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# **LIGO**

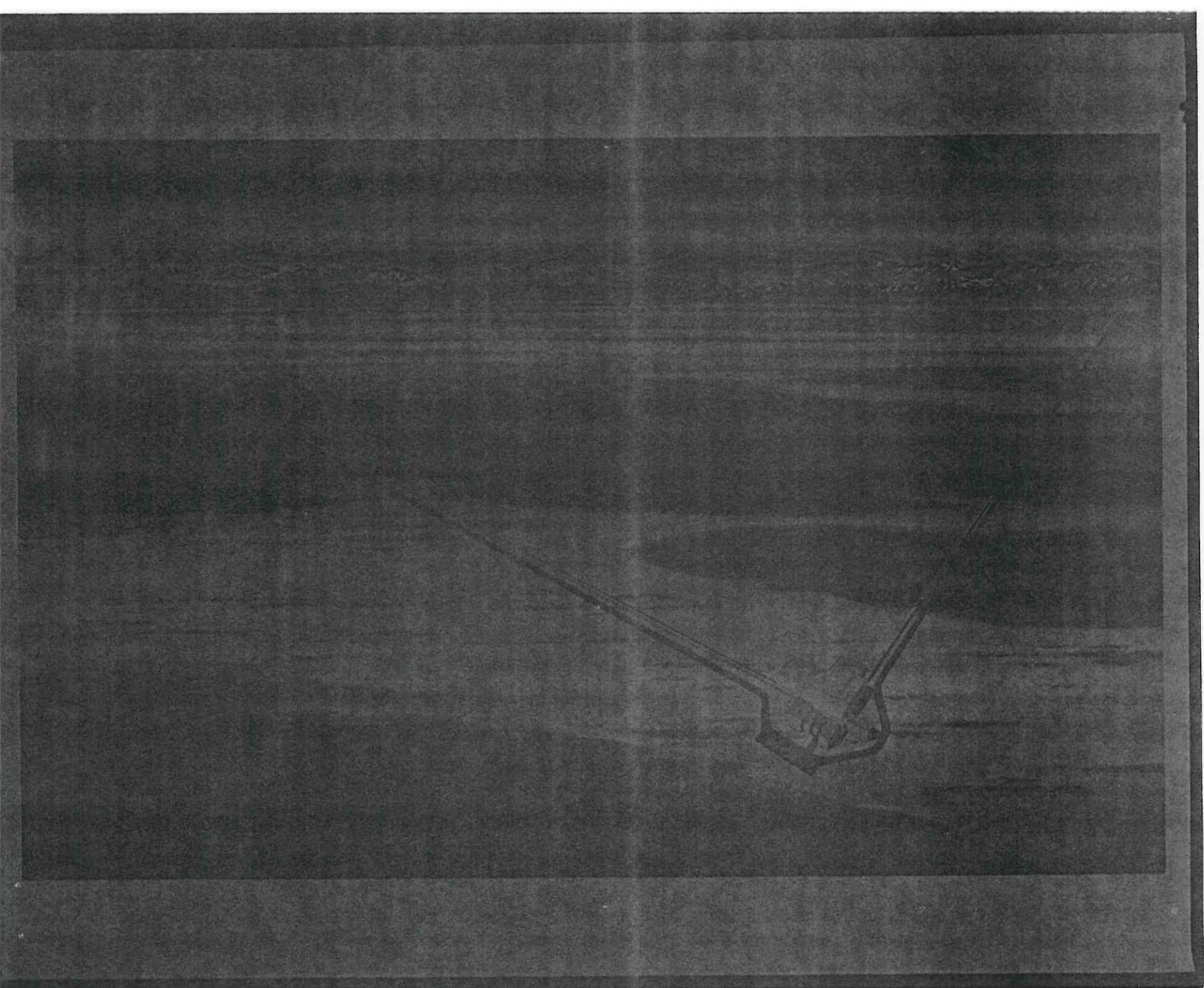
# **All Hands Meeting**

Barry Barish  
March 10, 1995

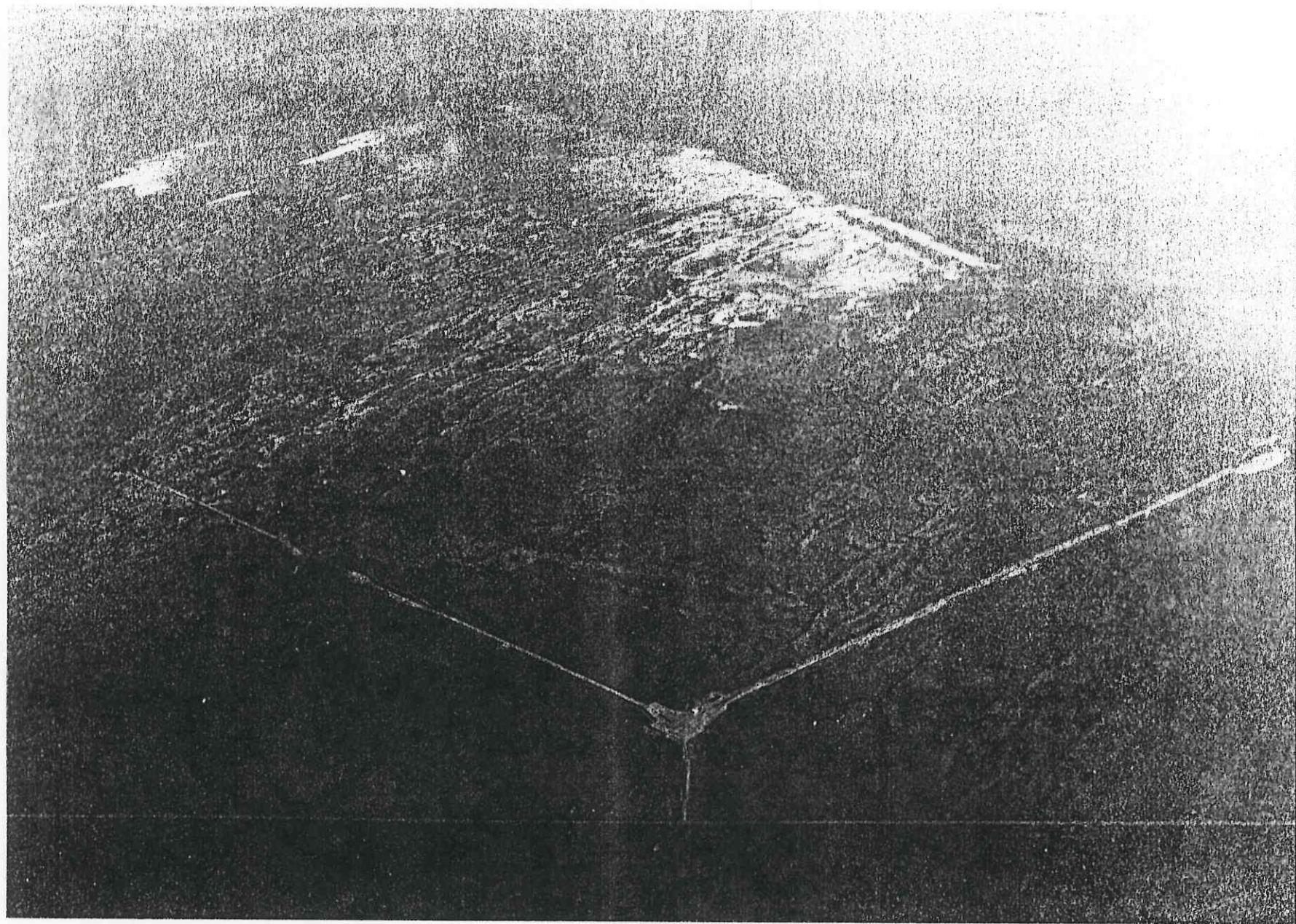
# The Obvious - -

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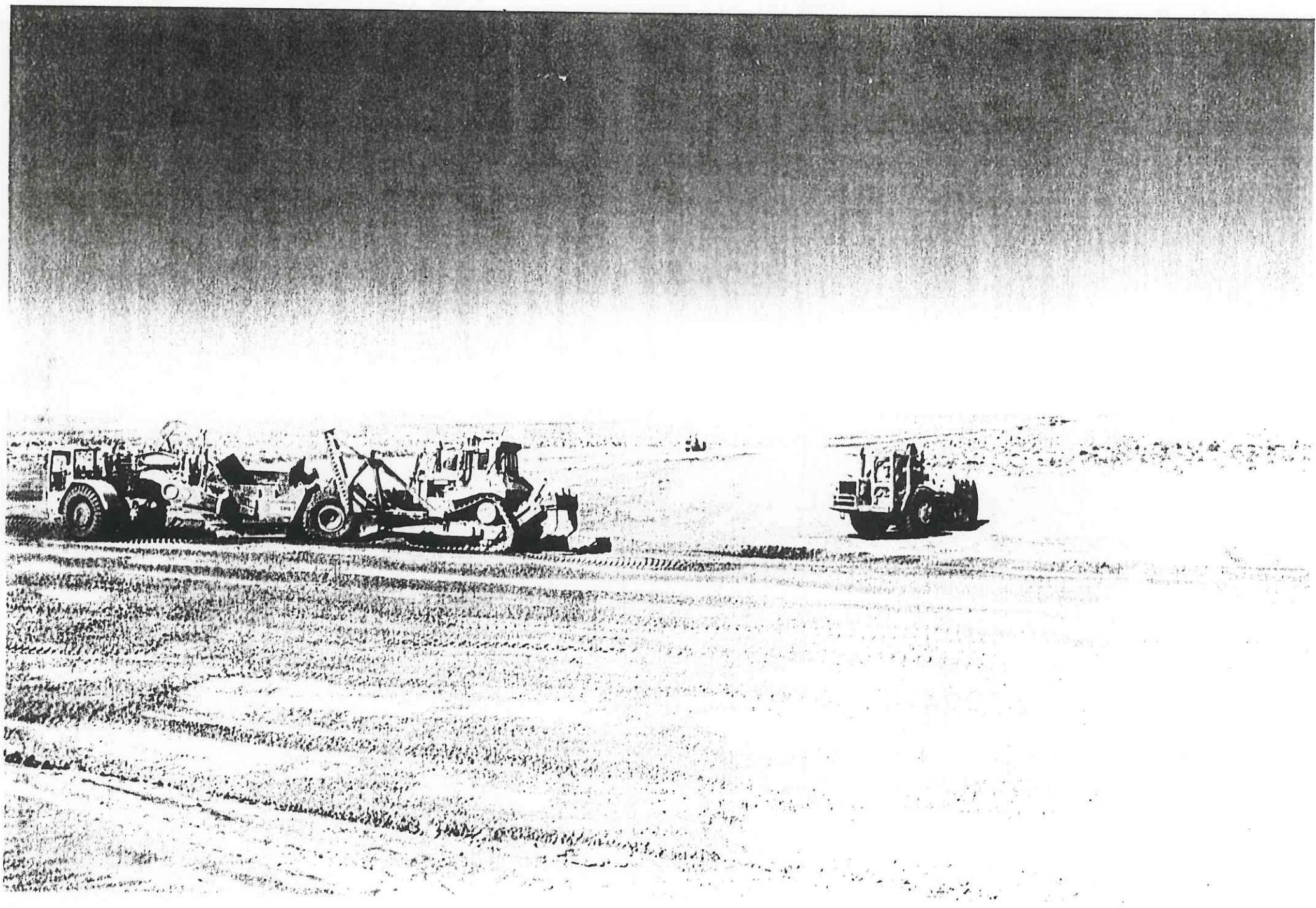
- The Pace is Picking Up!!
  - ◆ A&E / Parsons
  - ◆ Vacuum Equipment Proposals
  - ◆ Beam Tube Qualification Test
  - ◆ R&D Recombination
  - ◆ Detector Baseline Design
- Growth is Rapid
  - ◆ \$\$ -- '95 = 3 x ('92+'93+'94)
  - ◆ People -- + 40 in '95 (almost x2)
- Project Structure in Place
  - ◆ Document Control
  - ◆ Integrated Schedule
  - ◆ Performance Measurement
  - ◆ Configuration Management



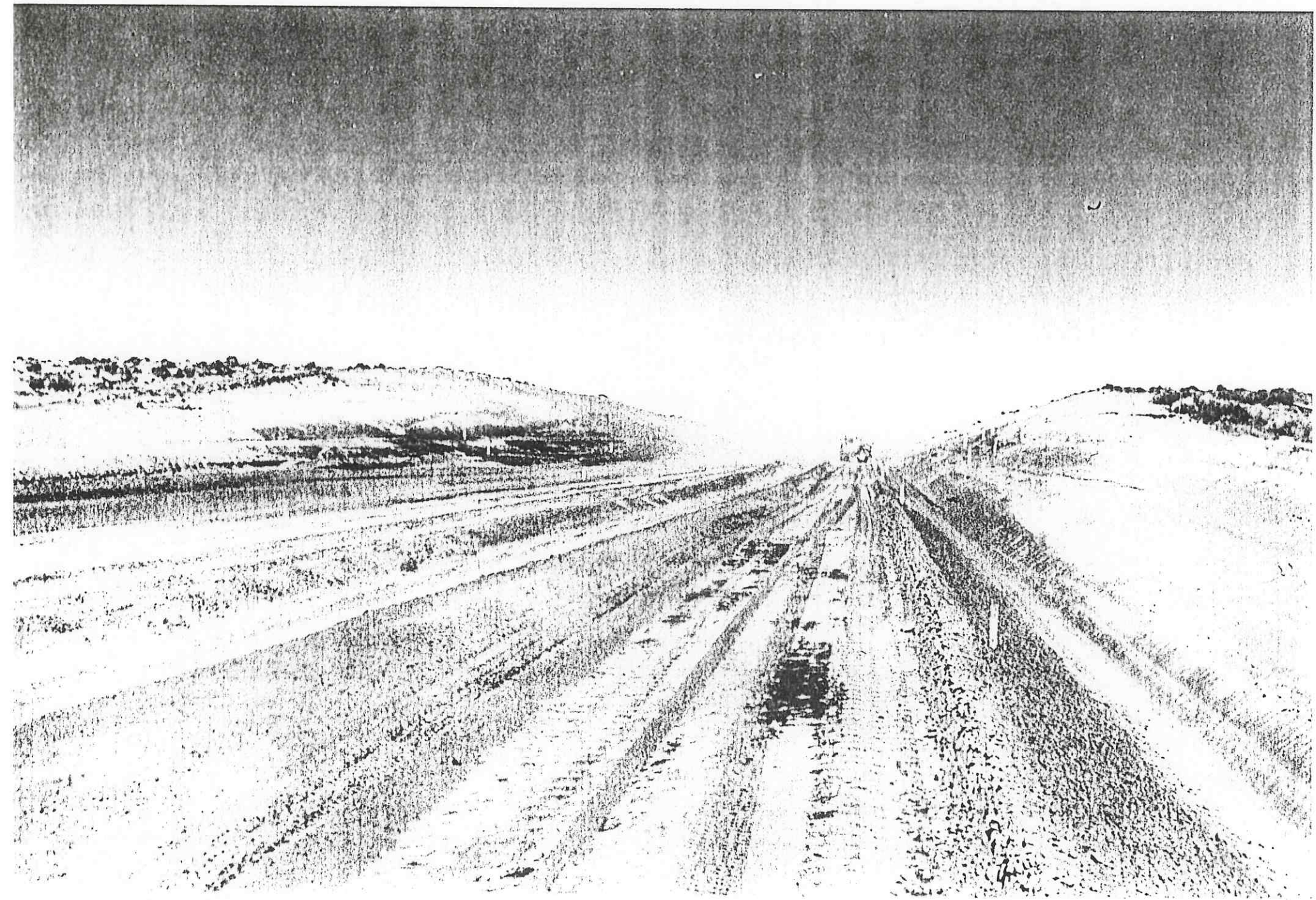




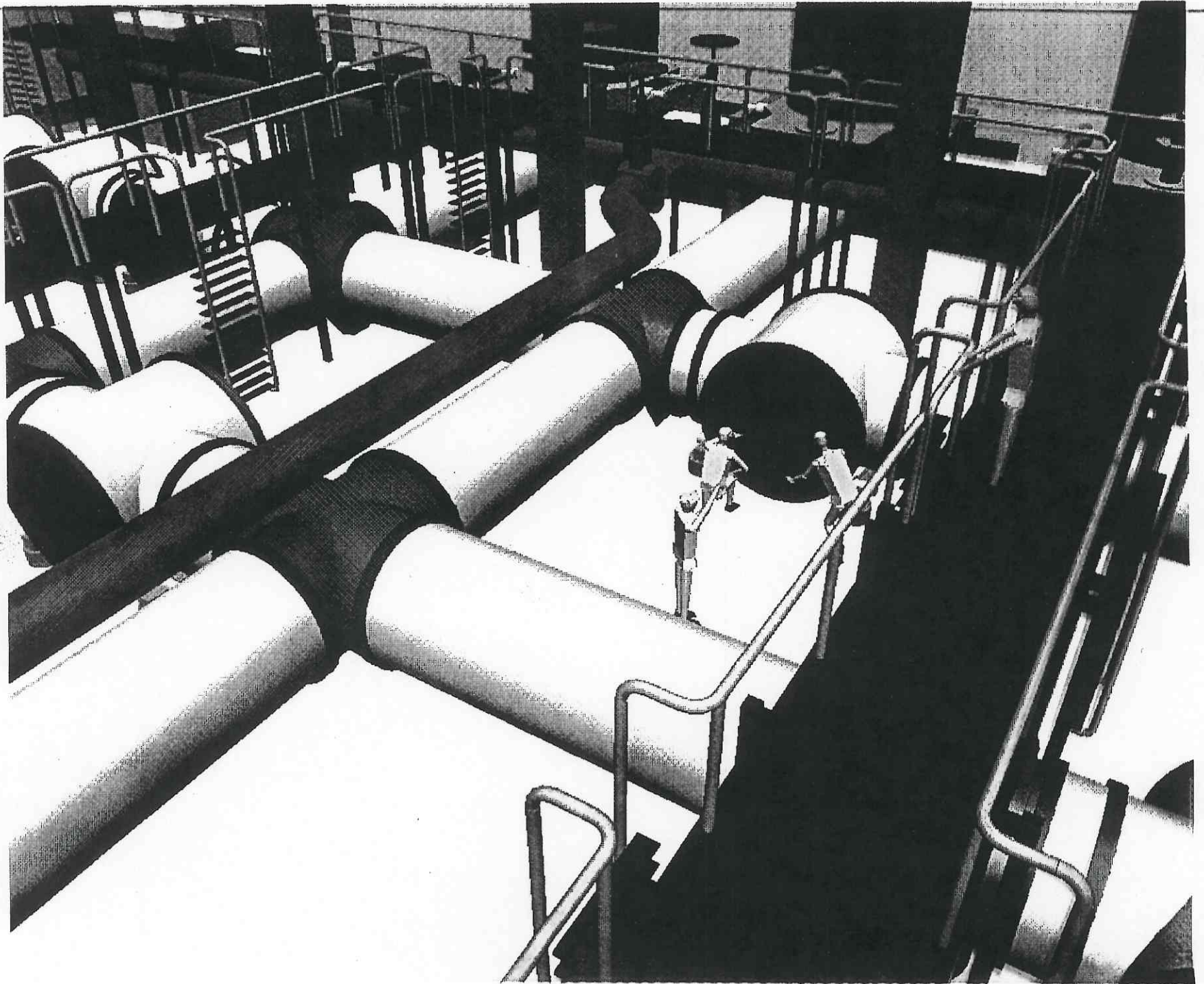








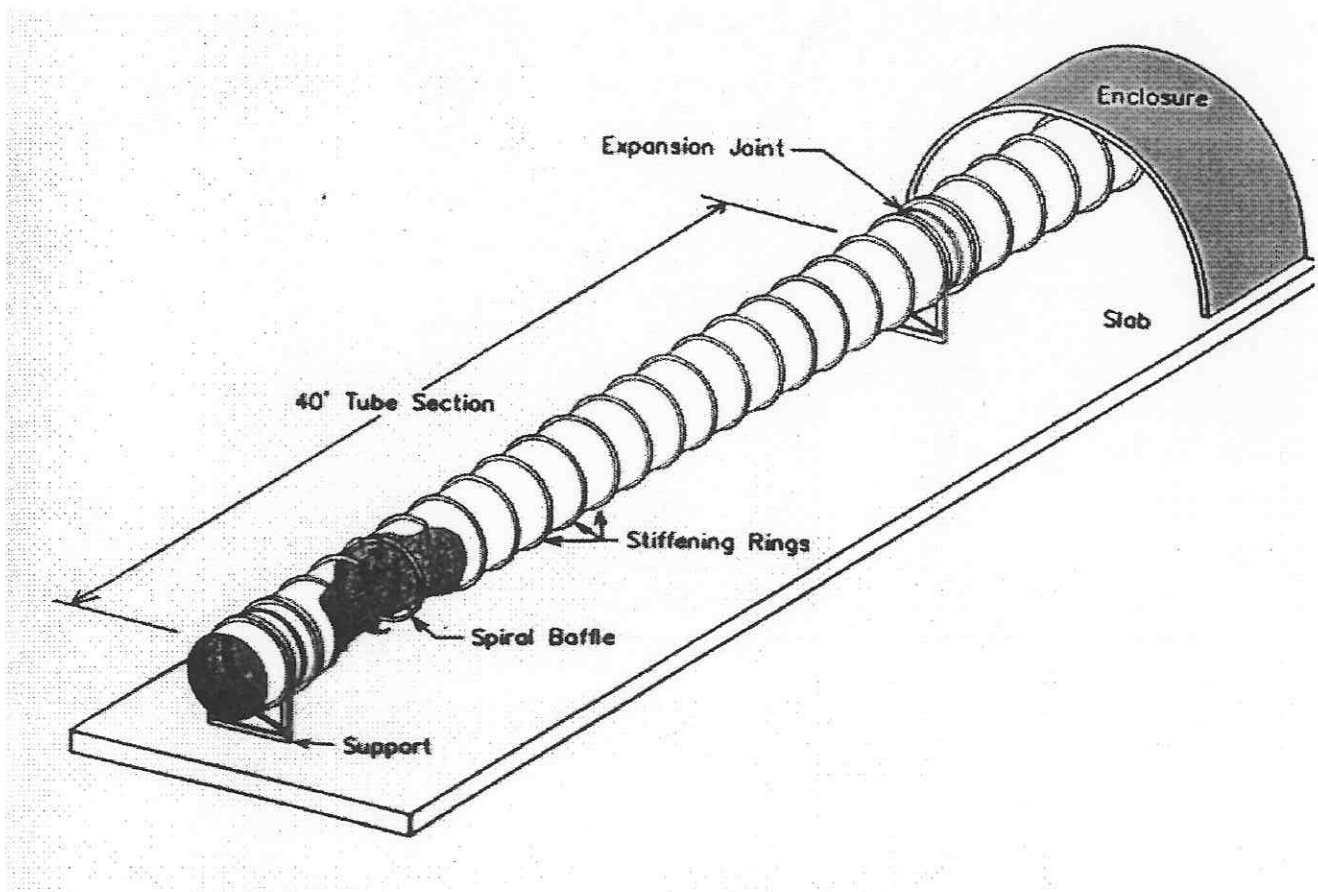




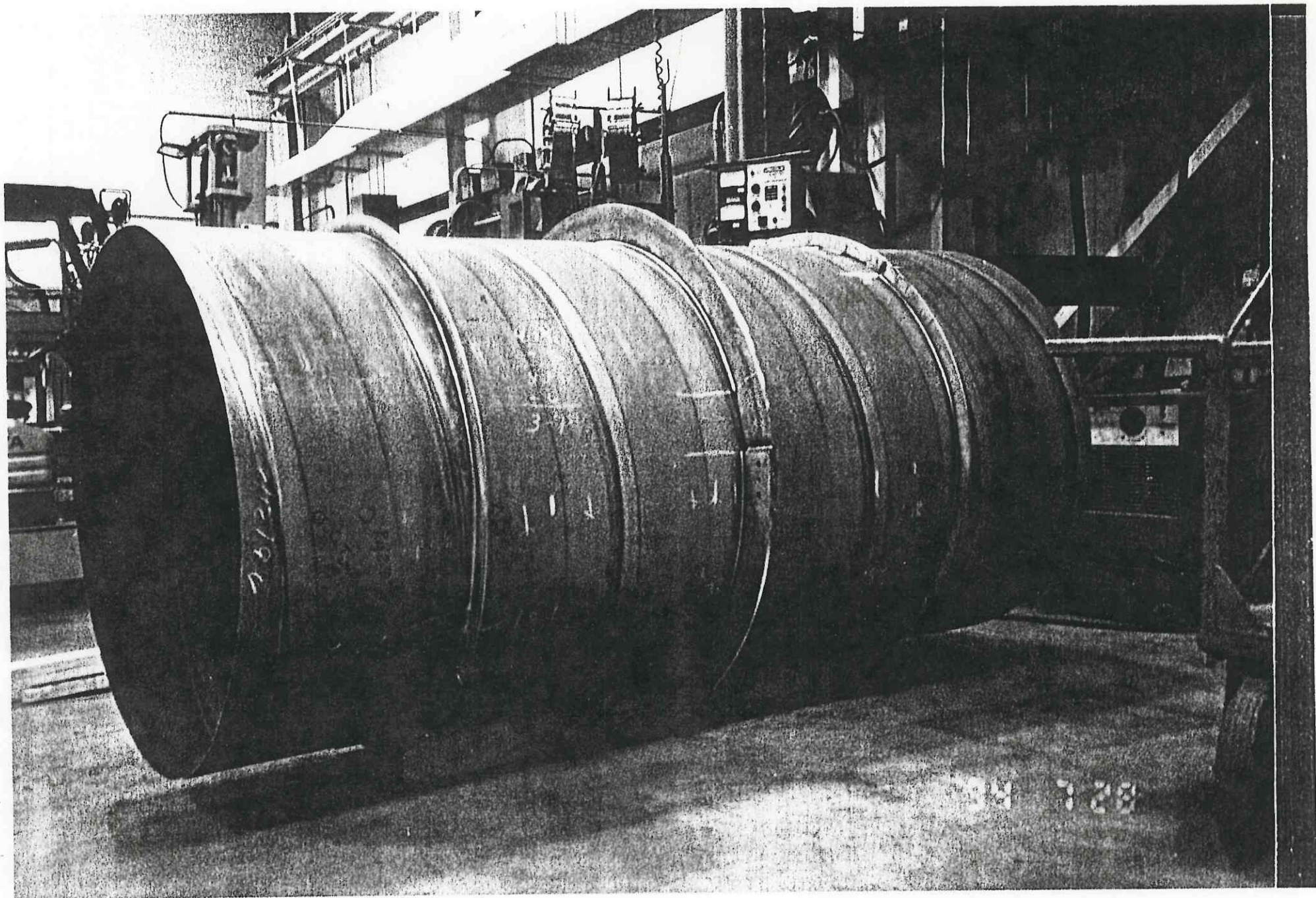
# Beam Tube

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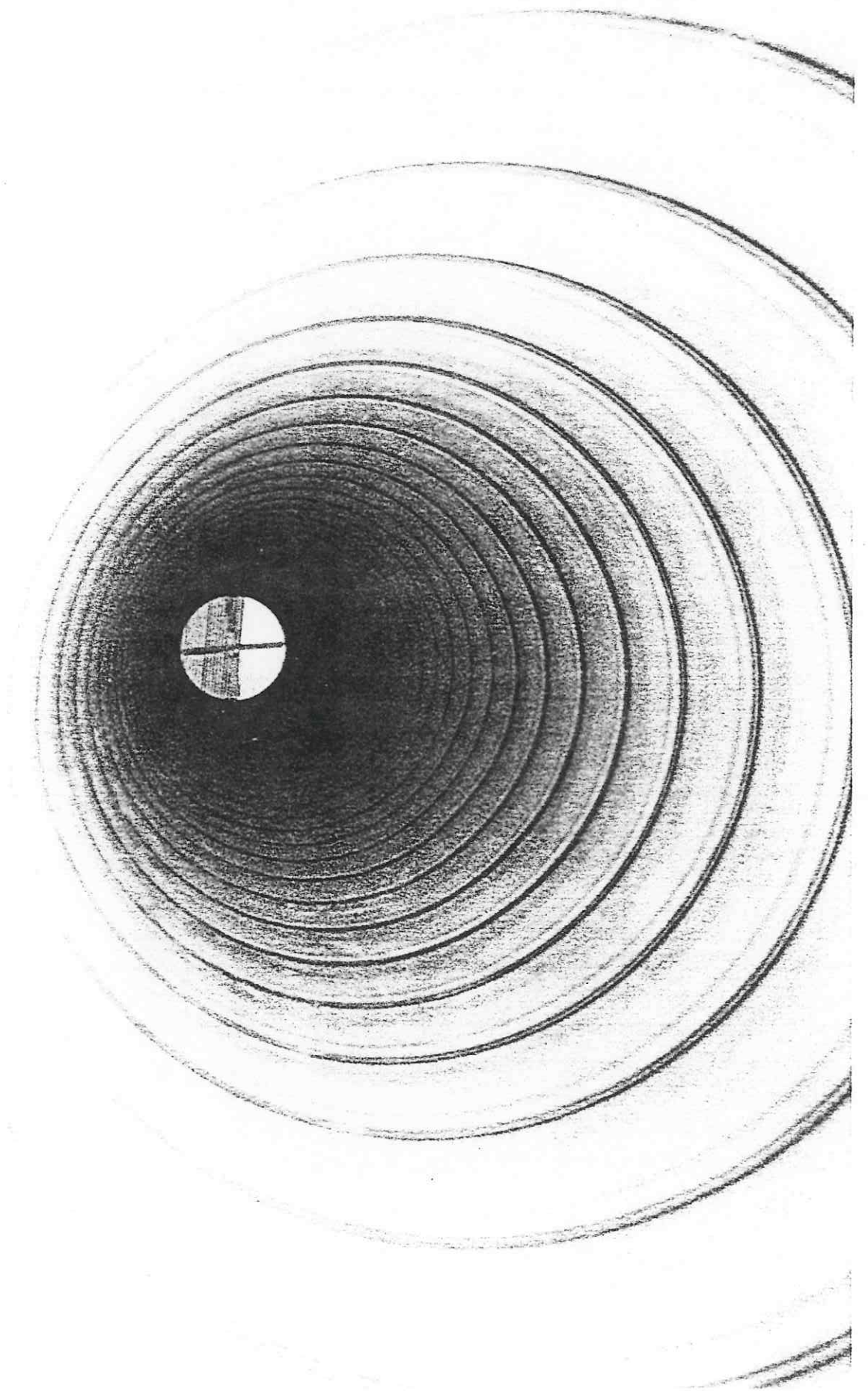
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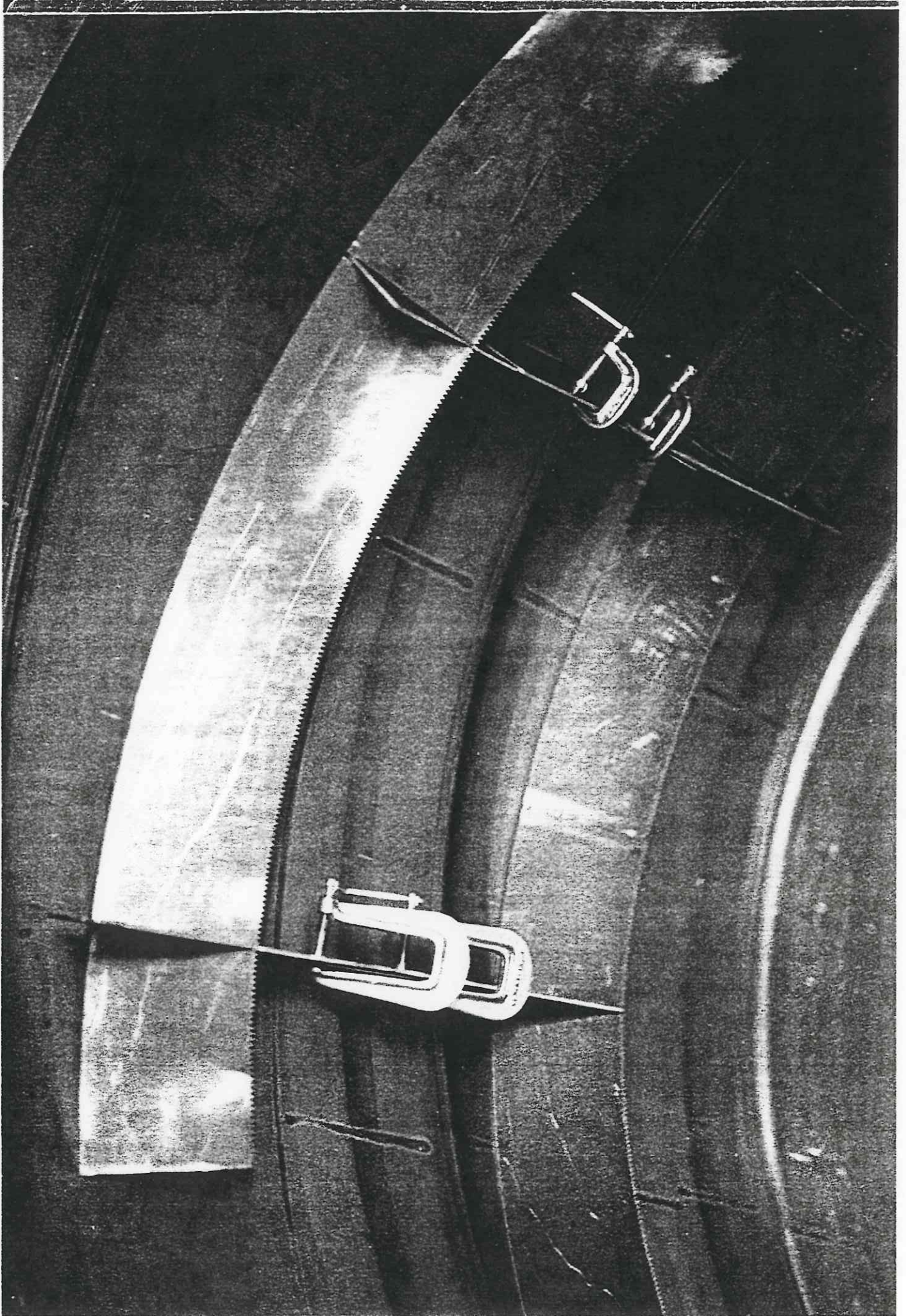




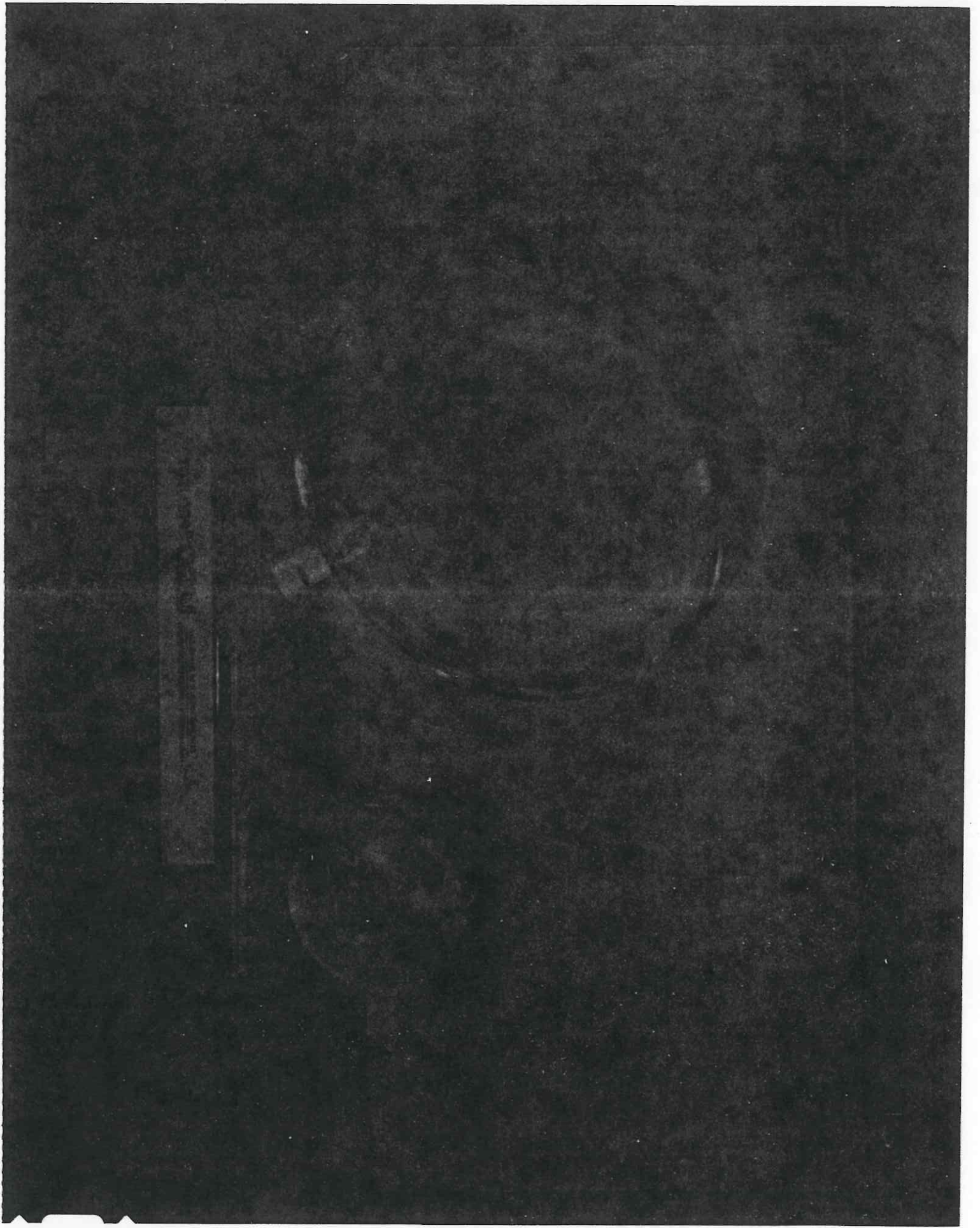










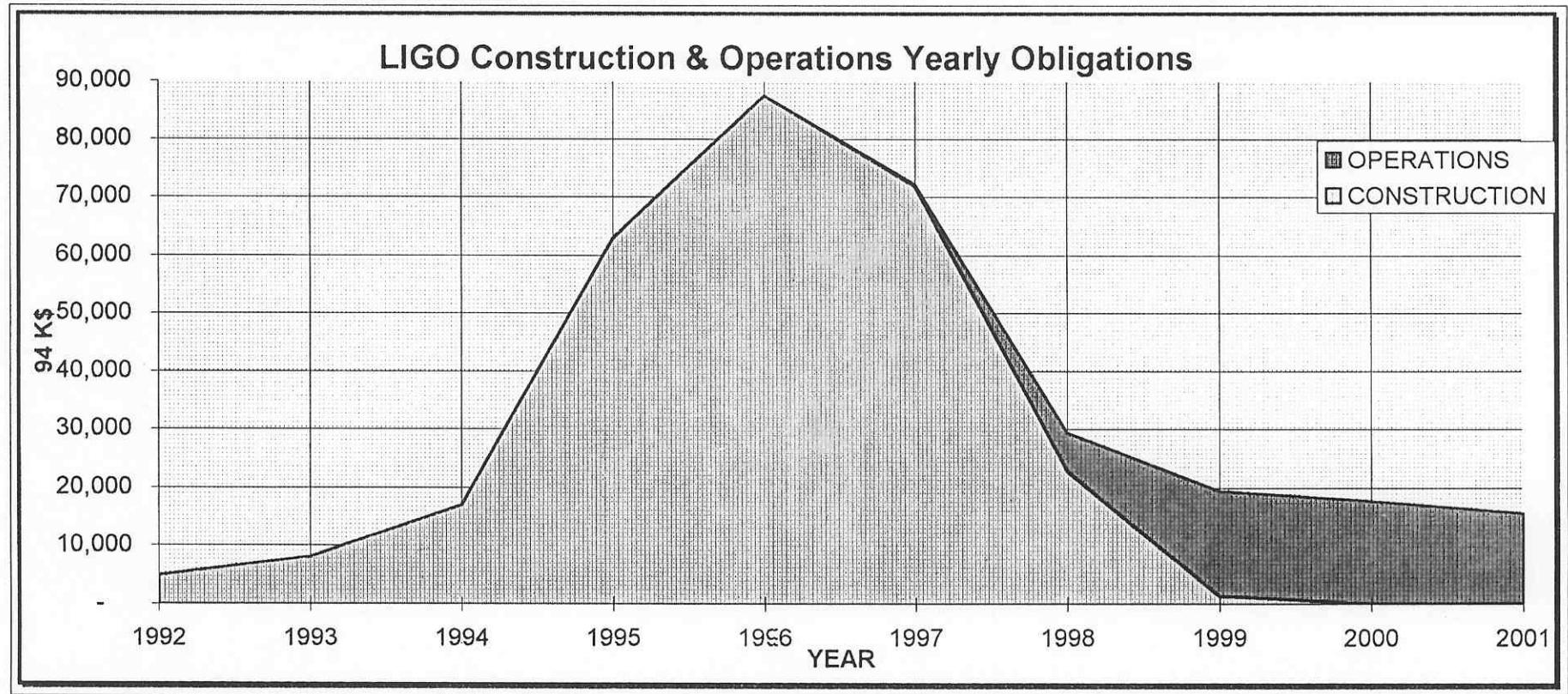




## LIGO Project Construction and Operations Summary (including contingency)

11/14/94

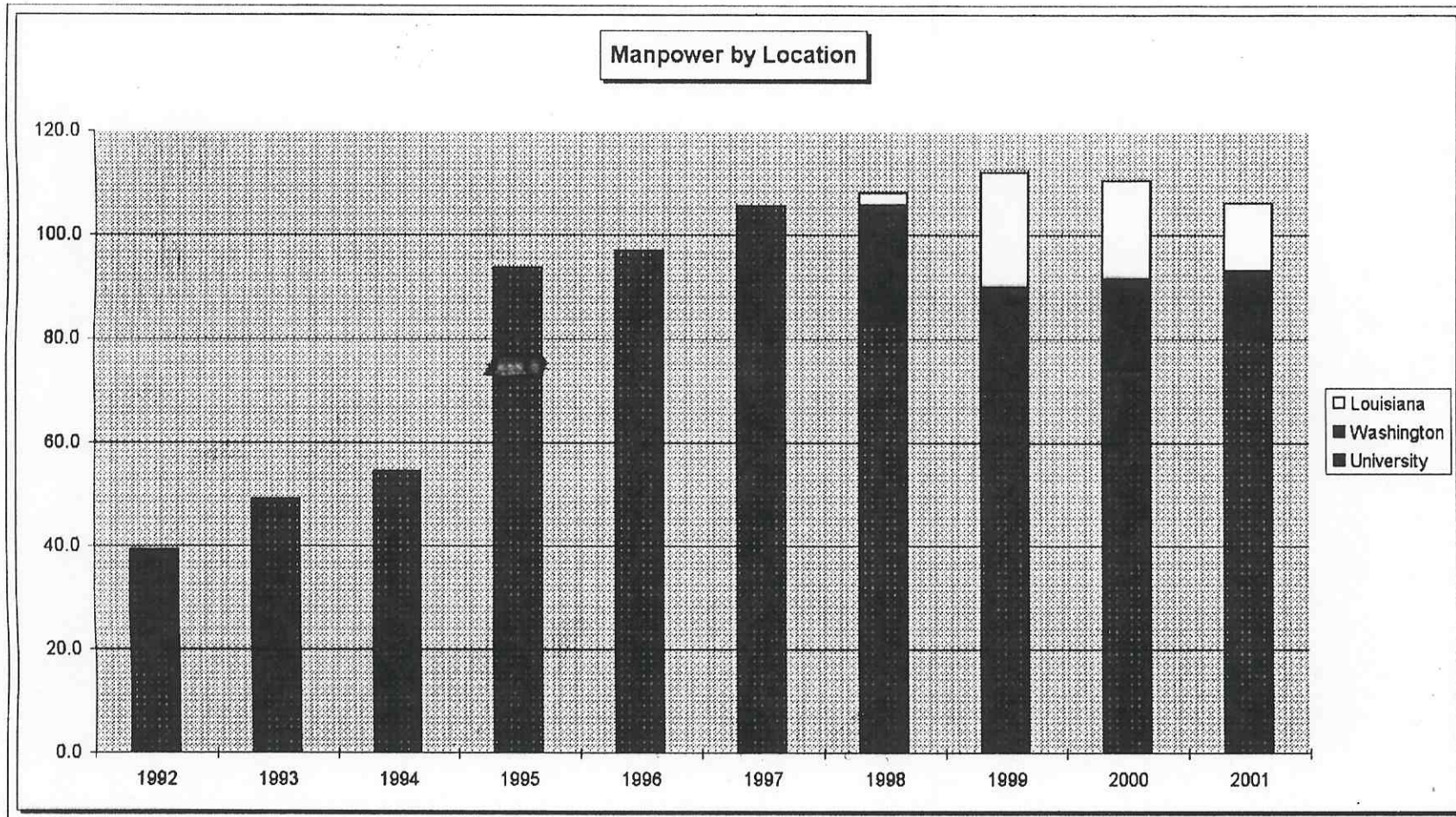
	FY 1994 \$K										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	TOTAL
CONSTRUCTION	4,860	8,014	16,987	62,913	87,444	71,855	22,818	1,326			276,217
OPERATIONS						233	6,513	18,066	17,749	15,624	58,185
<b>TOTAL</b>	<b>4,860</b>	<b>8,014</b>	<b>16,987</b>	<b>62,913</b>	<b>87,444</b>	<b>72,088</b>	<b>29,331</b>	<b>19,392</b>	<b>17,749</b>	<b>15,624</b>	<b>334,402</b>





LIGO

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
University	39.1	49.0	54.5	93.7	97.0	105.6	83.5	89.9	74.0	80.1
Washington							22.0	20.0	17.5	13.0
Louisiana							2.6	22.2	18.9	13.0
	39.1	49.0	54.5	93.7	97.0	105.6	108.1	112.0	110.3	106.1





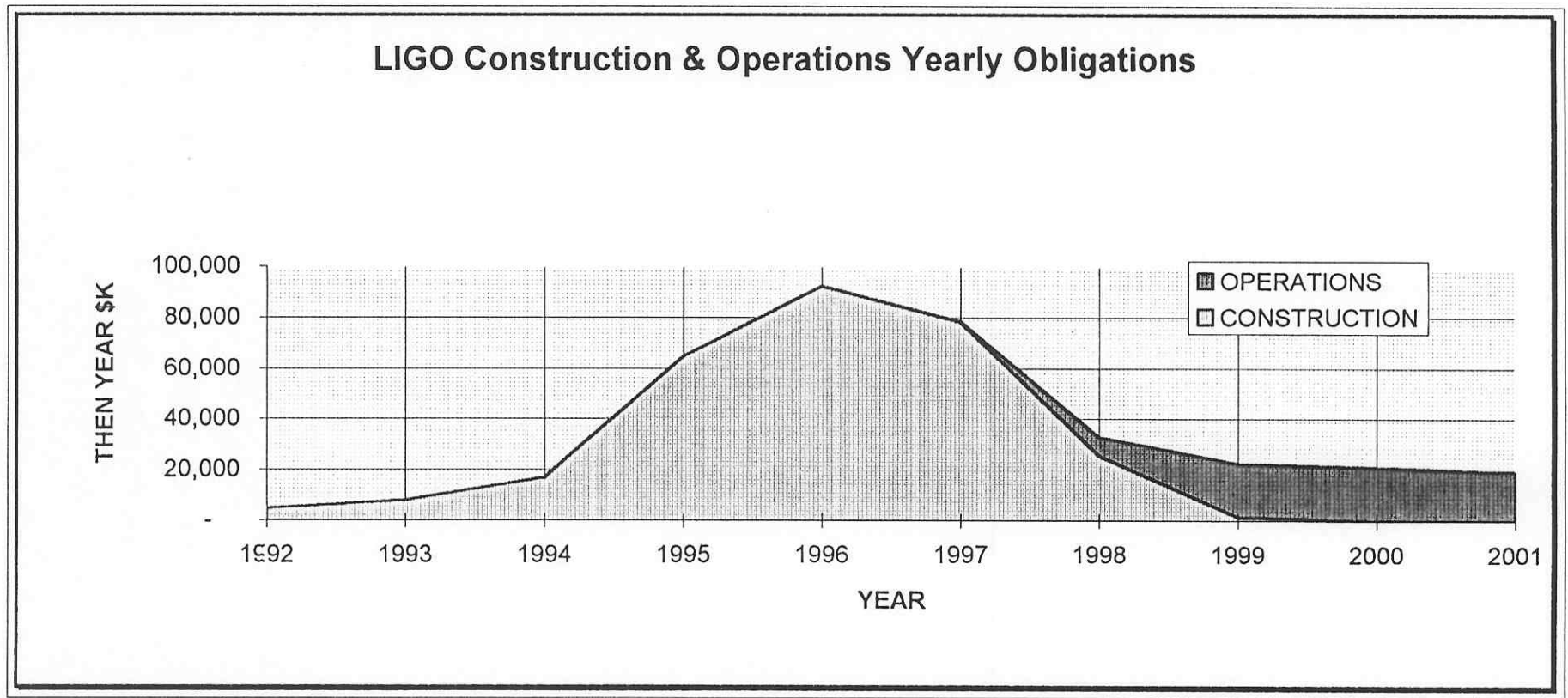
# What's Ahead ....

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- Construction Project
  - ◆ Facilities
    - ⇒ Construction '95 thru '98
  - ◆ Detector
    - ⇒ Design '95 - '96
    - ⇒ Construction '97 - '98
  - ◆ R&D
    - ⇒ Support Detector Design '95-'96
    - ⇒ Advanced Detectors '97 - -
  
- Commissioning/Operations
  - ◆ Initiate by 1998
  - ◆ Different Organization/Tasks etc

## LIGO Project Construction and Operations Summary (including contingency)

	THEN YEAR \$K										
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	TOTAL
CONSTRUCTION	4,860	8,014	16,987	64,652	92,417	78,212	25,594	1,532			292,268
OPERATIONS						254	7,305	20,877	21,114	19,117	68,666
TOTAL	4,860	8,014	16,987	64,652	92,417	78,465	32,899	22,410	21,114	19,117	360,935



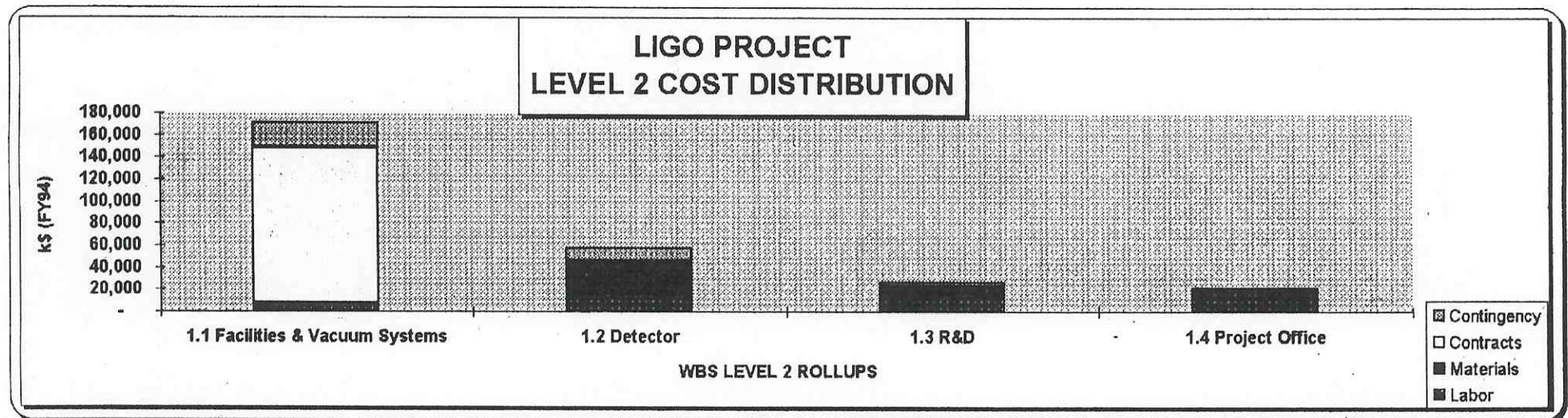


# LIGO PROJECT

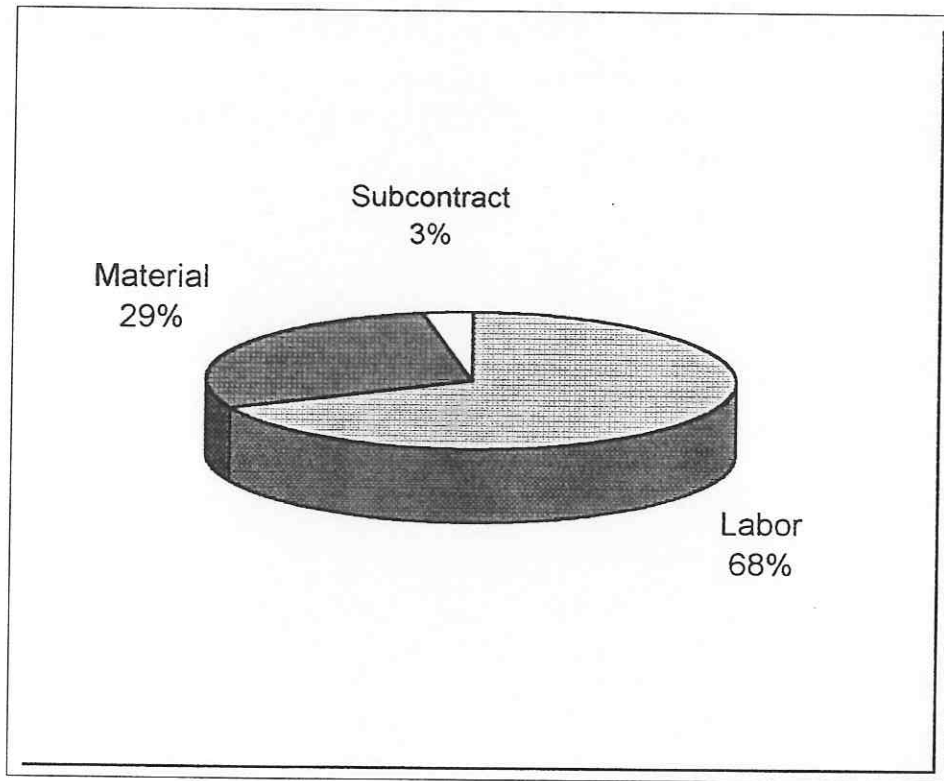
## LEVEL 2 COST DISTRIBUTION (FY94 \$K)

SEPTEMBER 1994

	1.1 Facilities & Vacuum Systems	1.2 Detector	1.3 R&D	1.4 Project Office	1. TOTAL LIGO
Labor	7,118	15,146	15,445	18,545	56,254
Materials	-	29,054	7,243	1,425	37,722
Contracts	140,859	894	-	-	141,753
Contingency	22,620	12,718	4,110	1,039	40,487
<b>Total</b>	<b>170,597</b>	<b>57,812</b>	<b>26,798</b>	<b>21,009</b>	<b>276,216</b>



# LIGO Operations Total Cost Estimate Allocation by Major Cost Category





# LIGO Operations

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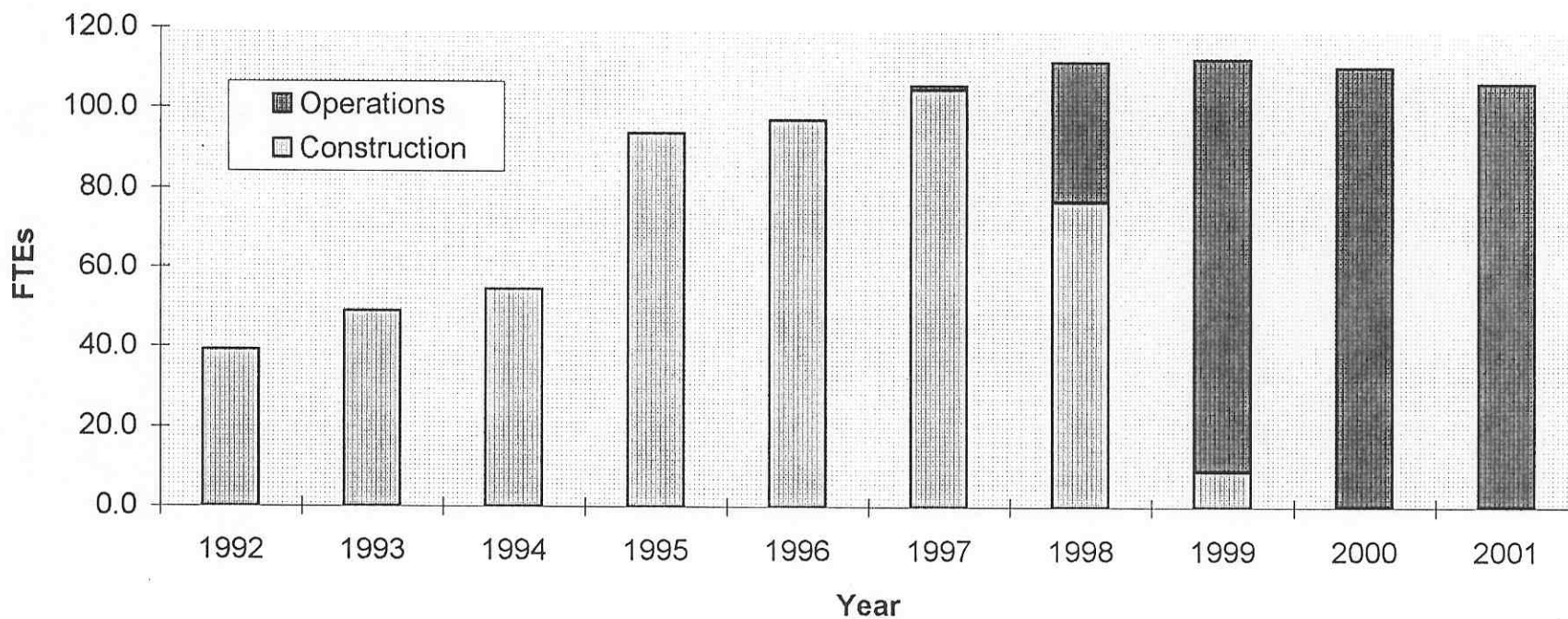
- Components of Operations
  - ◆ Wash/Louisiana Site Support
  - ◆ Administrative Support
  - ◆ Physics Research (MIT/Caltech)
  - ◆ Detector Development(MIT/Caltech)
- Milestones
  - ◆ Initiate Startup ~1998
  - ◆ Operational Detector July 2000
  - ◆ Design Sensitivity Dec 2001
- Full Operations (2001+)
  - ◆ Full Operations: \$19.1M/yr
  - ◆ Equipment/: \$ 6M/yr?
- Total Operations (4 years)
  - ◆ Total (1998-2001) \$68.7M



### LIGO Construction and Operations Labor by Year

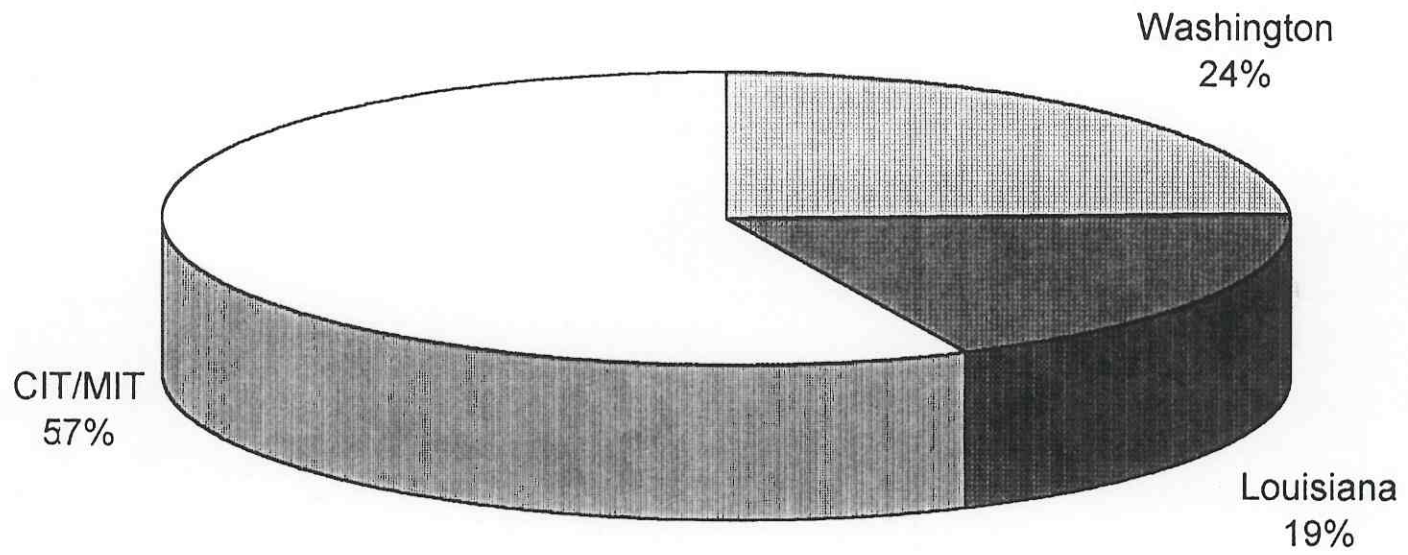
		Labor (FTEs) by Year									
		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Construction</b>		39.1	49.0	54.5	93.7	97.0	104.5	76.7	8.9		
<b>Operations</b>							1.1	34.8	103.4	110.1	106.1
<b>Total</b>		39.1	49.0	54.5	93.7	97.0	105.6	111.4	112.3	110.1	106.1

### Construction and Operations Labor by Year





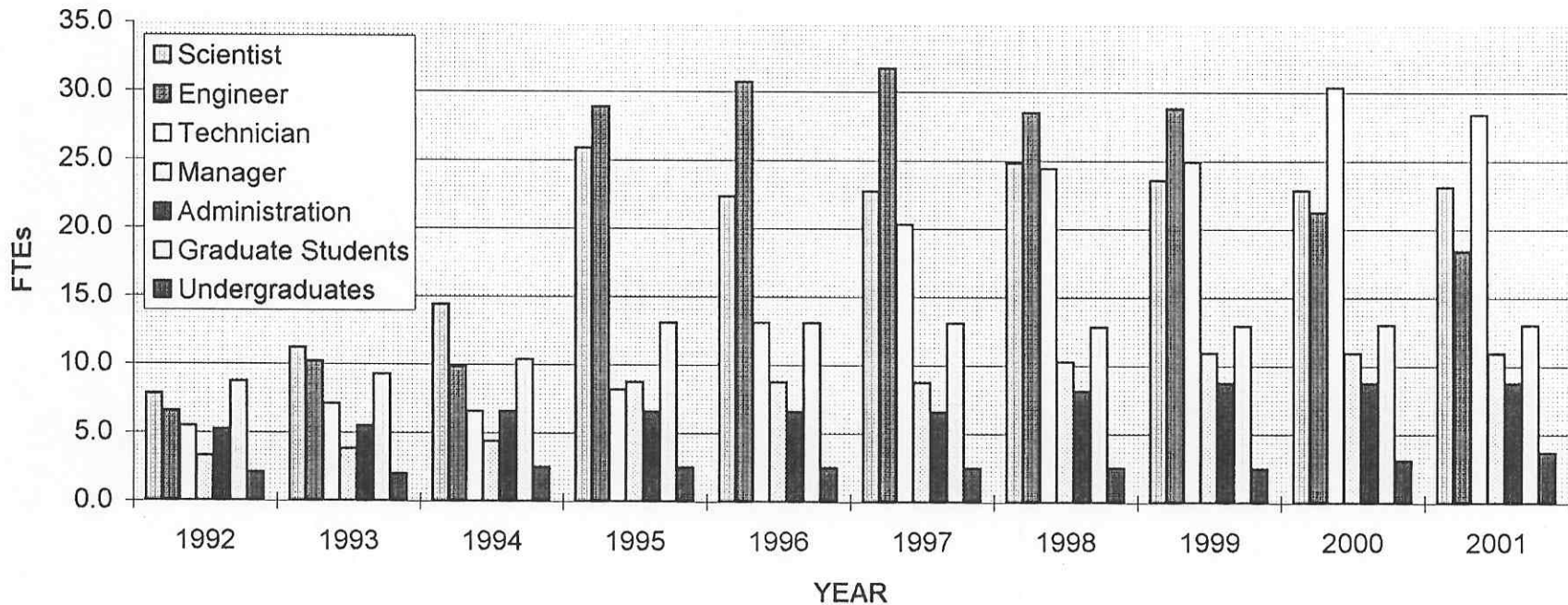
LIGO OPERATIONS DOLLARS BY SITE



### LIGO Labor by Category and Year

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Scientist</b>	7.8	11.2	14.4	25.9	22.3	22.7	24.8	23.5	22.8	23.1
<b>Engineer</b>	6.5	10.2	9.8	28.9	30.7	31.7	28.5	28.8	21.2	18.4
<b>Technician</b>	5.5	7.1	6.5	8.1	13.1	20.3	24.4	24.9	30.4	28.4
<b>Manager</b>	3.3	3.8	4.4	8.7	8.7	8.7	10.3	10.9	10.9	10.9
<b>Administration</b>	5.2	5.5	6.5	6.5	6.5	6.5	8.1	8.7	8.7	8.7
<b>Graduate Students</b>	8.7	9.3	10.4	13.1	13.1	13.1	12.8	12.9	13.0	13.0
<b>Undergraduates</b>	2.1	2.0	2.5	2.5	2.5	2.5	2.5	2.5	3.1	3.6
<b>TOTAL</b>	39.1	49.0	54.5	93.7	97.0	105.6	111.4	112.3	110.1	106.1

### LIGO Labor (FTEs) by Labor Category





# Evolution to LIGO Operations

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- Planning Being Done Now
  - ◆ Funding Approved
  - ◆ Proposal/Plan by May '95
- Overlaps Constuction ~'98 -
- Manpower
  - ◆ Total LIGO Manpower ~ 100+
  - ◆ Resident at Sites ~26 - 40+?
  - ◆ Caltech Campus
    - ⇒ reduced duirng operations
    - ⇒ different skill mix
  - ◆ We need to know your desires for planning purposes.
    - ⇒ Do you want to stay with LIGO?
    - ⇒ Location?
- A View of Operations at the Sites

(F. Raab)

# LIGO Permanent Staff Estimate for Hanford,WA

FJR—3/10/95

<b>Technician Operators</b>	<b>operate interferometer available for other duties during down times</b>	<b>10 positions</b>
<b>Technician Specialists</b>	<b>Electronic/Data Systems Vacuum/Mechanical Optics</b>	<b>3 positions</b>
<b>Engineers</b>	<b>Electronics/Data Vacuum/Mechanical Network/Software</b>	<b>3 positions</b>
<b>Site Administration</b>	<b>Facilities Manager Administrative Assistant</b>	<b>3 positions</b>
<b>Scientists</b>	<b>Observatory Head Science Staff</b>	<b>3 positions</b>

Expect similar staffing level in Livingston, LA