SAND78-8261
Unlimited Release

2
9-13-78

MASTER

W70 Mod 3 Road Test No. 6902

L. R. Myers

Sandia Laboratories

SAND78-8261
Unlimited Release
Printed August 1978

W70 Mod 3 Road Test
No. 6902

L. R. Myers
Test Projects Division 8412
Sandia Laboratories, Livermore

ABSTRACT

This road test of the LANCE missile system with the W70 Mod 3 warhead evaluated the vibration input during transportation environments of the Self Propelled Launcher and the Loader Transporter tracked vehicles. As a result of these road tests, the vibration input levels and frequencies were revised and laboratory tests were conducted which verified that the warhead and all components could survive and function after being subjected to these vibration levels.

NOTICE
This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

CONTENTS

	<u>PAGE</u>
Introduction	9
Purpose of Test	9
Test Description	9
Results	10
Conclusions	11
Appendix	21

ILLUSTRATIONS

<u>FIGURE</u>		<u>PAGE</u>
1	APG Instrumentation Recording Van and Self Propelled Launcher Vehicle	12
2-7	Power Spectral Density Plots	13-18

TABLES

<u>TABLE</u>		<u>PAGE</u>
1	W70-3 Road Test Unit Instrumentation List	19
2	W70-3 Road Test - Sequence of Tests and RMS Data from Z Axis Mtg. Flange	20

W70 MOD 3 ROAD TEST

Introduction

A series of road tests was conducted at Aberdeen Proving Grounds, MD with a W70 Mod 3 laboratory test warhead assembled into an inert Lance M6 missile. The instrumented test missile was subjected to various STS shock and vibration transportation environments while mounted on the M752 Self-Propelled Launcher (SPL) and the M688 Loader Transporter (LT) tracked vehicles.

Purpose of Test

The purpose of this test series was to record the W70 Mod 3 warhead response characteristics to establish frequency and acceleration levels for laboratory shock and vibration testing. An additional purpose was to verify that the warhead and all internal components could adequately survive and function after being subjected to transportation environments in the Lance tracked vehicles.

Test Description

The W70 Mod 3 road test unit (RTU) warhead used in this test is defined by SLL drawing K95382. For this test, the Mod 3 warhead was assembled in the M234 warhead section, which was mated to a M6, training guided missile main assemblage. This instrumented Lance warhead/missile assembly was then mounted on the Self Propelled Launcher (SPL) and the Loader Transporter (LT) on the curbside for the following transportation

test conditions:

Gravel Road - 10, 15, 20, 25, and 27 MPH

6" Washboard - 3, 5, 8, 12, and 16 MPH

Spaced Bump - 12, 15, 18, and 20 MPH

Radial Washboard - 12 and 15 MPH

6" Ramps - 5, 6, 7 and 7.5 MPH

Paved Road - 10 to 34 MPH in 2 MPH increments

Table I instrumentation list lists the location and axis of warhead accelerometers recorded during this road test.

Figure 1 shows the Instrumentation Recording Van and the Self Propelled Launcher with the W70-3 test unit prior to a test run. For a complete detailed description of the various road conditions used during this test see Aberdeen Proving Ground Facilities report TOP 1-1-0011 and/or SLL, W70 Road Test, Report SAND74-0001, RS 8232-2/41865, May 1974.

Results

Table II lists the sequence in which the tests were conducted and lists the acceleration G RMS levels recorded in the Z axis (vertical) at the warhead mounting flange, warhead section, Station 62.375.

Shown in Figures 2, 3 and 4 are composite plots of power spectral density data from the warhead mounting flange accelerometers A8X (longitudinal), A9Y (lateral) and A11Z (vertical) at Station 62.375 recorded during the Self Propelled Launcher vehicle tests.

Shown in Figures 5, 6 and 7 are composite plots of power spectral density data from the warhead mounting flange accelerometers A8X (longitudinal), A9Y (lateral) and A11Z (vertical) at Station 62.375 recorded during the Loader Transporter vehicle tests.

Additional data recorded for each accelerometer during each test is available for review from Division 8412, test number 6902 file.

As a result of this road test series, the W70 Mod 3 transportation and endurance vibration test input levels and frequencies were revised, and laboratory tests were conducted which verified that the warhead and all components could adequately survive and function after being subjected to these vibratic levels.

Conclusions (D. Pegan, Division 8168)

All SLL test objectives of the W70-3 road tests were met and the W70-3 warhead successfully survived the transportation test environment.

After analysis of the road test data, the transportation sine and random vibration test specifications for warhead input simulation were updated, as shown in Appendix A, to represent the W70 Mod 3 response characteristics.

Figure 1. APG Instrumentation Recording Van and Self Propelled Launcher Vehicle

W70-3 ROAD TEST TEST NO. 06902 TEST DATE 11/19/76
 Effective Filter Bandwidth = 2.6Hz
 ASX MID. FLANGE, 0 DEG. SPL COMPOSITE
 Longitudinal

Figure 2.

Figure 3.

W70-3 ROAD TEST TEST NO. 06902 TEST DATE 11/19/76
Effective Filter Bandwidth = 2.6Hz

A112 MTG. FLANGE, 270 DEG. SPL COMPOSITE

Figure 4.

Vertical

W70-3 ROAD TEST TEST NO. C '902 TEST DATE 11/20/76

Effective Filter Bandwidth $\Delta f = 2.6\text{Hz}$

RBX MTG. FLANGE, 0 DEG. 1/T CURBSIDE COMPOSITE
Longitudinal

Figure 5.

W70-3 ROAD TEST TEST NO. 06902 TEST DATE 11/20/76

Effective Filter Bandwidth = 2.6Hz

RAY MTG. FLANGE, 0 DEG. LT CURBSIDE COMPOSITE
Lateral

Figure 6.

W70-3 ROAD TEST TEST NO. 06902 TEST DATE 11/20/76

Effective Filter Bandwidth = 2.6Hz

A112 MTG. FLANGE, 270 DEG. LT CURBSIDE COMPOSITE
Vertical

Figure 7.

TABLE I
W70-3 ROAD TEST UNIT
INSTRUMENTATION LIST

<u>TRANSDUCER ID</u>	<u>TYPE</u>	<u>WHS AXIS</u>	<u>LOCATION*</u>
A1	2228C	X	
A2	2228C	Y	
A3	2228C	Z	
A4	2224C	X	
A5	2224C	Y	
A6	2224C	Z	
A7	2224C	Z	
A8	2228C	X	MTG. FLANGE, 0°
A9	2228C	Y	MTG. FLANGE, 0°
A11	2221	Z	MTG. FLANGE 270°
A12	2221	X	
A13	2221	Z	
A14	2228C	X	
A15	2228C	Y	
A16	2228C	Z	
A17	2221	Z	
A18	2221	Z	
A19	2221	Z	

*Instrumentation location is shown on SLL drawing K95382.

TABLE II

W70-3 Road Test
Sequence of Tests and RMS Data
From Z Axis Mtg. Flange (2.6 EDW PSD Plots)

SPL (Self Propelled Launcher)			LT (Loader Transporter)		
Run #	Test Condition	(G) RMS	Run #	Test Condition	(G) RMS
9	Gravel Road 10 MPH	.41	66	Gravel Road 10 MPH	.41
10	Gravel Road 15 MPH	.60	67	Gravel Road 15 MPH	.64
12	Gravel Road 20 MPH	.69	68	Gravel Road 20 MPH	*
15	Gravel Road 25 MPH	.85	69	Gravel Road 25 MPH	.73
14	Gravel Road 27 MPH	.92	72	6" Washboard 3 MPH	.15
17	6" Washboard 3 MPH	.17	73	6" Washboard 5 MPH	.34
18	6" Washboard 5 MPH	.33	75	6" Washboard 8 MPH	.65
20	6" Washboard 8 MPH	.63	77	6" Washboard 12 MPH	.77
22	6" Washboard 12 MPH	.66	80	6" Washboard 16 MPH	1.02
24	6" Washboard 16 MPH	1.00	82	Spaced Bump 12 MPH	.45
27	Spaced Bump 12 MPH	.45	83	Radial Washboard 12 MPH	.61
28	Radial Washboard 12 MPH	.61	85	Spaced Bump 15 MPH	.67
31	Spaced Bump 15 MPH	.60	86	Radial Washboard 15 MPH	.87
32	Radial Washboard 15 MPH	.83	88	Spaced Bump 18 MPH	.66
34	Spaced Bump 18 MPH	.78	90	Spaced Bump 20 MPH	.75
36	Spaced Bump 20 MPH	.89	92	6" Ramps 5 MPH	.21
38	6" Ramps 5 MPH	.24	94	6" Ramps 6 MPH	.29
40	6" Ramps 6 MPH	.28	96	6" Ramps 7 MPH	*
42	6" Ramps 7 MPH	.39	98	Paved Road 10 MPH	.40
44	6" Ramps 7.5 MPH	*	99	Paved Road 12 MPH	*
46	Paved Road 10 MPH	.36	100	Paved Road 14 MPH	.49
47	Paved Road 12 MPH	.36	101	Paved Road 16 MPH	.59
48	Paved Road 14 MPH	.47	102	Paved Road 18 MPH	.62
49	Paved Road 16 MPH	.67	103	Paved Road 20 MPH	.63
50	Paved Road 18 MPH	.73	104	Paved Road 22 MPH	.63
51	Paved Road 20 MPH	.73	105	Paved Road 24 MPH	.69
52	Paved Road 22 MPH	.85	106	Paved Road 26 MPH	*
54	Paved Road 24 MPH	.80	108	Paved Road 28 MPH	.73
55	Paved Road 26 MPH	.87	109	Paved Road 30 MPH	.81
56	Paved Road 28 MPH	.86	111	Paved Road 32 MPH	.84
57	Paved Road 30 MPH	1.15	112	Paved Road 34 MPH	.93
			114	Paved Road 34 MPH	.79

*Data is not valid

APPENDIX

W70-3

Transportation and Endurance Vibration Test

I. Transportation Vibration at Temperature Extremes

A. Random

Random vibration tests in each axis will be for 25 minutes at each of the following temperature conditions, 140°F, room temperature, and -30°F. Total vibration time for each axis will be 1-1/4 hours.

1. X-axis, see Figure 1.
2. Y-axis, see Figure 2.
3. Z-axis, see Figure 3.

B. Sine (No tracking filter on control channel)

Sinusoidal vibration tests in each axis will be for 2 sweeps at 1/2 oct/min at each of the following temperature conditions; 140°F, room temperature, and -30°F. Total vibration time in each axis will be 1-3/4 hours for X axis test and 2-1/2 hours for the Y and Z axis.

1. X-axis, see Figure 4.
2. Y-axis, see Figure 5.
3. Z-axis, see Figure 6.

II. Endurance Transportation Vibration

A. Random

Random vibration tests in each axis will be for 1 hour in each of the four periods as shown in High and Low Thermal Cycles, Figure 7 and Figure 8. Total vibration time in each axis will be 8 hours, 4 hours in the low temperature thermal cycle and 4 hours in the high temperature thermal cycle.

1. X-axis, see Figure 1.
2. Y-axis, see Figure 2.
3. Z-axis, see Figure 3.

B. Sine (No tracking filter on control channel)

Sinusoidal vibration tests in each axis will have a sweep rate of 1/2 oct/min. for 1/2 hour in each of the four periods as shown in High and Low Thermal Cycles, Figure 7 and Figure 8. Total vibration time in each axis will be 4 hours, 2 hours in the low temperature thermal cycle and 2 hours in the high temperature thermal cycle.

1. X-axis, see Figure 4.
2. Y-axis, see Figure 5.
3. Z-axis, see Figure 6.

X Axis
WH Input
W70-3 Transportation Random Vibration

3/11/77

Figure 1.

Figure 2.

Z Axis
WH Input
"70-3 Transportation Random Vibration

3/11/77

Figure 3.

3/11/77

Figure 4.

3/11/77

Figure 5.

3/11/77

Z Axis
W1 Input
W70-5 Transportation Sine Vibration

Figure 6.

FIGURE 7.

FIGURE 8.