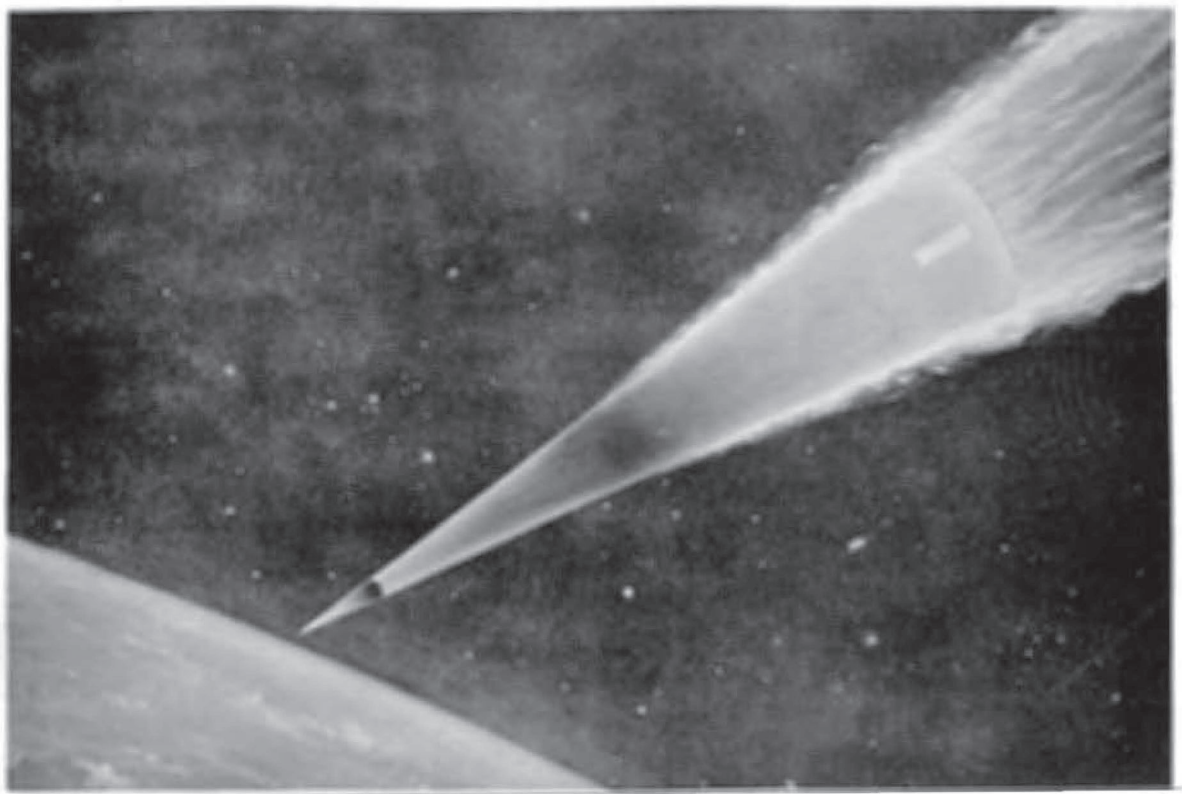


Re-entry-F

TURBULENT HEATING EXPERIMENT

LANGLEY RESEARCH CENTER



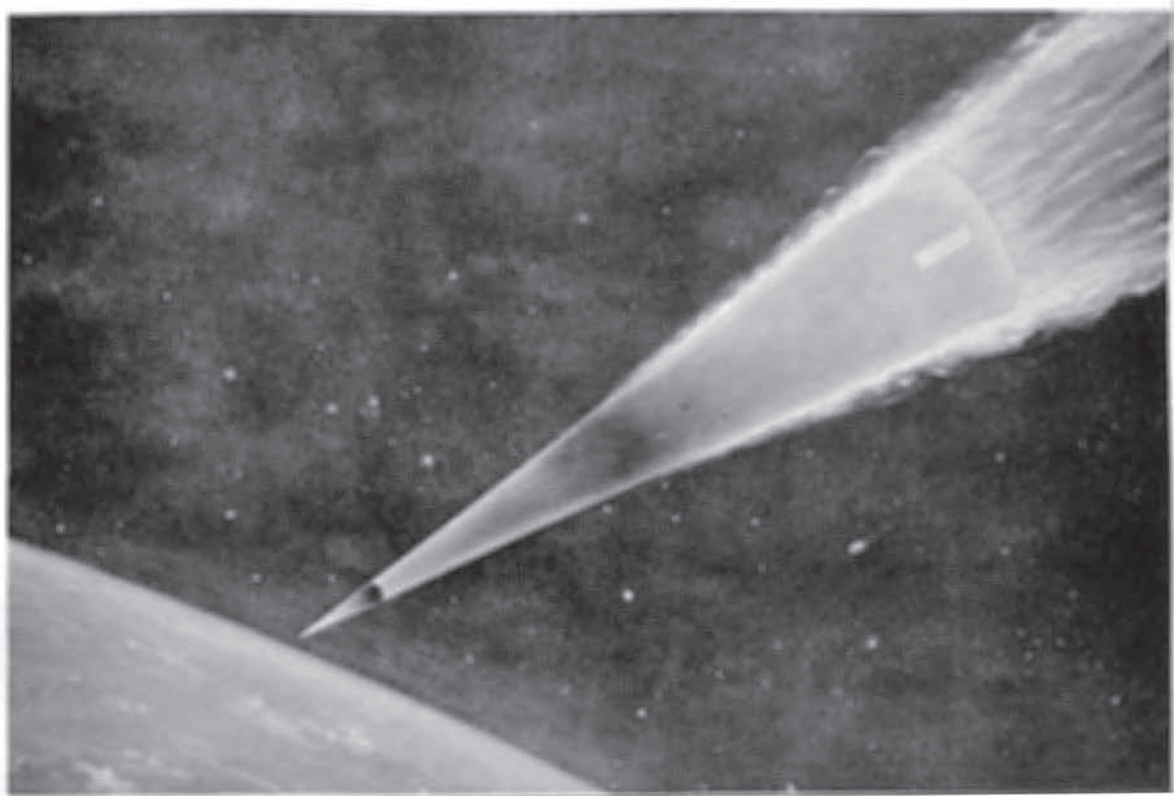
National Aeronautics and Space Administration

GENERAL  ELECTRIC
RE-ENTRY SYSTEMS
3198 Chestnut Street, Philadelphia, Pa. 19101

Re-entry-F

TURBULENT HEATING EXPERIMENT

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Re-entry F

Turbulent Heating Experiment

Langley Research Center

NASA

BACKGROUND

A NASA review of hypersonic boundary layer research needs and programs indicates that a high speed, re-entry flight experiment is needed for the following reasons:

1. To provide real environmental turbulent heating rate data for correlation with ground facility test results and with theoretical methods in an advanced flight regime.
2. To determine the transition Reynolds Number on a slender cone at flight conditions typical of advanced vehicles.

The Re-entry F flight experiment is intended to fulfill these needs by obtaining real environmental turbulent heating rate and transition data at conditions sufficiently ahead of existing ground research capability to be of lasting interest, and at conditions commensurate with advanced vehicle concepts.

OBJECTIVES

To obtain measurements of heat transfer in a fully developed turbulent boundary layer on a simple shape with a minimum of complicating variables.

To determine the Reynolds Number at which transition from laminar to turbulent flow occurs.

EXPERIMENT PLAN

Obtain telemetered heat transfer data from a slender, sharply pointed, conical, metallic spacecraft during re-entry. The Beryllium heatshield of the spacecraft serves as a calorimeter and incorporated 84 thermocouples at selected depths and locations. Launch will be from Wallops Island in April, 1968, and will utilize a modified three-stage Scout boost vehicle. Re-entry will be off Bermuda.

GOVERNMENT SPONSOR

The Re-entry F Project is under the direction of the Office of Advanced Research and Technology, National Aeronautics and Space Administration, and is being managed by the Applied Materials and Physics Division of the Langley Research Center, Hampton, Virginia.

GENERAL ELECTRIC ROLE

General Electric Re-entry Systems, Philadelphia, Pennsylvania, is responsible for the Turbulent Heating Experiment spacecraft analysis, design and development, fabrication of three spacecraft, and for flight planning and launch operations support.

RE-ENTRY F

PROGRAM OBJECTIVES

Heating Rate ($\pm 15\%$)
Transition RN ($\pm 10\%$)

Will Meet
Will Meet

RE-ENTRY CONDITIONS

Velocity
Start Transition
First Melt (4 Ft Sta)
Data Period

20K FPS/20°
105K Ft
49K Ft
7 Seconds

SPACECRAFT DESIGN

Length/Base Diam/Cone Angle
Weight & Static Margin
Calorimeter
Inner Structure
Nose Tip
Antenna Window

155" /27.3" /5°
570# /5%; 600# /6.5%
0.60" Beryllium
Alum Ring/Skin
ATJ Graphite
Quartz

TELEMETRY SYSTEM

Type
Channels

PDM/FM/FM
8 Cont, 3 Comm

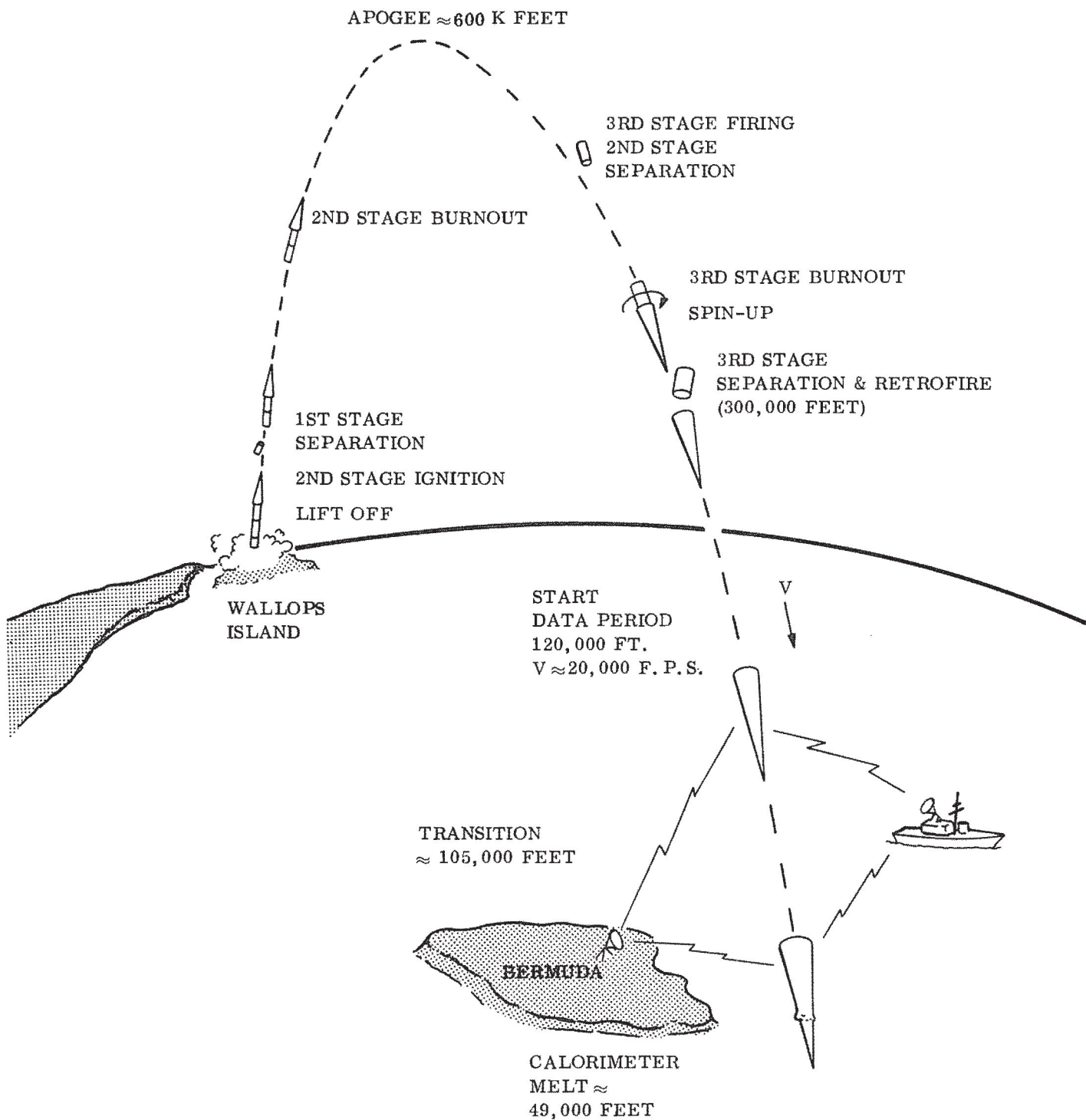
SENSORS

Calorimeter Thermal Sensors
Aero Pressures (5 Ranges)
Body Motion Rates (2 Ranges)
Accelerations (3 & 2 Ranges)
Diagnostic

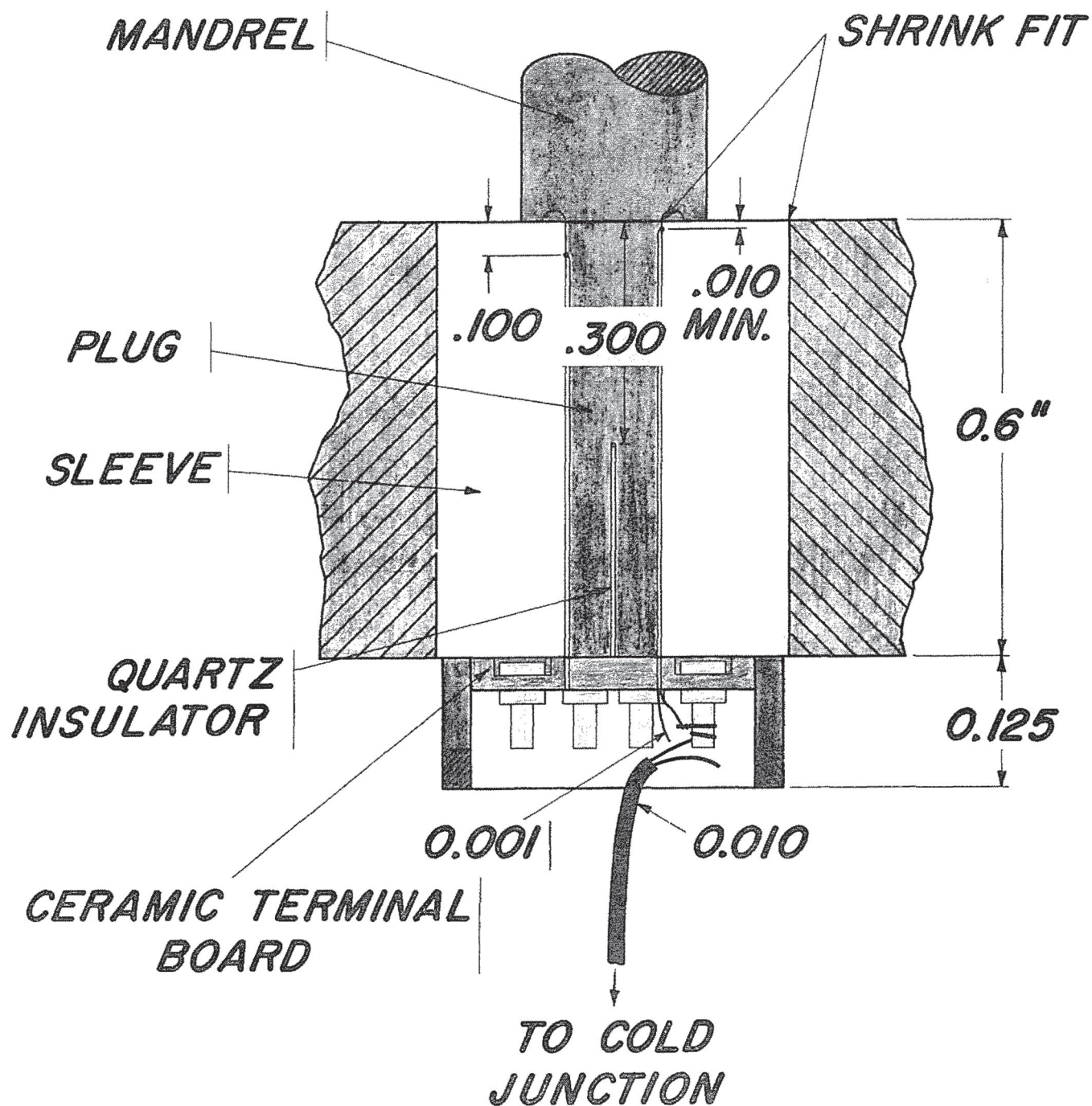
21 (84 TC'S)
30
Roll, Pitch, Yaw
Axial, Pitch, Yaw
Temps, PWR, VSWR

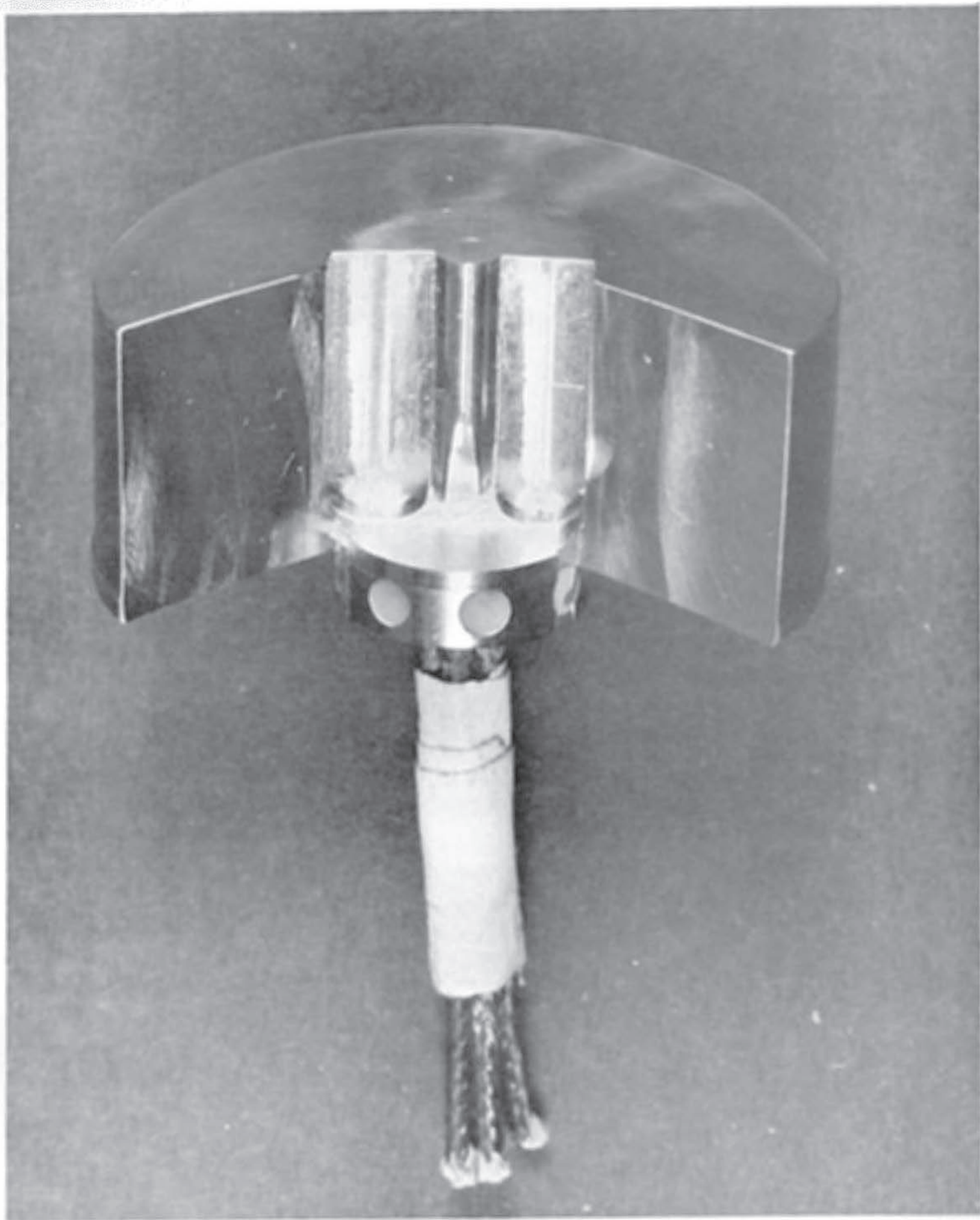
TRACKING AID

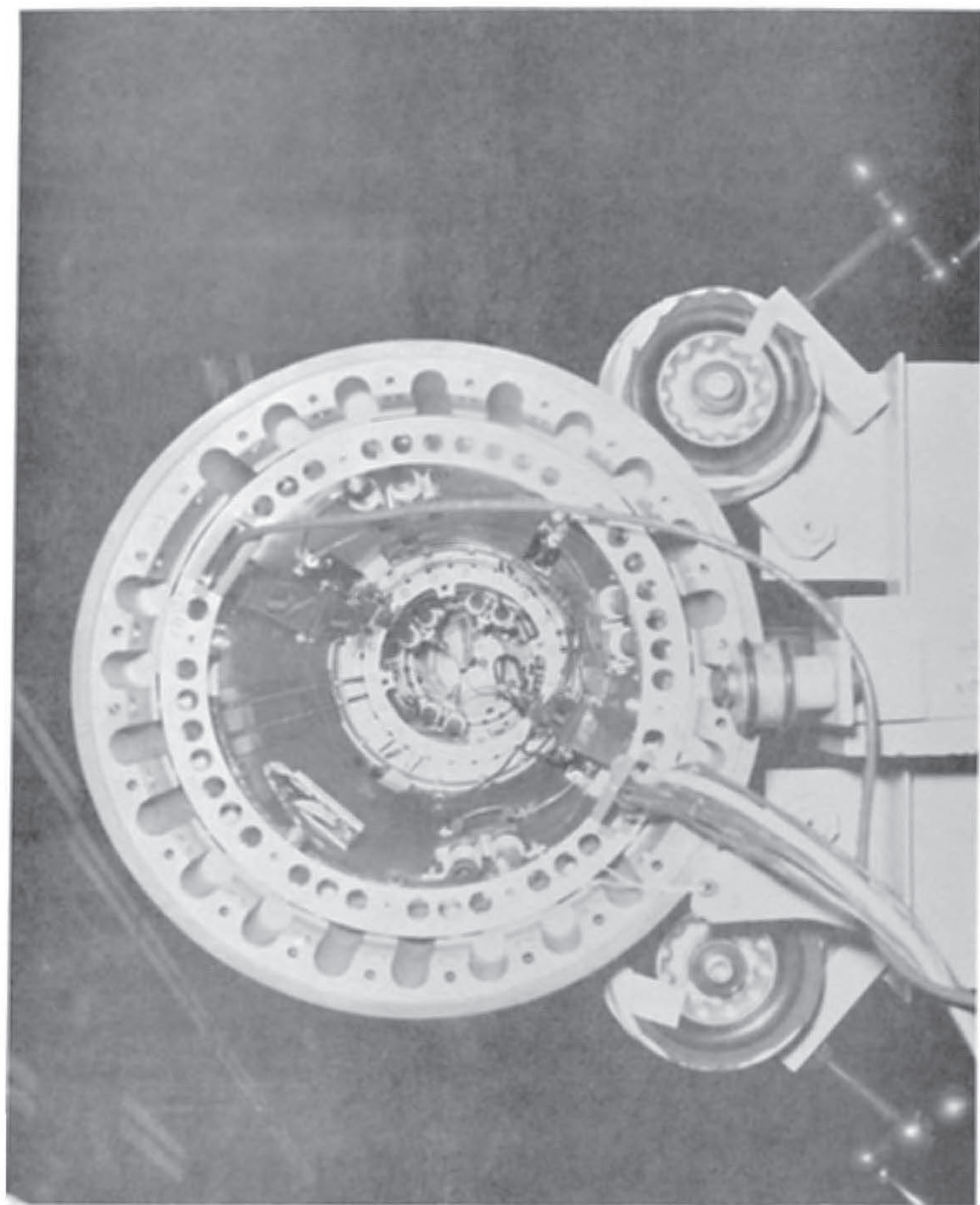
C-Band Beacon

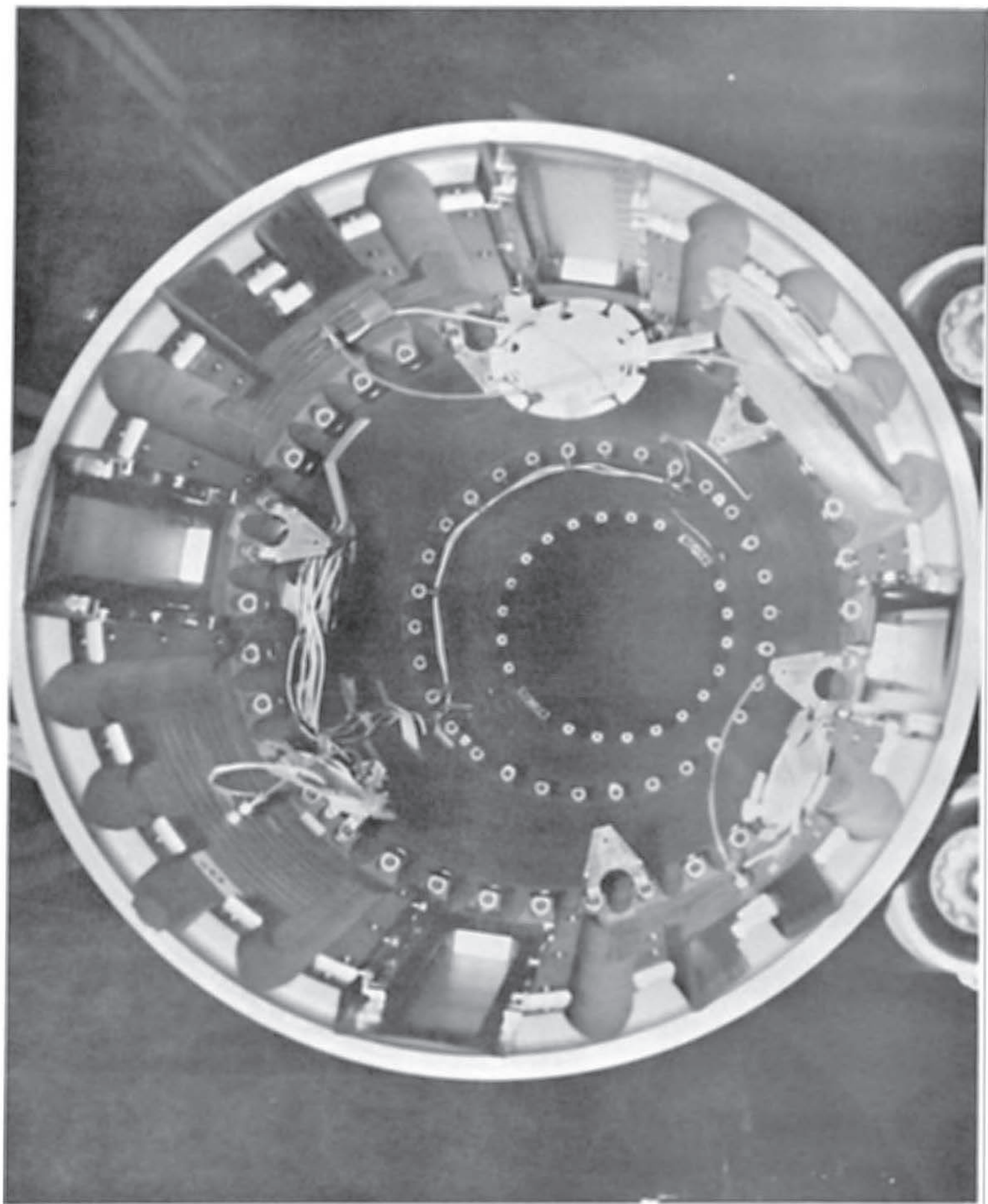


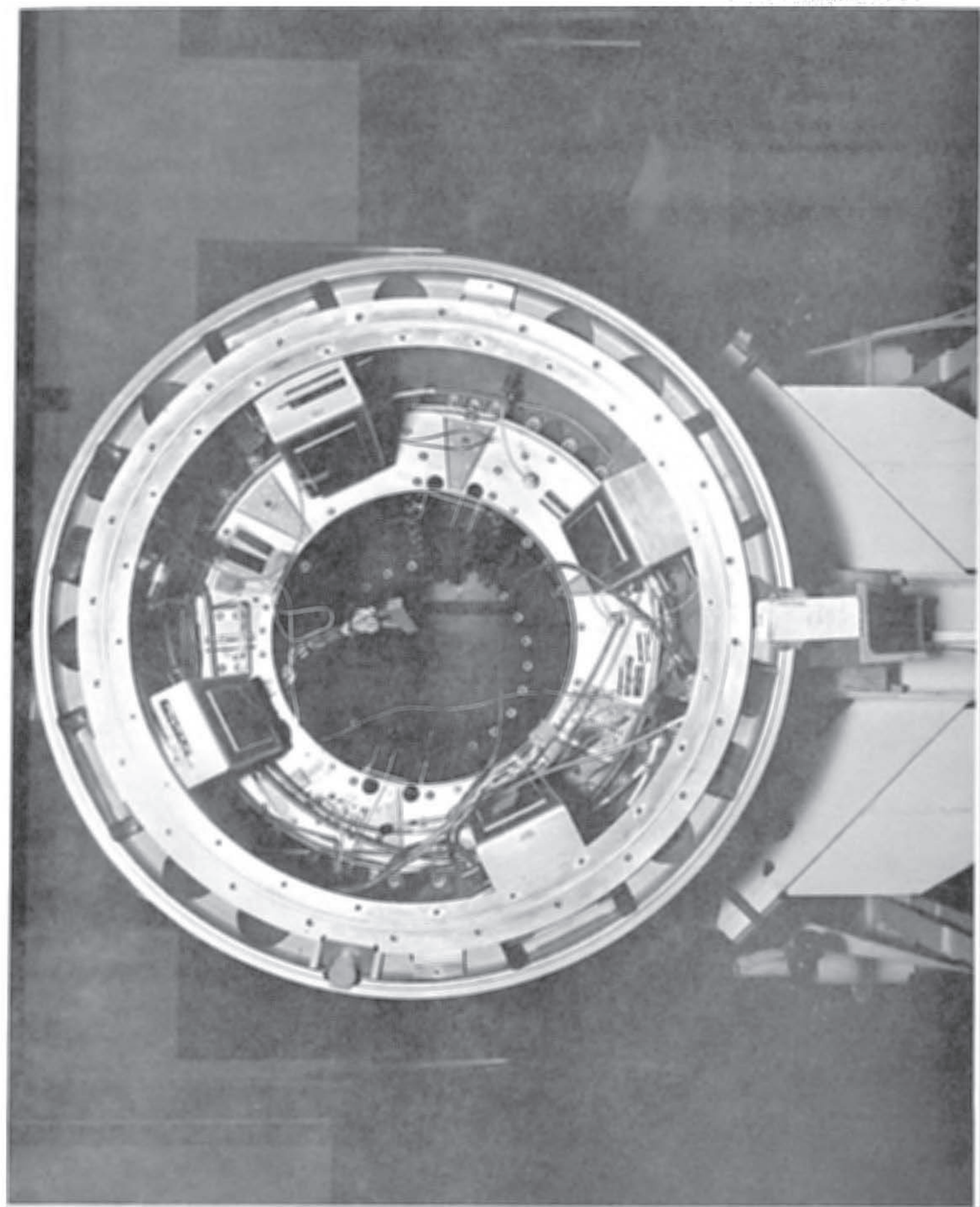
SENSOR RE-ENTRY F THERMAL

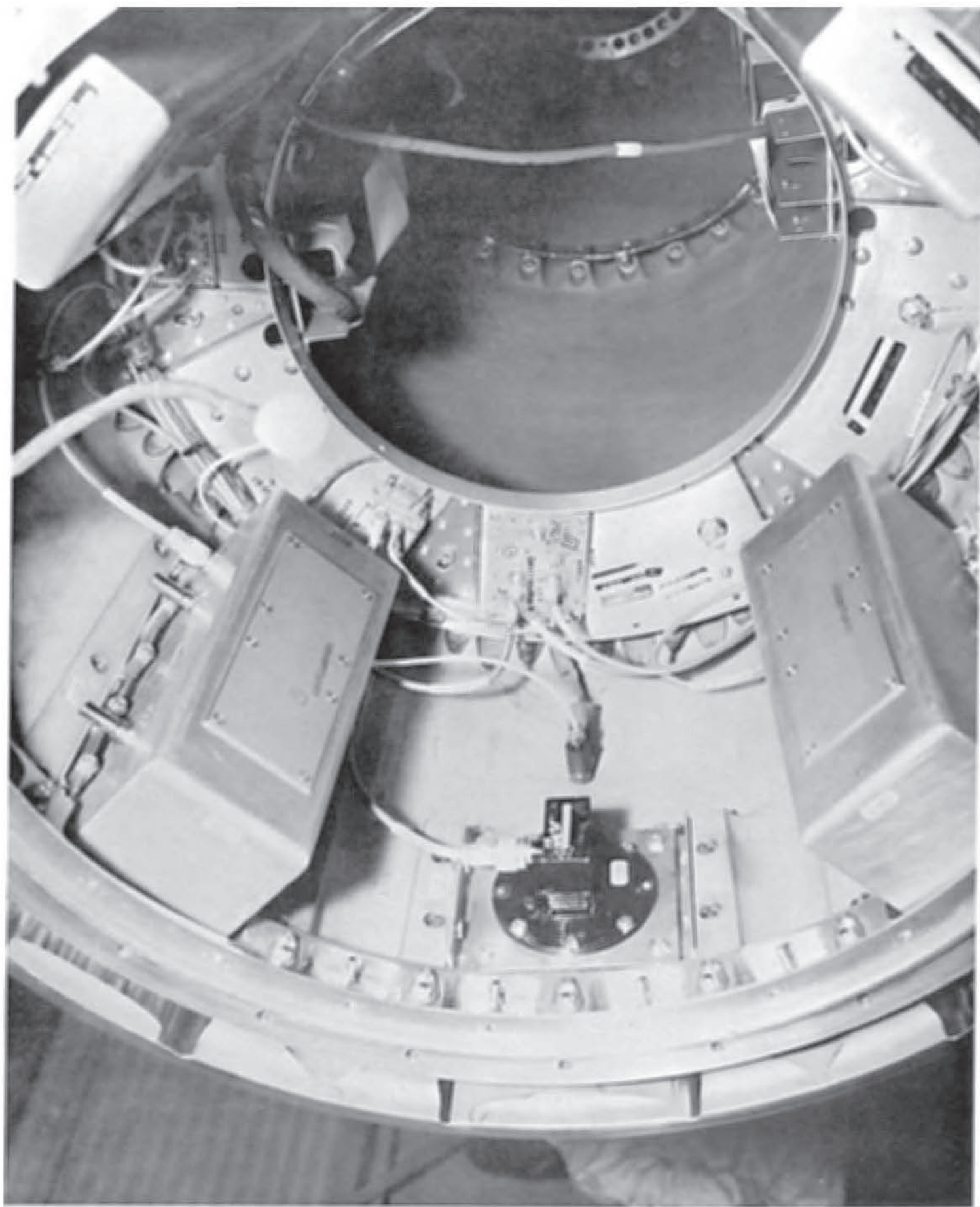


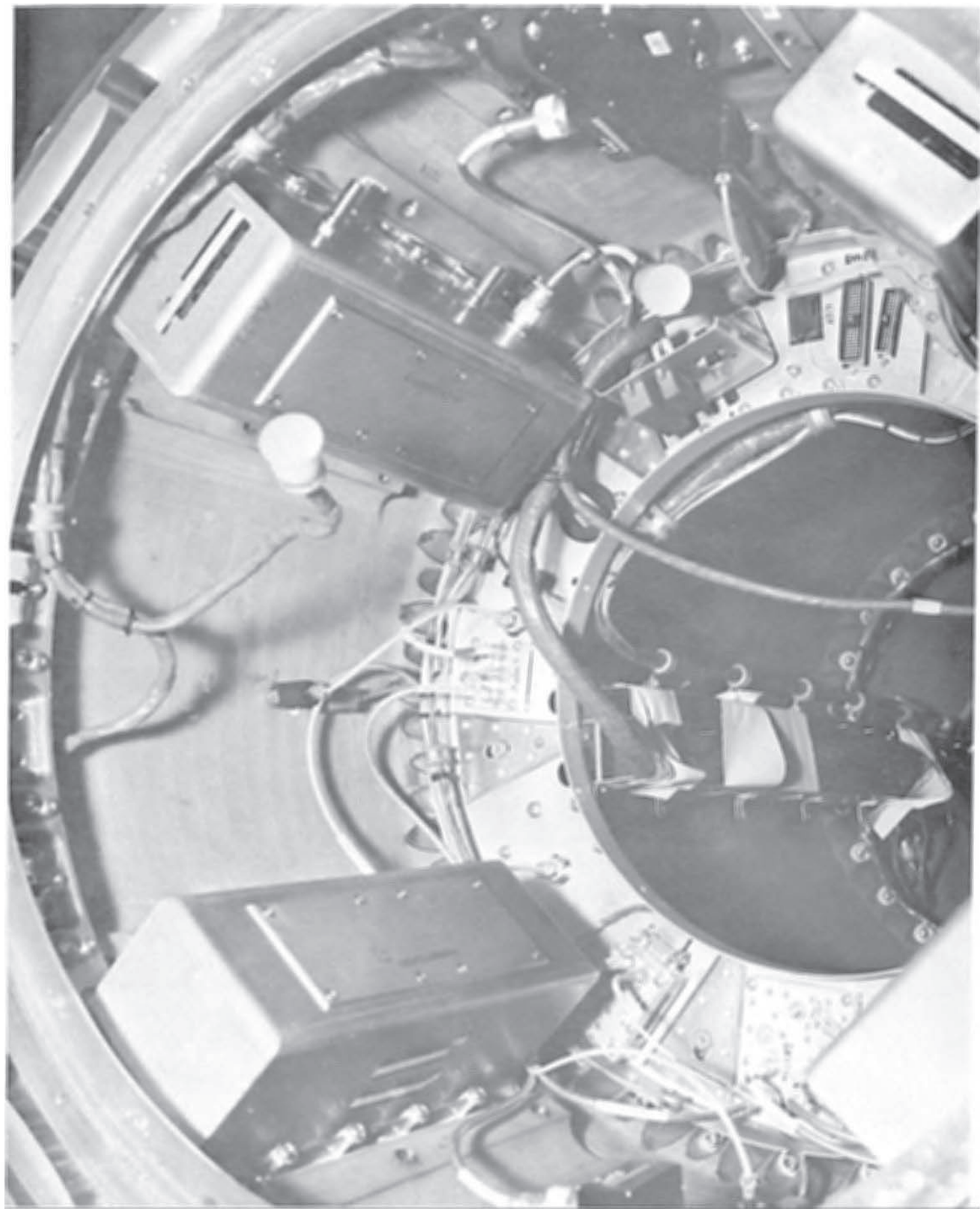


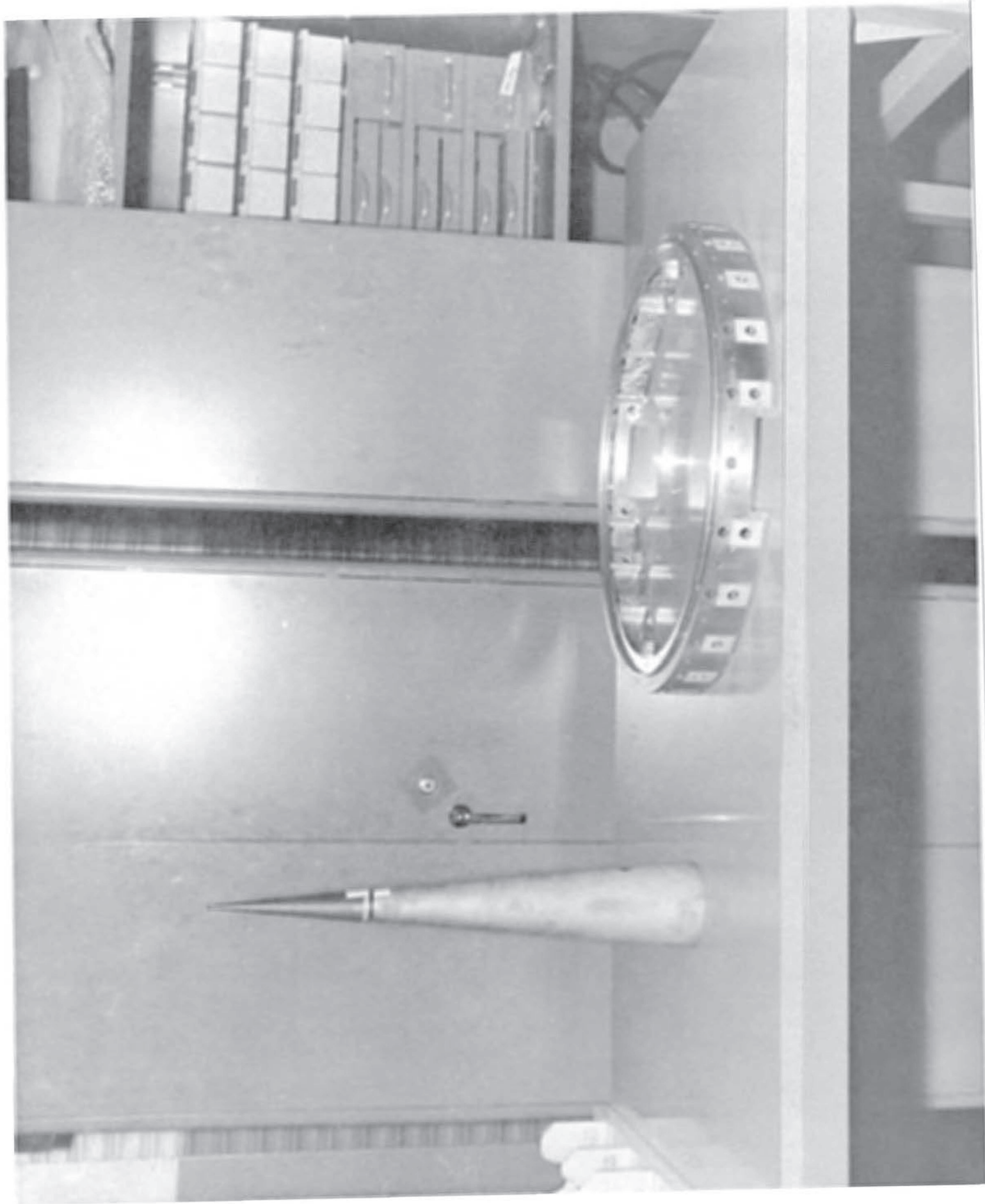


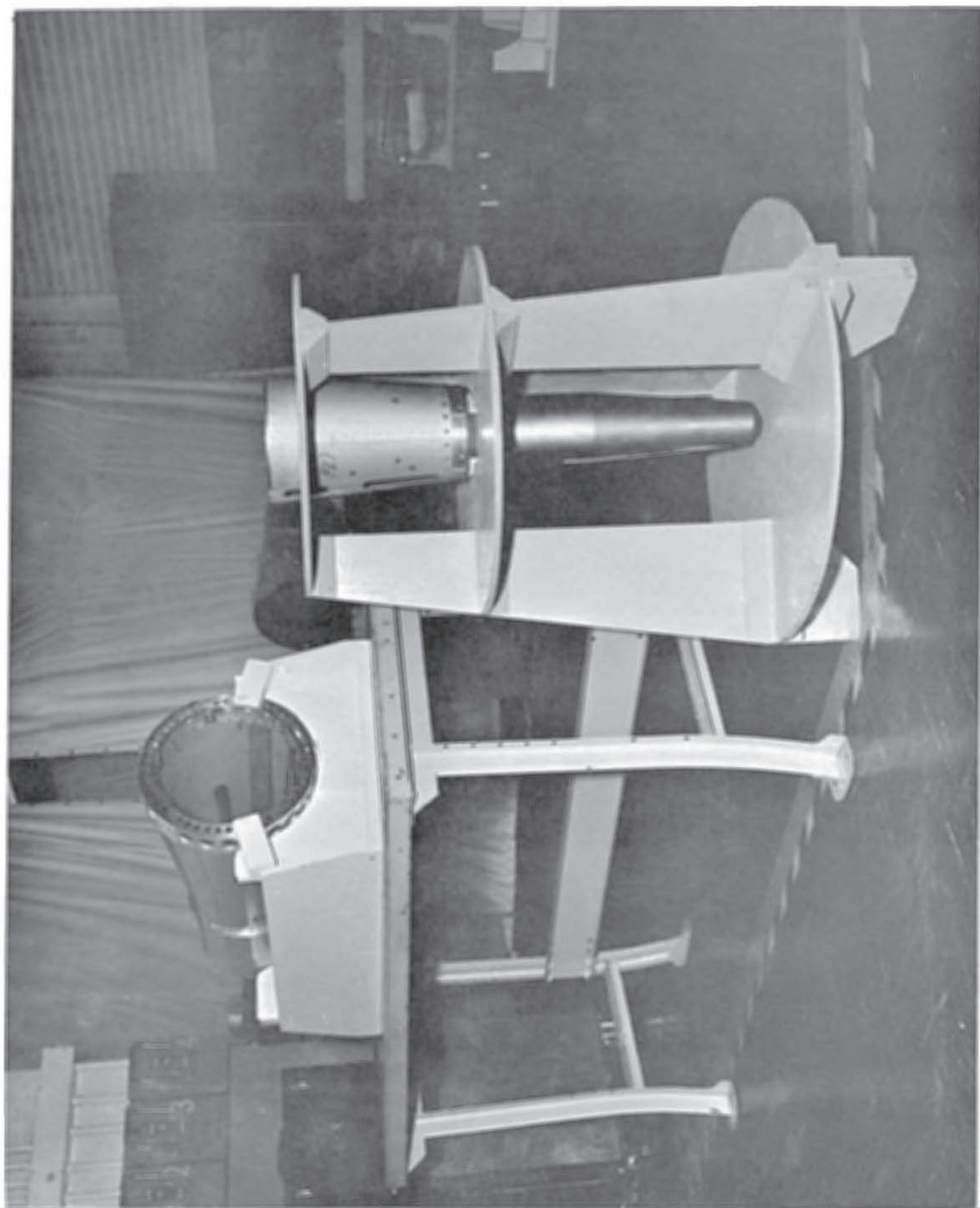


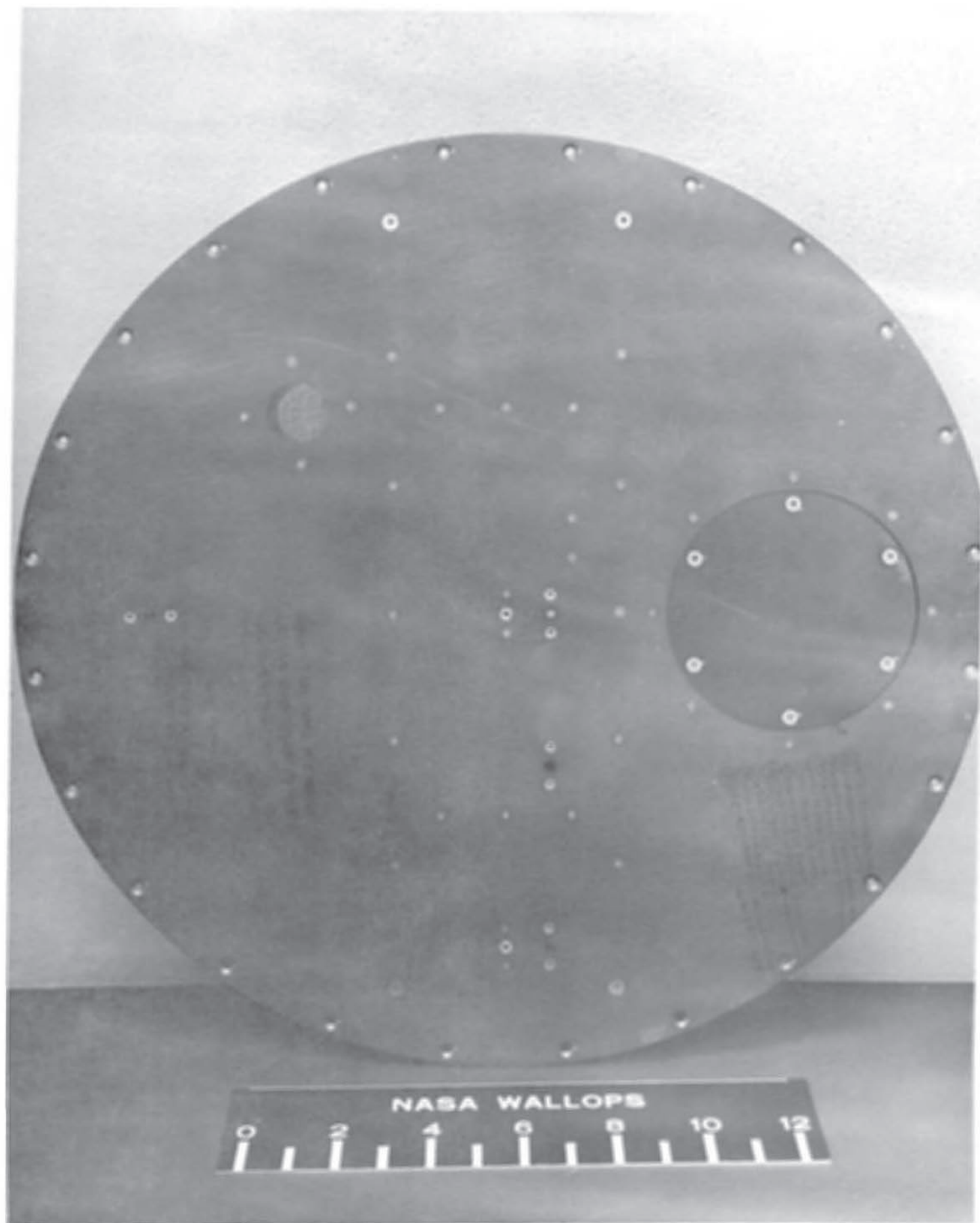


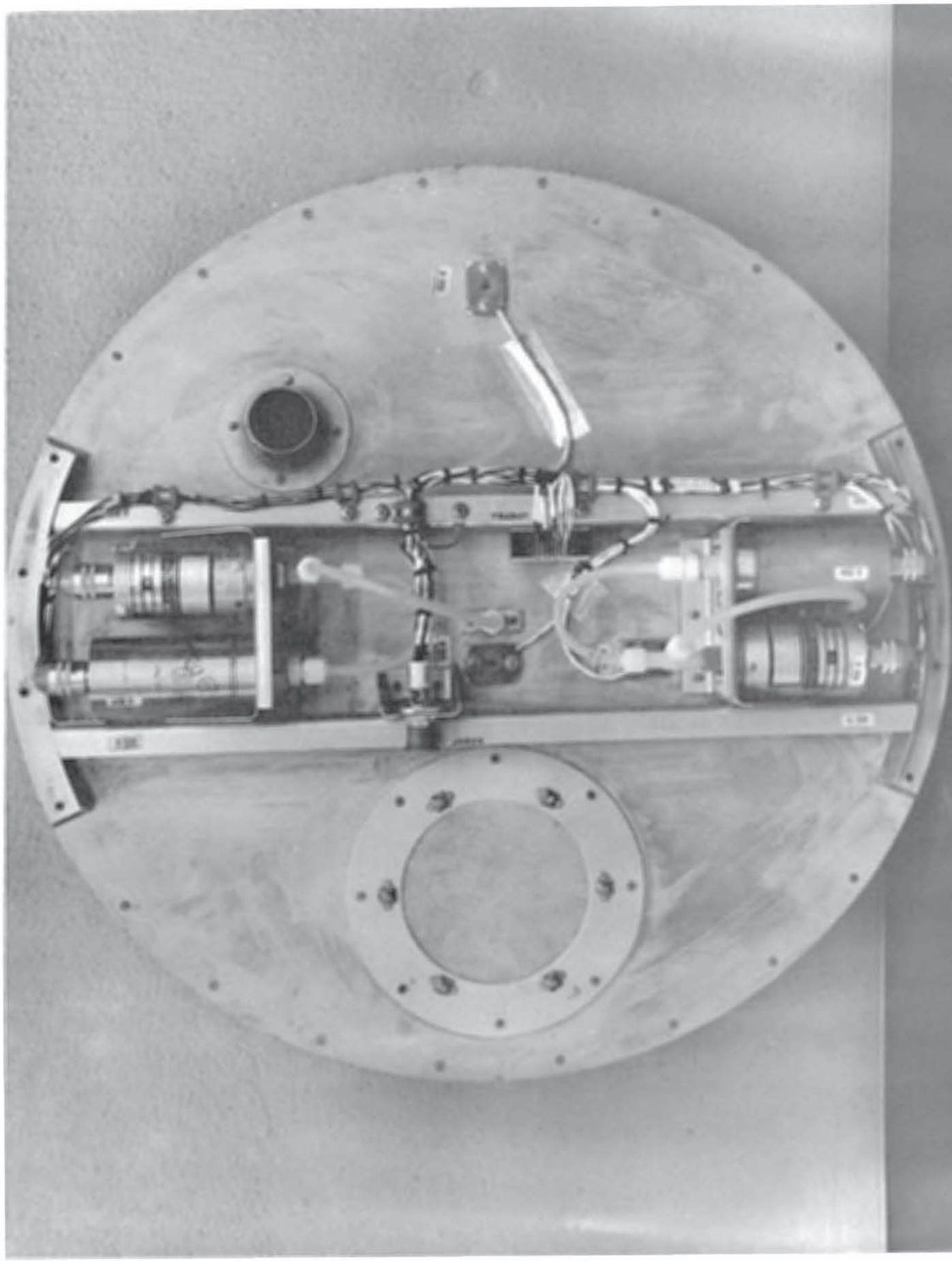




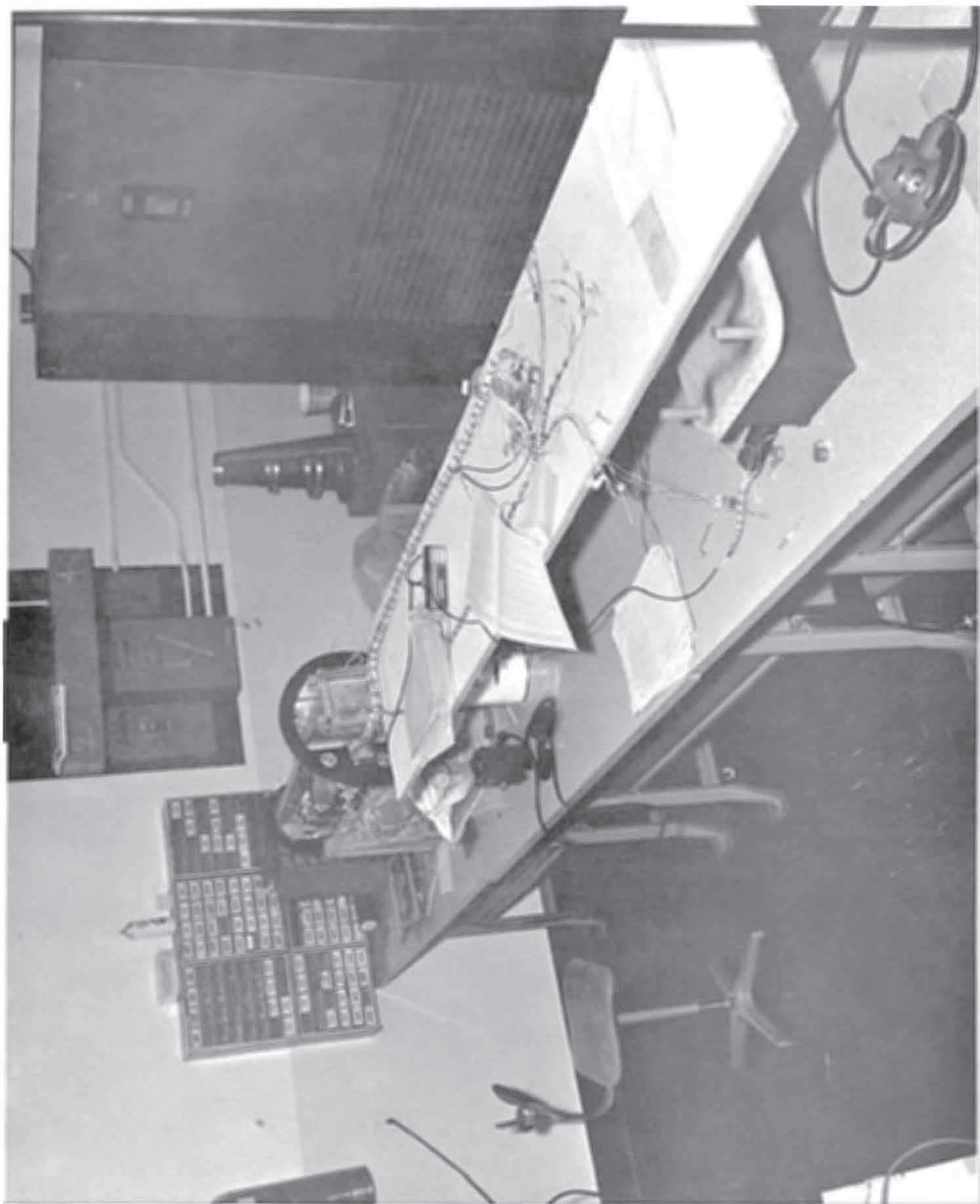


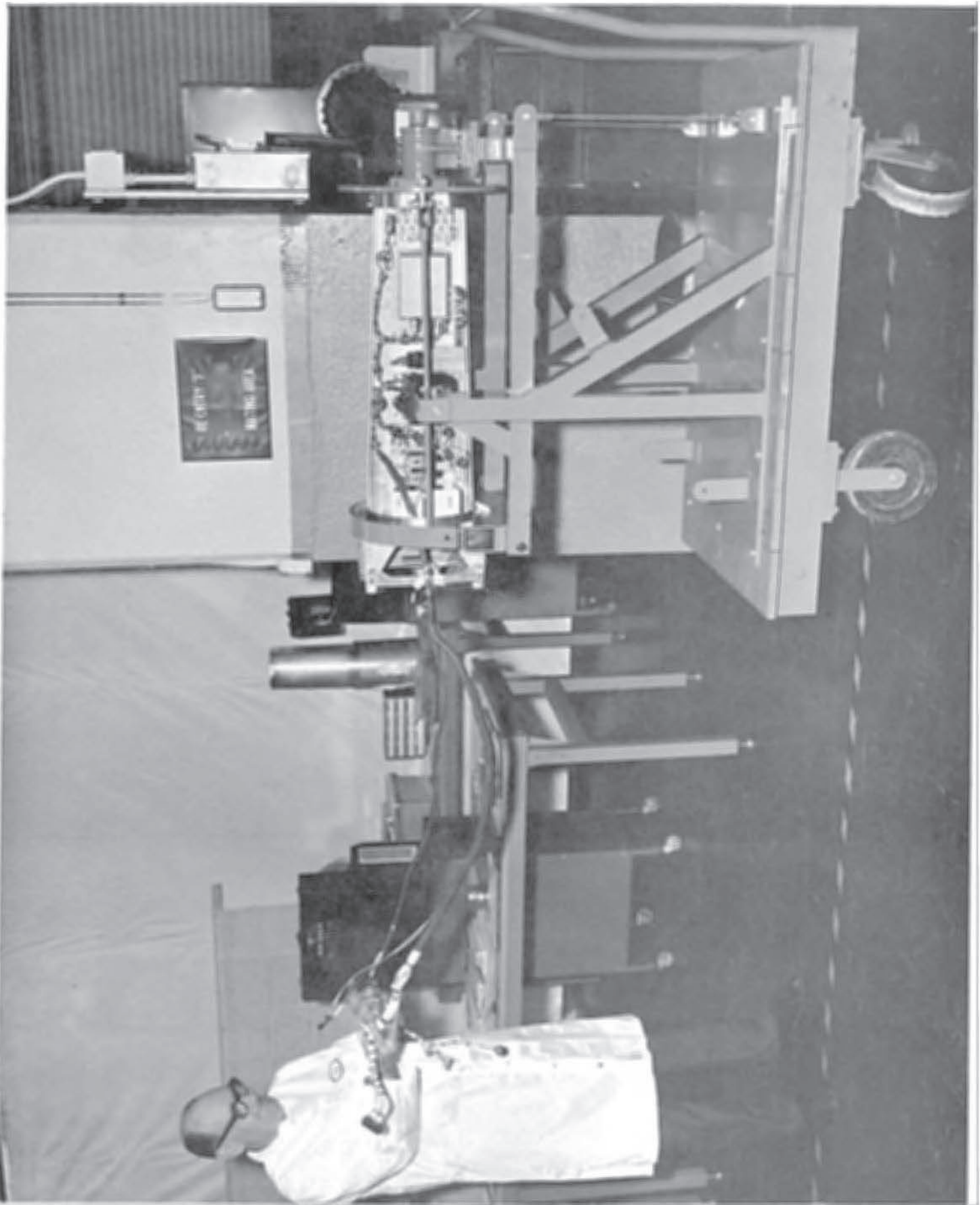


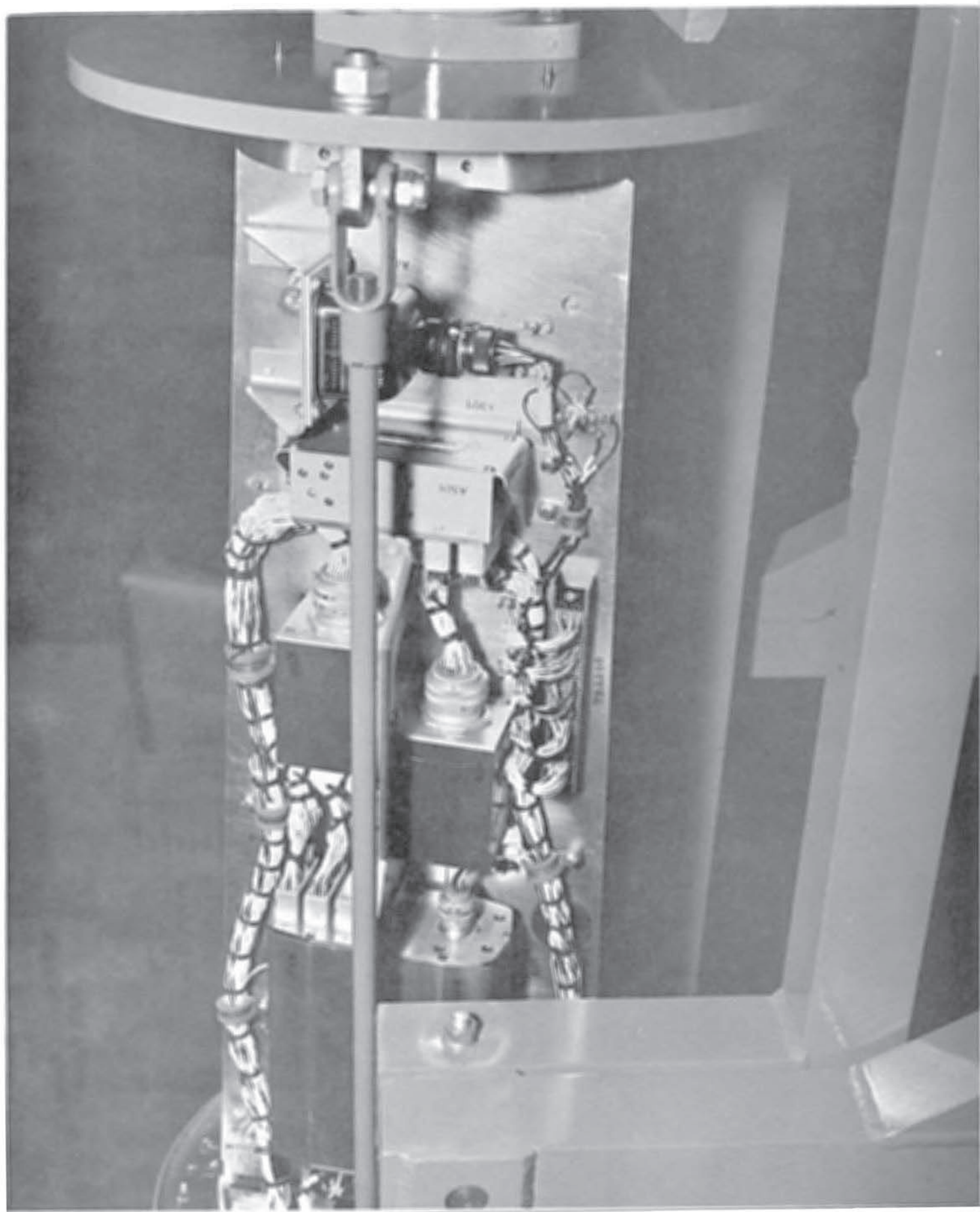


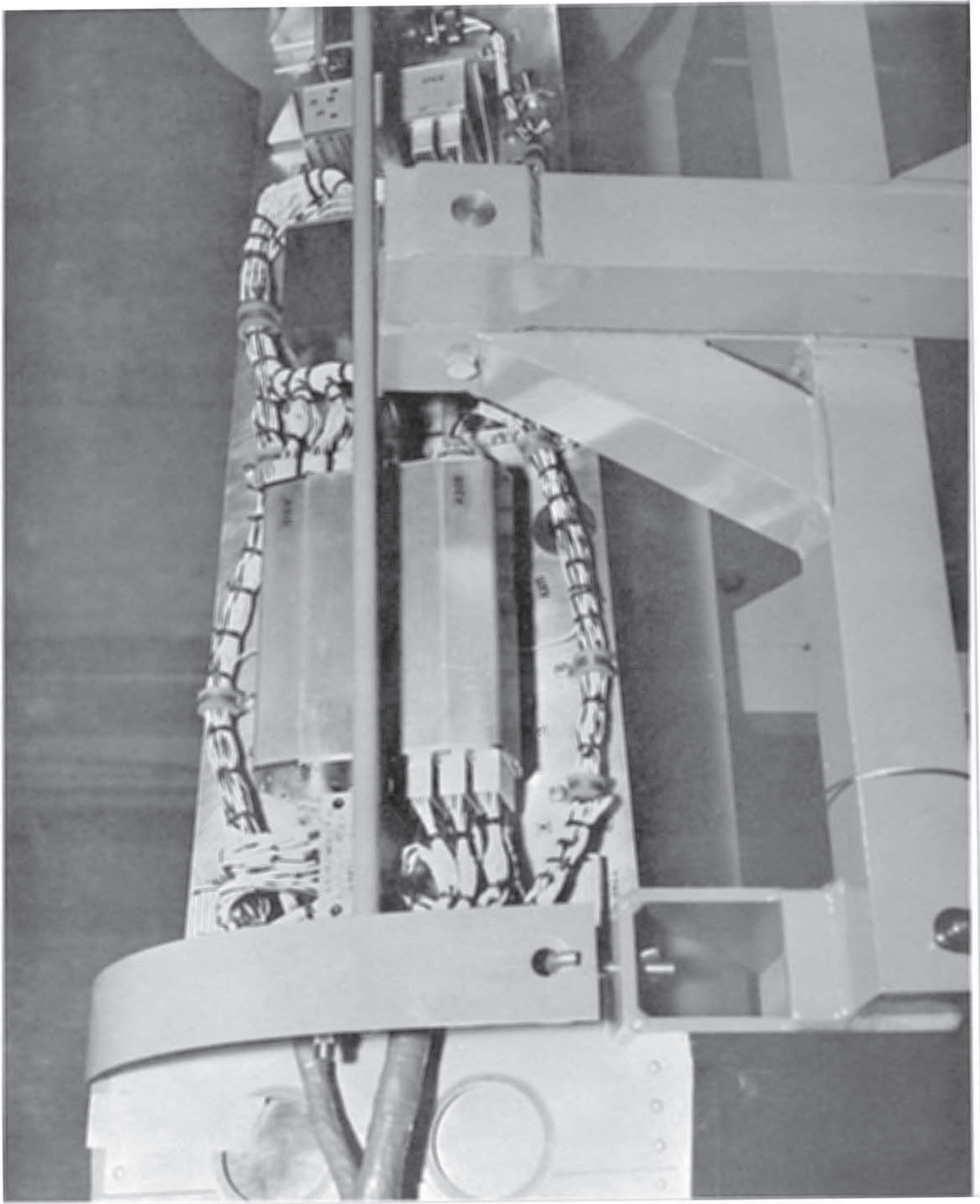


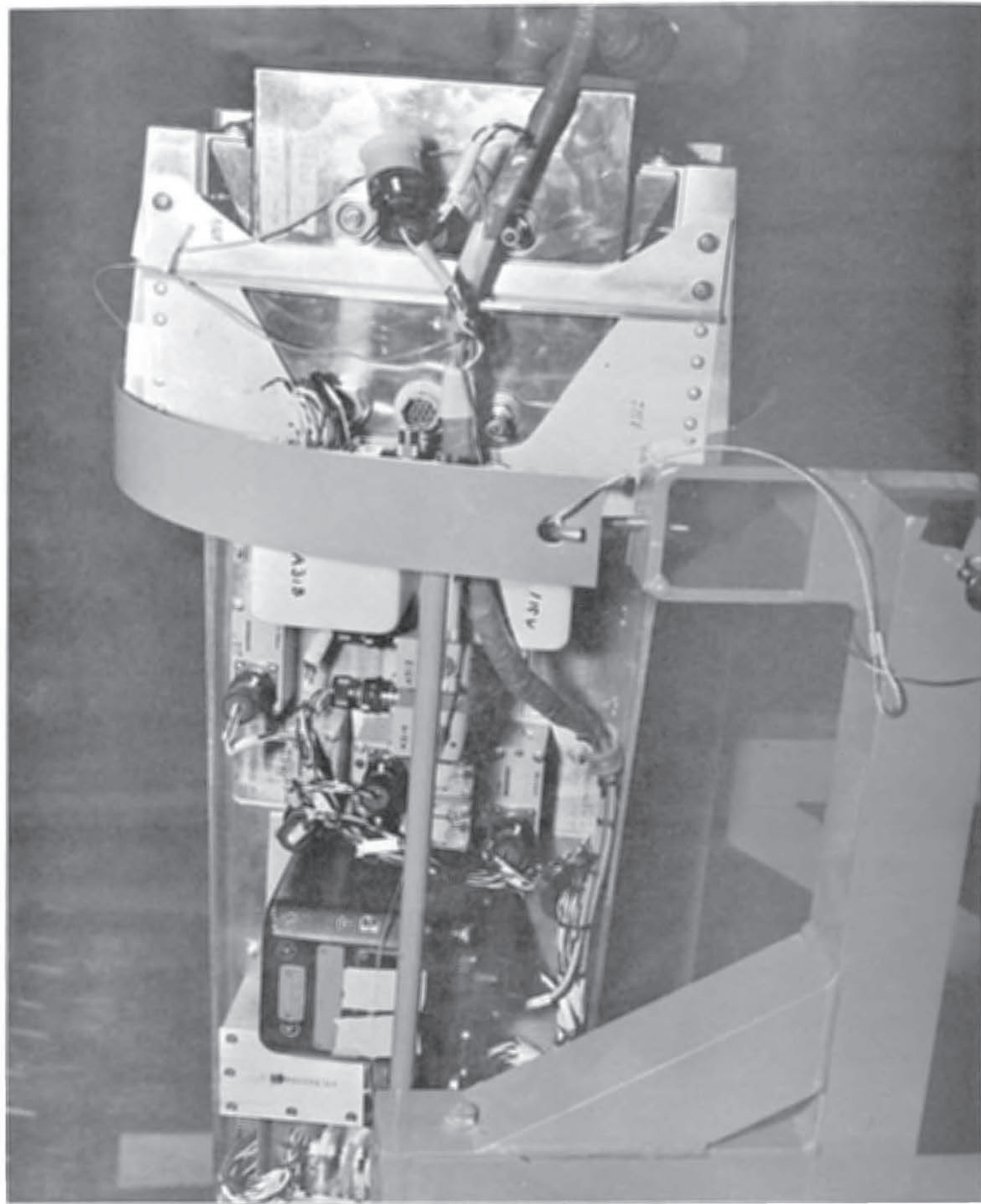
NASA WALLOPS 0 2 4 6 8 10 12

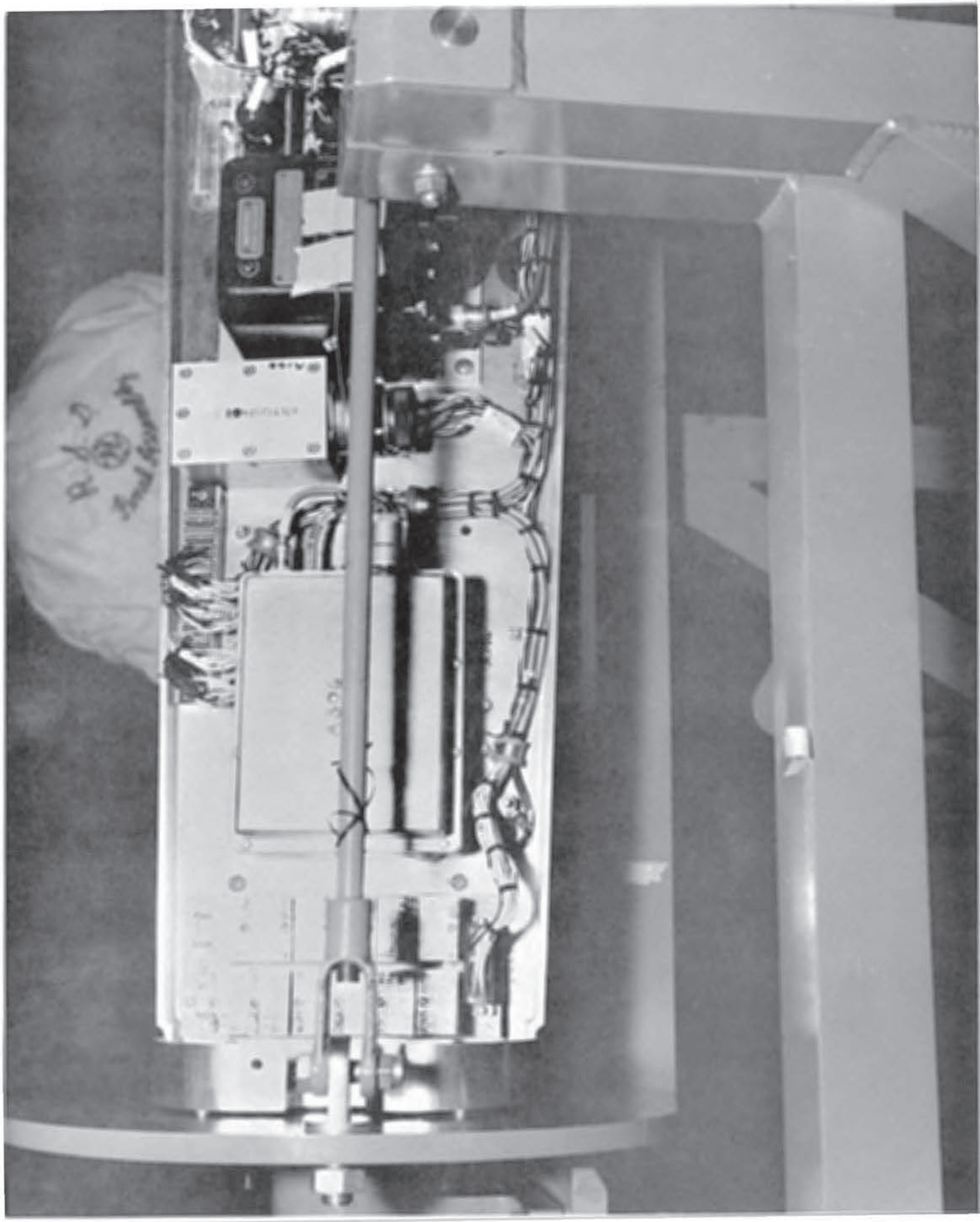


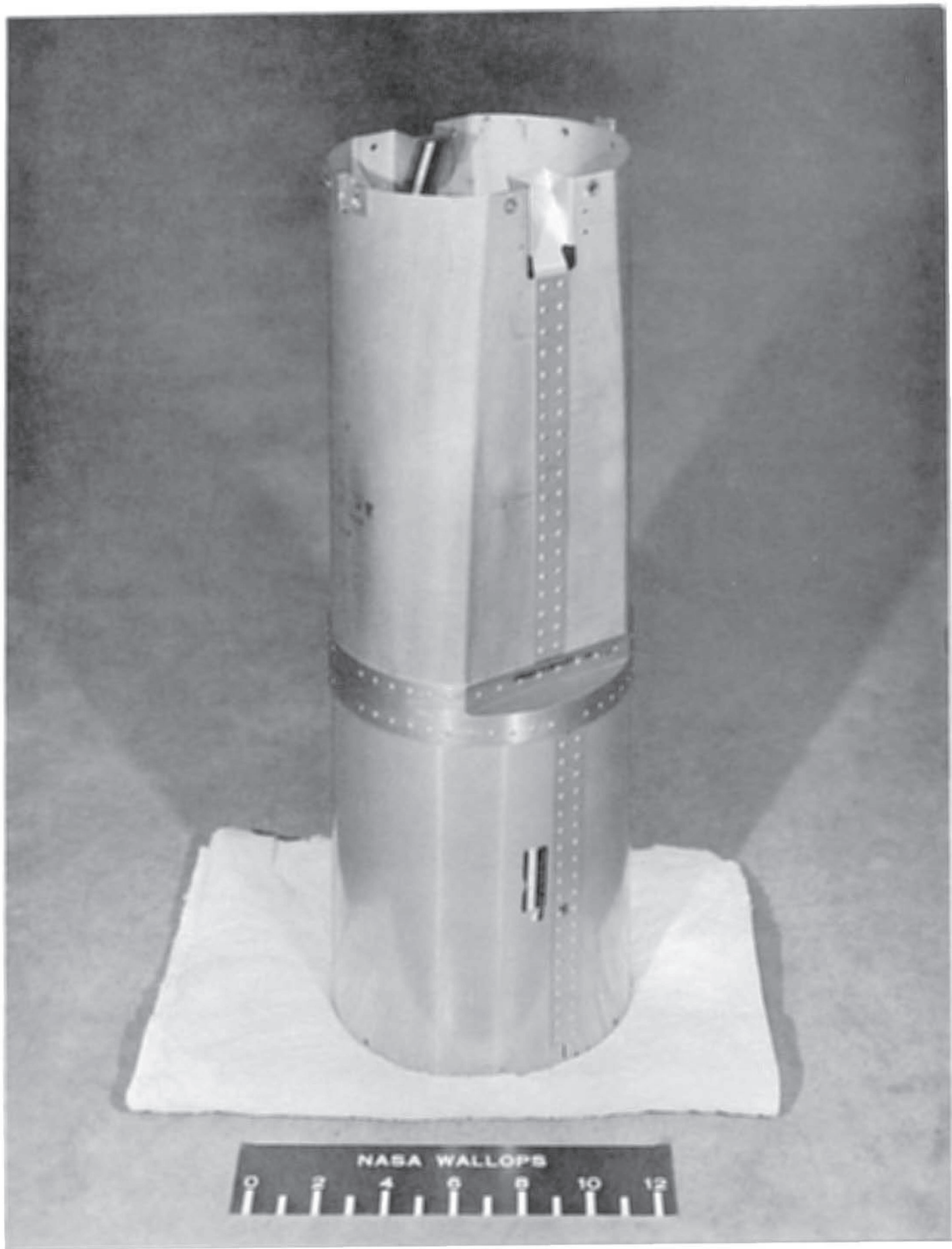


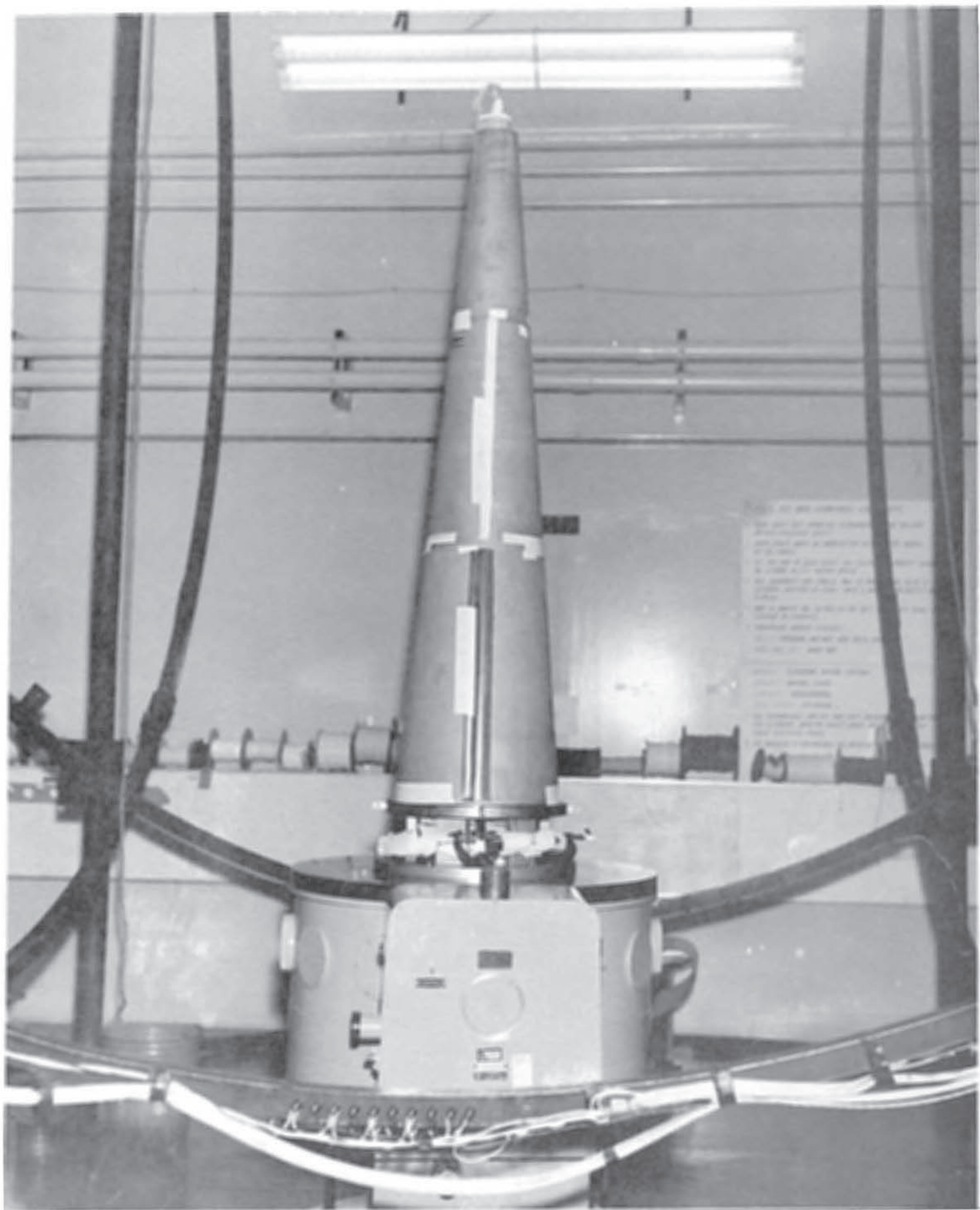


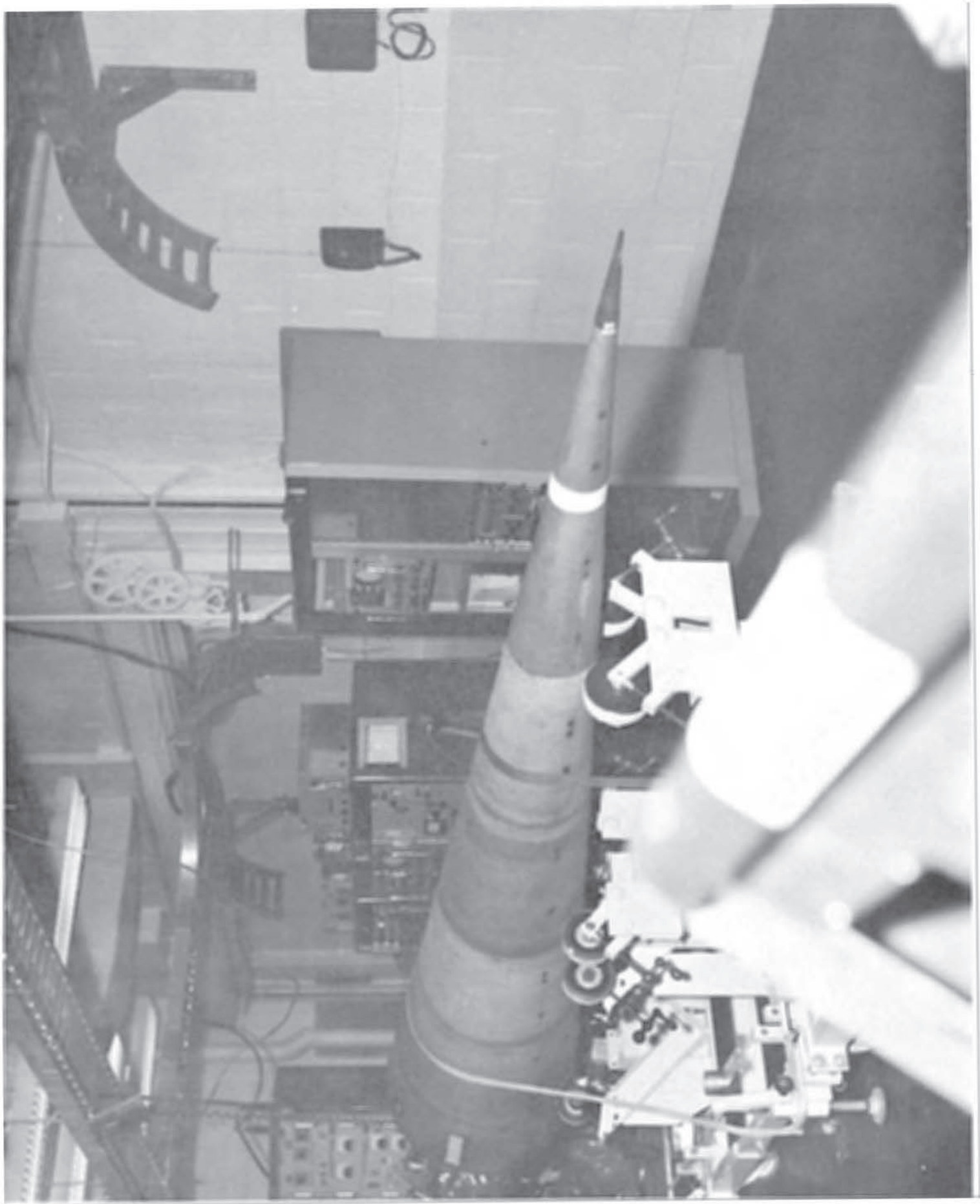


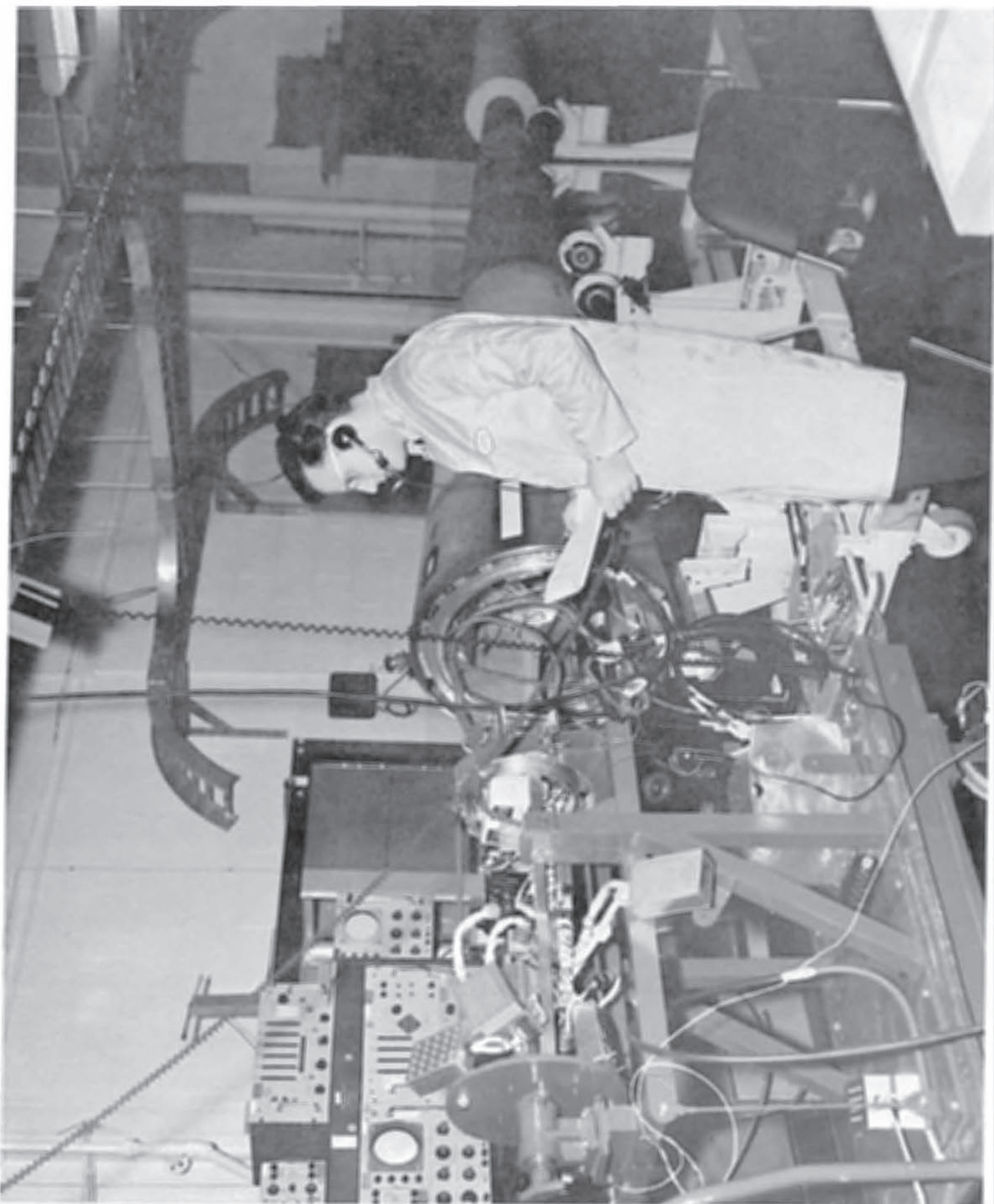


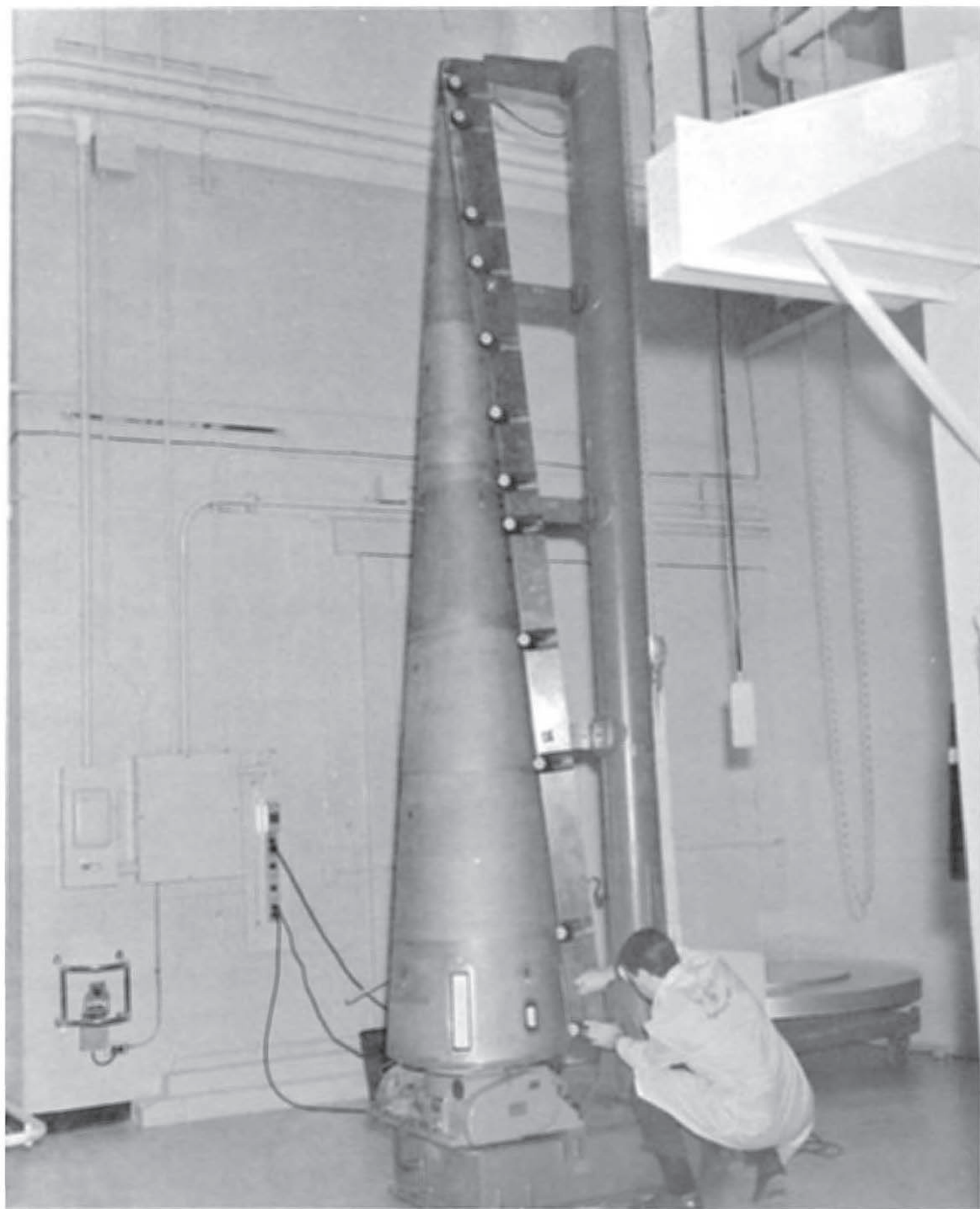






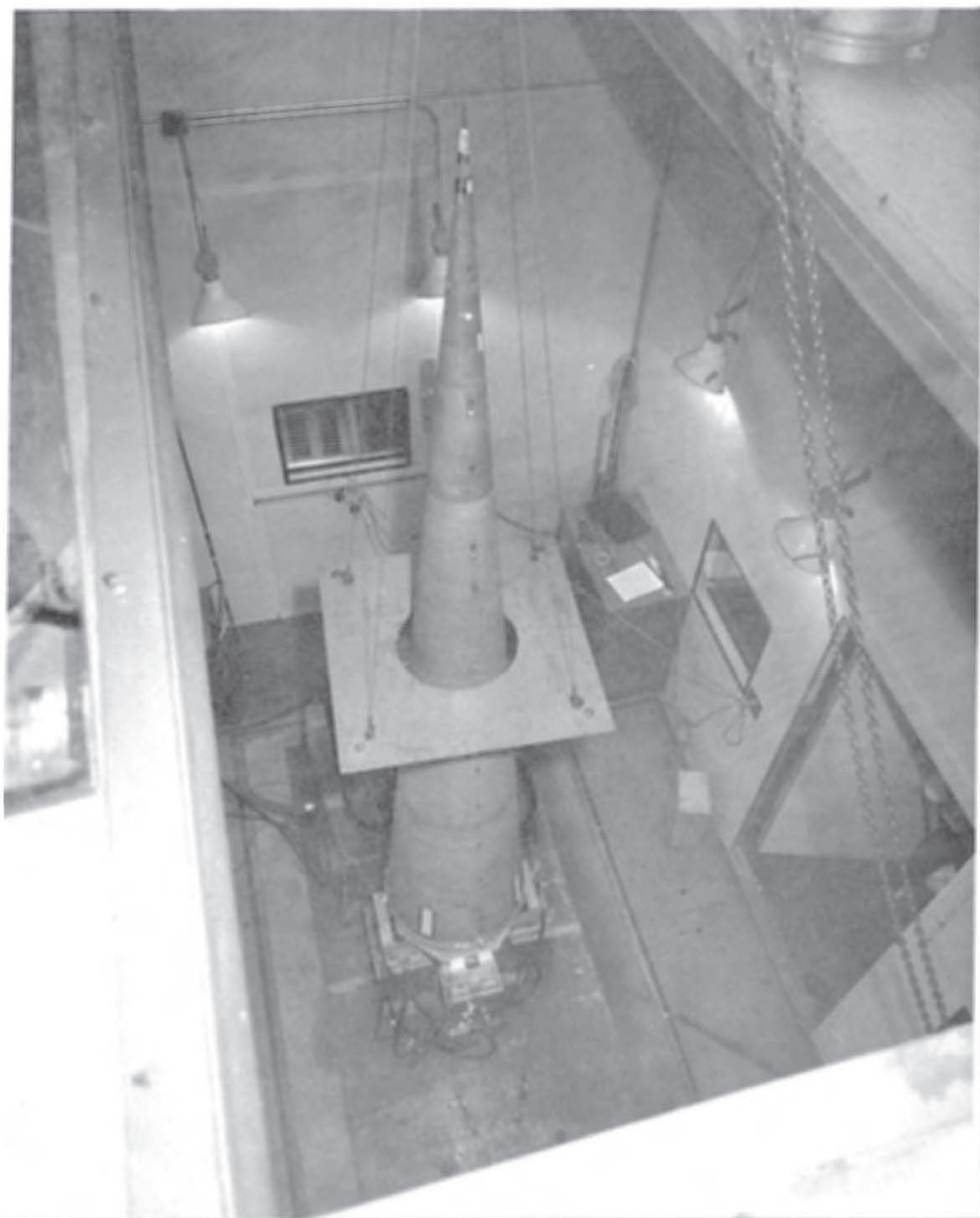


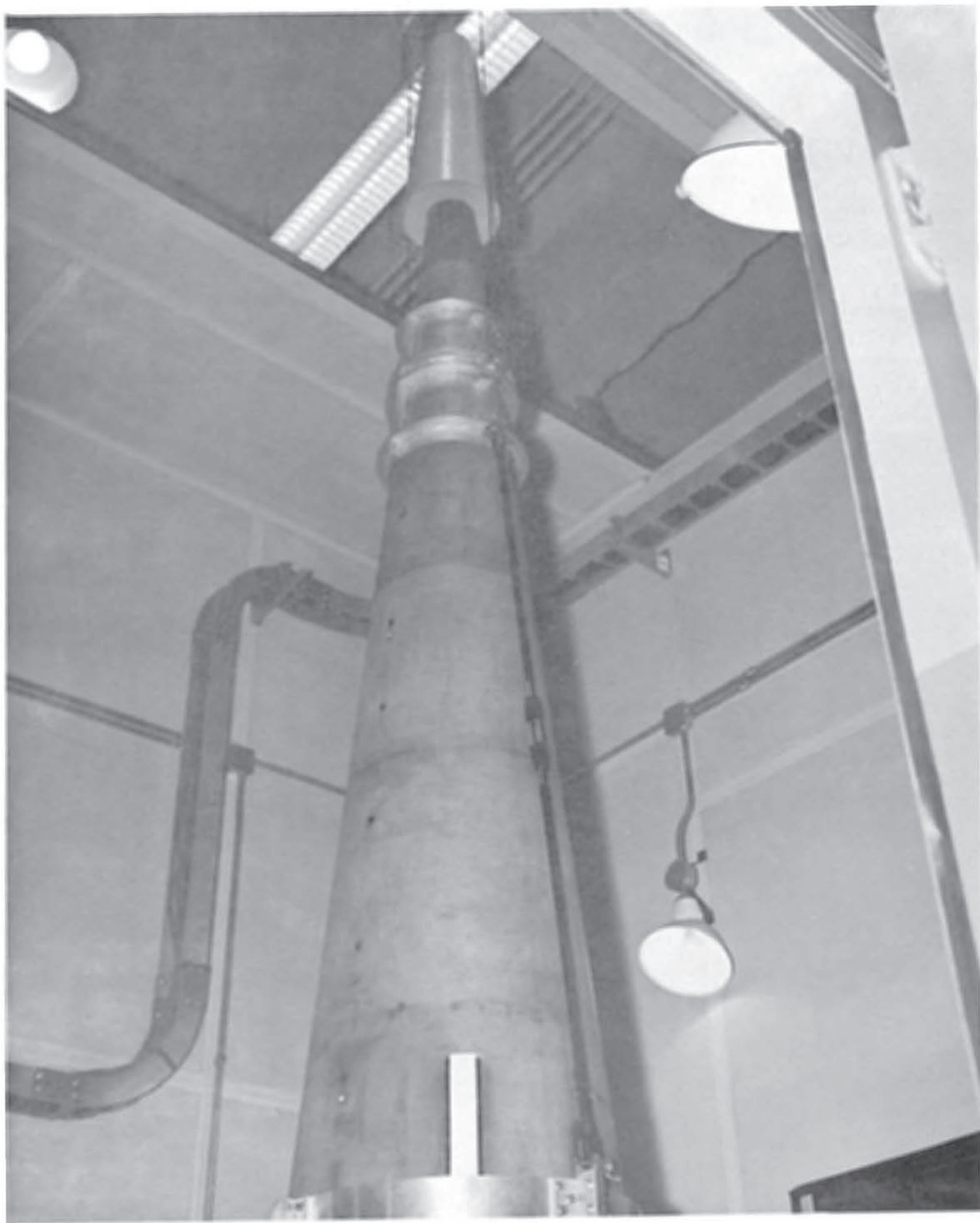


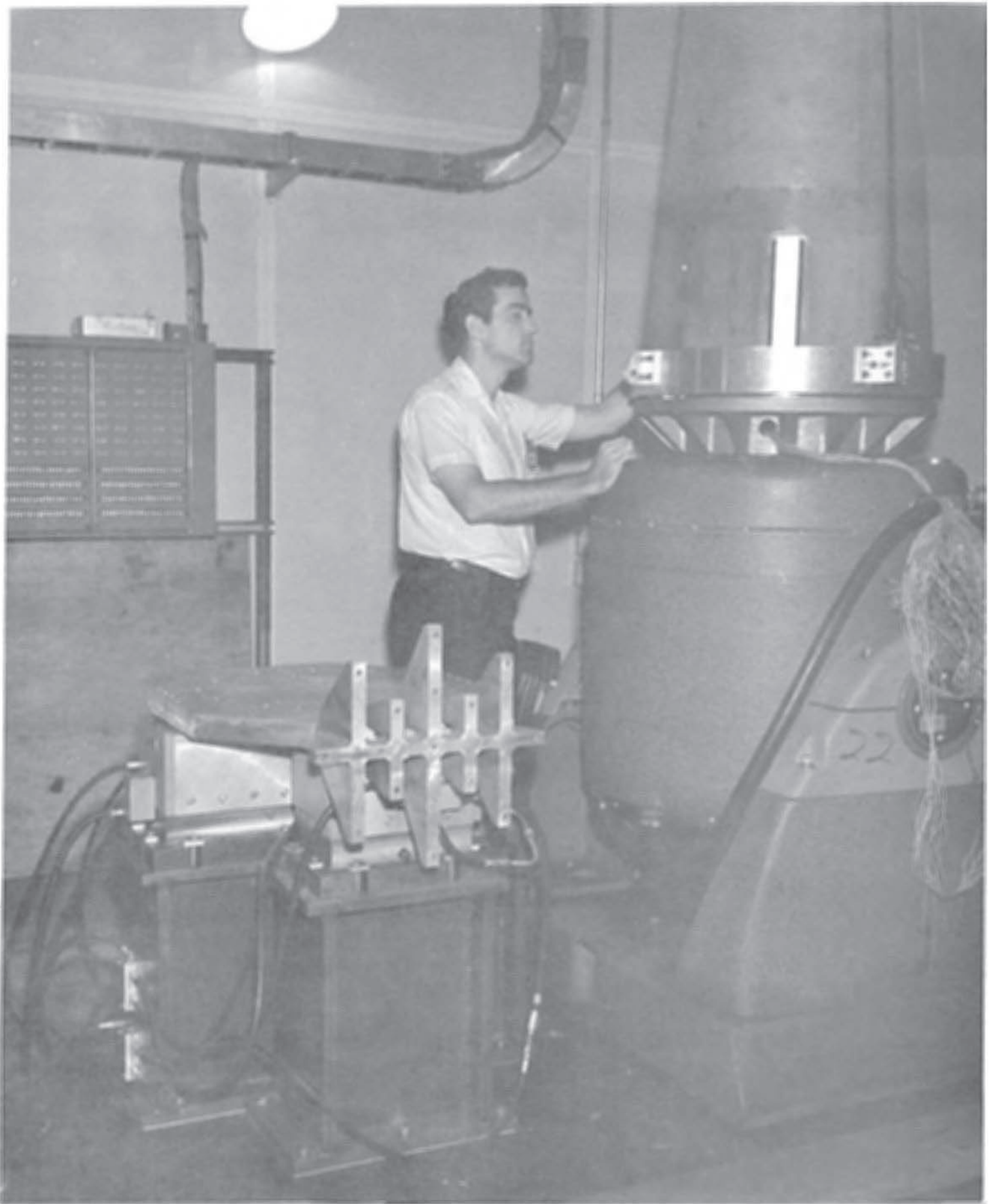


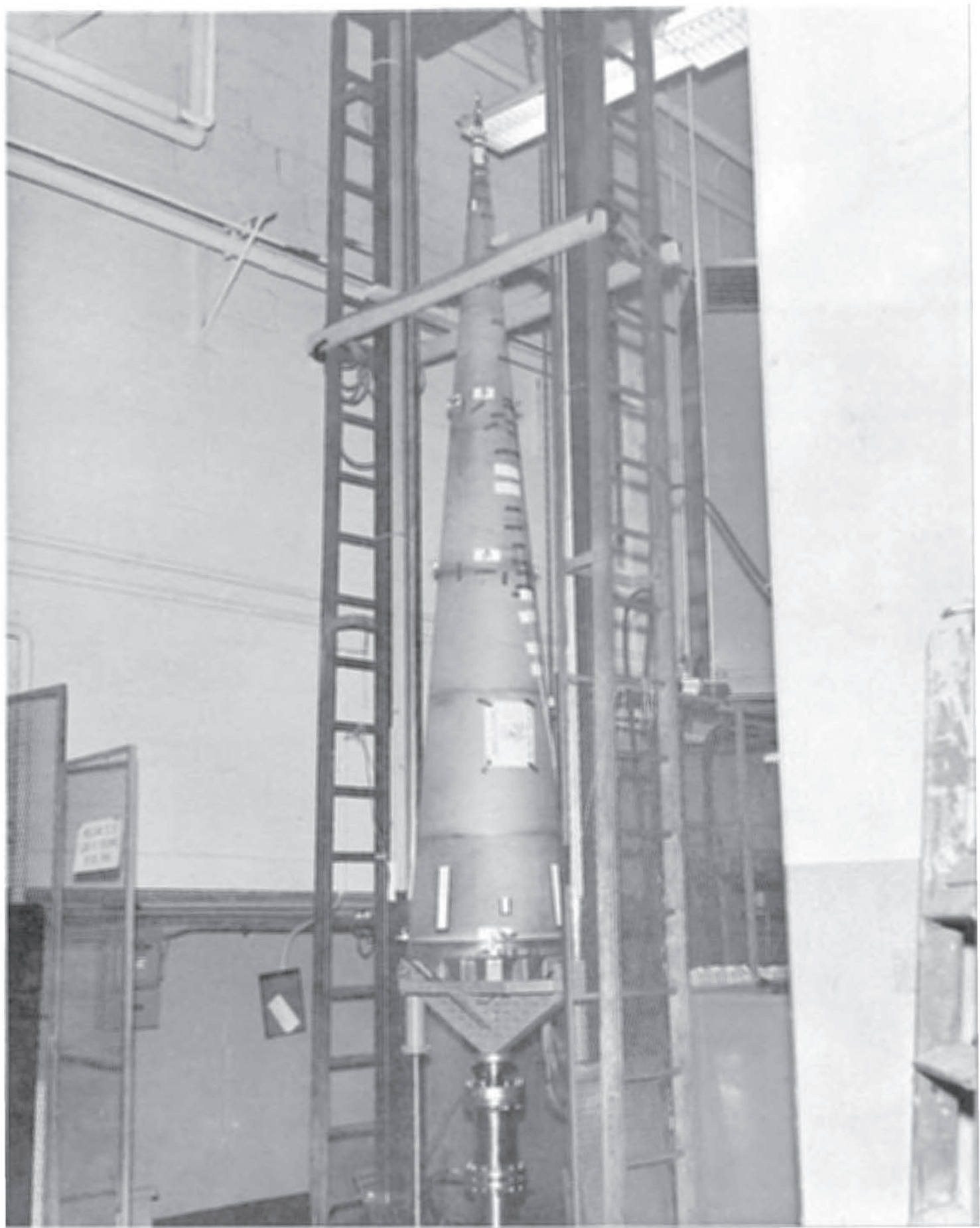


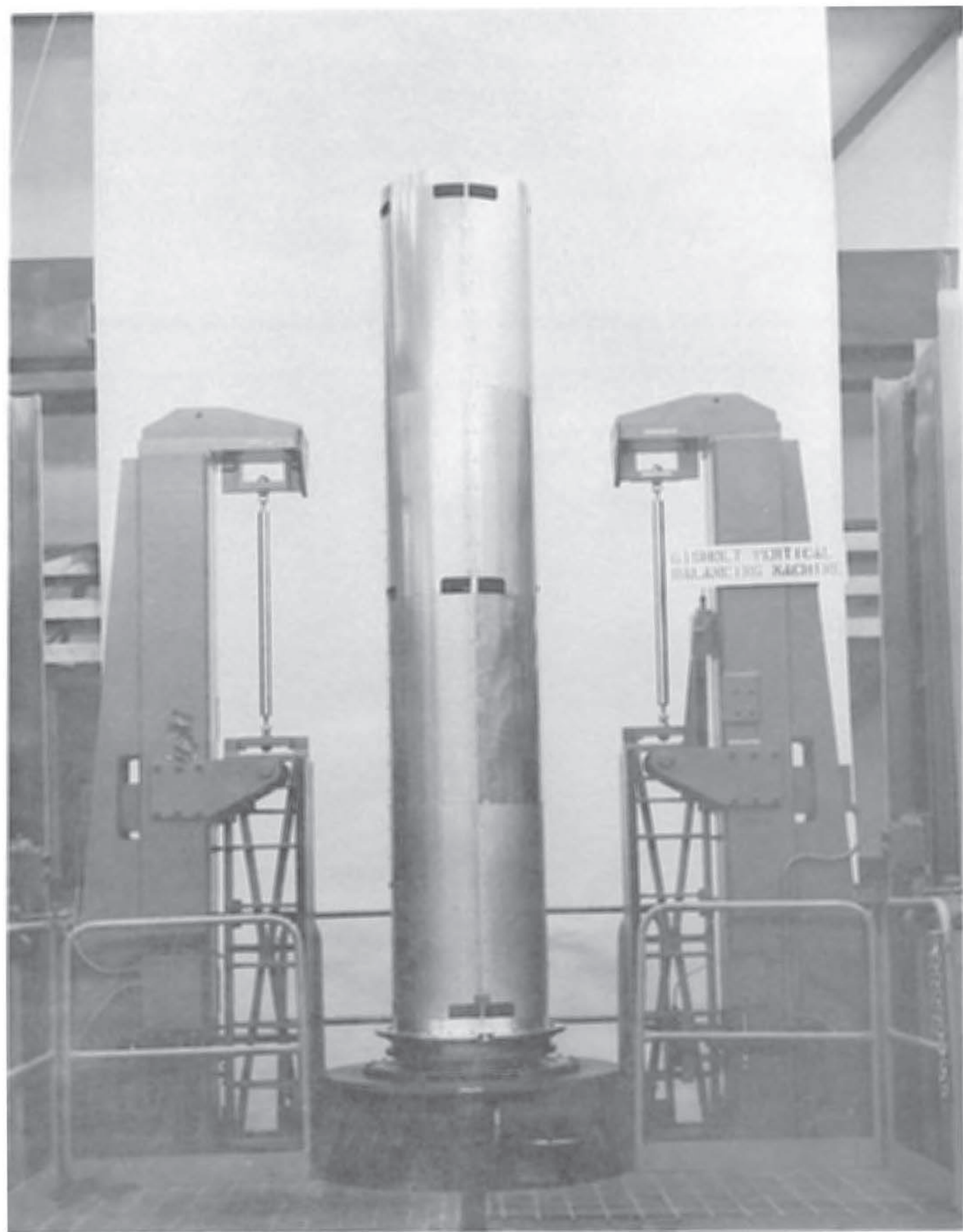


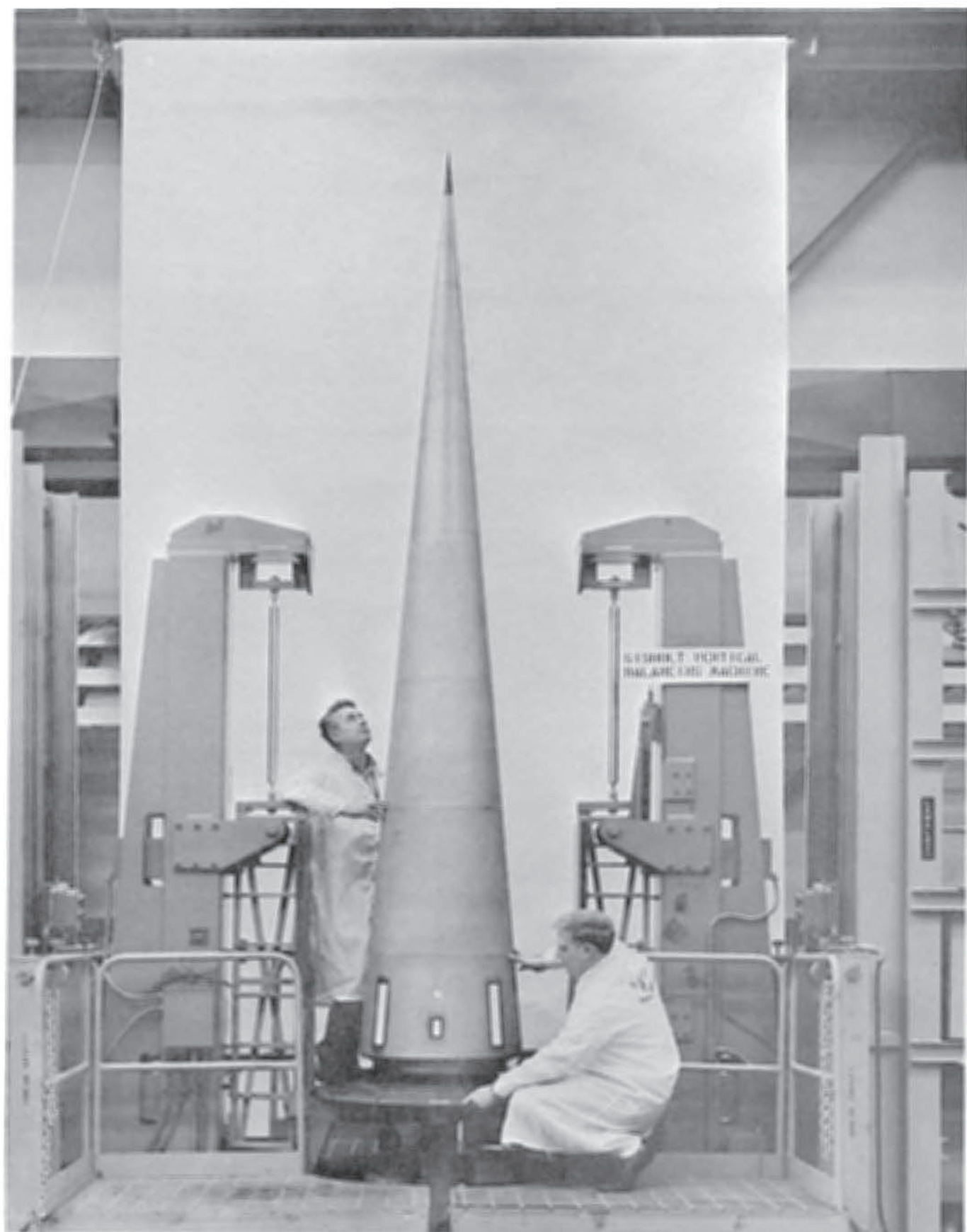


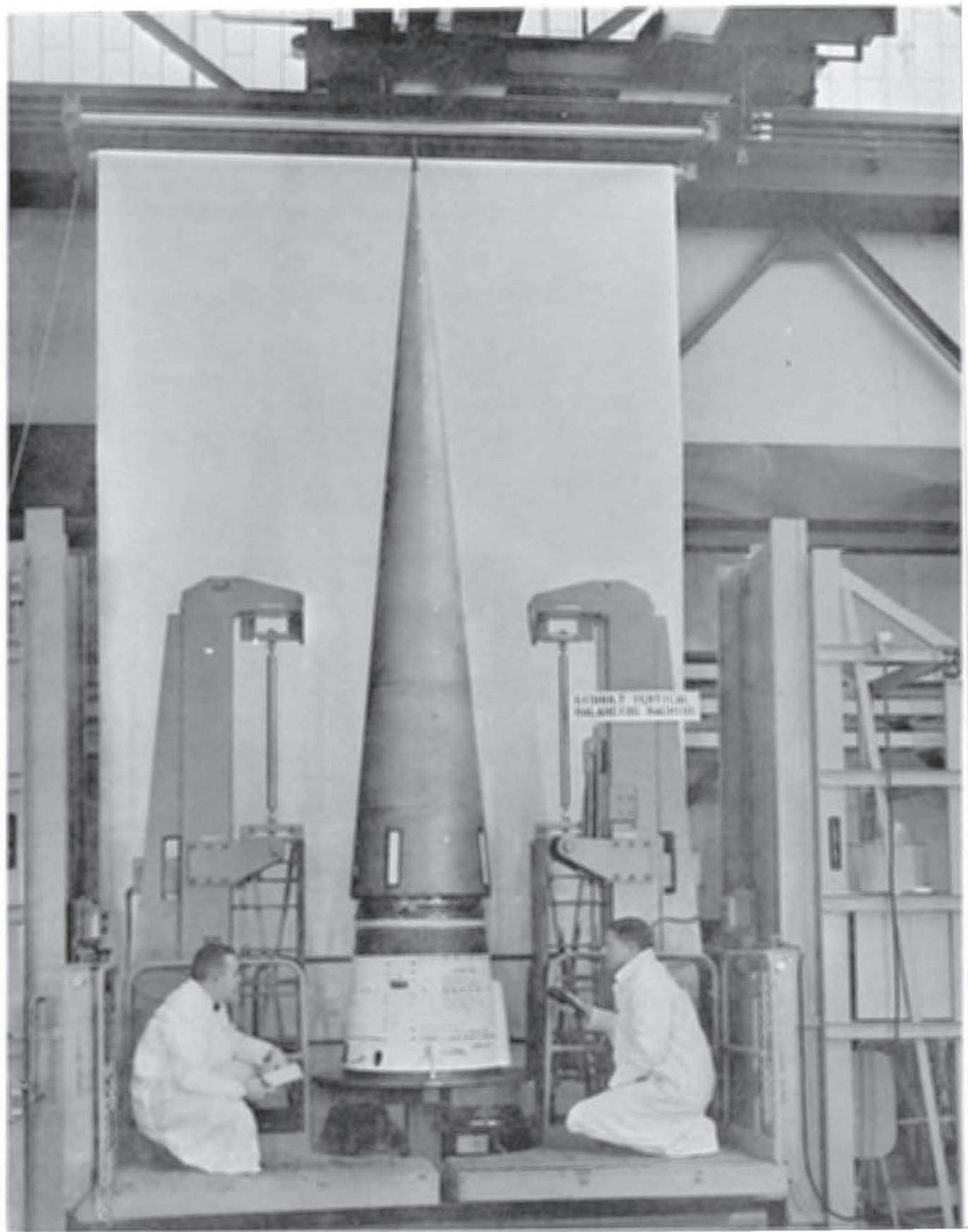


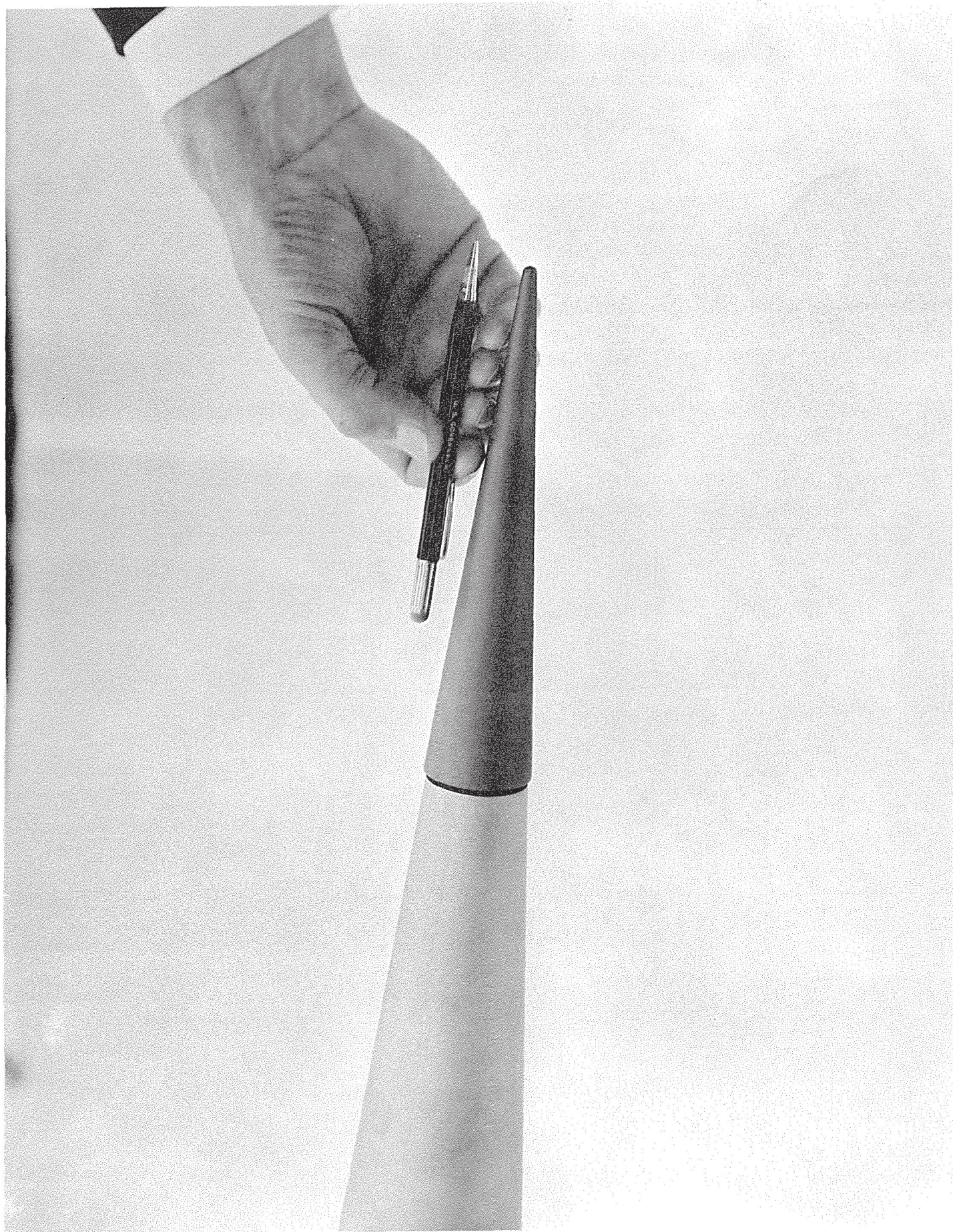




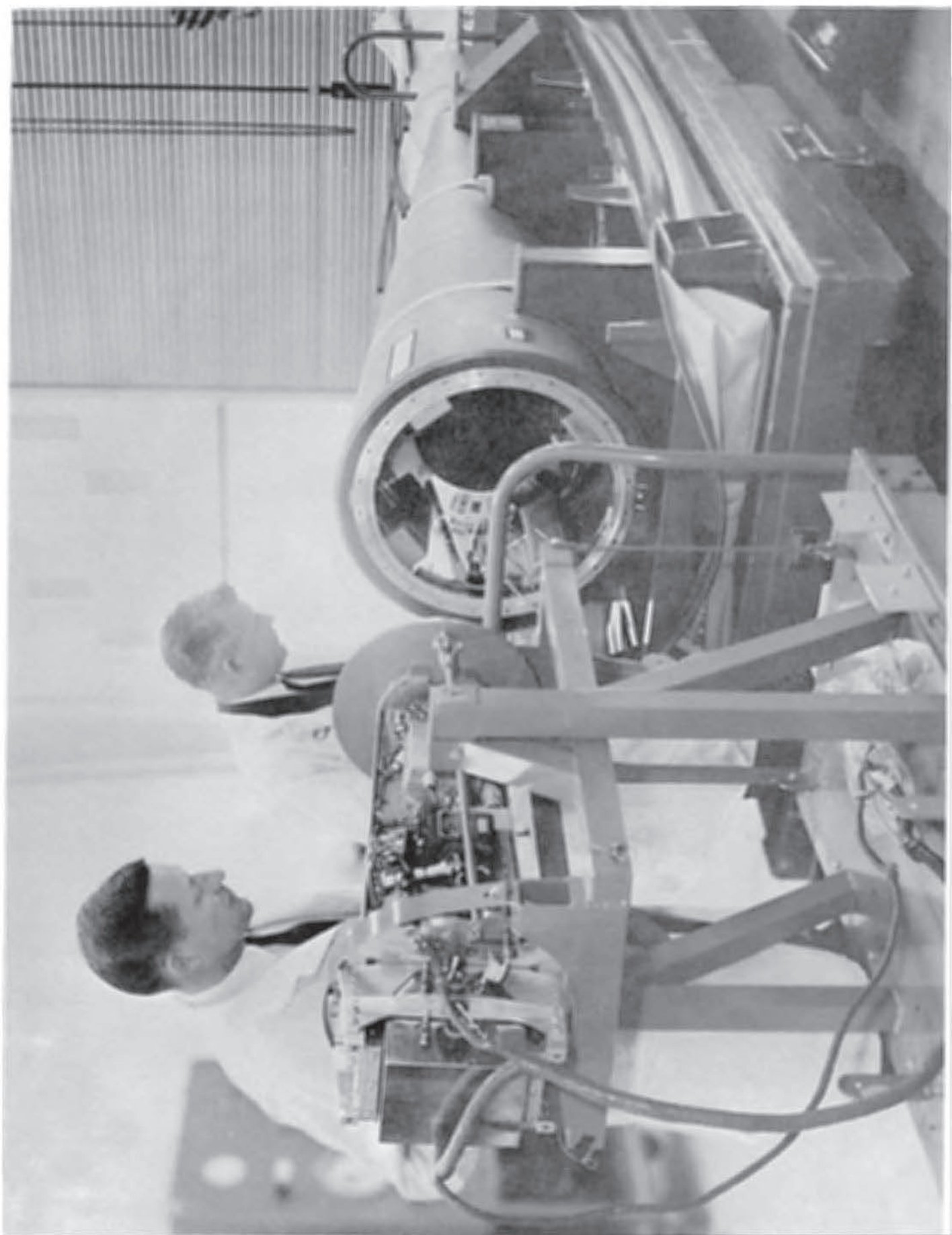


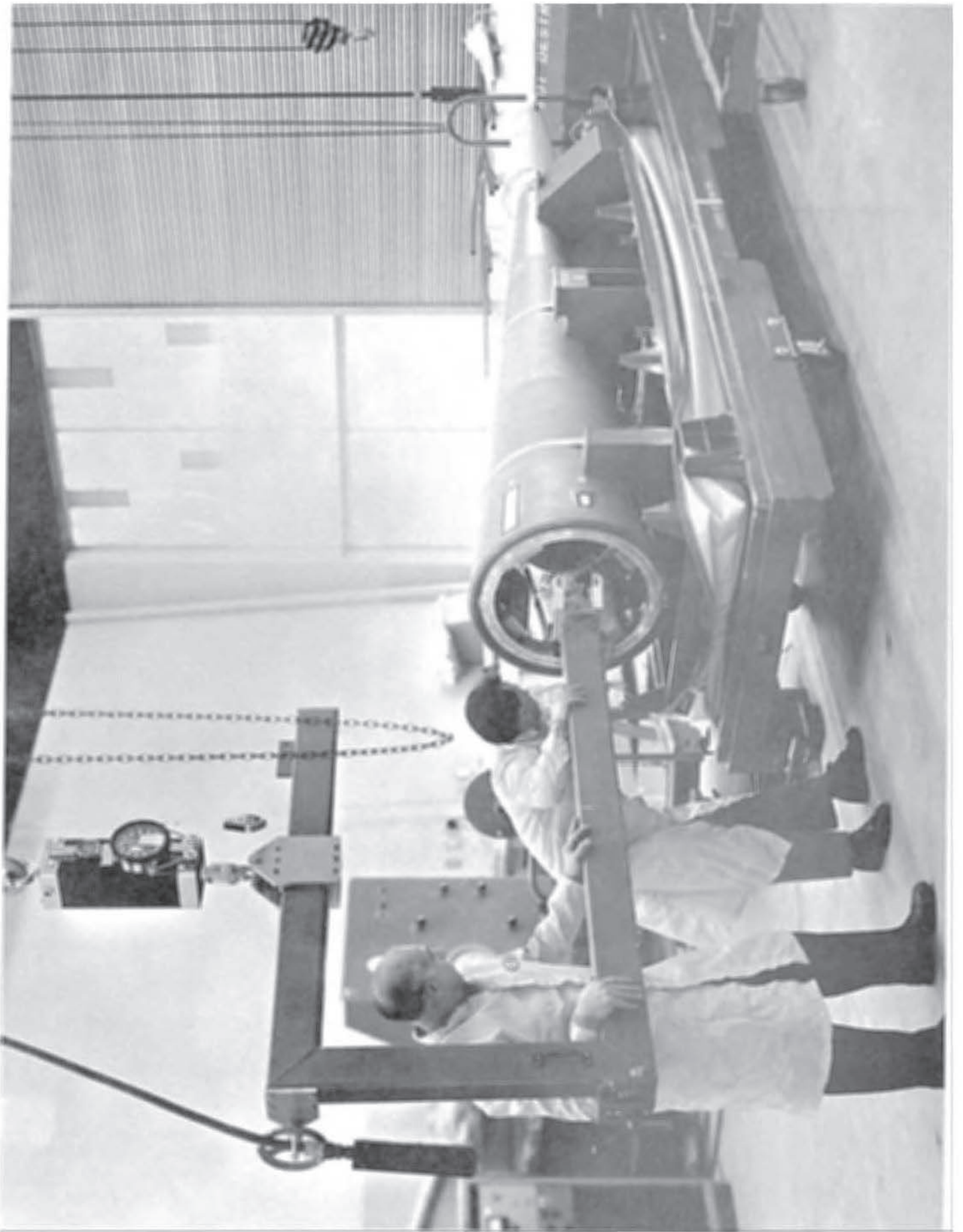


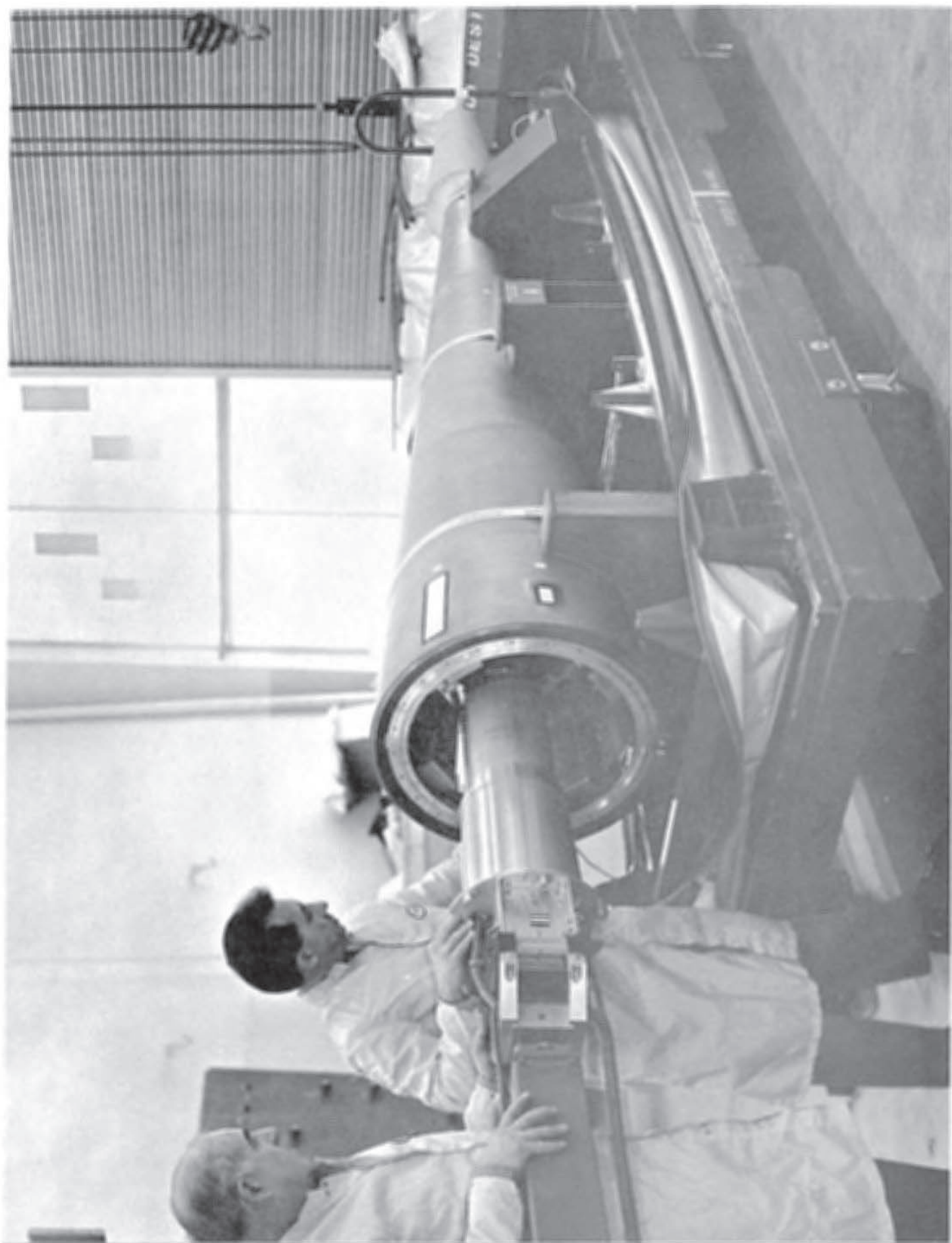


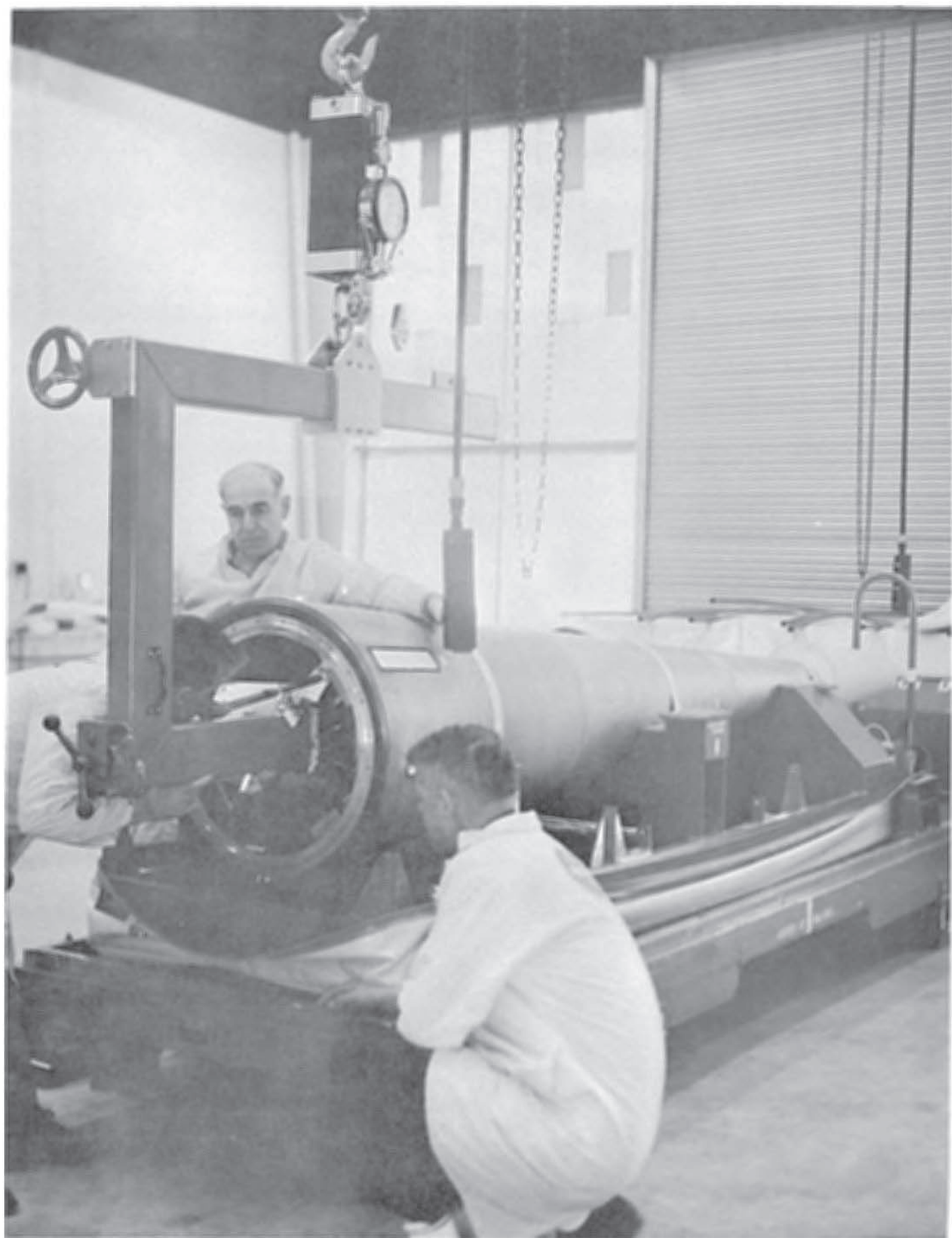




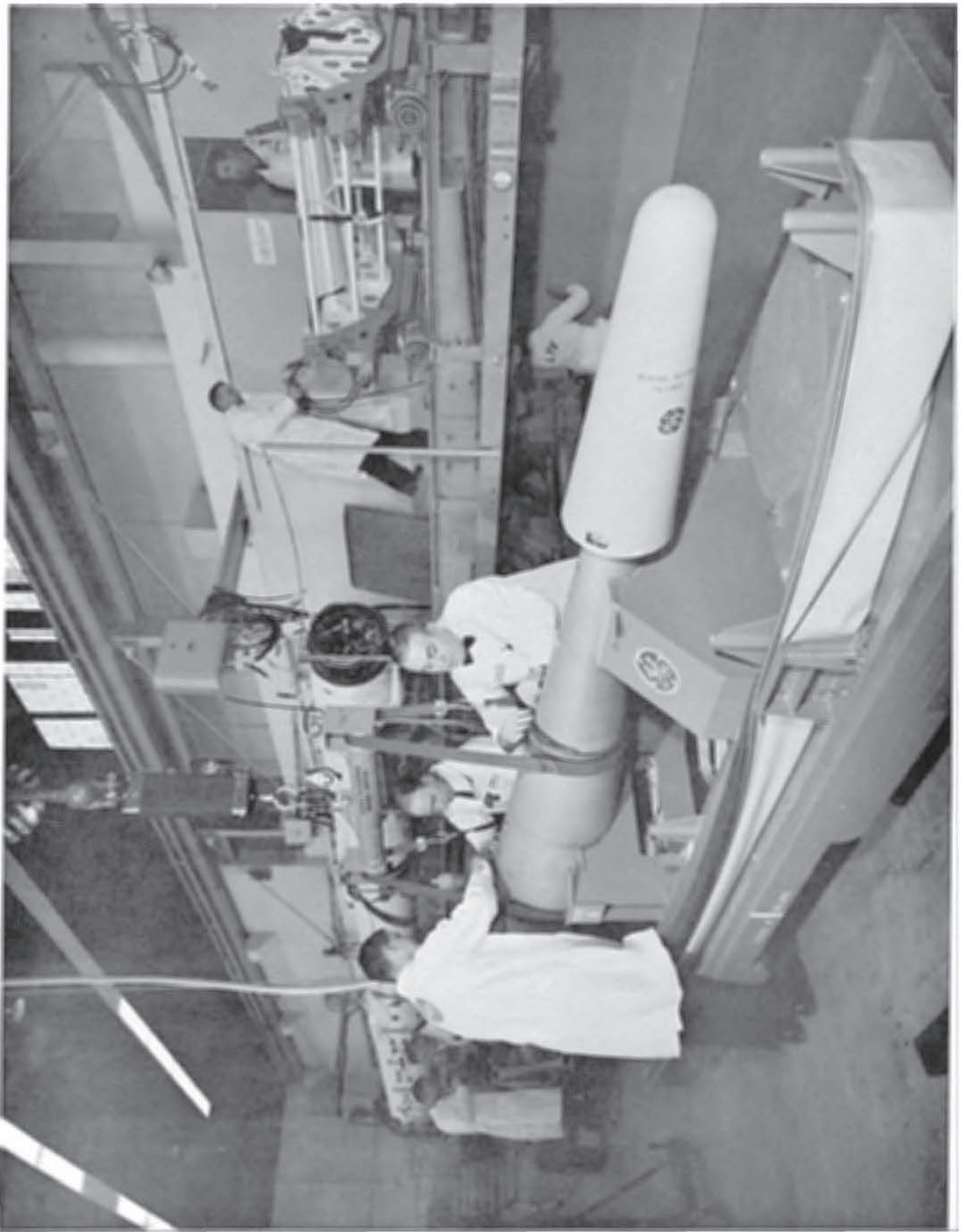


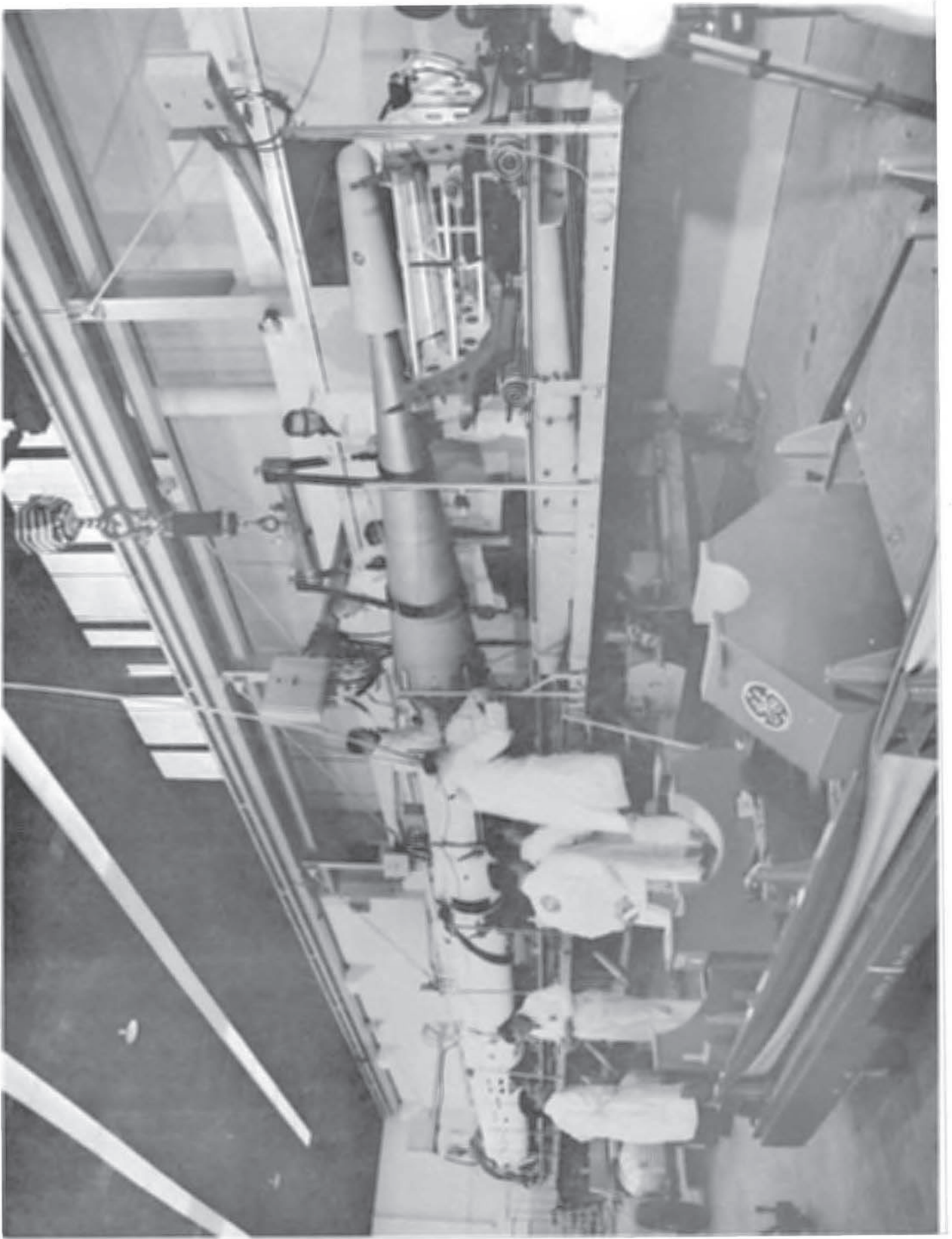


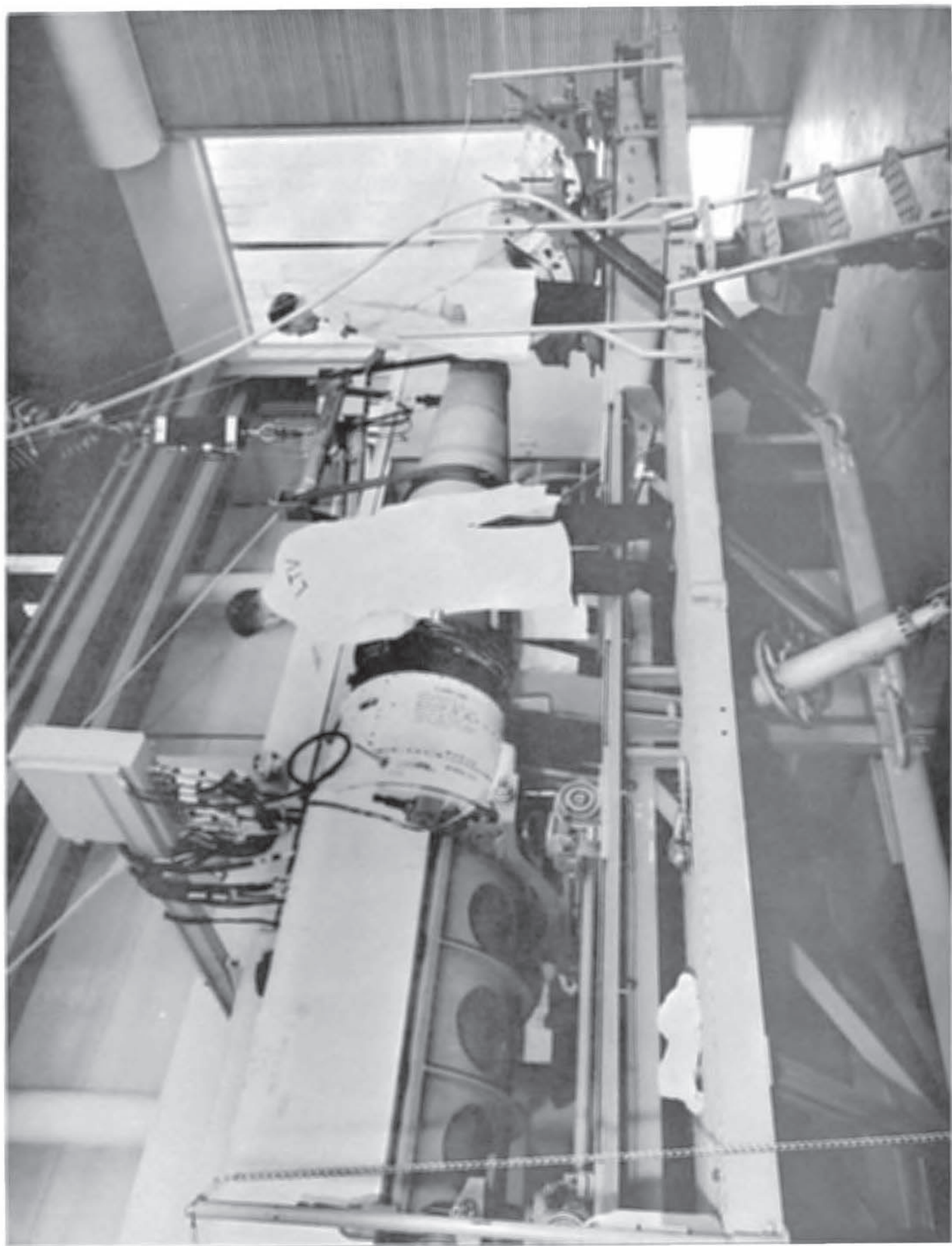


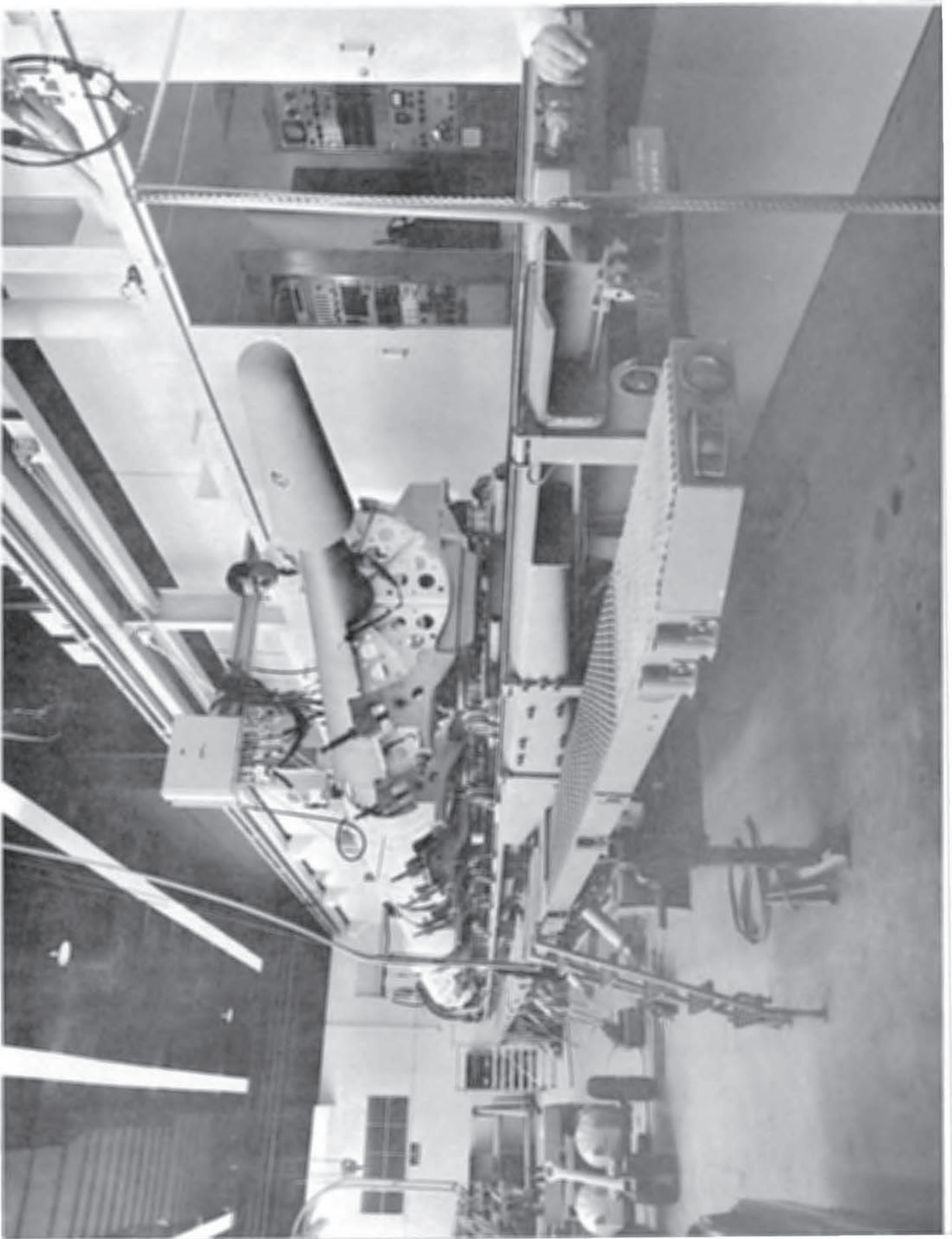












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