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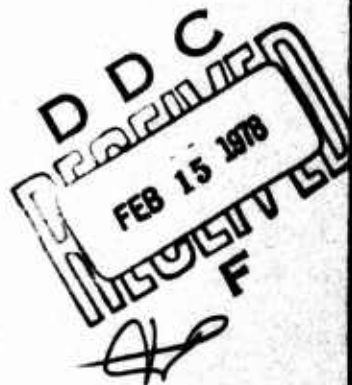
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XM714 DELAY FUZE TESTS

GUNS, ROCKETS AND EXPLOSIVES DIVISION

NOVEMBER 1976

**FINAL REPORT FOR PERIOD
JUNE 1976-JULY 1976**



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Presented in this report are the results of the XM714 delay fuze tests performed by AFATL at Eglin AFB, Florida. The fuze was carried by a lightweight, thin-walled 20mm projectile body with a mechanically locked plastic rotating band. Forty inert fuzes and projectiles were fired to evaluate fuze structural integrity, and 266 live high-explosive (HE) projectiles and fuzes were fired to evaluate fuze performance. Standard M103A1 20mm cases were used with WC870 propellant. The fuzes were fired against aluminum targets of various thicknesses at various impact velocities and impact angles. Fuze delay distances		

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↓ 20. ABSTRACT (CONCLUDED)

were determined using witness plates, x-rays, and counter times. Fuze arming was determined by x-rays. ↗

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PREFACE

This test was conducted in response to Program Management Directive No. R-P4029(3)/64603F/2079, dated 20 June 1975. Testing began on 7 June 1976. Personnel responsible for testing, evaluation, and report preparation were Mr. Seymour Slotkin, Project Engineer, and 1st Lt William F. Wade, Jr., Test Engineer.

This report has been reviewed and is approved for publication.

FOR THE COMMANDER

Richard A. DiBona

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SECTION I

INTRODUCTION

A development program, in support of the Improved 20mm Ammunition Program, was conducted to modify the XM714 fuze for function delay. The modification consisted of replacing the setback spring with a crush washer, removing the self-destruct steel balls, and incorporating a solid ogive. The base thread diameter was increased (larger than the M505 fuze diameter) to permit strengthening the ogive wall for increased fuze survivability during target penetration. This caused an incompatibility with standard 20mm projectiles. A 20mm projectile "fuze tester" compatible with the XM714 delay fuze and M61A1 gun was provided to enable the fuze to be tested. The object of these tests was to demonstrate XM714 delay fuze performance at various impact conditions.

SECTION II

TEST PROCEDURES

The test item (Figures 1 and 2) consisted of an XM714 delay fuze and a 20mm high-explosive (HE), thin-walled, lightweight projectile used as a test vehicle. The fuze consisted of the standard XM714 safe and arming (S&A) assembly plus a crush washer, a slide weight and one plastic ball, all enclosed in a solid steel ogive. The nominal weight was 564 grains. The nominal projectile weight was 622 grains and included a plastic rotating band and 193 grains of explosive with a charge-to-mass ratio (C/M) of 0.342.

Three types of tests were conducted:

(1) Structural Integrity - To determine fuze survivability at various impact conditions.

(2) Sensitivity - To determine fuze function against very light material (0.04 inch aluminum), low oblique impact angles (0 degrees) and minimum impact velocities (1500 feet per second).

(3) Function Delay - To determine function delay performance at various impact conditions.

All test projectiles were fired from a 20mm gain twist Mann barrel at a range of 103 feet. Target material was 0.040 to 0.125 inch thick 2024-T3 aluminum. Muzzle velocities were 2500, 3000, and 3500 feet per second and impact angles included 0- to 80-degree obliquities. Target size was 12 x 24 inches (Figure 3) for all structural integrity and function delay tests. A 12 x 12-inch target (Figure 4) was used for the sensitivity test. The target was mounted firmly on all four sides against a 0.75-inch-thick steel plate target frame.

SECTION III

TARGET AND INSTRUMENTATION

Figures 5 and 6 show the range set-up and relative positions of the instrumentation and targets.

Projectile velocity was obtained using circuit paper triggering devices for starting and stopping a counter. The triggering devices were positioned approximately 61 feet and 71 feet downrange from the muzzle (Figure 5).

Two 150-KV x-ray heads were set up along the trajectory (Figure 5). One head was positioned ahead of the target for determining fuze arming and the other head was positioned behind the target for determining delay distance and fuze survivability.

Delay time was recorded by a counter that indicated time between projectile target impact and fuze function. The counter was started by a circuit paper triggering device on the target and stopped by a photo cell that detected projectile detonation flash. Delay time was determined by multiplying the counter time, in μsec , by the projectile velocity.

An aluminum plate (fragment witness plate) positioned behind the target parallel to and lower than the projectile flight path was used as an alternate method of determining fuze delay distance (Figure 7). The fragment pattern on the plate shows a distinct line from which a measurement can be made and used to indicate approximate delay distances.

A secondary target was positioned approximately 5 feet behind the primary target (Figure 5). This target, 0.090 to 0.100 inch aluminum, was used to distinguish between a sensitivity problem and no function. This plate also indicated possible low order detonations.

The witness paper was placed approximately 5 feet behind the secondary target (Figure 5). The witness paper aided in determining a no function or low order detonation.

SECTION IV

TEST RESULTS AND DISCUSSION

During this test 266 live rounds and 40 inert rounds, for a total of 306, were fired. Of these, 277 data points were acceptable for evaluation. The remaining 29 were unacceptable due to projectiles hitting the target frame or missing the target completely. The x-ray data and counter time provided an excellent method of determining fuze arming and fuze delay distances. Figure 8 shows a typical x-ray of the projectile before impact. Figure 9 shows an x-ray of a live HE projectile after impact. Figure 10 shows an x-ray of an inert filled projectile after impact. Witness plate measurements are recorded in Table 1. A vector sum of estimated projectile velocity and fragment velocity are not shown due to inconsistent delay distances when using witness plate measurements. The values recorded in Table 1 for the witness plate delay are the measured horizontal and vertical distances from the impact point on the target to the fragment line on the fragment witness plate.

The velocity recorded is an average projectile velocity beginning 61 feet 2 inches downrange and ending 71 feet 2 inches downrange. This velocity is used in computing the delay distance from the x-rays and the counter. The delay distances obtained from the counter are slightly higher than those of the x-rays due to the higher velocity measured uprange from the target. This inaccuracy is acceptable for the purpose of this test.

Table 2 shows the results of the fuze integrity test. The projectile velocities ranged from 2500 to 3500 feet per second. Targets were 0.090 and 0.125 inch thick and positioned at 70- and 80-degree obliquity angles. All projectiles failed at 80 degrees against 0.125 inch targets. Shot number 21 (Figure 16) is representative of a fuze-body interface failure. Shot number 5 (Figure 17) is representative of a fuze body misaligned with respect to the projectile body.

Table 3 shows the results of the fuze sensitivity tests. One of the fuze performance goals is that the fuze will function on 0.040 inch thick 2024-T3 aluminum at 0 degrees impact angle and a projectile velocity of 1,000 feet per second. The shots were made at 1500 feet per second because previous work performed by the contractor indicated that the fuze would not arm at 1,000 feet per second. All five shots failed to function on the primary targets.

Table 1 shows the results of the function delay test. Five data points were collected for each test condition, giving a total of 245 data points. Impact angles varied from 0 to 80 degrees obliquity, target thicknesses ranged from 0.063 inch to 0.125 inch, and nominal projectile velocities varied from 2500 to 3500 feet per second. A total of 60 shots did not function on the primary target; 17 of these did not detonate until hitting the armor plate backstop. Of these 17 shots, only nine were oriented on the x-ray film such that a determination of arming could be

made. Four of the nine indicated no arming. Figures 11 and 12 show a comparison of a properly armed fuze (detonator aligned) and a partially armed fuze (detonator not aligned). Of the 17 shots, 13 were with projectile velocities of 3000 feet per second, and one was with a projectile velocity of 2500 feet per second. Figures 13, 14, and 15 are curves of delay distance versus effective thickness. Effective thickness is the actual thickness that the projectile penetrates. It is determined by dividing the target thickness by the cosine of the oblique angle of impact.

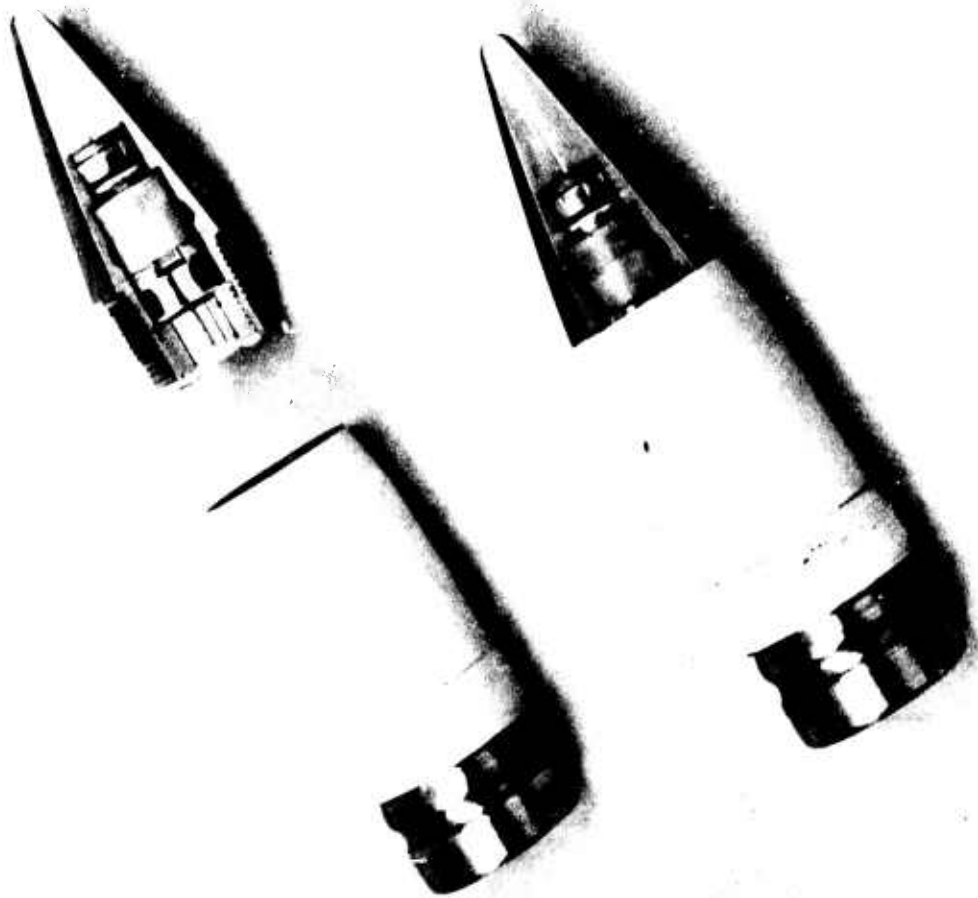


Figure 1. XM714 Delay Fuze

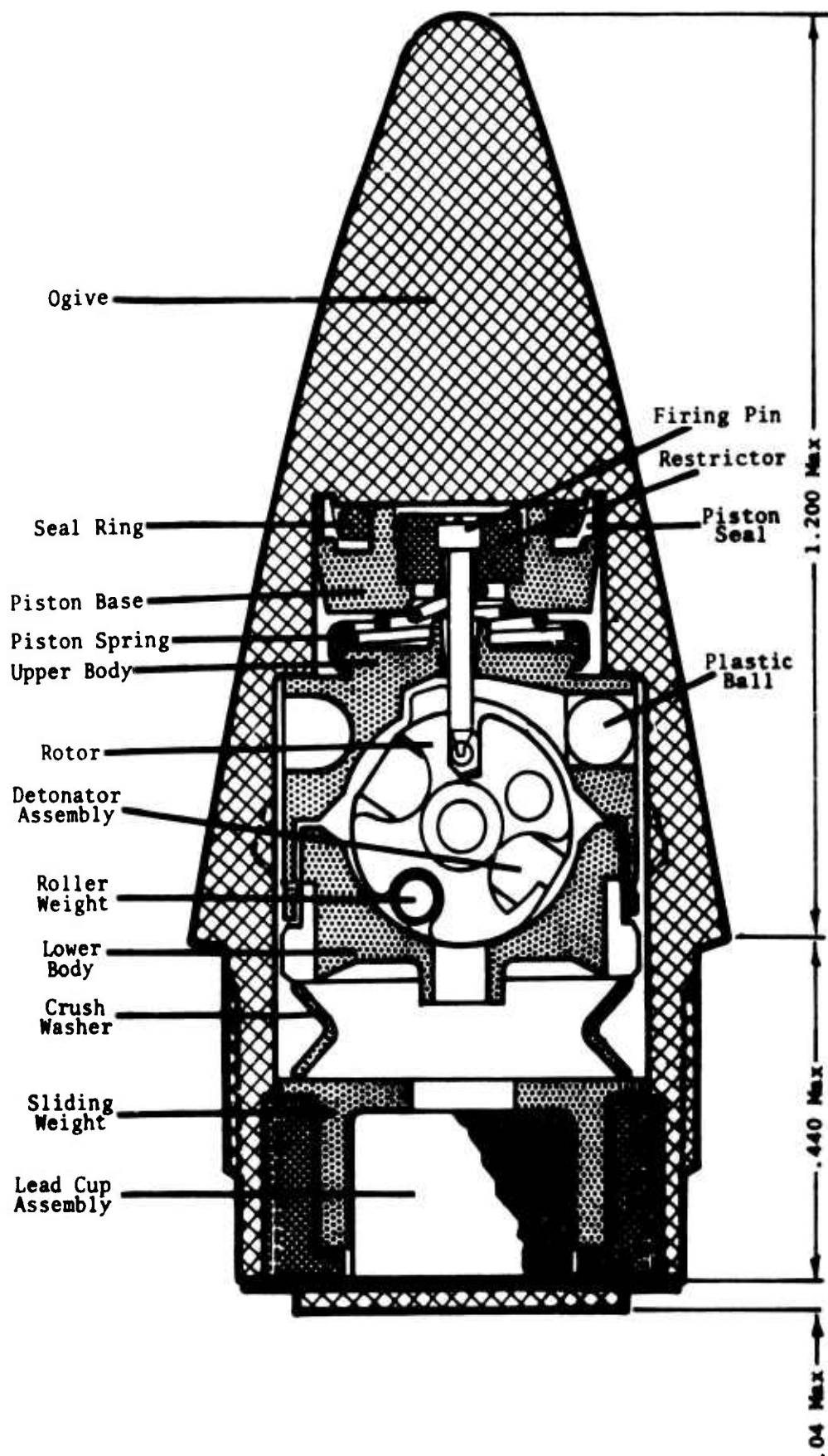
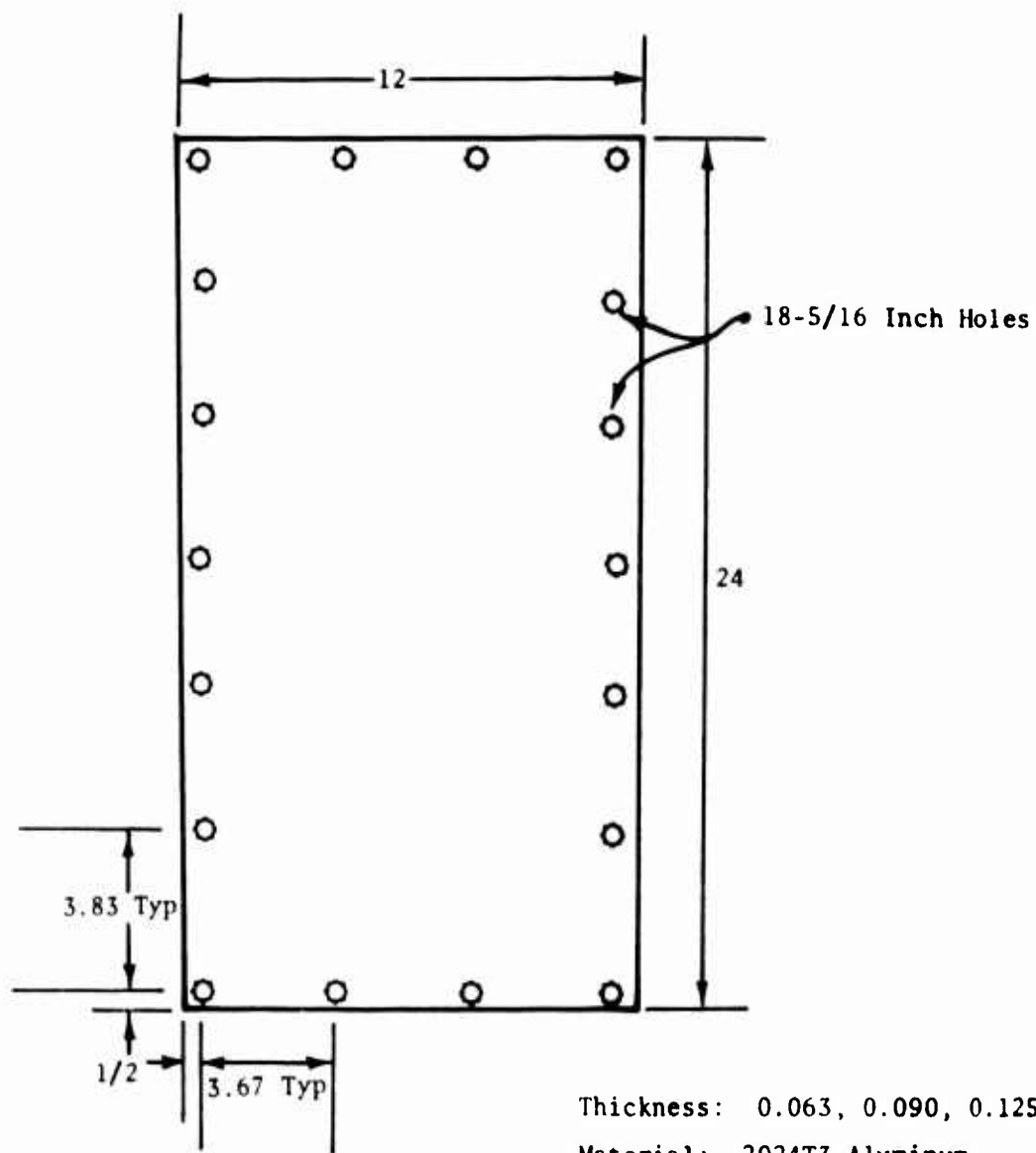
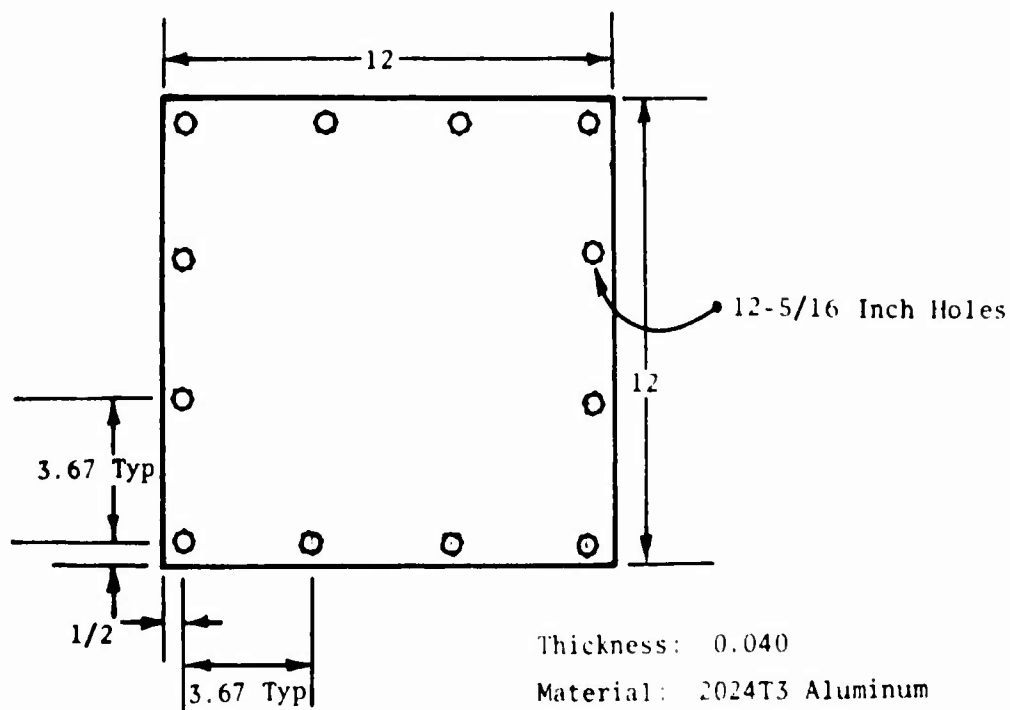


Figure 2. Schematic of Delay Fuze, XM714A3



NOTE: All Dimensions in Inches

Figure 3. Structural Integrity and
Function Delay Tests Target



NOTE: All Dimensions in Inches

Figure 4. Sensitivity Tests Target

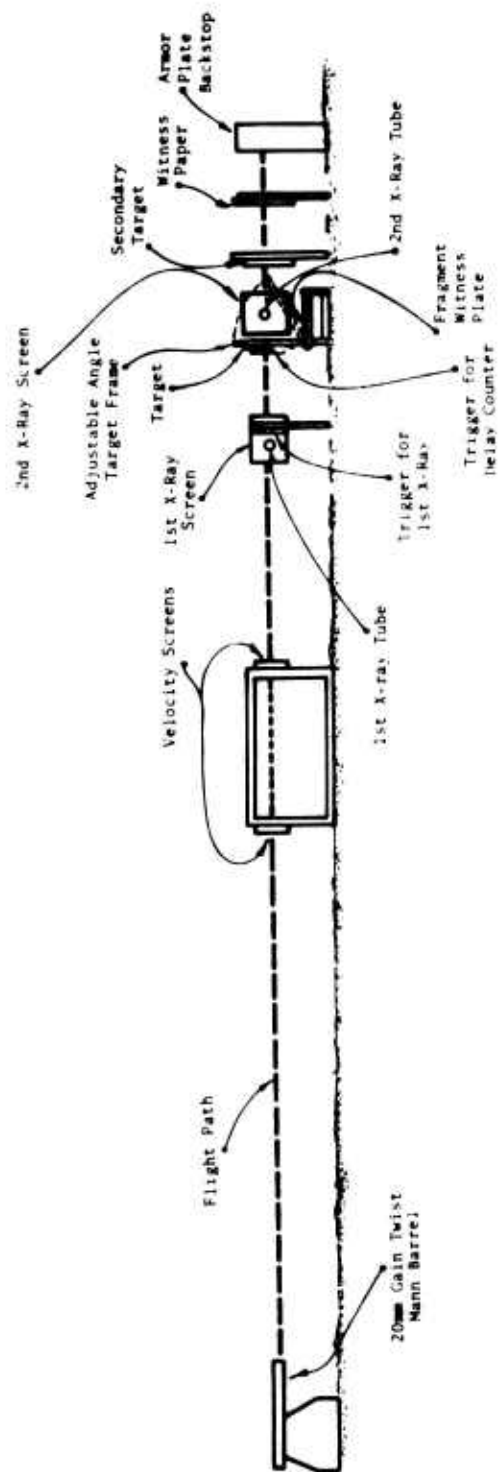


Figure 6. XM714 Fuze Test Set-Up - Elevation View

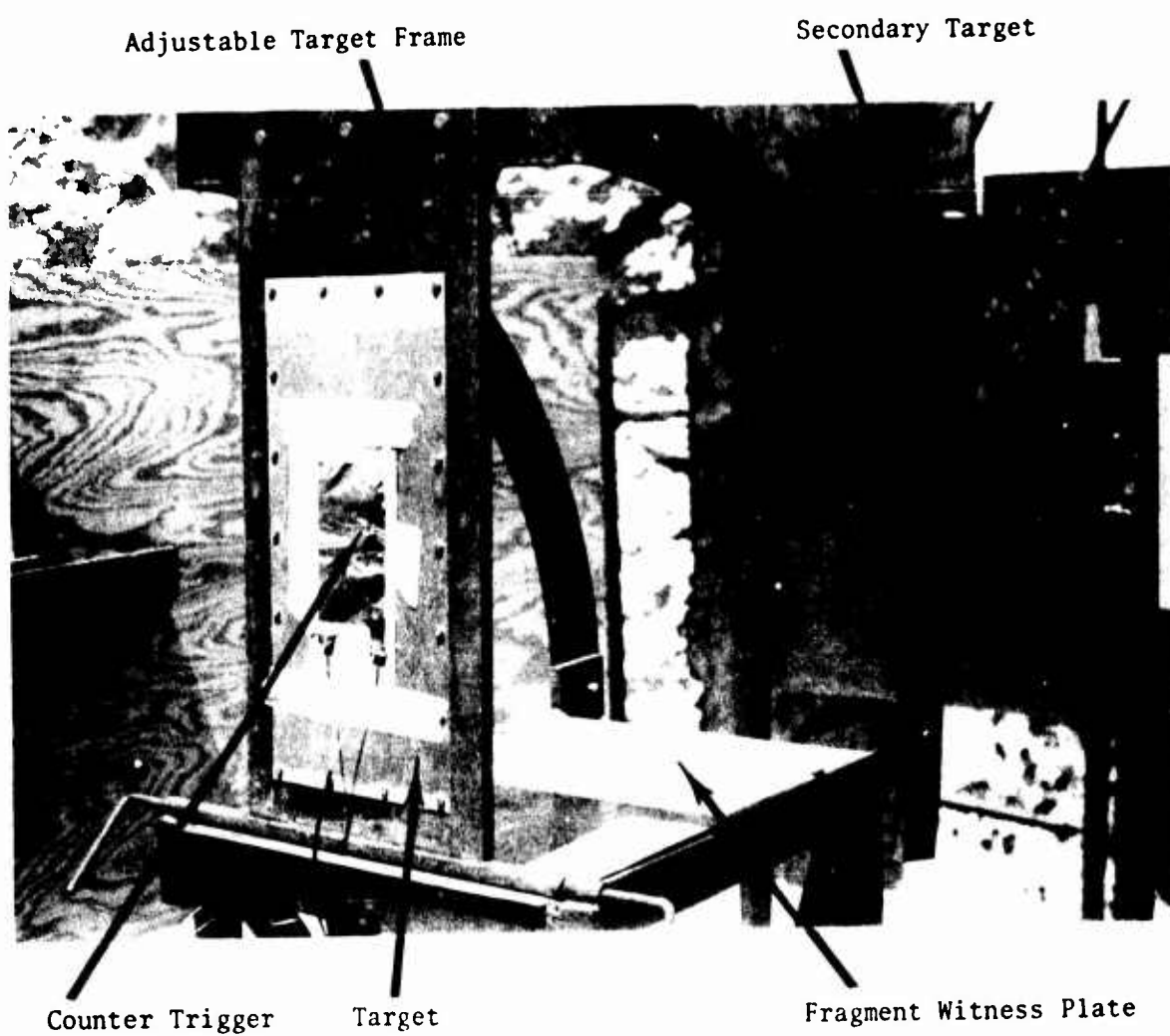


Figure 7. Primary and Secondary Targets Set-Up

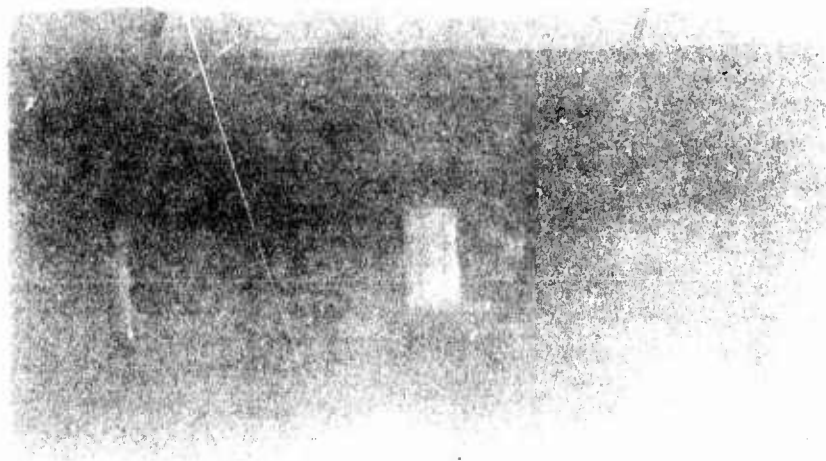


Figure 8. X-Ray of Projectile Before Impact



Figure 9. X-Ray of Live Projectile After Impact

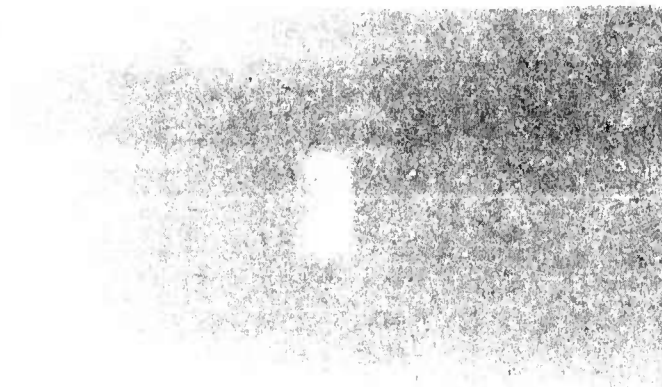


Figure 10. X-Ray of Inert Filled
Projectile After Impact



Figure 11. X-Ray of Properly Armed
Fuze (Detonator Aligned)



Figure 12. X-Ray of Partially Armed Fuze
(Detonator Not Aligned)

○ X-Ray Delay
 □ Witness Plate Delay

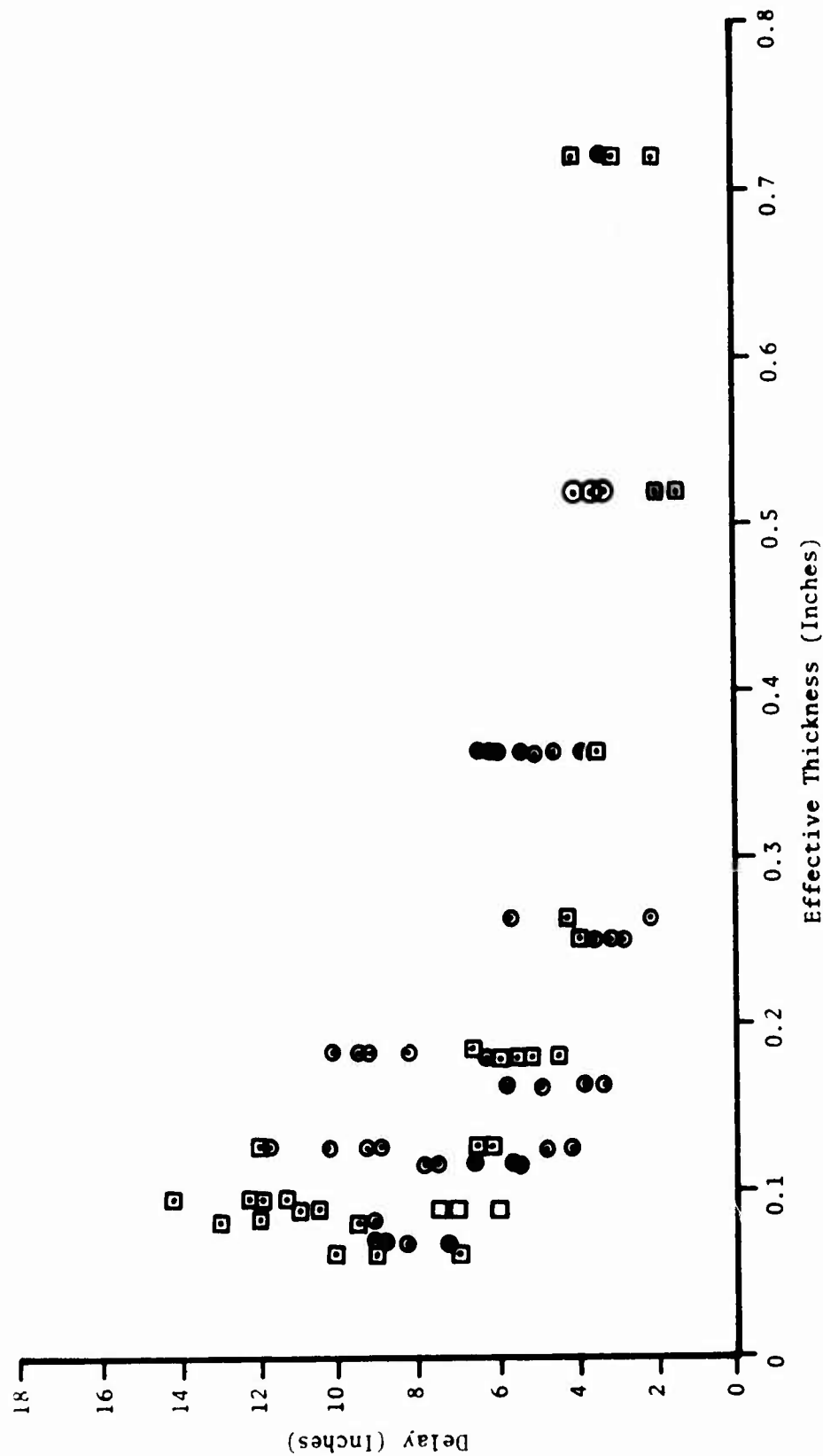


Figure 13. Fuze Delay Versus Effective Target Thickness
(Nominal Velocity - 2500 Feet Per Second)

⊙ X-Ray Delay
 □ Witness Plate Delay

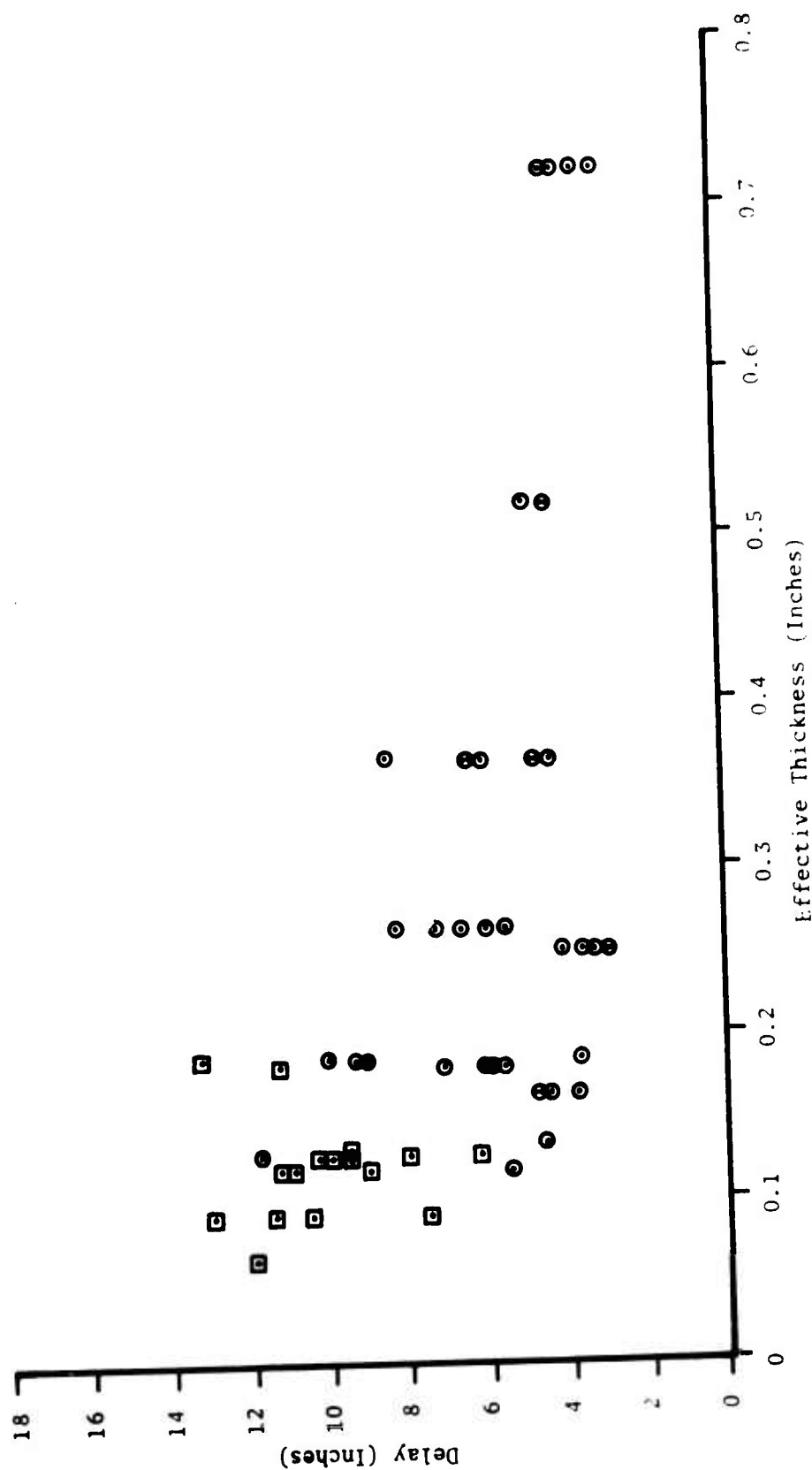


Figure 14. Fuze Delay Versus Effective Target Thickness
(Nominal Velocity - 3000 Feet Per Second)

○ X-Ray Delay
 □ Witness Plate Delay

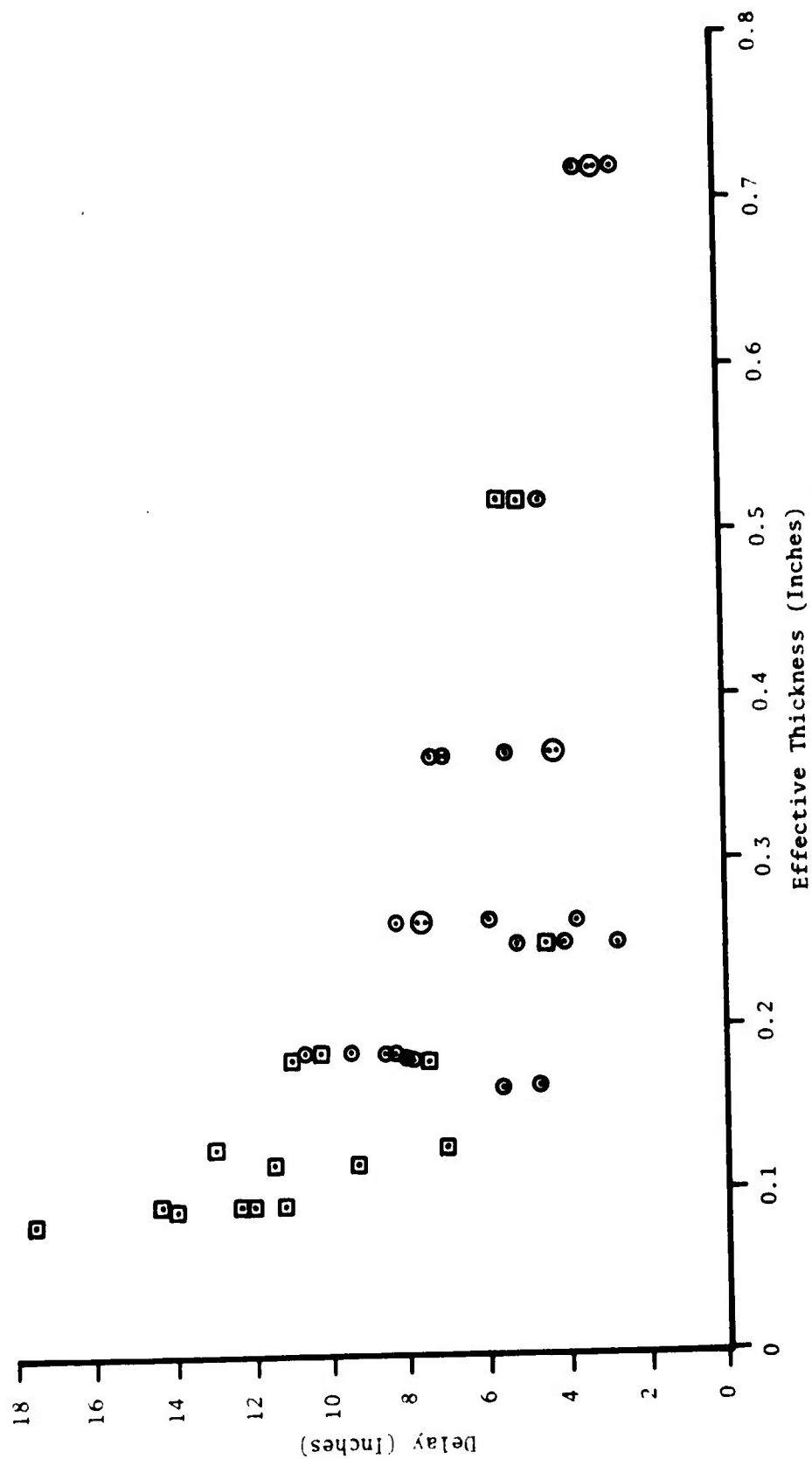


Figure 15. Fuze Delay Versus Effective Target Thickness
 (Nominal Velocity - 3500 Feet Per Second)



Figure 16. Fuze/Body Interface Failure



Figure 17. Fuze Body Misaligned
With Respect to Projectile Body

TABLE 1. FUNCTION DELAY

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
1	80.2	0	0.063	2382	15	7	*	*	*	Super quick (SQ) on second target Delay on second target
2	80.2			2417	15.5	9	*	*	*	
3	80.0			2611	*	*	*	*	*	
4	80.4			2506	*	*	*	*	*	
5	80.1			2550	15.25	10	*	*	*	
6	80.1			2955	14	12	*	*	*	Delay on second target Delay on second target Delay on second target
7	80.1			3002	*	*	*	*	*	
8	80.0			2990	*	*	*	*	*	
9	80.3			2982	*	*	*	*	*	
10	80.2			3011	*	*	*	*	*	
11	80.3			3463	*	*	*	*	*	Delay on second target Delay on second target Delay on second target Delay on second target Delay on second target
12	80.0			3458	*	*	*	*	*	
13	80.0			3478	*	*	*	*	*	
14	80.1			3545	*	*	*	*	*	
15	80.1	0	0.063	3489	*	*	*	*	*	
16	80.2	0	0.090	2561	13.5	11	*	*	*	
17	80.1			2539	14.5	7.5	*	*	*	
18	80.0			2571	13.5	7	*	*	*	
19	79.9			2513	13.5	6	*	*	*	
20	80.0			2528	13.75	10.5	*	*	*	

* No Data Obtained

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
21	80.2	0	0.090	2991	14.5	7.5	*	*	*	
22	80.2			2997	14.5	13	*	*	*	
23	80.2			2974	14.5	11.5	*	*	*	
24	80.3			2979	13	13	*	*	*	
25	79.8			2962	14.5	10.5	*	*	8.1	
26	80.3			3525	*	*	*	*	*	Delay on second target
27	80.0			3566	13.25	14	*	*	*	
28	80.0			3492	*	*	*	*	*	Delay on second target
29	80.2			3447	*	*	*	*	*	No function
30	80.2	0	0.090	3470	*	*	*	*	*	Delay low order on second target
31	80.4	0	0.125	2534	13	6.25	*	*	*	Delay on second target
32	80.4			2490	14.25	6	*	*	4.2	
33	80.3			2462	13.5	6	195	5.8	4.8	
34	80.2			2480	14.5	6.5	*	*	*	
35	80.4			2476	*	*	*	*	*	Delay low order on second target
36	80.1			2939	15	10	*	*	*	
37	80.1			2983	13.5	10.25	*	*	*	
38	80.2			2960	14.5	12.5	276	9.8	9.5	
39	80.0			3025	*	*	*	*	*	Delay on second target
40	80.0			3023	*	*	*	*	*	No function

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
41	80.3	0	0.125	3508	*	*	*	*	*	No function
42	80.4			3537	*	*	*	*	*	No function
43	80.2			3506	*	*	*	*	*	No function
44	80.4			3530	*	*	*	*	*	No function
45	80.2	0	0.125	3557	*	*	*	*	*	No function
46	80.0	20	0.063	2492	15	9	309	9.2	8.8	Delay on second target
47	80.2			2686	14.75	9.5	279	9.0	8.3	
48	80.1			*	*	*	*	*	*	
49	80.0			2679	14.5	10	294	9.5	9.0	
50	80.1	20	0.063	2660	14	9	*	*	7.2	SQ on second target
51	79.7	20	0.090	3447	13	14.25	*	*	*	
52	79.7			3569	*	*	*	*	*	
53	80.2			3497	10	12	*	*	*	
54	79.9			3515	12	11.25	*	*	*	
55	79.8	20	0.090	3520	13	12.25	*	*	*	
56	79.8	20	0.125	2894	15.5	7.5	150	5.2	4.7	SQ on second target SQ on second target Delay on second target SQ on second target
57	79.9			3007	*	*	*	*	*	
58	80.2			3092	*	*	*	*	*	
59	80.0			*	*	*	*	*	*	
60	80.4			3051	*	*	*	*	*	

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
61	80.4	20	0.125	3534	*	*	*	*	*	SQ on second target
62	80.0			3500	*	*	*	*	*	SQ on second target
63	80.2			3530	*	*	*	*	*	No function
64	80.1			3551	*	*	*	*	*	No function
65	80.0	20	0.125	3524	*	*	*	*	*	SQ on second target
66	80.0	40	0.063	2519	11.75	9.5	*	*	*	
67	79.9			2550	12	13	*	*	*	
68	79.8			2518	12.5	12	*	*	*	
69	79.9			2388	11.5	13	*	*	*	
70	79.9			2418	13	9.5	336	9.8	9.1	
71	79.9			3055	*	*	*	*	*	SQ on second target
72	80.2			2957	*	*	*	*	*	Delay on second target
73	80.0			3051	*	*	*	*	*	SQ on second target
74	79.9			2959	*	*	570	20.2	*	
75	79.8			3021	*	*	*	*	*	Delay on second target
76	80.2			3434	12	19.5	441	18.2	*	
77	79.7			3521	*	*	*	*	*	Delay on second target
78	80.1			3498	11.75	17.5	*	*	*	
79	80.2			3500	*	*	*	*	*	Delay on second target
80	80.1	40	0.063	3521	*	*	*	*	*	No function

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
81	80.3	40	0.090	2499	11	7	214	6.4	5.7	
82	80.1			2524	12.25	7.5	232	7.0	6.6	
83	79.9			2520	12	6.5	271	8.2	7.5	
84	80.5			*	13	6	203	6.1	5.6	
85	80.1			*	10.5	8.5	270	8.1	7.8	
86	80.0			*	11.5	11	225	8.1	> 6.7	
87	80.1			*	*	*	653	23.5	*	
88	79.7			2993	11.25	9	172	6.2	> 4.7	
89	79.9			2982	11.5	11.25	*	*	*	
90	79.8			*	12.25	12.25	185	6.6	5.5	
91	80.1			3508	*	*	*	*	*	SQ on second target
92	80.1			3524	*	*	*	*	*	Delay on second target
93	80.0			3504	11.5	9.25	*	*	*	
94	80.2			3505	*	*	*	*	*	SQ on second target
95	80.1	40	0.090	3531	10.5	11.5	*	*	*	
96	80.0	40	0.125	2468	11.5	4.5	153	4.5	3.8	
97	80.1			2521	10.5	5	163	4.9	3.9	
98	80.4			2476	12.5	5	211	6.3	5.8	
99	80.3			2506	10.25	4.5	146	4.4	3.4	
100	80.1			2486	12	6	187	5.6	4.9	

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
101	80.0	40	0.125	2988	11.25	6.5	153	5.5	4.5	
102	80.0			3008	11.5	6	125	4.5	3.8	
103	80.0			*	11.5	8.75	152	5.5	4.7	
104	79.9			2975	*	*	*	*	*	Delay on second target
105	80.0			3008	11.75	7.5	162	5.9	4.8	
106	80.0			3487	*	*	*	*	*	No function
107	79.9			3561	9	7.5	159	6.8	5.6	
108	79.9			3503	11.75	7.5	126	5.3	4.7	
109	80.1			3561	*	*	*	*	*	Not armed
110	80.1	40	0.125	3493	*	*	*	*	*	SQ on second target
111	79.9	60	0.063	2403	7	12	470	13.6	*	
112	80.0			2491	9	9.5	339	10.2	10.2	
113	80.0			2533	9.25	8.5	*	*	8.9	
114	79.9			2490	7.5	11	423	12.6	11.9	
115	80.0			2528	7	9	305	9.3	9.2	
116	79.7			2971	*	*	*	*	*	SQ on second target
117	80.1			2974	9	12.5	365	13.0	11.8	
118	80.1			2971	7.5	9.5	366	13.0	*	
119	80.1			3028	8	8	365	13.3	*	
120	80.0			3009	8.5	6.25	316	11.4	*	

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
121	80.1	60	0.063	3547	8.25	7	316	13.5	*	Delay on second target Delay on second target Delay on second target
122	79.6			3489	8.25	13	*	*	*	
123	80.1			3535	*	*	*	*	*	
124	80.2			3478	*	*	*	*	*	
125	79.8	60	0.063	3519	*	*	*	*	*	
126	79.9	60	0.090	2510	8.25	6	201	6.0	*	
127	80.0			2680	7.5	6	214	6.9	6.3	
128	80.0			2488	9	4.5	202	6.0	*	
129	80.1			2547	8	5.5	211	6.5	*	
130	80.1			2528	7	5.25	206	6.3	*	
131	79.9			3087	8.75	6	159	5.9	5.6	
132	80.2			3023	8.25	7	203	7.4	7.1	
133	80.1			2965	7.5	6	173	6.1	6.0	
134	80.2			2861	8	6	169	5.8	5.8	
135	79.9			3152	7.75	11.25	*	*	*	
136	80.0			3520	8.25	7.5	168	7.1	*	Delay on second target
137	79.9			3494	8.5	11	216	9.1	*	
138	79.9			3524	*	*	*	*	*	
139	80.2			3478	8	8	*	*	7.8	
140	80.3	60	0.090	3495	8.75	10.5	*	*	8.0	

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
141	80.3	60	0.125	2494	8.5	2.5	*	*	3.6	
142	80.4			2524	7	4	*	*	2.9	
143	79.8			2536	8	2.75	138	4.2	2.8	
144	79.8			2494	7.5	2.5	147	4.4	3.1	
145	79.9			2489	8	4	166	5.0	*	
146	80.0			2956	8	4	127	4.5	3.1	
147	79.7			2934	7	4.25	135	4.8	3.3	
148	79.8			3012	6.5	3.75	109	3.9	2.9	
149	79.8			2982	7.75	4.5	135	4.8	3.6	
150	79.3			3010	5.75	4.5	134	4.8	4.1	
151	79.8			3532	6.75	6.5	146	6.2	5.2	
152	79.9			3550	6.25	5.0	104	4.4	2.7	
153	80.2			3515	5.0	4.5	*	*	*	
154	79.8			3493	7.5	5.0	123	5.2	4.0	
155	79.8	60	0.125	3512	6.0	19.0	346	14.6	*	
156	80.2	70	0.063	2472	3.75	8.5	339	10.1	9.2	
157	80.0			2523	6.0	6.5	311	9.4	*	
158	79.8			2518	4.25	8.0	320	9.7	9.4	
159	80.0			2462	4.5	8.25	378	11.2	10.1	
160	80.0			2467	5.0	6.5	305	9.0	8.2	

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
161	80.0	70	0.063	3057	4.75	8.75	322	11.8	10.1	
162	80.0			3025	3.0	6.75	258	9.4	3.7	
163	79.9			2945	4.25	8.25	282	10.0	9.3	
164	80.1			2915	4.0	13.25	425	14.9	*	
165	80.0			2933	5.0	7.75	294	10.3	9.0	
166	79.6			3475	6.0	10.25	281	11.7	*	
167	79.8			3509	4.5	8.25	201	8.5	8.2	
168	79.9			3506	4.25	10.25	275	11.6	10.6	
169	79.9			3504	5.5	8.25	230	9.7	8.5	
170	79.7	70	0.063	3481	3.75	9.0	252	10.5	9.4	
171	79.9	70	0.090	2492	4.25	3.5	196	5.8	5.7	
172	79.8			2523	*	*	*	*	*	Not armed
173	79.7			2505	5.5	3.0	201	6.0	2.2	
174	79.7			2563	3.0	4.5	196	6.0	2.2	
175	80.0			2511	5.0	4.25	219	6.6	*	
176	79.8			2921	6.5	5.0	200	7.0	5.5	
177	80.1			2922	4.25	6.5	230	8.1	7.2	
178	80.3			2935	5.75	6.5	257	9.0	8.2	
179	80.3			2996	4.75	4.5	197	7.1	6.0	
180	79.8			2927	4.5	4.75	209	7.3	6.6	

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
181	79.7	70	0.090	3511	4.5	7.0	200	8.4	7.4	
182	80.0			3519	2.25	7.5	223	9.4	8.2	
183	80.0			3524	4.75	6.75	204	8.6	7.6	
184	80.0			3494	4.0	3.0	120	5.0	3.7	
185	79.9	70	0.090	3501	3.5	5.25	164	6.9	5.9	
186	80.1	70	0.125	2525	5.5	2.25	*	*	3.9	
187	80.1			2541	4.5	2.0	*	*	3.9	
188	79.8			2527	5.25	3.25	190	5.8	5.1	
189	79.7			2532	6.0	3.0	212	6.4	5.4	
190	79.7			2505	4.75	3.0	197	5.9	5.1	
191	79.8			2932	5.25	3.5	147	5.2	4.7	
192	79.9			3032	4.75	7.25	255	9.3	8.4	
193	80.1			3028	4.5	3.0	115	4.2	4.4	
194	79.9			3034	5.25	4.75	189	6.9	6.3	
195	80.1			3018	4.5	4.0	*	*	4.8	
196	80.1			3415	3.25	4.0	*	*	5.4	
197	79.8			3465	4.5	3.0	109	4.5	4.1	
198	79.9			3469	*	*	*	*	*	
199	79.8			3429	5.0	3.5	115	4.7	4.2	
200	80.0	70	0.125	3483	*	*	*	*	*	Not armed

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
201	79.9	80	0.063	2457	2.75	3.75	214	6.3	4.6	
202	79.6			2473	2.25	3.0	212	6.3	6.4	
203	79.7			2482	2.75	3.75	243	7.2	6.0	
204	79.7			2483	4.5	3.5	*	*	*	
205	79.8			2473	3.0	3.0	259	7.7	6.2	
206	79.8			2970	2.25	4.0	207	7.4	6.0	
207	80.0			2994	*	*	570	20.5	*	
208	80.1			2988	2.5	4.5	178	6.4	*	
209	79.0			2960	2.0	4.0	208	7.4	6.4	
210	79.9			2999	2.25	4.25	201	7.2	6.0	
211	79.8			3444	2.25	4.25	*	*	6.9	
212	79.7			3472	2.5	4.75	178	7.4	7.0	
213	79.8			3478	3.25	4.75	183	7.6	6.9	
214	79.9			3487	2.75	4.75	188	7.9	7.2	
215	80.1	80	0.063	3526	2.5	4.25	87	3.7	*	
216	80.2	80	0.090	2469	2.75	2.5	189	5.6	3.6	
217	79.9			2494	2.75	1.5	*	*	*	
218	80.0			2458	2.0	2.0	*	*	*	
219	79.7			2461	2.75	2.0	178	5.3	3.4	
220	80.2			2511	3.25	2.0	165	5.0	4.0	

TABLE 1. FUNCTION DELAY (CONTINUED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
221	79.8	80	0.090	2984	3.0	3.0	167	6.0	4.8	No function
222	80.0			*	*	*	*	*	*	
223	79.8			2968	2.75	2.5	152	5.4	4.3	
224	79.8			*	3.5	3.5	165	5.9	4.4	
225	80.0			*	*	*	*	*	*	
226	79.8			3483	3.25	5.0	169	7.1	*	Not armed
227	80.1			3394	*	*	*	*	*	
228	79.7			3435	3.0	3.75	*	*	4.5	
229	79.8			3419	1.75	5.5	137	5.6	*	
230	80.2	80	0.090	3490	*	*	*	*	*	
231	79.7	80	0.125	2511	*	*	*	*	*	
232	79.9			2625	3.5	2.0	*	*	3.2	
233	79.8			2467	2.0	4.0	*	*	*	
234	80.0			2484	3.5	3.0	178	5.3	*	
235	80.0			2509	4.0	2.0	*	*	0.2	
236	80.1			3008	1.75	3.0	136	4.9	*	
237	79.8			2990	3.0	4.0	142	5.1	*	
238	80.0			3015	3.0	3.5	139	5.0	*	
239	79.8			2969	2.75	4.25	161	5.7	*	
240	79.8			3018	3.5	4.0	157	5.7	*	

TABLE 1. FUNCTION DELAY (CONCLUDED)

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Witness Plate Delay (In)		Counter Delay		X-Ray Delay (In)	Remarks
					Vert	Horiz	Time (Msec)	Distance (In)		
241	80.1	80	0.125	3526	2.0	2.0	58	2.5	*	
242	79.8			3536	2.0	3.0	69	2.9	*	
243	80.4			3511	2.5	3.5	*	*	*	
244	80.1			3441	2.0	2.0	76	3.1	*	
245	79.9	80	0.125	3446	*	*	83	3.4	*	

For Shot Numbers 86 and 88:

- > The detonation time could not be accurately determined because the x-ray captured the projectile image a long time after projectile detonation. Therefore, a conservative estimate was used providing for a computed x-ray delay distance lower than expected.

TABLE 2. FUZE INTEGRITY

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Remarks
1	79.6	70	0.125	2545	BPSH ^a No x-ray
2	79.7	70	0.125	2521	Fuze body misaligned
3	79.5	70	0.125	2525	Fuze body misaligned
4	79.4	70	0.125	2574	Fuze body misaligned
5	79.7	70	0.125	2535	Fuze body misaligned
6	79.7	70	0.125	3531	Fuze body misaligned
7	79.4	70	0.125	3526	Fuze body misaligned
8	79.5	70	0.125	3520	Fuze body misaligned
9	79.5	70	0.125	3493	Intact
10	79.5	80	0.090	2492	Intact
11	79.7	80	0.090	2514	Fuze body misaligned
12	79.9	80	0.090	2558	BPSH ^a No x-ray
13	79.6	80	0.090	2511	BPSH ^a No x-ray
14	79.3	80	0.090	2515	BPSH ^a No x-ray
15	79.3	80	0.090	2539	BPSH ^a No x-ray
16	79.5	80	0.090	3532	Fuze body misaligned
17	79.6	80	0.090	3482	Fuze body misaligned
18	79.5	80	0.090	3475	Fuze body misaligned
19	79.6	80	0.125	2481	Fuze/projectile interface separation
20	79.4	80	0.125	2500 - No Vel	Fuze/projectile interface separation
21	79.3	80	0.125	3530	Fuze/projectile interface separation
22	79.4	80	0.125	3463	Fuze/projectile interface separation

^aBPSH - Back Plate Single Hole (Indicates that the projectile did not break up on impact.)

TABLE 3. FUZE SENSITIVITY

Shot No.	Proj Wt (Gm)	Impact Angle (Deg)	Target Thickness (In)	Proj Velocity (Ft/Sec)	Remarks
1	79.8	0	0.040	1437	Detonated at secondary target
2	80.2	0	0.040	1421	Detonated at secondary target
3	80.1	0	0.040	1531	Detonated after secondary target
4	80.2	0	0.040	1598	Detonated at secondary target
5	79.9	0	0.040	1532	Detonated at secondary target

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