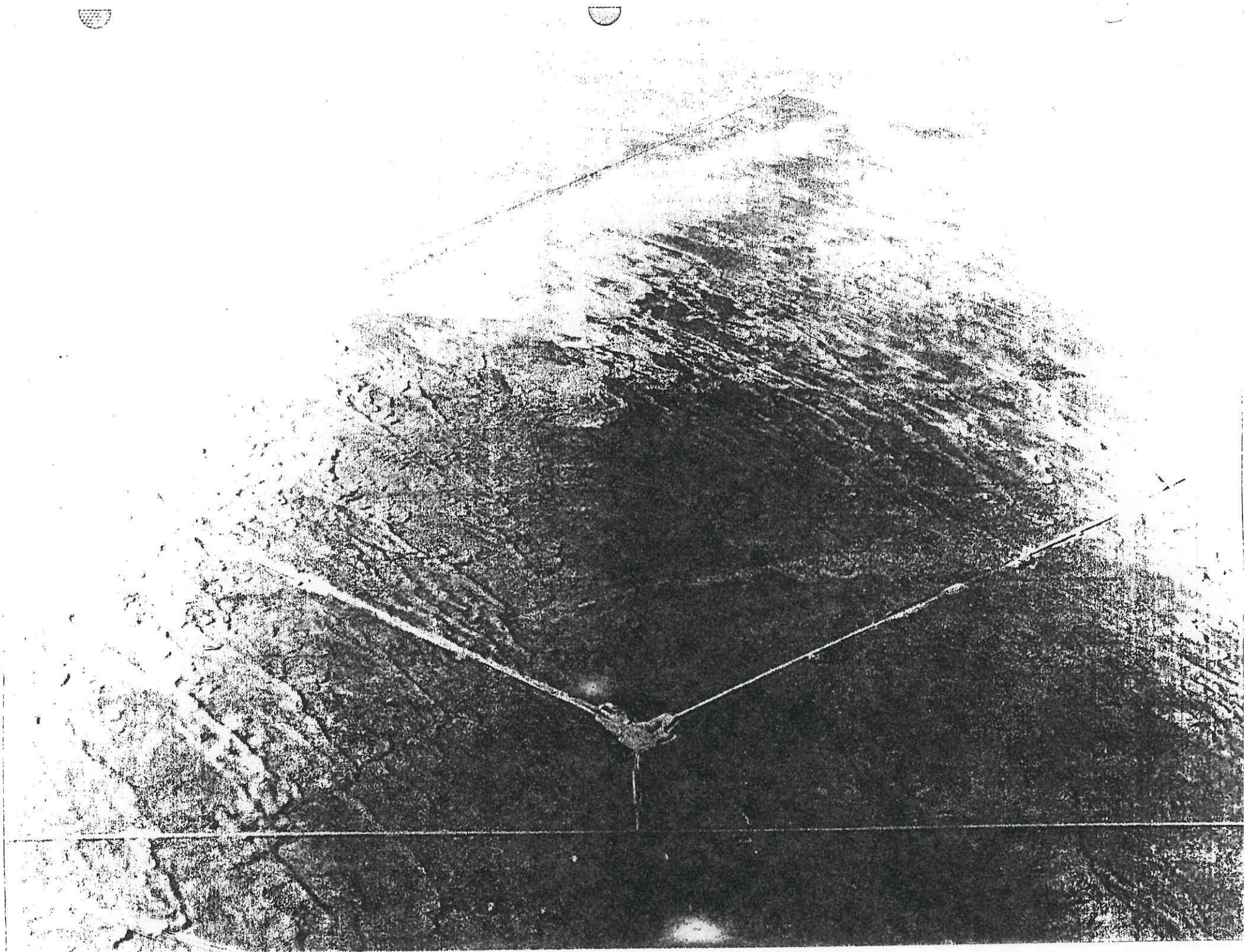


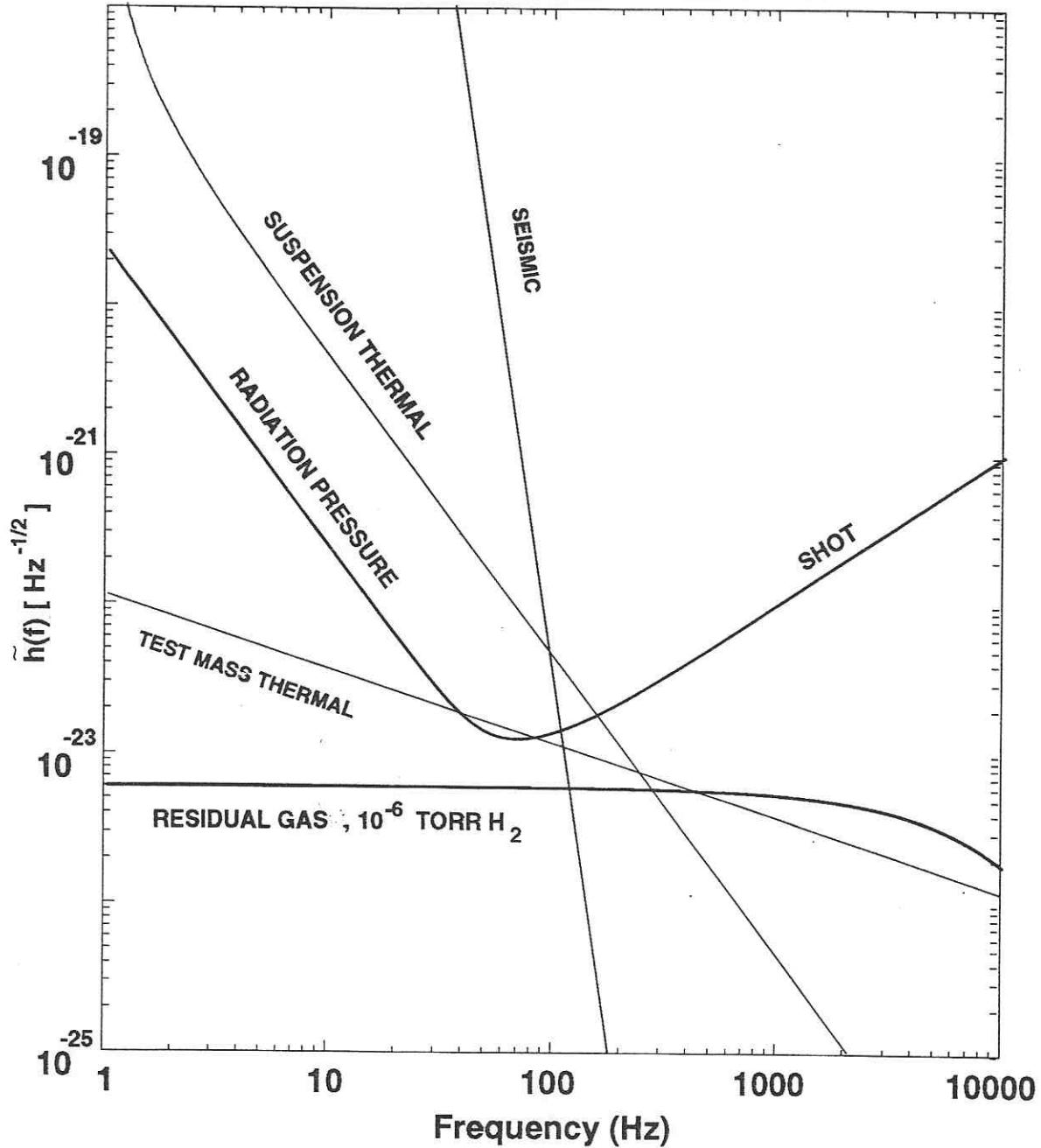
Facilities Overview and Status

- **Civil construction**
 - » Facility design and construction
 - » Beam tube enclosure
- **Vacuum Equipment**
 - » Chambers
 - » Pumps
 - » Valves
 - » Vacuum instrumentation
- **Beam Tube**
 - » Spiral weld beam tube
 - » Bellows
 - » Supports
 - » Baffles



INITIAL DESIGN PERFORMANCE GOAL

INITIAL INTERFEROMETER SENSITIVITY



LIGO DESIGN

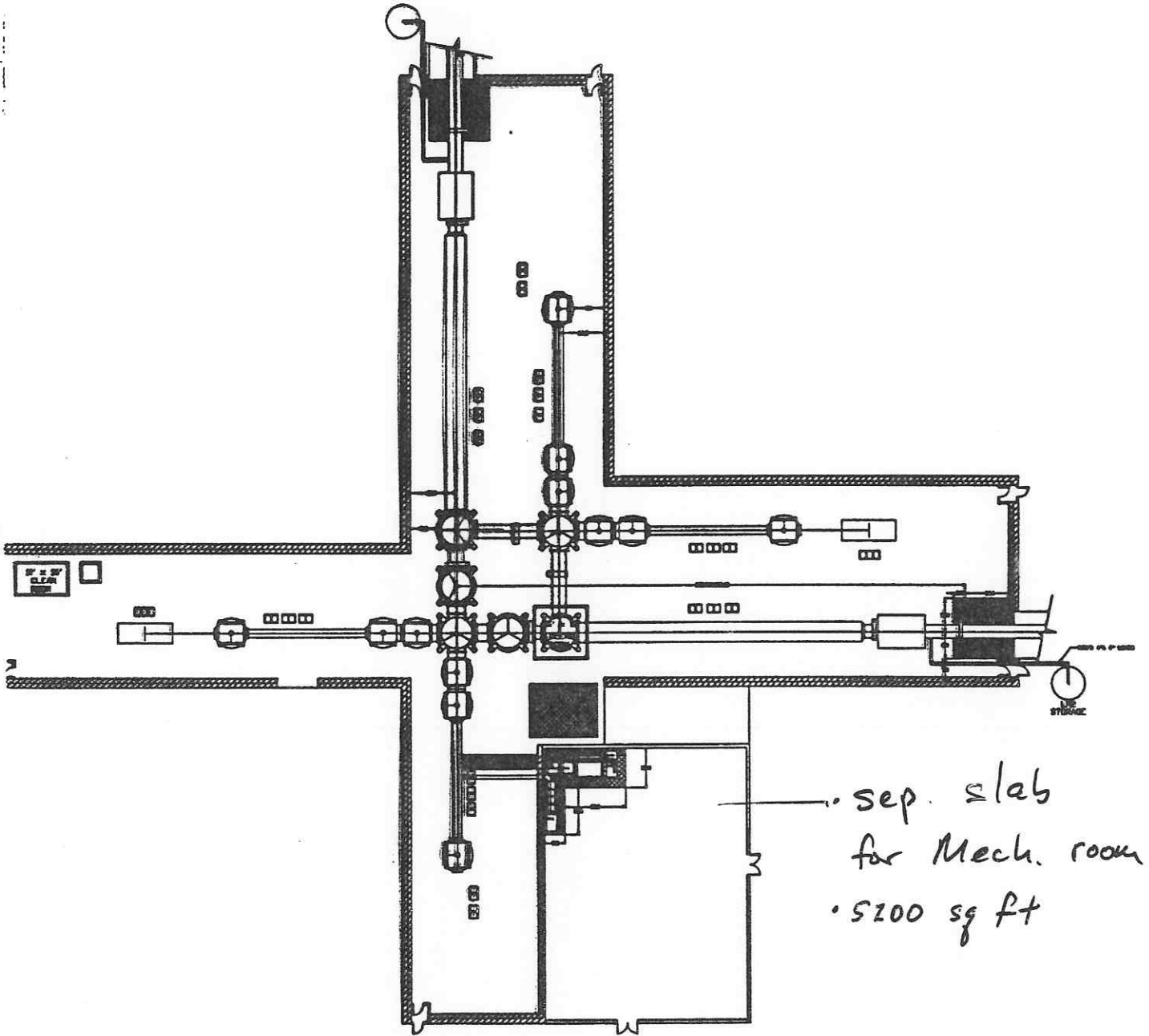
• OBSERVATORY CHARACTERISTICS

- TWO SITES: HANFORD, WASHINGTON & LIVINGSTON, LOUISIANA
- TWO 4KM INTERFEROMETERS & ONE 2 KM INTERFEROMETER (HANFORD)
- ARMS ORIENTED “PARALLEL” TO ONE ANOTHER
- COINCIDENT OBSERVATIONS AMONG ALL THREE INTERFEROMETERS
- INITIAL SENSITIVITY: $h_{\text{rms}} \leq 10^{-21}$ WITHIN 100 HZ BAND CENTERED AT MAXIMUM SENSITIVITY
- OBSERVATORY EXTENSIBILITY:
 - EVENTUAL EXPANSION TO 9 INTERFEROMETERS
 - LIMITING SENSITIVITIES:
 - Naturally occurring gravity gradients (at lowest frequencies)
 - Scattered light phase noise (in the mid-frequency range)
 - Residual gas phase noise (at the highest high-frequencies)

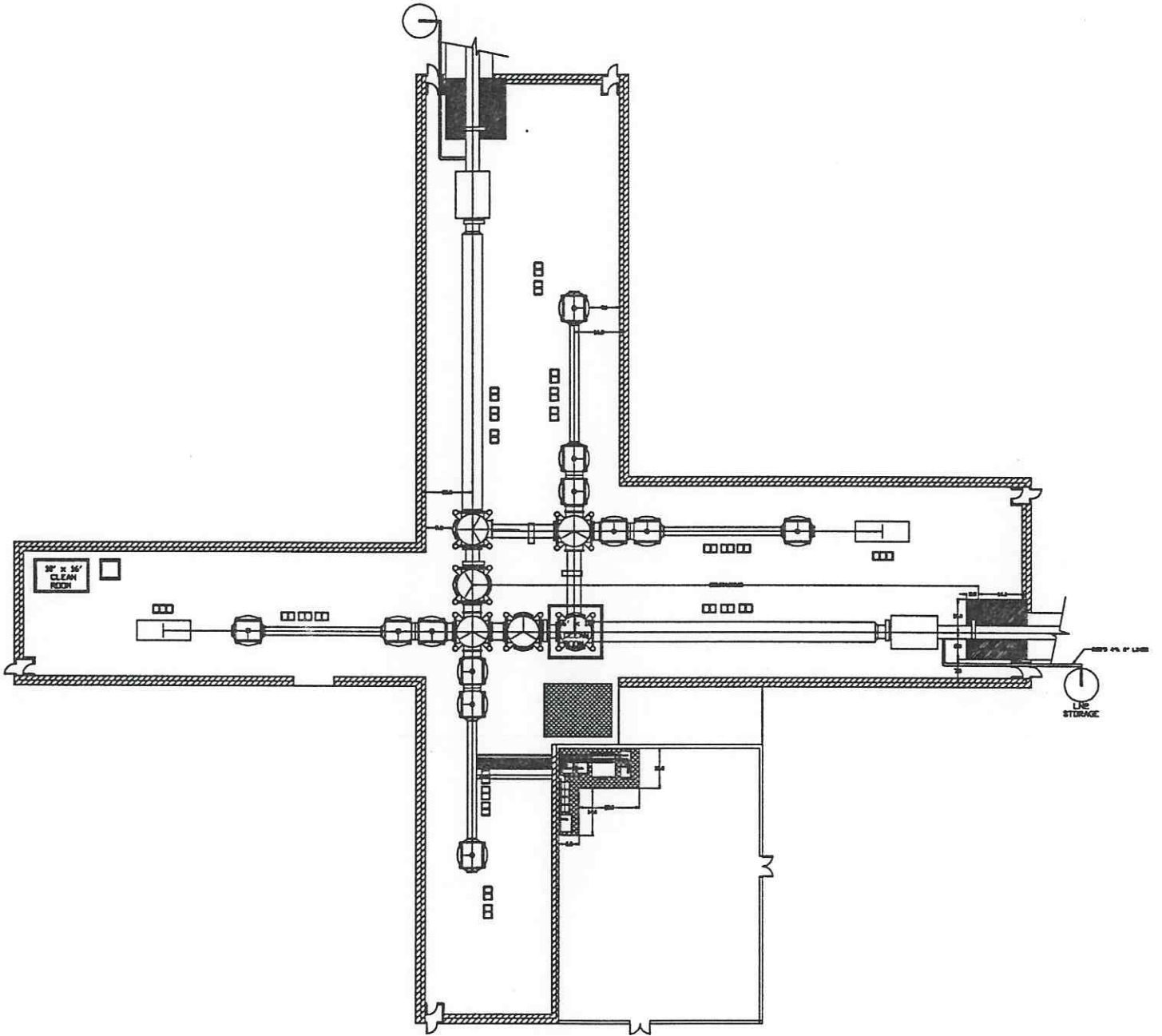


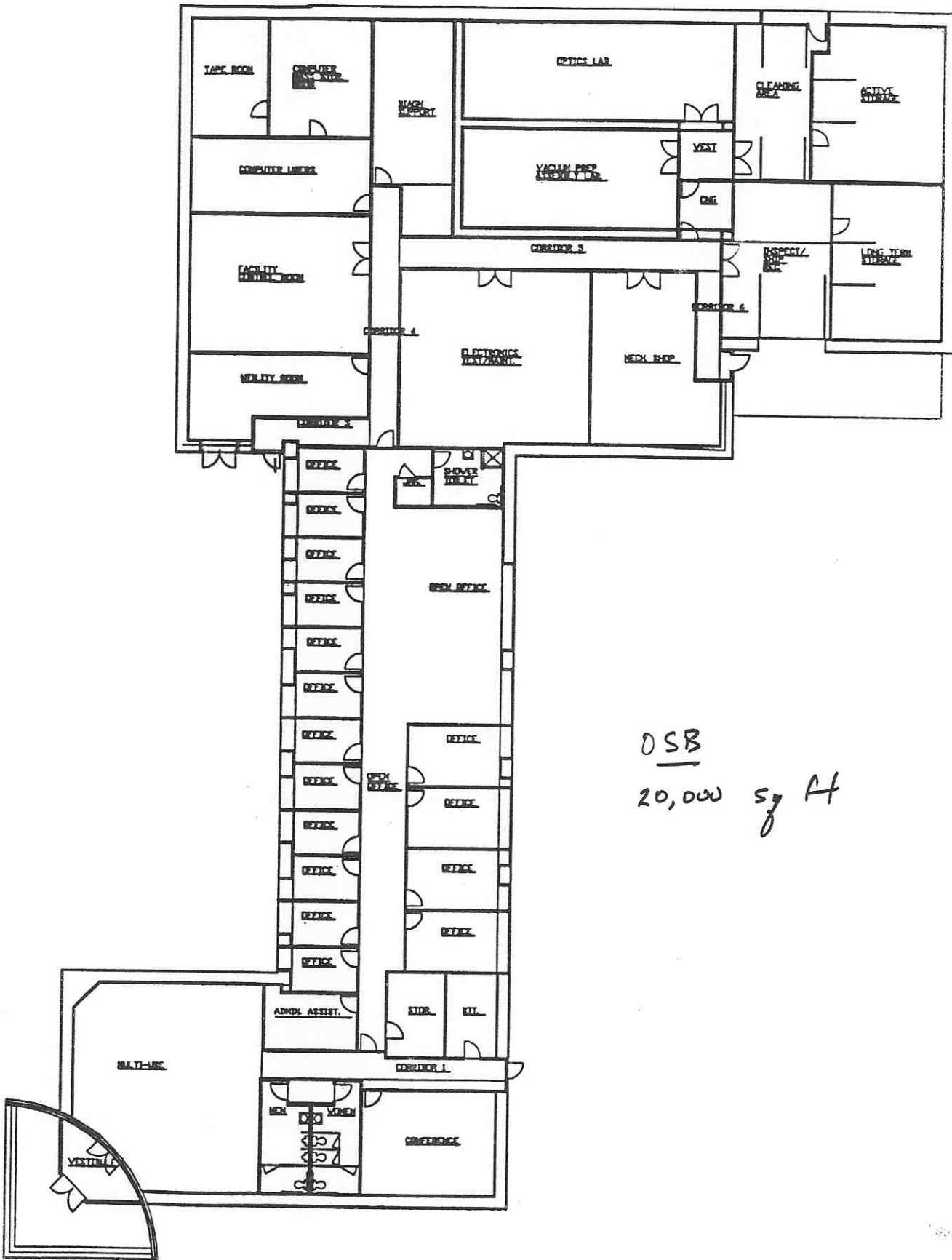
LVEA - Washington

36,000 sq ft

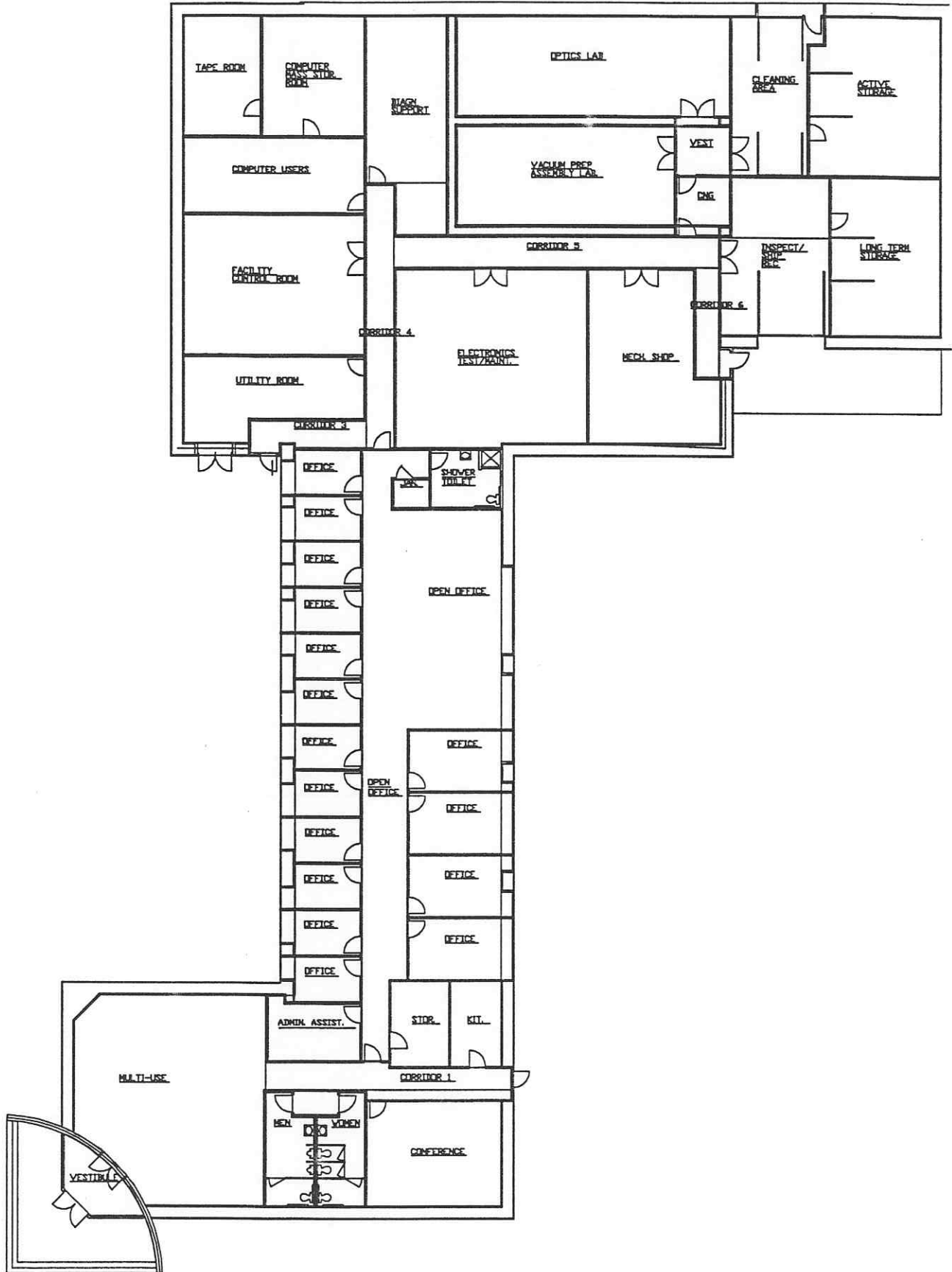


• sep. slab
for Mech. room
• 5200 sq ft

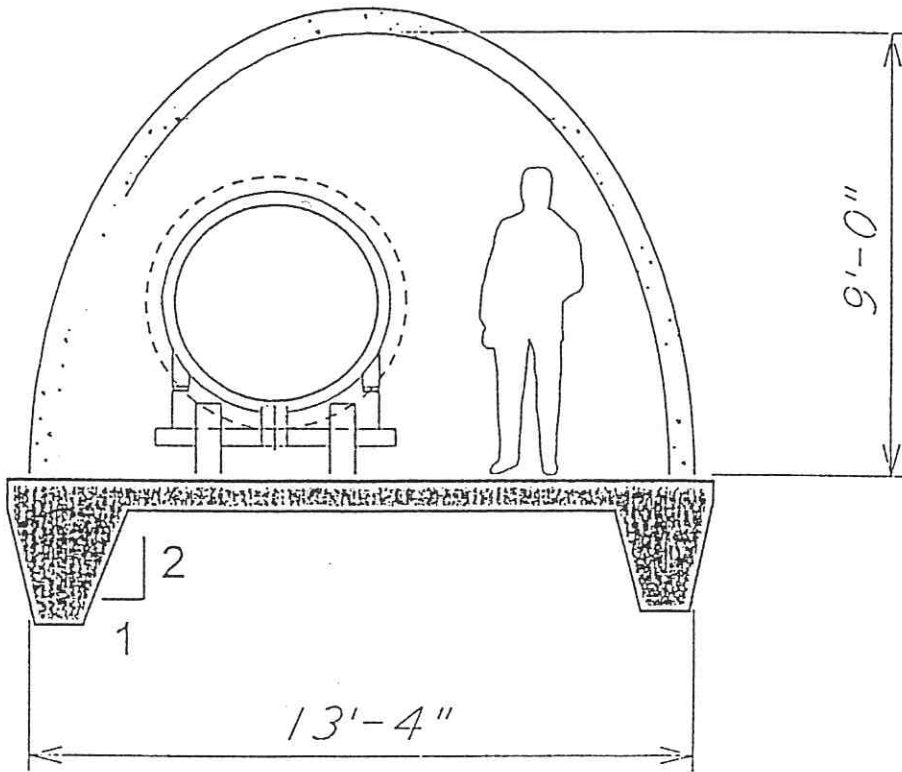


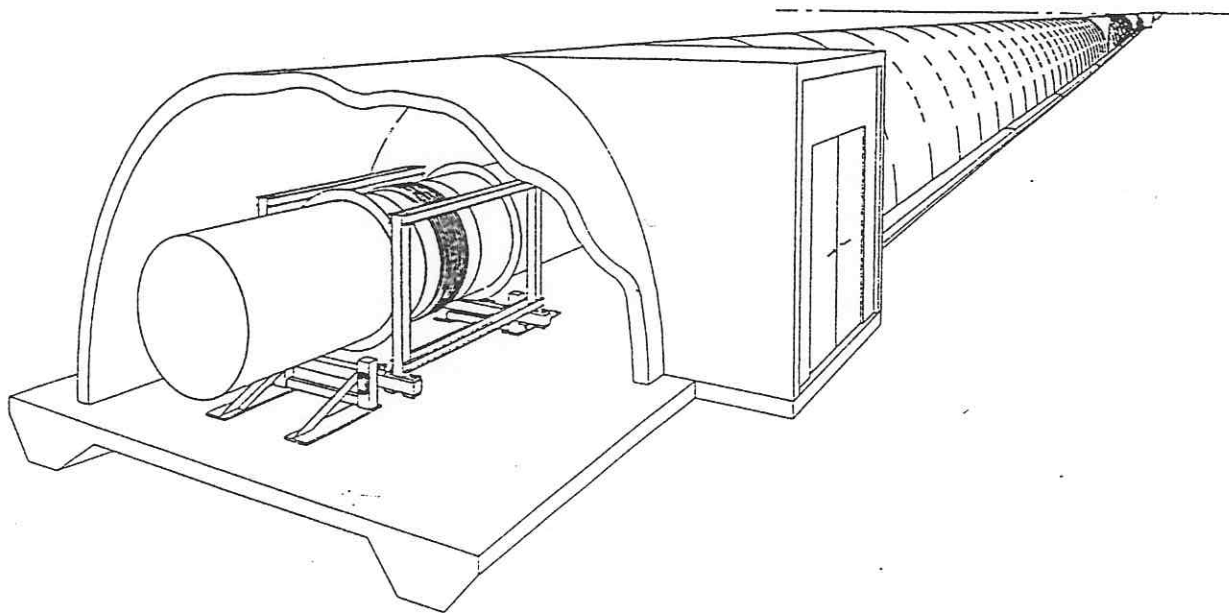


OSB
20,000 sq ft



Beam Tube Enclosure





Civil Construction Accomplishments:

- **Design:**

- » Ralph M. Parsons on-board as AECM since January 1995
- » Conceptual design of buildings and beam tube enclosure complete
- » Development of detailed designs in progress

- **Hanford site:**

- » Ambient ground noise measurements completed
- » Rough grading completed

- **Livingston site:**

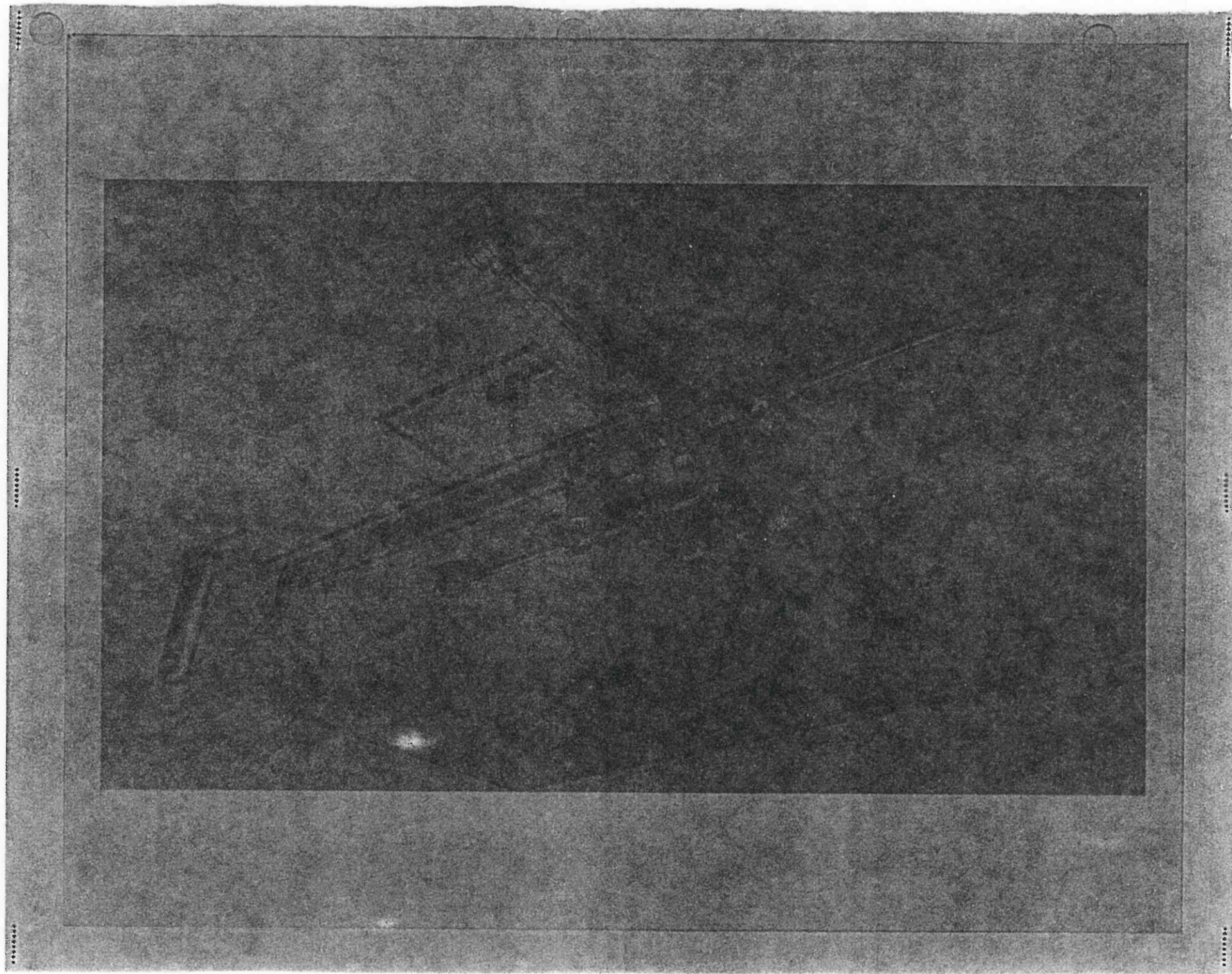
- » Wetlands delineation complete
- » Clearing and grubbing of site completed

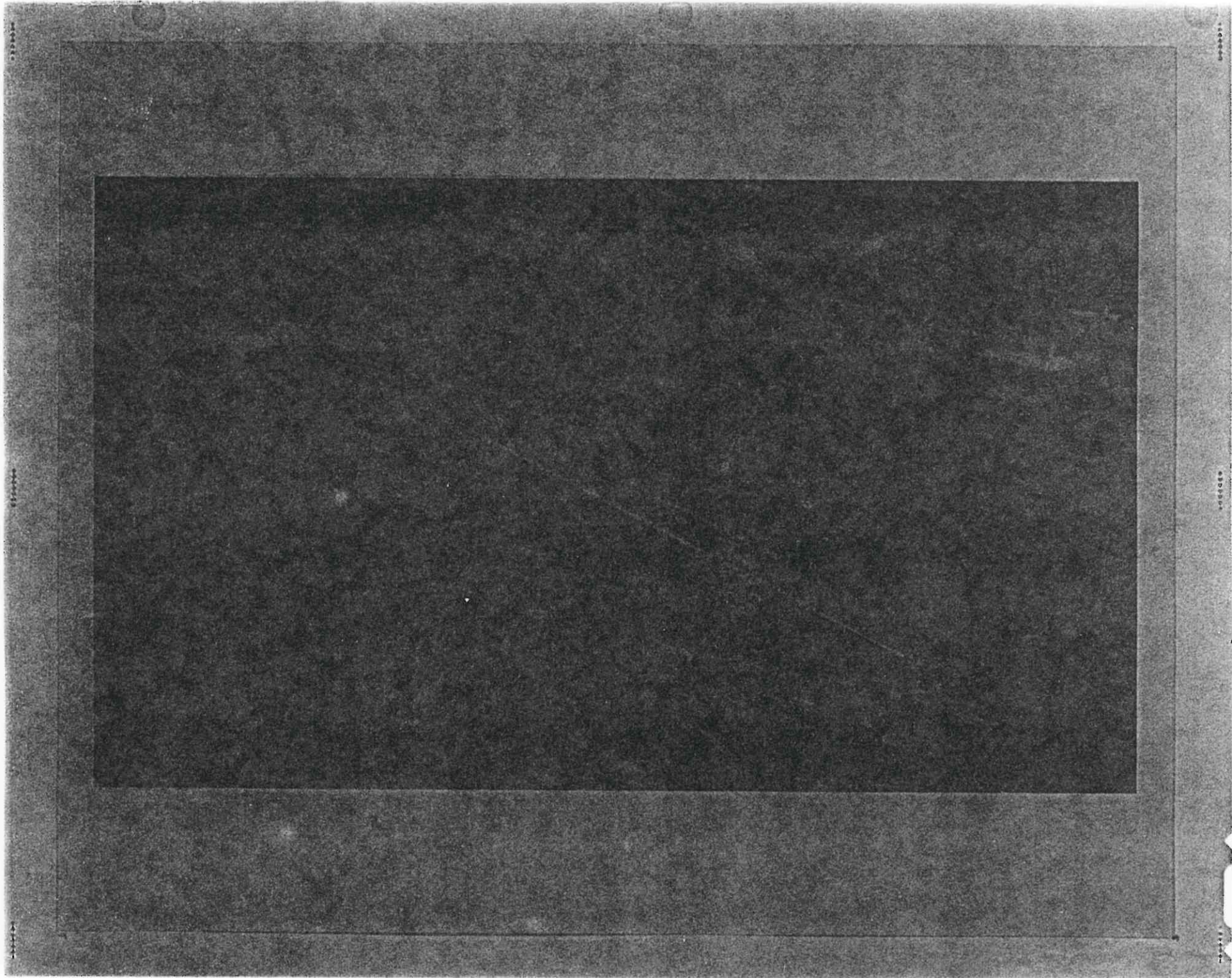
Near-term objectives:

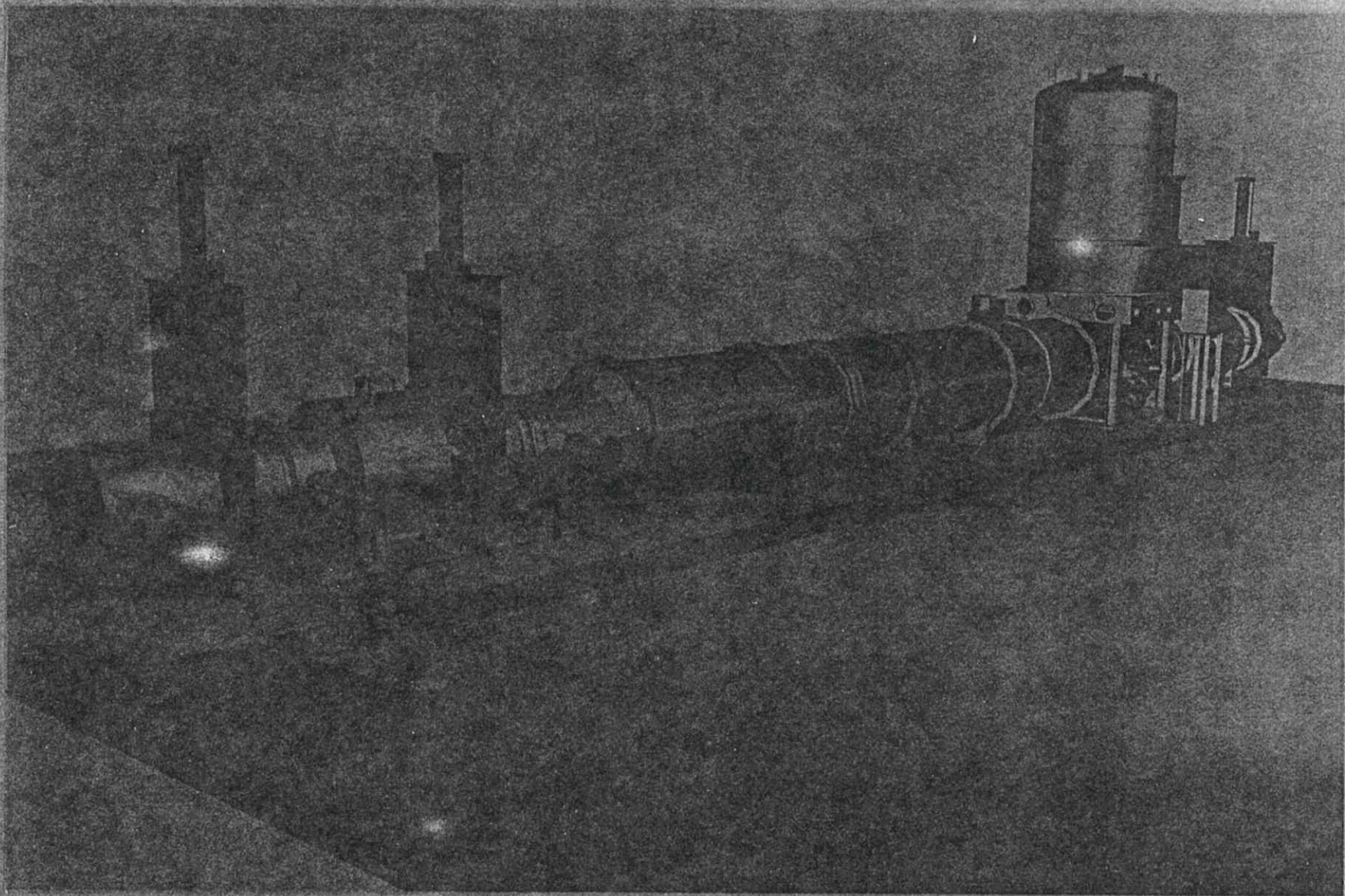
- 10/95 Complete pipeline crossings LA
- 10/95 Complete/approve beam tube enclosure
- 10/95 Ambient noise measurements LA
- ~11/95 Begin rough grading on LA site
- ~5/96 Final design of bldgs

Other milestones:

- ~7/96 Initiate construction on WA site
- ~2/97 Initiate construction on LA site
- ~12/97 Beneficial occupancy WA
- ~9/98 Beneficial occupancy LA

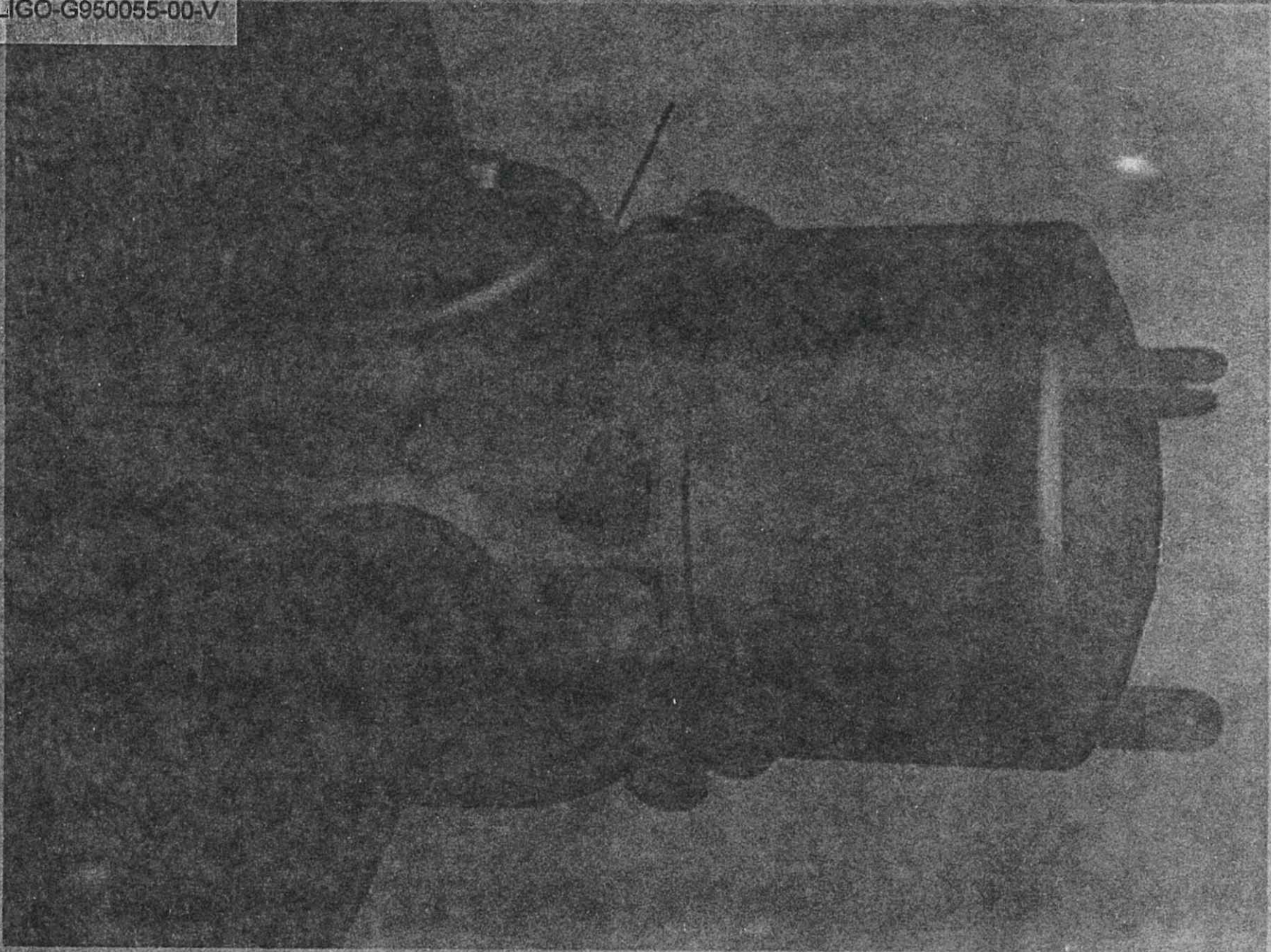






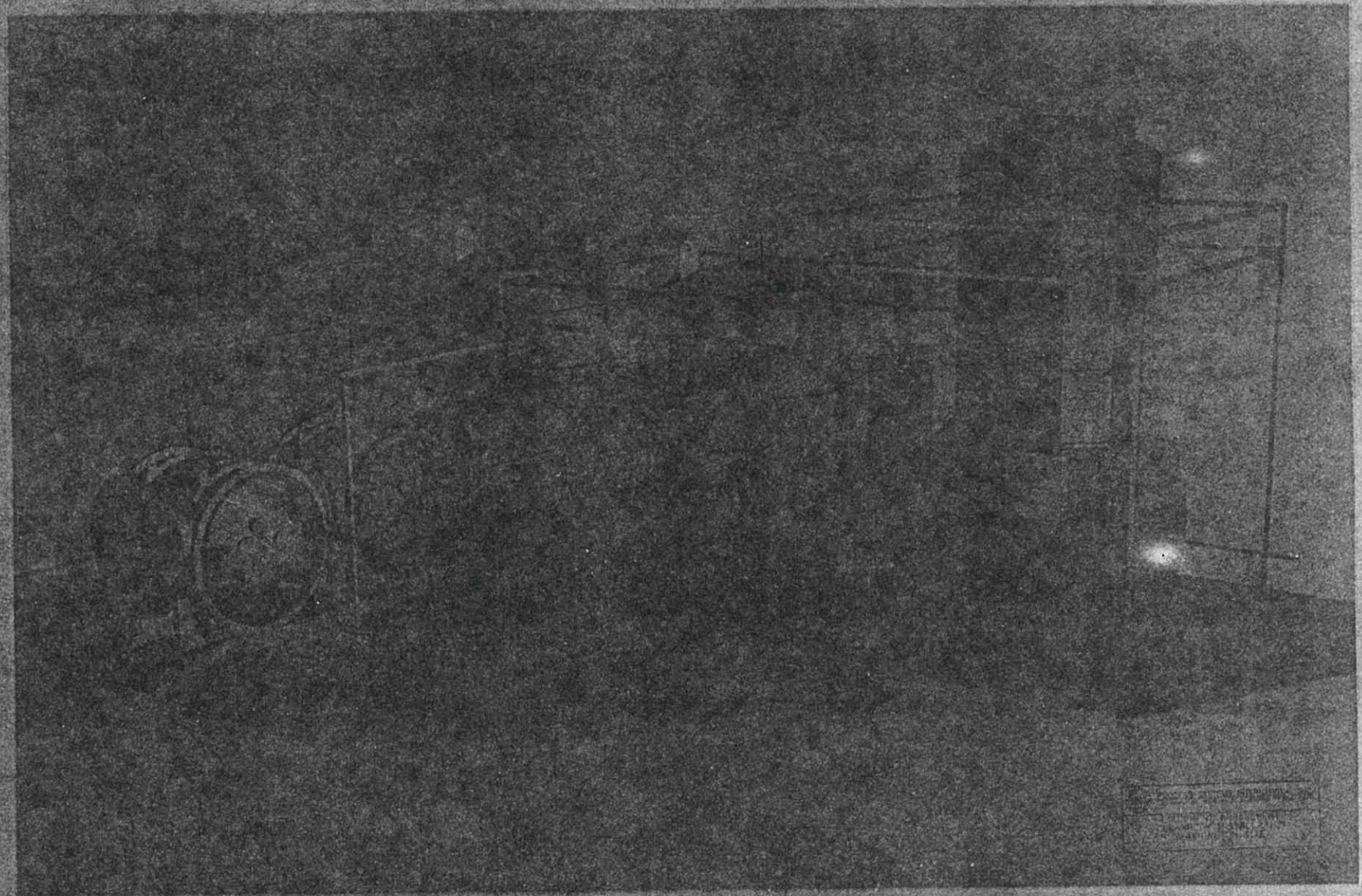
Set # 2
Sheet 6 of 7

LIGO-G950055-00-V



LIGO-G950055-00-V

Set # 2
Sheet 3 of 1



PHOTOGRAPHED BY
L. J. BROWN
AT THE
LIGO
LABORATORY

VACUUM EQUIPMENT

- CHARACTERISTICS

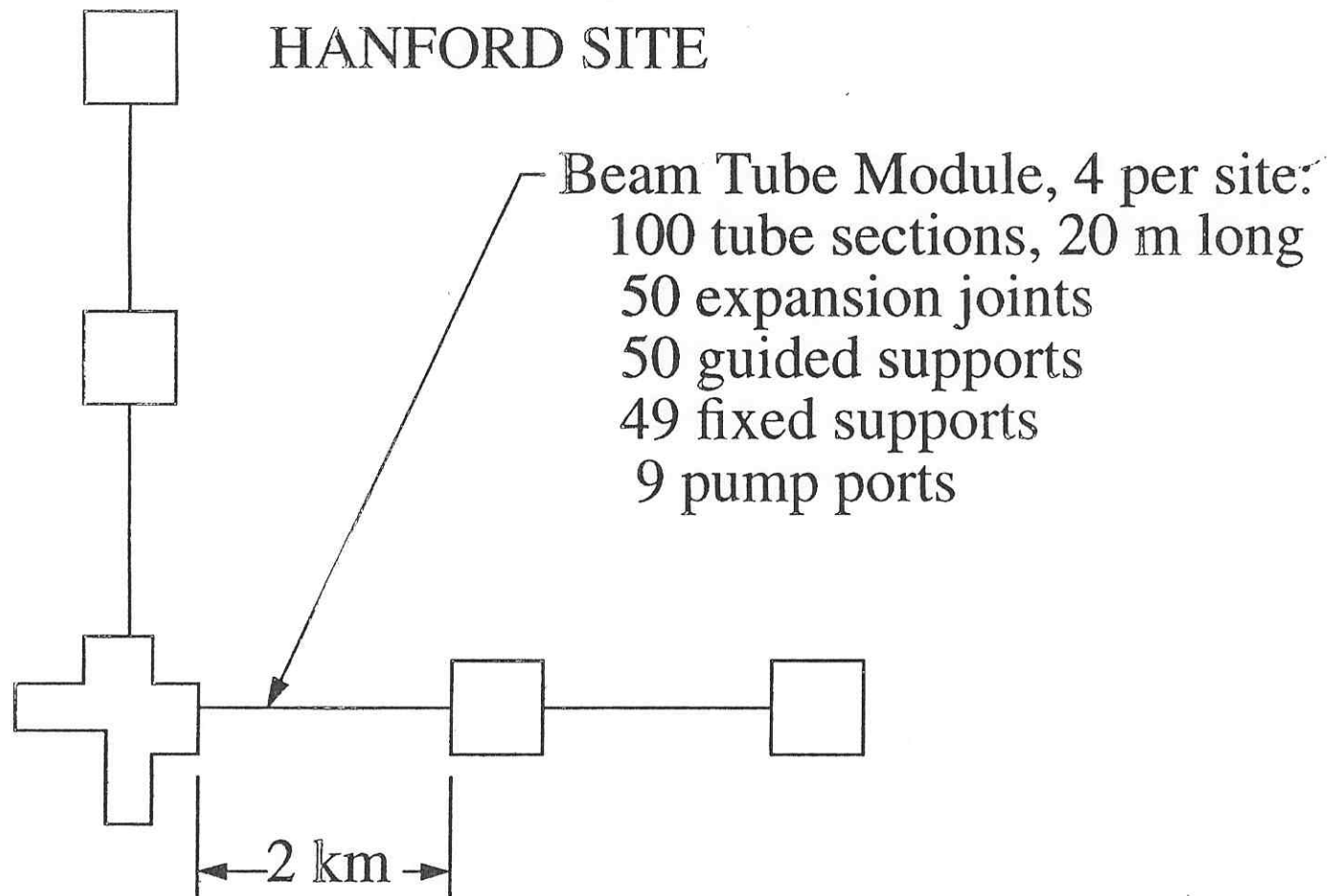
- THE LIGO VACUUM SYSTEM (VACUUM EQUIPMENT + BEAM TUBES) PROVIDES:
 - A CLEAR APERTURE FOR THE INTERFEROMETERS --VERY LARGE APERTURE GATE VALVES TO ISOLATE 1.22 M BEAM TUBES
 - A CLEAN ENVIRONMENT FOR THE PRECISION OPTICS.
 - A LOW PRESSURE IN ORDER TO MINIMIZE DIFFRACTION AND ACOUSTIC COUPLING.
 - EXTENSIVE CONTROLS AND MONITORING EQUIPMENT TO ENSURE SAFE OPERATION
 - LARGE PUMPING SPEEDS AND VOLUMES -- BEAM TUBE PUMPING SOLELY FROM 4KM ENDS
- THE LIGO VACUUM SYSTEM WILL BE THE WORLD'S LARGEST HIGH PERFORMANCE VACUUM SYSTEM WITH A PUMPED VOLUME OF ROUGHLY 20,000 M³
- MOSTLY CONVENTIONAL VACUUM HARDWARE

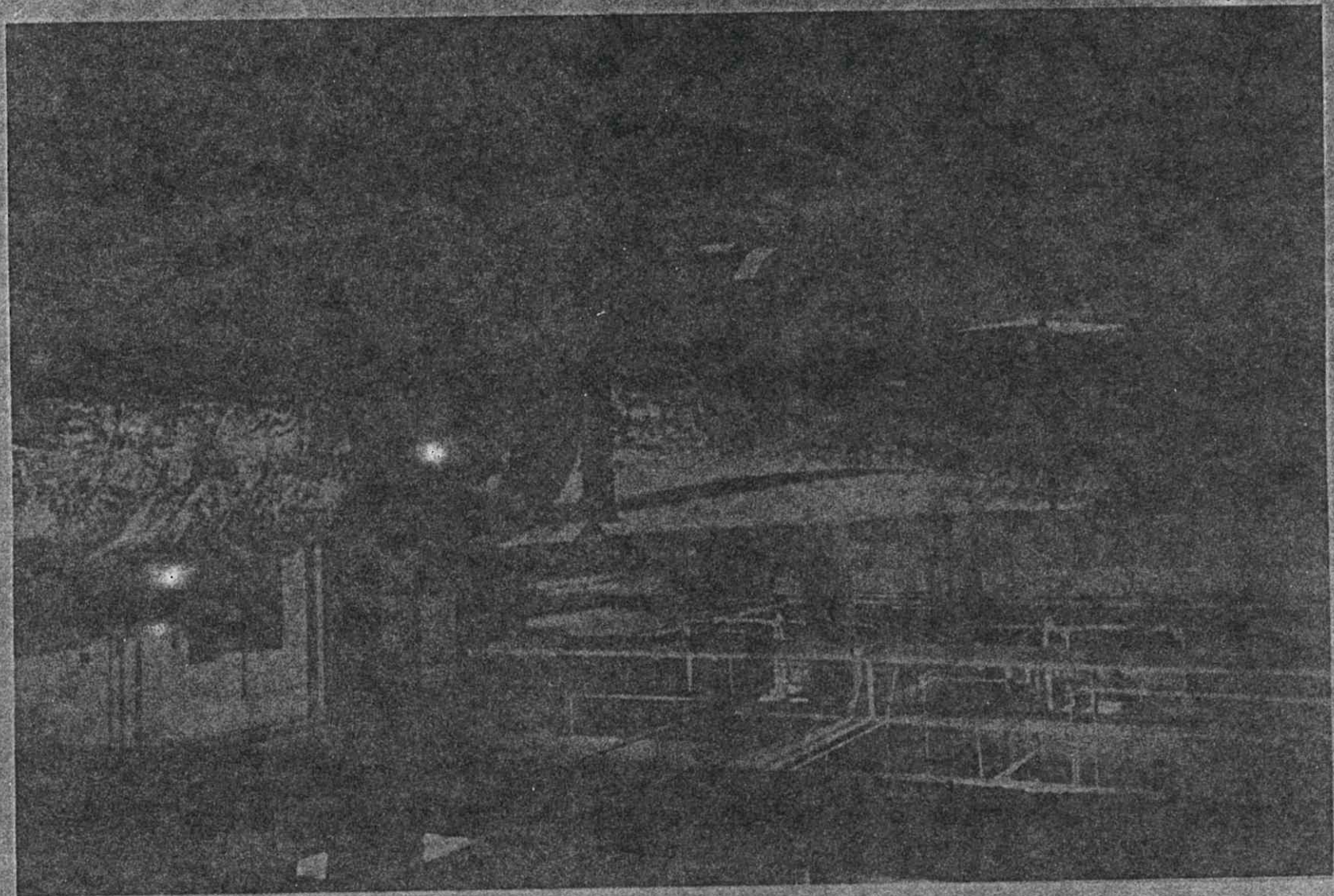


Vacuum Equipment

- 8/94 Science Requirements review to refine specs
- 12/94 RFP for prelim design competition
- 4/95 Begin design competition and estimate production costs
(CB&I, PSI)
- 6/95 PDR's held to evaluate competition
- 8/95 PSI selected to provide Vacuum Equipment

BEAM TUBE MODULES







BEAM TUBE BACKGROUND

- Design & Qualification Test Phase Contract with CBI
 - ›› Contract Initiation: August, 1993
 - ›› Preliminary Design Review: November, 1993
 - ›› Final Design Review: April, 1994
 - ›› Qualification Test: March, 1995
 - ›› Qualification Test Review: April, 1995

BEAM TUBE CURRENT STATUS

- Successfully completed Qualification Test (March, 1995)
 - ›› Demonstrated Design, Fabrication, Assembly
 - ›› Demonstrated acceptable leakage: $< 1 \times 10^{-11}$ atm cc/s
 - ›› Demonstrated acceptable outgassing: $\text{H}_2, < 1 \times 10^{-13}$ t•l/s•cm²
 $\text{H}_2\text{O}, < 1 \times 10^{-16}$ t•l/s•cm²
- Qualification Test Review held (April, 1995)
 - ›› Board endorsed the fact that all aspects of the test have been met
 - ›› Board concurs LIGO is ready to commence fabrication & installation of beam tubes

Summary

- Feasibility of beam tube vacuum requirements has been industrially demonstrated.
- LIGO is becoming a construction project
- Major subcontracts for vacuum equipment and beam tube will begin in the next FY