

| REPORT DOCUMENTATION PAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                             |                                                            | Form Approved<br>OMB No. 0704-0188                  |                                                        |
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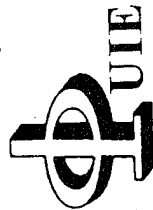
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M.M.L.I.



ENTERPRISES

# HPD PULSER UPGRADE TO IMPROVE RISE TIME

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Presented to the  
AMEREM  
31 May 1996

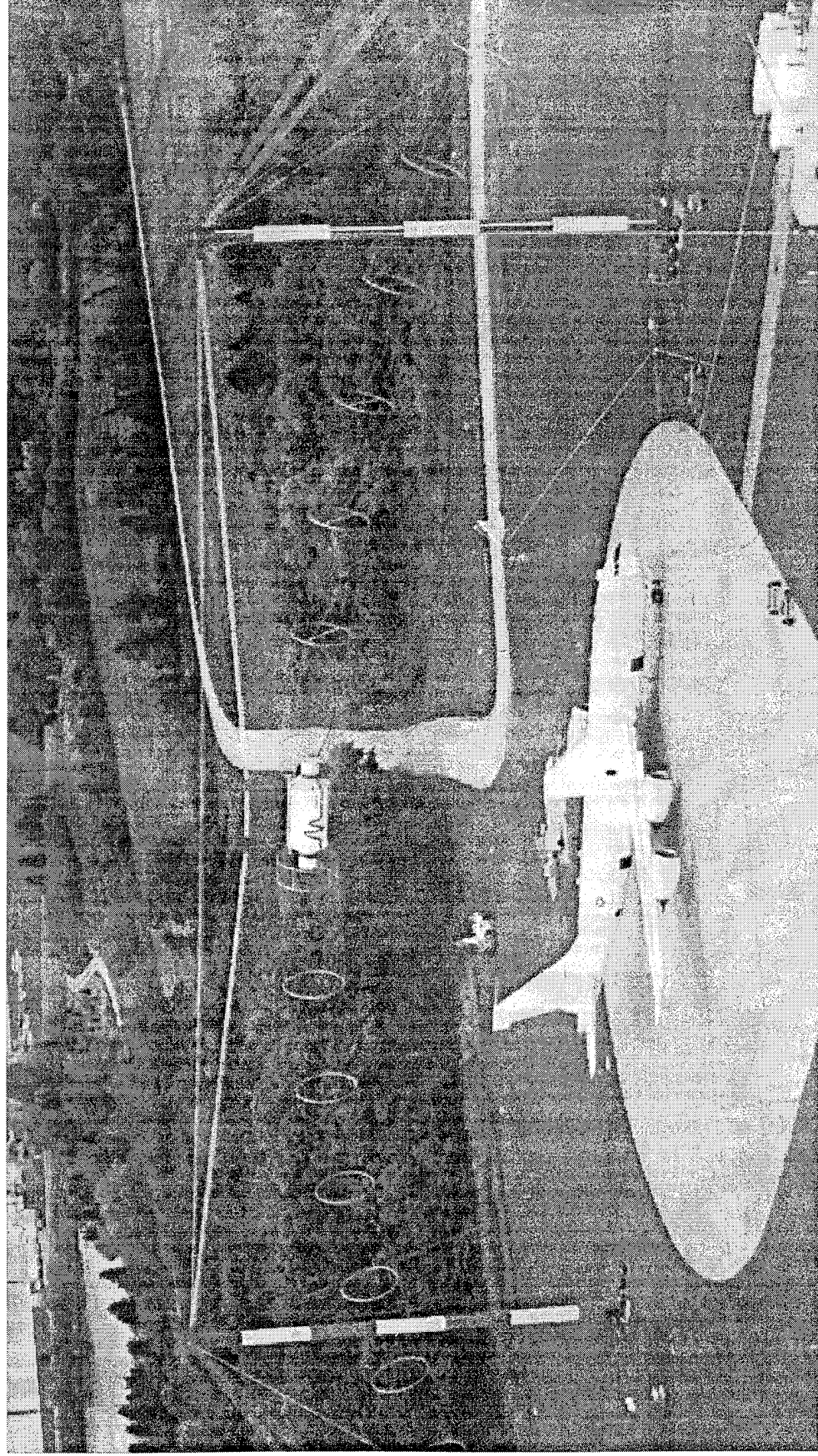
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*Shaul A. Shaul*  
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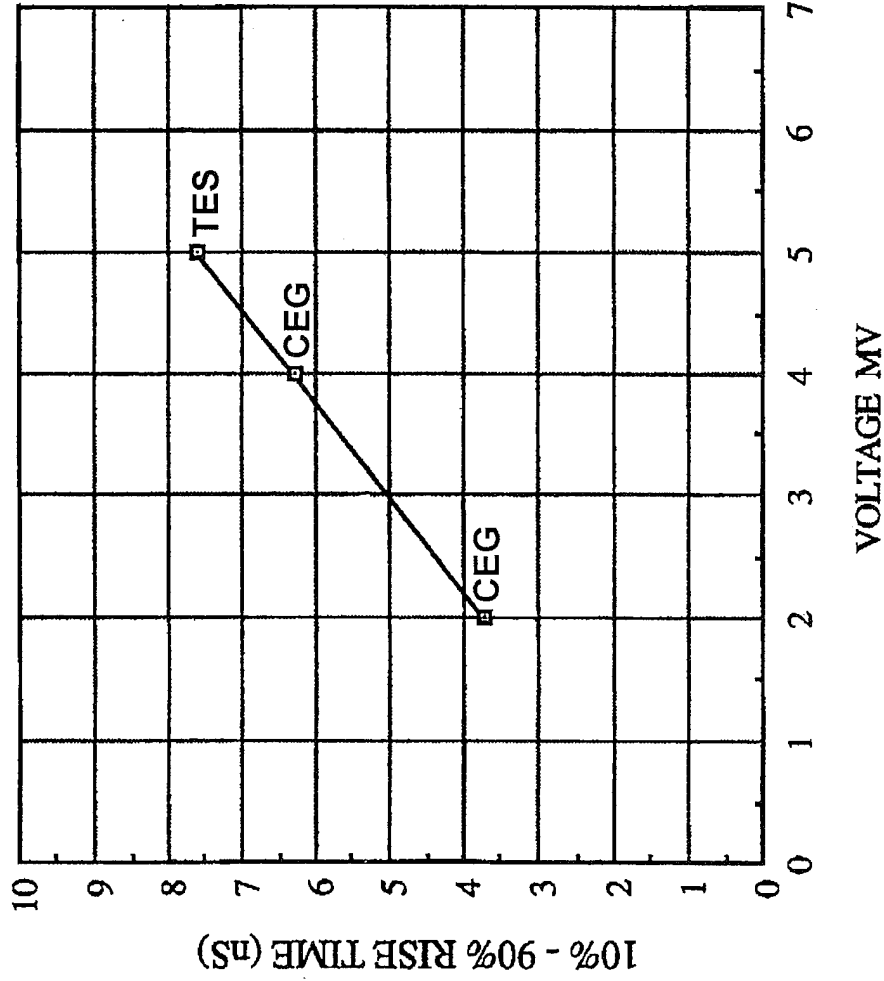


# HORIZONTALLY POLARIZED DIPOLE FACILITY





# RISE TIME OF CONVENTIONAL SF<sub>6</sub> FILLED GAS SWITCH



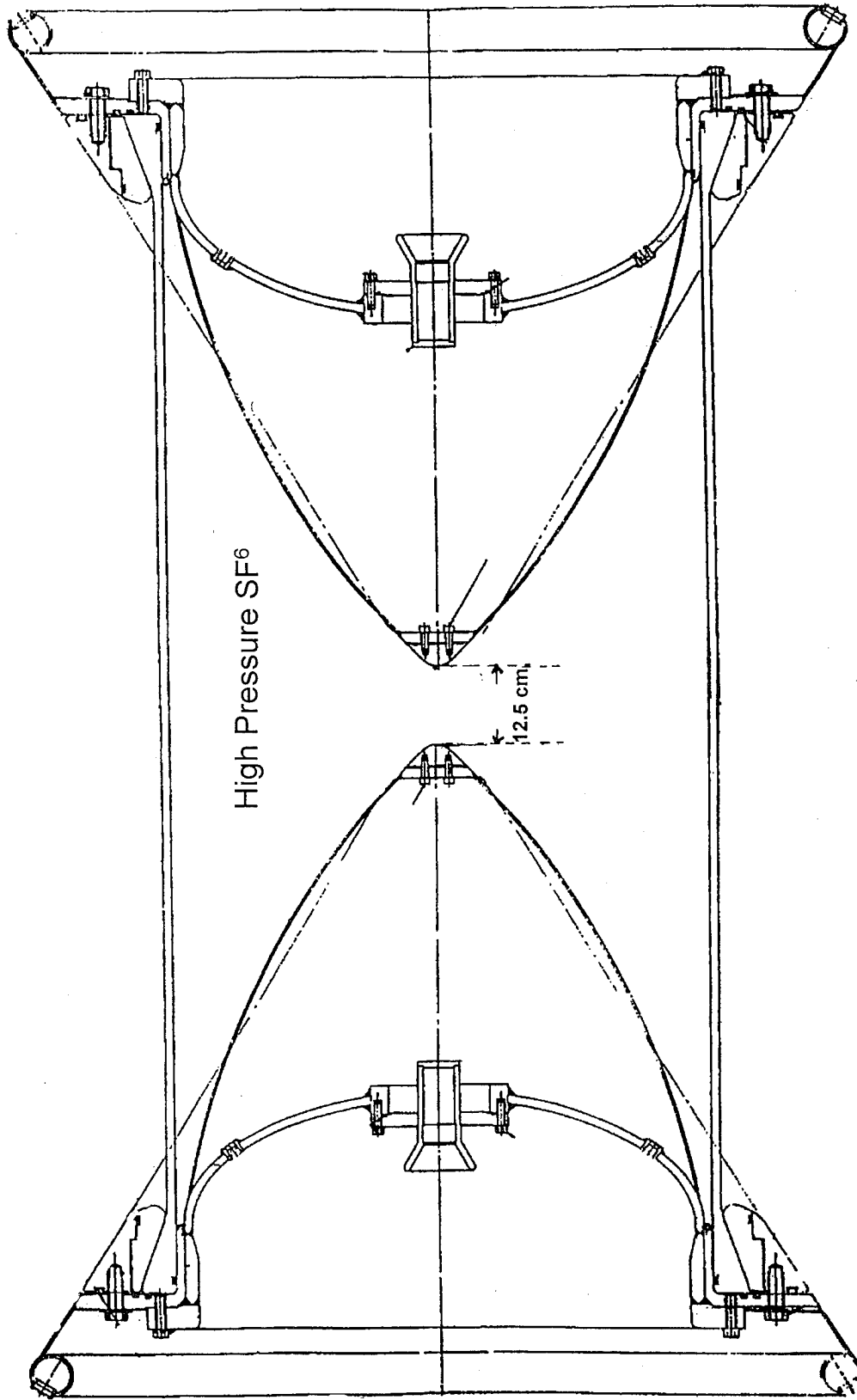


# ORIGINAL SF<sub>6</sub> FILLED OUTPUT SWITCH

M.M.L.I.



AND  
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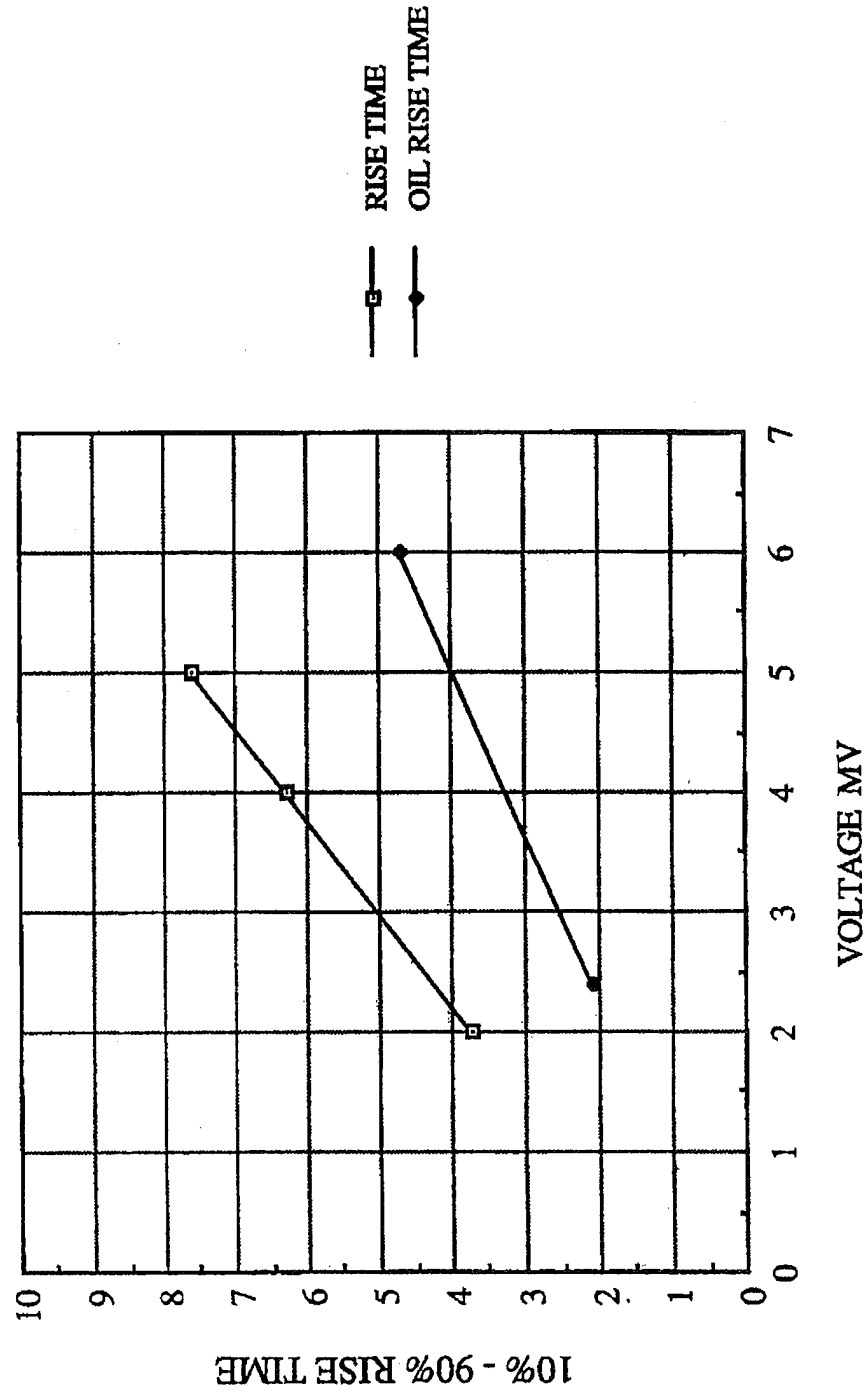




# EXPECTED OIL SWITCH RISE TIME

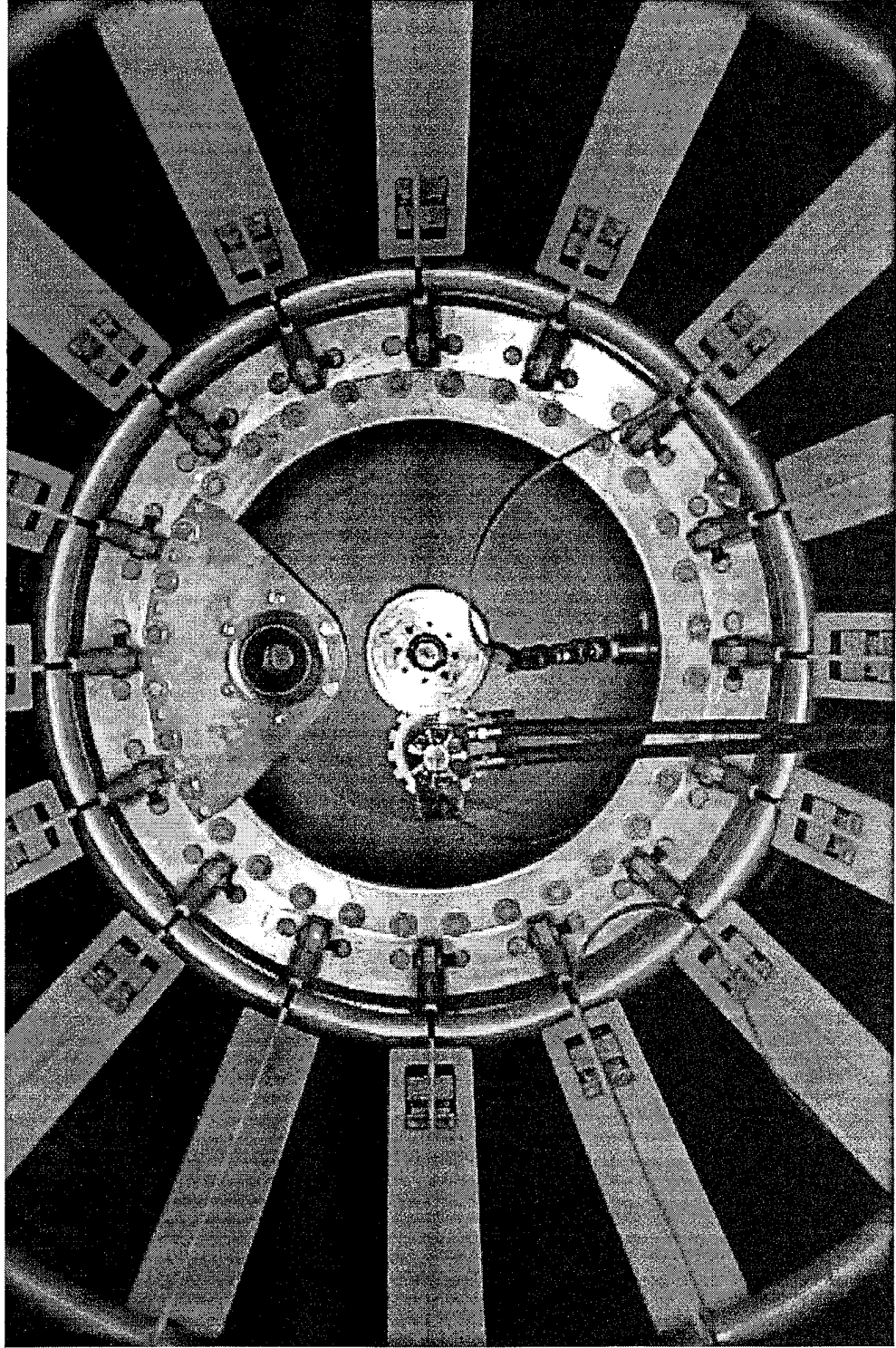
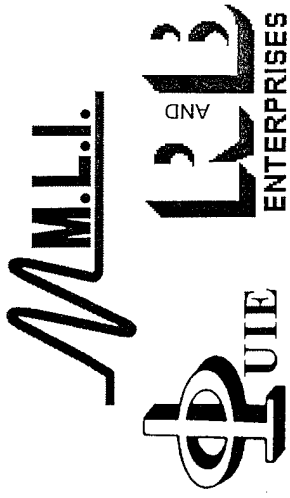
**M.L.I.**

**Φ<sub>UIE</sub>**  
**AND**  
**RLB**  
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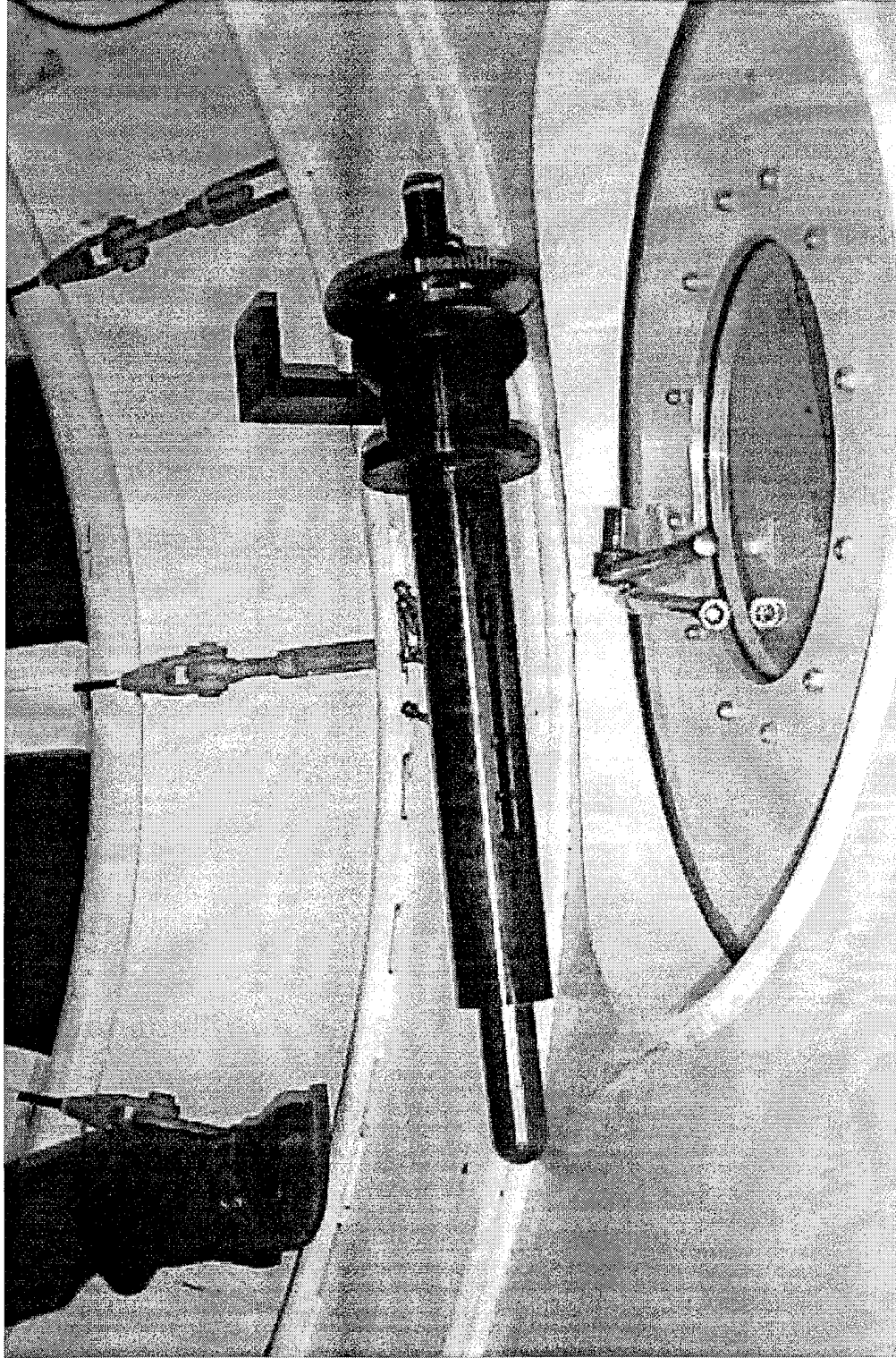


# GAP ADJUSTMENT



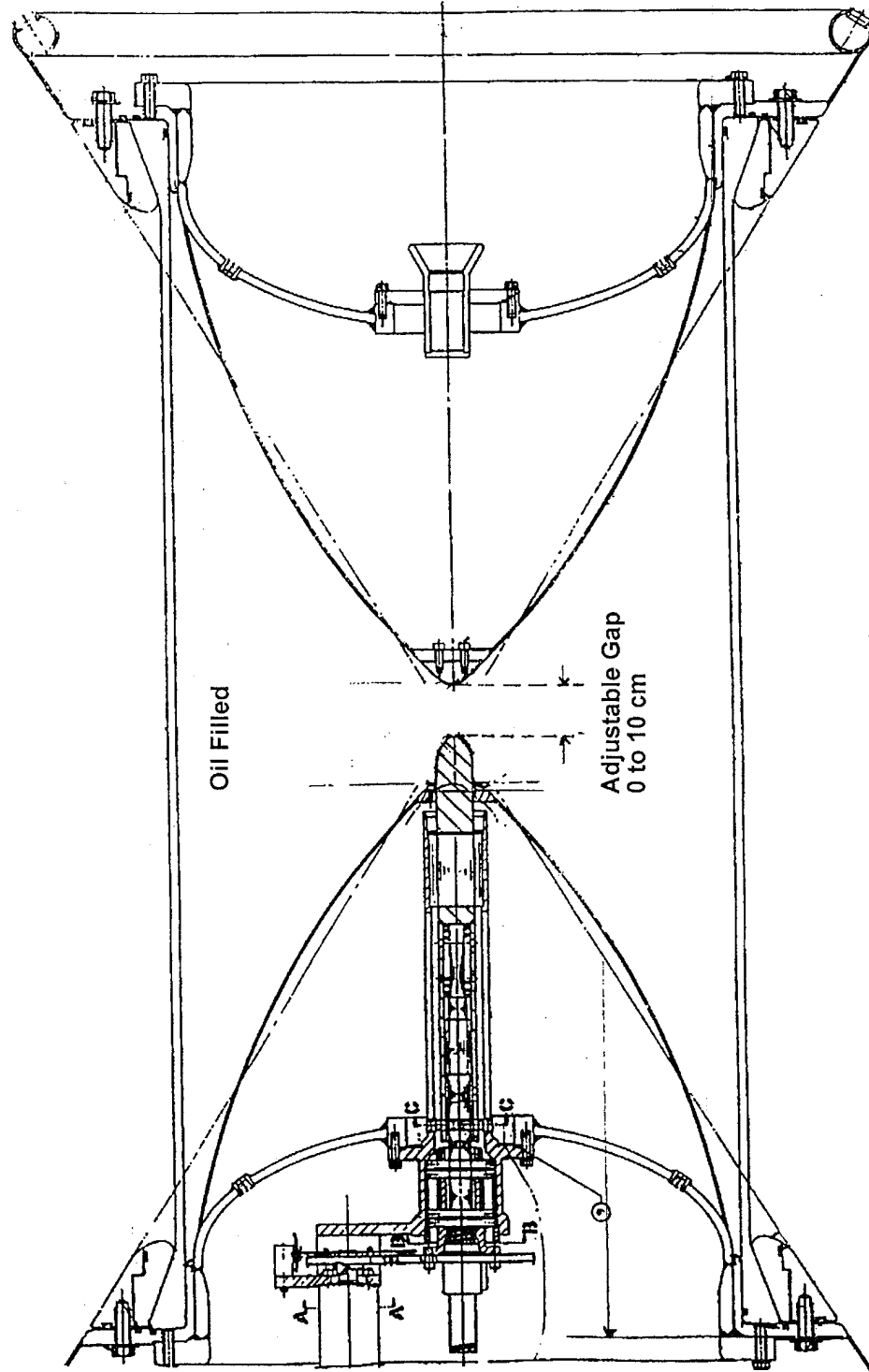
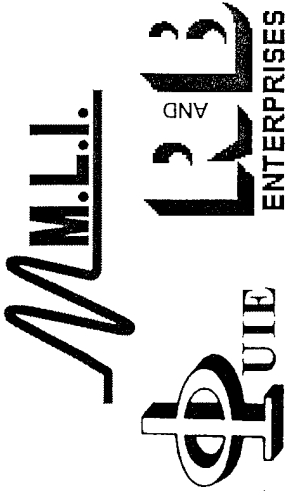


# MOVABLE ELECTRODE



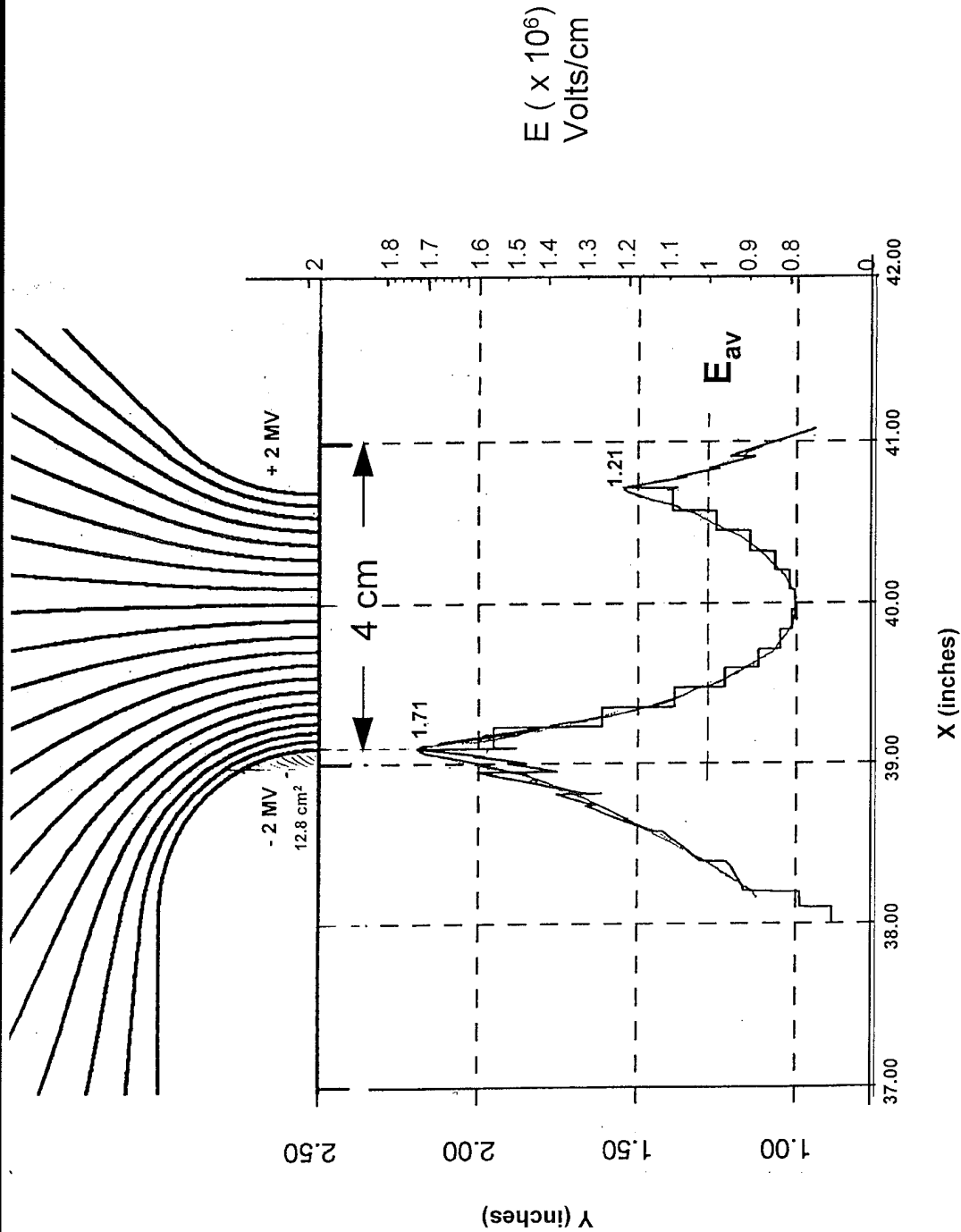
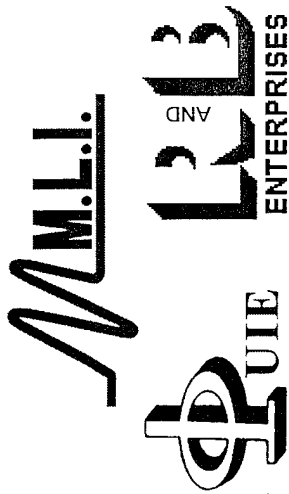


# OIL FILLED OUTPUT SWITCH





# 4 CM OIL GAP FIELD PLOT



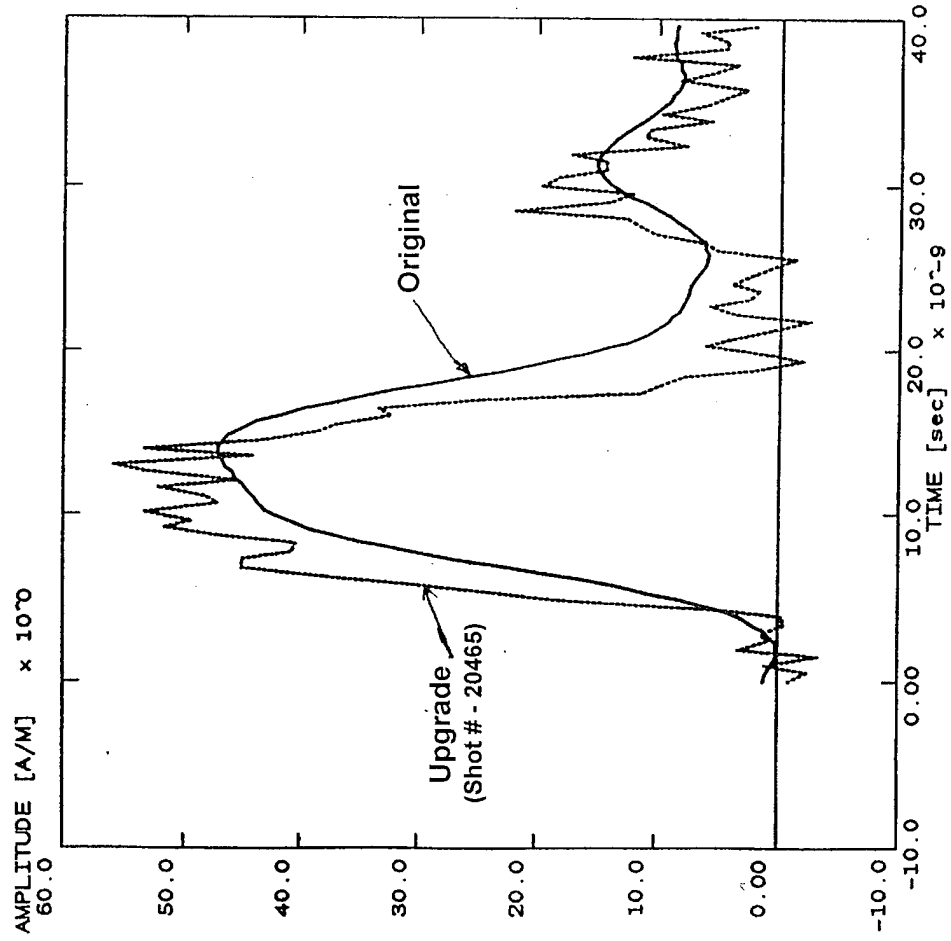


# PRELIMINARY FIELD MEASUREMENT DATA

M.M.L.I.



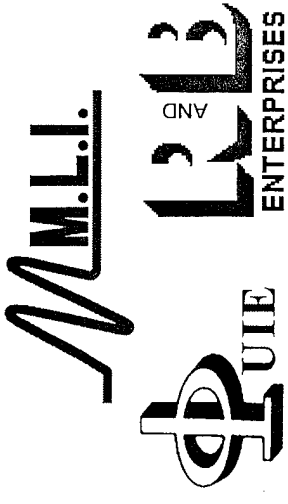
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L.L.B.  
ENTERPRISES



Rise Time Improved  
From 7.8 ns to 3.5 ns



# FAST RISING PULSE OIL BREAKDOWN



Generally Accepted Fast Rising Positive Field Oil Breakdown

$$F_{BD}^{+} = \frac{0.49}{t_e^{1/3} \cdot A_e^{1/13.7}}$$

Substitute:

$$t_e = 0.05 \mu s, A_e = 5 \text{ cm}^2$$

$$F_{BD}^{+} = 1.183 \text{ MV/cm}$$

TES Upgrade Oil Switch

V = 4 MV, Gap = 4.14 cm

Peak Field at Positive Electrode Tip = 1.178 MV/cm



## CONCLUSION



1. The Goal of Improving TES Pulser Rise Time to Better Than 4 ns Has Been Achieved.
2. The Upgraded Oil Field Output Switch Can Now Deliver Better Than:  
  
1 ns/MV      10% - 90% Rise Time Pulse
3. Risetime Can Be Varied By Controlling Pulser Charge Voltage.



# FIELD MEASUREMENTS

M.M.L.I.

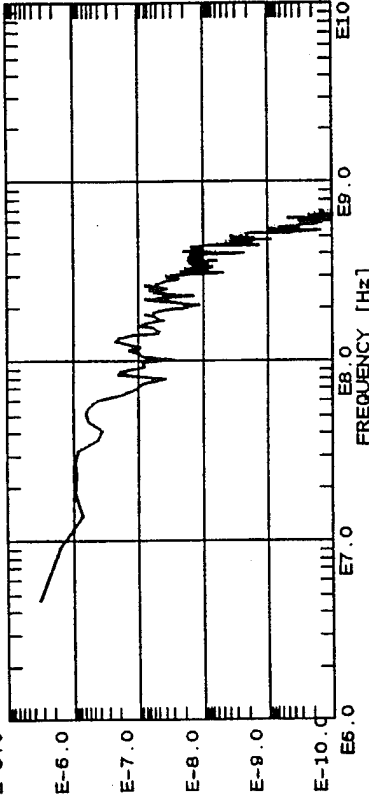


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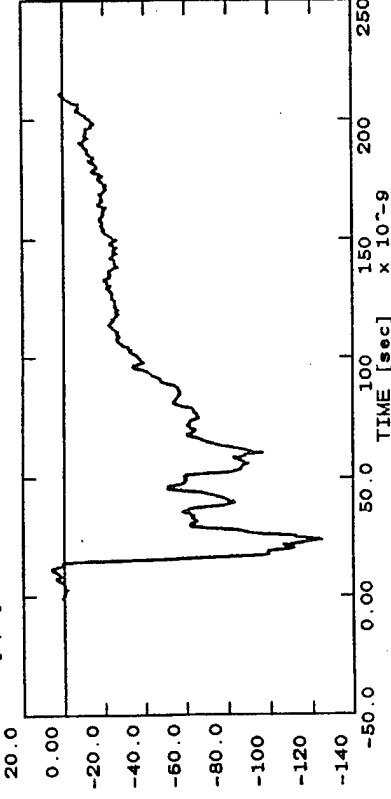
## CORRECTED FIELD MAP DATA

7-MAY-96 10:15:05 FILE: DAS\_DATA:ISCMGL2D\_0023\_02\_1\_1.RAW

MAGNITUDE [A/M/Hz]  
E-5.0



AMPLITUDE [A/M] x 10<sup>10</sup>

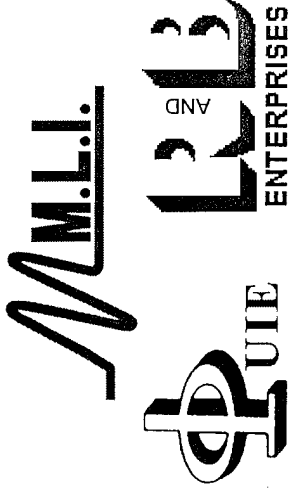


|                           |                      |
|---------------------------|----------------------|
| Test ID                   | FIELD_MAP            |
| Experiment Number         | 1                    |
| Pulse Number              | 20573                |
| Pulse Date                | 17-APR-1996 14:39:50 |
| Ref Field [kV/m]          | 0.0000               |
| Rise Time [sec]           | 23.52 E-09           |
| Measurement Type          | HZ                   |
| Measurement Priority      | A                    |
| Probe type                | MGL-6                |
| Probe Eu Conv. factor     | 1.260 E-09           |
| Transmitter Gain [db]     | -21                  |
| Total Scalar Gain         | -231                 |
| Peak [A/M]                | -124.4               |
| 10%-70% Time [sec]        | 1.891 E-09           |
| Signal/Noise Ratio [dB]   | 45                   |
| Projected Rise Time [sec] | 2.521 E-09           |
| Decay Time (1/e) [sec]    | 67.95 E-09           |

|      |            |            |         |
|------|------------|------------|---------|
| %E   | Alpha      | Beta       | Delay   |
| 82.1 | 7.498 E+06 | 14.10 E+06 | 4.4E-08 |
| %E   | Freq (Hz)  | Amplitude  | Q       |
| 78.0 | 4.702 E+06 | 168.5      | 0.6     |
|      |            |            | 1.7E-07 |



# FIELD MEASUREMENTS

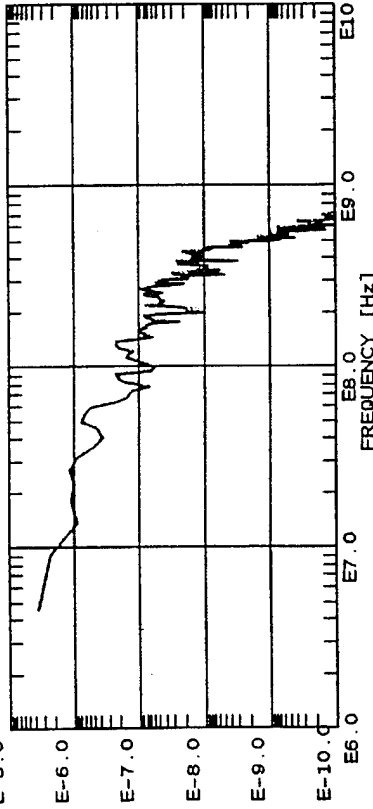


## CORRECTED FIELD MAP DATA

7-MAY-96 10:16:24

FILE: DAS\_DATA:ISCMGL2D\_0024\_02\_1\_RAW

MAGNITUDE [A/M/Hz]  
E-5.0



Test ID

Experiment Number

Pulse Number

Pulse Date

Ref Field [kV/m]

Rise Time [sec]

Measurement Type

Measurement Priority

Probe type

Probe Eu Conv. factor

Transmitter Gain [db]

Total Scalar Gain [db]

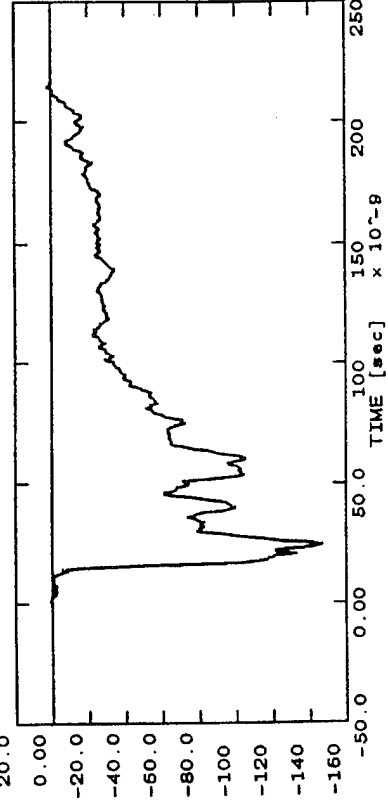
Peak [A/M]

Signal/Noise Ratio [dB]

Projected Rise Time [sec]

Decay Time (1/e) [sec]

AMPLITUDE [A/M] x 10<sup>10</sup>



FIELD\_MAP

20574

17-APR-1996 14:45:35

0.0000

32.86 E-09

HZ

A

MGL-6

1.260 E-09

-21

-231

-146.7

1.928 E-09

42

2.571 E-09

62.51 E-09

|      |            |            |         |
|------|------------|------------|---------|
| %E   | Alpha      | Beta       | Delay   |
| 88.2 | 8.402 E+06 | 13.80 E+06 | 1.1E-08 |
| %E   | Freq (Hz)  | Amplitude  | Delay   |
| 71.5 | 4.601 E+06 | -140.0     | 5.7E-08 |
|      |            | Q          | 0.8     |



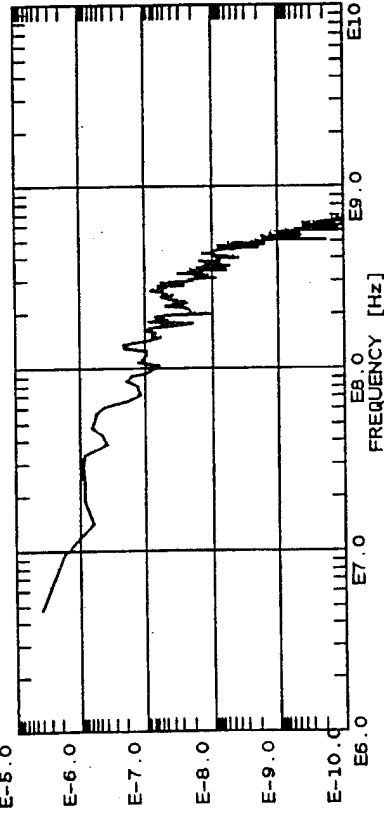
# FIELD MEASUREMENTS



## CORRECTED FIELD MAP DATA

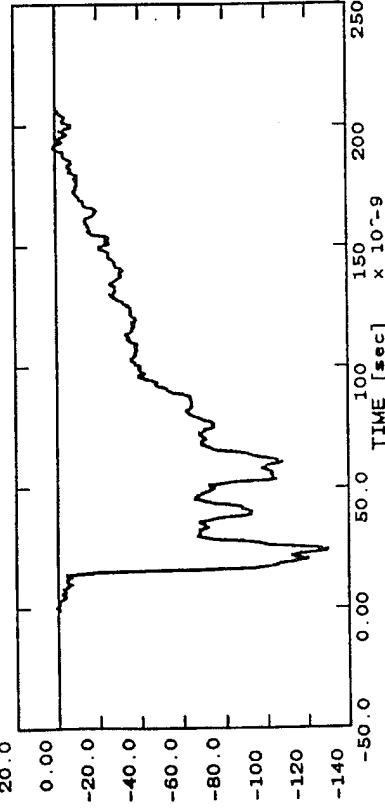
7-MAY-96 10:17:44 FILE: DAS\_DATA:ISCMGL2D\_0025\_02\_1\_RAW

MAGNITUDE [A/M/Hz]



|                           |                      |
|---------------------------|----------------------|
| Test ID                   | FIELD_MAP            |
| Experiment Number         | 1                    |
| Pulse Number              | 20575                |
| Pulse Date                | 17-APR-1996 14:58:51 |
| Ref Field [kV/m]          | 0.0000               |
| Rise Time [sec]           | 45.63 E-09           |
| Measurement Type          | HZ                   |
| Measurement Priority      | A                    |
| Probe type                | MGL-6                |
| Probe Eu Conv. factor     | 1.260 E-09           |
| Transmitter Gain [dB]     | -21                  |
| Total Scalar Gain [dB]    | -231                 |
| Peak [A/M]                | -129.3               |
| Signal/Noise Ratio [dB]   | 1.923 E-09           |
| Projected Rise Time [sec] | 40                   |
| Decay Time (1/e) [sec]    | 2.564 E-09           |
|                           | 70.17 E-09           |

AMPLITUDE [A/M] x 10<sup>0</sup>



|       |            |            |         |
|-------|------------|------------|---------|
| XE    | Alpha      | Beta       | Delay   |
| 100.8 | 7.449 E+06 | 14.46 E+06 | 4.3E-08 |