FINAL REPORT
MARCH 1992

REPORT NO. 92-06

M621 PLASTIC CONTAINER PERFORMANCE ORIENTED PACKAGING (POP) TEST

Prepared for:
U.S. Army Armament Research,
Development and Engineering Center
ATTN: SMCAR-ESK
Rock Island, IL 61299-7300

Distribution Unlimited

VALIDATION ENGINEERING DIVISION
SAVANNA, ILLINOIS 61074-9639

U.S. ARMY
ARMAMENT
MUNITIONS
CHEMICAL COMMAND
U.S. ARMY DEFENSE AMMUNITION
CENTER AND SCHOOL

AVAILABILITY NOTICE

A copy of this report will be furnished each attendee on automatic distribution. Additional copies or authority for reprinting may be obtained by written request from Director, U.S. Army Defense Ammunition Center and School, ATTN: SMCAC-DEV, Savanna, IL 61074-9639.

DISTRIBUTION INSTRUCTIONS

Destroy this report when no longer needed. Do not return.

***

Citation of trade names in this report does not constitute an official endorsement.

***

The information contained herein will not be used for advertising purposes.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT UNLIMITED
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 92-06	5. MONITORING ORGANIZATION REPORT NUMBER(S)

6a. NAME OF PERFORMING ORGANIZATION U.S. Army Defense Ammunition Center and School	6b. OFFICE SYMBOL (if applicable) SMCAC-DEV	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) ATTN: SMCAC-DEV Savanna, IL 61074-9639		7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION U.S. Army Armament Research, Development and Engineering Center	8b. OFFICE SYMBOL (if applicable) SMCAR-ESK	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) ATTN: SMCAR-ESK Rock Island, IL 61299-7300		10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO	WORK UNIT ACCESSION NO

11. TITLE (Include Security Classification)
M621 Plastic Container Performance Oriented Packaging (POP) Test

12. PERSONAL AUTHOR(S)
Jason B. Solberg

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Final	FROM ——— TO ———	1992 March	

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to test the M621 container. This report contains the procedures, results, and recommendations from the Performance Oriented Packaging (POP) testing conducted. As tested, the M621 container successfully passed level II packaging requirements for POP testing.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT XX UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
JEROME H. KROHN	815-273-8929	SMCAC-DEV

DD Form 1473, Jun 86 — Previous editions are obsolete

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
VALIDATION ENGINEERING DIVISION
SAVANNA, IL 61074-9639

REPORT NO. 92-06

M621 PLASTIC CONTAINER
PERFORMANCE ORIENTED PACKAGING (POP) TEST

TABLE OF CONTENTS

PART I

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to perform Performance Oriented Packaging (POP) testing on the M621 container.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of this series of tests was to verify that M621 containers meet United Nations (UN) POP, level II, packaging requirements for transportation and storage of hazardous materiels.

D. CONCLUSION. As tested, the M621 container passed level II packaging requirements for POP tests. Although some damage occurred during the corner drop test, there was not enough damage to adversely effect the performance of the container.

E. RECOMMENDATION. As the engineering test showed, the M621 container may not be sufficient for level I packaging, since the container catastrophically failed the 6-foot drop test.

PART 2

22-24 and 27-28 JANUARY 1992; 11 FEBRUARY 1992

ATTENDEES

Jason B. Solberg General Engineer DSN 585-8079 815-273-8079	Director U.S. Army Defense Ammunition Center and School ATTN: SMCAC-DEV Savanna, IL 61074-9639
William R. Meyer General Engineer DSN 585-8090 815-273-8090	Director U.S. Army Defense Ammunition Center and School ATTN: SMCAC-DEV Savanna, IL 61074-9639
Steven L. Von Thun Engineering Draftsman DSN 585-8093 815-273-8093	Director U.S. Army Defense Ammunition Center and School ATTN: SMCAC-DEV Savanna, IL 61074-9639

PART 3

TEST PROCEDURES

PERFORMANCE ORIENTED PACKAGING TESTING. Test procedures outlined herein were summarized from the Federal Register, Volume 55, Rules and Regulations, section 178.601 - 178.606. This publication identifies the steps that a package must undergo to be considered acceptable for POP requirements. The tests that were conducted on the test specimens are synopsized below.

A. STACKING TEST. Three test samples were required for each different packaging. The test sample must be subjected to a force applied to the top surface of the test sample equivalent to the total weight of identical packages which might be stacked on it during transport. The minimum height of the stack, including the test sample, must be 3.0 meters (10 feet). The jerricans and composite packaging 6HH, intended for liquids, were subjected to the stacking test for a period of 28 days at a temperature of not less than 40 degrees Centigrade (104 degrees Fahrenheit).

B. VIBRATION TEST.

1. Three sample packagings, selected at random, were filled and closed as for shipment. The three samples were placed on a vibrating platform that has a vertical double-amplitude (peak-to-peak displacement) of one inch. The packages were constrained horizontally to prevent them from falling off the platform, but were left free to move vertically, bounce, and rotate.

2. The test was performed for one hour at a frequency that caused the package to be raised from the vibrating platform to such a degree that a piece of material of approximately 1.6mm (0.063-inch) thickness could be passed between the bottom of any package and the platform.

C. DROP TEST. The test samples were filled to 96 percent of their capacity for solids and 98 percent in the case of liquids, with the inert material being of equal or higher specific gravity than normally filled the package. Paper and fiberboard containers were preconditioned for a period of 24 hours before testing. Plastic containers were preconditioned to -18.0 degrees Centigrade (0 degrees Fahrenheit) before testing. Drop height for packing group I was 5.9 feet, packaging group II was 3.9 feet, and packaging group III was 3 feet. For containers containing specific gravity exceeding 1.2 the drop height for packaging group I was 4.9 feet, packaging group II was 3 feet, and packaging group III was 2.2 feet. The number of containers dropped and the drop orientation are as follows:

Type	Number	Orientation
Drums	3	Containers must strike the target diagonally on the chime or circumferential seem or edge.
	3	Containers must strike the target on the weakest point not tested by the first drop such as closure, seam on drum body, etc.
Boxes	1	Flat to the bottom.
	1	Flat to the top.
	1	Flat to the long side.
	1	Flat on the short side.
	1	On the container corner.

PART 4

TEST EQUIPMENT

A. TEST SPECIMEN.

1. Description:	M621 Container
2. Height:	14.25 inches (36.20cm)
3. Width:	5.75 inches (14.60cm)
4. Length:	13.75 inches (34.92cm)
5. Weight:	55 pounds (25kg)

B. COMPRESSION TESTER.

1. Manufacturer:	Ormond Manufacturing
2. Platform:	60 inches by 60 inches
3. Compression Limit:	50,000 pounds
4. Tension Limit:	50,000 pounds

C. TRANSPORTATION SIMULATOR.

1. Manufacturer:	Gaynes Laboratory
2. Capacity:	6,000-pound pallet
3. Displacement:	1/2-inch Amplitude
4. Speed:	50 to 400 rpm
5. Platform:	5 foot by 8 foot

PART 5

TEST RESULTS

A. STACKING TEST. During the stacking test, two M621 containers were subjected to 730 pounds compression to the top of the container to simulate an equivalent 16-foot-high stack. One container was subjected to 1,960 pounds to the side to attempt to simulate a "worst case" orientation. The 1,960-pound load was also used to simulate a 16-foot-high stack. No damage was noted during the stacking test.

B. VIBRATION TEST. During the vibration test, tnree M621 containers were vibrated for 1 hour each at 250 rpm to provide a .063-inch gap under the containers. Each container was oriented with a different face against the vibration table. No damage was noted during the vibration test.

C. DROP TEST. Five containers were then drop tested after temperature conditioning to approximately 0 degrees Fahrenheit oriented to impact to the top, the bottom, the long side, the short side, and a corner of the containers from a height of 3.9 feet. The exact preconditioning temperatures at the times immediately before the drop tests are shown below.

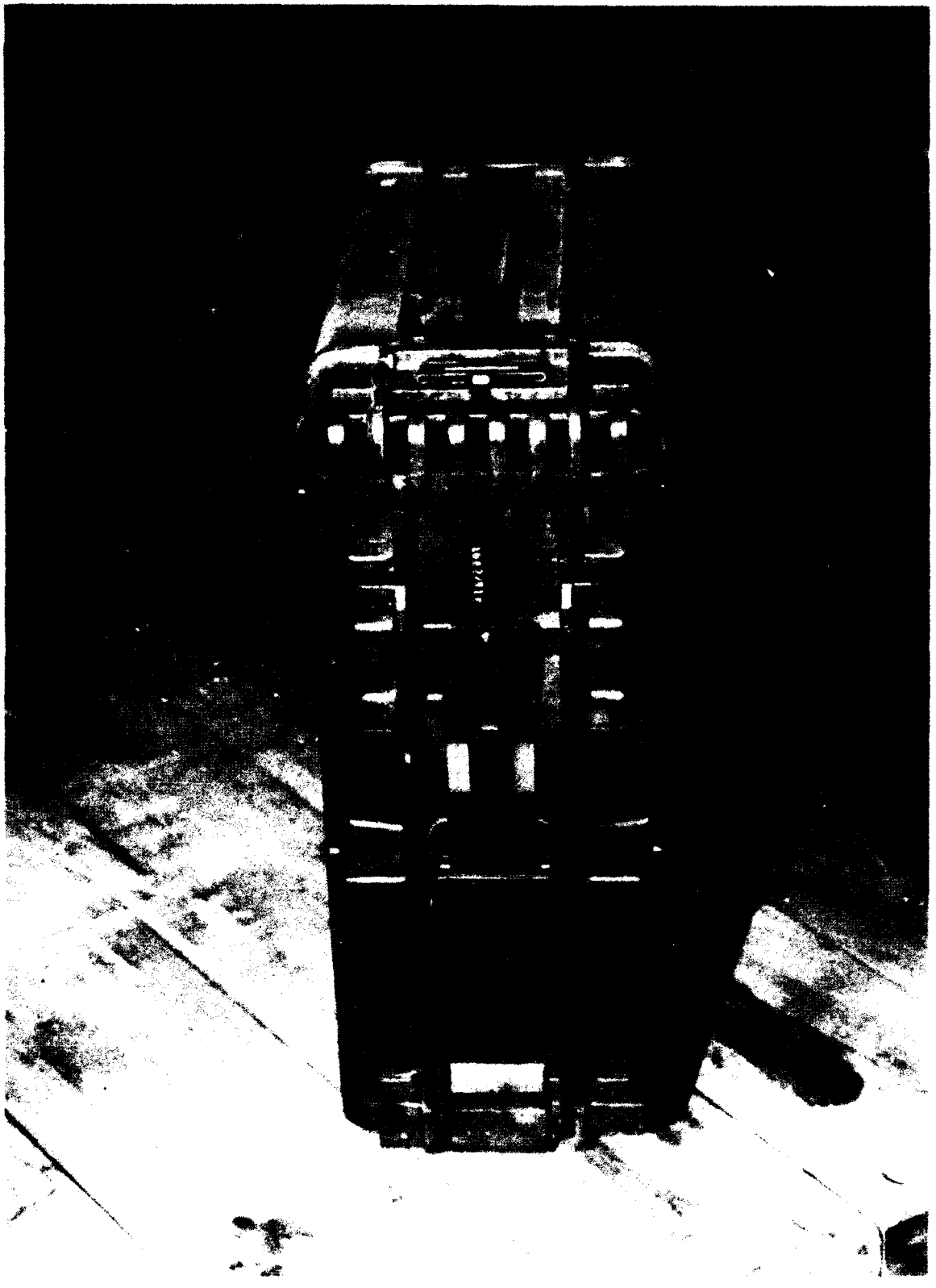
Results from Environmental Preconditioning of M621 Container Prior to Drop Testing on 2 February 1992			
Conditioning Time	Internal Container Temp. Deg./F.	External Container Temp. Deg./F.	Conditioning Chamber Temp. Deg./F.
12:19:03	2.4	-7.6	-13.2
12:34:03	0.7	-12.0	-17.5
12:49:03	-0.9	-13.3	-18.0
13:04:03	-2.3	-13.6	-17.7
13:23:27	-3.7	-6.8	-3.6
13:56:27	-3.2	-2.4	2.4 *
14:11:27	-2.7	-2.3	-3.7
* - door to chamber was opened momentarily			

Only the corner drop showed some damage (see photos nos. 1 - 5). Three hinge attachment points out of eight were damaged. One of the damaged attachment points was completely severed, and two of the points had partial cracks.

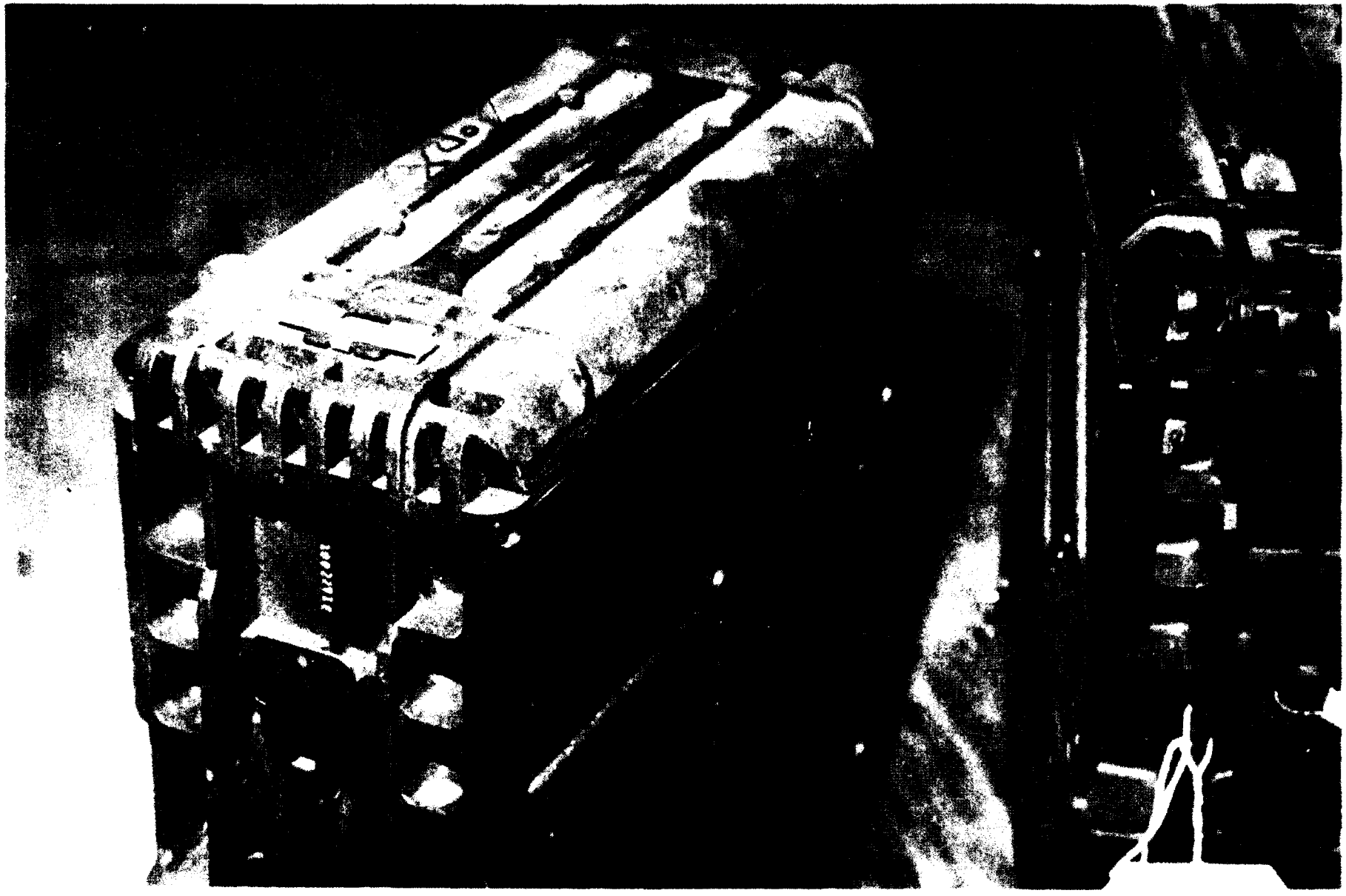
D. ENGINEERING TEST. Prior to POP testing, a 6-foot corner drop test was performed on one M621 container to determine whether any problems would occur during later tests. The container failed catastrophically at the hinges (see photo no. 6). Since this test was chosen to simulate a "worst case" test for level I POP testing, the results have no impact on the level II POP test results (see recommendation).

PART 6

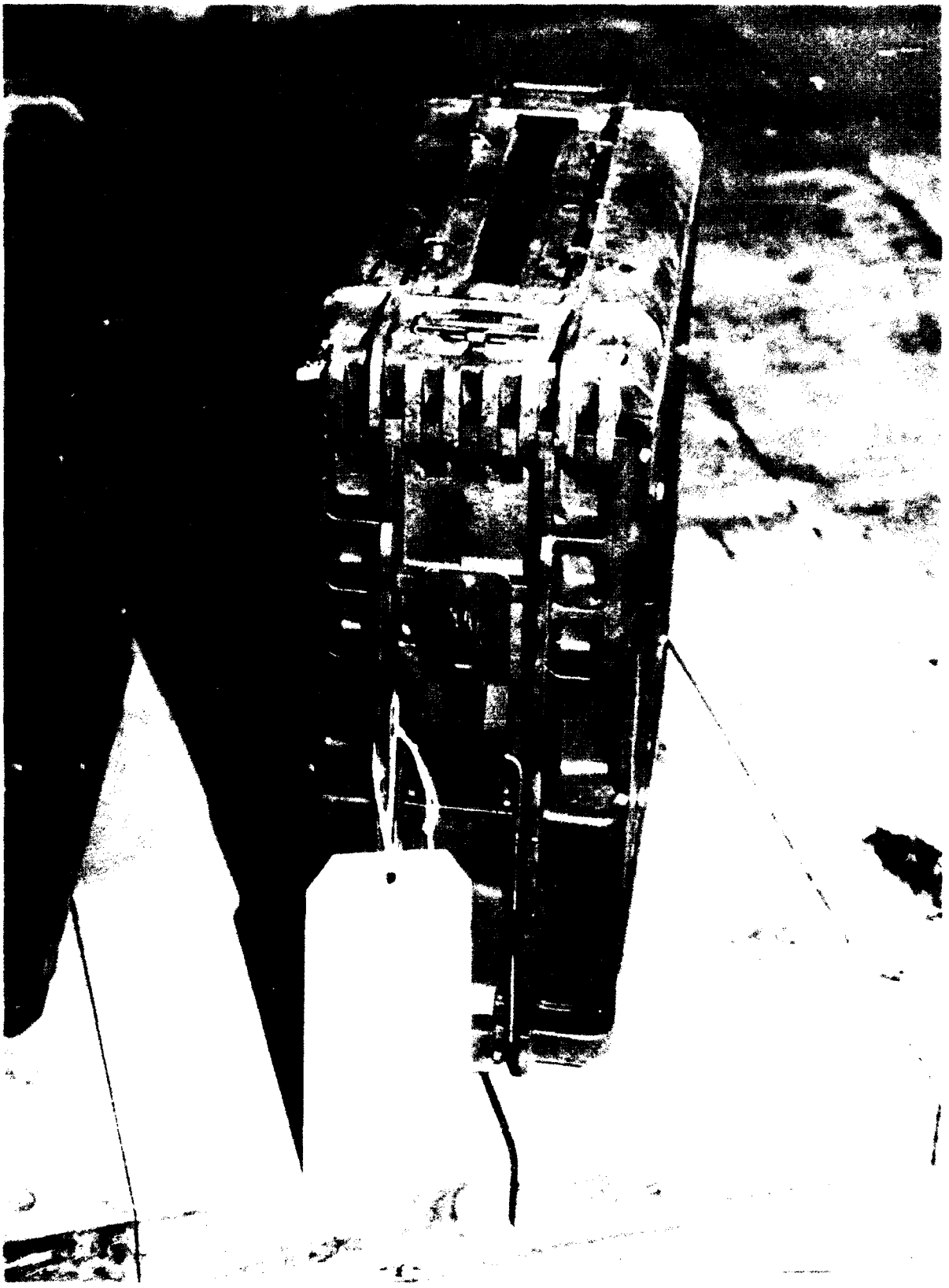
PHOTOGRAPHS



	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-92-147-1141. This photo shows an undamaged container following drop test to the top face.		

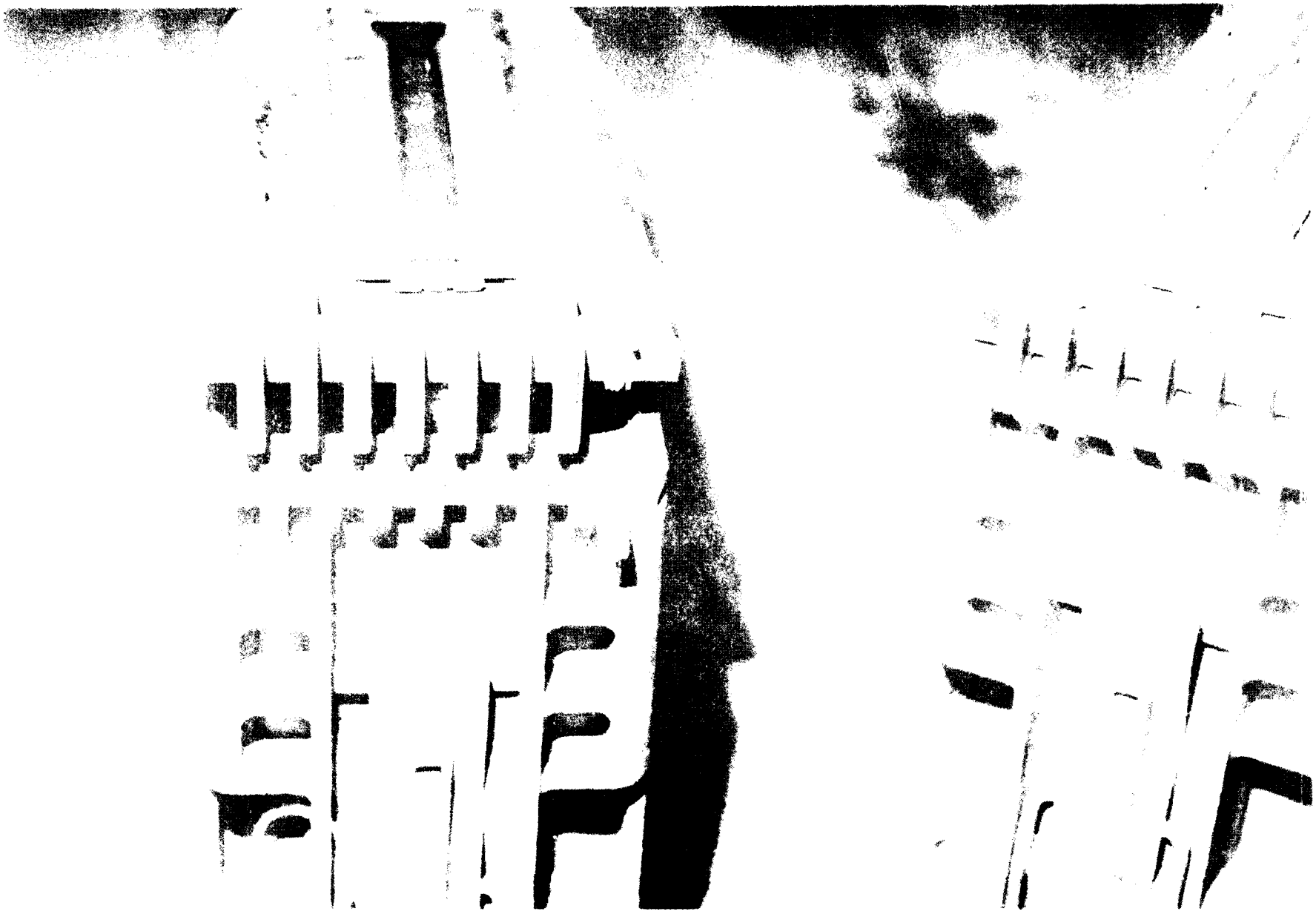


	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-92-147-1136. This photo shows an undamaged container following drop test to the top face.		



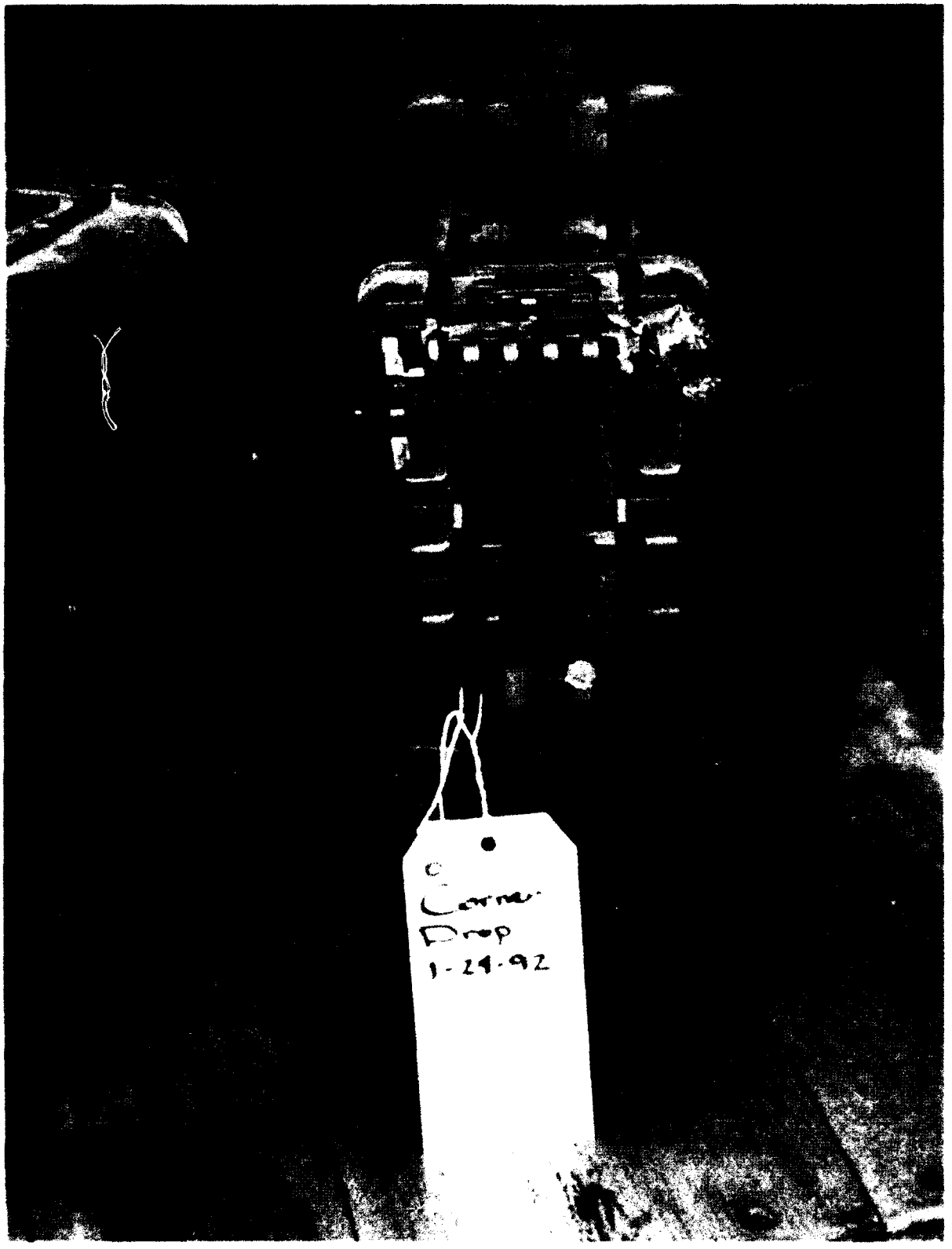
	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-92-147-1138. This photo shows the container with some damage to the hinge. Note, the cracks in the right three attachment points.		

	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-92-147-1139. This photo shows the container with some damage to the hinge. Note, the cracks in the right three attachment points.		



U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

Photo No. AO317-SPN-92-147-1143. This photo shows the disassembled hinge of the corner dropped container Note, the attachment point which was completely severed.



	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-92-147-1140. This photo shows the catastrophic results of the level I packaging engineering test. Note, the completely severed hinge.		

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

Photo No. AO317-SPN-92-147-1142. This photo shows three previously tested containers. From left to right: dropped to the top face, dropped 6 feet to the corner, and dropped 3.9 feet to the corner.