

UNCLASSIFIED

AD NUMBER	
AD354019	
CLASSIFICATION CHANGES	
TO:	UNCLASSIFIED
FROM:	CONFIDENTIAL
LIMITATION CHANGES	
TO: Approved for public release; distribution is unlimited.	
FROM: Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; JUL 1964. Other requests shall be referred to Picatinny Arsenal, Dover, NJ.	
AUTHORITY	
USAARDCOM ltr 31 Aug 1982 ; USAARDCOM ltr 31 Aug 1982	

THIS PAGE IS UNCLASSIFIED

THIS REPORT HAS BEEN DELIMITED
AND CLEARED FOR PUBLIC RELEASE
UNDER DOD DIRECTIVE 5200.20 AND
NO RESTRICTIONS ARE IMPOSED UPON
ITS USE AND DISCLOSURE.

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

UNCLASSIFIED

AD 354019

CLASSIFICATION CHANGED

TO: UNCLASSIFIED

FROM: CONFIDENTIAL

AUTHORITY: US AARDC om

1/31 Aug 82



UNCLASSIFIED

UNCLASSIFIED

AD 3 5 4 0 1 9

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION, ALEXANDRIA, VIRGINIA



UNCLASSIFIED

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

NOTICE:

THIS DOCUMENT CONTAINS INFORMATION
AFFECTING THE NATIONAL DEFENSE OF
THE UNITED STATES WITHIN THE MEAN-
ING OF THE ESPIONAGE LAWS, TITLE 18,
U.S.C., SECTIONS 793 and 794. THE
TRANSMISSION OR THE REVELATION OF
ITS CONTENTS IN ANY MANNER TO AN
UNAUTHORIZED PERSON IS PROHIBITED
BY LAW.

**Best
Available
Copy**

DDC 354019



354019

TECHNICAL MEMORANDUM 1459

COMPARATIVE BLAST MEASUREMENTS
OF
VARIOUS HIGH EXPLOSIVE COMPOSITIONS
IN A
STANDARD WARHEAD CONFIGURATION (U)

HENRY L. HERMAN

COPY 43 OF 44

JULY 1964

DOWNGRADED AT 3-YEAR INTERVALS,
DECLASSIFIED AFTER 12 YEARS.

OCT 14 1964

DDC-IRA A

PICATINNY ARSENAL
DOVER, NEW JERSEY

The findings in this Report are not to be construed as an official Department of the Army position.

DISPOSITION

When this report is no longer needed, Department of Defense agencies will destroy it in accordance with AR 380-5. Contractors will destroy it in accordance with the Industrial Security Manual or instructions furnished by the contracting officer.

DDC AVAILABILITY NOTICE

Qualified requesters may obtain copies of this report from DDC.

~~CONFIDENTIAL~~

TECHNICAL MEMORANDUM 1459

COMPARATIVE BLAST MEASUREMENTS
OF
VARIOUS HIGH EXPLOSIVE COMPOSITIONS
IN A
STANDARD WARHEAD CONFIGURATION (U)

BY

HENRY L. HERMAN

JULY 1964

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, U.S.C., Sections 793 and 794. The transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

REVIEWED BY

W. F. Conway
W. F. CONWAY
Chief, Instrumentation
Section

APPROVED BY

K. G. Ottoson
K. G. OTTOSON
Chief, Technical
Services Laboratory

AMMUNITION ENGINEERING DIRECTORATE
PICATINNY ARSENAL
DOVER, NEW JERSEY

~~CONFIDENTIAL~~

TABLE OF CONTENTS

Section	Page
ABSTRACT	1
INTRODUCTION	2
DISCUSSION OF RESULTS	2
CONCLUSIONS	3
RECOMMENDATIONS	3
RESULTS	3
PROCEDURE	4
REFERENCES	5
APPENDICES	
A. Tables	6
B. Figures	11
ABSTRACT DATA	19
TABLE OF DISTRIBUTION	20

ACKNOWLEDGMENT

The author is grateful to Glenn Ward, Noble Lockhart, Fonzo E. Baker of the Technical Services Laboratory for their contributions in instrumenting the program.

(U) ABSTRACT

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges (Figure 2) of these compositions:

Non-deaerated cast TNT from Lot KNK-11-639

Cast Composition B-3 from Lot HOL-11-92

Compression-molded Composition A-3 from Lot WAB-1-158

Compression-molded PBXN-1 from Lot HOL-SR-338-59

Cast Composition B from Lot HOL-7-1928

Compression molded PBX 9010 from Lot HOL-SR-490-61

Compression molded PBXN-3 from Lot HOL-SR-45-63

Compression molded 86/14 HMX/Butvar B72A

Cast 83/17 HMX/Laminac Styrene Binder

Cast 75/25 Cyclotol from Lot HOL-6-62

Compression molded PBX Type A from Lot OAC-596-55

Compression molded PBX Type B from Lot HOL-SR-46-57

The blast parameters were measured of distances of 10, 15 and 20 feet from transducer arrays redundant at 180° (Figure 3 and 4).

(U) INTRODUCTION

This is the second Technical Services Laboratory report (Reference 2) resulting from a continuing study by the Explosive Laboratory of Feltman Research Laboratory, connected with the "Continuing Characterization of Existing Explosive Compositions" (Reference 1). A reference point for the study exists in the use of a centrally initiated constant volume barrel-shaped charge geometry as a standard test vehicle (Figure 2). The characterization of these compositions is evolved by comparison of the HE generated blast parameters of side-on peak overpressure and impulse (including positive impulse duration) as well as shock wave time-of-arrival information measured by use of a redundant gage array (Figure 1, 3 and 4).

(U) DISCUSSION OF RESULTS

At the writing of this report the following round was not available for characterization:

PBX 9010, one round

35mm film records were lost from the "North Array" on Composition A-3 Round 0284-2, from both arrays on Composition 86/14 HMX/Bulvar B72A, Round 147 and from Composition PBX-Type A, Round 058-1.

Extreme turbulence effects -- indicative of charge break-up -- were especially noted on the 35mm film records from the Composition A-3 Round 309-2. Irregular or abnormal impulse analogs, indicative of (in some instances) a fireball effect on the gages, were noted on the 35mm film records from: Composition 86/14 HMX/Bulvar B72A, Round 149, 150 and 151; 83/17 HMX/Laminac-Styrene binder, Round 0651-1; 75/25 Cyclotal, Round 057-4; Composition B-3, Round 0342-6; Composition PBX-9010, Round 057-2; Composition PBX-Type A, Round 009-3, 069-56.

Comparison of the results for TNT and Composition B of the present report with those of the first report (Reference 2) indicate a variation well within the overall accuracy of the measurement system.

(U) CONCLUSIONS

The results of this study to date indicate, that for the round geometry being used, at the 10-foot distance peak side-on overpressure is the most sensitive blast characterization criteria; at the 20-foot distance side-on positive impulse is the more sensitive criteria.

(U) RECOMMENDATIONS

The subject explosive characterization study be continued and expanded in scope.

(U) RESULTS

Measured parameter averages at the 10-, 15- and 20-foot distances for all compositions are presented in Table 1 and 2, (in Appendix A). Individual results are presented as Table 3 and 4.

(U) PROCEDURE (REFERENCE 2 and 3)

The program was conducted at Picatinny Arsenal during April-June 1964.

The rounds were positioned with their longitudinal axis in a vertical plane at a height of 10 feet above ground level (Figure 3). The transducer arrays, redundant at 180° (called "North Array" and "South Array" in Table 3 and 4) were placed in a horizontal plane perpendicular to the center of each round's longitudinal axis (Figure 3 and 4). Each individual array, consisting of two time-of-arrival gages (ARC-BD-20) which bracketed a side-on pressure-time gage (ARC-LC-33C) (Figure 4) was positioned at 10-, 15- and 20-foot distances from the longitudinal axis of the round. Shock wave time-of-arrival measurements were made using an ionization switch ("Chronograph Contactor" -- Dupont Model KC23 HRR) attached to each round. Closure of the switch (by detonation of the round) started the sweep of the Tektronix Model 545 oscilloscope (Figure 1). Time-of-arrival analogs were obtained (Figure 8) at the 9.5-foot distance and the 10.5-foot distance by hard wiring in parallel the series output of the two gages of the "South Array" to the Tektronix Oscilloscope.

The gages were hard wired using coaxial cable to two four-beam ETC (Model K470) oscilloscopes (for the side-on measurements) and to a dual-beam Tektronix Oscilloscope (for the time-of-arrival measurements). 35mm film records (Figure 7) were made of the information presented on the four-beam ETC oscilloscopes, using General Radio Model 651-5 streak cameras. Time-of-arrival records at the 10-foot distance were made using polaroid film (Figure 8). Figure 1 is a block diagram of the instrumentation.

The rounds were positioned for firing using a cardboard tube-cardboard cone arrangement. The firing train is shown in Figure 2. The M36 Electric Detonator was fired using 2,000 volts to insure operation. Figure 5 shows the individual detonator centering mechanism used with each charge.

The data was reduced using a Gerber analog to digital data reduction system accurate to 0.1% (Figure 6). Peak overpressure was computed from time-of-arrival information using the Rankine-Hugenoit relationship. Integration of the P-t analogs yielded positive impulse. Shock wave time-of-arrival information was obtained from the polaroid traces to the 10-foot distance and from the 35mm film records for the 15 and 20 foot distances. Positive impulse duration, ^{was} of course, also obtained from the 35mm film records.

Overall accuracy of the entire parameter measurement system is $\pm 5\%$.

REFERENCES

1. T. Costain, J. D. Hopper, Job Order Memorandum 4634-11-005 (470) TR 115-64, 25 February 1964.
2. H. L. Herman, Comparative Blast Evaluation of Various HE Compositions in a Standard Warhead Configuration, Picatinny Arsenal Technical Memorandum 1279, December 1963.
3. F. E. Baker, Research and Engineering Logbook No. 270-28, U. S. Army Munitions Command, Dover, New Jersey, June 1964.

APPENDICES

APPENDIX A

Tables

CONFIDENTIAL

(C) TABLE 1

SUMMARY OF BLAST PARAMETER MEASUREMENTS

AVERAGED VALUES (U)

Compositions	Film Record Sample Size	Peak Overpressure, psi			Impulse, psi-seconds		
		10 ft.	15 ft.	20 ft.	10 ft.	15 ft.	20 ft.
TNT (Non-deaerated)	10	19.6	7.0	4.4	13.4	6.9	6.0
Composition B	10	35.4	12.7	6.8	19.9	12.3	10.0
Composition A-3	10	30.6	13.1	6.9	24.7	13.7	9.0
PBXN-1	10	30.8	13.2	8.2	21.5	12.6	8.1
Composition B-3	10	32.6	12.4	8.2	22.1	11.6	11.0
PBX-9010	8	32.6	16.3	8.2	19.6	15.0	12.2
83/17 HMX/Laminac Styrene Binder	10	31.9	13.5	9.5	24.8	13.3	8.5
75/25 Cyclotol	10	32.7	16.1	7.1	19.0	14.5	9.6
PBXN-3	10	25.8	11.5	9.1	25.0	15.5	8.9
86/14 HMX/Butvar 2A	8	30.4	13.7	7.1	18.0	12.1	9.9
PBX-Type A	8	33.3	12.9	6.6	19.7	12.2	7.4
PBX-Type B	10	31.5	12.2	7.8	18.2	12.1	9.6

CONFIDENTIAL

CONFIDENTIAL

(C) TABLE 2

AVERAGED VALUES

SHOCK WAVE TIME-OF-ARRIVAL AND IMPULSE DURATION

MEASUREMENTS IN MILLISECONDS (U)

Composition	Film Record Sample Size	10 ft.	ID 10 ft.	15 ft.	ID 15 ft.	20 ft.	ID 20 ft.
TNT (Non-deaerated)	11	3.46	2.44	6.96	2.66	10.64	3.19
Composition B	11	2.27	1.88	5.247	2.74	8.909	3.62
Composition A-3	11	2.485	2.36	5.475	2.9	9.265	3.21
PBXN-1	9	2.728	2.57	5.908	2.88	9.914	3.62
Composition B-3	11	2.742	2.67	5.852	2.74	9.558	3.44
PBX-9010	9	2.445	2.43	2.557	2.85	9.343	3.4
83/17 HMX Laminac Styrene	12	2.940	1.95	5.909	2.682	9.509	3.168
75/25 Cyclotol	9	2.543	1.8	5.649	2.66	9.235	3.2
PBXN-3	12	2.914	2.20	5.886	2.70	9.461	2.61
86/14 HMX/Butvar 2A	9	2.776	2.01	5.910	2.7	9.805	3.3
PBX-Type A	11	2.714	2.33	6.257	2.63	10.239	3.31
PBX-Type B	9	2.488	2.26	5.620	2.8	9.667	3.26

CONFIDENTIAL

CONFIDENTIAL

(C) TABLE 3
INDIVIDUAL BLAST PARAMETER MEASUREMENTS

Sample No.	COMPOSITION B					COMPOSITION A-3 (LOT WAB-1-158)					COMPOSITION A-3 (LOT HOL-SR-338-59)					COMPOSITION A-3 (LOT HOL-SR-490-61)				
	Peak Overpressure, psi					Peak Overpressure, psi					Peak Overpressure, psi					Peak Overpressure, psi				
	10 feet	15 feet	20 feet	10 feet	15 feet	10 feet	15 feet	20 feet	10 feet	15 feet	10 feet	15 feet	20 feet	10 feet	15 feet	10 feet	15 feet	20 feet	10 feet	15 feet
COMPOSITION B																				
Peak Overpressure, psi																				
0272-3	29.4	11.6	---	---	---	35.3	10.0	---	---	---	---	---	---	---	---	---	---	---	---	---
0731-6	33.5	14.7	7.4	32.7	13.0	7.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0272-4	30.5	13.8	7.4	36.4	13.9	7.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0731-2	32.5	13.6	6.2	35.5	13.6	7.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0272-5	33.2	11.5	5.3	39.2	12.4	6.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Impulse, psi-Milliseconds																				
0272-3	14.9	11.9	---	---	---	18.5	10.0	---	---	---	---	---	---	---	---	---	---	---	---	---
0731-6	19.7	13.6	9.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0272-4	19.3	15.0	8.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0731-2	28.4	16.1	13.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0272-5	16.6	11.6	---	---	---	22.4	11.0	---	---	---	---	---	---	---	---	---	---	---	---	---
TNT																				
Peak Overpressure, psi																				
0301-2	23.3	9.3	1.6	21.9	5.0	5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0272-7	19.7	3.8	3.8	23.0	5.0	5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0292-3	16.2	4.8	3.8	17.4	5.4	5.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0292-4	18.1	13.9	5.3	18.1	9.2	4.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0292-12	20.7	9.2	4.9	17.7	7.8	4.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Impulse, psi-Milliseconds																				
0272-3	13.0	9.9	1.7	15.6	5.4	6.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0231-6	14.1	3.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0292-3	10.5	4.7	---	12.2	5.6	6.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0292-4	15.8	10.7	8.1	13.0	8.8	5.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0292-12	13.2	8.1	8.6	13.4	6.6	5.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
COMPOSITION A-3 (LOT WAB-1-158)																				
Peak Overpressure, psi																				
0284-2	34.5	12.2	12.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
309-1	26.7	11.1	6.6	25.9	9.9	6.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---
284-3	31.8	10.5	7.4	41.0	10.5	7.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
311-11	36.1	13.6	6.7	33.2	13.1	7.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
309-2	24.5	11.3	6.7	21.9	13.9	6.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Impulse, psi-Milliseconds																				
0284-2	18.9	10.7	8.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
309-1	20.5	10.5	10.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
284-3	17.2	9.4	9.0	33.5	10.1	8.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
311-11	45.5	14.1	9.1	34.0	15.9	10.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
309-2	12.4	11.0	9.6	11.7	22.5	6.9	---	---	---	---	---	---	---	---	---	---	---	---	---	---
COMPOSITION A-3 (LOT HOL-SR-338-59)																				
Peak Overpressure, psi																				
241-1	19.7	11.8	6.4	29.1	17.5	7.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
016-1	39.7	11.6	6.6	32.0	12.2	5.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---
256-1	31.9	11.3	12.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
256-2	30.5	12.7	7.5	27.8	15.6	5.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---
016-2	32.2	12.8	7.5	34.3	11.7	6.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Impulse, psi-Milliseconds																				
241-1	12.7	13.6	9.8	19.8	15.4	8.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---
016-1	41.5	9.8	10.9	23.0	11.2	2.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
256-1	18.2	12.1	7.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
256-2	24.6	11.8	10.9	16.4	15.4	6.9	---	---	---	---	---	---	---	---	---	---	---	---	---	---
016-2	21.7	11.8	10.1	21.7	11.4	7.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---
COMPOSITION A-3 (LOT HOL-SR-490-61)																				
Peak Overpressure, psi																				
None (1)	28.3	8.5	6.2	28.5	12.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
None (2)	21.5	12.8	6.9	19.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
051-1	37.3	14.1	7.2	32.0	12.8	6.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---
027-1	31.2	10.2	7.7	26.9	9.5	6.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---
107-1	31.6	13.1	7.1	29.7	11.7	8.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Impulse, psi-Milliseconds																				
None (1)	25.4	13.3	11.0	44.0	20.65	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
None (2)	18.1	17.1	7.1	18.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
051-1	22.0	13.6	7.1	13.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---



COMPOSITION A-3 (LOT WAB-1-158)

	Peak Overpressure, psi				
0284-2	34.5	12.2	12.6	---	---
309-1	26.7	11.1	6.6	25.9	9.9
284-3	31.8	10.5	7.4	41.0	10.5
311-11	36.1	13.6	6.7	33.2	7.1
309-2	24.5	11.3	6.7	21.9	13.9
		Impulse, psi-Milliseconds			

PRXN-1 (LOT HOL-SR-338-59)

	Peak Overpressure, psi				
0284-2	18.9	10.7	8.0	---	---
309-1	20.5	10.5	10.7	---	---
284-3	17.2	9.4	9.0	33.5	10.1
311-11	45.5	14.1	9.1	34.0	10.0
309-2	12.4	11.0	9.6	11.7	6.9
		Impulse, psi-Milliseconds			

PRXN-3 (LOT HOL-SR-490-61)

	Peak Overpressure, psi				
241-1	19.7	11.8	6.4	29.1	17.5
016-1	39.7	11.6	6.6	32.0	12.2
256-1	31.9	11.3	12.4	---	5.3
256-2	30.5	12.7	5.5	27.8	15.6
016-2	32.2	12.8	7.5	34.3	11.7
		Impulse, psi-Milliseconds			

PRXN-3 (LOT HOL-SR-490-61)

	Peak Overpressure, psi				
241-1	12.7	13.6	9.8	19.8	15.4
016-1	41.5	9.8	10.9	23.0	11.2
256-1	18.2	12.1	7.8	---	---
256-2	24.6	11.8	10.9	16.4	15.4
016-2	21.7	11.8	10.1	21.7	11.4
		Impulse, psi-Milliseconds			

PRXN-3 (LOT HOL-SR-490-61)

	Peak Overpressure, psi				
None (1)	28.3	8.5	6.2	28.5	12.6
None (2)	21.5	12.8	6.9	19.5	15.7
051-1	37.3	14.1	7.2	32.0	12.8
027-1	31.2	10.2	7.7	26.9	9.5
107-1	31.6	13.1	7.1	29.7	11.7
		Impulse, psi-Milliseconds			

PRXN-3 (LOT HOL-SR-490-61)

	Peak Overpressure, psi				
None (1)	25.4	13.3	11.0	44.0	20.65
None (2)	18.1	17.1	7.1	18.5	---
051-1	23.0	13.4	9.7	14.7	11.8
107-1	25.4	9.1	10.6	13.2	7.7
	21.1	11.6	---	16.5	10.9
		Impulse, psi-Milliseconds			

Sb/14 HMX/BUTVAK 2A

Film record lost as electric 220 fuse blew when round fired

	Peak Overpressure, psi				
147	32.6	13.4	7.5	31.0	12.9
148	29.1	14.3	6.6	29.1	13.4
149	32.7	12.3	7.0	25.2	12.3
150	34.5	16.3	6.7	28.9	14.3
151					
		Impulse, psi-Milliseconds			

Sb/14 HMX/BUTVAK 2A

	Peak Overpressure, psi				
148	19.0	11.2	15.7	14.2	11.6
149	---	13.2	10.9	14.7	10.9
150	---	12.5	8.3	15.1	9.6
151	---	15.6	11.9	14.4	11.9
		Impulse, psi-Milliseconds			

83/17 HMX/LAMINAG-STYRENE BINDER

	Peak Overpressure, psi				
None (1)	---	---	7.5	27.4	---
None (2)	33.7	---	16.7	32.3	6.8
None (3)	29.0	15.4	7.1	35.4	8.8
0651-3	29.9	11.6	6.1	33.8	13.3
0651-1	36.7	13.5	5.3	36.7	11.9
		Impulse, psi-Milliseconds			

83/17 HMX/LAMINAG-STYRENE BINDER

	Peak Overpressure, psi				
None (1)	---	---	7.7	22.5	---
None (2)	24.0	17.2	14.4	29.1	6.1
None (3)	22.6	10.9	5.2	33.2	7.4
0651-3	15.5	13.3	7.1	19.3	10.6
0651-1	30.4				10.3
		Impulse, psi-Milliseconds			12.7

75/25 CYCLOTOL (HOL-6-62)

	Peak Overpressure, psi				
0571-4	31.0	14.9	8.4	34.4	12.4
0592-3	35.4	15.6	6.2	35.4	7.1
0592-4	34.0	14.9	6.9	39.3	6.2
0592-5	---	---	---	31.0	6.9
0592-6	24.9	---	---	30.4	6.7
		Impulse, psi-Milliseconds			

75/25 CYCLOTOL (HOL-6-62)

	Peak Overpressure, psi				
0571-4	---	14.0	11.8	19.6	7.6
0592-3	20.8	17.5	10.3	11.9	8.5
0592-4	22.7	13.9	9.3	14.8	8.2
0592-5	---	---	---	21.7	7.8
0592-6	13.6	---	---	16.7	7.6
		Impulse, psi-Milliseconds			

CONTINUED

CONFIDENTIAL

CONFIDENTIAL

(C) TABLE 3 (CONT'D)

<u>PBX-TYPE A (LOT OAC-596-55)</u>						
Peak Overpressure, psi						
Sample No.	South Array			North Array		
	10 feet	15 feet	20 feet	10 feet	15 feet	20 feet
058-1	Film destroyed - No Time Marks on Film					
069-2	34.9	12.4	4.8	33.3	17.8	-----
069-3	33.3	12.6	6.9	32.3	12.3	7.0
064-2	31.9	10.6	7.8	30.0	9.7	6.5
069-5	34.8	12.9	6.0	34.8	14.8	6.6
Impulse psi-Milliseconds						
069-2	18.9	12.8	6.4	20.2	16.6	-----
069-3	20.4	11.2	---	17.1	11.0	7.2
064-2	17.9	10.6	9.1	15.8	8.8	7.4
069-5	26.2	12.0	----	20.3	14.4	6.5
<u>PBX-TYPE B (LOT OAC-46-57)</u>						
Peak Overpressure, psi						
059-1	33.0	9.7	12.9	----	----	11.7
064-1	35.0	12.7	5.8	----	----	7.5
070-1	25.0	12.7	5.5	27.1	12.7	6.5
070-4	27.9	9.4	5.7	32.2	13.7	7.4
070-5	35.6	13.0	7.4	35.6	12.6	7.0
Impulse, psi-Milliseconds						
059-1	24.5	----	17.5	----	----	13.5
064-1	23.7	13.2	9.8	----	----	9.0
070-1	12.9	11.8	7.6	14.4	12.3	5.9
070-4	17.3	10.0	9.0	15.6	12.2	8.1
070-5	19.3	12.5	7.4	20.1	12.3	7.3
<u>COMPOSITION B-3 (LOT HOL-11-92)</u>						
Peak Overpressure, psi						
0442-3	25.7	12.1	7.6	31.1	12.3	6.6
0442-2	32.9	----	---	34.1	11.5	6.9
0442-1	34.2	16.3	7.0	----	13.0	6.3
0342-3	27.8	9.2	7.9	38.1	11.8	7.5
0342-6	31.1	10.0	10.6	36.7	15.4	12.6
Impulse, psi-Milliseconds						
0442-3	16.4	10.4	9.7	16.1	12.2	6.3
0442-2	25.7	----	---	19.7	10.6	7.2
0442-1	25.9	14.2	10.0	----	12.0	6.9
0342-3	24.2	10.8	19.9	31.5	9.8	11.1
0342-6	16.5	10.7	11.5	----	13.6	14.4
<u>COMPOSITION PBX-90/0 (LOT HOL-SR-490-61)</u>						
Peak Overpressure, psi						
051-2	26.9	13.6	6.4	26.9	20.5	5.9
058-2	32.3	20.1	6.8	31.6	20.1	7.1
057-1	34.4	15.1	8.0	39.9	----	7.9
057-2	34.4	11.5	11.7	34.4	11.7	11.7
Impulse, psi-Milliseconds						
051-2	13.6	11.5	8.8	21.1	22.8	7.9
058-2	19.8	19.6	13.4	19.0	14.4	6.9
057-1	29.2	13.8	12.1	21.5	----	10.5
057-2	15.7	10.2	----	16.9	11.3	12.7

CONFIDENTIAL

(C) TABLE 4

SHOCK WAVE TIME OF ARRIVAL AND IMPULSE DURATION MEASUREMENTS,
MILLISECONDS

COMPOSITION B					
Number	10 Ft.	15 Ft.	20 Ft.	25 Ft.	30 Ft.
0272-3	2.550	1.7	5.550	2.8	9.250
0731-6	2.640	2.2	5.690	2.55	9.240
0272-4	1.306	2.0	4.156	2.55	7.706
0731-2	2.591	2.0	5.591	2.9	9.441
0272-5	-----	1.5	-----	2.9	-----
0292-12	3.57	2.85	7.02	2.45	10.77
0301-2	3.13	2.1	6.65	2.6	10.35
0292-4	3.44	2.55	7.14	2.75	10.94
0272-7	3.703	2.5	7.003	2.8	10.503
0292-3	-----	2.15	-----	2.9	-----
TNT					
0284-2	3.445	2.1	5.645	2.7	9.345
309-2	2.554	2.2	5.704	2.7	9.354
284-3	2.515	1.85	5.615	2.9	9.215
311-11	2.663	2.9	5.613	3.2	9.613
309-1	1.247	2.75	4.797	3.0	8.797
COMPOSITION A-3					
0442-2	3.010	2.70	6.060	2.50	9.720
0342-3	2.421	3.15	5.671	3.15	9.421
0442-1	3.130	3.40	6.330	2.5	10.080
0342-6	2.856	2.20	5.806	2.85	9.481
0442-3	2.290	1.90	5.390	2.7	9.090
COMPOSITION B-3					
PBXN-1					
0241-1	2.565	2.50	5.625	2.8	9.238
016-1	2.764	3.05	5.939	2.85	9.699
0256-2	2.870	3.10	6.130	2.85	9.955
016-2	2.715	2.20	5.940	2.80	9.765
0256-1	-----	2.00	-----	3.10	-----
PBX 9010					
058-2	2.563	2.35	5.688	3.2	9.238
051-2	2.198	2.00	5.423	2.65	9.303
057-2	2.505	1.80	5.590	2.6	9.565
057-1	2.510	3.55	5.585	2.95	9.265
PBXN-3					
None	3.200	2.112	6.000	-----	9.510
None	-----	2.273	-----	2.690	-----
107-1	2.595	2.75	5.600	2.60	9.160
027-1	2.705	1.95	6.085	2.55	9.870
051-1	2.59	1.90	6.455	2.75	9.205

0284-2	3.445	2.1	5.645	2.7	9.345	2.8
309-2	2.554	2.2	5.704	2.7	9.354	3.15
284-3	2.515	1.85	5.615	2.9	9.215	3.2
311-11	2.663	2.9	5.613	3.2	9.613	3.2
309-1	1.247	2.75	4.797	3.0	8.797	3.7

COMPOSITION B-3

0442-2	3.010	2.70	6.060	2.50	9.720	3.00
0342-3	2.421	3.15	5.671	3.15	9.421	4.60
0442-1	3.130	3.40	6.330	2.5	10.080	3.15
0342-6	2.856	2.20	5.806	2.85	9.481	3.45
0442-3	2.290	1.90	5.390	2.7	9.090	3.00

PBXN-1

0241-1	2.565	2.50	5.625	2.8	9.238	3.50
016-1	2.764	3.05	5.939	2.85	9.699	2.90
0256-2	2.870	3.10	6.130	2.85	9.955	4.05
016-2	2.715	2.20	5.940	2.80	9.765	3.40
0256-1	-----	2.00	-----	3.10	-----	4.25

PBX 9010

058-2	2.563	2.35	5.688	3.2	9.238	3.90
051-2	2.198	2.00	5.423	2.65	9.303	3.10
057-2	2.505	1.80	5.590	2.6	9.565	2.90
057-1	2.510	3.55	5.585	2.95	9.265	3.50

PBXN-3

None	3.200	2.112	6.000	-----	9.510	2.075
None	-----	2.273	-----	2.690	-----	2.735
107-1	2.595	2.75	5.600	2.60	9.160	2.70
027-1	2.705	1.95	6.085	2.55	9.870	3.05
051-1	2.59	1.90	6.455	2.75	9.205	3.30

86/14 HMX/BUTVAR 2A

148	2.713	2.25	5.963	2.60	9.563	3.40
149	3.165	2.00	6.204	2.70	9.879	3.40
147	2.540	2.10	6.000	3.00	9.805	3.30
151	2.575	7.7	5.475	3.60	8.975	3.10

83/17 HMX/LAMINAC-STYRENE BINDER

None	3.400	1.888	6.350	2.638	9.910	3.180
None	-----	1.733	-----	2.533	-----	3.370
None	-----	1.752	-----	2.778	-----	2.220
0651-1	2.703	3.00	5.578	2.00	9.128	2.70
0651-3	2.255	1.85	5.355	2.65	9.085	5.00

75/25 CYCLOTOL

0592-6	2.595	1.7	5.705	2.60	9.435	3.60
0571-4	2.548	2.2	5.513	2.80	9.068	2.70
0592-3	2.530	1.6	5.680	2.95	9.405	3.60
0592-5	2.499	1.88	5.699	2.30	9.049	2.90

PBX-TYPE A

069-5	2.600	2.70	5.680	2.7	9.405	2.50
058-1	2.485	2.65	-----	2.5	-----	2.90
069-3	3.170	2.15	6.380	2.55	10.080	5.40
069-2	2.675	2.20	6.285	2.75	11.135	2.80
064-2	2.640	1.95	6.690	2.65	10.335	2.95

PBX-TYPE B

064-1	2.473	2.40	5.623	2.8	9.423	3.85
070-5	2.580	2.35	5.550	2.8	9.290	2.60
059-1	2.213	2.50	5.398	2.9	9.018	3.50
070-1	2.685	1.80	5.910	2.85	9.945	3.10

CONFIDENTIAL



APPENDIX B

Figures

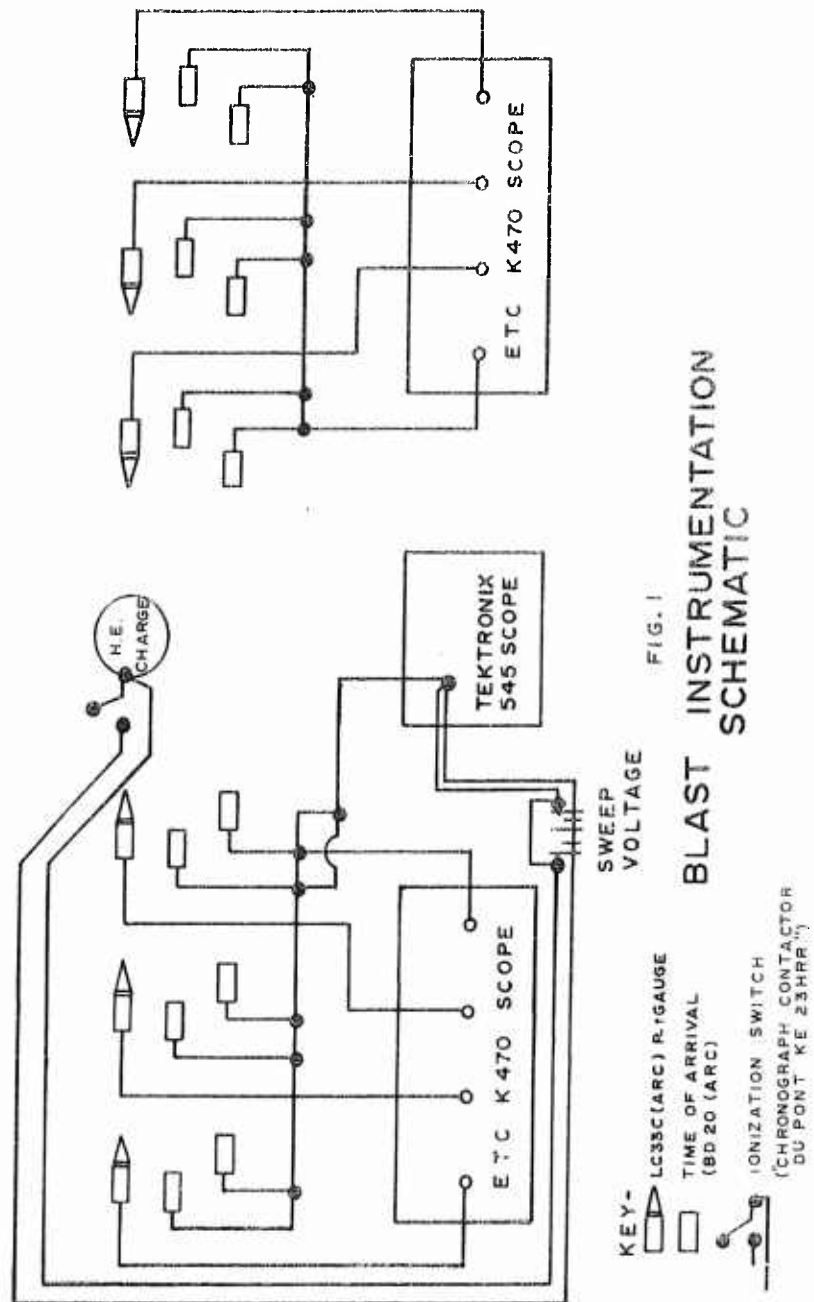


FIG. 1

BLAST INSTRUMENTATION SCHEMATIC

001 PAGE 1177-1

SRV	DESCRIPTION	DATE	APPROVAL
-----	-------------	------	----------

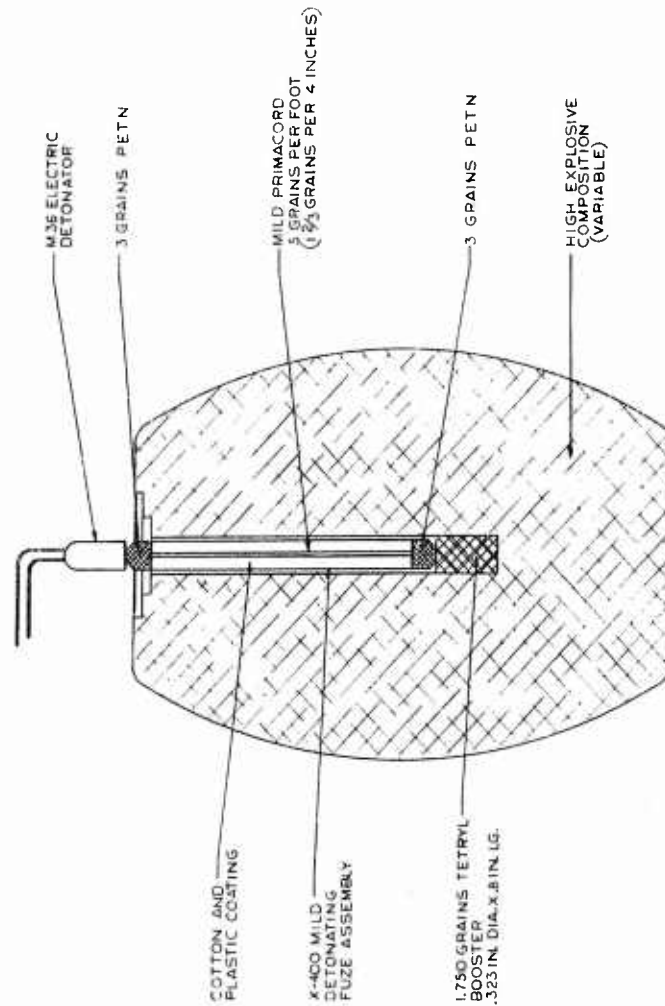


FIG. 2
INITIATION TRAIN

CONFIDENTIAL

[illegible]



FIGURE 3
Blast Parameter Measurement Transducer Arrays, showing relative position
of HE Charge.

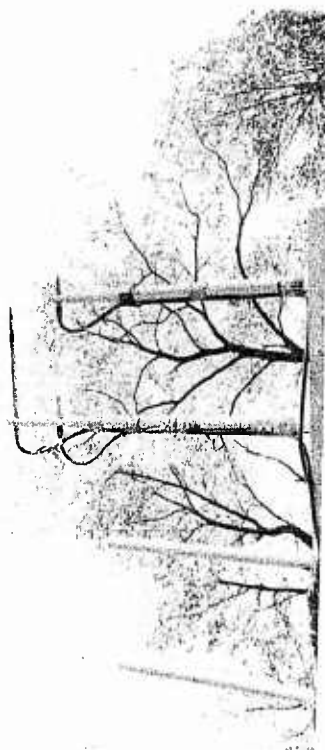


FIGURE 4

Detail of a Transducer Array Position showing side-on P-t Cage bracketed by two
time-of arrival gages.

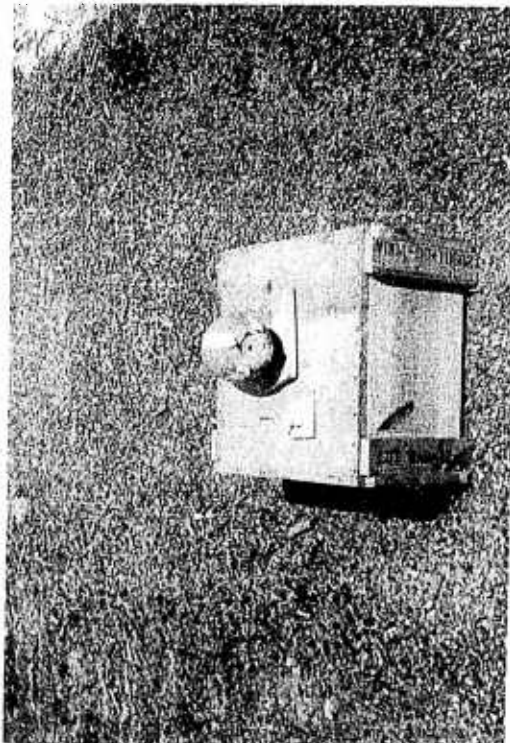
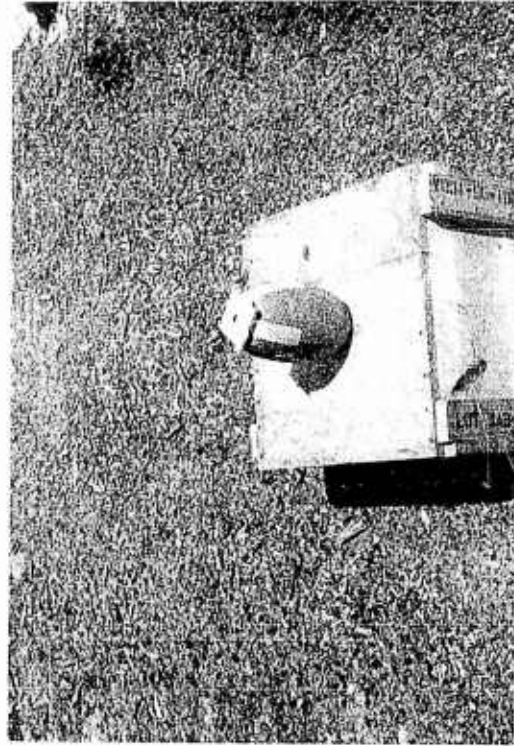


FIGURE 5
Views of a Typical Constant Volume HE Charge

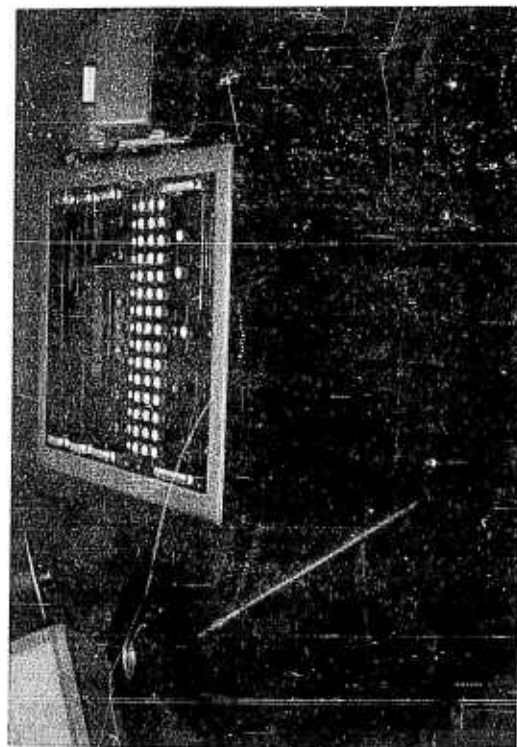
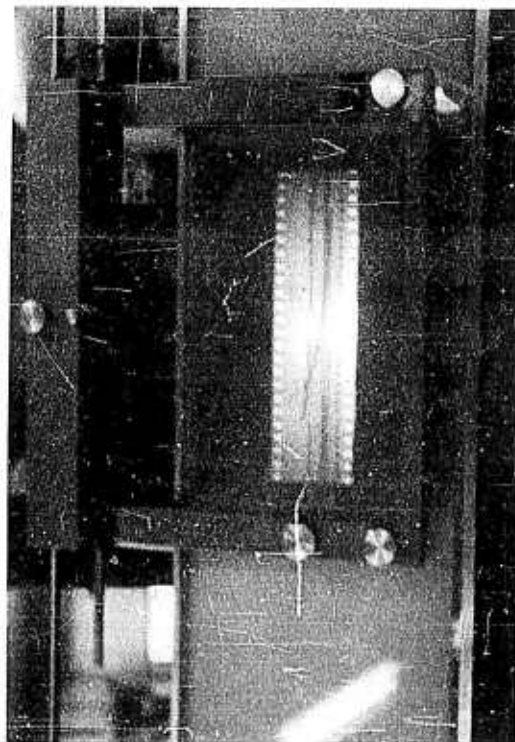


FIGURE 6

Gerber Analog to Digital Data Reduction System. Left, trace analog projection from 35mm film record; right - Gerber System programming Console and Digital Data Print-Out Device.

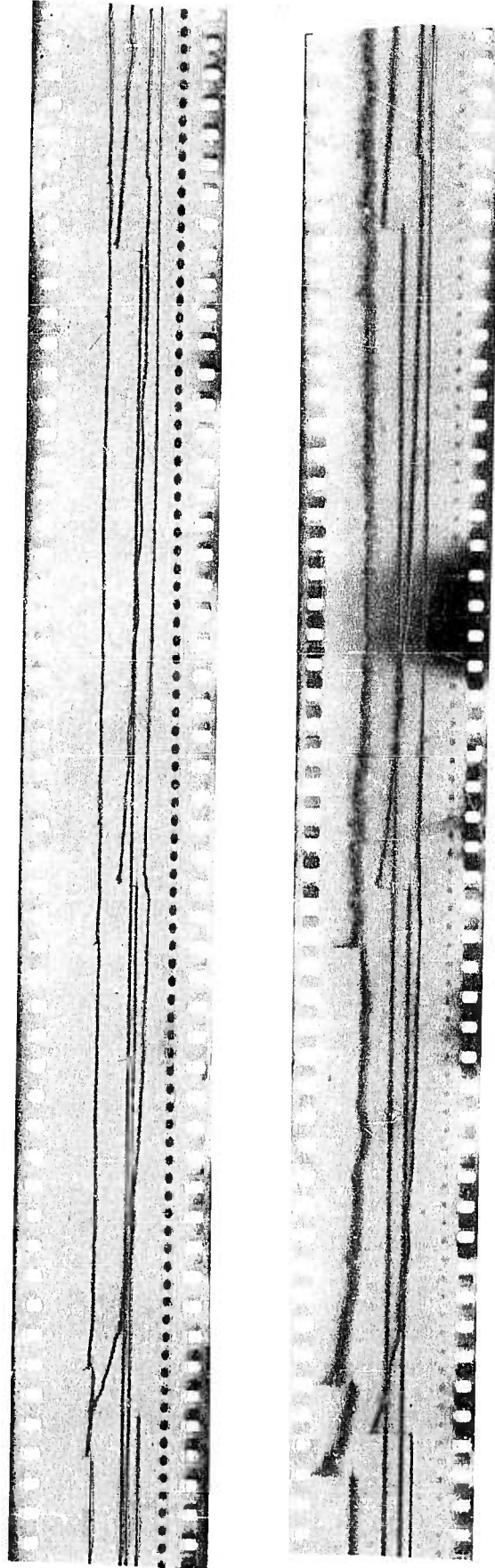
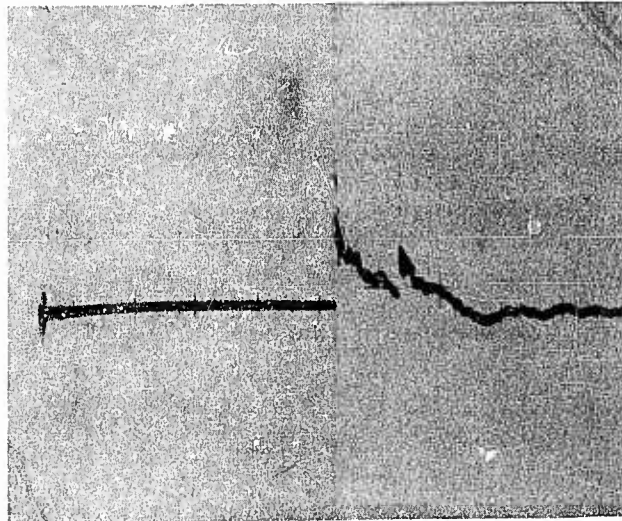


FIGURE 7

Typical 35mm Film Analog Records of Blast Parameters measured by the Redundant Principal Array. (Left to Right: Ten foot Distance, 15 foot Distance, 20 foot Distance). Top to Bottom: Time of Arrival Analog Distance, 20 foot P-t analog, 15 foot P-t analog, 10 foot P-t analog, Timing Generator Indications (10 KC).



(U) FIGURE 8

Air Shock Wave Time-of-Arrival Analogs. A sample Oscilloscope Trace is shown. Sweep generated by Ionization Switch Closure on HE Charge (Figure 1). Oscilloscope sweep rate is 0.5 milliseconds per centimeter. Time-of-Arrival gages are not calibrated as to Amplitude of Analog.

From Left to Right --

First Analog is the output of 9.5-foot distance time-of-arrival gage.

Second Analog output is generated by the output of the 10.5-foot distance time-of-arrival gage.

ABSTRACT DATA

(U) ABSTRACT

Accession No. _____ AD _____

Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH
EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD
CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp,
figures, tables. CONFIDENTIAL report from
the Technical Services Laboratory, Ammunition
Engineering Directorate.

Presented in the report are the measured
blast parameters of side-on peak overpressure
and positive impulse (including positive
impulse duration) plus the measured air shock
wave time-of-arrival information generated by
the free-air detonation of 57 uncased,
centrally initiated, 7-lb. (approximate weight)
constant volume high explosive charges.

UNCLASSIFIED

1. High Explosive
Compositions and
Ammunition
- I. Comparative Blast
Measurements of
Various High Explosive
Compositions in a
Standard Warhead
Configuration.
- II. Herman, Henry L.

UNITERMS

TNT
Composition A-3
Composition E
HMX
Butvar
Laminac
Cyclotol
HE
Herman, H. L.

Accession No. AD
Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED
I. High Explosive Compositions and Ammunition

I. TITLE
II. Herman, Henry L.

UNITERMS

TNT
Composition A-3
Composition B
HMX

Butvar
Laminac
Cyclotol
HE
Herman, H. L.

UNCLASSIFIED

Accession No. AD
Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED
I. High Explosive Compositions and Ammunition

I. TITLE
II. Herman, Henry L.

UNITERMS

TNT
Composition A-3
Composition B
HMX

Butvar
Laminac
Cyclotol
HE
Herman, H. L.

UNCLASSIFIED

Accession No. AD
Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED
I. High Explosive Compositions and Ammunition

I. TITLE
II. Herman, Henry L.

UNITERMS

TNT
Composition A-3
Composition B
HMX

Butvar
Laminac
Cyclotol
HE
Herman, H. L.

UNCLASSIFIED

Accession No. AD
Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED
I. High Explosive Compositions and Ammunition

I. TITLE
II. Herman, Henry L.

UNITERMS

TNT
Composition A-3
Composition B
HMX

Butvar
Laminac
Cyclotol
HE
Herman, H. L.

UNCLASSIFIED

Accession No. _____ AD _____
Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED

- I. High Explosive Compositions and Ammunition

I. TITLE

- II. Herman, Henry L.

UNITERMS

TNT

Composition A-3
Composition B

HMX

Butvar

Laminac

Cyclotol

HE

Herman, H. L.

UNCLASSIFIED

Accession No. _____ AD _____
Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED

- I. High Explosive Compositions and Ammunition

I. TITLE

- II. Herman, Henry L.

UNITERMS

TNT

Composition A-3
Composition B

HMX

Butvar

Laminac

Cyclotol

HE

Herman, H. L.

UNCLASSIFIED

Accession No. _____ AD _____

Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED

- I. High Explosive Compositions and Ammunition

I. TITLE

- II. Herman, Henry L.

UNITERMS

TNT

Composition A-3
Composition B

HMX

Butvar

Laminac

Cyclotol

HE

Herman, H. L.

UNCLASSIFIED

Accession No. _____ AD _____

Picatinny Arsenal, Dover, New Jersey

COMPARATIVE BLAST MEASUREMENTS OF VARIOUS HIGH EXPLOSIVE COMPOSITIONS IN A STANDARD WARHEAD CONFIGURATION (U)

Henry L. Herman

Technical Memorandum 1459, July 1964, 20 pp, figures, tables. CONFIDENTIAL report from the Technical Services Laboratory, Ammunition Engineering Directorate.

Presented in the report are the measured blast parameters of side-on peak overpressure and positive impulse (including positive impulse duration) plus the measured air shock wave time-of-arrival information generated by the free-air detonation of 57 uncased, centrally initiated, 7-lb. (approximate weight) constant volume high explosive charges.

UNCLASSIFIED

- I. High Explosive Compositions and Ammunition

I. TITLE

- II. Herman, Henry L.

UNITERMS

TNT

Composition A-3
Composition B

HMX

Butvar

Laminac

Cyclotol

HE

Herman, H. L.

UNCLASSIFIED

TABLE OF DISTRIBUTION

TABLE OF DISTRIBUTION

	Copy No.
1. Commanding Officer Picatinny Arsenal Dover, New Jersey ATTN: SMUPA-DT4 SMUPA-VE (D.Hopper, T.Costain) SMUPA-VA6 SMUPA-DX1	1-10 11-12 13-17 18-19
2. Commanding Officer Harry Diamond Laboratories Washington 25, D. C. ATTN: Library	20
3. Commandant U. S. Army Ordnance Center and School Aberdeen Proving Ground, Maryland ATTN: AISO-SL	21
4. Commanding Officer Ammunition Procurement & Supply Agency Joliet, Illinois ATTN: SMUAP-AE	22
5. Commanding Officer U. S. Army Engineer Research & Development Laboratories Fort Belvoir, Virginia ATTN: STINFO Branch	23-24
6. Defense Documentation Center Cameron Station Alexandria, Virginia	25-44