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REPORT NO. 88-R-07
AFPEA PROJECT NO. 87-P-111
88-P-116

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EVALUATION OF ENGINEERING CHANGE PROPOSALS 10 AND 31 AND PERFORMANCE ORIENTED PACKAGING TESTING OF CNU-399E/425E FIBERGLASS MAVERICK MISSILE CONTAINER

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION ACTIVITY
Wright-Patterson AFB OH 45433-5999

24 JANUARY 1989

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ABSTRACT

Aeronautical Systems Division, ASD/SDML, requested assistance from the Air Force Packaging Evaluation Activity to conduct testing on the CNU-399E/425E fiberglass Maverick missile container for engineering change proposals and performance oriented packaging.

The CNU-399E/425E container was designed and fabricated by Plastics Research Corporation, 13538 Excelsior Dr., Santa Fe Springs CA 90670. The containers are environmentally sealed with a humidity indicator, desiccant port, and a pressure relief valve. The containers are designed to protect one AGM-65A/B/C/D/E/F all-up-round Maverick missile during world-wide shipment, storage, and handling. The containers will also be used for one missile without the guidance unit and for one missile without the guidance unit and the hydraulic actuation system. The CNU-425/E is the Air Force version of the container. The CNU-399/E is the Navy version and differs from the CNU-425/E only in some external Navy-specific handling features.

The test plan used for these containers was derived from ASD/SDML Specification Number CON 319 dated 30 May 86, Federal Test Method Standard No. 101, U.N. Standard (Ref. ICAD 4.3).

Results of the tests conducted on the containers were acceptable. The container's cradle system did not crack during the rough handling tests and the containers did successfully pass the POP tests, as prescribed by the UN test criteria.

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Evaluation Activity

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INTRODUCTION

BACKGROUND: Aeronautical Systems Division, ASD/SDML, requested assistance from the Air Force Packaging Evaluation Activity to conduct testing on the CNU-399E/425E fiberglass Maverick missile container for engineering change proposals (ECP) and performance oriented packaging (POP) testing. The CNU-399E/425E container was designed and fabricated by Plastics Research Corporation (PRC), 13538 Excelsior Dr., Santa Fe Springs CA 90670.

PURPOSE: The purpose of this project was to determine whether testing the CNU-399E/425E container would damage the squaring blocks (ECP 7: adding squaring blocks to the container configuration) or the cradle system (ECP 31: changing the cradle clamp fabrication process from open mold to compression mold) and whether the container would spill its contents (POP testing). The container is designed to protect one AGM-65A/B/C/D/E/F all-up-round Maverick missile during world-wide shipment, storage, and handling. The container will also be used for one missile without the guidance unit and for one missile without the guidance unit and the hydraulic actuation system. The CNU-425/E is the Air Force version of the container. The CNU-399/E is the Navy version and differs from the CNU-425/E only in some external Navy-specific handling features. The United Nations (UN) hazard code for the missile is class 1.1F. The packing code is Group II, with the packing method of E146.

TEST SPECIMEN

Four CNU-425/E containers (serial numbers 83-25120, 83-25121, 83-25385 and 25386) were sent from PRC. The corners of the containers were numbered from the aft end (see figure 1).

DESIGN: The containers are environmentally sealed with a humidity indicator, desiccant port, and a pressure relief valve. The container is designed to limit the transmission of shocks to the missile at 40G or less when subjected to the conditions in ASD/SDML Specification CON 319. Twenty t-bolts attach the container cover to the container base. The missile is attached to the cradle system by forward and aft clamps.

CONSTRUCTION: The container consists of a fiberglass reinforced plastic cover, base, cradle, forward clamp and aft clamp, which have been gel coated. Rubber pads between the missile and the cradle prevent scratching or scarring of the missile body. Two pound density polyethylene foam provides cushioning between the cradle and the container base. A neoprene (or equivalent) gasket provides a seal between the container base and the container cover.

TEST OUTLINE AND TEST EQUIPMENT

TEST PLAN: Tests were conducted in accordance with table I. Test methods and procedures used were as outlined in Federal Test Method Standard 101 (FTMS No. 101), Military Standard 648 (MIL-STD-648), U.N. Standard (Ref. ICAD 4.3) and ASD/SDML Specification CON 319 dated 30 May 86. Any modifications to the standard procedures are noted in the test plan or the results.

TEST CONTAINERS: The tests in this report were performed on CNU-425/E, serial number 83-25121 except for the UN stacking test (test no. 10) where the CNU-425/E, serial number 83-25120 was used. Only one container was used for UN drop tests (test no. 9) since the tests were severe and it would be too costly to provide a new container for each drop.

TEST LOADS: All tests were conducted using the standard heavy test load weighing 670 pounds. A container base loaded with 3150 pounds (three times the gross weight of a container with a heavy standard load) was also used for test number 10 to simulate stacked containers.

TEST SITES: Testing was conducted at AFPEA, HQ AFLC/DSTZ, Building 70, Area C, Wright-Patterson AFB OH. The equipment required for testing was a temperature chamber and a forklift truck.

TEST PROCEDURES AND RESULTS

INSPECTION

Test No. 1: The containers, as received, were visually inspected. The exterior and interior surfaces, hardware, cushioning, markings, and container seal were inspected.

Results: All container features were found to be acceptable.

LEAK TEST

Test No. 2: The pneumatic pressure test was conducted in accordance with FTMS No. 101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was 0.013 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period, container 83-25121 had a pressure test leak rate of 0.012 psig. No leaks were evident on the container. The results of this test are acceptable.

ROUGH HANDLING TESTS (+140^{o}F)

Test No. 3A: The high temperature edgewise-drop (rotational) test was conducted in accordance with FTMS No. 101, Method 5008.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no apparent damage to the exterior of container 83-25121.

Test No. 3B: The high temperature cornerwise-drop (rotational) test was conducted in accordance with FTMS No. 101, Method 5005.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no apparent damage to the exterior of container 83-25121.

Test No. 3C: The high temperature pendulum-impact test was conducted in accordance with FTMS No. 101, Method 5012. The impact velocity was 7 ft/sec from a drop height of 9.0 inches.

Results: Visual inspection revealed no apparent damage to the exterior of container 83-25121.

The container 83-25121 was opened and the container straps had loosened. Also, two small gouges were evident on the forward clamp. It should be noted that the strap design had changed to a folded, no twist configuration from a closed loop, twisted configuration.

ROUGH HANDLING TESTS ($-40^{o}F$)

Test No. 4A: The low temperature edgewise-drop (rotational) test was conducted in accordance with FTMS No. 101, Method 5008.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no apparent damage to the exterior of container 83-25121.

Test No. 4B: The low temperature cornerwise-drop (rotational) test was conducted in accordance with FTMS No. 101, Method 5005.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no apparent damage to the exterior of container 83-25121.

Test No. 4C: The low temperature pendulum-impact test was conducted in accordance with FTMS No. 101, Method 5012. The impact velocity was 7 ft/sec from a drop height of 9.0 inches.

Results: Visual inspection revealed no apparent damage to the exterior of container 83-25121.

The container 83-25121 was opened and the container straps had loosened further. Also, the rubber padding on the forward clamp was deformed.

LEAK TEST

Test No. 5: The pneumatic pressure test was conducted in accordance with FTMS No. 101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was 0.013 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period, container 83-25121 had a pressure test leak rate of 0.000 psig. It should be noted that the room temperature rose from 24.9°C to 25.1°C during the leak test and leaks were evident around the forkwell bolt below t-bolt 18 and at t-bolt 14. The results of this test are acceptable.

SQUARING BLOCK SUPPORT TEST

Test No. 6A: The edge roll was conducted to determine whether impacting the squaring block would influence the seal of container 83-25121.

Test No. 6B: The side by side impact was conducted to determine whether impacting the squaring block would influence the seal of container 83-25121.

Test No. 6C: The side impact was conducted to determine whether impacting the squaring block would influence the seal of container 83-25121.

LEAK TEST

Test No. 7: The pneumatic pressure test was conducted in accordance with FTMS No. 101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was 0.013 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period, container 83-25121 had a pressure test leak rate of 0.000 psig. It should be noted that the room temperature rose from 25.1°C to 25.3°C during the leak test and leaks were evident around the forkwell bolt below t-bolt 18 and at t-bolt 14. The results of this test are acceptable.

INSPECTION

Test No. 8: Container 83-25121 was visually inspected. The exterior and interior surfaces, hardware, cushioning, markings, and container seal were inspected.

Results: Abrasion damage was evident on the squaring blocks on side 2 of container 83-25121. The results of this test are acceptable.

UN DROP TEST

Test No. 9: Container 83-25121 was conditioned at 32°F for 24 hours then dropped flat on the bottom, side 4 (long side), side 3 (short side, see figure 2), the top (see figure 3) and top corner 2-3. The container shall not spill its contents.

Results: Visual inspection revealed that side 3 and the top corner 2-3 had deformed (see figure 4). The container was opened and the following damage was found: the forward and aft straps on side 2 broke (see figure 5 and 6); the latches disengaged on side 4 of the forward clamp (see figure 7), on side 2 of the aft clamp (see figure 8) and on side 4 of the aft clamp (see figure 9); the missile traveled inside the container damaging the top portion of the forward clamp (see figure 10), bending the fin on side 2 of the missile (see figure 11), delaminating side 3 on the cover (see figure 12) and crushing the desiccant basket; and the cradle cushion was torn and unglued from the container base (see figure 13). However, the container did not spill its contents. Results of this test are acceptable.

UN STACKING TEST

Test No. 10: At ambient temperature, a superimposed load of 3150 pounds was placed on container 83-25120 for 24 hours. The container shall not permanently deform.

Results: Container 83-25120 was dimensionally checked and no permanent deformation occurred during the stacking test. The results of this test are acceptable.

CONCLUSION

1. The container successfully passed the squaring block tests and did not affect the container seal.

2. The container successfully passed the high and low temperature rough handling test without cracking the clamps on the cradle system.

3. The container successfully passed the POP tests, as prescribed by the UN test criteria.

TABLE I.

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-116, 87-P-111

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	110x32x30	1050	670	61		11 Jan 89

ITEM NAME	MANUFACTURER
AGM-65 Maverick Missile	Plastics Research Corporation

CONTAINER NAME	CONTAINER COST
CNU-399/E and CNU-425/E (UN Tests, ECPs 10 & 31)	$1200

PACK DESCRIPTION

Fiberglass Container

CONDITIONING

As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
1.	INSPECTION	Visually inspect container before testing.		
2.	LEAK TEST FED-STD-101 Method 5009.2 *(4.2.2.1.13)	Pneumatic pressure at 1.00 PSI. Test duration to be a minimum of 15 minutes. Leakage rate shall not exceed 0.05 PSI/HR after temperature stabilization.	Test at ambient condition from compressed air supply/vacuum pump.	Water manometer
3.	ROUGH HANDLING TESTS (HIGH TEMPERATURE +140°F)			
a.	FED-STD-101 Method 5008.1 (4.2.2.1.7)	Edgewise-drop (rotational) test. Condition at +140°F for not less than 24 hours. Drop height 20 inches.	Test performed in chamber. One drop on 2 adjacent bottom edges, total of 2 drops.** Test w/ heaviest AUR.	
b.	FED-STD-101 Method 5005.1 (4.2.2.1.7)	Cornerwise-drop (rotational) test. Condition at +140°F for not less than 24 hours. Drop height 20 inches.	Test performed in chamber. One drop on diagonal bottom corners, total of two drops.***	

COMMENTS: * Figures in parenthesis refer to paragraph in Spec. No. CON 319.
** Remaining edge drops to be performed in Test No. 4a.
*** Remaining corner drops to be performed in Test No. 4b.

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Susan Hughey, Mechanical Engineer

APPROVED BY:
TED HINDS, Chief, Design Br., AFPEA

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AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-116, 87-P-111

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	110x32x30	1050	670	61		11 Jan 89

ITEM NAME	MANUFACTURER
AGM-65 Maverick Missile	Plastics Research Corporation

CONTAINER NAME	CONTAINER COST
CNU-399/E and CNU-425/E (UN Tests, ECPs 10 & 31)	$1200

PACK DESCRIPTION
Fiberglass Container

CONDITIONING
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
			Test with heaviest AUR.	
c.	FED-STD-101 Method 5012 (4.2.2.1.7)	Pendulum-impact test. Condition at +165°F. Temperature of shock mitigation system at time of test shall be +140(±5°F). Impact velocity 7 ft/sec*, drop height 9 inches.	One impact on each side and each end, total of four impacts. Test with heaviest AUR.	
4.	ROUGH HANDLING TESTS (LOW TEMPERATURE -40°F)			
a.	FED-STD-101 Method 5008.1 (4.2.2.1.8)	Edgewise-drop (rotational) test. Condition at -40°F for not less than 24 hours. Drop height 20 inches.	Test performed in chamber. One drop on two adjacent bottom edges, total of two drops.** Test with heaviest AUR.	
b.	FED-STD-101 Method 5005.1 (4.2.2.1.7)	Cornerwise-drop (rotational) test. Condition at -40°F for not less than 24 hours. Drop height 20 inches.	Test performed in chamber. One drop on diagonal bottom corners, total of two drops.*** Test with heaviest AUR.	

COMMENTS: * Impact velocity revised per ASD/TAML letter dated 24 Aug 87.
** These edges are opposite those impacted in Test No. 3a.
*** These corners are opposite those impacted in Test No. 3b.

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AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-116, 87-P-111

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	110x32x30	1050	670	61		11 Jan 89

ITEM NAME: AGM-65 Maverick Missile

MANUFACTURER: Plastics Research Corporation

CONTAINER NAME: CNU-399/E and CNU-425/E (UN Tests, ECPs 10 & 31)

CONTAINER COST: $1200

PACK DESCRIPTION: Fiberglass Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
c.	FED-STD-101 Method 5012 (4.2.2.1.7)	Pendulum-impact test. Condition at -65°F. Temperature of shock mitigation system at time of test shall be -40 (±5°F). Impact velocity 7 ft/sec*, drop height 9 inches.	One impact on each side and each end, total of four impacts. Test with heaviest AUR.	
5.	LEAK TEST			
	FED-STD-101 Method 5009.2 (4.2.2.1.13)	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes. Leakage rate shall not exceed 0.05 PSI/HR after temperature stabilization.	Ambient	Water manometer
6.	SQUARING BLOCK SUPPORT TEST			
a.	Edge Roll:	Lift loaded container with squaring blocks up on edge and allow to roll on its side.	Test with heaviest AUR.	Forklift truck

COMMENTS: * Impact velocity revised per ASD/TAML letter dated 24 Aug 87.

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APPROVED BY: TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-116, 87-P-111

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	110x32x30	1050	670	61		11 Jan 89

ITEM NAME: AGM-65 Maverick Missile

MANUFACTURER: Plastics Research Corporation

CONTAINER NAME: CNU-399/E and CNU-425/E (UN Tests, ECPs 10 & 31)

CONTAINER COST: $1200

PACK DESCRIPTION: Fiberglass Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
b.	Side by Side:	Place container 1 (loaded) side by side with container 2 (squaring blocks attached). With a forklift, lift container 1 to approximately 30 inches. Move container 1 so its flange area is directly above the squaring blocks of container 2. Allow container 1 to drop, impacting the squaring blocks of container 2.	Test with heaviest AUR.	Forklift truck
c.	Side Impact:	Lift a loaded container with a forklift truck to 18 inches. Side impact a loaded stationary container that has squaring blocks with the loaded container. The forklift truck carrying the loaded container shall impact the loaded stationary container at a speed of 5 ft/sec.	Test with heaviest AUR.	Forklift truck

COMMENTS:

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AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-116, 87-P-111

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	110x32x30	1050	670	61		11 Jan 89

ITEM NAME: AGM-65 Maverick Missile

MANUFACTURER: Plastics Research Corporation

CONTAINER NAME: CNU-399/E and CNU-425/E (UN Tests, ECPs 10 & 31)

CONTAINER COST: $1200

PACK DESCRIPTION: Fiberglass Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
7.	LEAK TEST FED-STD-101 Method 5009.2 (4.2.2.1.13)	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes. Leakage rate shall not exceed 0.05 PSI/HR after temperature stabilization.	Ambient	Water manometer
8.	INSPECTION	Visually inspect. Note any damage to squaring block and squaring block attachment points.		
9.	UN DROP TEST *(9.7.3)	Condition at +32°F for not less than 24 hours. Drop height 1.2m (3.94 ft) as required for Packaging Group II. The container shall not spill its contents. A different container may be used for each drop.	One each flat drop on the bottom, top, long side, short side and a corner. Total of 5 drops. Test with the heaviest AUR.	
10.	UN STACKING TEST *(9.7.6)	Simulate stacking to a minimum height of 3m (9.84 ft) for 24 hours. There shall be no permanent deformation.**		

COMMENTS: * Refer to UN "Orange Book" requirements.
** The superimposed load test in MIL-STD-648 exceeds the UN stacking test.

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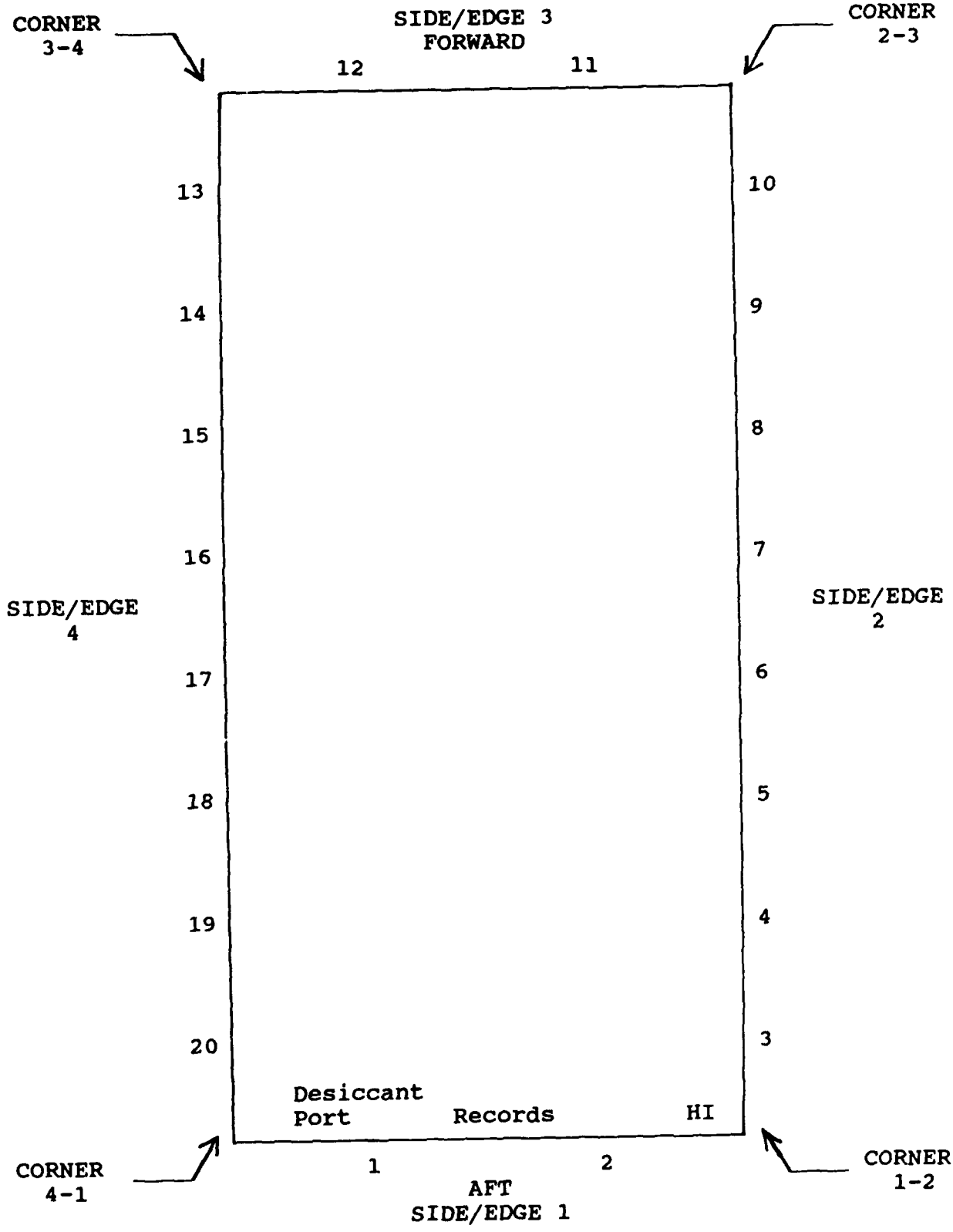

FIGURE 1. CONTAINER CONFIGURATION

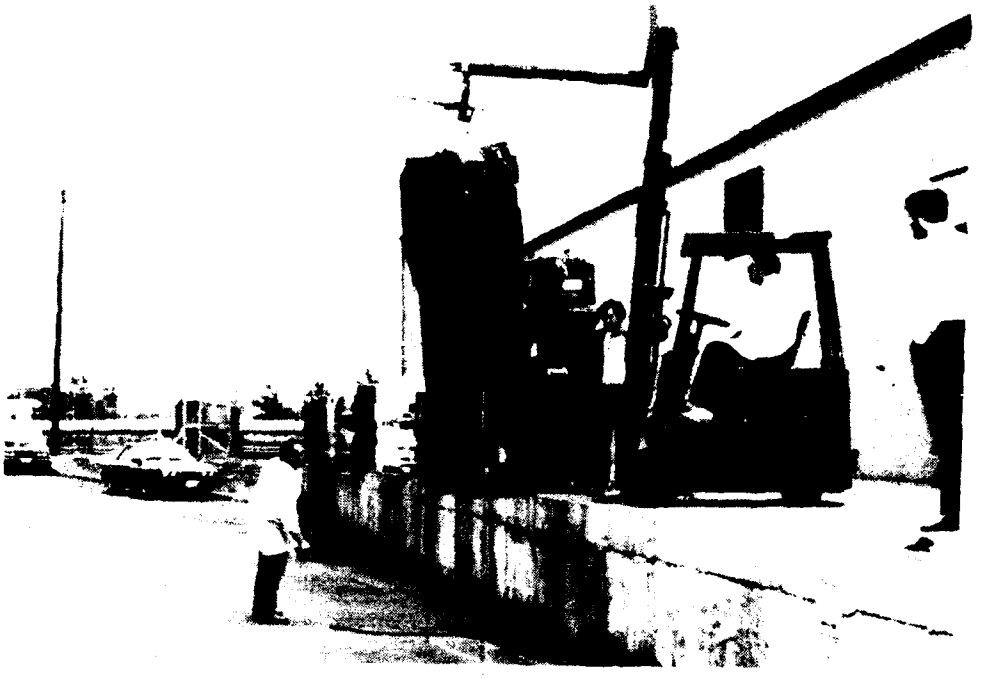

FIGURE 2. UN DROP TEST, SIDE 3.

FIGURE 3. UN DROP TEST, TOP.

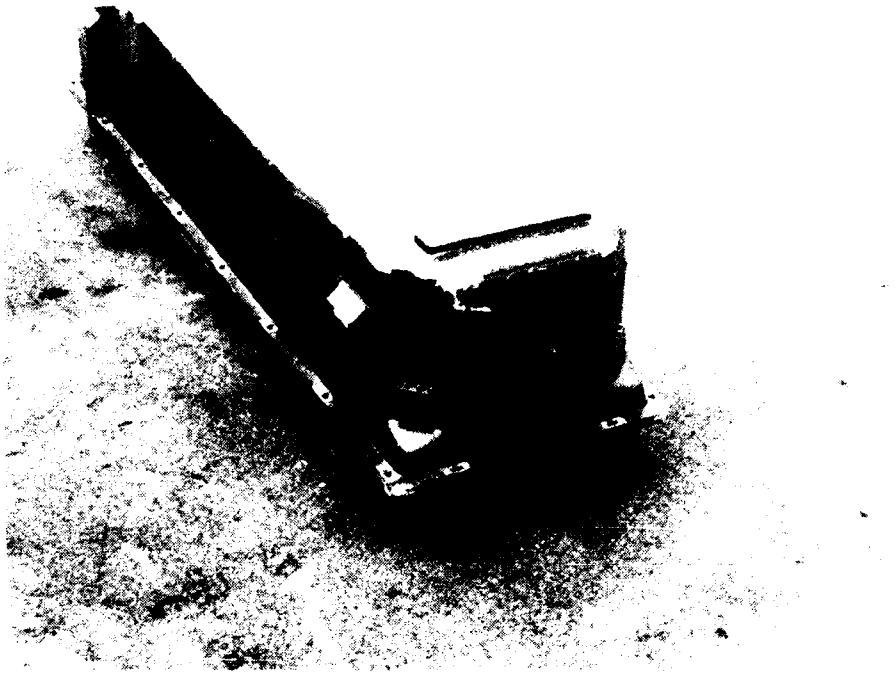

FIGURE 4. DAMAGE TO SIDE 3.

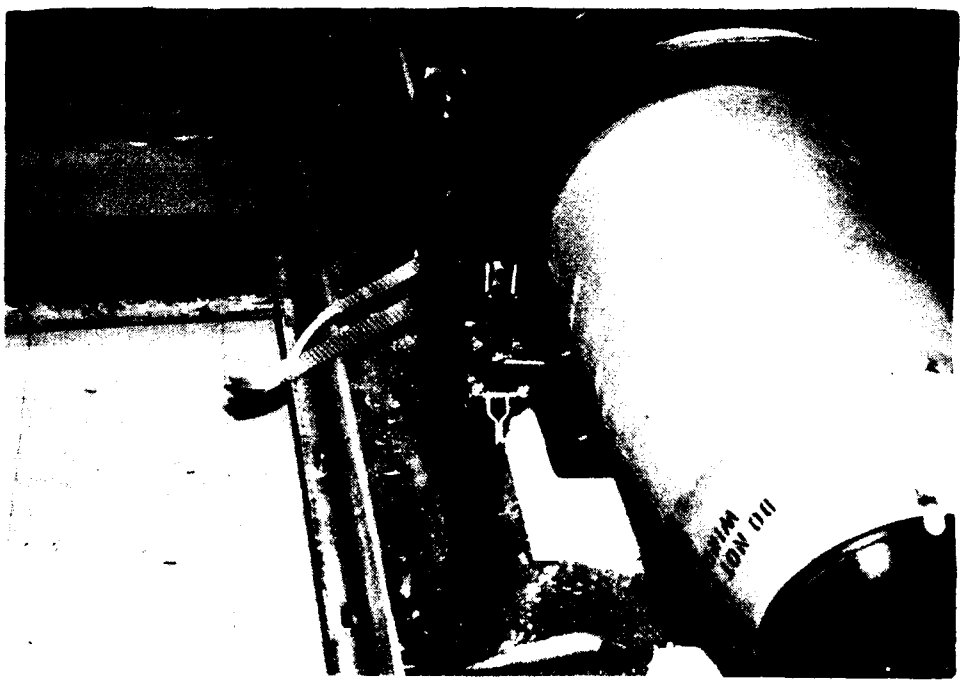

FIGURE 5. SIDE 2 FORWARD STRAP.

FIGURE 6. SIDE 2 AFT STRAP.

FIGURE 7. DISENGAGED LATCH, SIDE 4 FORWARD CLAMP.

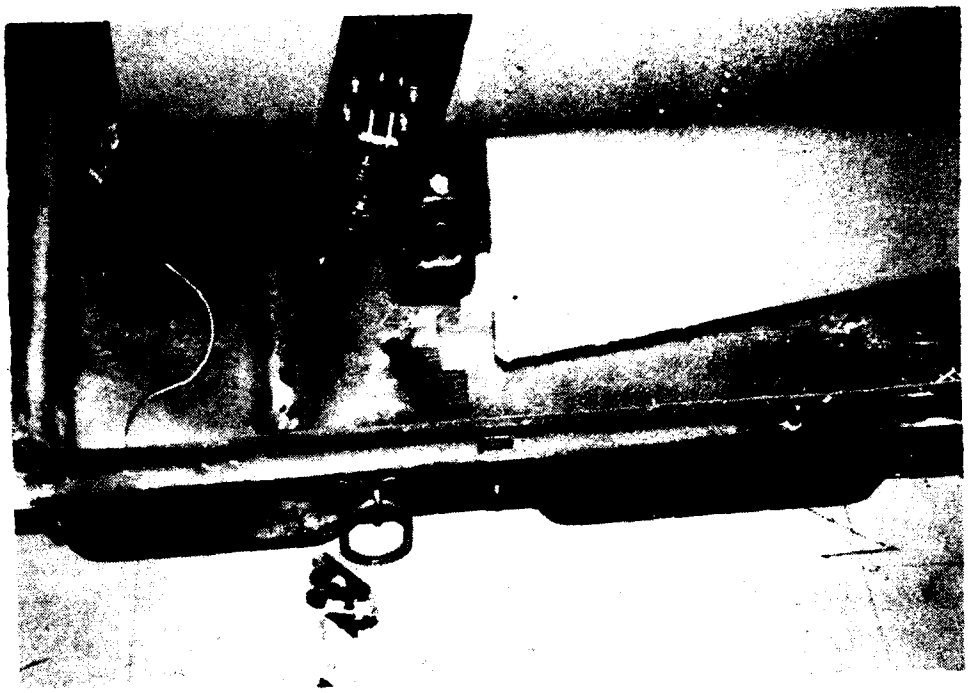

FIGURE 8. DISENGAGED LATCH, SIDE 2 AFT CLAMP.

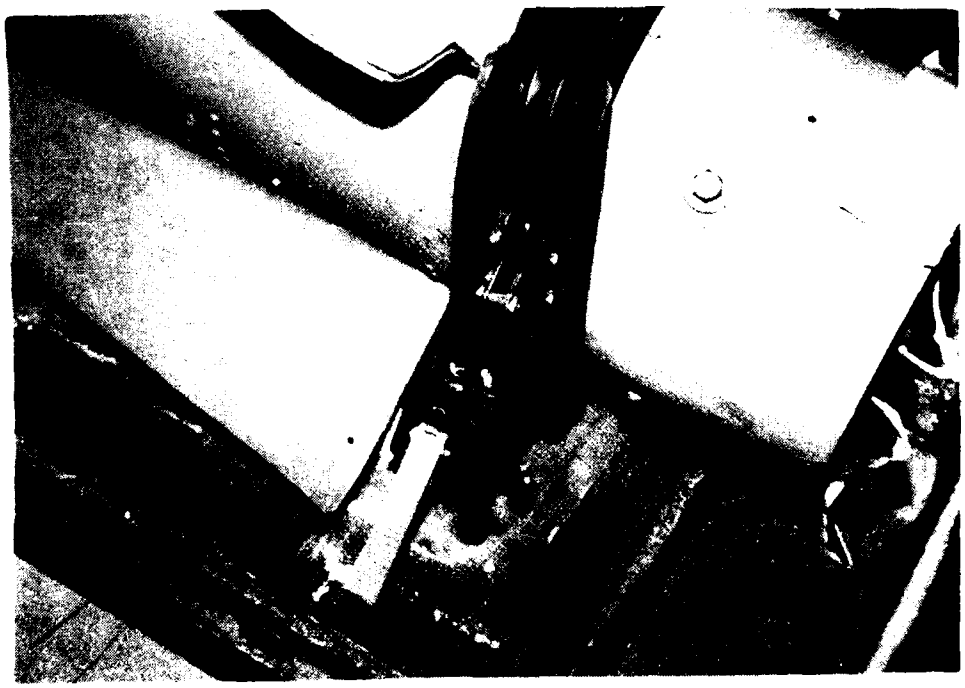

FIGURE 9. DISENGAGED LATCH, SIDE 4 AFT CLAMP.

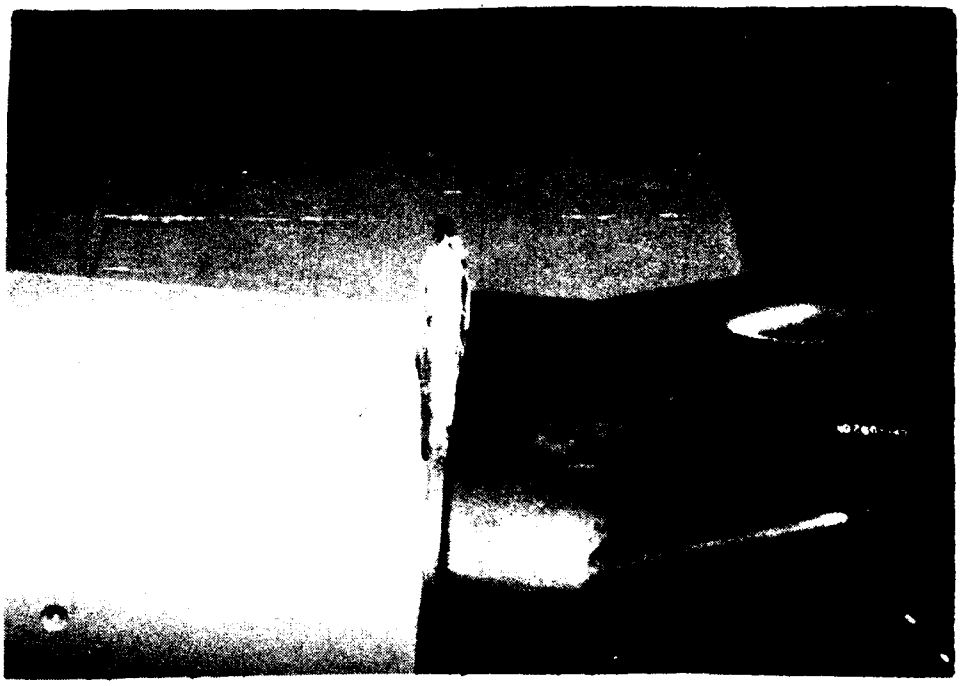

FIGURE 10. DAMAGED FORWARD CLAMP.

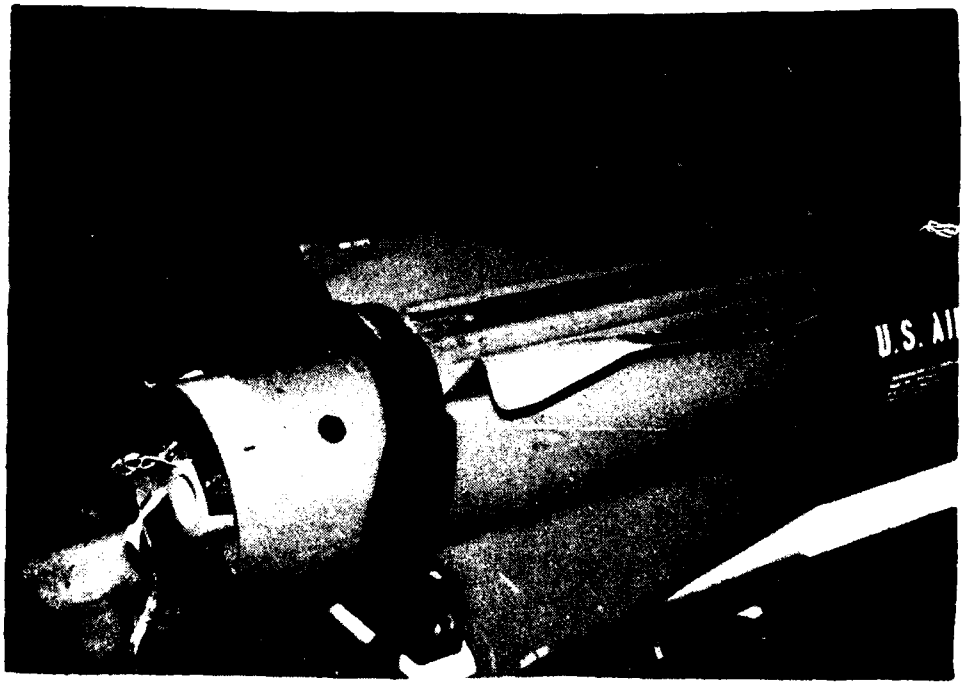

FIGURE 11. BENT FIN, SIDE 2 OF MISSILE.

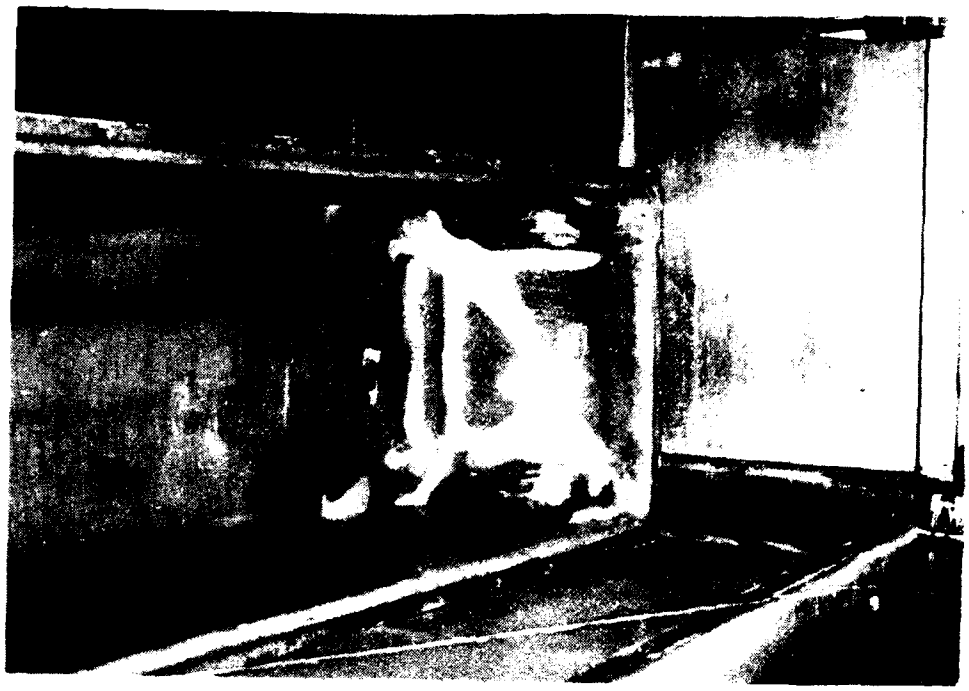

FIGURE 12. DELAMINATION ON SIDE 3 OF COVER.

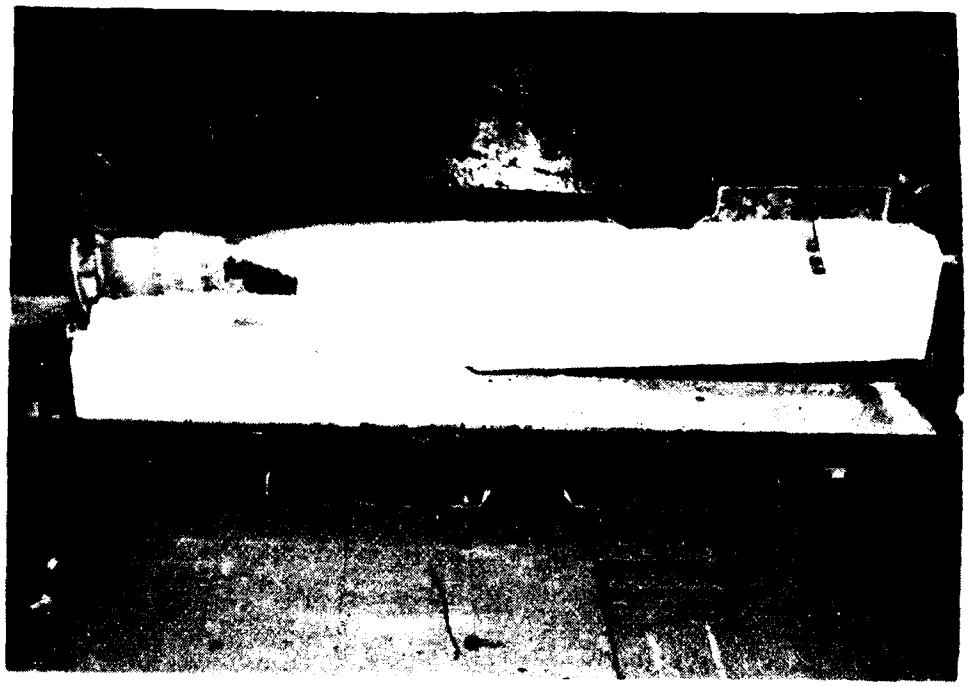

FIGURE 13. CRADLE CUSHION, TORN AND UNGLUED.

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

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1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
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11. TITLE (Include Security Classification)
Evaluation of Engineering Change Proposals 10 and 31 and Performance Oriented Packaging Testing of CNU-399/425 Fiberglass Maverick Missile Container

12. PERSONAL AUTHOR(S)
Susan M. Hughey

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16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	CNU-399/425, Performance Oriented Packaging Testing, United Nations' Testing, Fiberglass Maverick Missile

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

Aeronautical Systems Division, ASD/SDML, requested assistance from the Air Force Packaging Evaluation Activity to conduct testing on the CNU-399E/425E fiberglass Maverick missile container for engineering change proposals and performance oriented packaging.

The CNU-399E/425E container was designed and fabricated by Plastics Research Corporation, 13538 Excelsior Dr., Santa Fe Springs CA 90670. The containers are environmentally sealed with a humidity indicator, desiccant port, and a pressure relief valve. The containers are designed to protect one AGM-65A/B/C/D/E/F all-up-round Maverick missile during world-wide shipment, storage, and handling. The containers will also be

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION	
☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS	Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL Susan M. Hughey	22b. TELEPHONE (Include Area Code) (513)257-3362	22c. OFFICE SYMBOL HQ AFLC/DSTZD

DD Form 1473, JUN 86 — Previous editions are obsolete. — SECURITY CLASSIFICATION OF THIS PAGE

19. (Continued)
used for one missile without the guidance unit and for one missile without the guidance unit and the hydraulic actuation system. The CNU-425/E is the Air Force version of the container. The CNU-399/E is the Navy version and differs from the CNU-425/E only in some external Navy-specific handling features.

The test plan used for these containers was derived from ASD/SDML Specification Number CON 319 dated 30 May 86, Federal Test Method Standard No. 101, U.N. Standard (Ref. ICAD 4.3).

Results of the tests conducted on the containers were acceptable. The container's cradle system did not crack during the rough handling tests and the containers did successfully pass the POP tests, as prescribed by the UN test criteria.

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