[redacted]

UNCLASSIFIED

APR 1 6 1964

File No: XW-62, 3-2
W-81207
RS 7331/238

RECEIVED
APR 17 1964
CENTRAL TECH FILE

CENTRAL TECHNICAL FILE
ACCOUNTABILITY CARD BB
FILE NO. ~~XW-62~~ 59 Minuteman 3-2

To: F. J. Maloney - 8124

Attn: W. Guntrum

From: J. E. Bear - 7331-1

Re: Preliminary Report on Explosive Gas Gun Tests of the Mk 12-L Vehicle (U)

This report summarizes the results of the Mk 12-L explosive gas gun tests performed to date. A complete report will be issued later when all testing under project number W-81207 has been completed.

The object of these tests is to determine the feasibility of using detonations of explosive gas mixtures in the Area III 26-inch air gun facility to simulate blast pressure loadings on the 12-L reentry vehicle. The desired acceleration for the unit tested is called out in an SRD memo from J. D. Benton to M. McWhirter, RS 8124/944, dtd May 21, 1963.

The test unit was an inert shape, approximately 72 inches long with a base diameter of 18 inches and a cone half-angle of 7.5°. Details are given in Dwg. Nos. K28192, Issue A, and K28322, Issue A. The vehicle weight was about 350 pounds. The complete test assembly consisted of the 12-L vehicle mounted in a 26-inch diameter air gun piston by a single 2-inch bolt. The complete assembly weighed 750 pounds.

Instrumentation consisted of Kistler 603 pressure transducers and Endevco 2213 and 2225M2 accelerometers. Data was recorded on a CEC 2600 tape recorder and played back at reduced speed on an Ampex FR-100B recorder. Overall frequency response was DC to 40,000 cps. Transducer locations are shown in Figure 1, with additional details of the pressure transducer mountings given in Dwg. No. K28322.

PROGRAM | ORG. | SUBJECT | DATE

DECLASSIFIED
SEP 1 4 1965
3428-3

INVENTORIED

Emelda Selph 6/9/98
W C Layne 6-15-98
PERSON VERIFYING INVENTORY & DATE

W. C. Layne
98SN2187
DATED: 6/2/98

[redacted]

UNCLASSIFIED

0225

[redacted] 12-8

A test is performed by inserting the 12-L vehicle and piston assembly into the muzzle of the air gun, drawing it to the breech and by a vacuum, and setting the piston brakes to hold the assembly in place against the initial gas pressure. The breech volume is then filled with a suitable gas mixture and fired by an electric spark gap. The mixtures used in these tests were hydrogen and oxygen in stoichiometric proportions.

Four tests have been performed to date. Test No. 1 yielded no useful results because the pressures were much lower than anticipated. This was attributed to an O-ring seal failure which allowed air to leak into the breech volume, diluting the gas mixture and reducing the explosion pressure. The friction brakes were not available for test No. 1, so piston braking was provided by sealing and pressurizing the muzzle portion of the air gun. The force on the piston after firing due to the muzzle pressure and to the vacuum formed in the breech by cooling of the detonation products caused the piston to rebound into the breech with sufficient force to strip the 12-L from its mounting bolt. However, the damage was easily repaired and did not affect following tests.

In Shot No. 2 the test setup apparently functioned properly, but no data was obtained because of a last-second power failure in the instrumentation system.

Results of Shot No. 3 are presented in Table I. Initial gas mixture conditions are also listed in the table. The pressure transducer data shows that the gas reaction had not yet "run up" into a detonation front when it passed transducers P-1 and P-4, indicated by the relatively slow rise times, but had achieved detonation by the time it passed P-2, just 12 inches aft of P-1 and P-4, as indicated by the very fast rise. No useful accelerometer data was obtained because of excessive ringing.

Results of Shot No. 4 are presented in Table II. A higher initial mixture pressure was used in an attempt to achieve a detonation in a shorter run up distance than in Shot No. 3, and the pressure transducer results indicate success. The acceleration record was obtained by inserting a 5000 cps low pass electronic filter between the accelerometer and recorder. The faired pulse, desired by drawing a line through the approximate midpoints of the oscillations, indicates an

UNCLASSIFIED

[redacted]

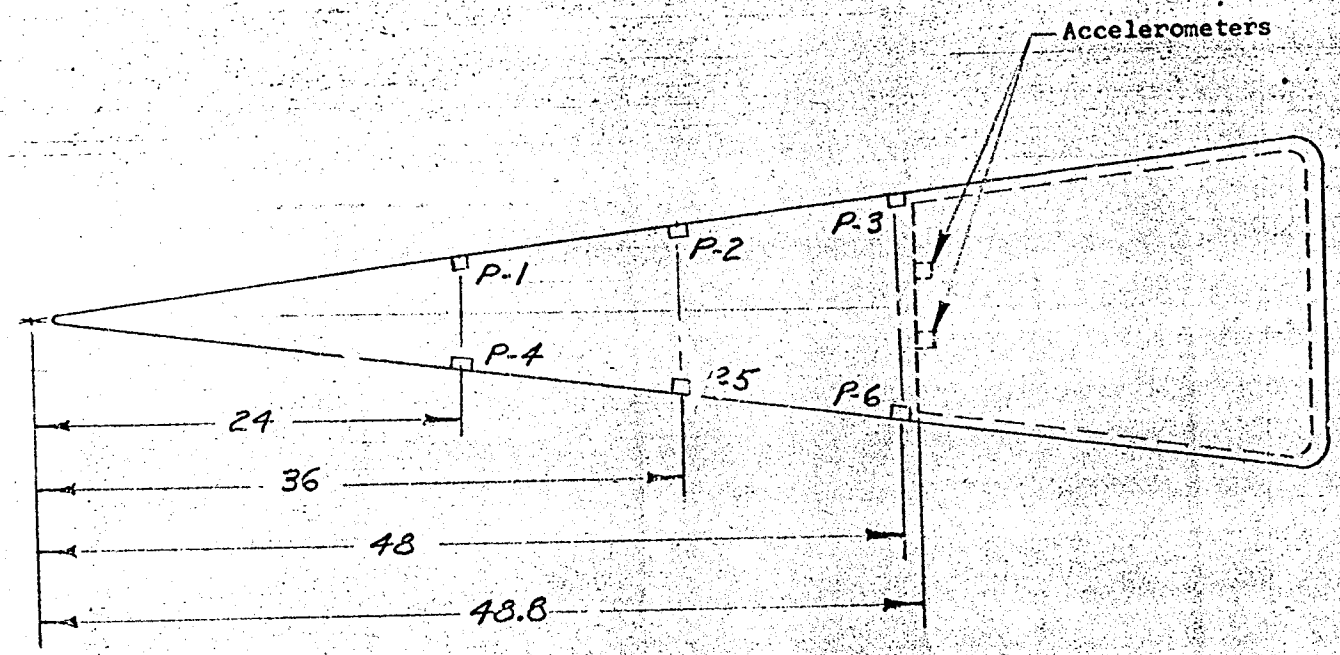
acceleration peak of 330g, with a rise time (10 to 90 percent of faired peak) of a 0.6 millisecond and a duration (above 10 percent of faired peak) of 15 milliseconds. Therefore, the faired pulse is very close to the specified pulse in the previously mentioned memo.

WMSigmon:7325-2:mw

Approved By: R D May
for E. White - 7331-1

Distribution:
1-3/7A - F. J. Maloney, 8124
4/7A - M. McWhirter, 7325, Attn: W. M. Sigmon
5/7A - E. H. Copeland, 7331
6/7A - Central Technical File, 3425-1
7/7A - Central Technical File, 3232-2

UNCLASSIFIED



NOTES: 1. P-1 thru P-6 are Kistler 603 Pressure Transducers.

2. All dimensions in inches.

FIG. 1 TRANSDUCER LOCATIONS ON 12-L TEST VEHICLE. EXPLOSIVE GAS GUN TESTS OF 12-L VEHICLE.

W-80207
RS 7331/233

UNCLASSIFIED

0228

TABLE [illegible]

TEST RESULTS

EXPLOSIVE GAS GUN TESTS OF 12-L VEHICLE

ENGINEERING [illegible] W-80207 SR 7331/28[illegible] PAGE 5 OF [illegible]

TEST CONDITIONS	
Shot No.	3
[redacted]	$2H_2 + O_2$ MIXTURE
[redacted]	25 PSIA INITIAL PRESSURE
[redacted]	6 CU. FT INITIAL VOLUME
Orientation	

COMMENTS

UNCLASSIFIED

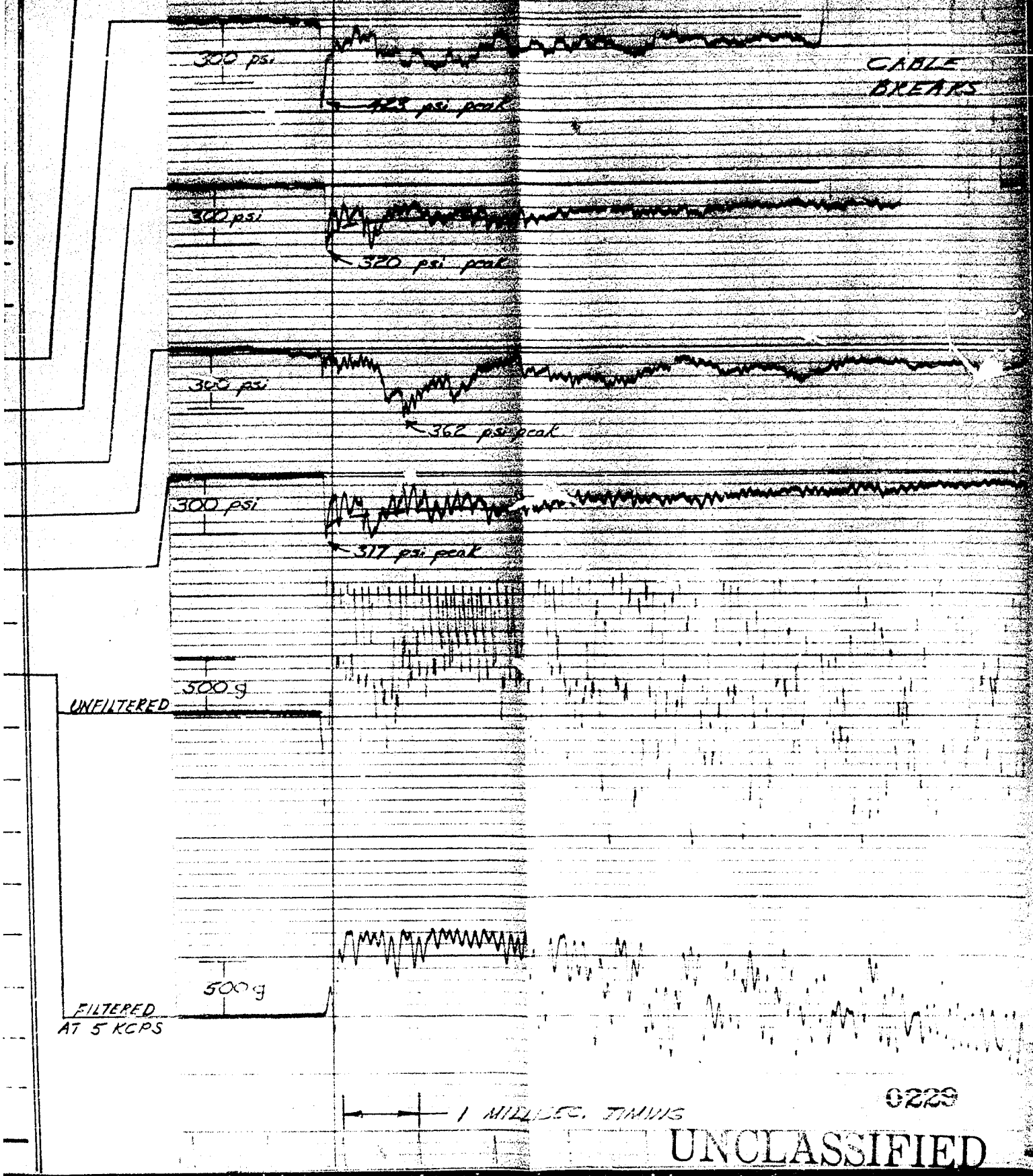
LEGEND
PD - PULSE DURATION
RT - RISE TIME
MFP - MAXIMUM FAIRED PULSE
A - ACCELEROMETER
P - PRESSURE TRANSDUCER

TRANSDUCER INFORMATION						TEST DATA				
No.	Location & Orientation	Model	S/N	fn and Range	Fig. Ref.	MAX (+)	MAX (-)	MFP	RT (ms)	PD (ms)
P-1	STATION 24.0 0 DEGREES	KISTLER 603	3652	200 KCPS 3000 PSI	1	372	—	372	1.5	APPROX. 12
P-2	STATION 36.0 0 DEGREES	KISTLER 603	4257	200 KCPS 3000 PSI	1	423	—	423	<0.1	
P-3	STATION 48.0 0 DEGREES	KISTLER 603	4259	200 KCPS 3000 PSI	1	320	—	320	<0.1	
P-4	STATION 24.0 180 DEGREES	KISTLER 603	4446	200 KCPS [illegible] PSI	1	362	—	362	1.1	
P-6	STATION 48.0 180 DEGREES	KISTLER 603	4254	200 KCPS 3000 PSI	1	317	—	317	<0.1	
A-1	STATION 48.8 LONGITUDINAL	ENDEVCO 2213	4663	30 KCPS 500 g	1	NO READINGS MADE				

UNCLASSIFIED

[redacted]

UNCLASSIFIED



UNCLASSIFIED

[redacted]

TABLE II
TEST RESULTS
EXPLOSIVE GAS GUN TESTS OF 12-L VEHICLE

PROJECT NO.	PAGE	OF
W-80207 RS 7331/238	8/6	

TEST CONDITIONS

Run No.	4
[redacted]	$2H_2 + O_2$ MIXTURE
[redacted]	32 PSIA INITIAL PRESSURE
[redacted]	6 CU. FT. INITIAL VOLUME
Orientation	

COMMENTS

PULSE DURATION READINGS FROM P-1 THRU P-4 ARE UNRELIABLE BECAUSE OF TEMPERATURE DRIFT WHICH SETS IN AFTER FIRING.

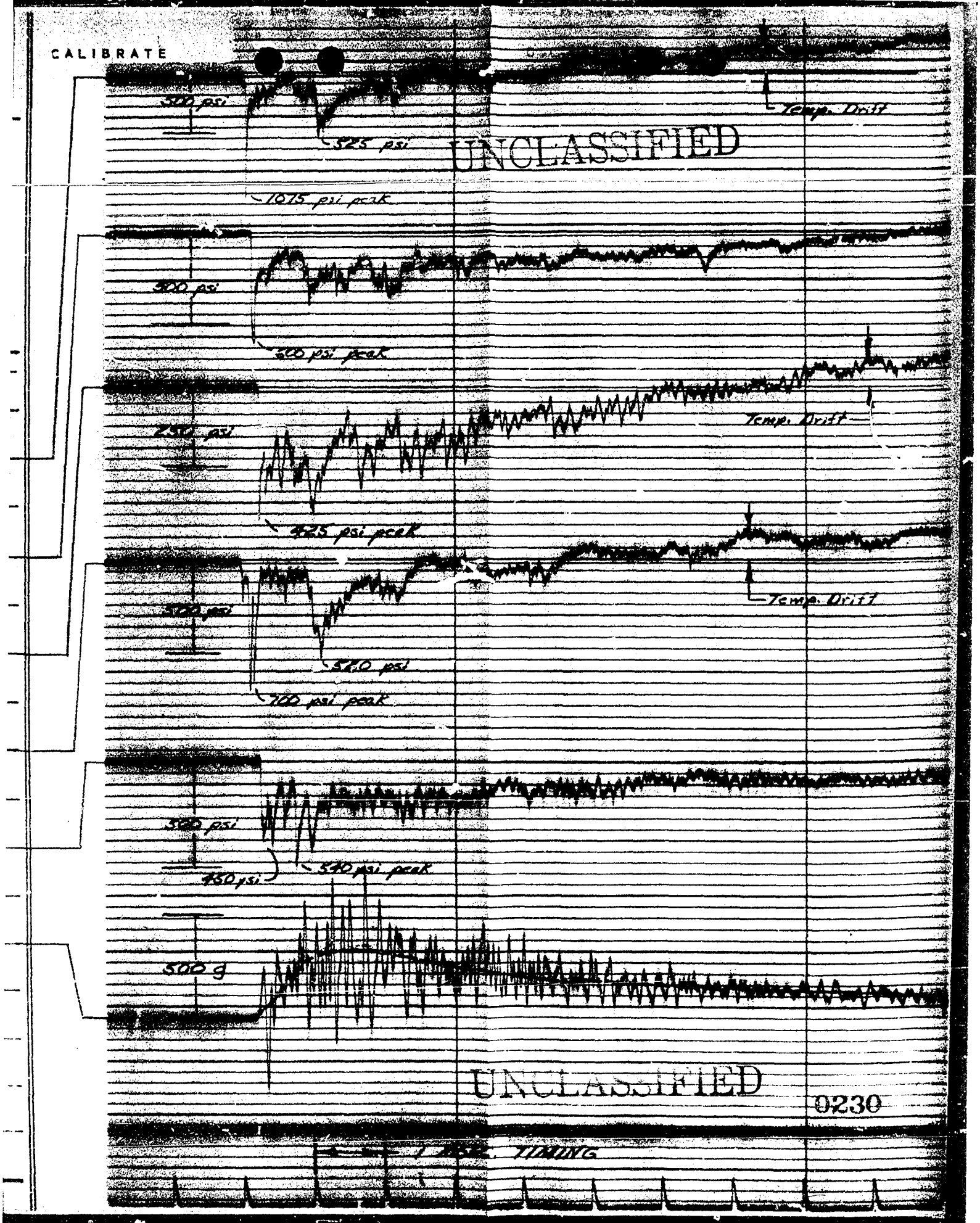
UNCLASSIFIED

LEGEND
PD - PULSE DURATION
RT - RISE TIME
MFP - MAXIMUM FAIRED PULSE
A - ACCELEROMETER
P - PRESSURE TRANSDUCER

TRANSDUCER INFORMATION						TEST DATA				
No.	Location & Orientation	Model	S/N	fn and Range	Fig. Ref.	MAX (+)	MAX (-)	MFP	RT (ms)	PD (ms)
P-1	STATION 24.0 0 DEGREES	KISTLER 603	3652	200 KCPS 3000 PSI	1	1075	—	630	<0.1	2.5
P-2	STATION 36.0 0 DEGREES	KISTLER 603	4257	200 KCPS 3000 PSI	1	600	—	600	<0.1	9.0
P-3	STATION 48.0 0 DEGREES	KISTLER 603	4259	200 KCPS 3000 PSI	1	425	—	425	<0.1	5.5
P-4	STATION 24.0 180 DEGREES	KISTLER 603	4446	200 KCPS 3000 PSI	1	700	—	700	<0.1	2.5
P-6	STATION 48.0 180 DEGREES	KISTLER 603	4254	200 KCPS 3000 PSI	1	540	—	540	<0.1	12
A-1	STATION 48.8 LONGITUDINAL	ENDEVCO 2225M2		FILTERED AT 5 KCPS	1	—	—	330	0.6	15

[redacted]

UNCLASSIFIED



UNCLASSIFIED

UNCLASSIFIED