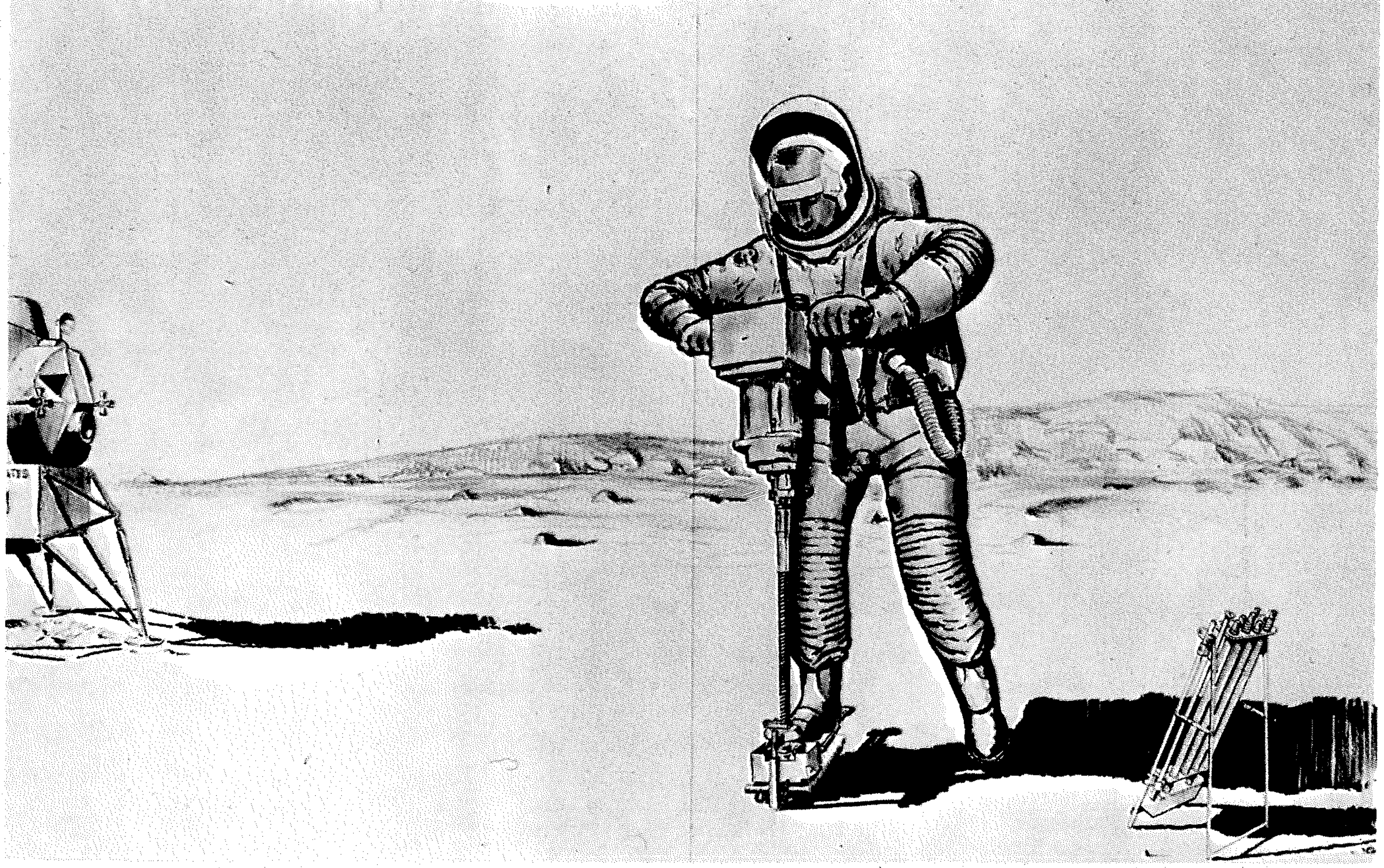


NASA
S-67-30835

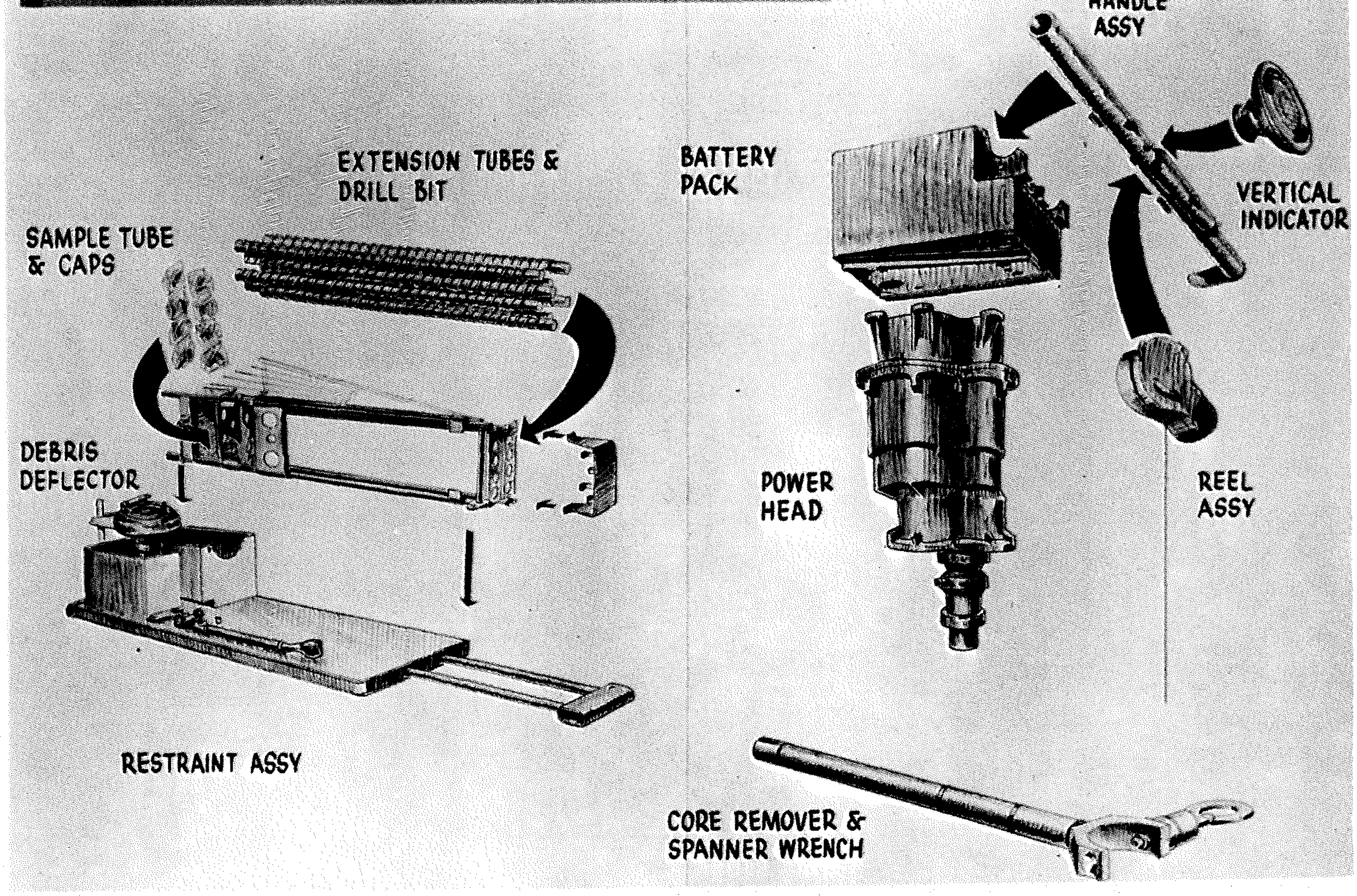
H.F.E. DELIVERABLE HARDWARE SCHEDULE

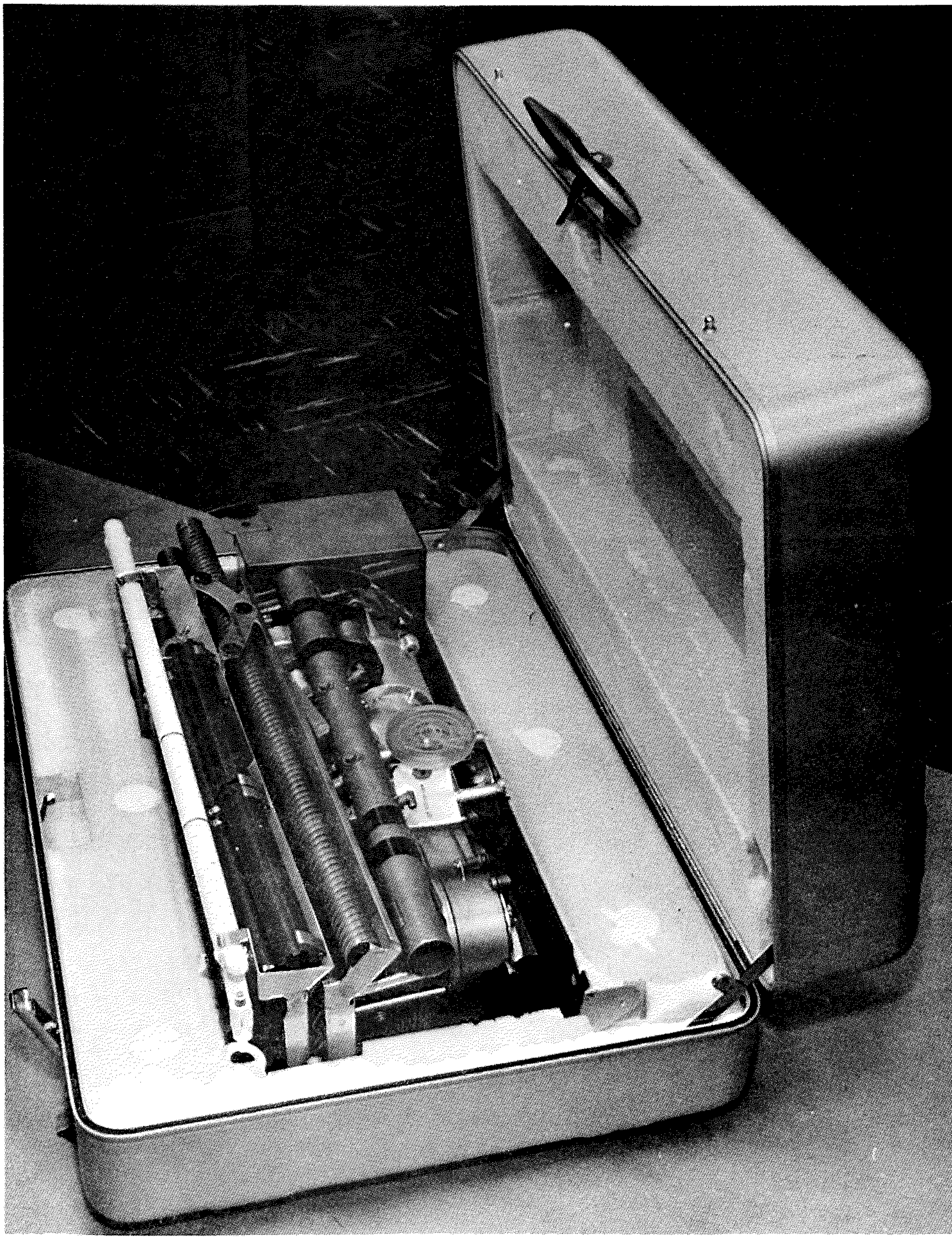


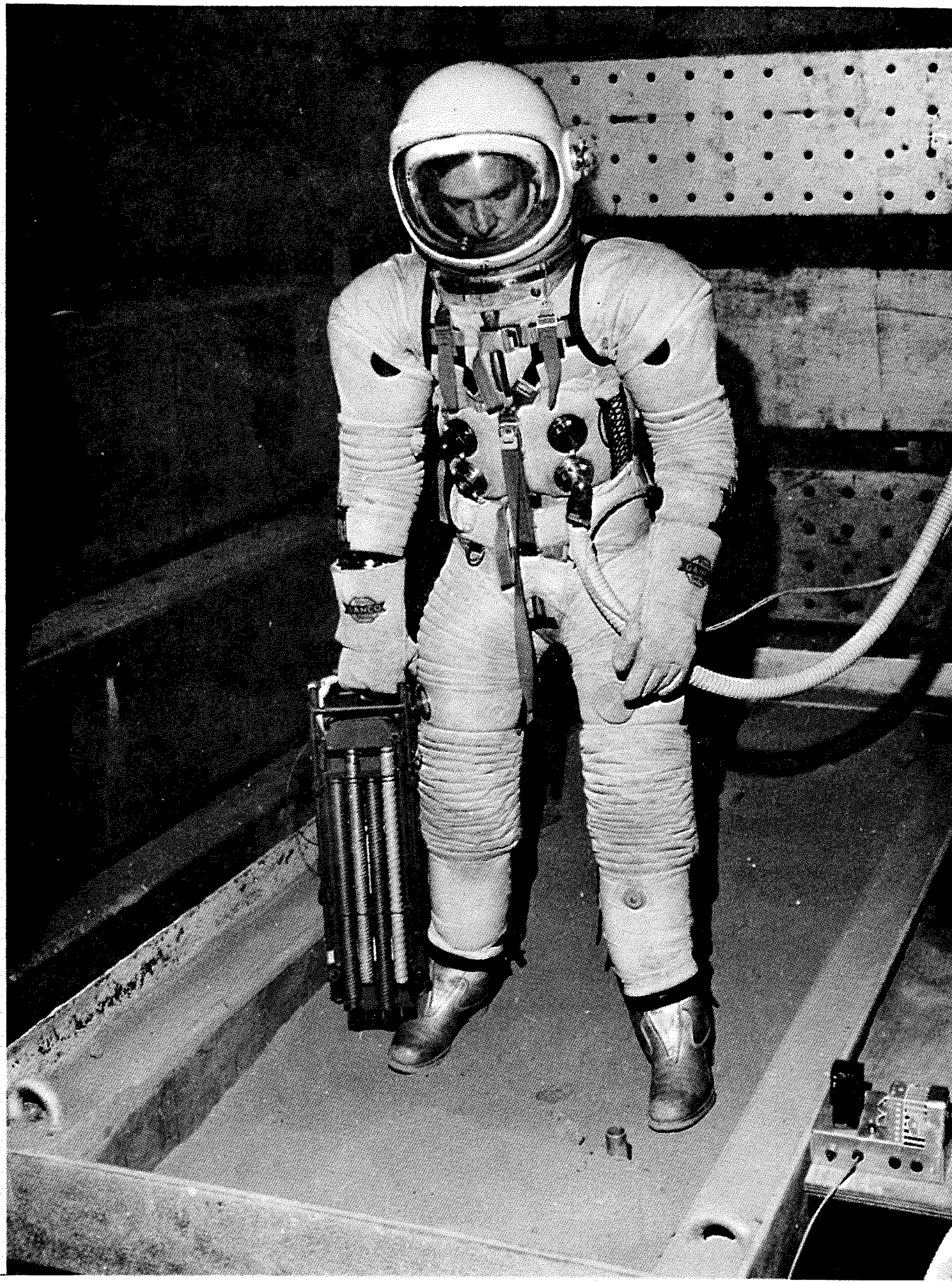
ALSD OPERATIONAL MODE

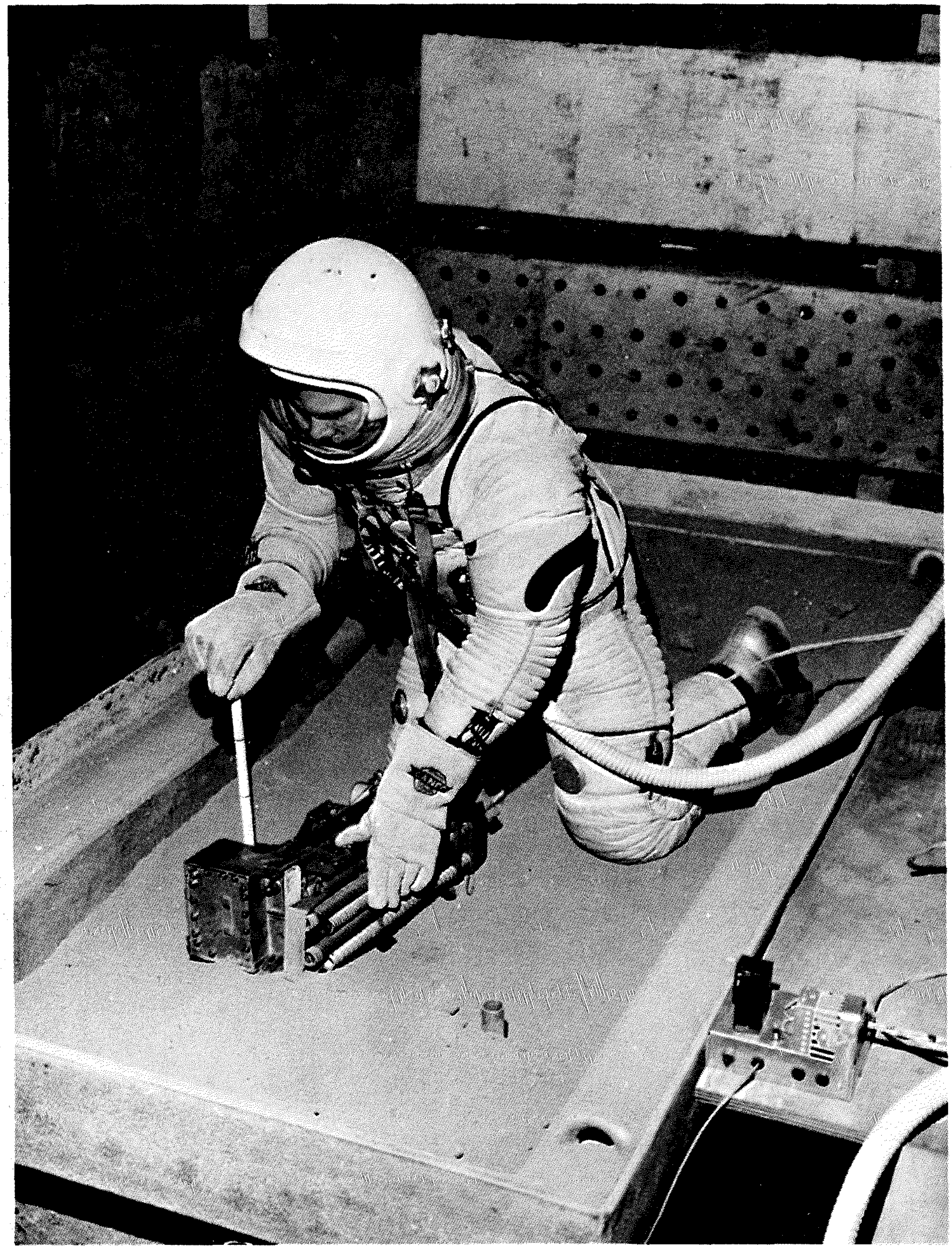


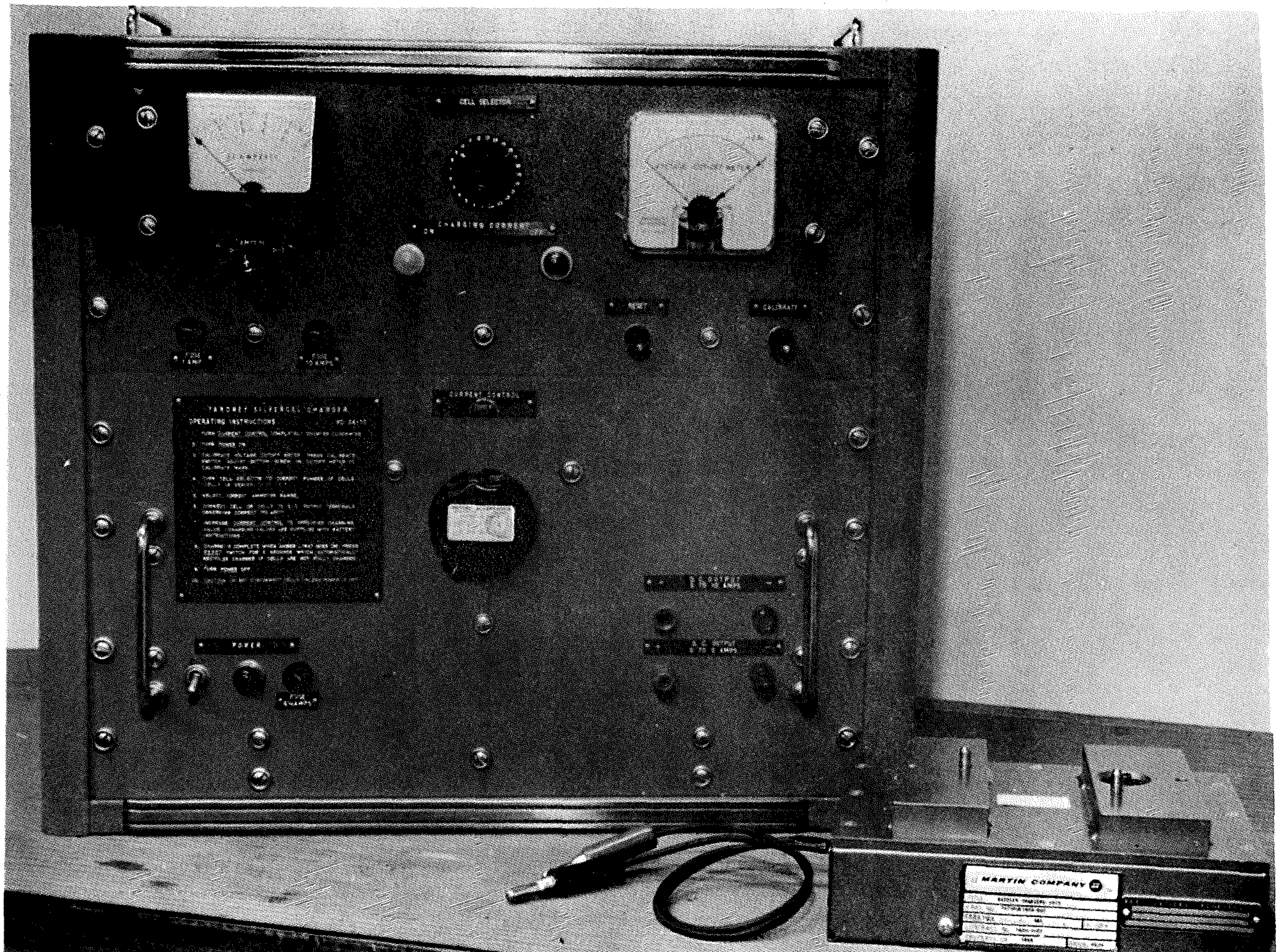
ALSD (ASSEMBLED)

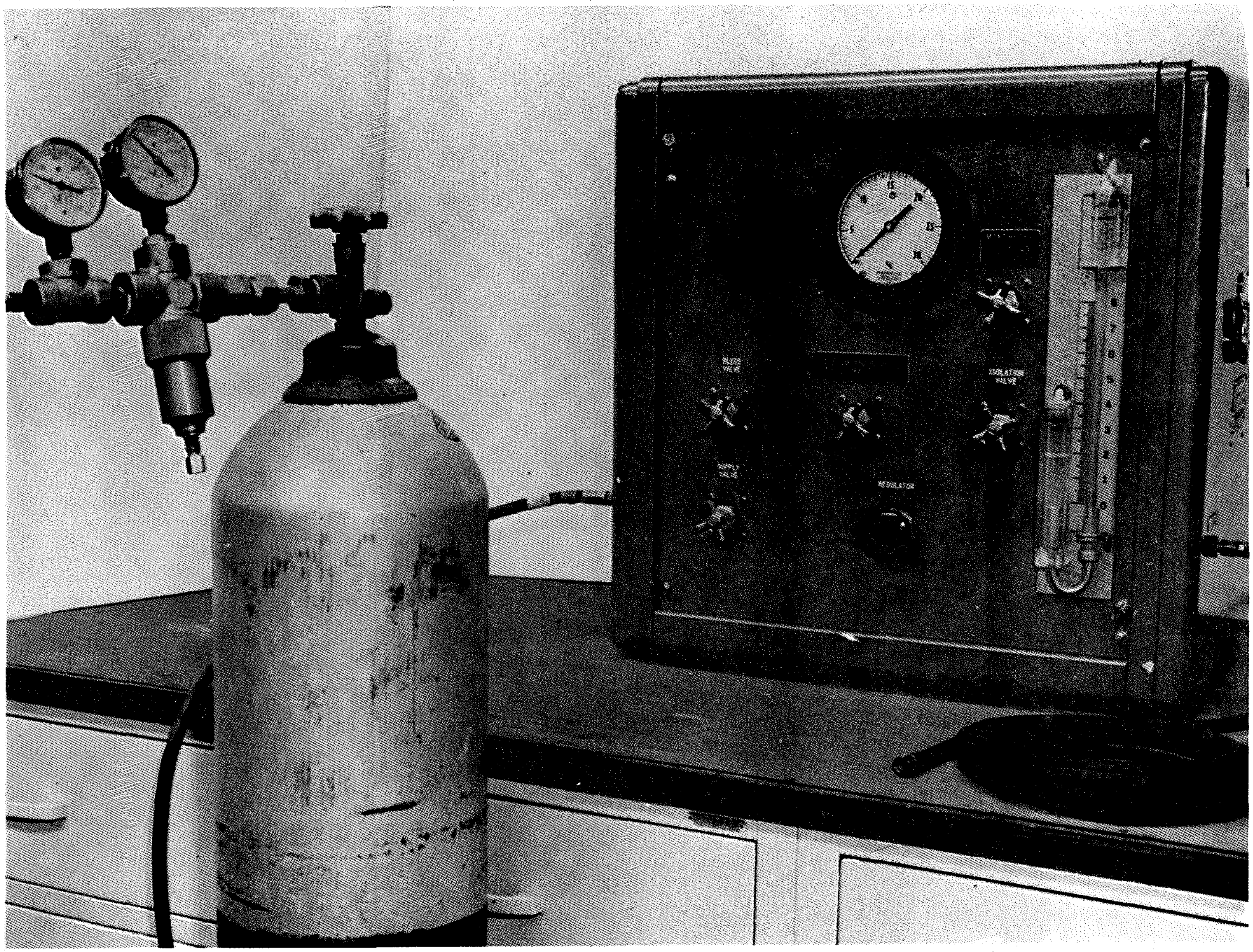









OPERATING INSTRUCTIONS
MARTIN COMPANY



NASA
S-67-30874

ALSD DEVELOPMENT TESTS

COMPLETED

- ELECTROMAGNETIC INTERFERENCE
- MAGNETIC FIELD MEASUREMENTS
- BATTERY CELL ELECTRICAL CHARACTERISTICS
- POWERHEAD MOTOR HIGH TEMPERATURE
- POWERHEAD SEALS
- START CYCLE POWER LOSSES
- PRELIMINARY ALSD DRILLING
- ELECTRICAL SWITCH LOW PRESSURE PERFORMANCE
- EXTENSION TUBES OPTIMIZATION
- DRILL STRING TEMPERATURE
- POWERHEAD PERCUSSION SPRING HIGH TEMPERATURE CYCLE LIFE

IN PROGRESS

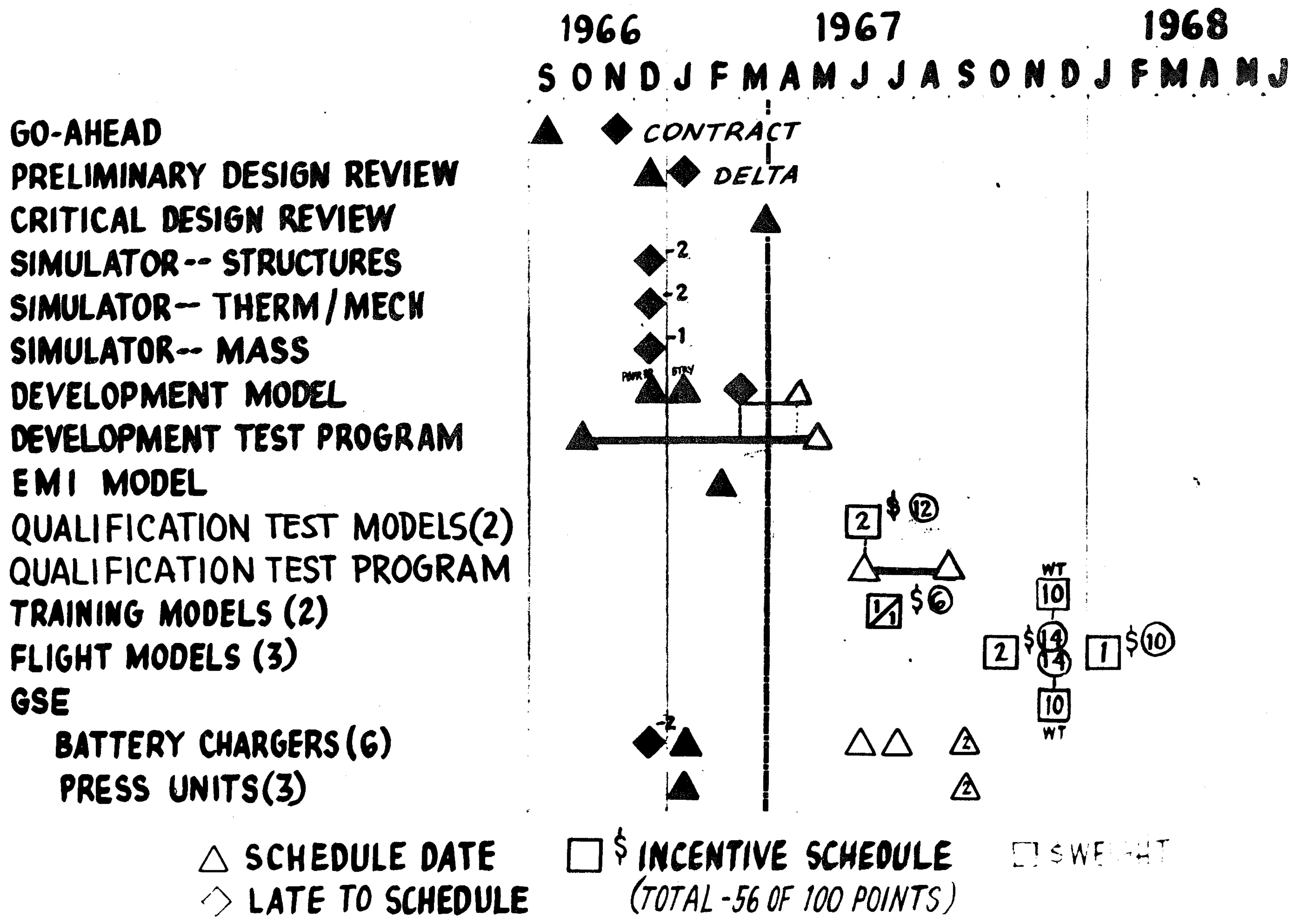
- CORE BIT OPTIMIZATION
- HOLE CASING SLEEVE TESTS
- SPACESUIT OPERABILITY

TO BE COMPLETED

- ALSD HIGH VACUUM

NASA
S-67-30871

ALSD MAJOR MILESTONES SCHEDULE



SNAP 27 SIGNIFICANT EVENTS

- MOD 15 SYSTEM (BENDIX QUAL UNIT) SHIPPED 4/24
- M6, M7, ASTRONAUT TRAINING MOCK-UPS PLACED ON HOLD TO 6/15
- TWO FUEL CAPSULES SET FOR FUELING (QUAL, 1ST FLIGHT)
- THIRD CAPSULE SET PARTS AVAILABLE (BACK-UP UNIT)
- CAPE KENNEDY SUPPORT PACKAGE ON HOLD
- FAMILIARIZATION MANUAL ISSUED
- FIRST IPU CABLE TRANSMITTED TO BENDIX
- BENDIX CONNECTOR INSTALLED ON MOD 15 GENERATOR
- SAFETY ANALYSIS REPORT RESCHEDULED TO JANUARY 1968
- QUALIFICATION COMPLETE ON IPU TEST CONSOLE
- QUAL COMPLETED ON GENERATOR AND BACKUP THRU SHRINK FIT
- HOT CAPSULE GENERATOR ASSEMBLY INSERTION TEST COMPLETED
- MOD 5 HOURS - ACCUMULATION 1925 HOURS THERMAL VACUUM (70.7 WATTS)
- FIRST GRAPHITE CASK MATERIALS RECEIVED
- PHASE I MAGNETIC MEASUREMENT COMPLETED

MOD 15 SYSTEM

GENERATOR ASSEMBLY

HOURS		> 500
POWER (WATTS)		
	LUNAR DAY	72.5
	LUNAR NIGHT	75.8
WEIGHT		27.968
CABLE		ROCKBESTOS 160"
CONNECTOR		BENDIX

GENERATOR SHIPPING CONTAINER

PRESSURIZED - ARGON/He

MODIFIED TO SUPPORT BENDIX CONNECTOR

TEST CONSOLE/CONSOLE SHIPPING CONTAINER

CONSOLE QUALIFIED AND CALIBRATED

MODIFIED FOR EMI SUPPRESSION

FLIGHT HANDLING TOOL/TOOL SHIPPING CONTAINER

TOOL WITH GOLD PLATED FACE

GROUND HANDLING TOOL/TOOL SHIPPING CONTAINER

TORQUING MECHANISM

HOT CAPSULE INSERTION TEST

- TEST PERFORMED IN THERMAL VACUUM

  $T_{SINK} = 8^{o}F$

  $T_{GENERATOR} = 80^{o}F$

  $T_{CAPSULE} = 800^{o}F$

- TEST RESULTS

  16 VOLTS OBTAINED IN 30 MINUTES - 0 WATTS

  16 VOLTS AND 27 WATTS IN 48 MINUTES

  WITH $1300^{o}F$ CAPSULE

  16 VOLTS & 56 WATTS - 60 MINUTES (ESTIMATE)

MAGNETIC TEST RESULTS

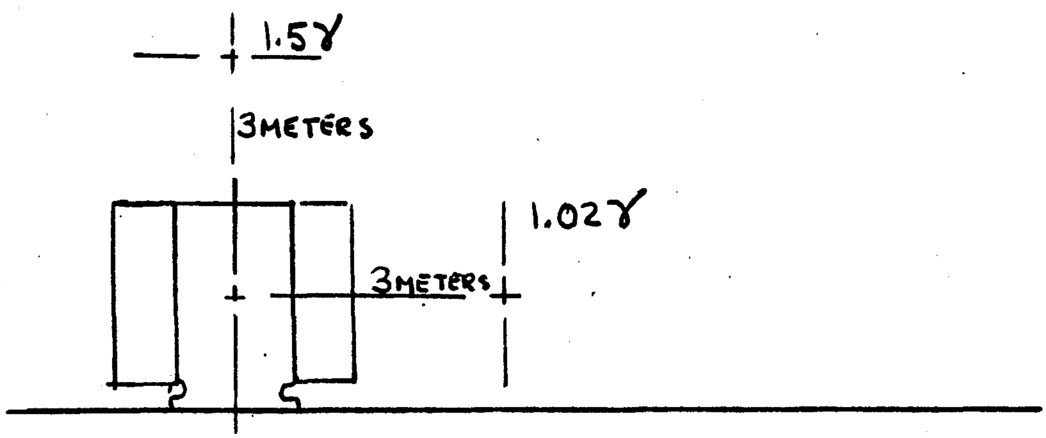
GENERATOR - MOD 8B

- MODIFIED ENGINEERING UNIT
- CONTAINED EXTRANEOUS IRON INSTRUMENTATION

PLACE - GODDARD SPACE CENTER

RESULTS

- GENERATOR ROOM TEMP
- CURRENT FLOW 4 AMPS
- PERM ADDED FOR VIBRATORY ENVIRONMENT



PREDICTION FOR PRIME GENERATOR AT TEMPERATURE $< .75\ \gamma$

AEC ESTIMATE OF SNAP-27 POWER

- BEGINNING OF LIFE (1,000 TO 2,000 BURNING AT 16 VOLTS

  = 70 WATTS)

- ESTIMATED POWER OUTPUT AFTER 1 YEAR OPERATION

  = 65 WATTS

  BASED ON PREDICTED 1.2% PER 1,000 HOUR DEGRADATION COMMENCING AFTER 3,000 HOURS

- WORST CASE CONDITION

  = 59 WATTS END OF LIFE

  BASED ON 3 YEARS FUEL CAPSULE STORAGE AND A MINIMUM FUEL CAPSULE LOADING COUPLED 1.2% PER 1,000 HOUR DEGRADATION COMMENCING AFTER 3,000 HOUR OPERATION

BENDIX PRESENTATION

ALSEP INTERFACE CONFERENCE

11 May 1967

In our last meeting at KSC on 5 April, I reported that the central station was on schedule supporting the original delivery date of 14 July. At the present time, we have every reason to be confident that this is still true. Although we are encountering the normal problems expected in any development program, these problems to date have not been of a nature to preclude meeting the original schedule. Chiefly, our problems encountered in the past month have been in areas of the qualification model where changes resulting from the Delta PDR were incorporated for the first time. However we have just this week successfully passed each of our qual model data subsystem component through component level functional, hot and cold tests. We expect to complete qual model central station integration and check-out next week, mechanical build up and PSE integration by the end of May and be ready for the other qual model experiments by 1 June.

Last month I showed several photographs of our hardware, so I won't repeat that again. However, I would like to show you just a few of the items which I did not include then.

Slide 1 - This is the prototype data subsystem integrated on the prototype thermal plate. As you know, the prototype central station was integrated and checked out on 9 March. Since that time we have successfully checked out and integrated with this central station, prototype models of the Solar Wind Experiment (twice), Passive Seismic Experiment, Magnetometer and the MSC Cold Cathode Gauge Experiment. In late April, we were fortunate to have three of these experiments at the same time (SWS, PSE, LSM) and successfully operated them together along with the System Test Set simulator for the SIDE in a complete system functional tests.

Since that time, all of these experiments except the LSM have been returned to their manufacturers for various additional work and tests. All are either back in Ann Arbor now or will be by next Monday so that we can complete final functional tests and fit checks prior to starting our system design verification tests by 1 June.

Slide 2 - Since I did not see any item on the agenda to cover it, I took the liberty of adding in here a picture of the MSC Cold Cathode Gauge Prototype Model. This model has been integrated successfully with both our engineering and prototype systems and is expected back in Ann Arbor next Monday for integration in the prototype system. This will complete its operation in the prototype, according to our present plan.

Slide 3 - I mentioned earlier the plan to run fit checks on each prototype experiment as soon as they are received. This is the prototype sunshield, complete with mounting brackets, ready for mechanical integration.

Slide 4 - In the mechanical area, one significant accomplishment over the past month has been the successful completion of our static structural tests with our Proto 1 Model. This slide shows that model as it was being assembled in our static test fixture. (Slide 11) Last Friday we completed these tests with the results confirming our analytical prediction extremely closely. The tests included the application of static loads in the Minus X (down on sunshield), plus X (up on sunshield) and Z (sideways) axes. These loads were applied from a level of 50% of qual level, up, in 10% increments, to 100% and then in 5% increments up to 115%. The loads were zeroed between each step. The 100% load was the static equivalent of the 27g load to be applied in the qualification dynamic tests.

The hardware involved is the flight configuration primary structure and thermal plate and a sunshield which differs from flight configuration only in a slight relocation of the experiment mounting points. All central station electronic components were simulated in mass and c.g. as well as the three experiments to be located on Pallet No. 1 in the Flight No. 1 configuration.

The tests showed no permanent set in the structural components and theoretical predictions of deflections were confirmed to within one precent.

The model is now being retrofitted with mechanical mockups of the SWS and PSE and the Ames dynamic model is being added. Instrumentation is being added to the structure and to the inputs to these experiments in preparation for the dynamic tests which will begin tomorrow.

These tests will begin with a one g sine scan up to 2,000 cycles in each axis to obtain test verification of the dynamic analysis in ATR-16. Following this, we will run the sine qualification level vibration test and then the random qualification level vibration tests. These tests will be to the qualification levels stated in ATR-16 and not to the levels suggested by the LTA-3 tests in keeping with MSC direction.

From all indications, we will have quite a group in attendance at these tests including Herb Cross and Bob Vale - but we welcome your observation of these important tests. The present schedule calls for completion of these tests about 19 May.

<u>Slide 5</u> - I couldn't resist just slipping in a couple of pictures of our qual hardware, even though they look just like their prototype equivalents. This is the qual model Command Decoder which passed its tests earlier this week.

<u>Slide 6</u> - This is the qual model Data Processor which also went through its tests last week. These component level tests, which we run on each component prior to central station integration, include full functional tests with the appropriate test sets at ambient, in a cold soak down to -22°F and in a hot box up to +158°F. As I mentioned earlier, difficulties were encountered in these tests on the PDU in the delayed ripple-off circuit, added since the prototype, and on the Command Decoder in the delayed timing command circuit, also added since the prototype. These problems have now been corrected, however, and central station integration is proceeding.

Before I go on to the schedule status, I would just like to mention briefly the status of the engineering model tests on which Lynn Lewis gave you a more detailed report last month. Since that time we have completed Category 2 tests (individual experiments) on all (eight) experiments, including the MSC CCGE.

We have also checked out the System Test Set software on all experiments except the ASE. We now have seven months of operation of the engineering model central station digital equipment without a fault.

We expect to complete all engineering model tests by 19 May by finishing the Array "B" Category III and IV tests over the next week.

Slide 7 - Moving on now to schedules, I have already described the status of the prototype model. As you can see, the LSM was delivered on 13 April. The PSE was delivered for functional integration on 15 April and will be returned this weekend following completion of the rest of its acceptance tests. The SWS was brought in for functional integration on 15 March, returned to JPL for additional tests, brought back to Bendix again on 10 April for integration with the other experiments, returned to JPL for additional rework and tests and, at the time this slide was made we expected it back yesterday but now understand it should be in by Monday, the 15th. The SIDE prototype was received for the first time yesterday. The MSC CCGE was delivered on 26 April, went through functional integration, was returned to MSC for additional work and will be back next Monday. These final deliveries will permit completion of experiment integration by 22 May and start of design verification tests by 1 June. These tests, will proceed according to the plan described by Al Schorken last month, including vibration and thermal vacuum, with completion scheduled for 30 June.

Slide 8 - On the Qual Model, we expect to complete central station integration by 31 May. These schedules show experiment deliveries on the dates indicated with diamonds. The short bar shows the receiving inspection and pre-integration acceptance tests and the arrows show the date on which integration with the central station is begun. This slide shows our latest inputs, prior to this meeting, on deliveries of each experiment. You will note the dashed line out to a date of 31 August for the qual model LSM. This date was received just a couple of days ago and we have not had time to consider the alternative actions to accomodate this slip. Accordingly, the mainstream schedule shown here is based upon our previous date of 21 June for the LSM qual model. On that basis, we should have completed experiment integration on 10 July and the qual tests on 26 September. These would be followed by the Mission Simulation Tests through 24 October.

Slide 9 - The first flight model is in component fab and assembly at the present time. This is expected to be completed by 20 May, followed by central station integration by 6 June. The PSE will be delivered on 2 June and ready for integration on 6 June. Based upon the dates we received earlier this week, we will not receive the next flight model experiment until 17 July (SWS) and 20 July (SIDE). Again, we are showing a mainstream program based upon the previous LSM date of 11 August, although we learned this week of the slip to 31 December. It is apparent that a schedule problem of this magnitude is going to take some additional work before we can establish a new plan.

Based upon the previous LSM date we would have completed experiment integration on 22 August and deliver the first flight model on 9 September.

Slide 10 - You will recall that last month Jack Small presented the currently approved Flight Arrays, including the Flight III array consisting of the Passive Seismic, Heat Flow, MSC Cold Cathode Gauge and Charged Particle Lunar Environment Experiments. This slide shows the present schedule for the prototype model of this configuration, replacing the previous Array B prototype schedule.

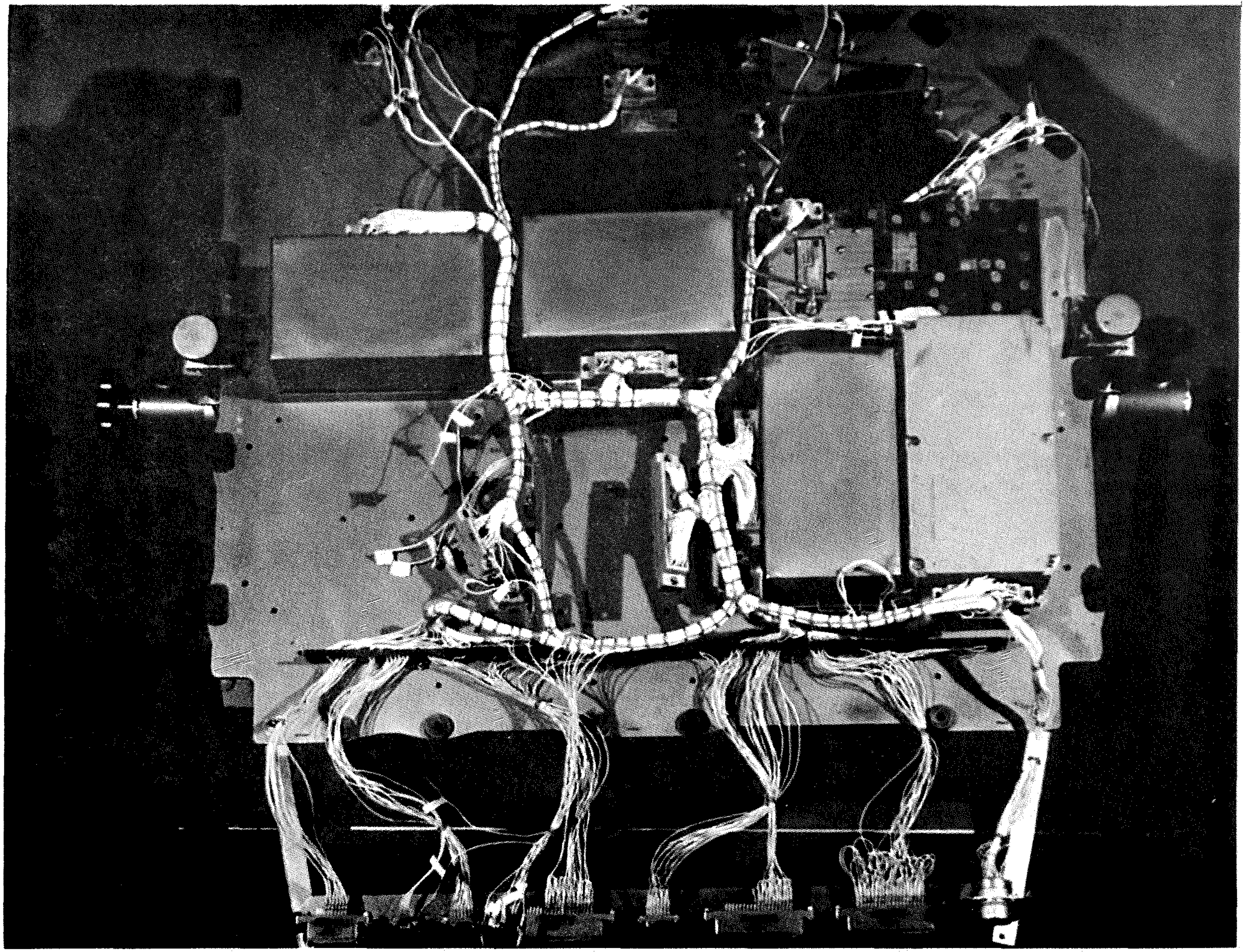
This schedule is paced by the prior prototype tests on the Flights I and II configurations which as I noted are scheduled for completion on 30 June. This will be followed by refurbishment and checkout of this model to the Flight III configuration including any necessary re-work and changes in the sunshield assembly, harness and the addition of any other parts unique to this configuration. The model will then be ready for experiment integration to begin on 11 August. This will be followed by design verification tests between 8 September and 13 October.

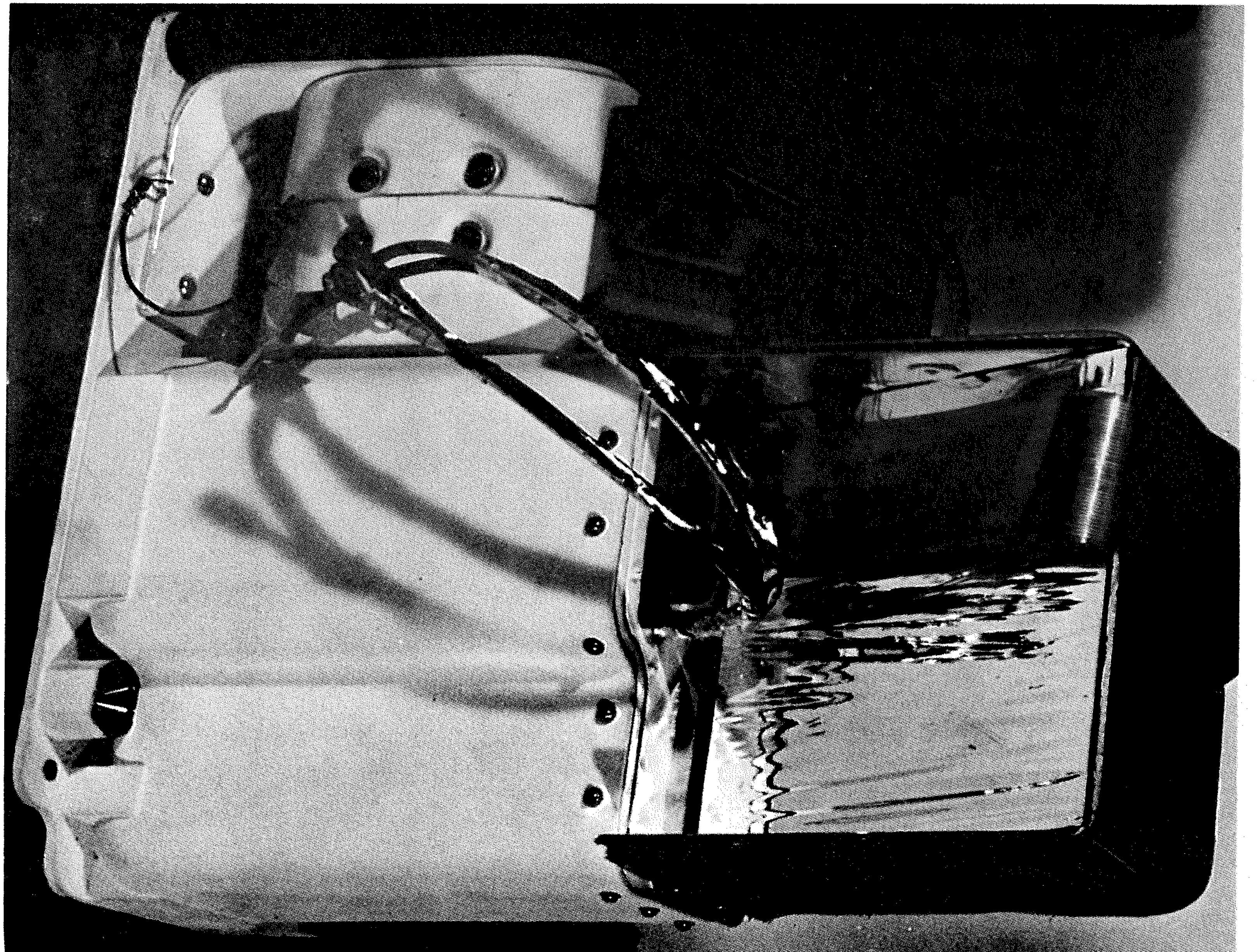
With this constraint of availability of the prototype central station, the current predicted prototype model deliveries of Flight III experiments is well within schedule requirements. The PSE and CCGE prototypes, of course, are available now. The dates for the CPLEE and HFE were given previously.

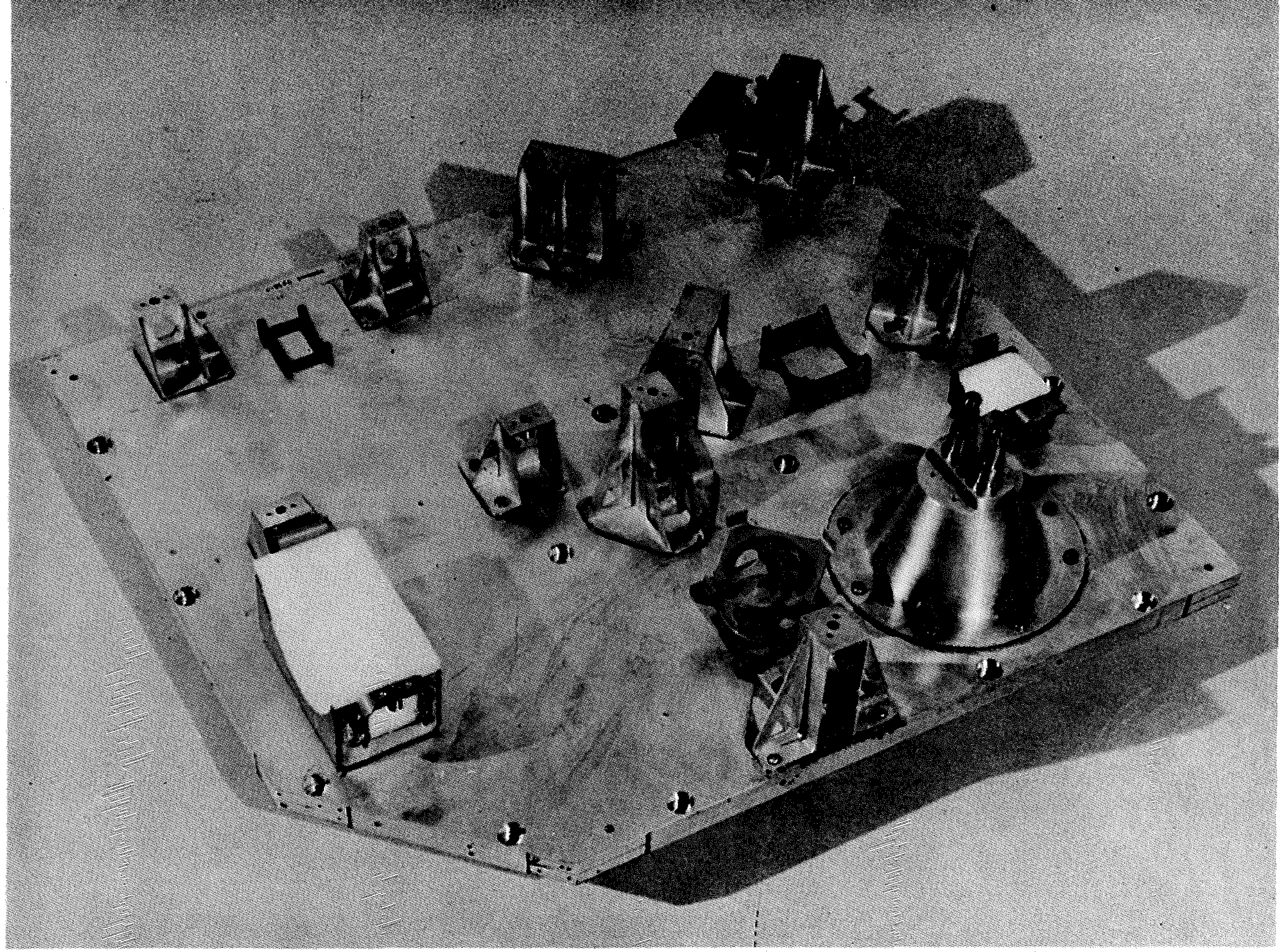
Although the assignment indicated last month for the ASE was to Flight IV, we are still proceeding with an ASE schedule which would be compatible with the Flight III array. Accordingly, I've shown on all these Flight III schedules, the Active Seismic dates. This prototype date of 11 August is the date shown by Jack McDowell earlier as the date the ASE prototype will be available for integration.

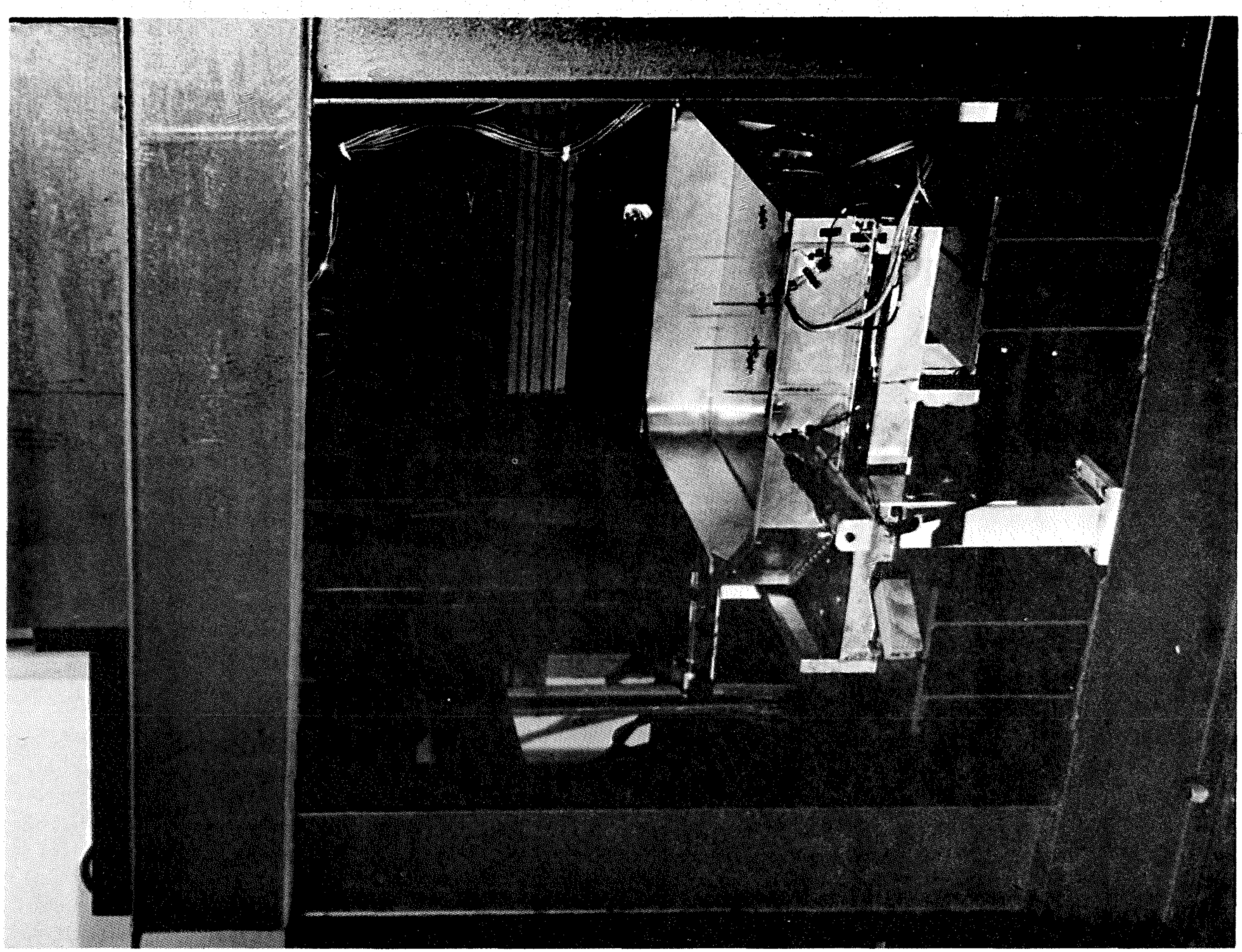
Slide 11 - The Qual Model of the Flight III configuration is also paced by the availability of the qual model central station from the qual tests on the Flight I and II configuration. I showed earlier how the experiment deliveries had delayed the qual model to the point where mission simulation tests are not completed until 24 October. At this point, we will start refurbishment and checkout of this model and, on 5 December, be ready to start experiment integration. As with the prototype, the Flight III experiment qual models as well as the ASE qual model will be available well in advance of this date. Experiment integration is completed by 9 January with qual tests completed by 15 March.

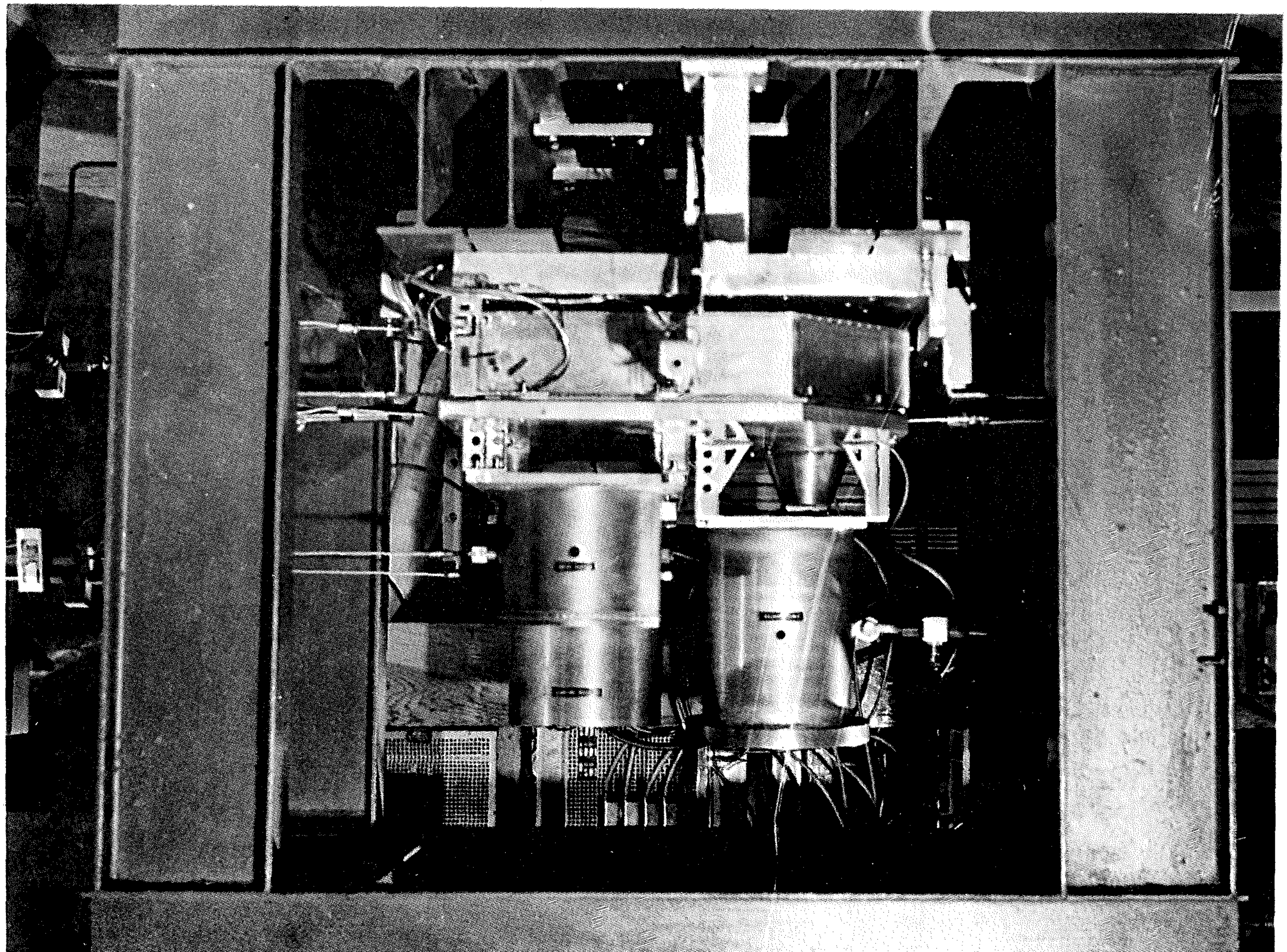
Slide 12 - The schedule for the Flight III flight model has not changed from the original contract dates. Once again, Flight III experiments are available well within the required dates and the ASE flight model is also compatible with this schedule.

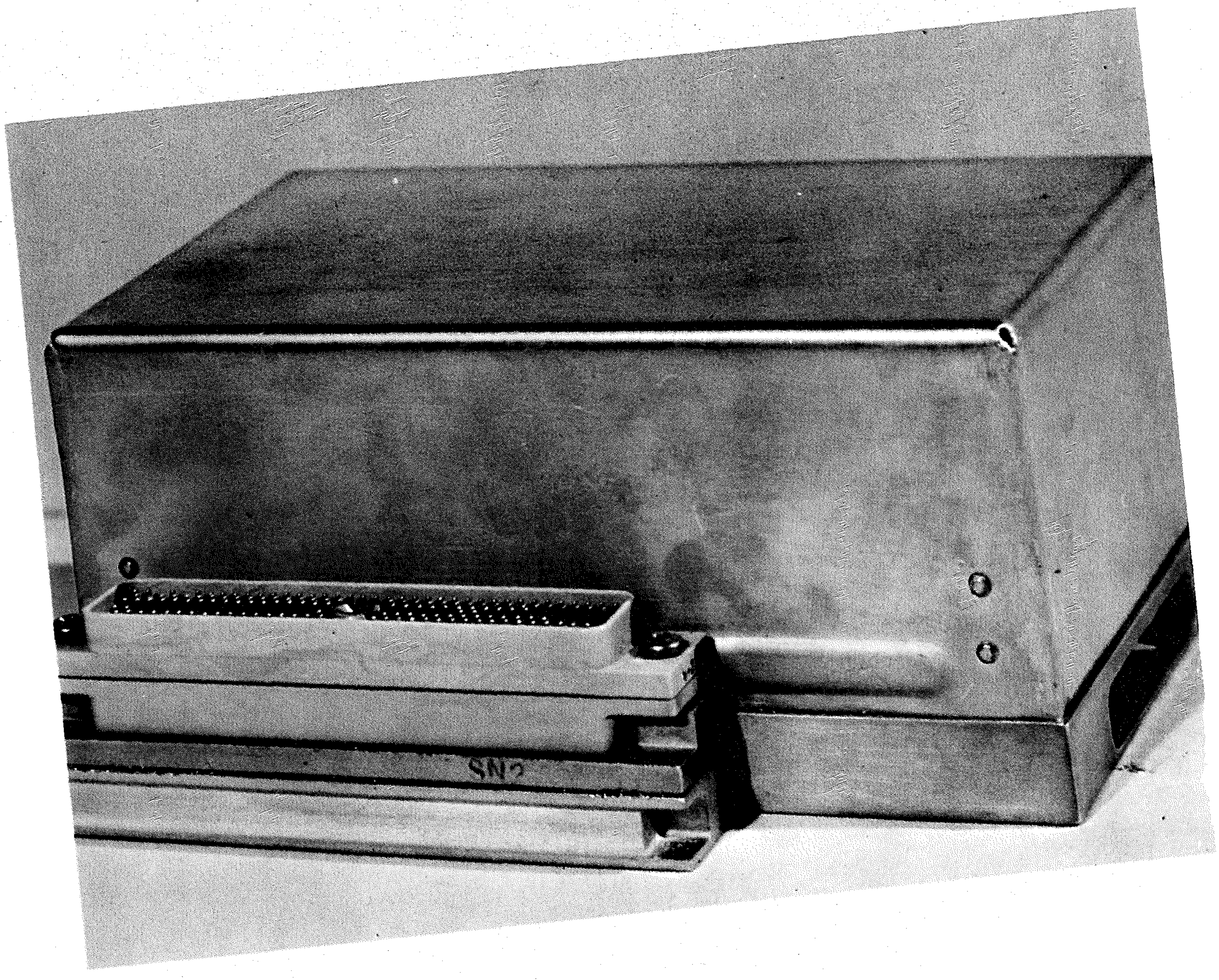


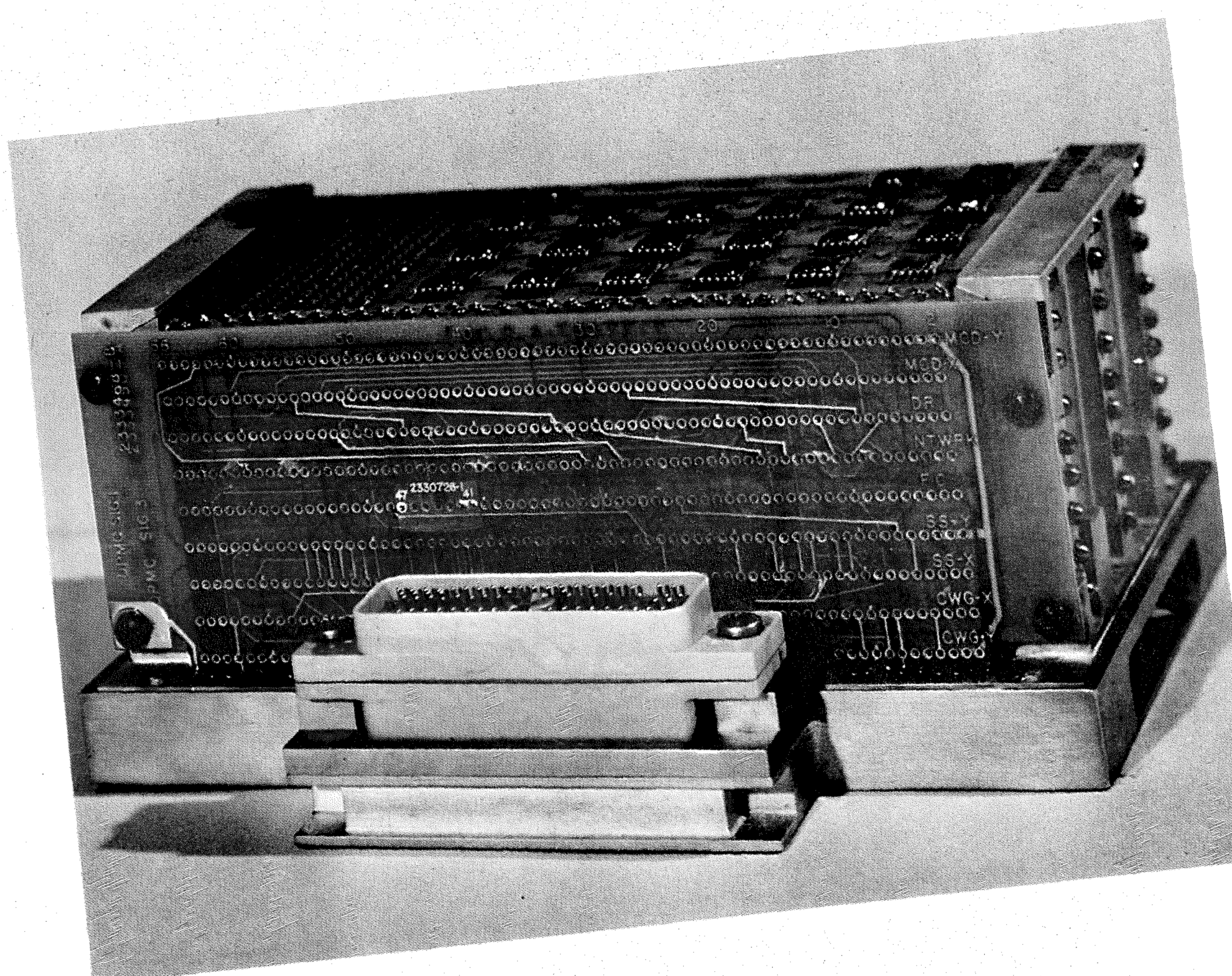








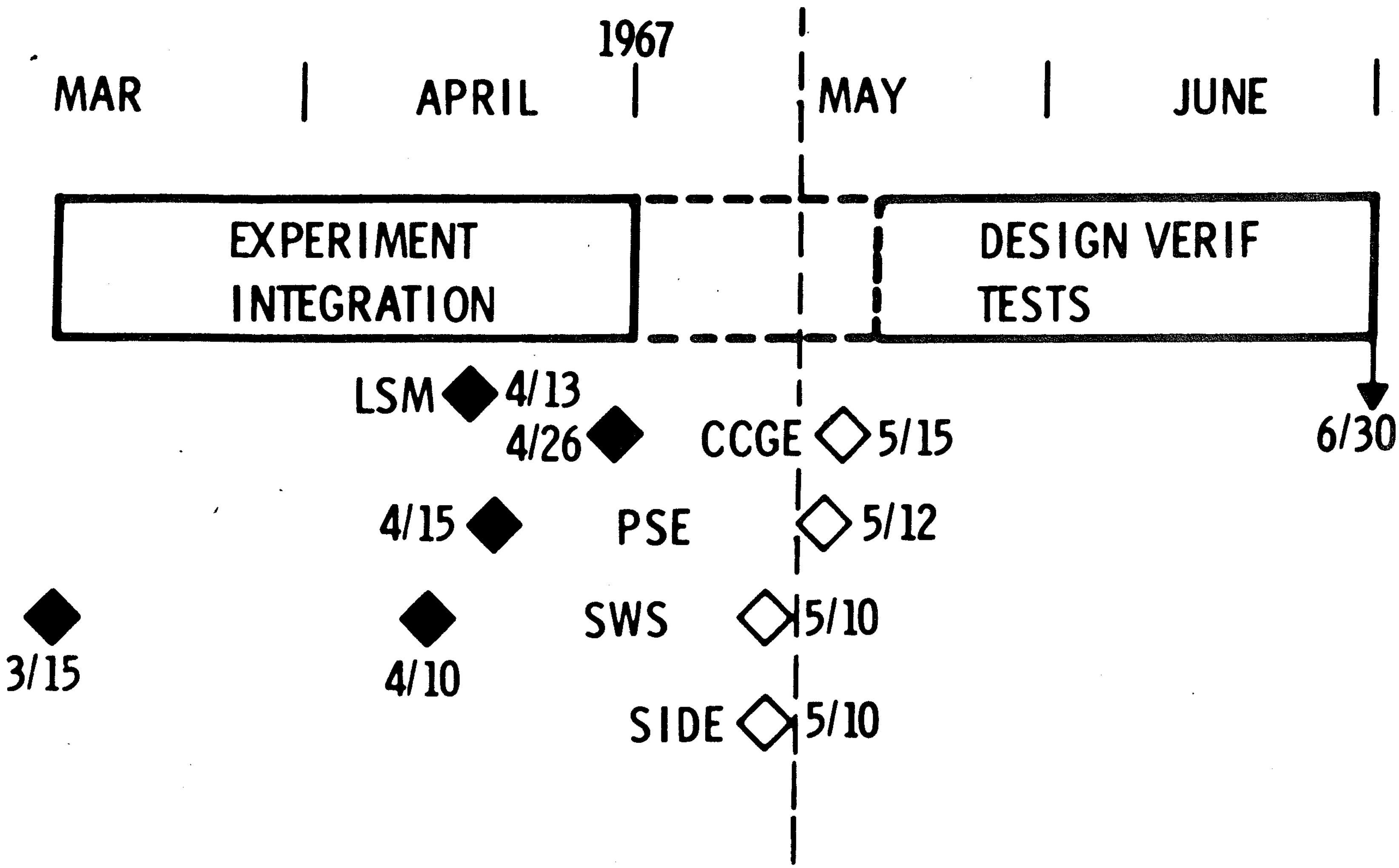




MSC 519467

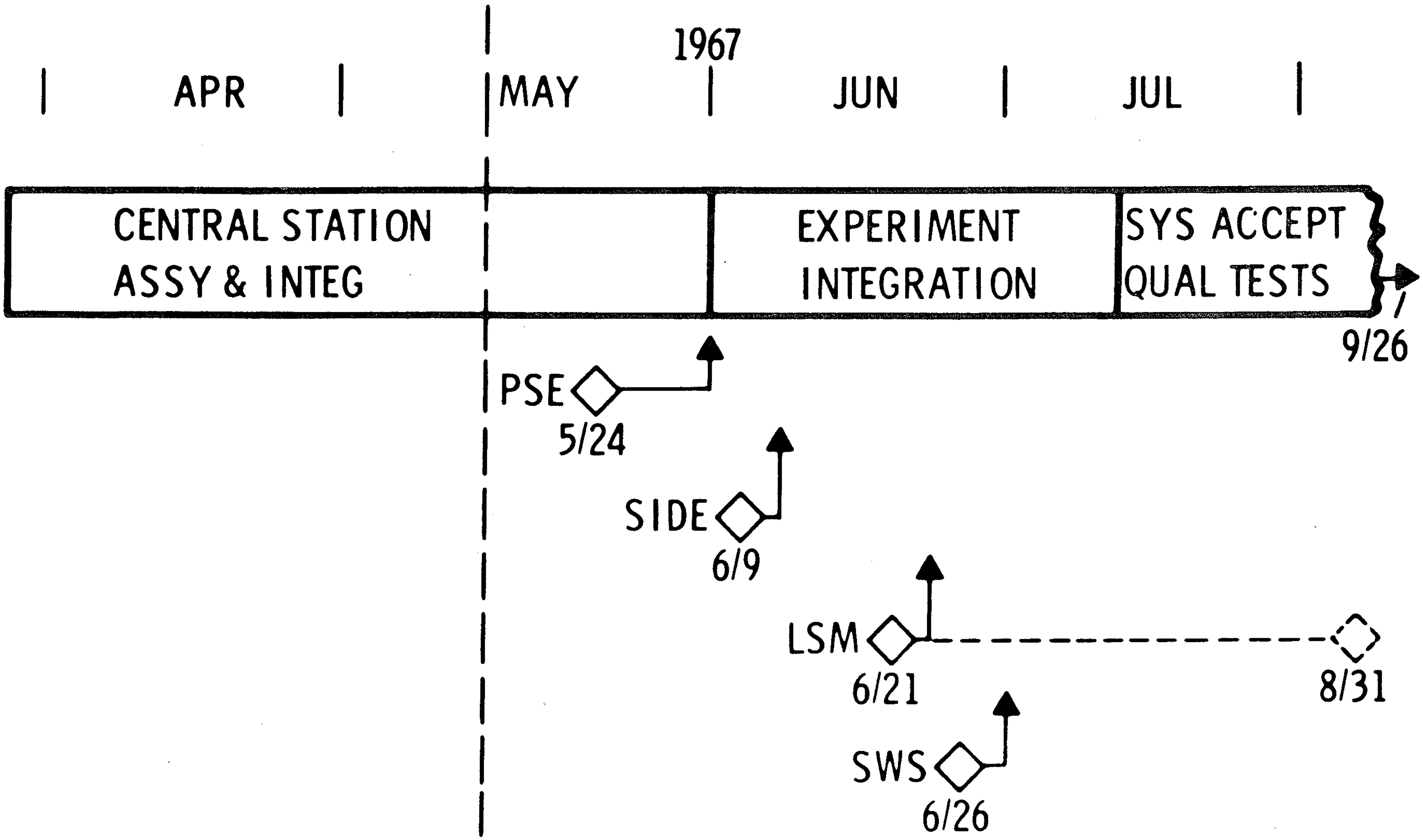
NASA
S-67-30870

PROTOTYPE SCHEDULE - FLIGHT 1 CONFIGURATION



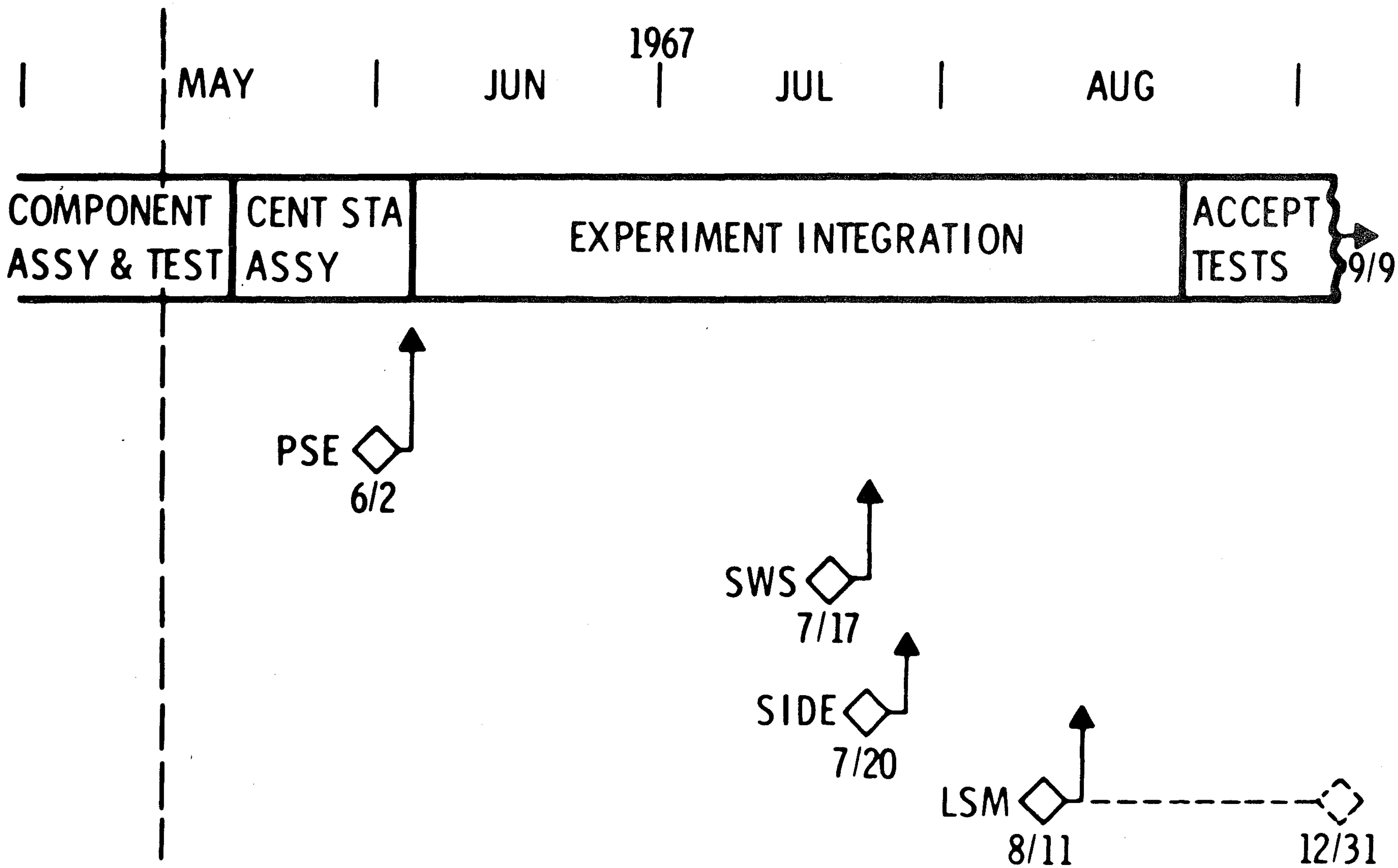
NASA
S-67-30875

QUAL MODEL SCHEDULE - FLIGHT 1 CONFIGURATION



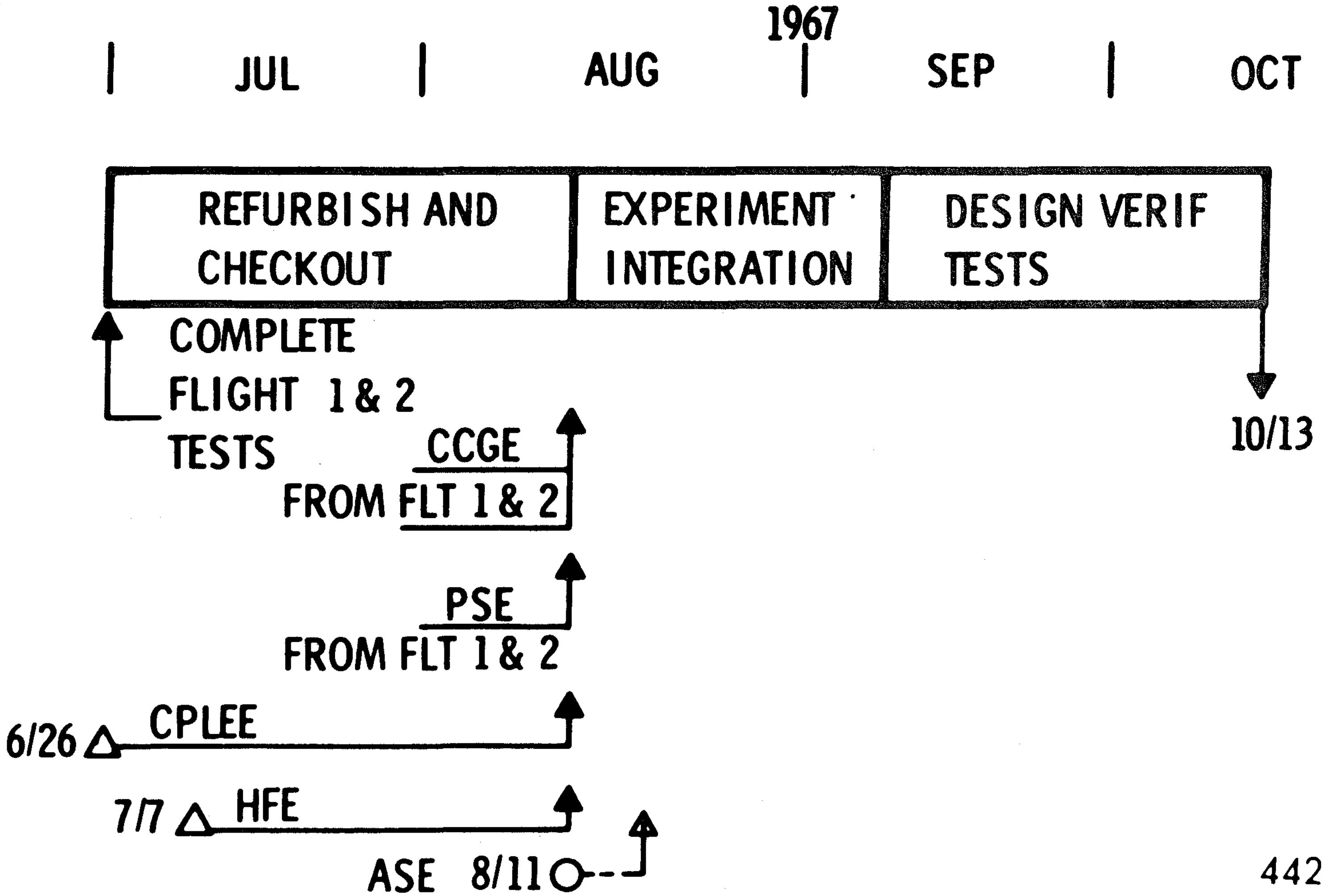
NASA
S-67-30878

FLIGHT 1 MODEL SCHEDULE



NASA
S-67-30853

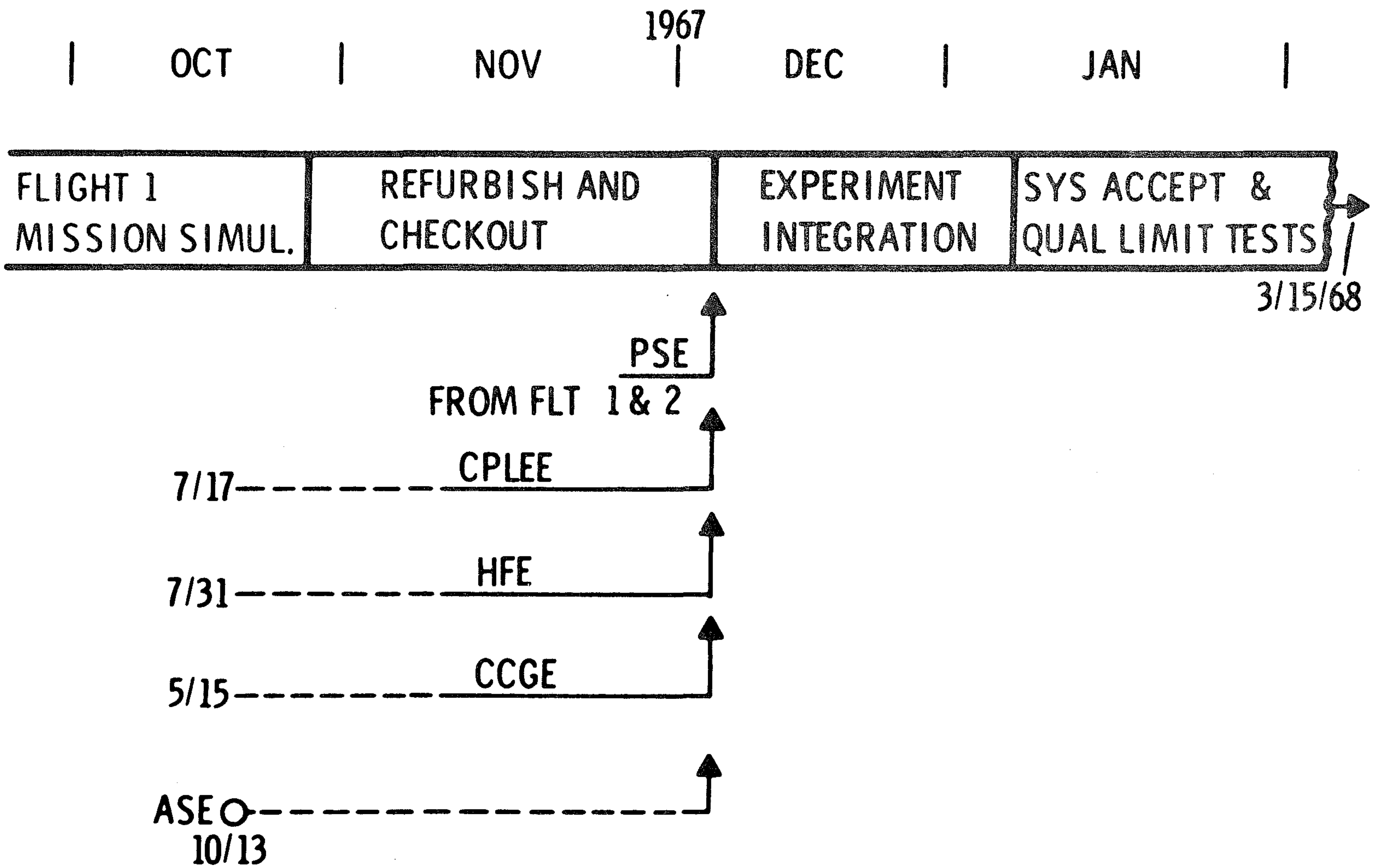
PROTOTYPE SCHEDULE - FLIGHT 3 CONFIGURATION



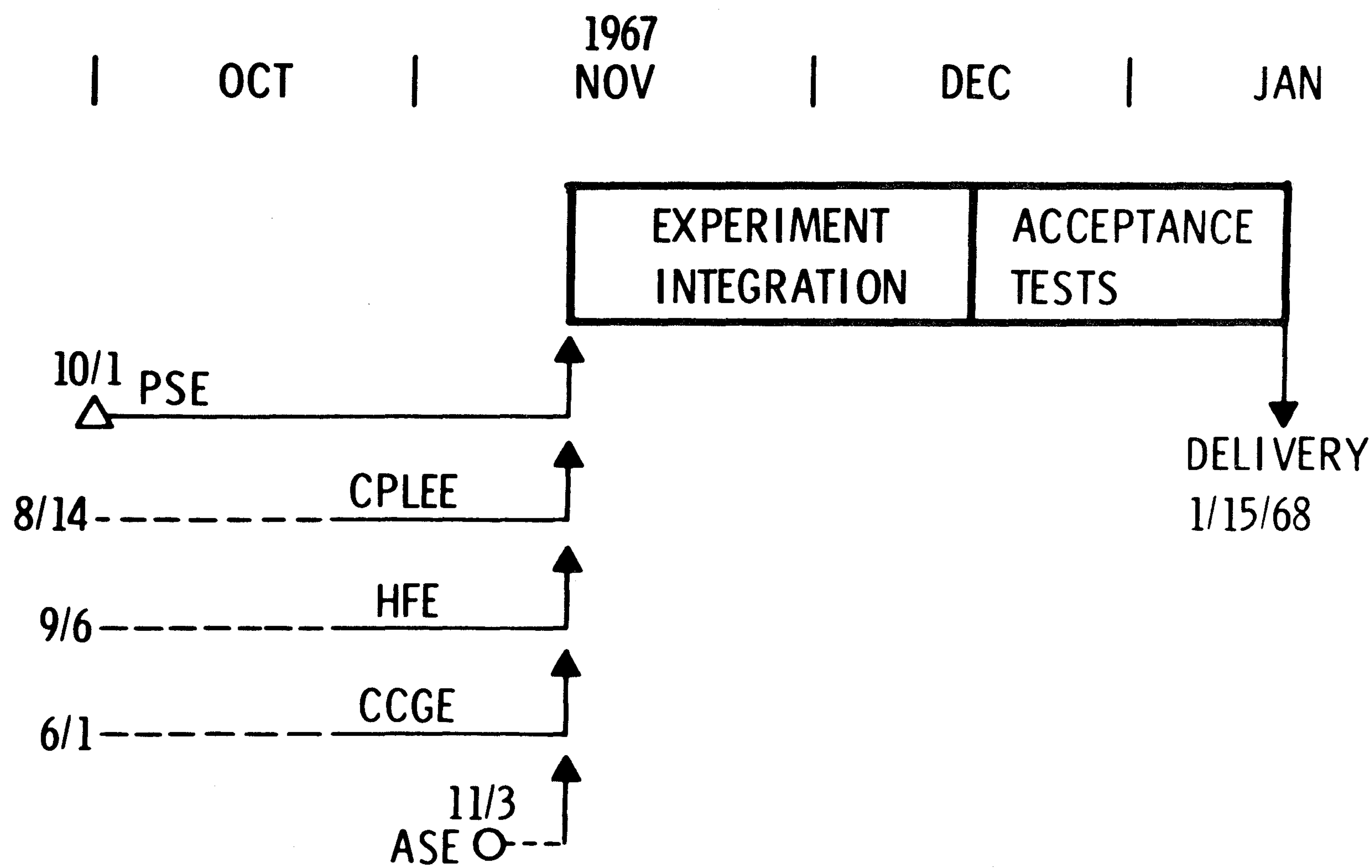
4422-2

NASA
S-67-30845

QUAL MODEL SCHEDULE - FLIGHT 3 CONFIGURATION



FLIGHT 3 MODEL SCHEDULE



FACTORY AND KSC PROCEDURE DOCUMENTATION

There are a large number of documents related to the ALSEP program that are contractually required. I want to talk for a few minutes mainly about the procedural documentation pertaining to the flight hardware during the factory and field site preparation and checkout phases. Some of what is to be said is applicable in the case of the qualification model and in the case of acceptance by the Lunar Surface Project Office of the GFE experiment or subsystem hardware.

The desire to talk about precedural documentation comes from two things. We are looking at schedules that show operations and testing in the immediate future. That is one thing. Next is that many of the procedures involved are of the type that have LSPO in the approval loop with a 20 day response time, and there are very few if any of these procedures that have been approved. With the lack of procedures approved or in the approval chain it would appear difficult to meet portions of the schedules.

The ALSEP program involves sophisticated and expensive equipment, and the handling and the operation of this equipment without thoroughly detailed and documented procedures is unacceptable. The practice of evolving procedures as we go through a test or proceeding on the basis of tests we are carrying around in our heads is expensive in terms of hardware and time. We have already had more than a sufficiency of examples which bear this out in the ALSEP program. (WSMR Test) The ALSEP qualification and flight hardware will be treated only in compliance with approved documentation.

Lets look at a list of documents that have some flavor of acceptance, checkout, and preparation about them (see ALSEP Documentation).

Lets go back to item 7, Test Procedures. The test documents are prepared for specific phases of Qualification, Acceptance, and Field Tests. They are used by personnel to conduct the tests. They call out the activities step by step. The steps are sequenced and time referenced. All safety and emergency procedures for out of tolerance conditions are included in detail. (See Test Procedure Content)

Before I stop I would make two points.

One is that we have a very decided feeling for the necessity of adequate documentation. Even if we could be dissuaded, our strong willed cousins at KSC would refuse to accept delivery of hardware which had not been preceeded by an adequate Acceptance Data Package.

Second, in anticipation of the question about just what should go into a test procedure, I would say assume you would be sick on test day and write it so anybody could use it and get the results you need without the risk of damaging your hardware.

ALSEP DOCUMENTATION

1. MEASUREMENTS DOCUMENT (I)
2. ALSEP EQUIPMENT MANUALS (I)
3. TRANSPORTATION AND HANDLING MANUALS (I)
4. END ITEM STORAGE PROCEDURES (II)
5. SYSTEM TEST SET CONFIGURATION RECORD (II)
6. ALSEP CONFIGURATION RECORD (II)
7. TEST PROCEDURES (I)
8. TEST DATA (I)
9. TEST REPORT (II)
10. FAILURE REPORTS (II & I)
11. ACCEPTANCE DATA PACKAGE (I)
12. MISSION READINESS REVIEW REPORT (I)

TEST PROCEDURE CONTENT

1. TEST OBJECTIVES
2. NOMINAL TEST INPUTS WITH TOLERANCES
3. NOMINAL TEST OUTPUTS WITH TOLERANCES
4. TEST SUPPORT REQUIREMENTS
5. SAFE INSTRUCTIONS
6. SPECIAL INSTRUCTIONS
7. TEST SET-UP INFORMATION
8. PRE-TEST PREPARATION CHECK LISTS
9. TIME SEQUENCE CHARTS
10. DETAILED TEST INSTRUCTIONS
11. POST TEST REQUIREMENTS
12. TEST DATA SHEETS
13. SUMMARY TEST DATA SHEETS
14. EMERGENCY SHUT-DOWN INSTRUCTIONS

IMPLICATIONS FOR ALSEP

- Review and Assure Optimum Power System Design and Manufacture
- Test Planning Must Be Improved
  - Identification and Control of All Possible Hazardous Test Conditions
  - Training for Personnel to Cope with Test Hazards Must Be Provided
  - Test/GSE Equipments Must Be Optimized to Minimize Test Hazards
  - Generation and Maintenance of Test Procedures MUST Be Improved. (Detail Must Be Provided, Flow of Tests Must Be Planned and Optimized, COMPLETE Test Procedures Must Be Available for All Participants Far Enough In Advance of Tests for THOROUGH Review.)

    <u>NO TEST WILL BE RUN WITHOUT COMPLETE TEST PLANS WHICH HAVE BEEN THOROUGHLY REVIEWED BY ALL TEST PERSONNEL.</u>
- Communication System MUST Not Cause Any Failure of Spacecraft Communications Systems (Ref. EMI). Ground Communications in ALL Tests Must Be Available and Reliable.
- Manufacturing Design for Electrical Wiring Must Be Optimized. Use of a 3-D Cable and Harness Jig is Required.

  <u>NO ELECTRICAL CONNECTORS ARE TO BE MADE OR BROKEN AT ANY TIME WITH POWER APPLIED TO THE SYSTEM.</u>

IMPLICATIONS FOR ALSEP
(Continued)

- Quality Control of Equipment in Manufacture and Test Must Be Thorough and Rigid

  NO TESTS OF EQUIPMENT WILL BE MADE WITH OPEN DR'S OR EO'S. NO ACCEPTANCE OF DELIVERABLE EQUIPMENT WILL BE MADE WITH OUTSTANDING EQUIPMENT DISCREPANCIES OR CHANGES.

- Program Management Must Recognize and Respond to Changing Program Requirements

- "Every Effort Must Be Made to Insure the Maximum Clarification and Understanding of the Responsibilities of All Organizations Involved, the Objective Being a Fuller Coordinated and Efficient Program."

SCIENTIFIC EQUIPMENT WEIGHT CONSTRAINTS

	Trans Lunar		Trans Earth	
	Max	Min	Max	Min
LUNAR MODULE				
Gross Weight	300	175	100	0
Ascent Stage	68	0	100	0
Descent Stage	260	175	0	0
Combined SEQ Compartments	195	150		
SEQ Compartment 1	115	75		
SEQ Compartment 2	115	75		
RTG Fuel Cask & Supports	65	25		
COMMAND MODULE	0	0	100	0

SCIENTIFIC EQUIPMENT WEIGHT CONTROL AND STATUS

	Control	Status
ASCENT STAGE		
SRC #1 SRC #2	25	26.8
Still Camera Package	15	23.8
Sequence Camera Extra Film Container	3.1	2.8
Film and Tape Container	4.4	6.0
	47.5	59.4

SCIENTIFIC EQUIPMENT WEIGHT CONTROL AND STATUS

FLIGHTS I & II

	Control	Status
DESCENT STAGE TOTAL	224.5	274.9
SEQ Compartment 1		
Data	30.0	32.8
Structure	15.0	26.1
Electrical Power	5.3	7.1
Magnetometer	14.5	16.5
Solar Wind	10.0	12.5
Passive Seismic	25.0	22.8
Subtotal	99.8	117.8
SEQ Compartment 2		
Data	0	2.1
Structure	5.5	13.8
Electrical Power	27.7	30.6
Passive Seismic	0.0	0.1
Suprathermal Ion Detector	12.5	18.0
Apollo Lunar Hand Tools	14.0	27.4
Subtotal	59.7	92.0
RTG Fuel Cask Assembly	65.0	65.1
TOTAL	272.0	334.3

SCIENTIFIC EQUIPMENT WEIGHT CONTROL AND STATUS

FLIGHT III

	Control	Status
DESCENT STAGE TOTAL	238.0	277.6
SEQ Compartment 1		
Data	30.0	33.5
Structure	15.0	24.9
Electrical Power	5.3	7.7
Passive Seismic	25.0	22.8
Heat Flow	9.3	9.3
Charged Particle	4.5	5.4
Cold Cathode Gauge	9.0	11.2
Subtotal	98.1	114.8
SEQ Compartment 2		
Data	0	2.1
Structure	5.5	12.6
Electrical Power	27.7	28.9
Apollo Lunar Hand Tools	14.0	27.4
Passive Seismic	0	0.1
Drill	27.7	26.6
Subtotal	74.9	97.7
RTG Fuel Cask Assembly	65.0	65.1
TOTAL	285.5	337.0

SCIENTIFIC EQUIPMENT WEIGHT CONTROL AND STATUS

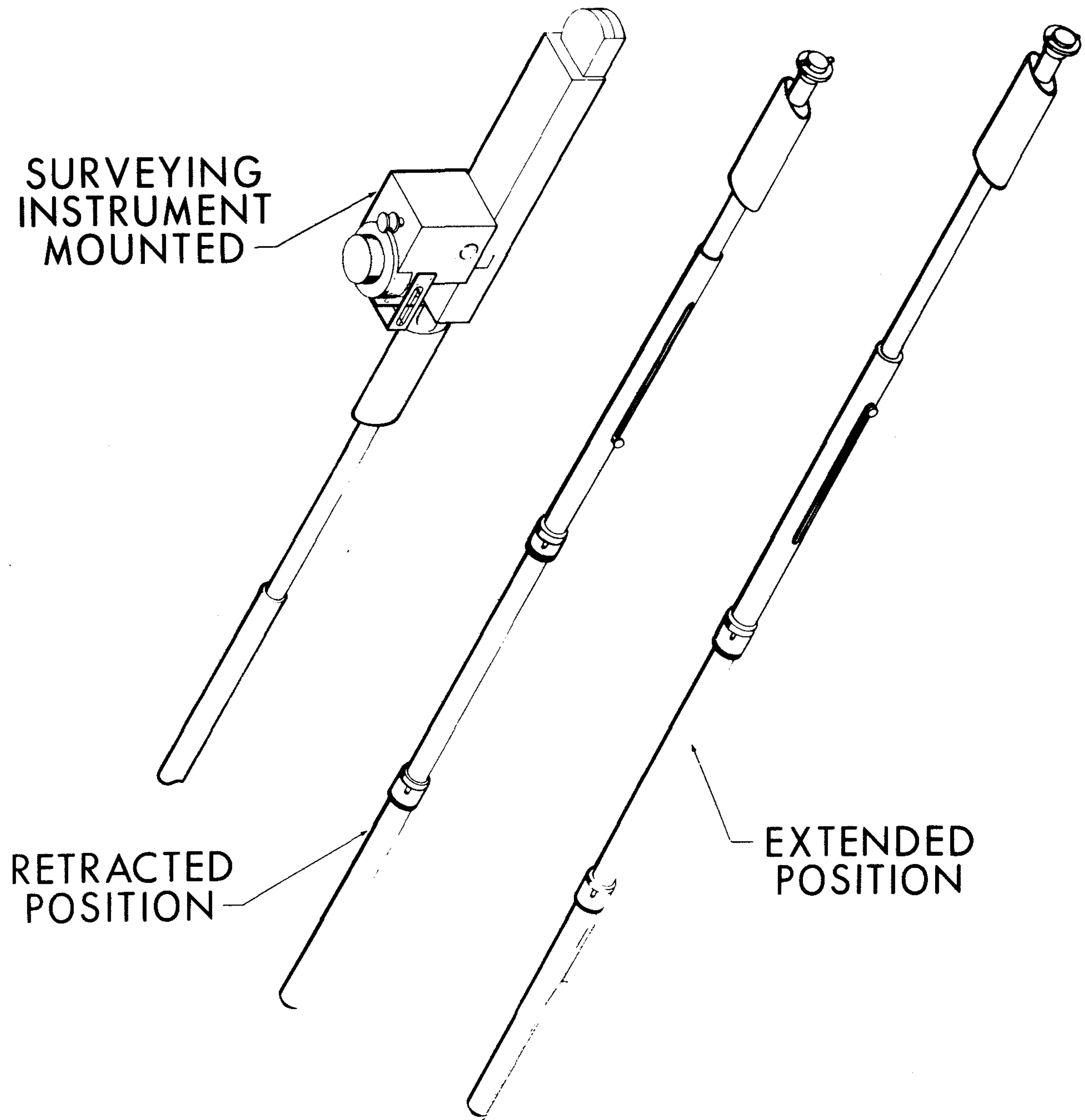
FLIGHT IV

		Control	Status
DESCENT STAGE TOTAL		221.0	275.6
SEQ Compartment 1			
Data		30.0	33.5
Structure		15.0	26.4
Electrical Power		5.3	6.3
Passive Seismic		25.0	22.8
Active Seismic		16.4	24.1
Charged Particle		4.5	5.4
	Subtotal	96.2	118.5
SEQ Compartment 2			
Data		0	2.1
Structure		5.5	13.8
Electrical Power		27.7	30.6
Apollo Lunar Hand Tools		14.0	27.4
Passive Seismic		0	0.1
SIDE/CCGE		12.5	18.0
	Subtotal	59.7	92.0
RTG Fuel Cask Assembly		65.0	65.1
	TOTAL	268.5	335.0

- HAND TOOLS
  - STAFF WITH SURVEYING INSTRUMENT
  - HAMMER
  - TONGS
  - SCRIBER/LENS/BRUSH
  - DRIVE TUBES (3)
  - ASEPTIC SAMPLE COLLECTOR (3)
  - SAMPLE BAGS (200)
  - SCOOP
  - GNOMON
  - TOOL CARRIER
- SAMPLE RETURN CONTAINERS
  - OUTER CONTAINER (2)
  - GAS ANALYSIS SAMPLE CONTAINER (2)
  - SPECIAL LUNAR ENVIRONMENT CONTAINER (2)

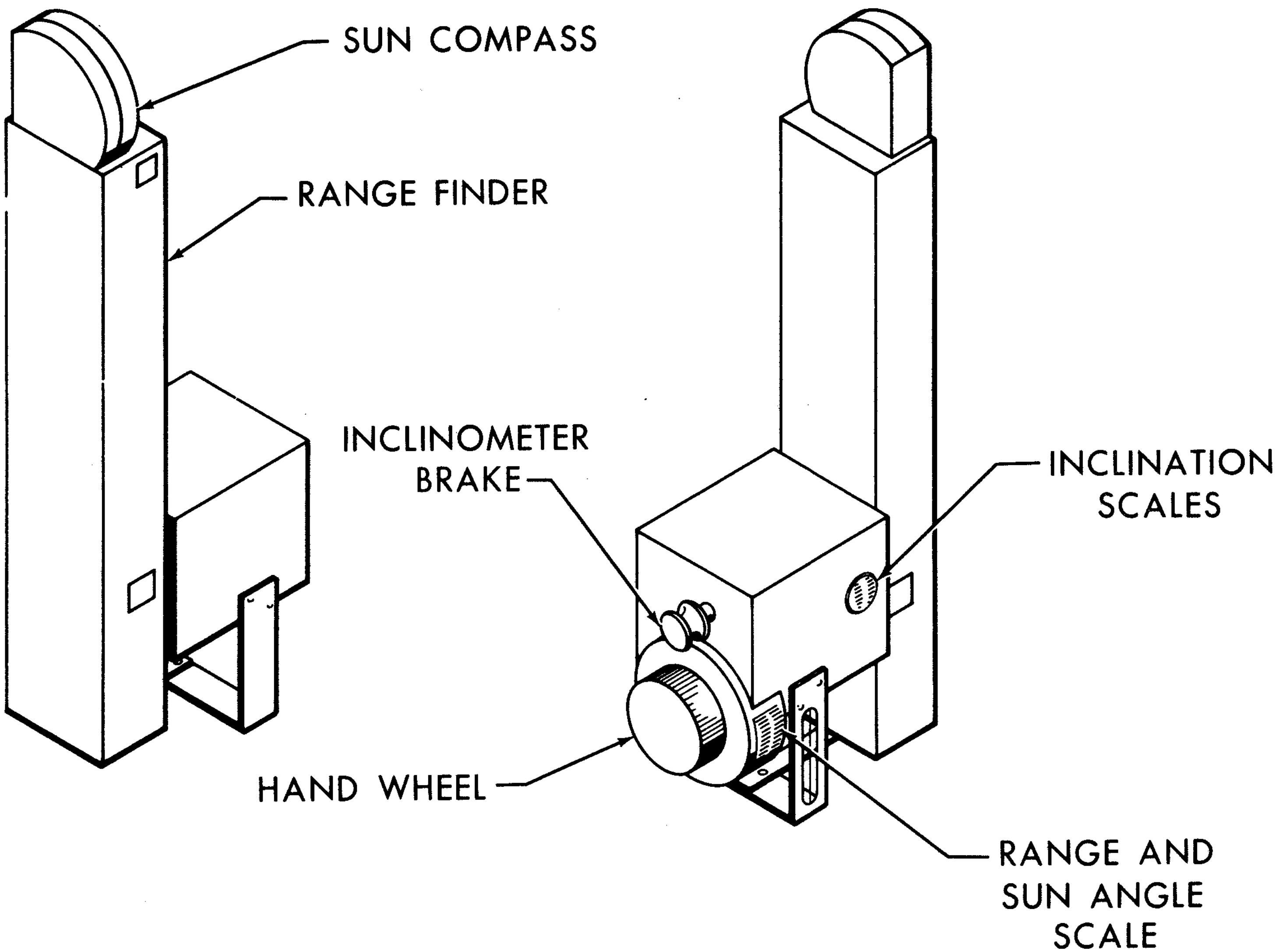
NASA-S-66-11395 NOV 23

INSTRUMENT STAFF



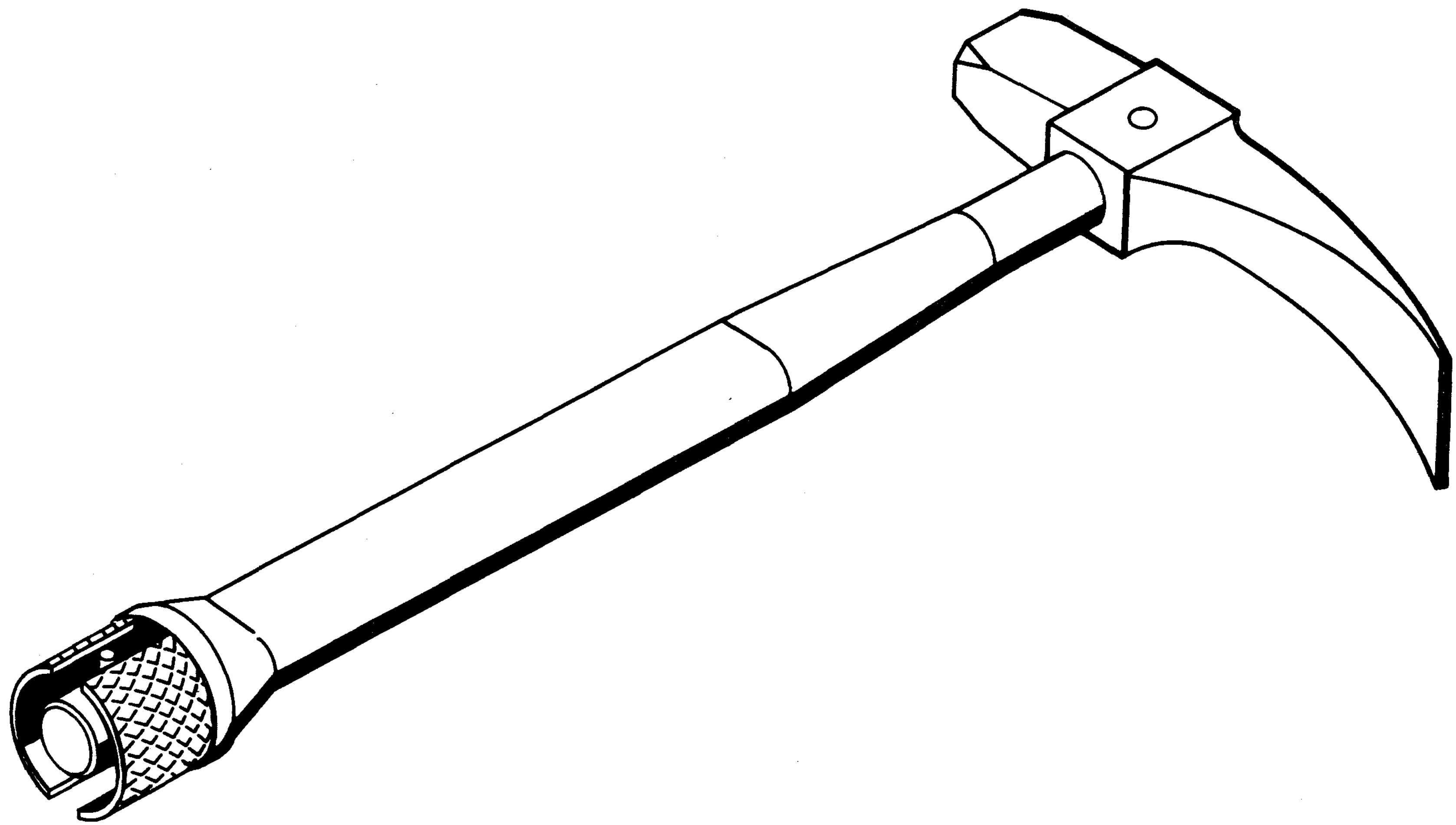
NASA-S-66-11396 NOV 23

SURVEYING INSTRUMENT



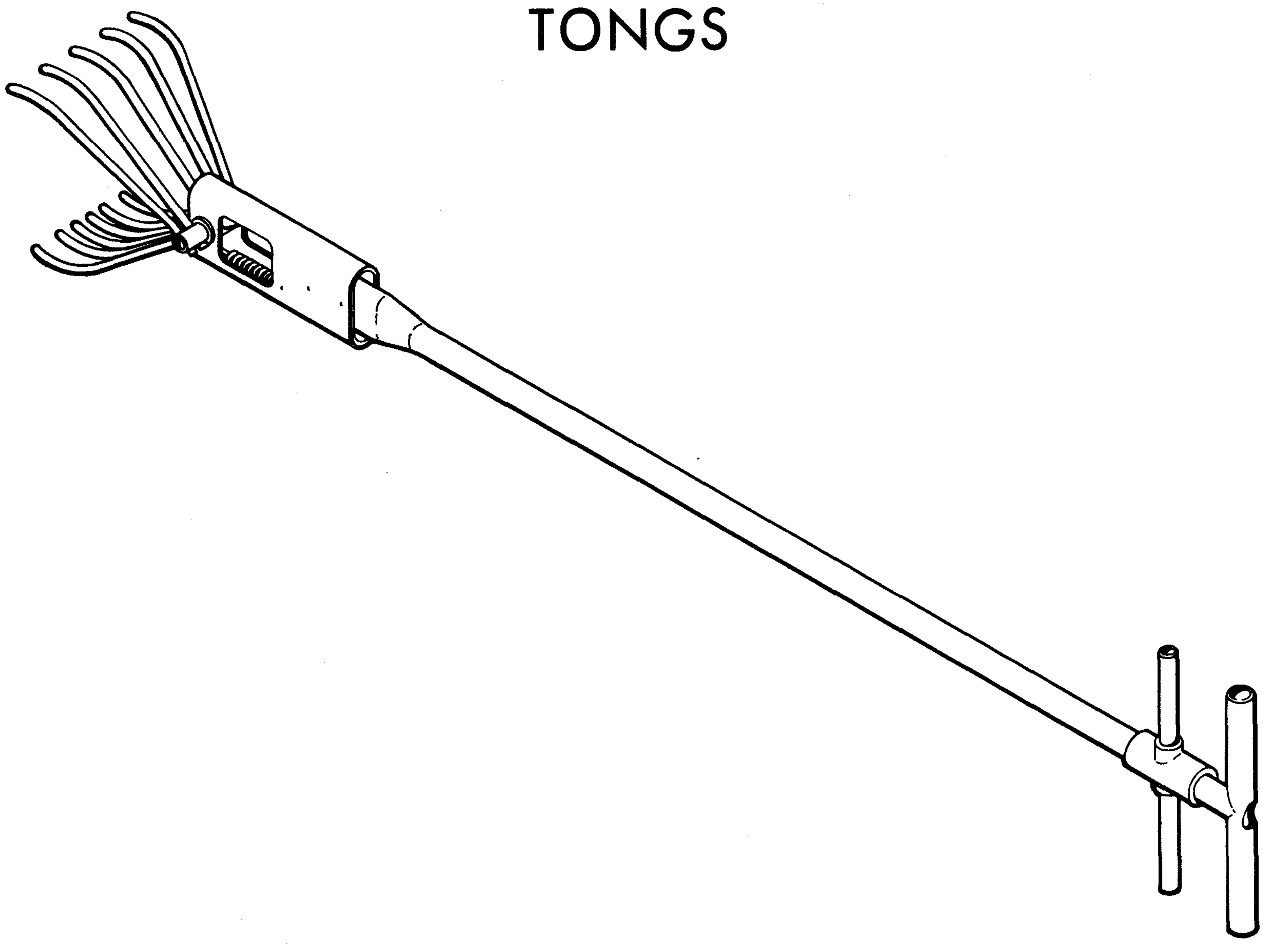
NASA-S-66-11392 NOV 23

HAMMER



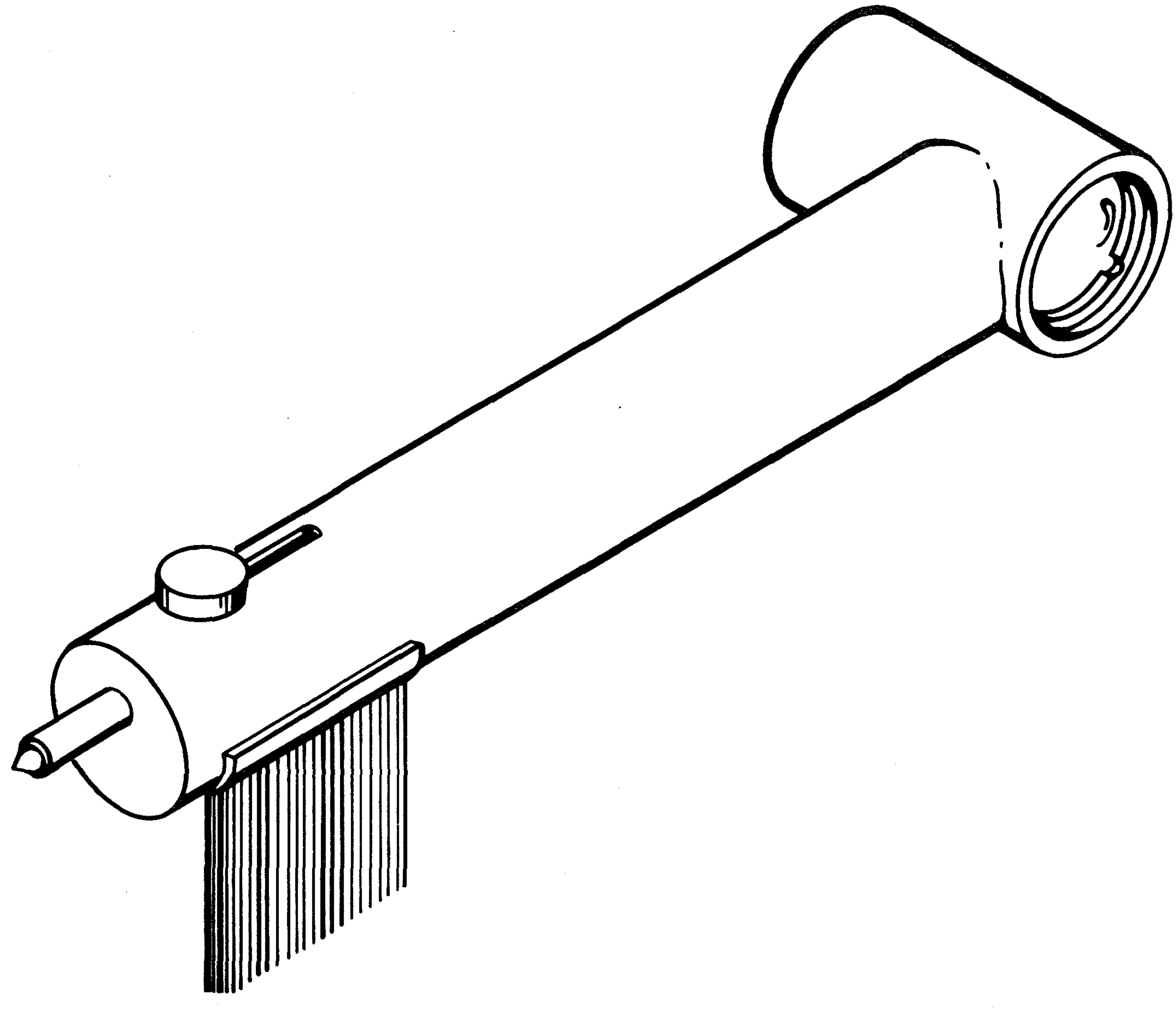
NASA-S-66-9599 OCT 21

TONGS



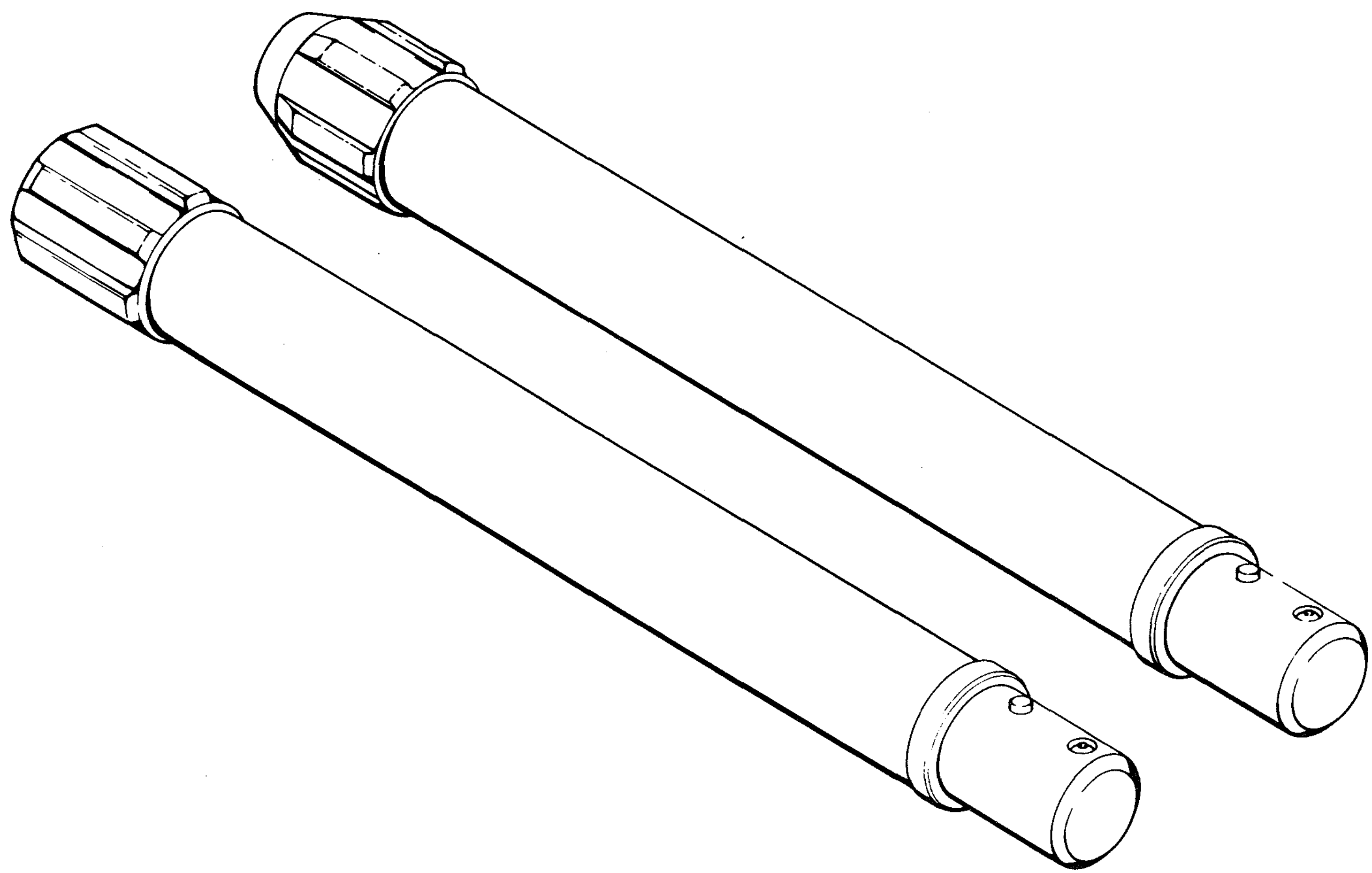
NASA-S-66-11394 NOV 23

BRUSH/SCRIBER/HAND LENS



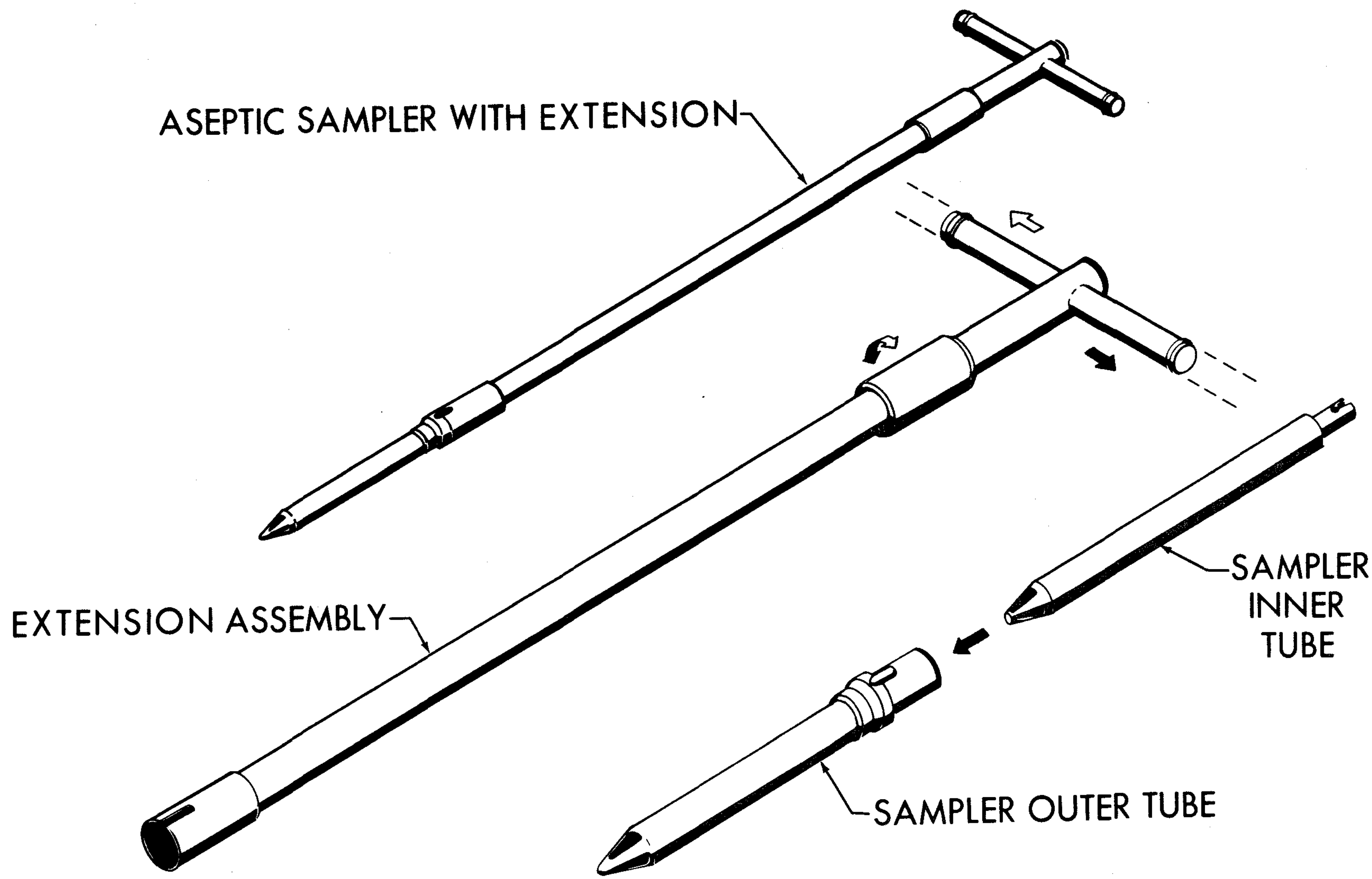
NASA-S-66-9656 OCT 21

CORE TUBE AND CAP



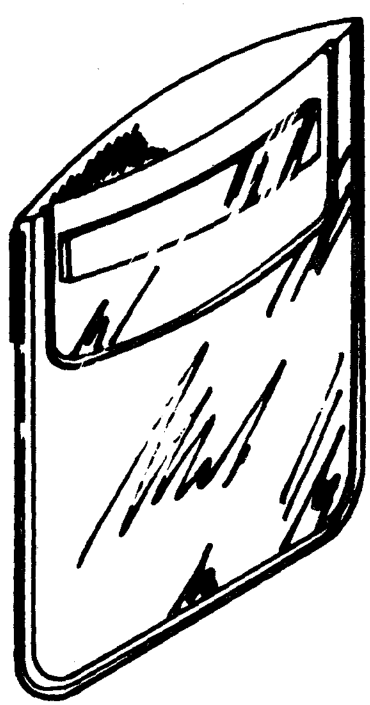
NASA-S-66-11390 NOV 23

ASEPTIC SAMPLER

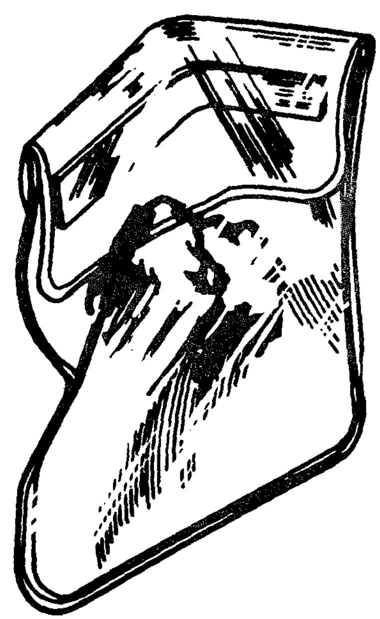


NASA-S-66-9597 OCT 21

FIELD SAMPLE BAG



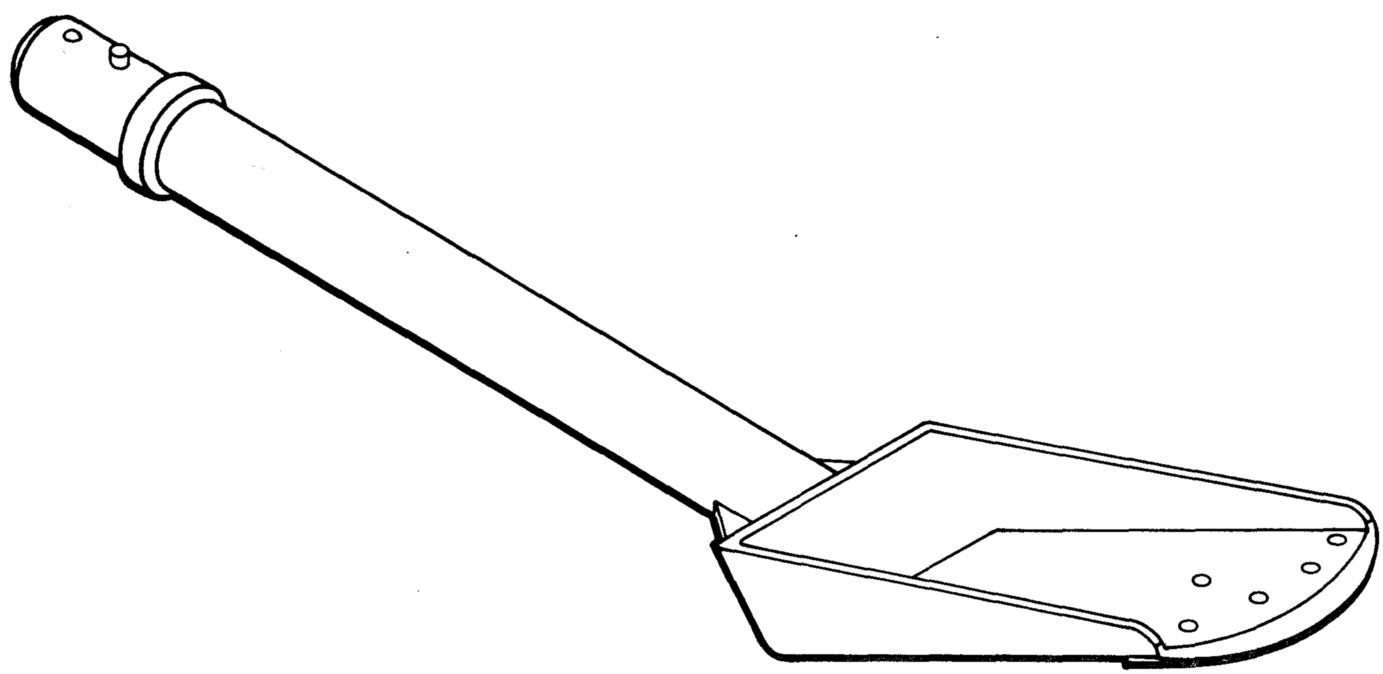
EMPTY



WITH SAMPLE

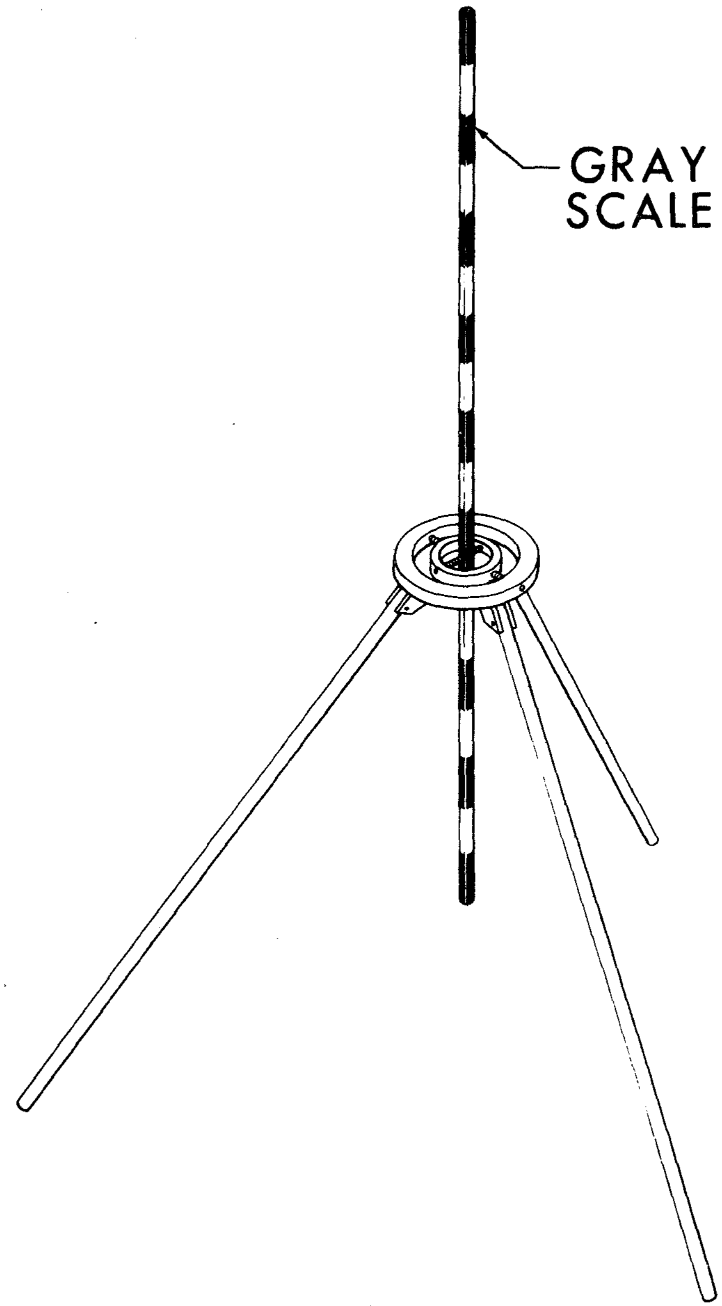
NASA-S-66-11391 NOV 23

SCOOP



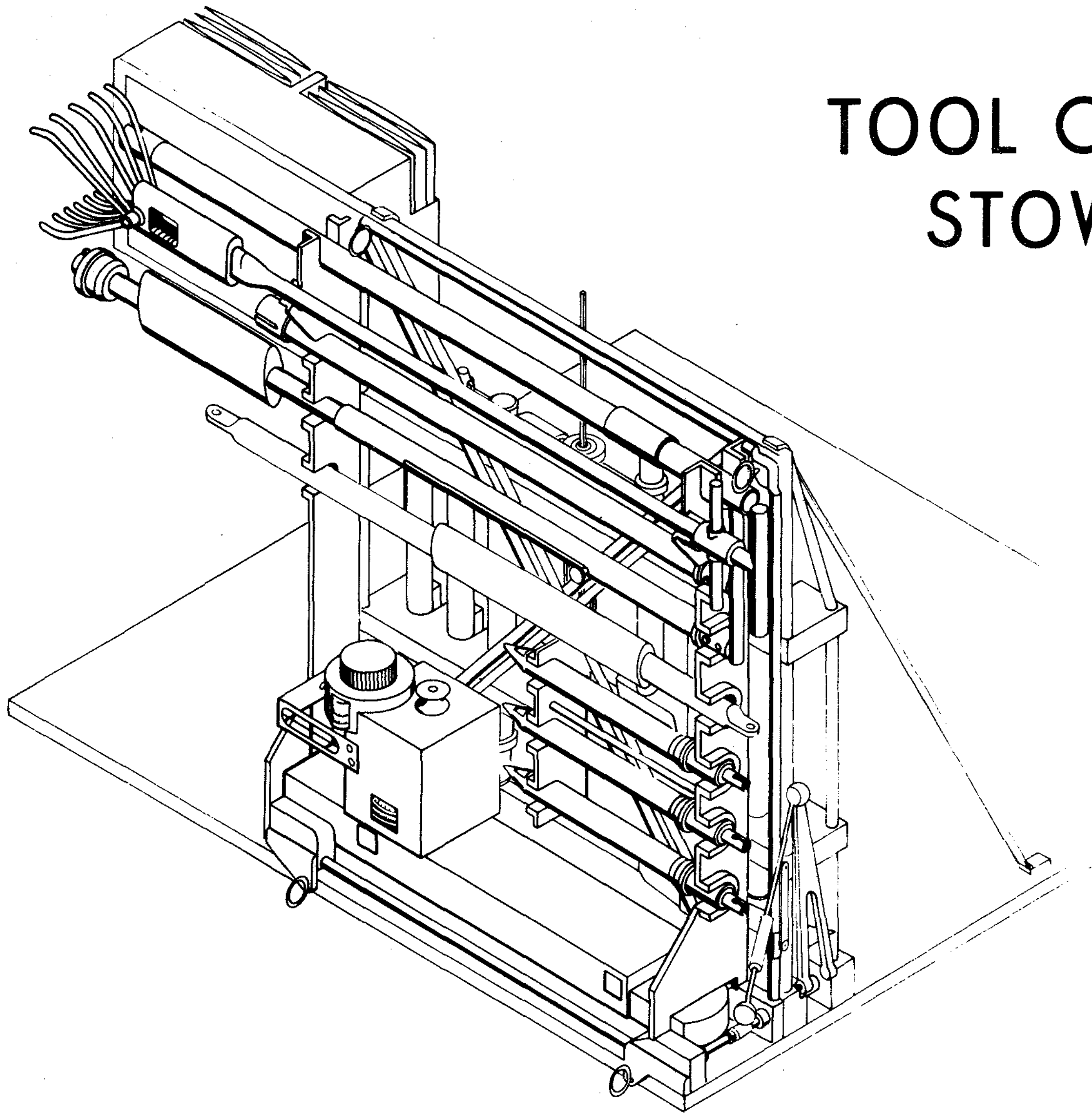
NASA-S-66-9600 OCT 21

GNOMON



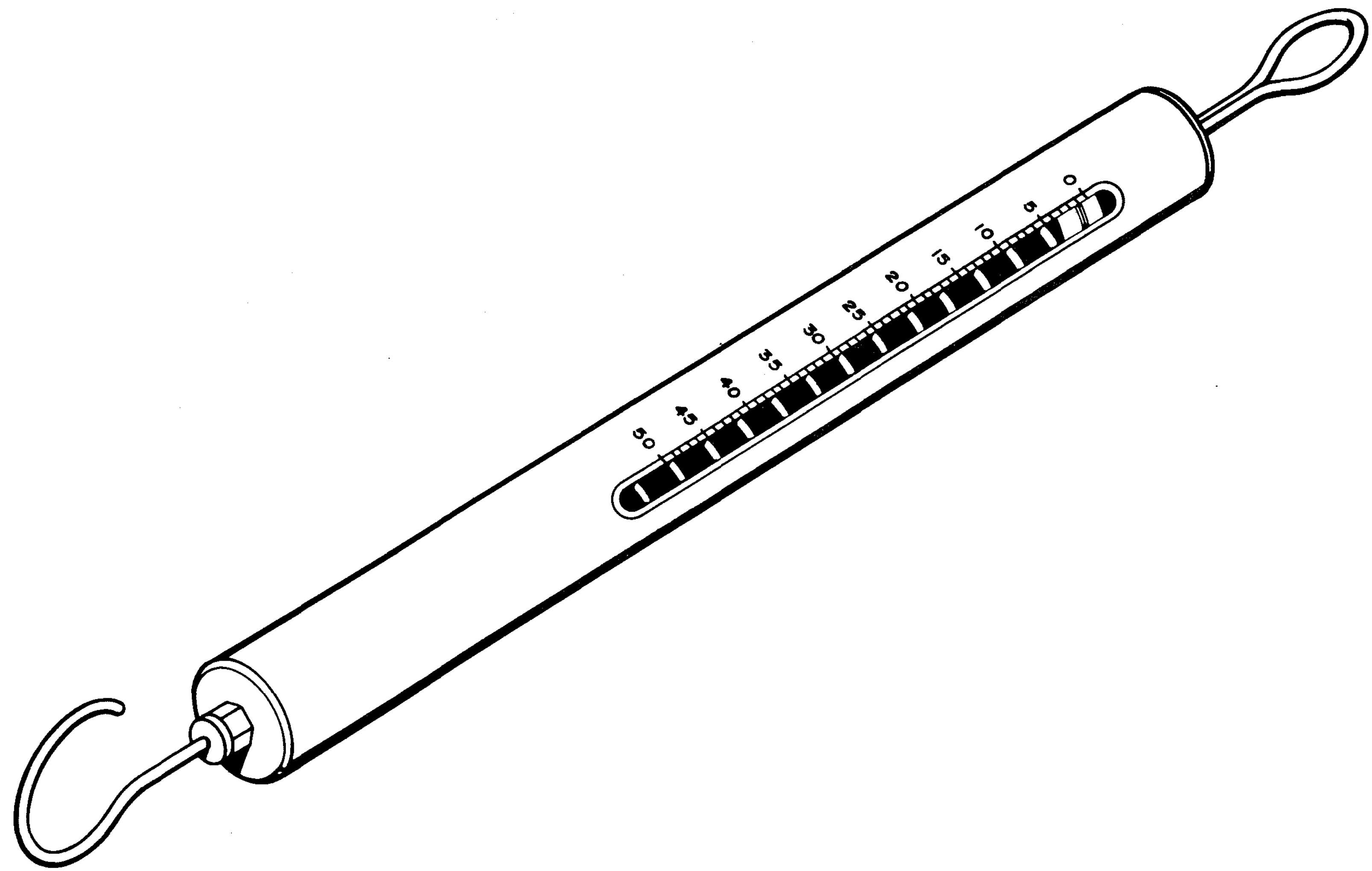
NASA-S-66-11398 NOV 23

TOOL CARRIER STOWED



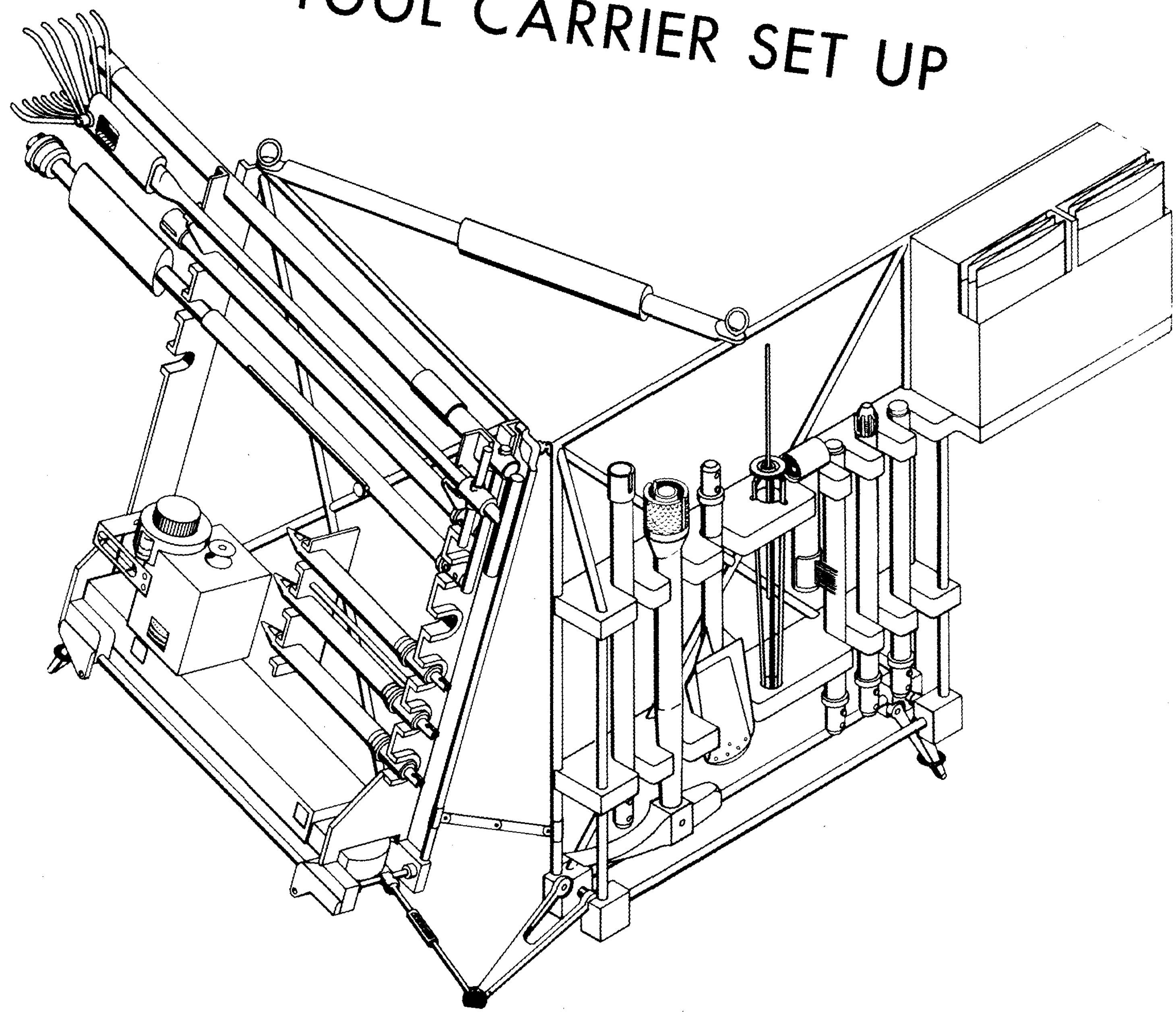
NASA-S-66-11393 NOV 23

SPRING SCALE

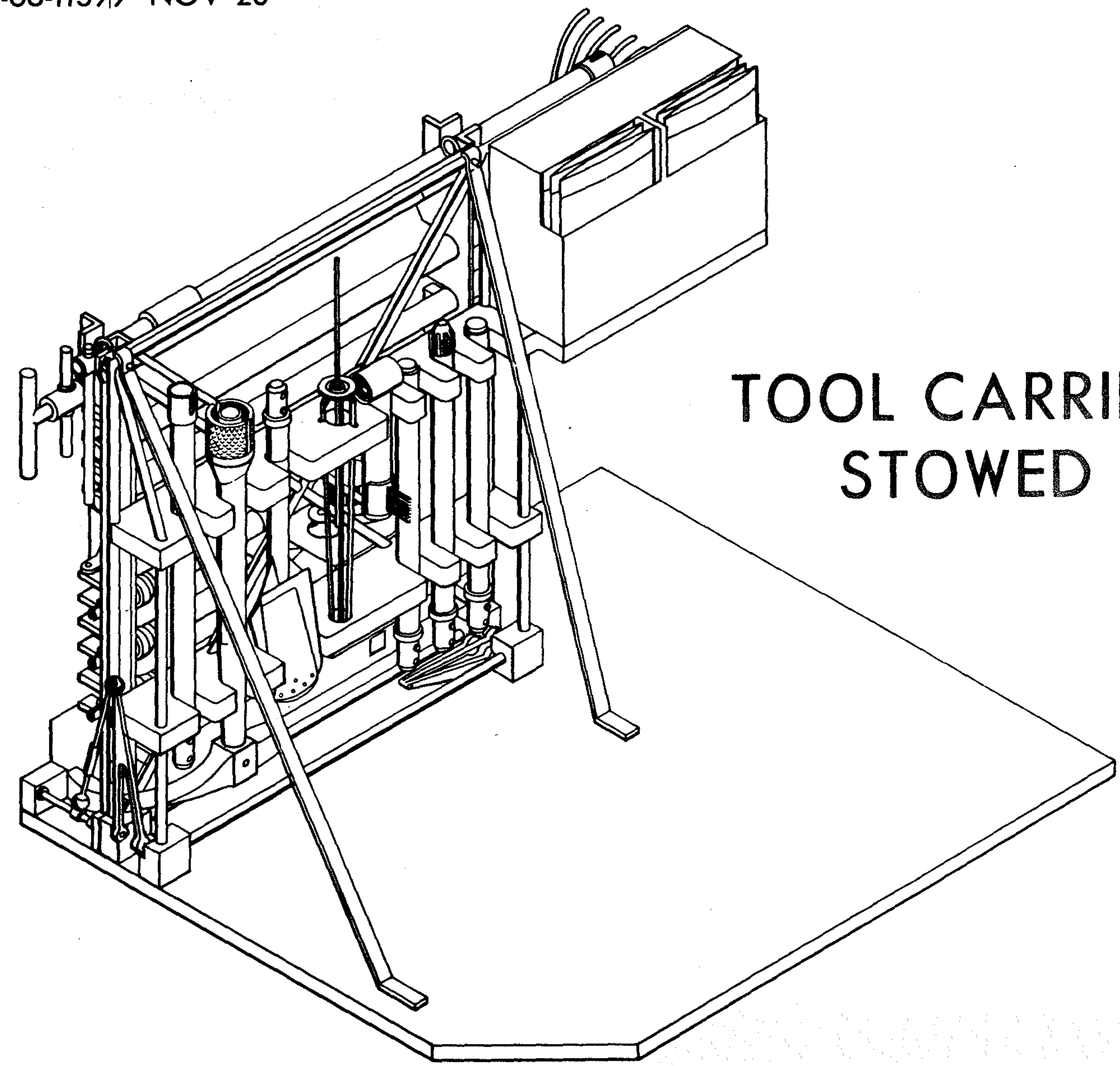


NASA-S-66-11397 NOV 23

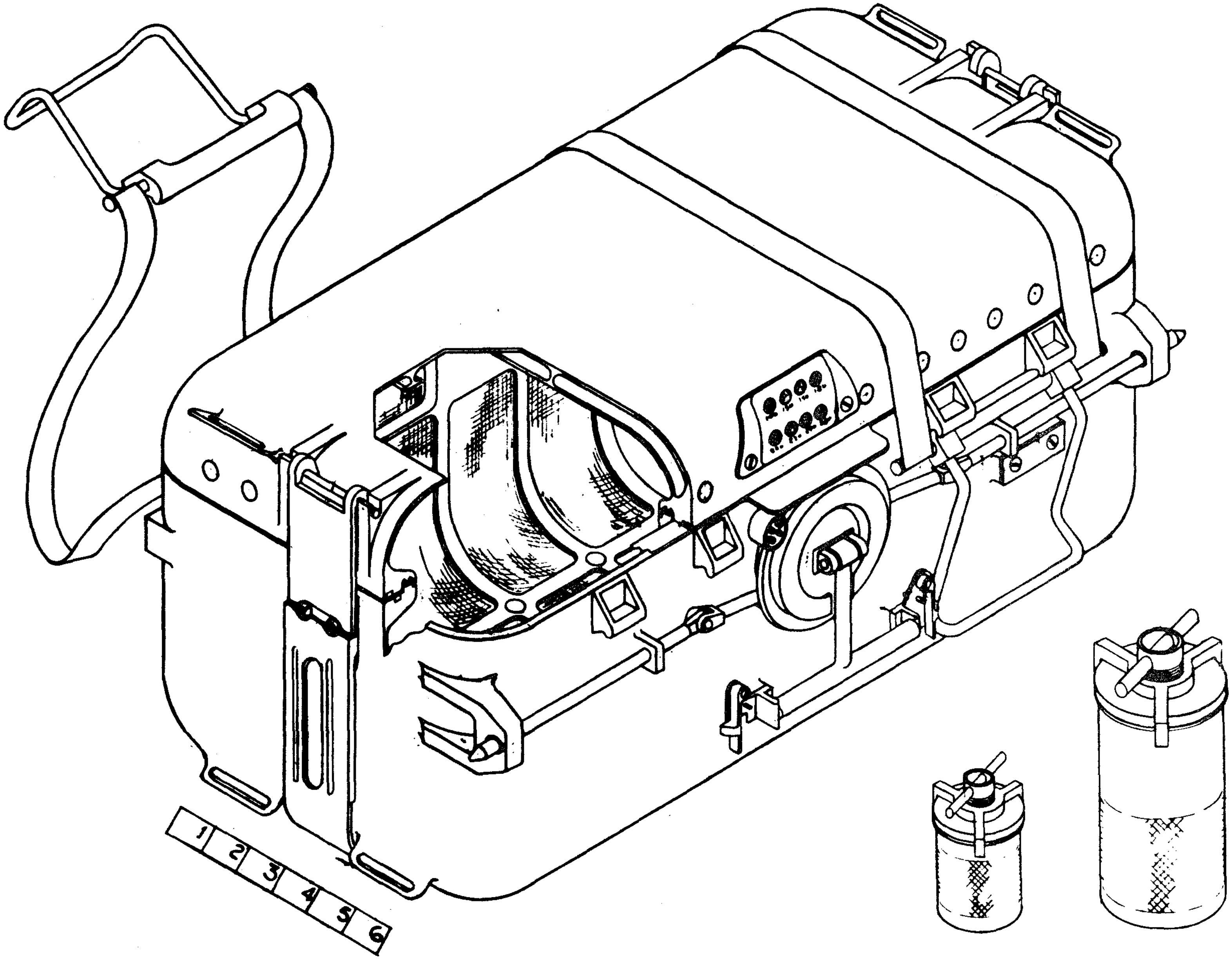
TOOL CARRIER SET UP



NASA-S-66-11399 NOV 23



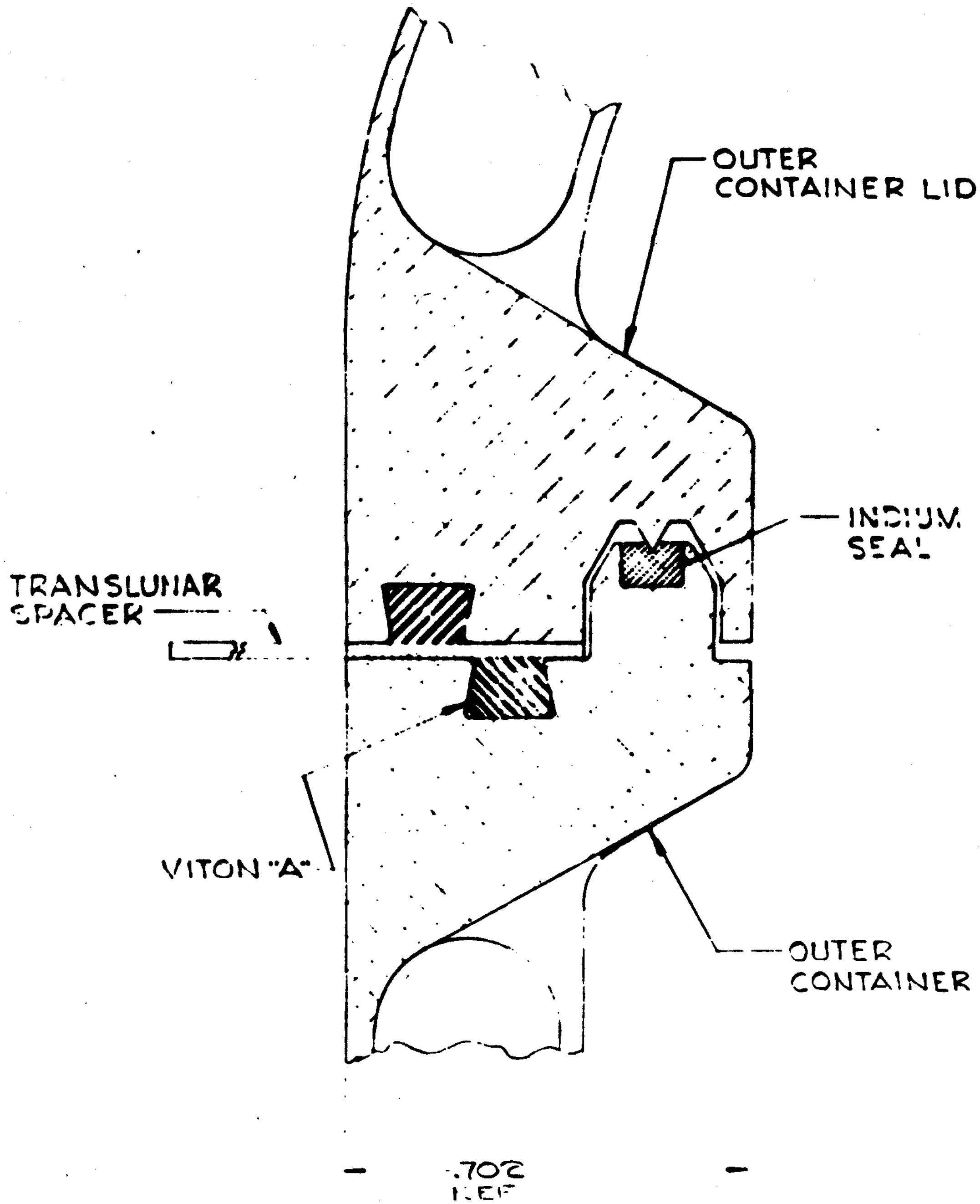
TOOL CARRIER
STOWED



UNION CARBIDE — Y-12 PLANT — Oak Ridge, Tennessee

APOLLO LUNAR SAMPLE RETURN CONTAINER

NASA
S-67-30869



SEAL CONFIGURATION

SCHEDULE

APOLLO LUNAR HAND TOOLS

ITEM	AT USER SITE DATE
PROTOTYPE	3-17-67
THERM/MECH. SIMULATOR	4-1 -67
SYSTEMS TEST MODEL	6-16-67
QUALIFICATION UNIT #1	6-16-67
TRAINING UNIT #1	6-16-67
TRAINING UNIT #2	7-1 -67
TRAINING UNIT #3	7-1 -67
TRAINING UNIT #4	7-1 -67
FLIGHT UNIT #1	7-1 -67
FLIGHT UNIT #2	8-21-67
FLIGHT UNIT #3 (B/V)	8-21-67
FLIGHT UNIT #4	11-21-67
FLIGHT UNIT #5	2-21-68

SCHEDULE

APOLLO LUNAR SAMPLE RETURN CONTAINERS

FIRST QUALIFICATION UNIT	6-23-67
SECOND QUALIFICATION UNIT	7-7-67
QUALIFICATION TESTS (6 WEEKS)	8-8-67
TRAINING UNIT #1	6-30-67
TRAINING UNIT #2	7-28-67
TWO FLIGHT UNITS (ONE ALSRC)	10-13-67
FOUR FLIGHT UNITS (TWO ALSRC'S)	10-28-67
FOUR FLIGHT UNITS (TWO ALSRC'S)	1-12-68
TWO FLIGHT UNITS (ONE ALSRC)	2-23-68

WEIGHT SUMMARY

APOLLO LUNAR HAND TOOLS

Component	On ALSEP	In ALSRC
Instrument Staff	1.200	
Scoop	.342	
Brush/Scribe/Hand Lens	.340	
Scale	.140	
Hammer	1.880	
Gnomon	.200	
Surveying Instrument	2.750	
Instrument Guard	.350	
Color Chart	.050	
Collection Bag	.600	
Tool Carrier	7.000	
Extension Handle	1.040	
Tongs	.210	
Aseptic Sampler		.750
Sample Bags		5.750
Core Tubes		1.100
	16.502	7.600

WEIGHT STATUS

APOLLO LUNAR SAMPLE RETURN CONTAINERS

		Box 1	Box 2
1.	LATCH PIN HARDWARE	0.250	0.250
2.	LID LATCH HARDWARE	1.250	1.250
3.	GASC	0.728	-
4.	SESC	1.538	-
5.	SKIM PROTECTOR (AL MESH)	0.405	0.405
6.	PACKING MATERIAL (AL MESH)	0.495	0.495
7.	VITON A O-RINGS	0.093	0.093
8.	INDIUM SEAL	0.128	0.128
9.	END LATCH SYSTEM	0.75	0.75
10.	OUTER CONTAINER - BOTTOM	5.82	5.82
11.	OUTER CONTAINER - LID	3.10	3.10
12.	SEAL SPACER AND SEAL PROTECTORS	0.25	0.25
13.	DRILL STRING MOUNTS	0.30	-
14.	CORE TUBE AND ASCEPTIC SAMPLER MOUNTS	-	.516
15.	BAG DISPENSER MOUNTS	0.120	0.120
16.	INNER CONTAINER STRAPS	0.46	-
	TOTAL	15.697 lbs.	13.177 lbs.

TOTAL PER SET = 28.874 lbs.