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QUALIFICATION TEST OF CNU-131/E AND CNU-263/E CONTAINERS FOR US--ETC(U)

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(9) Test rept. Jun - Sep 78,

(6)

QUALIFICATION TEST OF CNU-131/E AND CNU-263/E CONTAINERS FOR USE WITH THE AGM-65E MAVERICK MISSILE .

AFALD/PTPD
AIR FORCE PACKAGING EVALUATION AGENCY
Wright-Patterson AFB OH 45433

(12) 18p.

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ABSTRACT

This test was performed as requested by ASD/SD65E to determine if two existing containers can qualify as shipping and storage containers for the proposed AGM-65E Maverick missile. One each of the CNU-131/E (metal) and CNU-263/E (fiberglass) containers were tested by the Air Force Packaging Evaluation Agency. Test results revealed that both containers were unable to satisfy specification requirements.

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PUBLICATION DATE:

4 DEC 1978

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INTRODUCTION

PURPOSE: The purpose of this test was to examine two existing containers (CNU-131/E and CNU-263/E) for capability to qualify as shipping and storage containers for the AGM-65E missile. Both containers were originally designed for earlier versions of the AGM-65 which were all dimensionally similar with slight variation in weights. The new "E" version, however, has a substantially increased mass and the question of using existing containers was raised.

BACKGROUND: The AGM-65E missile is a proposed Navy/Marine anti-ship missile derived from the current Air Force Maverick missile family. In its proposed role, the AGM-65E will incorporate a modified armament subsection increasing the total missile weight by approximately 170 pounds. The external dimensions of the "E" version will remain the same as previous Maverick missiles.

APPROACH

The Air Force Packaging Evaluation Agency's (AFPEA) approach to determine whether the existing containers are qualified was to compare test results with performance requirements specified in AFSC Specification 1308, PART I, dated 21 November 1977, titled "AGM-65 Maverick Container, Shipping and Storage." A test plan was prepared using the 1308 specification as a guideline. Failure of any test was deemed sufficient to disqualify the container, thus testing would be discontinued upon failure. If both containers were found to be unqualified, then additional testing, evaluation, and investigation would be performed with recommendations and information provided in a follow-up report. The follow-up report will be used to establish direction in producing a qualified container.

TEST PROCEDURE

The applicable test requirements of AFSC Specification 1308 were grouped into six categories, each designated by a test number on the test plan shown on page 12. All tests except Test No. 2 were conducted in accordance with a referenced method of Federal Standard Number 101B. Test No. 2 was conducted in accordance with Specification 1308. A brief description of each test group is provided in the following paragraphs.

TEST NO. 1 - This test involved a series of shock tests at room temperature. The shock tests were a combination of edge and corner rotational drops and pendulum impacts (Methods 5008, 5005, and 5012 respectively). Rotational drops were conducted from a height of 24 inches while the pendulum impacts were at seven feet per second. The drop tests totaled four, consisting of an edgewise drop on each end and a cornerwise drop on opposite corners. Pendulum impact tests also totaled four with one impact on each of the four sides.

TEST NO. 2 - Termed "Special Shock" and is described in AFSC Specification 1308: "A free fall flat drop test shall be conducted as follows: The container shall be suspended from a height of 10 inches and allowed to fall freely to a concrete surface. The container shall not be damaged and the shock load on the missile shall not exceed 30 G's." Testing was conducted at ambient conditions.

TEST NO. 3 - Repeating the shock tests in Test No. 1, this test introduces conditioning of the test specimen at -40°F. This test which called for removing the container from the chamber prior to testing was slightly modified by performing the drop tests inside the low temperature chamber while still at -40°F. However, the impact tests were done by removing the container from the low temperature chamber and conducting the tests at room temperature (75°F) as quickly as possible.

TEST NO. 4 - Again, the shock tests in Test No. 1 were repeated but conditioning was at +140°F. The four drop tests were performed inside the chamber while the four impact tests were at room temperature as was done in the previous low temperature tests.

TEST NO. 5 - Container vibration requirements were tested in accordance with Method 5020 for sinusoidal motion. Testing was conducted at room temperature.

TEST NO. 6 - The final test was superimposed loading at elevated temperatures. At +140°F the test specimen was loaded with a simulated weight of four loaded containers on top of the test specimen. Purpose of this test was to examine stacking capability.

TEST SPECIMENS

Two containers were used for testing during this project. One test load was used and placed in the container under test. Description of these major pieces follow:

CNU-131/E - The CNU-131/E is a metal container for shipping and storage of one Maverick missile. External dimensions of this container were approximatley 105 inches in length by 26 inches in width by 28 inches in height. Empty container weight was 350 pounds. The container is fitted with an elastomeric shock mounted suspension system for shock isolation (see Figure 1). This specific container was manufactured by the Champion Company under Contract No. F33657-68-C-0829 with Serial No. 147. The container had no major deficiencies that would affect test results.

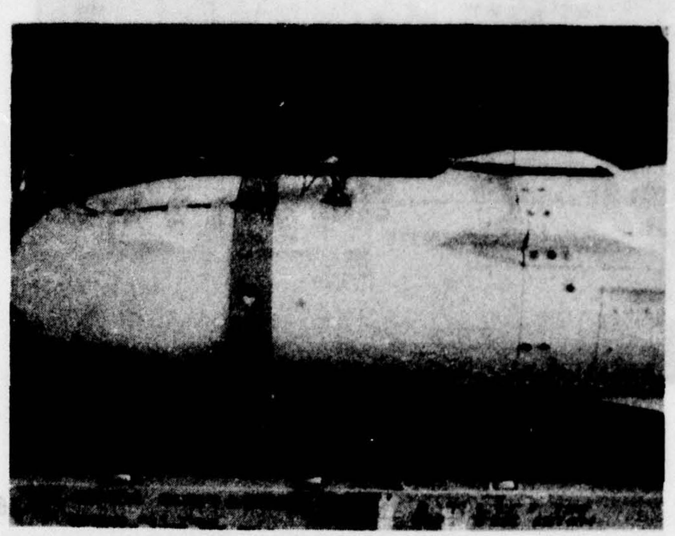


FIGURE 1. SHOCK ISOLATION SYSTEM, FORWARD MOUNT, CNU-131/E

CNU-263/E - The CNU-263/E is a fiberglass reinforced plastic container for shipping and storage of one Maverick missile. External dimensions of this container were approximately 107 inches in length by 29 inches in width by 30 inches in height. Empty container weight was 262 pounds. Shock isolation was accomplished by placing six cushioning pads under the missile (see Figure 2a and 2b). This specific container was manufactured by Plastics Research Corporation under Contract No. F33657-75-C-0663 with Serial No. 77148. The container had no major deficiencies that would affect results.

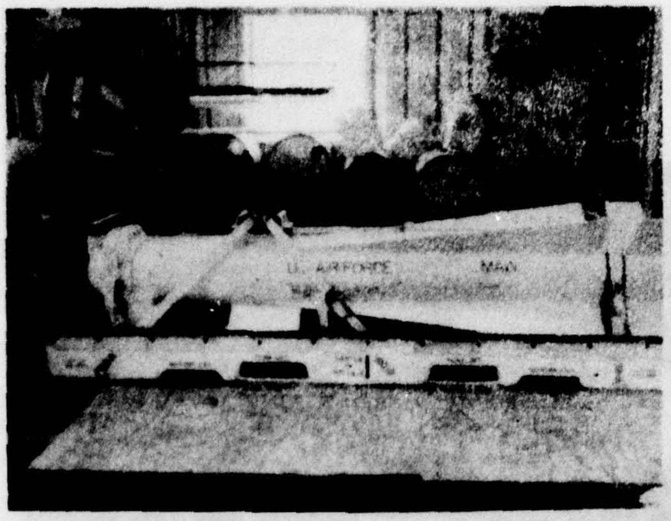
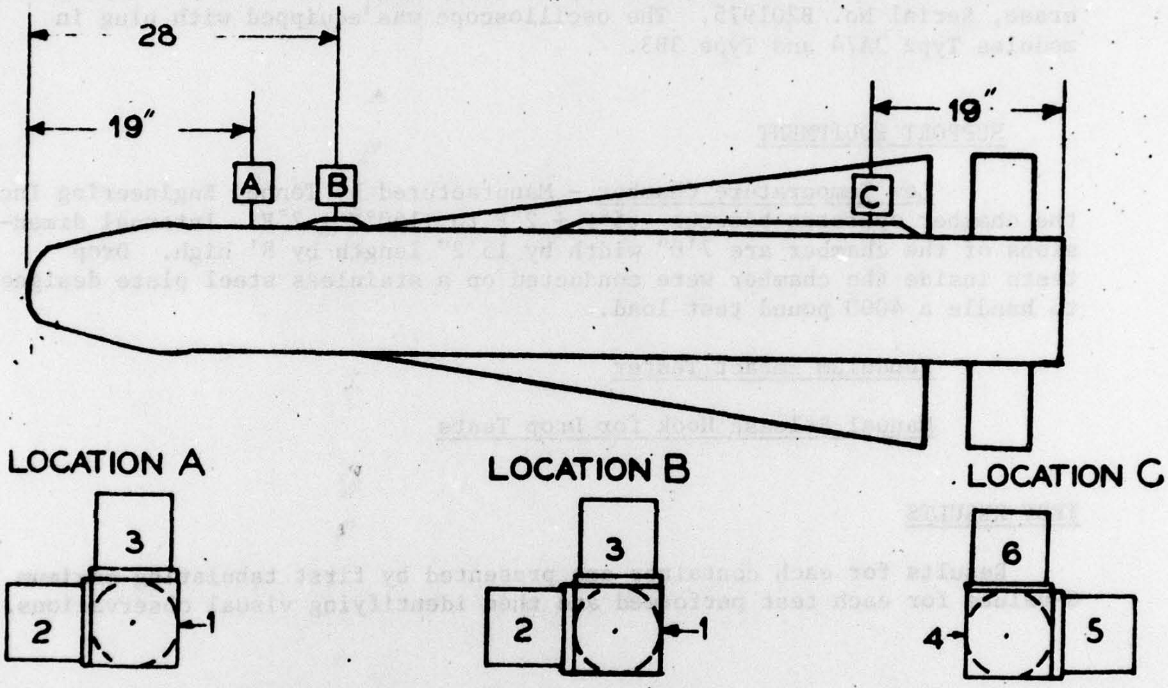


FIGURE 2a. TEST MISSILE IN PLACE IN BOTTOM OF CNU-263/E

FIGURE 2b. FORWARD CUSHIONING PADS ON CNU-263/E

TEST LOAD

The simulated test load consisted of a modified AGM 65A-T training missile. Modifications to the missile increased the weight by some 170 pounds without changing any external missile dimensions. To monitor the tests, the test load was instrumented with two accelerometer blocks as shown in Figure 3. Each accelerometer block was fitted with three accelerometers creating a tri-axial sensor.



CONTAINER	ACCELEROMETER TEST LOCATIONS	ACCELEROMETER NO.	SERIAL NO.	ORIENTATION
CNU-131/E	B - C	1	CE14	HORIZONTAL-LATITUDE
		2	AY29	HORIZONTAL-LONGITUDE
CNU-263/E	A - C	3	CC98	VERTICAL
		4	CE30	HORIZONTAL-LATITUDE
		5	VE48	HORIZONTAL-LONGITUDE
		6	VE52	VERTICAL

FIGURE 3

ACCELEROMETER BLOCK LOCATION AND IDENTIFICATION

TEST EQUIPMENT

TEST INSTRUMENTATION - Accelerometers on the test load provided the input for displaying shock information. These transducers were all Endevco Model 2233E piezoresistive accelerometers. Connection of the accelerometers to the amplifiers was by Endevco accelerometer transducer cable 3090A. Each accelerometer was matched to an Endevco Model 2614C amplifier and powered by an Endevco Model 2622C power supply. The signal was then input into a Tektronix Type 564B storage oscilloscope with auto-erase, Serial No. B201975. The oscilloscope was equipped with plug in modules Type 3A74 and Type 3B3.

SUPPORT EQUIPMENT

Low Temperature Chamber - Manufactured by Tenney Engineering Inc., the chamber operates between -65°F ± 2°F to +160°F ± 2°F. Internal dimensions of the chamber are 7'6" width by 15'2" length by 8' high. Drop tests inside the chamber were conducted on a stainless steel plate designed to handle a 4000 pound test load.

Pendulum Impact Tester

Manual Release Hook for Drop Tests

TEST RESULTS

Results for each container are presented by first tabulating maximum G-values for each test performed and then identifying visual observations.

CNU-131/E

TABLE 1

TEST NUMBER DESCRIPTION	MAXIMUM G'S RECORDED (ROOM TEMP) CHANNELS 1	2	3	*R	(LOW TEMP) CHANNELS 1	2	3	*R	(HIGH TEMP) CHANNELS 1	2	3	*R
1a. FWD EDGE DROP	28	2	8	29	40				18			
b. FWD CORNER DROP	16	3	6	17	20	4	5	21	12	8	4	15
c. AFT EDGE DROP	58	20	20	65	30				32			
d. AFT CORNER DROP	30	4	4	31	25	5	5	26	30	14	6	34
e. FWD END IMPACT	10	10			14	15			17	9		
f. RIGHT SIDE IMPACT	10				14	14			15	10		
g. AFT END IMPACT	10	12			56	36			15	13		
h. LEFT SIDE IMPACT	14				25	13			8	12		
2 SPECIAL SHOCK TEST	10											

***R - Resultant force for three axis measurements**

Visual observations of the container after these tests revealed several items of interest. The index pin located on the bottom of the missile's nose was sheared off. This pin is used on the CNU-131/E container to prevent shifting of the missile when secured in the suspension system. The pin is 0.495 inches in diameter and protrudes roughly 1.2 inches from the surface of the missile. A 0.563 hole is located in the forward saddle to receive the pin. At some point during the testing, the pin was sheared off at its threaded portion imbedded in the missile. The lower pair of wings were indented near the surface of the missile where contact with the aft suspension frame occurred. The lower pair of aft fins impacted the floor of the container at least two different times. Additional damage consisted of skid deformation on the forward end of the container and also slight deformation of vertical reinforcements located on the outside of the container due to pendulum impacts. In both cases the function of the container was unaffected.

CNU-263/E (Trial #1)

TABLE 2

TEST NUMBER DESCRIPTION	MAXIMUM G'S RECORDED (ROOM TEMP) CHANNELS 1	2	3	*R
1a. FWD EDGE DROP	150	100	100	206
b. FWD CORNER DROP	20	5		
c. AFT EDGE DROP	40	15		
d. AFT CORNER DROP	20	20		
2 SPECIAL SHOCK TEST	13	18		

R* - Resultant force for three axis measurements

Visual observations found the nose strap to have slipped over the nose of the missile. The aft right fin was found to have made contact with the wall of the container.

CNU-263/E (Trial #2)

TABLE 3

TEST NUMBER DESCRIPTION		MAXIMUM G'S RECORDED (ROOM TEMP) CHANNELS 1	2	3	*R
1a.	FWD EDGE DROP	25	45		
b.	FWD CORNER DROP	20	12	4	24
c.	AFT EDGE DROP	22			
d.	AFT CORNER DROP	24	10	8	27
e.	FWD END IMPACT	12	6		
f.	RIGHT SIDE IMPACT	32	20		
g.	RIGHT SIDE IMPACT	30	16		
h.	LEFT SIDE IMPACT	40	12		
2	SPECIAL SHOCK TEST	20	16 (spike to 60)		

*R Resultant force for three axis measurements

Visual observations showed the missile moved aft a net distance of 0.7 inch and ending up about 1.2 inches from the container wall. The upper right aft fin had made contact with the wall leaving residue on the fin. The missile's tail section left extensive marks on the desiccant basket and aft end of the container, however, the contact had little affect on the tail section. At the conclusion of this test, the missile was observed to be resting off center. The forward rubberized hair pad had two creases indicating extensive missile movement during testing.

DISCUSSION

CNU-131/E - Examination of the shock data in Table 1 identifies the tests resulting in high G-values to be most often centered around the aft portion of the missile. In this case, each aft edge and aft corner drop was near or above the 30 G maximum. Supporting this were the visual observations concerning damage in the aft area. Indentation damage to the wings appear to be the result of the sheared index pin. Once this pin was removed, forward and aft movement was somewhat unrestrained. Since the wings are normally positioned close to the saddle there was little room for missile movement in the suspension system during the test. Aft impacts and drops would probably be sufficiently severe to cause damage especially at low temperatures where the elastomeric mounts stiffen. Regarding impacts with the container floor, there is an initial clearance of just about two inches between the floor and the bottom of the aft fins. Contact with the floor indicates the missile required more than two inches of movement with the existing suspension system. High G-values generated by the forward edge drops appear to be the result of the index pin contacting the suspension frame and this could account for the pin being sheared off. The absence of the pin during the high temperature forward edge drop could also account for the low G's obtained during this test. In summary, it is evident that the existing CNU-131/E will not provide protection for the AGM-65E missile as specified in AFSC Specification 1308.

CNU-263/E - During the first set of drop tests, extensive spiking on the oscilloscope was observed. High G-values were recorded on all three axis and raised considerable question. After the drop tests were concluded in Trail #1, it was observed that the nose strap had slid off of the missile. From the information available it was determined that the strap had slipped over the nose of the missile on the second drop test. The high G-values on the forward edge drop were attributed to the tiedown strap tightener (metal) vibrating against the side of the missile. This vibration of the tightener was supported by visual evidence of marks on the side of the missile as well as creases in the nose cushions. If the strap came off during the initial impact of the second drop, the vibration would occur only on the first drop and would account for the results. Even the high G-values obtained on the aft corner drop would be explained since without the nose strap there would be little control of lateral movement. A second series of tests was conducted with the metal tighteners cushioned and the missile more securely strapped. Again, high G-values were obtained on several drops and evidence of container missile contact was present. Movement in the forward and aft mode seemed to be only slightly restricted as tail section-container contact was obvious even though the missile was approximately equal distance from both ends at the beginning of the test. In summary, the existing CNU-263/E will not provide protection for the AGM-65E missile as specified in AFSC Sepcification 1308.

CONCLUSIONS

Both existing CNU-131/E and CNU-263/E containers will not meet specification requirements for the AGM-65E missile.

Damage to the AGM-65E missile may be expected when using existing CNU-131/E and CNU-263/E containers.

AIR FORCE PACKAGING EVALUATION AGENCY
(Container Test Plan)

AFPEA PROJECT NUMBER 78-P7-21						
CONTAINER SIZE	**(GROSS) WT**	**(ITEM) WT**	**CUBE**	**QUANTITY**	**DATE**	
107" x 29" x 30"	897	635	54	1	26 June 1978	

ITEM NAME
AGM-65E MISSILE

MANUFACTURER
PLASTICS RESEARCH

CONTAINER NAME
CNU-263/E

CONTAINER COST
N/A

PACK DESCRIPTION
FRP CONTAINER WITH FOAM CUSHIONING

CONDITIONING
AS REQUIRED

TEST NO.	IAW	PARAMETERS	ORIENTATION	INSTRUMENTED
1	FED STD 101B METHOD	Ambient Shocks		Yes
		Rotational Drops		
a.	5008	Edge, Fwd		
b.	5005	Corner, Fwd		
c.	5008	Edge, Aft		
d.	5005	Corner, Aft		
		Pendulum Impact		
e.	5012	Fwd End		
f.	5012	Right Side		
g.	5012	Aft End		
h.	5012	Left Side		
2	AFSC Spec 1308	Special Shock Test 10-Inch Free Fall, Flat Drop at Ambient Temperature		Yes
3	FED STD 101B METHOD	Low Temperature Shocks Temp = -40°F		Yes
		Rotational Drops		
a.	5008	Edge, Fwd		
b.	5005	Corner, Fwd		
c.	5008	Edge, Aft		
d.	5005	Corner, Aft		
		Pendulum Impact		
e.	5012	Fwd End		
f.	5012	Right Side		
g.	5012	Aft End		
h.	5012	Left Side		

COMMENTS

If the container should fail at any point during the testing sequence, testing will be discontinued.

PREPARED BY
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APPROVED BY

FORM

AIR FORCE PACKAGING EVALUATION AGENCY
(Container Test Plan)

AFPEA PROJECT NUMBER: 78-P7-21

CONTAINER SIZE	(GROSS) WT	(ITEM) WT	CUBE	QUANTITY	DATE
107" x 29" x 30"		635		1	26 June 1978

ITEM NAME	MANUFACTURER
AGM-65E MISSILE	PLASTICS RESEARCH

CONTAINER NAME	CONTAINER COST
CNU-263/E	N/A

PACK DESCRIPTION

FRP CONTAINER WITH FOAM CUSHIONING

CONDITIONING

TEST NO.	IAW	PARAMETERS	ORIENTATION	INSTRUMENTED
4	FED STD 101B METHOD	High Temperature Shocks Temp = +140°F Rotational Drops		Yes
a.	5008	Edge, Fwd		
b.	5005	Corner, Fwd		
c.	5008	Edge, Aft		
d.	5005	Corner, Aft		
		Pendulum Impact		
e.	5012	Fwd End		
f.	5012	Right Side		
g.	5012	Aft End		
h.	5012	Left Side		
5	FED STD 101B METHOD 5020	Vibration, Sinusoidal Ambient Temperature		Yes
6	FED STD 101B METHOD 5016	Superimposed-Load Temp = +140°F Stacking Weight = 5 Loaded Containers		No

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1. REPORT NUMBER PTPD REPORT NO. 78-20	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) QUALIFICATION TEST OF CNU-131/E AND CNU-263/E CONTAINERS FOR USE WITH THE AGM-65E MAVERICK MISSILE		5. TYPE OF REPORT & PERIOD COVERED TEST JUNE - SEPTEMBER 1978
		6. PERFORMING ORG. REPORT NUMBER AFPEA PROJECT NO. 78-P7-21
7. AUTHOR(s) DARYL A. EDWARDS		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS AFALD/PTPD (DESIGN DIVISION) WPAFB OH 45433		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS AFALD/PTP (AIR FORCE PACKAGING EVALUATION AGENCY) WPAFB OH 45433		12. REPORT DATE OCTOBER 1978
		13. NUMBER OF PAGES 25
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

CONTAINERS SHIPPING MISSILE
PACKAGING STORAGE

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

This test was performed by request from ASD/SD65E to determine if two existing containers can qualify to be used as shipping and storage containers for the proposed AGM-65E Maverick missile. One each CNU-131/E and CNU-263/E containers was tested by the Air Force Packaging Evaluation Agency. Test results found both containers unable to qualify to specification requirements.