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13. ABSTRACT (Maximum 200 words) <p>The intent of this testing was to reveal and confirm real Maximum Credible Events (MCE) on parked combat aircraft loaded with live air-to-air weapons. The MCE for a particular aircraft/load configuration is the largest instantaneous or practically instantaneous high-order detonation of explosives on the aircraft that can be expected as a result of a mishap. This was determined by conducting three series of sympathetic detonation tests for multiple missile types including 100-inch separation tests, rocket motor contribution tests, and aircraft configuration tests.</p>				
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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 46TH TEST WING (AFMC)  
EGLIN AIR FORCE BASE, FLORIDA

JUL 16 2002

MEMORANDUM FOR HQ AFSC/SEW  
ATTN: MR ERIC OLSON  
9700 G AVE SE  
KIRTLAND AFB NM 87117-5670

FROM: 46 OG/OGM  
205 West D Ave, Ste 241  
Eglin AFB FL 32542-6866

SUBJECT: AAC Letter Report 02-46, Maximum Credible Event Testing of Air Defense  
Weapon Loads, JON AFZE0025

**1. BACKGROUND.** The Air Force Safety Center, HQ AFSC/SEW, has requested that the 46th Test Wing, 46th Operations Group, Munitions Test Division, Weapons Test Flight, Ground Test Branch (46 OG/OGMTG), provide test support to determine the Maximum Credible Event (MCE) of air defense weapon loads. The intent of this testing is to reveal and confirm real MCEs on parked combat aircraft loaded with live air-to-air weapons. The MCE for a particular aircraft/load configuration is the largest instantaneous or practically instantaneous high-order detonation of explosives loaded on the aircraft that can credibly be expected as a result of a mishap. This was determined by conducting three series of sympathetic detonation tests for multiple missile types including 100-inch separation tests, rocket motor contribution tests, and aircraft configuration tests.

**2. OBJECTIVE 1.** Collect data to determine if a donor warhead will initiate a high-order sympathetic detonation in an acceptor warhead with 100 inches of separation.

**2.1. PROCEDURE.** Four different warheads, WDU-33/B, WDU-41/B, WAU-10/B, and WAU-17A/B, were tested to determine if a donor warhead will cause a high-order sympathetic detonation in an acceptor warhead. Three tests were conducted for each warhead type, giving a total number of 12 tests for this objective.

For each test, three warheads of the same type with the appropriate booster were aligned radially 48 inches above the ground and 100 inches apart (Figure 1). The warhead in the center was designated as the donor. The only difference in test setup procedures for the different warhead types was that the WDU-33/B and the WAU-17A/B warhead donors were positioned so that a row of fragments on the outside of the casing were lined up with the acceptor warheads. Since the WDU-33/B and the WAU-17A/B warheads had 33 fragment rows, the donor warhead was elevated by approximately 5 inches so that a fragment row could be aligned with each acceptor. All donor warheads were detonated with an RP-83.

A 4-foot by 8-foot by 1/2-inch-thick steel witness plate was placed under each warhead, with the 8-foot length perpendicular to the warhead axis, to aid in determining if a high-order detonation occurred for that warhead. Two rows of pressure gauges were placed 0° and 180° from the side of the donor warhead to record blast pressure and to aid in determining if multiple detonations occurred if the physical evidence was not conclusive. The pressure gauges were placed at distances determined by the Department of Defense Explosives Safety Board Blast Effects Computer Version 5.0 to produce 10, 5, 1, and 0.5 psi for each warhead type. Since each warhead type has a different net explosive weight, the pressure gauges were located at different distances from the center of the arena for the different warheads. The distances of the pressure gauges for each warhead type are listed in Table 1. Before any testing was conducted with the warheads, 11.25 pounds of C-4 were detonated to get a pressure reflectivity value of the range. High-speed video was utilized to document the test and serve as an additional tool to aid in determining if a sympathetic high-order detonation of an acceptor warhead had occurred.

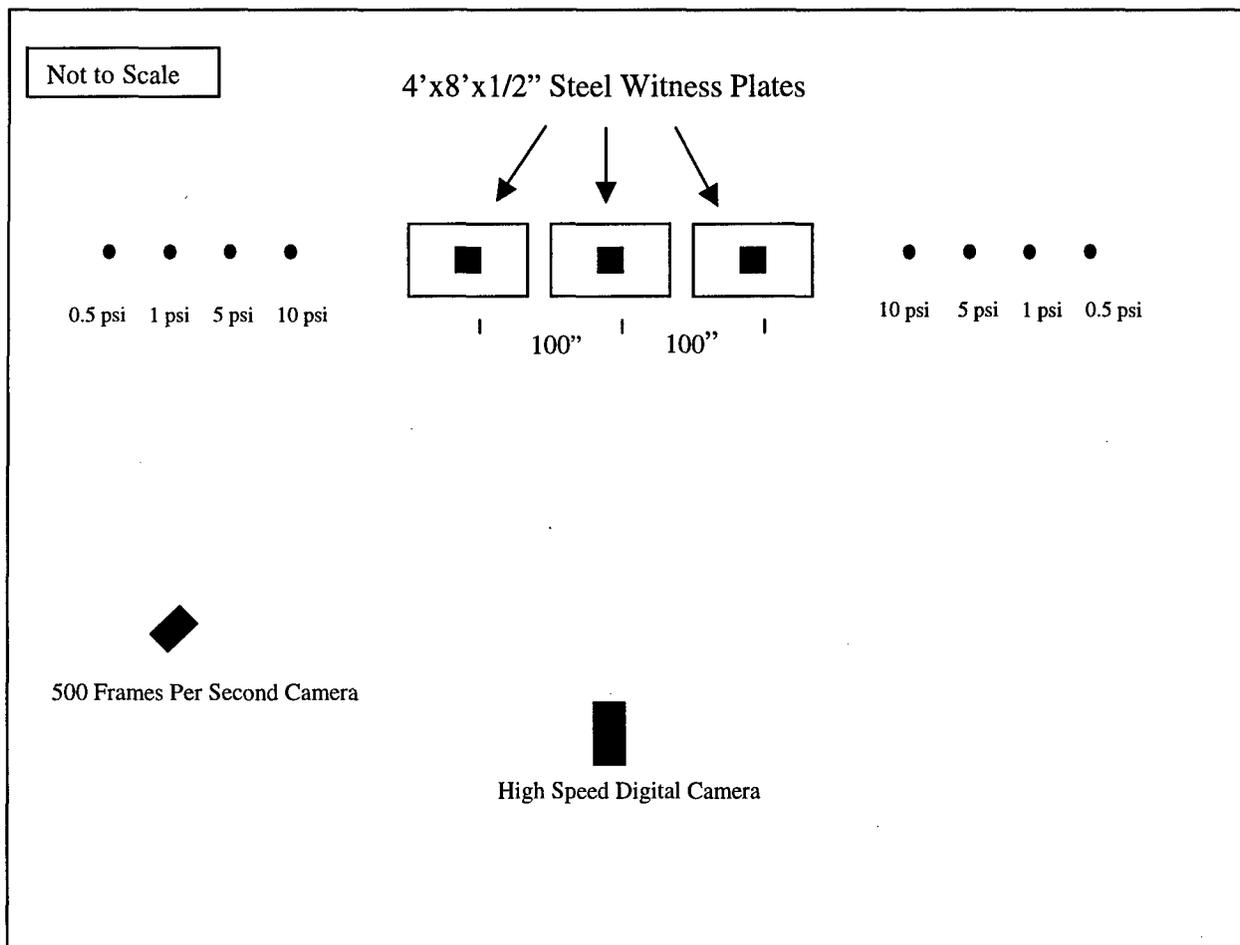


Figure 1. Test Setup

Table 1. Pressure Gauge Distance From Arena Center

Warhead Type	10 PSI Gauge	5 PSI Gauge	1 PSI Gauge	0.5 PSI Gauge
WDU-33/B	22.8 ft	32.1 ft	85.0 ft	130.0 ft
WDU-41/B	25.3 ft	35.7 ft	93.7 ft	143.7 ft
WAW-10	26.7 ft	37.7 ft	99.7 ft	152.8 ft
WAW-17	33.0 ft	46.5 ft	122.2 ft	187.3 ft

**2.2 RESULTS.** The physical evidence for each warhead test was sufficient to determine that no sympathetic detonations occurred during this series of testing. At the request of AFSC/SEW, the location of the fragment impacts on the donor witness plate from the first test of each warhead type was documented. These data are shown in the Attachment. A breakdown of results by individual test follows.

**2.2.1 WDU-33/B Test 1.** Both acceptor warheads were found near the test setup. The left acceptor was penetrated by fragments, which caused the PBX-108 to burn out completely (Figure 2). The warhead burned on the ground for approximately 10 minutes after the test. The right acceptor was found with some abrasions, but was not penetrated (Figure 3).

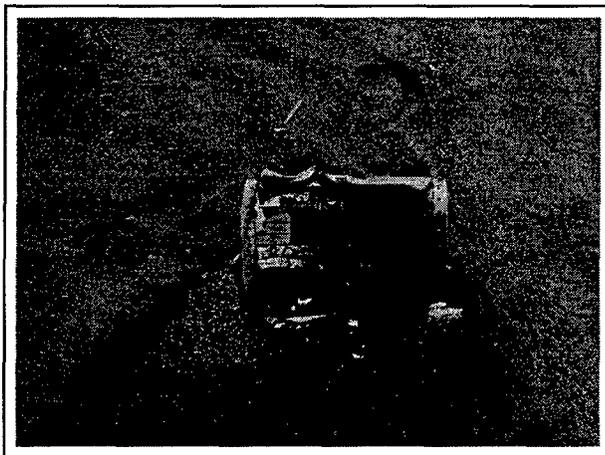


Figure 2. WDU-33/B-1 Left Acceptor

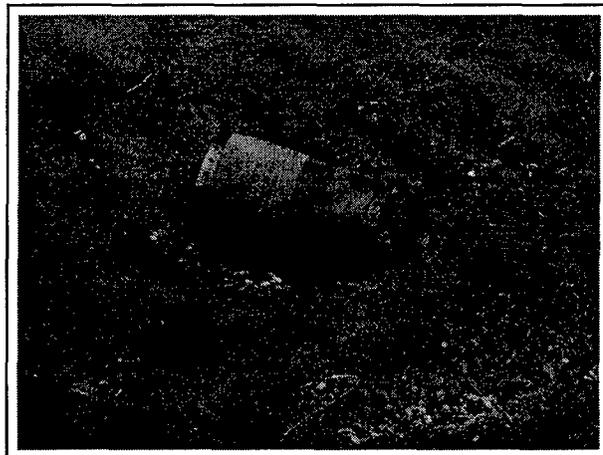


Figure 3. WDU-33/B-1 Right Acceptor

**2.2.2 WDU-33/B Test 2.** Both acceptor warheads were found near the test setup. Both acceptors were penetrated by fragments, which caused the PBX-108 to burn out completely (Figures 4 and 5). The warheads burned on the ground for approximately 10 minutes after the test.



Figure 4. WDU-33/B-2 Left Acceptor



Figure 5. WDU-33/B-2 Right Acceptor

**2.2.3 WDU-33/B Test 3.** Both acceptor warheads were found near the test setup. Both acceptors were found with some abrasions, but were not penetrated (Figures 6 and 7).

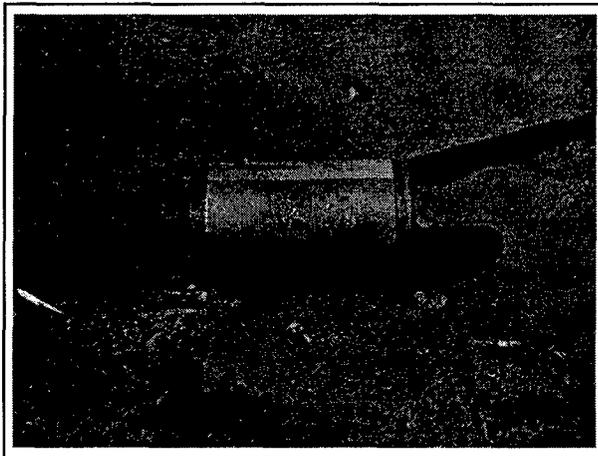


Figure 6. WDU-33-3/B Left Acceptor

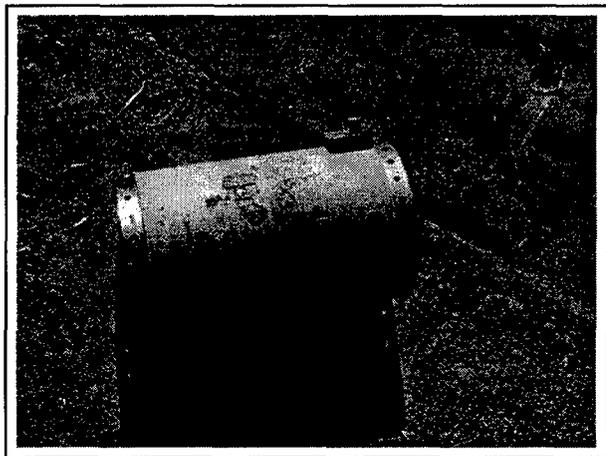


Figure 7. WDU-33/B-3 Right Acceptor

**2.2.4 WDU-41/B Test 1.** Both acceptor warheads were found near the test setup. Both acceptors were penetrated by fragments, which caused the PBXN-110 to burn out completely (Figures 8 and 9). The warheads burned on the ground for approximately 10 minutes after the test.



Figure 8. WDU-41/B-1 Left Acceptor



Figure 9. WDU-41/B-1 Right Acceptor

**2.2.5 WDU-41/B Test 2.** Both acceptor warheads were found near the test setup. The left acceptor was found with some abrasions, but was not penetrated (Figure 10). The right acceptor was penetrated by fragments, which caused the PBXN-110 to burn out completely (Figure 11). The warheads burned on the ground for approximately 10 minutes after the test. .

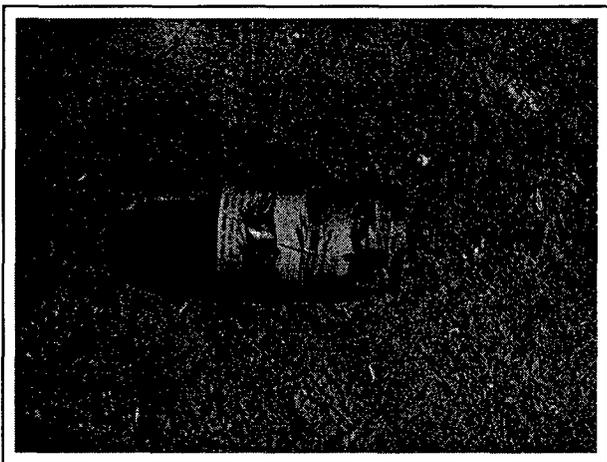


Figure 10. WDU-41/B-2 Left Acceptor

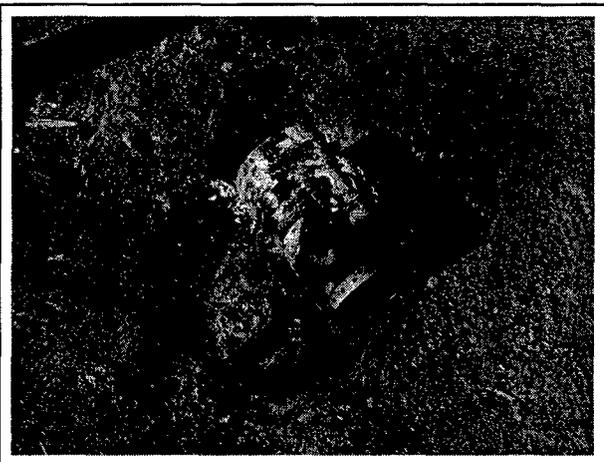


Figure 11. WDU-41/B-2 Right Acceptor

**2.2.6 WDU-41/B Test 3.** Both acceptor warheads were found near the test setup. Both acceptors were penetrated by fragments, which caused the PBXN-110 to burn out completely (Figures 12 and 13). The warheads burned on the ground for approximately 10 minutes ground after the test.



Figure 12. WDU-41/B-3 Left Acceptor



Figure 13. WDU-41/B-3 Right Acceptor

**2.2.7 WAU-17A/B Test 1.** Both acceptor warheads were hit and penetrated by fragments (Figures 14 and 15). Both warhead pieces shown in Figure 14, and two of the pieces shown in Figure 15 were found within 50 feet of the target center. A third piece from Figure 15 was found approximately 400 feet from target center. PBXN-3 was found scattered around the test setup.



Figure 14. WAU-17A/B-1 Left Acceptor

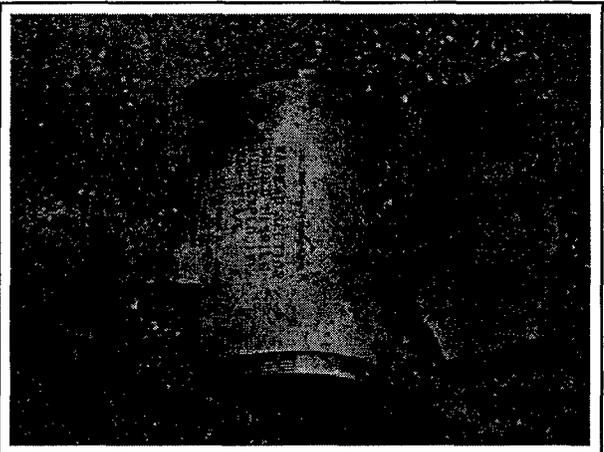


Figure 15. WAU-17A/B-1 Right Acceptor

**2.2.8 WAU-17A/B Test 2.** Both acceptor warheads were found near the test setup with some abrasions, but were not penetrated (Figures 16 and 17).

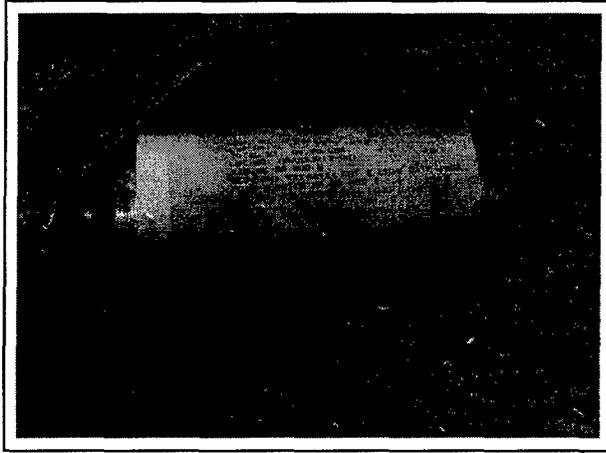


Figure 16. WAU-17A/B-2 Left Acceptor



Figure 17. WAU-17A/B-2 Right Acceptor

**2.2.9 WAU-17A/B Test 3.** Both acceptor warheads were hit and penetrated by fragments (Figures 18 and 19). The pieces for both warheads were found up to approximately 600 feet away from the test setup. Since the warheads from this test were broken up more than those in any other test, and much of the warhead casing was not found, the PBXN-3 was collected and weighed. Approximately 8.5 lbs of PBXN-3 were collected on the left side of the test setup, and 17.5 lbs of PBXN-3 were collected on the right side.



Figure 18. WAU-17A/B-3 Left Acceptor

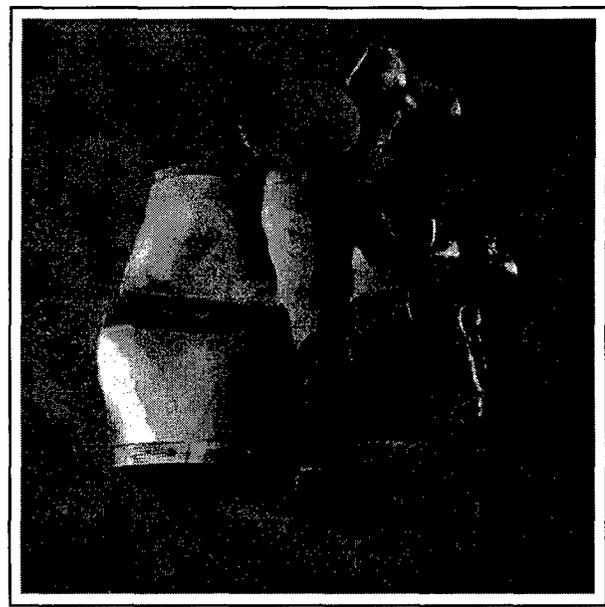


Figure 19. WAU-17A/B-3 Right Acceptor

**2.2.10 WAU-10/B Test 1.** Both acceptor warheads were hit and penetrated by fragments (Figures 20 and 21). The PBXN-4 was found scattered on the ground near the warheads and inside the warhead cases. Neither warhead burned after the donor detonation.



Figure 20. WAU-10/B-1 Left Acceptor



Figure 21. WAU-10/B-1 Right Acceptor

**2.2.11 WAU-10/B Test 2.** Both acceptor warheads were hit and penetrated by fragments (Figures 22 and 23). The PBXN-4 was found scattered on the ground near the warheads and inside the warhead cases. Neither warhead burned after the donor detonation.

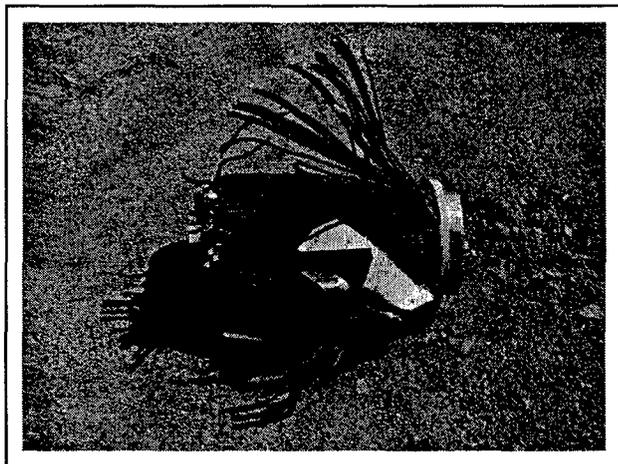


Figure 22. WAU-10/B-2 Left Acceptor



Figure 23. WAU-10/B-2 Right Acceptor

**2.2.12 WAU-10/B Test 3.** Both acceptor warheads were hit and penetrated by fragments (Figures 24 and 25). The PBXN-4 was found scattered on the ground near the warheads and inside the warhead cases. Neither warhead burned after the donor detonation.



Figure 24. WAU-10/B-3 Left Acceptor

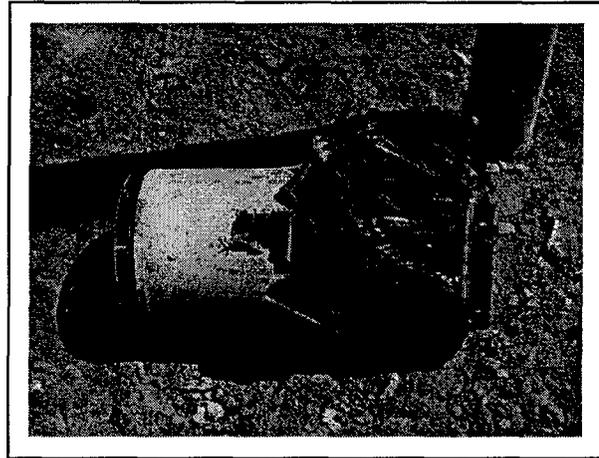


Figure 25. WAU-10/B-3 Right Acceptor

**3. OBJECTIVE 2.** Collect data to determine if a donor warhead will initiate a high-order sympathetic detonation in an acceptor rocket motor.

**3.1. PROCEDURE.** AFSC/SEW determined that the worst-case warhead/rocket motor scenario for an air-to-air combat load was an AIM-120 loaded on station 2B and an AIM-7 loaded on station 3 of an F-15A-D. The WDU-33/B warhead from the AIM-120 and the MK-58 rocket motor from the AIM-7 were positioned 48 inches high and relative to each other in the same manner that they would be on the selected F-15 configuration (Figure 26). The overall test setup was similar to that in Figure 1 with the WDU-33/B donor being set as the test center.

A 4-foot by 8-foot by 1/2-inch-thick steel witness plate was placed under the WDU-33/B warhead, with the 8-foot length perpendicular to the warhead axis. A 4-foot by 8-foot by 1/8-inch-thick steel witness plate was placed under the MK-58 Rocket Motor, with the 8-foot length perpendicular to the rocket motor axis, to aid in determining if a high-order detonation occurred. Two rows of pressure gauges were placed 0° and 180° from the side of the WDU-33/B to record blast pressure and to aid in determining if the rocket motor had a pressure contribution. The pressure gauges were placed at distances determined by the Department of Defense Explosives Safety Board Blast Effects Computer Version 5.0 to produce 10, 5, 1, and 0.5 psi for the WDU-33/B. High-speed video was utilized to document the test, and serve as an additional tool to aid in determining if a sympathetic high-order detonation of the MK-58 rocket motor had occurred. A MK-44 booster was placed in the WDU-33/B booster cup and detonated with an RP-83. The rocket motor was secured by attaching a cable to its aft end. This test was completed three times.

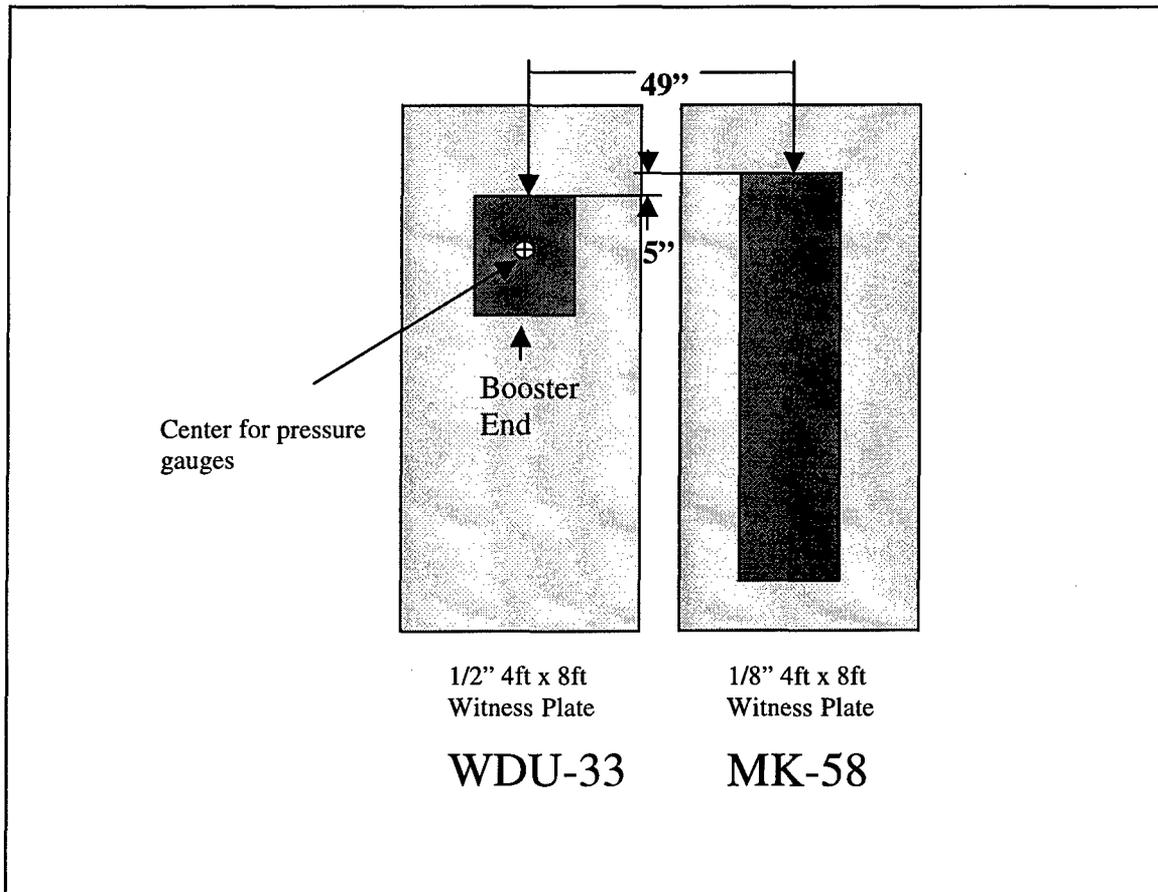


Figure 26. Warhead/Rocket Motor Positioning

**3.2 RESULTS.** The results were essentially the same for all three tests for this objective. The detonation of the WDU-33/B resulted in fragments penetrating into the MK-58 rocket motor causing the propellant in the rocket motor to ignite. The propellant burned for approximately 1 minute after the detonation, then continued to smoke and smolder for approximately 10 more minutes. Several pieces of the rocket motor case from the area where the WDU-33/B fragments hit the rocket motor were found up to 300 feet away from target center. Figures 27-29 show the remains of the rocket motor after each test. The physical evidence for each test was sufficient to determine that no sympathetic detonations occurred during this series of testing.



Figure 27. MK-58 Case, Test 1

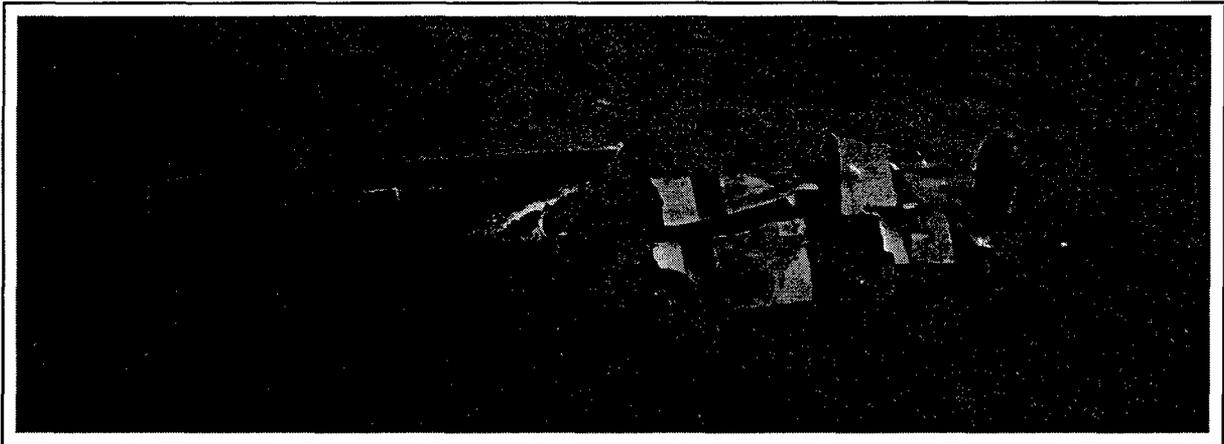


Figure 28. MK-58 Case, Test 2



Figure 29. MK-58 Case, Test 3

**4. Objective 3.** Collect data to determine if a donor warhead will initiate a high-order sympathetic detonation in an acceptor warhead when placed to represent actual aircraft configurations.

**4.1 Procedure.** AFSC/SEW determined that the worst-case adjacent warhead scenario for an air-to-air combat load was an AIM-120 loaded on station 2 and an AIM-120 loaded on station 3 of an F-16. The AIM-120 warheads were positioned 48 inches high and relative to each other in the same manner that they would be on the selected F-16 configuration (Figure 30). The overall test setup was similar to that in Figure 1 with the WDU-33/B donor being set as the test center.

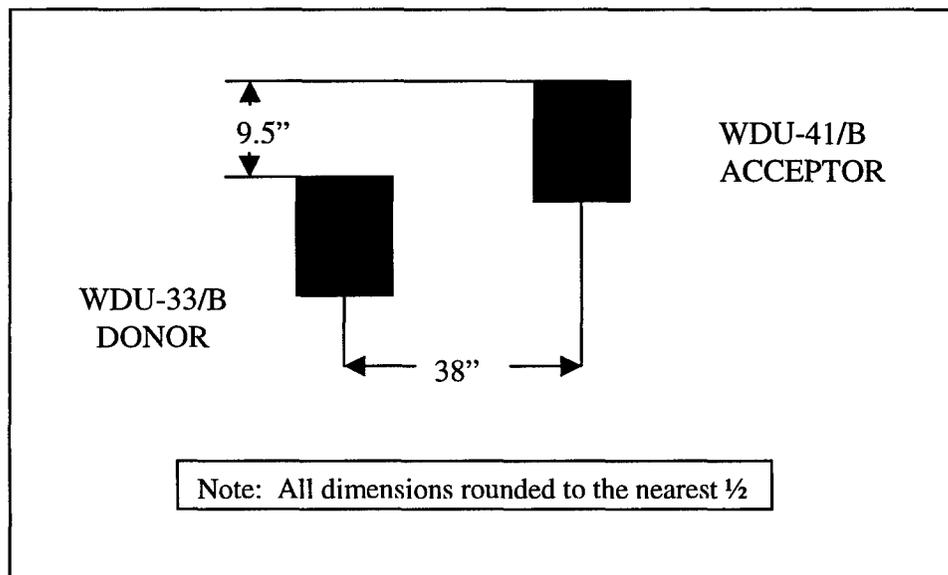


Figure 30. Warhead Configuration for Aircraft Configuration Test

A 4-foot by 8-foot by 1/2-inch-thick steel witness plate was placed under each warhead, with the 8-foot length perpendicular to the warhead axis, to determine if a high-order detonation occurred. Two rows of pressure gauges were placed 0° and 180° from the side of the WDU-33/B to record blast pressure and aid in determining if a high-order detonation occurred in the acceptor warhead. The pressure gauges were placed at distances determined by the Department of Defense Explosives Safety Board Blast Effects Computer Version 5.0 to produce 10, 5, 1, and 0.5 psi for the WDU-33/B. High-speed video was utilized to document the test and serve as an additional tool to aid in determining if a sympathetic high-order detonation of the acceptor warhead had occurred. A MK-44 booster was placed in each warhead booster cup, and the donor was detonated with an RP-83. This test was completed three times.

**4.2 RESULTS.** The physical evidence for each warhead test was sufficient to determine that no sympathetic detonations occurred during this series of testing. The acceptor warheads from the first two tests of this series were penetrated by multiple fragments and burned. The acceptor warhead case from the third test of this series was hit by fragments and split open allowing the PBXN-110 to fall out. Photographs of the acceptor warheads after the donor detonation are shown in Figures 31-33



Figure 31. Aircraft Configuration Test 1 Acceptor Warhead



Figure 32. Aircraft Configuration Test 2 Acceptor Warhead



Figure 33. Aircraft Configuration Test 3 Acceptor Warhead

**5. CONCLUSIONS.** Based on the physical evidence from each individual warhead test and rocket motor test, no sympathetic high-order detonations occurred with any of the acceptor warheads or rocket motors. The witness plates, pressure data, and video support the determination that no sympathetic high-order detonations occurred. All photographs and pressure data from these tests were given to the customer, HQ AFSC/SEW.

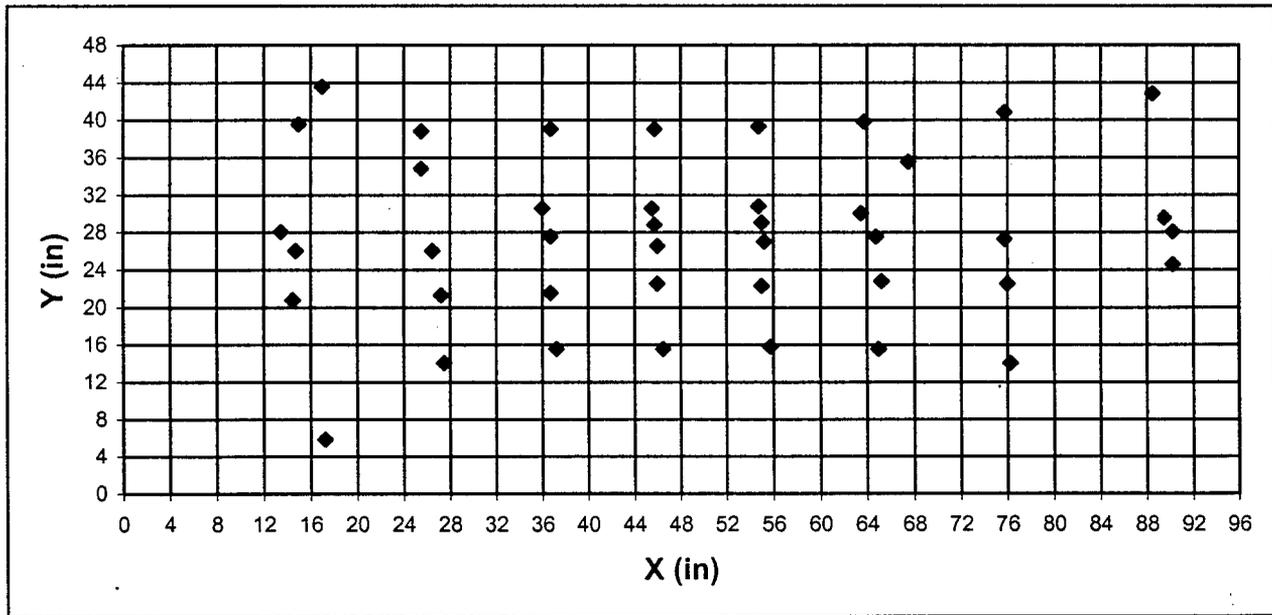
*Thomas C. Lamonica*

THOMAS C. LAMONICA  
Acting Technical Director  
Munitions Test Division

**ATTACHMENT to AAC LR 02-46  
FRAGMENT IMPACT SCORE DATA**

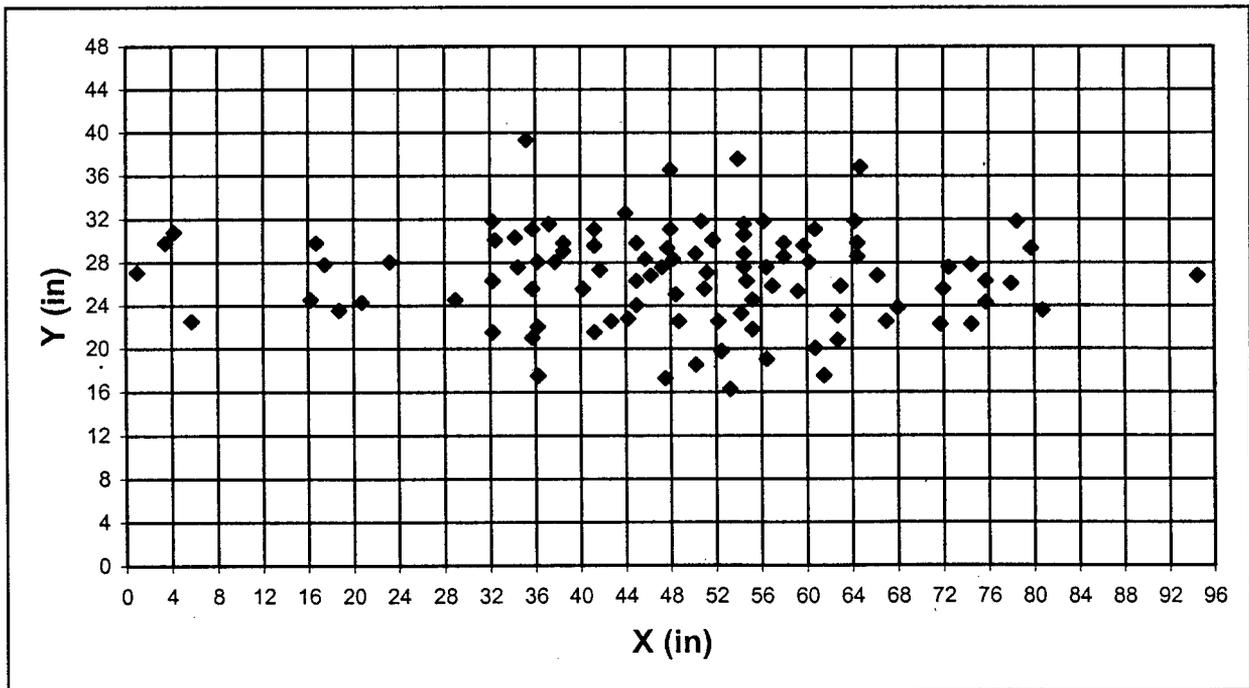
**WDU-33/B FRAGMENT PENETRATION LOCATIONS**

X (in)	Y (in)	X (in)	Y (in)	X (in)	Y (in)
17.25	5.75	13.50	28.00	89.50	29.50
27.50	14.00	26.50	26.00	15.00	39.50
37.25	15.50	36.75	27.50	25.50	34.75
46.50	15.50	36.00	30.50	25.50	38.75
55.75	15.75	46.00	26.50	36.75	39.00
65.00	15.50	45.75	28.75	45.75	39.00
76.25	14.00	45.50	30.50	54.75	39.25
14.50	20.75	55.25	27.00	63.75	39.75
27.25	21.25	55.00	29.00	67.50	35.50
36.75	21.50	54.75	30.75	75.75	40.75
46.00	22.50	64.75	27.50	17.00	43.50
55.00	22.25	63.50	30.00	88.50	42.75
65.25	22.75	75.75	27.25	---	---
76.00	22.50	90.25	24.50	---	---
14.75	26.00	90.25	28.00	---	---



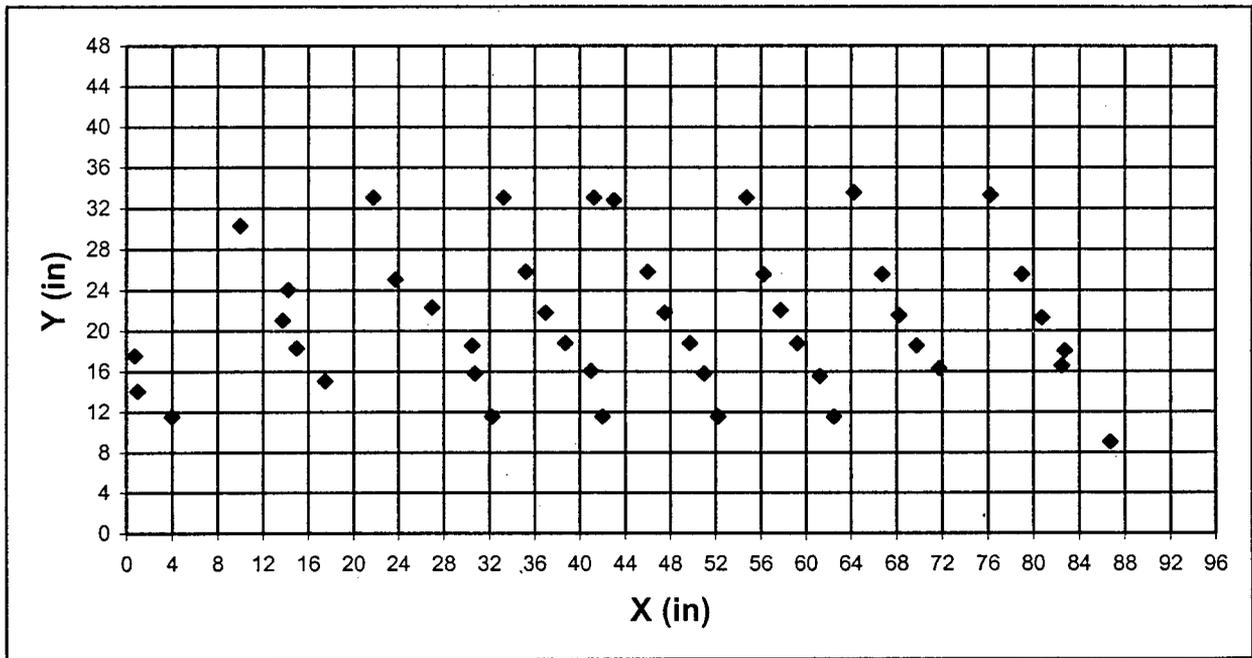
### WDU-41/B FRAGMENT PENETRATION LOCATIONS

X (in)	Y (in)						
5.75	22.50	74.50	22.25	75.75	26.25	50.75	31.75
16.25	24.50	80.75	23.50	78.00	26.00	51.75	30.00
18.75	23.50	94.50	26.75	3.50	29.75	54.75	26.25
20.75	24.25	1.00	27.00	4.25	30.75	54.50	27.50
29.00	24.50	16.75	29.75	32.50	30.00	54.50	28.75
32.25	21.50	17.50	27.75	32.25	31.75	54.50	30.50
36.25	17.50	23.25	28.00	34.50	27.50	54.50	31.50
35.75	21.00	32.25	26.25	34.25	30.25	56.50	27.50
36.25	22.00	35.75	25.50	36.25	28.00	56.25	31.75
41.25	21.50	40.25	25.50	35.75	31.00	54.00	37.50
42.75	22.50	45.00	26.25	37.25	31.50	58.00	28.50
44.25	22.75	46.25	26.75	37.75	28.00	58.00	29.75
45.00	24.00	41.75	27.25	38.50	29.00	60.25	28.00
48.75	22.50	47.25	27.50	38.50	29.75	59.75	29.50
47.50	17.25	48.50	25.00	41.25	29.50	60.75	31.00
50.25	18.50	51.00	25.50	35.25	39.25	64.50	28.50
52.50	19.75	52.25	22.50	41.25	31.00	64.50	29.75
53.25	16.25	54.25	23.25	44.00	32.50	64.25	31.75
55.25	21.75	55.25	24.50	45.00	29.75	64.75	36.75
56.50	19.00	57.00	25.75	45.75	28.25	72.50	27.50
60.75	20.00	59.25	25.25	48.00	36.50	74.50	27.75
62.75	20.75	61.50	17.50	48.25	28.25	79.75	29.25
62.75	23.00	63.00	25.75	47.75	29.25	78.50	31.75
67.00	22.50	66.25	26.75	48.00	31.00	---	---
68.00	23.75	72.00	25.50	50.25	28.75	---	---
71.75	22.25	75.75	24.25	51.25	27.00	---	---



### WAU-17A/B FRAGMENT PENETRATION LOCATIONS

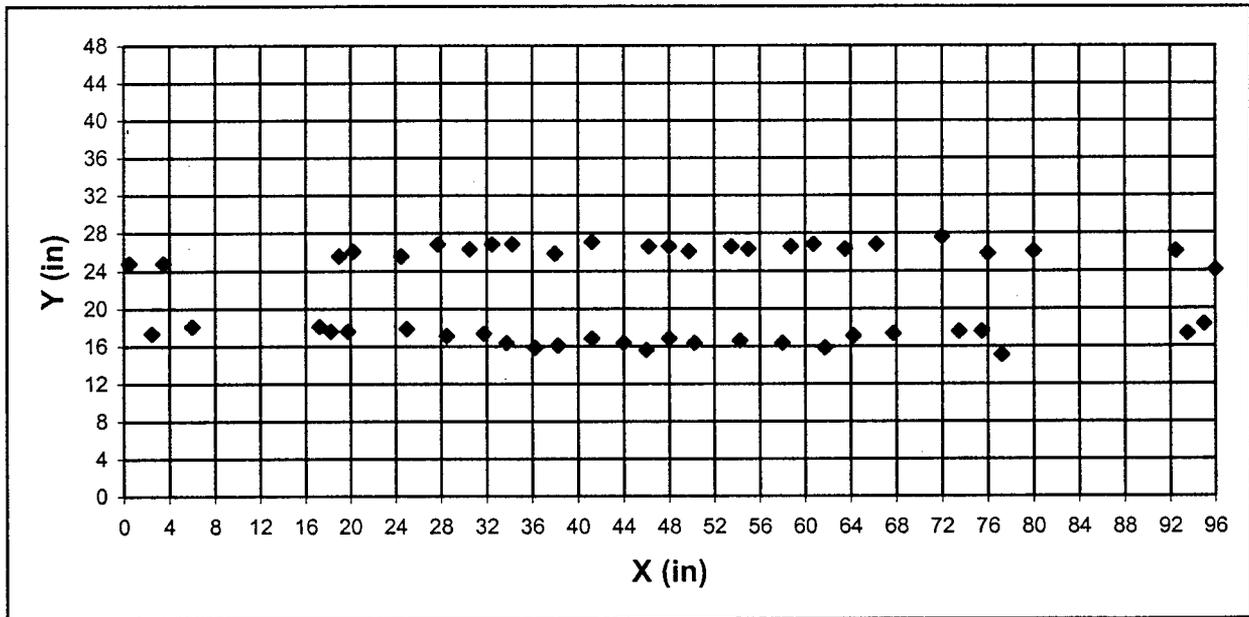
X (in)	Y (in)	X (in)	Y (in)	X (in)	Y (in)
4.00	11.50	82.50	16.50	80.75	21.25
32.25	11.50	71.75	16.25	35.25	25.75
42.00	11.50	61.25	15.50	46.00	25.75
52.25	11.50	51.00	15.75	56.25	25.50
62.50	11.50	41.00	16.00	66.75	25.50
86.75	9.00	30.75	15.75	79.00	25.50
1.00	14.00	15.00	18.25	10.00	30.25
0.75	17.50	13.75	21.00	21.75	33.00
17.50	15.00	14.25	24.00	33.25	33.00
30.50	18.50	27.00	22.25	41.25	33.00
38.75	18.75	23.75	25.00	43.00	32.75
49.75	18.75	37.00	21.75	54.75	33.00
59.25	18.75	47.50	21.75	64.25	33.50
69.75	18.50	57.75	22.00	76.25	33.25
82.75	18.00	68.25	21.50	---	---



## WAU-10/B FRAGMENT PENETRATION LOCATIONS

**Note: These locations are for the corners of the continuous expanding rod**

X (in)	Y (in)	X (in)	Y (in)	X (in)	Y (in)
2.50	17.25	58.00	16.25	46.25	26.50
6.00	18.00	61.75	15.75	48.00	26.50
17.25	18.00	64.25	17.00	49.75	26.00
18.25	17.50	67.75	17.25	53.50	26.50
19.75	17.50	73.50	17.50	55.00	26.25
25.00	17.75	75.50	17.50	58.75	26.50
28.50	17.00	0.50	24.75	60.75	26.75
31.75	17.25	3.50	24.75	63.50	26.25
33.75	16.25	19.00	25.50	66.25	26.75
36.25	15.75	20.25	26.00	72.00	27.50
38.25	16.00	24.50	25.50	76.00	25.75
41.25	16.75	27.75	26.75	77.25	15.00
44.00	16.25	30.50	26.25	93.50	17.25
46.00	15.50	32.50	26.75	95.00	18.25
48.00	16.75	34.25	26.75	80.00	26.00
50.25	16.25	38.00	25.75	92.50	26.00
54.25	16.50	41.25	27.00	96.00	24.00





DEPARTMENT OF THE ARMY  
US ARMY MEDICAL RESEARCH AND MATERIEL COMMAND  
504 SCOTT STREET  
FORT DETRICK, MARYLAND 21702-5012

REPLY TO  
ATTENTION OF:

MCMR-RMI-S (70-1y)

1 Apr 03

MEMORANDUM FOR Administrator, Defense Technical Information  
Center (DTIC-OCA), 8725 John J. Kingman Road, Fort Belvoir,  
VA 22060-6218

SUBJECT: Request Change in Distribution Statement

1. The U.S. Army Medical Research and Materiel Command has reexamined the need for the limitation assigned to technical reports written for this Command. Request the limited distribution statement for the enclosed accession document numbers be changed to "Approved for public release; distribution unlimited." Copies of these reports should be released to the National Technical Information Service.

2. Point of contact for this request is Ms. Judy Pawlus at DSN 343-7322 or by e-mail at judy.pawlus@det.amedd.army.mil.

FOR THE COMMANDER:

Encl

  
PHYLLIS M. RINEHART  
Deputy Chief of Staff for  
Information Management

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