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USATECOM PROJECT NO. 7-6-0739-01

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RESEARCH TEST OF
RECORDER, VELOCITY SHOCK, ELECTRONIC

FINAL REPORT

BY

JOSEPH F. BRUGH

SEPTEMBER 1967

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GENERAL EQUIPMENT TEST ACTIVITY
FORT LEE, VIRGINIA

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(9) FINAL REPORT.

BY

(10) JOSEPH F. BRUGH
Engineering Test Directorate

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FORT LEE, VIRGINIA

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U. S. ARMY GENERAL EQUIPMENT TEST ACTIVITY
FORT LEE, VIRGINIA

USATECOM 7-6-0739-01

Final Report of
Recorder, Velocity Shock, Electronic

Conducted at USA Natick Laboratories, Mass.,
Tobyhanna Army Depot, Penn., and USAGETA, Fort Lee, Va.

September 1967

Abstract

A Research Test (RE) of Recorder, Velocity Shock, Electronic, was conducted from 22 March through 6 July 1967, to collect data pertinent to the shipping environment of a normal rail shipment to enable the USA Natick Laboratories to determine the operational reliability of the test item under actual field conditions. The test also included a determination of the shock input to the test containers occurring during rail transport and the magnitude and frequency of its occurrence relative to the number of miles traversed.

It was concluded that the operational reliability of the experimental electronic velocity shock recorder, as presently designed, is not satisfactory.

It was recommended that the defect causing a constant drain on the test item's batteries be corrected.

FOREWORD

The U. S. Army General Equipment Test Activity (USAGETA) was responsible for preparing the test plan, executing the test, and preparing the test report.

This test was authorized and conducted under the authority of the following: Letter, AMSTE-GE, Headquarters, U. S. Army Test and Evaluation Command, 20 September 1966, subject: "Test Directive, USATECOM Project No. 7-6-0739-01 Research Test (RE) of Recorder, Velocity Shock, Electronic."

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SECTION 1. INTRODUCTION

1.1 BACKGROUND

One of the major obstacles in the development of effective packaging and container systems is the lack of reliable information relative to conditions encountered by military supplies during shipment, handling, and storage. Container design in the past has been based chiefly on visual observations made over a long period of time on the actual field performance of many types of containers of various size and construction. This method of comparative performance may represent costly overpackaging of both material and labor. Conversely, the strength of the container is sometimes exceeded resulting in it and its contents being damaged. To obtain quantitative data on supply line conditions needed for the design and performance evaluation of shipping containers, the General Equipment & Packaging Laboratory, U. S. Army Natick Laboratories (USANL) has developed an electronic velocity shock recorder (VSR).

During the period of April through July 1967 a USAGETA Test Team supported USANL in this test project by conducting a shipping and handling test to collect data for a comparative performance evaluation with current laboratory techniques.

1.2 DESCRIPTION OF MATERIEL

The test item (Fig. 1) is a solid state electronic device powered by alkaline batteries. It was designed to operate unattended for periods up to six months.

The experimental recorder is small enough to fit in a standard No. 10 can shipping case measuring 18 9/16 by 12 3/8 by 7 inches. Impact velocity is sensed by a transducer consisting of a rod magnet which rides within an aluminum tube. The magnet is connected at one end to a coil spring which, in turn, is fastened to the end of the tube. Several hundred turns of magnet wire are spaced uniformly along the length of the tube. At impact, the relative motion of the magnetic flux field, with respect to the coils, produces a voltage proportional to the impact velocity. Three of the velocity transducers are mounted in mutually perpendicular planes so as to make possible the measurement of shock inputs from horizontal, vertical and lateral directions. Voltage signals produced by the transducers are fed to a 4-channel recorder head and recorded on a 100-foot reel of

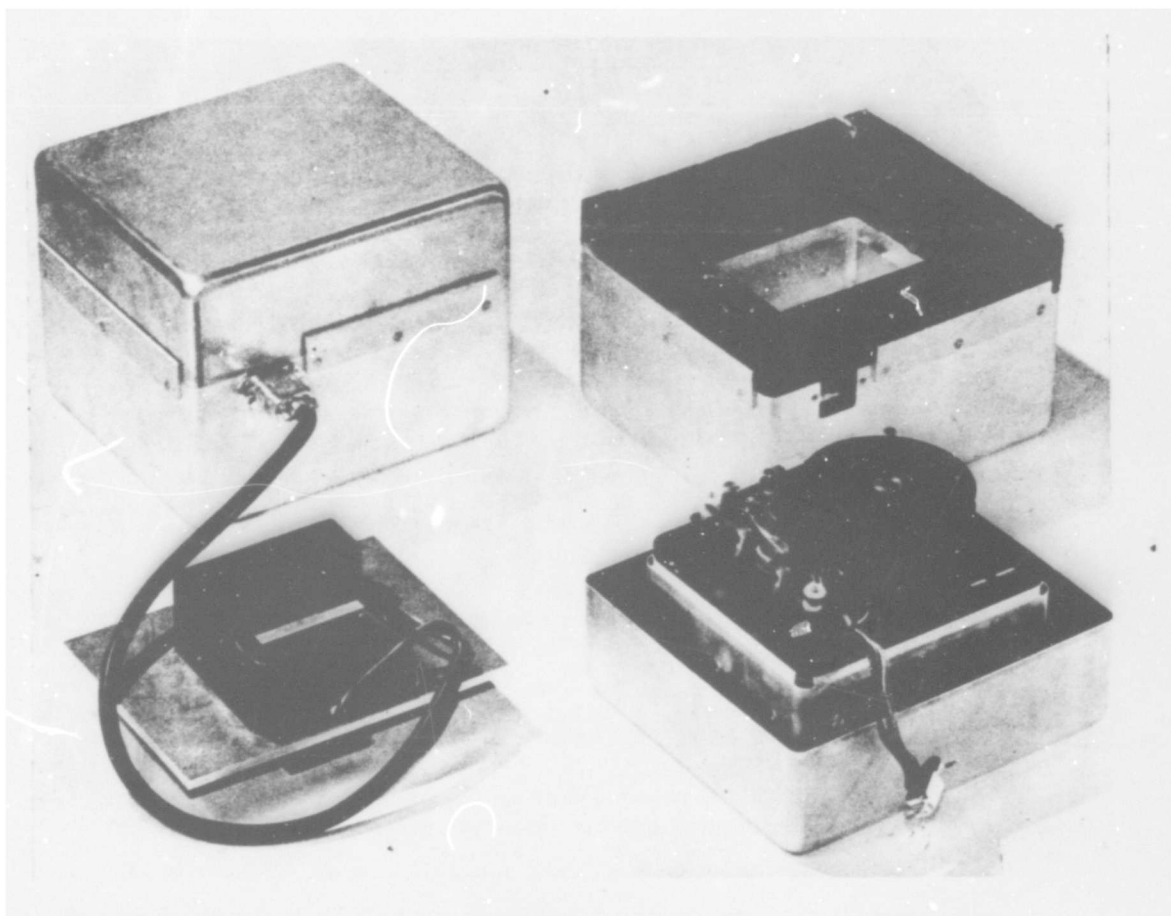


Figure 1. View of Solid State Electronic Velocity Shock Recorder (VSR)

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magnetic tape. Recordings are made while the tape is stationary thereby conserving on power requirements which greatly simplifies the system's design. The fourth tape channel is used for recording a timing mark once each hour which will be used to determine at what time and place in the shipment the shock input occurred. The equivalent drop height can readily be calculated from the measured impact velocity.

1.3 TEST OBJECTIVE

To collect sufficient data concerning the shipping environment of a normal rail shipment to enable USANL to determine the following:

- a. Operational reliability of the velocity shock recorders under actual field conditions.
- b. Influence of the weight of contents on the drop heights experienced by the shipping containers.
- c. Container drop heights relative to conditions under which containers are handled in loading and unloading operations.
- d. Comparative rough-handling experienced between containers combined into unitized loads and those shipped individually.
- e. Shock inputs to containers occurring during transport and the magnitude and frequency of occurrence of these shock inputs relative to the miles traveled.

1.4 SUMMARY OF RESULTS

- a. The power supply of the velocity shock recorders is insufficient for continuous operation. (Deficiency)
- b. The alkaline battery proved to be less efficient than the mercury battery for this type of operation.

1.5 CONCLUSIONS

- a. As designed, the operational reliability of the velocity shock recorder is not satisfactory.

b. Container drop heights did not normally exceed 18 inches during loading and unloading operations.

c. The test shipment was subjected to approximately the same amount of fork lift truck handling as previous test shipments.

1.6 RECOMMENDATION

It is recommended that the defect in the VSR causing a constant drain on the batteries be corrected.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

Twelve prototype electronic shock recorders were calibrated and mounted in individual shipping cases and unitized loads by USANL personnel. Both instrumented containers and unitized loads were included in a one rail car shipment. The test items were subjected to several handling test operations during a round trip shipment from USANL, Natick, Mass. to USAGETA, Fort Lee, Va. All instrumented containers were constructed and weighed so as to appear identical to other fiberboard containers comprising the test shipment.

The test shipment, was assembled at USANL, using fiberboard containers filled with canned subsistence items consisting of the following:

a. Five hundred twelve regular slotted Style V3c corrugated fiberboard containers filled with No. 10 cans of maple syrup (gross weight 60 pounds per case).

b. Five hundred twelve regular slotted Style V3c corrugated fiberboard containers filled with No. 10 cans of diced dehydrated potatoes (gross weight 21 pounds per case).

c. Five hundred twelve regular slotted Style V3c corrugated fiberboard containers filled with No. 10 cans of peas (gross weight 47 pounds per case).

d. Twenty unitized modular loads containing a combination of No. 10 cans of syrup, standard 4 1/2 inch rolls of toilet tissue, and loose cleaning rags packaged in five different size containers. Filled containers of a five-size container system were assembled on a pallet base, sheathed and capped. The unitized loads weighed approximately 1,840 lbs; their load configuration was 40 x 48 x 54 1/2 inches.

2.2 SHIPPING AND HANDLING TEST

2.2.1 Objective

See paragraph 1.3.

2.2.2 Method

The shipping and handling test was divided into two phases. Phase I covered the period beginning with the departure of the test shipment from USANL on 30 March 1967 and ended with the final warehouse handling test operations conducted by USAGETA at Fort Lee, Va., on 1 May 1967. Phase II included the period of 25 May 1967 beginning with the outloading of the test shipment at USAGETA, Fort Lee, Va., and ending with off-loading of the rail car at USANL, Natick, Mass. on 30 June 1967. During both test phases an intermediate transfer of cargo, consisting of off loading, warehousing and reloading operations, was accomplished at Tobyhanna Army Depot, Pennsylvania.

a. Phase I

(1) The test shipment consisting of subsistence and miscellaneous material was assembled at Sudberry Annex, Mass. Prior to shipment, the experimental velocity shock recorders were calibrated and installed in standard size shipping containers and unitized loads. The instrumented containers were then coded and subjected to an 18 inch free fall drop to be used as a reference point on playback of recording tapes.

(2) Loading operations were accomplished by moving individual cases on pallets into the rail car by fork lift truck and manually stacking them by commodity item in one end of the rail car. The opposite end of the rail car was filled with unitized loads stacked in two tiers. The cargo was securely gated, strapped, blocked and braced to prevent shifting and damage during transit. Hygrothermographs were mounted on top of the test loads and at the floor level of the rail car to record humidity and temperature during shipment.

(3) The test shipment arrived at the aforementioned intermediate transfer point on 17 April 1967, after being misrouted several hundred miles by the railroads. On its arrival at this point, the rail car was opened and the cargo was inspected for damage. The test cargo was then moved into a depot warehouse for storage. Pallets and fork lift trucks were utilized in transferring the test shipment from the rail carrier to the storage warehouse.

(4) On 18 April 1967, the test cargo was removed from storage and reloaded into the rail car. A three man crew removed individual containers from pallets and manually stacked them in the rail car following the

same general loading plan and procedures used at the Sudberry Annex, Mass. With one exception, the stacking height of the cargo in the car was lowered to form a longer and more solid block load against the unitized loads, thus eliminating the blocking and bracing (Fig. 2).

(5) The test shipment was routed through Norfolk, Virginia. It arrived at Fort Lee, Va., on 28 April 1967. Upon its arrival, the rail car was opened and the test cargo was again inspected for damage by the Activity's test team. A military six man work detail off loaded the test cargo by stacking individual cases on pallets and moving them into a transportation warehouse for temperature storage. On 2 May, the cargo was moved to a USAGETA storage area using fork lift trucks and 2 1/2 ton capacity standard cargo trucks. All unitized loads and individual containers were inspected for damage. The 12 experimental velocity shock recorders were removed from the shipment, examined for damage, and then subjected to operational checks as prescribed by the test plan. All recording tapes were removed and returned to USANL for further analysis.

b. Phase II

(1) Phase II of the test was conducted after a modification of the velocity shock recorders was accomplished by USANL. All test recorders were reassembled with new batteries and recording tapes then packaged in new fibreboard containers. Before their return to the test shipment, each of the individual instrumented containers were subjected to two 18 inch free fall drops to a concrete surface to serve as a reference point on playback of the tapes.

(2) On 1 June 1967 the test shipment was loaded into a 50 foot rail car for shipment to Tobyhanna Army Depot, Penn. This operation was accomplished by transporting the test cargo to the rail siding on military 2 1/2 ton capacity cargo trucks. A seven man military work detail (Fig. 3) manually stacked the individual containers in the rail car following the same loading method employed at USANL. On the shipment's arrival at the Tobyhanna Army Depot transfer point on 16 June 1967, off loading and loading procedures used were identical to those as described in par. 2.2.2a. (2) (3) and (4). The test shipment departed Tobyhanna Army Depot on 17 June 1967 arriving at Natick, Mass., on 30 June 1967. The rail car was opened and the cargo inspected for damage. Individual

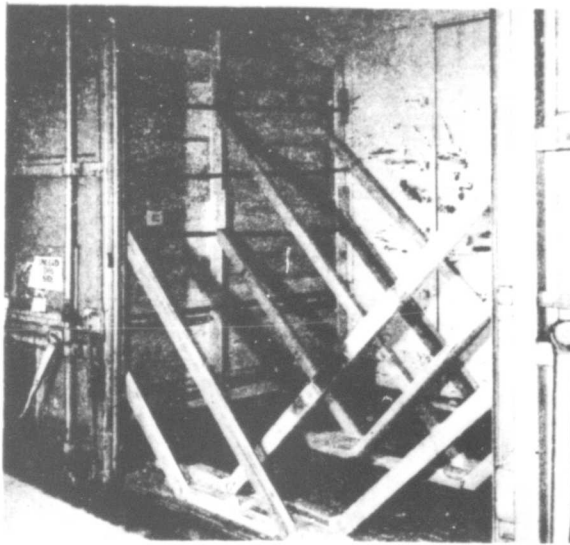


Figure 2. Test shipment loaded in rail car at Sudberry Annex, Massachusetts.

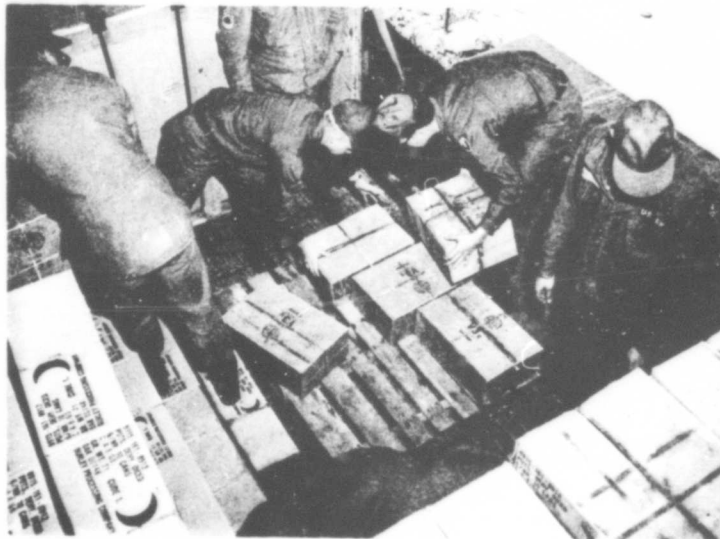


Figure 3. Manual stacking of test containers on pallet during off loading test operations.

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containers were stacked on pallets by a four man work crew and then moved into a storage area by fork lift trucks. All instrumented containers were removed from the shipment, inspected for damage and then subjected to an operational check. All recording tapes and velocity shock recorders were returned to USANL for further analysis.

2. 2. 3 Results

2. 2. 3. 1 Operation Reliability of the Velocity Shock Recorders

a. Phase I

All instrumented containers were opened for inspection and operational checks as prescribed by the test plan. An examination of the instrumented containers by USAGETA's test team at Fort Lee, Va. showed that the fiberboard containers were only slightly scuffed and were in a serviceable condition. Visual inspection also showed that no damage had been incurred by the experimental recorders as a result of the test shipping and handling operations.

During the operational check it was found that 7 of the 12 experimental recorders were not operating properly due to a drop in battery voltage on all of the recorders. Data pertaining to the operational reliability of the velocity shock recorders during Phase I are shown in Table 1.

b. Phase II

Upon their arrival at Sudberry Annex, Mass., the instrumented containers were removed from the test shipment and opened for operational checks of the recorders. All instrumented fiberboard containers and recorders were found undamaged and in serviceable condition.

The operational check revealed that 4 recorders were not operating and that the battery voltage had again dropped below acceptable limits prescribed for the recorders. Data pertaining to the operational reliability of the velocity shock recorders during Phase II are shown in Table II.

TABLE I

RESULTS OF OPERATIONAL INSPECTION OF THE VELOCITY SHOCK
RECORDERS EQUIPPED WITH ALKALINE BATTERIES UPON COMPLETION OF PHASE I

Recorder Number	Commodity	Capacitor Voltage	Watch Voltage	Remarks
A-1	Unitized load	15v	1.4v	Not operating
A-2	Unitized load	34v	1.4v	Operating
A-3	Unitized load	35v	1.4v	Operating
4	Peas	13v	1.3v	Not operating
5	Peas	2v	1.5v	Not operating
6	Peas	35v	1.5v	Operating
7	Syrup	37v	1.4v	Operating
8	Syrup	1v	1.4v	Not operating
9	Syrup	15v	1.4v	Not operating
101	Deh Pot	0v	1.4v	Not operating
102	Deh Pot	33v	1.4v	Operating
103	Deh Pot	18v	1.0v	Not operating

TABLE II

RESULTS OF OPERATIONAL INSPECTION OF THE VELOCITY SHOCK
RECORDERS EQUIPPED WITH MERCURY BATTERIES UPON COMPLETION OF PHASE II

Recorder Number	Commodity	Capacitor Voltage	Remarks
A-1	Unitized load	38v	Operating (Timers not working)
A-2	Unitized load	20v	Not operating (Timers not working)
A-3	Unitized load	37v	Operating
4	Peas	34v	Operating
5	Peas	25v	Not operating (Ruptured cells)
6	Peas	40v	Operating
7	Syrup	20v	Not operating (Timers not working)
8	Syrup	38v	Operating
9	Syrup	39v	Operating
101	Deh Pot	3v	Not operating
102	Deh Pot	40v	Operating
103	Deh Pot	40v	Operating

2. 2. 3. 2 Shipping and Handling Data

A USAGETA test team accompanied the test shipment to collect data and observe all shipping and handling test operations. A visual inspection of the containers was conducted at each transfer point; any damage incurred was recorded. Containers classified as failures were removed from the shipment. No evaluation of the canned subsistence items was attempted since these items were subjected to a previous shipping, handling and storage test. Table III Shows a Summary of the number and types of handlings and the approximate number and heights of drops occurring during the entire test period for each recorder.

A detailed chronological history of each of the 12 recorders is shown in Appendix I.

The shipping and handling procedures at Tobyhanna Army Depot, Penn , and Fort Lee, Va. were typical operations for those installations and consisted of the movement of cargo by 4,000 pound capacity fork lift trucks and work details for manually handling the individual container.

2. 2. 3. 3 Environmental Data

At each transfer point seven day-clock-type Hygrothermographs were mounted at specific points in the rail car to record the relative humidity and temperatures during the rail shipment.

Data relative to the daily maximum and minimum temperatures and humidity recorded during the test shipment are shown in Appendix III.

2. 2. 4 Analysis

2. 2. 4. 1 Operational Reliability of Velocity Shock Recorder

a. Phase I

Each test velocity shock recorder was equipped with a 6 month duration, 45 volt alkaline battery. Recorder capacitors were designed to operate on a 42 to 45 volt power supply. The electric timing device operates on 1.5 volts. An analysis of the battery voltage (Table I) shows that the voltage was below the normal operating ranges for all recorders.

TABLE III

NUMBER AND HEIGHTS OF DROPS
OCCURRING DURING TEST SHIPMENT

Recorder No.	Commodity	No. of Handlings Manual	No. of Fork Lift Handlines	No. & Height of Drops		
				4"-18"	19"-36"	37" & Up
A-1	Unitized load	4*	10	4		
A-2	Unitized load	4*	11	4		1
A-3	Unitized load	4*	12	4		
4	Peas	12	19	9	1	1
5	Peas	13	12	9		1
6	Peas	12	10	11		1
7	Syrup	13	12	12		1
8	Syrup	12	12	11		1
9	Syrup	10	11	10		1
101	Deh Pot	13	9	11		1
102	Deh Pot	10	9	9	1	1
103	Deh Pot	12	10	12		1

*Occurred during handling of recorders while unitized loads were disassembled.

In addition, the operational deficiency of the 7 recorders not operating was primarily caused by the constant drain on the batteries. It was not due to mechanical damage caused by shock incurred during shipment.

The magnitude of the constant voltage drain was determined by USANL prior to the conduct of Phase II. The alkaline cells were replaced with mercury cells to compensate for this deficiency. Mercury cells possess a longer life than alkaline cells under constant drain. However, they are adversely affected by low temperatures. Since the remaining phase of this test was to be conducted during warm weather this disadvantage would be of no consequence.

b. Phase II

Table II shows that the mercury cells failed to provide the desired 42 to 45 volt power supply throughout a 30 day test shipment.

Although the operational reliability of the velocity shock recorders was somewhat improved by the installation of the mercury cells, the overall performance of the experimental recorders falls short of acceptable results. Extensive analysis will be required to determine the causes of the constant drain voltage and adequate modifications accomplished before satisfactory performance of the velocity shock recorder can be expected.

Examination of Table II shows that all of the recorders in the unitized loads received an average of eleven fork lift truck handlings with only one load dropped more than 18 inches. This load, with recorder coded A-2, fell 48 inches from the top layer of a stack to the rail car's floor during unloading operations at Tobyhanna Depot. An average of eleven fork lift truck handlings can be considered about normal for a test shipment of subsistence items. To cite two examples, during an Engineer Design Test of Modular Unitized Load, USATECOM Project No. 7-3-0150-06, conducted by USAGETA, the test items received 11 handlings from fork lift trucks. Ten handlings were accomplished during a shipping test from New Cumberland Army Depot, Pennsylvania to Panama (USATECOM Project No. 7-3-0150-03) by employing the use of forklift trucks.

All of the recorders in individual containers of subsistence items were subjected to approximately the same amount of handling, most of which consisted of drops under 18 inches. Each recorder received one drop of more than 37 inches. Recorders designated as numbers 102 and 4

received one drop each consisting of more than 19 inches. With the exception of Tobyhanna Depot, all manual handling was accomplished with inexperienced personnel. However, all fork lift trucks were operated by skilled drivers.

At all transfer points, the cargo handling equipment was adequate to handle both unitized loads and individual containers of subsistence with little difficulty. Data pertaining to the types of damage to individual containers are shown in Appendix II.

Ten fork lift truck handlings were accomplished during an Engineer Design Test of Expendable Unitized Load Containers (USATECOM Project No. 7-3-0150-03).

2.2.4.2 Shipping and Handling Test Data

During both phases of testing the overall damage to individual containers and unitized loads was considered to be extremely light. However, a number of containers received major damage which resulted from the strapping used in blocking and bracing the cargo in the rail car during transport from USANL, Natick, Mass. to the intermediate transfer point at Tobyhanna Army Depot.

A modification in loading patterns eliminated the possibility of this type of damage during the remainder of the test.

SECTION 3. APPENDICES

- APPENDIX I - RECORD OF DROP HEIGHTS AND LOCATIONS,
DATES, TIMES AND CONDITIONS
- APPENDIX II - TYPE OF DAMAGE OCCURRING DURING SHIP-
MENT BY LOCATION AND SUBSISTENCE ITEMS
- APPENDIX III - RECORD OF MAXIMUM AND MINIMUM TEM-
PERATURE AND HUMIDITY WITHIN RAIL CAR
DURING SHIPMENT
- APPENDIX IV - REFERENCE
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APPENDIX I

RECORD OF DROP HEIGHTS AND
LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER A-1
UNITIZED LOAD #1

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Loaded on 2½ ton capacity cargo truck using fork lift.
		0900	Off loaded at rail siding using fork lift.
		0920	Moved into rail car with fork lift.
		0922	Was shoved into corner by other unit loads and fork lift.
Tobyhanna Army Depot, Penn.	17 Apr 67	1605	Off loaded from rail car and moved into storage warehouse.
	18 Apr 67	1550	Moved from storage and loaded into rail car with fork lift.
	19 Apr 67	1345	Rail car was bumped by switch engine.
Fort Lee, Va.	28 Apr 67	1340	Off loaded from rail car and pushed into front of 2½ ton capacity cargo truck with fork lift.
		1412	Transported to warehouse in 2½ ton capacity cargo truck.
		1425	Off loaded and placed in storage warehouse with fork lift.
	25 May 67	1342	Instrumented container dropped 18 inches onto concrete surface.
		1412	Instrumented container dropped 18 inches onto concrete surface.
	26 May 67	1235	Manually loaded in pickup truck and dropped 4 inches into truck bed. Transported 1 mile to warehouse.

APPENDIX I

RECORDER NUMBER A-1 UNITIZED LOAD #1

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
		1500	Assembled in unitized load. Dropped approximately 6 inches onto top of other containers.
	31 May 67	1445	Loaded on 2½ ton capacity cargo truck by fork lift truck and transported to warehouse at rail siding.
		1530	Unloaded from truck into warehouse by fork lift.
	1 Jun 67	0937	Moved into rail car and placed in second tier by fork lift.
Tobyhanna Army Depot, Penn.	16 Jun 67	1415	Load moved from rail car to storage warehouse by fork lift.
	19 Jun 67	0914	Load moved into rail car. Placed in second tier by fork lift.
Natick, Mass.	30 Jun 67	1340	Load moved from rail car to rail siding by fork lift.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER A-2
UNITIZED LOAD #2

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0930	Loaded into 2½ ton capacity cargo truck with fork lift.
		0945	Dragged from front of truck to platform by fork lift.
		0952	Moved into rail car by fork lift.
		0954	Shoved into position in rail car.
		0958	Load was bumped by fork lift truck used in loading rail car.
Tobyhanna Army Depot, Penn.	17 Apr 67	1543	Off loaded from rail car and placed in storage using fork lift.
	18 Apr 67	1535	Loaded into rail car by fork lift.
	19 Apr 67	1345	Rail car was bumped by switch engine.
Fort Lee, Va.	28 Apr 67	1330	Off loaded from rail car and moved into warehouse by fork lift.
	1 May 67	1000	Loaded onto 2½ ton capacity cargo truck by fork lift and transported 2 miles to storage.
		1003	Shoved to front of truck by other loads by fork lift.
		1025	Off loaded and placed in storage by fork lift.
	25 May 67	1355	Instrumented container dropped 18 inches onto a concrete surface.

APPENDIX I

RECORDER NUMBER A-2 UNITIZED LOAD #2

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
		1408	Instrumented container dropped 18 inches onto a concrete surface.
	26 May 67	1235	Container manually loaded into pickup truck and moved to warehouse. Dropped 4 inches into truck bed.
	31 May 67	1445	Container assembled into unitized load. Dropped 6 inches onto other containers.
		1450	Unitized loaded onto 2½ ton capacity cargo truck by fork lift and transported to storage warehouse.
Fort Lee, Va.	1 Jun 67	0930	Load placed in rail car by fork lift.
Tobyhanna Army Depot, Penn.	16 Jun 67	1316	Load toppled from top tier and fell 48 inches to floor of rail car during unloading operations.
		1325- 1330	Load tilted into upright position by fork lift and moved into storage warehouse.
	19 Jun 67	0910	Load moved to rail car by fork lift and placed in 3rd row onto top left side.
Natick, Mass.	30 Jun 67	1333	Load moved from rail car to rail siding by fork lift.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER A-3
UNITIZED LOAD #3

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0930	Loaded onto 2½ ton capacity cargo truck by fork lift.
		0945	Off loaded at rail siding by fork lift.
		1143	Moved into rail car by fork lift.
		1145	Shoved into position into rail car by fork lift.
Tobyhanna Army Depot, Penn.	17 Apr 67	1530	Off loaded from rail car by fork lift and moved to storage.
	18 Apr 67	1505	Moved from storage warehouse into rail car by fork lift.
	19 Apr 67	1345	Rail car bumped by switch engine.
Fort Lee, Va.	28 Apr 67	1325	Off loaded and placed in storage warehouse by fork lift.
	1 May 67	0920	Loaded onto 2½ ton capacity cargo truck by fork lift.
		0923	Was shoved to front of truck by fork lift with other loads.
		0925	Shoved to front of truck by fork lift with other loads.
		0927	Transported 2 miles to storage warehouse.
		0945	Off loaded and placed in storage by fork lift.
Fort Lee, Va.	25 May 67	1352	Instrumented container dropped 18 inches onto concrete surface.

APPENDIX I

RECORDER NUMBER A-3
UNITIZED LOAD #3

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
		1410	Instrumented container dropped 18 inches onto concrete surface.
	26 May 67	1445	Instrumented container placed onto ½ ton capacity cargo truck and transported to warehouse. Dropped 4 inches into truck bed.
Fort Lee, Va.	1 Jun 67	0925	Container assembled into unitized load. Dropped 6 inches onto other containers.
		0930	Unitized load loaded onto 2½ ton capacity cargo truck by fork lift and transported to rail siding.
		1000	Load moved from truck into rail car and placed on floor of rail car near the end of car.
Tobyhanna Army Depot, Penn.	16 Jun 67	1311	Load moved from rail car into storage warehouse by fork lift.
	19 Jun 67	0907	Load moved to new location in warehouse by fork lift.
		1025	Load moved from warehouse into rail car by fork lift truck and placed in 3rd row onto top of pallet.
Natick, Mass.	30 Jun 67	1335	Load moved from rail car to rail siding by fork lift.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 4
CANNED PEAS

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Container dropped 4 feet onto black top surface while loading in the cargo truck.
		0900	Arrived at rail siding 1545. Container manually placed on pallet and moved into storage warehouse by fork lift. Dropped 6 inches onto pallet.
	31 Mar 67	0900	Pallet moved from storage warehouse to rail siding by fork lift.
		1030	Container was manually stacked into rail car. Dropped 4 inches onto other containers.
Tobyhanna Army Depot, Penn.	18 Apr 67	1011	Container was manually stacked onto pallet, dropped 6 inches onto other containers and moved into warehouse by fork lift.
	19 Apr 67	1355	Pallet was moved into rail car and container manually stacked in the load. Dropped 6 inches onto other containers.
Fort Lee, Va.	28 Apr 67	1105	Container was dropped 2 feet onto rail car floor during manual loading onto pallet. Pallet moved into storage warehouse by fork lift.
	2 May 67	1001	Pallet load was loaded onto 2½ ton capacity cargo truck by fork lift and transported 2 miles to warehouse.
		1033	Pallet was unloaded from truck using fork lift.
	25 May 67	1337	Dropped 18 inches onto concrete surface.
		1403	Dropped 18 inches onto concrete surface.

APPENDIX I

RECORDER NUMBER 4 CANNED PEAS

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
	1 Jun 67	0842	Placed onto pallet and loaded onto cargo truck by fork lift and transported to rail siding.
		1335	Manually stacked in rail car and dropped approximately 6 inches onto top of other containers.
Tobyhanna Army Depot, Penn.	16 Jun 67	1300	Manually stacked onto pallet and dropped approximately 14 inches onto wooden pallet.
	19 Jun 67	1340	Container manually stacked in rail car. Dropped approximately 5 inches onto top of other containers.
Natick, Mass.	30 Jun 67	----	Removed from test shipment and opened.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 5
CANNED PEAS

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Containers dropped 4 feet onto black top surface.
		0900	Arrived at rail siding and placed onto ramp.
		1545	Container stacked onto pallet and moved to storage warehouse.
	31 Mar 67	0900	Pallet moved from storage to rail siding by fork lift.
		0906	Containers manually stacked in rail car. Dropped 4 inches onto other containers.
Tobyhanna Army Depot, Penn.	18 Apr 67	1040	Containers manually stacked onto pallet and dropped 6 inches onto other containers. Moved to storage warehouse by fork lift.
	19 Apr 67	1235	Pallet moved into rail car and containers manually stacked in load. Dropped 6 inches onto other containers.
		1335	Rail car was shifted onto tracks by switch engine.
Fort Lee, Va.	28 Apr 67	1300	Container was dropped 10 inches while loading onto pallet. Pallet moved by fork lift into storage warehouse.
	2 May 67	0954	Pallet loaded onto 2½ ton capacity cargo truck by fork lift.
		0956	Pallet shoved to front of truck with other loads by fork lift.
		1045	Transported 2 miles to warehouse and unloaded with fork lift.

APPENDIX I

RECORDER NUMBER 5 CANNED PEAS

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
	25 May 67	1400	Dropped 18 inches onto concrete surface.
		1404	Dropped 18 inches onto concrete surface.
	1 Jun 67	0840	Dropped 4 inches onto pallet and loaded onto 2½ ton capacity cargo truck by fork lift for transportation to rail siding.
		1325	Manually stacked in rail car. Dropped 10 inches onto other containers.
Tobyhanna Army Depot, Penn.	16 Jun 67	1310	Unloaded onto wooden pallet. Dropped 8 inches onto other containers.
		1315	Pallet moved into storage warehouse by fork lift.
	19 Jun 67	1335	Pallet moved from storage and container manually stacked in rail car.
Natick, Mass.	30 Jun 67	----	Removed from shipment and opened.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 6
CANNED PEAS

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Dropped 4 feet onto black top surface.
		0900	Arrived at rail siding and off loaded.
		1545	Manually stacked onto pallets and dropped 4 inches. Moved to rail siding by fork lift.
	31 Mar 67	0900	Pallet moved to rail siding by fork lift.
		0945	Container manually stacked in rail car. Dropped 6 inches onto other pallets.
Tobyhanna Army Depot, Penn.	18 Apr 67	1025	Container manually stacked onto pallet and dropped 10 inches. Moved to storage.
	19 Apr 67	1320	Pallet moved into rail car and container stacked in load. Dropped 12 inches onto other containers.
Fort Lee, Va.	28 Apr 67	1305	Container dropped 6 inches onto pallet.
	1 May 67	1504	Pallet was loaded into 2½ ton capacity cargo truck by fork lift.
		1507	Pallet shoved to front of 2½ ton capacity cargo truck by other loads and fork lift.
		1535	Pallet transported to warehouse and unloaded with fork lift.
	25 May 67	1353	Dropped 18 inches onto concrete surface.
		1409	Dropped 18 inches onto concrete surface.
	1 Jun 67	0842	Placed onto pallet and transported to rail siding.

APPENDIX I

RECORDER NUMBER 6 CANNED PEAS

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
		1350	Manually stacked in rail car and dropped approximately 6 inches onto other containers.
Tobyhanna Army Depot, Penn.	16 Jun 67	1125	Dropped approximately 8 inches onto wooden pallet and moved into storage by fork lift.
	19 Jun 67	1455	Pallet moved from storage warehouse into rail car and manually stacked in rail car and dropped approximately 6 inches onto other containers.
Natick, Mass.	30 Jun 67	----	Removed from test load.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 7
CANNED SYRUP

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Dropped 4 feet onto black top surface.
		0900	Arrived at rail siding and off loaded. Dropped 6 inches onto other containers.
		1030	Manually stacked onto pallet. Dropped 6 inches onto other containers.
		1045	Manually moved in rail car and placed in stack.
Tobyhanna Army Depot, Penn.	18 Apr 67	1402	Manually stacked onto pallet and dropped 10 inches. Moved to warehouse by fork lift.
	19 Apr 67	1045	Moved from storage and manually stacked in rail car. Dropped 6 inches onto other con- tainers.
		1345	Rail car was bumped by switch engine.
Fort Lee, Va.	28 Apr 67	1405	Container dropped approximately 5 inches onto floor while unloading. Container picked up and placed on pallet and moved into warehouse.
	1 May 67	1005	Pallet loaded onto truck by fork lift for transport into warehouse.
	1 May 67	1535	Pallet off loaded and placed into storage using fork lift.
	25 May 67	1345	Dropped 18 inches onto concrete surface.
		1420	Dropped 18 inches onto concrete surface.

APPENDIX I

RECORDER NUMBER 7 CANNED SYRUP

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
	1 Jun 67	0842	Manually stacked onto pallet and dropped 4 inches and loaded onto 2½ ton capacity cargo truck by fork lift and transported to rail siding.
		1030	Off loaded from 2½ ton capacity cargo truck by fork lift.
		1102	Moved into rail car and manually stacked into rail car. Dropped approximately 6 inches onto other containers.
Tobyhanna Army Depot, Penn.	16 Jun 67	1345	Dropped approximately 10 inches onto wooden pallet and moved into storage warehouse by fork lift.
	19 Jun 67	1048	Moved into rail car by fork lift and manually stacked into rail car. Dropped approximately 5 inches onto rail car's floor.
Natick, Mass.	1 Jun 67	----	Removed from load and opened for inspection.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 8
CANNED SYRUP

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Dropped 4 feet onto black top surface.
		0900	Arrived at rail siding. Dropped 4 inches onto other containers.
		1545	Manually placed onto pallets and moved into rail car by fork lift.
		1547	Manually stacked into load. Dropped approximately 4 inches onto other containers.
Tobyhanna Army Depot, Penn.	18 Apr 67	1320	Dropped 12 inches onto pallet and moved into warehouse by fork lift.
	19 Apr 67	1120	Pallet moved into rail car by fork lift.
		1122	Manually stacked into load. Dropped approximately 6 inches onto other containers.
		1345	Rail car moved by switch engine.
Fort Lee, Va.	28 Apr 67	1310	Dropped 1 foot onto pallet while off loading rail car.
		1315	Pallet moved into storage warehouse by fork lift.
	1 May 67	1012	Pallet loaded onto 2½ ton capacity cargo truck by fork lift.
		1019	Pallet shoved to floor by other loads and fork lift.
		1030	Load transported 2 miles into storage warehouse.
		1335	Pallet load dragged to rear of 2½ ton capacity cargo truck with rope and fork lift.

APPENDIX I

RECORDER NUMBER 8 CANNED SYRUP

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
		1338	Pallet off loaded and placed into storage warehouse by fork lift.
	25 May 67	1335	Dropped 18 inches onto concrete surface.
		1418	Dropped 18 inches onto concrete surface.
	1 Jun 67	0844	Manually stacked onto pallet and transported into rail siding. Dropped 6 inches onto other containers.
Fort Lee, Va.	1 Jun 67	0920	Moved into rail car by fork lift truck and manually stacked into rail car. Dropped 15 inches onto the rail car's floor.
Tobyhanna Army Depot, Penn.	16 Jun 67	1503	Manually stacked onto pallet and dropped approximately 6 inches onto other containers and moved into storage warehouse by fork lift.
	19 Jun 67	0845	Moved into rail car and manually stacked into rail car. Dropped 18 inches onto rail car's floor.
Natick, Mass.	30 Jun 67	1250	Removed from load and placed onto other containers.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 9
CANNED SYRUP

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Dropped 4 feet onto black top surface while loading 2½ ton capacity cargo truck.
		0900	Arrived at rail siding and dropped 4 inches onto wooden pallet.
		1105	Pallet moved into rail car by fork lift.
		1400	Manually placed into load and dropped 6 inches onto other containers.
Tobyhanna Army Depot, Penn.	18 Apr 67	1320	Manually stacked onto pallet and dropped 6 inches onto other containers.
		1323	Pallet moved into storage warehouse by fork lift.
Fort Lee, Va.	19 Apr 67	1120	Pallet moved into rail car by fork lift.
	28 Apr 67	1355	Manually stacked onto pallet and dropped 6 inches onto other containers.
		1558	Pallet moved into storage warehouse by fork lift.
	1 May 67	1015	Pallet loaded on 2½ ton capacity cargo truck with fork lift.
		1021	Pallet was shoved to front of truck by other loads and fork lift.
		1030	Transported 2 miles to storage warehouse.
		1335	Dragged to rear of 2½ ton capacity cargo truck with rope.
		1340	Off loaded from truck and placed into storage warehouse with fork lift.

APPENDIX I

RECORDER NUMBER 9
CANNED SYRUP

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Tobyhanna Army Depot, Penn.	25 May 67	1340	Dropped 18 inches onto concrete surface.
		1401	Dropped 18 inches onto concrete surface.
	1 Jun 67	0844	Manually stacked onto pallet, loaded onto truck by fork lift and transported to rail siding. Dropped 6 inches onto other containers.
		1005	Moved into rail car by fork lift and manually stacked into rail car. Dropped 6 inches onto other containers.
	16 Jun 67	1405	Manually stacked onto pallet. Dropped 4 inches onto other containers. Moved into warehouse by fork lift.
Natick, Mass.	19 Jun 67	1105	Moved into rail car and manually stacked into rail car. Dropped 6 inches onto top of other containers.
	30 Jun 67	1235	Container removed from load and placed on top of other containers.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 101 CANNED DEHYDRATED POTATOES

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Dropped 4 feet onto black top surface while loading onto 2½ ton capacity cargo truck.
		0900	Arrived at rail siding. Dropped 4 inches.
		1545	Manually placed onto pallet and moved into warehouse for storage.
	31 Mar 67	0900	Pallet moved from warehouse to rail siding by fork lift.
		1125	Manually moved into rail car and stacked in load. Dropped 6 inches onto other containers.
Tobyhanna Army Depot, Penn.	18 Apr 67	0915	Manually stacked onto pallets and moved to storage warehouse by fork lift. Dropped 6 inches onto pallet.
	19 Apr 67	1415	Moved from storage and manually stacked in rail car. Dropped 6 inches onto other containers.
Fort Lee, Va.	28 Apr 67	1035	Stacked onto pallets and moved to storage warehouse on fork lift. Dropped 10 inches onto pallet.
	1 May 67	1250	Moved from storage warehouse and loaded onto cargo truck by fork lift. Pallet was used to shove 2 loads forward in the truck's bed.
		1252	Pallet was shoved to forward area onto 2½ ton capacity cargo truck by other pallets.
		1303	Pallet was again shoved forward and was transported approximately 2 miles to warehouse.

APPENDIX I

RECORDER NUMBER 101 CANNED DEHYDRATED POTATOES

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
		1316	Pallet was off loaded and placed in storage using fork lift.
	25 May 67	1349	Dropped 18 inches onto wooden pallet of rail car.
		1412	Dropped 18 inches onto wooden surface.
	1 Jun 67	0842	Manually loaded onto cargo truck. Dropped 12 inches in truck. Transported 1 mile to rail siding.
		1435	Manually stacked in rail car. Dropped approximately 10 inches in the stack.
Tobyhanna Army Depot, Penn.	16 Jun 67	1017	Manually stacked onto wooden pallet. Dropped approximately 6 inches onto top of other containers.
		1018	Pallet moved into storage warehouse.
	19 Jun 67	1518	Pallet moved from warehouse into rail car.
	19 Jun 67	1520	Stacked in rail car. Dropped approximately 6 inches onto other containers.
Natick, Mass.	29 Jun 67	----	Removed from test shipment and opened.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 102
CANNED DEHYDRATED POTATOES

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Dropped 4 feet onto black top surface street while loading into cargo truck.
		0900	Arrived at rail siding 1545. Manually placed onto pallets and moved into warehouse for storage. Dropped 4 inches onto pallet.
	31 Mar 67	0900	Moved from warehouse to rail siding onto pallet by fork lift.
		1335	Manually stacked in rail car. Dropped 6 inches onto other containers.
Tobyhanna Army Depot, Penn.	18 Apr 67	0850	Manually stacked onto pallets and moved into storage warehouse by fork lift. Dropped 6 inches onto other containers on pallet.
	19 Apr 67	1525	Pallet load was moved from storage warehouse by fork lift and container manually stacked in rail car.
Fort Lee, Va.	28 Apr 67	1055	Container was dropped approximately 2 feet onto the rail car's floor then manually placed onto pallet and moved into storage warehouse by fork lift.
	1 May 67	1050	Pallet was loaded onto the cargo truck by fork lift and transported approximately 2 miles to warehouse.
		1111	Pallet was off loaded and placed in storage by fork lift.
	25 May 67	1445	Dropped 18 inches twice onto concrete surface.

APPENDIX I

RECORDER NUMBER 102 CANNED DEHYDRATED POTATOES

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
	1 Jun 67	0840	Dropped approximately 6 inches onto wooden pallet, loaded on cargo truck by fork lift and transported to rail siding.
		1455	Moved into rail car by fork lift and manually stacked in shipment. Dropped approximately 6 inches onto other containers.
Tobyhanna Army Depot, Penn.	16 Jun 67	1030	Manually stacked onto pallet. Dropped approximately 6 inches onto other containers.
	16 Jun 67	1031	Pallet moved to warehouse for storage.
	19 Jun 67	1544	Pallet moved from storage into rail car.
	19 Jun 67	1545	Manually stacked in rail car. Dropped approximately 6 inches onto other containers.
Natick, Mass.	29 Jun 67	1505	Dropped approximately 6 inches onto wooden pallet.

APPENDIX I

RECORD OF DROP HEIGHTS AND LOCATIONS, DATES, TIMES AND CONDITIONS

RECORDER NUMBER 103
CANNED DEHYDRATED POTATOES

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
Natick, Mass.	30 Mar 67	0830	Dropped 4 feet onto black top surface while loading into cargo truck.
		0900	Arrived at rail siding 1545. Manually stacked onto pallets and moved into warehouse for storage by fork lift. Dropped less than 4 inches.
	31 Mar 67	0900	Manually carried into rail car. Dropped 2 inches.
		1350	Manually stacked in rail car. Dropped 4 inches onto rail car floor.
Tobyhanna Army Depot, Penn.	18 Apr 67	0840	Manually stacked onto pallet and moved into storage warehouse by fork lift.
	19 Apr 67	1535	Pallet load was moved from storage warehouse and container was manually stacked in rail car. Dropped 6 inches onto other containers.
Fort Lee, Va.	28 Apr 67	1035	Container was manually placed onto pallet and moved into storage warehouse by fork lift truck. Dropped 6 inches onto pallets.
	1 May 67	1250	Pallet with container was loaded in 2½ ton capacity cargo truck and pallet was used to shove other loads to the front of the cargo truck.
		1252	Pallet was used to shove loads to front of cargo truck by other loads and fork lift.
		1303	Pallet loads were transported approximately 2 miles to storage warehouse.
		1316	Pallets were unloaded by fork lift.

APPENDIX I

RECORDER NUMBER 103 CANNED DEHYDRATED POTATOES

<u>Location</u>	<u>Date</u>	<u>Time</u>	<u>Remarks</u>
	25 May 67	1357	Dropped approximately 18 inches onto concrete surface.
		1400	Dropped approximately 18 inches onto concrete surface.
Fort Lee, Va.	1 Jun 67	0844	Dropped 4 inches onto pallet. Transported to rail siding in pickup truck. Dropped 6 inches in bed of pickup truck.
		0900	Removed from pickup truck and placed in storage warehouse. Manually stacked in rail car. Dropped approximately 6 inches onto other containers.
Tobyhanna Army Depot, Penn.	16 Jun 67	1015	Manually stacked onto pallets. Dropped approximately 6 inches onto other containers and moved into storage warehouse.
	19 Jun 67	1515	Moved from storage warehouse into rail car. Manually stacked in car. Dropped approximately 10 inches onto other containers.
Natick, Mass.	30 Jun 67	0905	Removed from test shipment and placed on wooden pallet.

APPENDIX II

TYPE OF DAMAGE OCCURRING DURING SHIPMENT BY LOCATION AND SUBSISTENCE ITEMS

Location	Date	Damage Inspection	Number of Containers Damaged* By Item Shipped							
			Peh. Potatoes		Maple Syrup		Peas			
			Mod.	Fail.	Mod.	Fail.	Mod.	Fail.	Mod.	Fail.
Tobyhanna Army Depot, Penn.	18 April	Seams: Score Line Walls	0	1	0	0	0	0	0	0
		Bulging	2	12	1	0	2	2	0	1
		Crushing: Side Walls Corners	0	0	0	0	0	0	7	2
		Holes: Large Small	1	6	0	1	0	1	1	5
		Water Damage	3	10	1	1	1	2	1	5
Tobyhanna Army Depot, Penn.	16 June	Seams: Score Line Walls	0	1	1	0	0	0	0	0
		Bulging	0	1	0	0	0	2	0	1
		Crushing: Side Walls Corners	0	0	0	0	0	0	0	0
			0	0	0	1	0	0	0	0
			0	0	0	0	0	0	0	0

*There was no determination of slight damage.

APPENDIX II

Location	Date	Damage Inspection	Number of Containers Damaged* By Item Shipped									
			Deh. Potatoes		Maple Syrup		Peas					
			Mod.	Fail.	Mod.	Fail.	Mod.	Fail.	Mod.	Fail.	Mod.	Fail.
Tobyhanna Army Depot, Penn.	16 June	Holes: Large	0	1	0	1	0	0	0	0	0	2
		Small	0	0	0	0	0	0	0	0	0	0
		Water Damage	0	0	0	0	0	0	0	0	0	0
Natick, Mass. (USANL)	30 June	Seams: Score Line Walls	0	1	0	0	0	0	0	0	0	0
		Bulging	0	0	0	0	0	0	0	0	0	0
		Crushing: Side Walls Corners	2	1	0	0	0	0	0	0	0	0
			2	5	0	0	0	0	1	0	0	0
		Holes: Large	1	1	0	0	0	0	0	0	0	0
		Small	0	0	0	0	0	0	0	0	0	0
		Water Damage	0	0	0	0	0	0	0	0	0	0

APPENDIX III

RECORD OF MAXIMUM AND MINIMUM TEMPERATURE AND HUMIDITY WITHIN RAIL CAR DURING SHIPMENT

Date	Top of Load Temperature		Humidity	
	Max.	Min.	Max.	Min.
30 March 67	66	32	90	32
31 March 67	80	32	96	29
1 April 67	87	53	72	36
2 April 67	98	61	70	32
3 April 67	83	32	96	42
4 April 67	73	39	97	40
5 April 67	81	46	97	32
19 April 67	70	41	89	70
20 April 67	79	46	86	50
21 April 67	82	53	76	56
22 April 67	85	48	88	46
23 April 67	76	48	90	50
24 April 67	62	45	90	62
25 April 67	77	46	90	54
1 June 67	104	68	82	28
2 June 67	98	58	Not Working	
3 June 67	104	62		
4 June 67	96	66		
5 June 67	102	60		
6 June 67	104	64		
7 June 67	104	69		

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APPENDIX IV. REFERENCE

Reference letter, AMSTE-GE, Headquarters, U. S. Army Test and Evaluation Command, 20 September 1966, subject: "Test Directive, USATECOM Project No. 7-6-0739-01, Research Test (RE) of Recorder, Velocity Shock, Electronic."

<p>AD</p> <p>Accession No.</p> <p>U. S. Army General Equipment Test Activity, Fort Lee, Virginia.</p> <p>UNCLASSIFIED</p> <p>I. VELOCITY SHOCK RECORDER I. Brugh, Joseph F. II. Title: Recorder, velocity shock, electronic, research test of III. USATECOM Project No. 7-6-0739-01</p> <p>FINAL REPORT OF RESEARCH TEST OF RECORDER, VELOCITY SHOCK, ELECTRONIC, by Joseph F. Brugh, September 1967, 49p. -tables, 5 Appendices p19-49. (TECOM Proj. No. 7-6-0739-01) Unclassified Report</p> <p>A Research Test (RE) of Recorder, Velocity Shock, Electronic, was conducted from 22 March through 6 July 1967, to collect data pertinent to the shipping environment of a normal rail shipment to enable the USA Natick Laboratories to determine the operational reliability of the test item under actual field conditions. The test also included a determination of the shock input to the test containers occurring during rail transport and the magnitude and frequency of its occurrence relative to the number of miles traversed.</p> <p>It was concluded that the operational reliability of the experimental electronic velocity shock recorder, as presently designed, is not satisfactory.</p> <p>It was recommended that the defect causing a constant drain on the test item's batteries be corrected.</p>	<p>AD</p> <p>Accession No.</p> <p>U. S. Army General Equipment Test Activity, Fort Lee, Virginia.</p> <p>UNCLASSIFIED</p> <p>I. VELOCITY SHOCK RECORDER I. Brugh, Joseph F. II. Title: Recorder, velocity shock, electronic, research test of III. USATECOM Project No. 7-6-0739-01</p> <p>FINAL REPORT OF RESEARCH TEST OF RECORDER, VELOCITY SHOCK, ELECTRONIC, by Joseph F. Brugh, September 1967, 49p. -tables, 5 Appendices p19-49. (TECOM Proj. No. 7-6-0739-01) Unclassified Report</p> <p>A Research Test (RE) of Recorder, Velocity Shock, Electronic, was conducted from 22 March through 6 July 1967, to collect data pertinent to the shipping environment of a normal rail shipment to enable the USA Natick Laboratories to determine the operational reliability of the test item under actual field conditions. The test also included a determination of the shock input to the test containers occurring during rail transport and the magnitude and frequency of its occurrence relative to the number of miles traversed.</p> <p>It was concluded that the operational reliability of the experimental electronic velocity shock recorder, as presently designed, is not satisfactory.</p> <p>It was recommended that the defect causing a constant drain on the test item's batteries be corrected.</p>
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