[redacted]

1600

TCG-SAFF-1; TCG-NNT-1

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW

1st Review Date: 11/2/98 Authority: ADC ADD Name: B Cramer 2nd Review Date: 11/9/98 Authority: ADD Name: W Layne	Determination (Circle Numbers) 1. Classification Retained 2. Classification Changed to: U 3. Contains No DOE Classified Information 4. Coordinate With: 5. Contains UCAI? 6. Comments: OK for Opennet

NOV 9 1955
Case No. 433.00
Ref. Sym: 1612 (247)
Project No. TM-318
H-194,3-2

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RECEIVED
NOV 10 1955
R & D FILES

MR. P. E. JOCKLE, JR., - 1281

Re: Ramp and Drop Test of the H-194/303 with the MC-383A

Summary of Results

An H-194/303 container carrying an MC-383A cartridge subassembly was subjected to a series of engineering ramp and package drop tests, as specified in SCS-5, in order to determine the ability of a new method of shock and vibration isolation to mitigate shocks received by the container. This method of isolation consisted of an Ensolite (modified polyvinyl chloride) liner two inches thick, which was installed on the base and in the cover of the H-194/303, and spacers to provide tight fits for the liner and MC-383A in the container.

The maximum faired shock accelerations recorded on the base (MC-385) of the MC-383A during the ramp test were 17.9 g longitudinal with a 22-ms rise time and 41-ms pulse duration and 11.9 g vertical. The maxima recorded during the drop test were 37.0 g vertical with a 5-ms rise time and a 17-ms pulse duration and 5.6 g longitudinal with a 4-ms rise time and 16-ms pulse duration. With the exception of the ramp test vertical acceleration, these maximum values are considerably smaller than the maximum accelerations recorded at similar locations on the contained units during several previous standard ramp and drop tests of H-194 containers having different shock isolation systems.

Two additional 12-inch drop tests of the H-194/303 were conducted with the container and contents cooled to a temperature of -40°F. The maximum faired accelerations measured on the MC-385 were 71.9 g vertical with a 4-ms rise time and 11-ms pulse duration and 12.2 g longitudinal with a 2-ms rise time and 5-ms duration. The Ensolite base pad on the H-194/303 was severely damaged during these tests but had regained its original shape when removed from the container at room temperature.

Two further 12-inch drop tests were made with a felt base pad on the H-194/303. The maximum faired accelerations recorded on the MC-385 were 69.9 g vertical with a 4-ms rise time and 11-ms duration and 5.4 g longitudinal.

Neither the H-194/303 container nor the MC-383A cartridge subassembly sustained damage as a result of the ramp and three groups of drop tests.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DOWNGRADING OR DECLASSIFICATION STAMP

CLASSIFICATION CHANGED TO: U Carmela Gallegos 12/9/98 PERSON CHANGING MARKING & DATE W C Layne 12/16/98 PERSON VERIFYING MARKING & DATE	AUTHORITY: W C Layne RECORD ID: 99SN0358 DATED: 11/9/98

CDL No.	
ACCOUNTABILITY CARD	dgd
FILE No.	H-194 3-2

[redacted]

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Object of Test

The object of this test was to subject the H-194/303 carrying the MC-383A to standard engineering ramp and package drop tests per SCS-5, in order to determine the ability of the Ensolite liner in the H-194/303 to mitigate shocks received by the container. To make this investigation, acceleration measurements were required on the base of the H-194/303 and on the MC-385.

Reason for Test

This test was requested in a Work Order Authorization from P. E. Jockle, Jr., 1281, to Division 1612, dated July 28, 1955.

Summary of Past Tests

A road test run on three H-194's with adapter kits H-302, H-303, and H-320 was conducted by Department 1610 and is reported in a memorandum to L. A. Dunn, 1284, from R. L. Ault, 1612, entitled, Road Test of the H-194, Ref. Sym: 1612 (121), issued July 23, 1954.

The TPM-4 Finn Mounts on the H-194/303 failed after 34 miles of road testing. The Barry Mount 896-35G (air damped) on the H-194/320 started failing after 92 miles of the test, with complete failure at the end of the 247 mile test. The Met-L-Flex 7002-P mounts used to replace the Finn mounts and the Barry mounts 990-30 on the H-194/302 performed satisfactorily throughout the test.

A ramp test on an H-194/302 containing a TX-6-X4 X-Unit and ramp and drop tests on an H-194/303 container carrying an A-fuze were performed by Department 1610 and reported in a memorandum to P. E. Jockle, Jr., 1281, from R. A. Buck, 1612, entitled Ramp and Drop Test of the H-194/302 and H-194/303, Ref. Sym: 1612 (163), issued April 6, 1955..

Two runs with a maximum velocity of 5.1 mph were made with the H-194/302. The TX-6-X4 was damaged and since no other was available, further testing of the H-194-302 container was postponed.

During the 7.0 mph ramp test of the H-194/303 two of the MC-73 vibration-mount inserts in the fuze plate of the A-fuze were broken out of the plate allowing the MC-73 to move freely on its mounts. The setting of the MC-73 could not be changed following a 7.0 mph ramp test with the component tied down.

The shock and vibration mounts of the H-303 adapter kit became progressively dished and dented during the 12-inch drop tests. The bracket of one of the MC-394 vibration mounts was fractured during the 12-inch drop tests in which the component was free on its mounts, so that the mount was detached from the component.

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A ramp and drop test was run on the H-194 with associated MC items by Division 1612 and is reported in a memorandum to J. O. Davis, 1281-1 from D. F. Hillyer, Jr., 1612, entitled Ramp and Drop Test of the H-194 and Associated MC Items, Ref. Sym: 1612 (224), issued August 23, 1955.

There were no complete failures in the container or components during the ramp and drop tests. The four Met-L-Flex mounts deformed during the ramp test.

For the ramp test with an impact velocity of 7.1 mph the faired longitudinal acceleration on the base was 25.5 g and on the mounting plate was 45.9 g.

The maximum vertical shock acceleration on the base for the four-inch drop was 310 g with a maximum faired vertical acceleration of 49.3 g on the mounting plate.

For the 12-inch drop the maximum vertical shock acceleration on the base was 418 g with a maximum vertical faired acceleration on the mounting plate of 157 g.

Electrical checks were made of the major components after the completion of drop and ramp testing and all components checked satisfactorily.

A ramp and drop test of the H-194/303 containing an MC-383A was conducted and is reported in a memorandum to P. E. Jockle, Jr., 1281, from R. L. Ault, 1612, entitled Ramp and Drop Test of the H-194/303 Containing the MC-383A, Ref. Sym: 1612 (228), issued August 18, 1955. Rubberized hair was employed as a shock isolator in the H-194/303 for this test.

The maximum faired vertical acceleration measured on the MC-385 during the drop test was 121 g, recorded during a 12-inch drop. At the conclusion of the drop test fractures were discovered at two locations on the bottom of the base of the H-194/303, one of which was perpendicular to another crack on the base which existed prior to the test.

The maximum faired accelerations measured on the MC-385 during the ramp test were 60 g longitudinal and 10 g vertical. After the 7.0 mph test one channel of the MC-73 was inoperative. Two additional fractures on the base of the H-194/303 were incurred during the ramp test.

Setup for Test

The H-194/303 containing the MC-383A cartridge subassembly was drop-tested using the equipment and setup shown in Fig. 1.

The container was ramp-tested using the method of tie-down on the ramp dolly shown in Fig. 2.

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The components of the H-194/303 container and the MC-383A cartridge subassembly given the ramp and drop tests are listed in Table I.

Instrumentation employed for the tests included:

Six Statham accelerometers (Table II and Figs. 2, 3, and 4)
Velocity gage (Fig. 2)

Test and recording equipment included:

Hathaway Type MRC-21 strain gage control (amplifier) unit with power supply, Serial No. 5492-2 (drop test)
Miller Model H oscillograph with power supply, Serial No. 159 (drop test)
Miller Type C-3 amplifier system, Serial No. 7 (ramp test)
Miller Model J oscillograph with power supply, Serial No. 99 (ramp test)
Remote control console (ramp test)
Engineering test ramp
Cable sling, quick release mechanism, and chain hoist (drop test)

Procedure

Drop Test -- Ensolite liner material (U. S. Rubber Co. No. 22266) was installed on the base and in the cover of the H-194/303 container in the manner shown in Figs. 3 and 5. Then a full base pad of Ensolite (two one-inch thicknesses) was placed on the container base and the MC-383A fuze set on the pad, as shown in Fig. 5. The cover was attached to the base of the H-194/303 in the usual manner, and the complete assembly was suspended for drop testing with the system pictured in Fig. 1.

The container was dropped from the release mechanism and allowed to impact as flatly as possible on a concrete floor. As required by SCS-5, twelve four-inch and six twelve-inch drops of the container were made with shock accelerations being recorded with accelerometers 1 to 4 during three four-inch and two twelve-inch tests.

Following the standard ramp and drop tests specified by SCS-5, six additional drop tests were conducted for the purpose of obtaining additional information regarding the Ensolite container liner material and comparative information concerning the shock mitigating properties of a felt liner material (American Felt Co. No. 5591). The H-194/303 was placed in a refrigeration chamber and allowed to stabilize at -40°F for six hours. After the stabilization period was completed, the container was removed from the chamber and immediately given two twelve-inch drop tests.

After these tests were completed, the container and its contents were allowed to stabilize at room temperature for approximately eighteen hours. The base pad on which the MC-383A rests was removed and replaced by a similar pad (two one-inch thicknesses) of the felt liner material. Then the container cover was reattached to the base, and the container given four more twelve-inch drop tests. Accelerations were recorded during three of these final six tests with Accelerometers 1 to 4.

Ramp Test -- The H-194/303 carrying the MC-383A was set on the ramp dolly and tied down in the manner shown in Fig. 2. The dolly was drawn up the incline, released, and allowed to impact upon one or two 4 x 4-inch pine blocks on the ramp stop. To achieve the impact velocities required by SCS-5, or greater, seven tests were run with the dolly being released from positions between 7 feet 2 inches and 11 feet 6 inches, as marked on the ramp incline. One impact block was employed on the ramp stop for tests at velocities up to 6.1 mph, and two were used for the higher velocity tests.

Impact shock accelerations were recorded on the MC-385 fuze plate of the MC-383A, the base of the H-194/303, and the ramp dolly frame with Accelerometers 1 to 6. The ramp dolly impact velocities were measured with a velocity gage consisting of a microswitch mounted on the dolly actuated by contact arms on the track a known distance apart. The signals from the microswitch circuit were recorded on the oscillograph along with the accelerometer signals.

After the ramp and drop tests had been completed, an electrical test of the fuze components was performed by Division 1215.

Results

Examination of the H-194/303 container and the MC-383 cartridge subassembly and electrical tests of the cartridge components following the ramp and drop tests showed that neither the H-194/303 or the MC-383A received damage from the tests.

The shock acceleration data derived from six ramp-test acceleration records are given in Table III. The individual items of data given are as defined in SCS-10 and illustrated in Fig. 6, which shows one of the test records.

The shock acceleration data obtained from seven drop-test records are tabulated in Table IV. One of the test records is shown in Fig. 7. The waveforms of the accelerations recorded on the MC-385, shown in Fig. 7 for a drop with the Ensolite base pad on the H-194/303 at room temperature, are generally similar to those recorded during the drop at -40°F and with the felt base pad on the container, although the pulse durations varied

somewhat. Available data regarding the change of accelerometer damping with temperature and the change of accelerometer response with damping indicate that the vertical acceleration measured on the MC-385 during the test at -40°F is probably accurate to within ten percent, although the longitudinal value recorded for a shorter duration pulse is likely less accurate due to decreased accelerometer sensitivity caused by the change in damping at the low temperature.

Comparison of comparable shock acceleration data recorded during the three ramp and drop tests mentioned in the Summary of Past Tests and during this present test reveals that the smallest accelerations were sustained by the contained unit and the maximum degree of shock mitigation was effected when the Ensolite liner was employed as a shock isolator in the H-194 container. The felt liner provided the second most effective shock isolator according to drop test data, but transmitted nearly twice as great accelerations to the contained unit as did the Ensolite liner. In addition, it is found that the accelerations transmitted by the Ensolite liner when cooled to -40°F were approximately the same as those transmitted by the felt liner at room temperature.

During the drop tests for which the H-194/303 was at a temperature of -40°F, the base (MC-385) of the MC-383A cut deeply into the top section of the Ensolite base pad in several places, particularly along the MC-385 perimeter, and caused splitting of the material in a number of locations. Also, the bottom section of the pad was severely split in one area, starting at the point where a slit had been made in the pad for accelerometer cables. The damaged areas of both sections of the pad are outlined, and the more severe damage is shown in Fig. 8. Although the base pad was damaged during these low temperature tests, the acceleration records taken on the MC-385 showed no evidence of the pad having "bottomed" during the tests.

R. A. Buck
R. A. BUCK - 1612-1

W. C. Clark
W. C. CLARK - 1612-1

RAB:1612-1:as

Approved by: Paul H. Adams
P. H. ADAMS - 1612

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T. B. Morse, 1610
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R. E. Fisher, 1621
C. L. Gomel, 5523
R. K. Smeltzer, 1922-2 ← [redacted]
F. C. Hale, 1922-3

[redacted]

#1606

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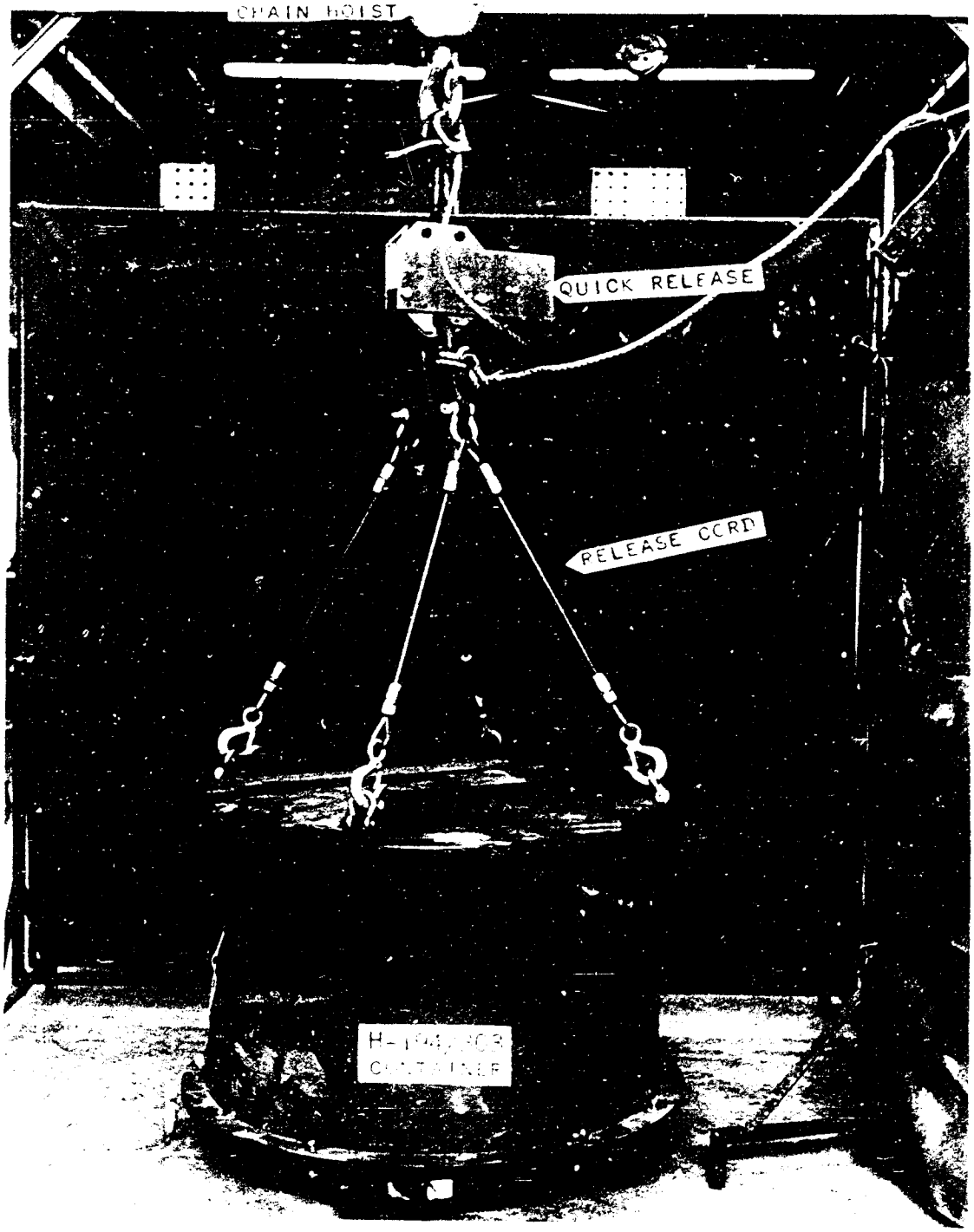

DROP [illegible] RAMP [illegible] DROP [illegible]
WITH [illegible] MC-[illegible].

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[redacted]

#66398

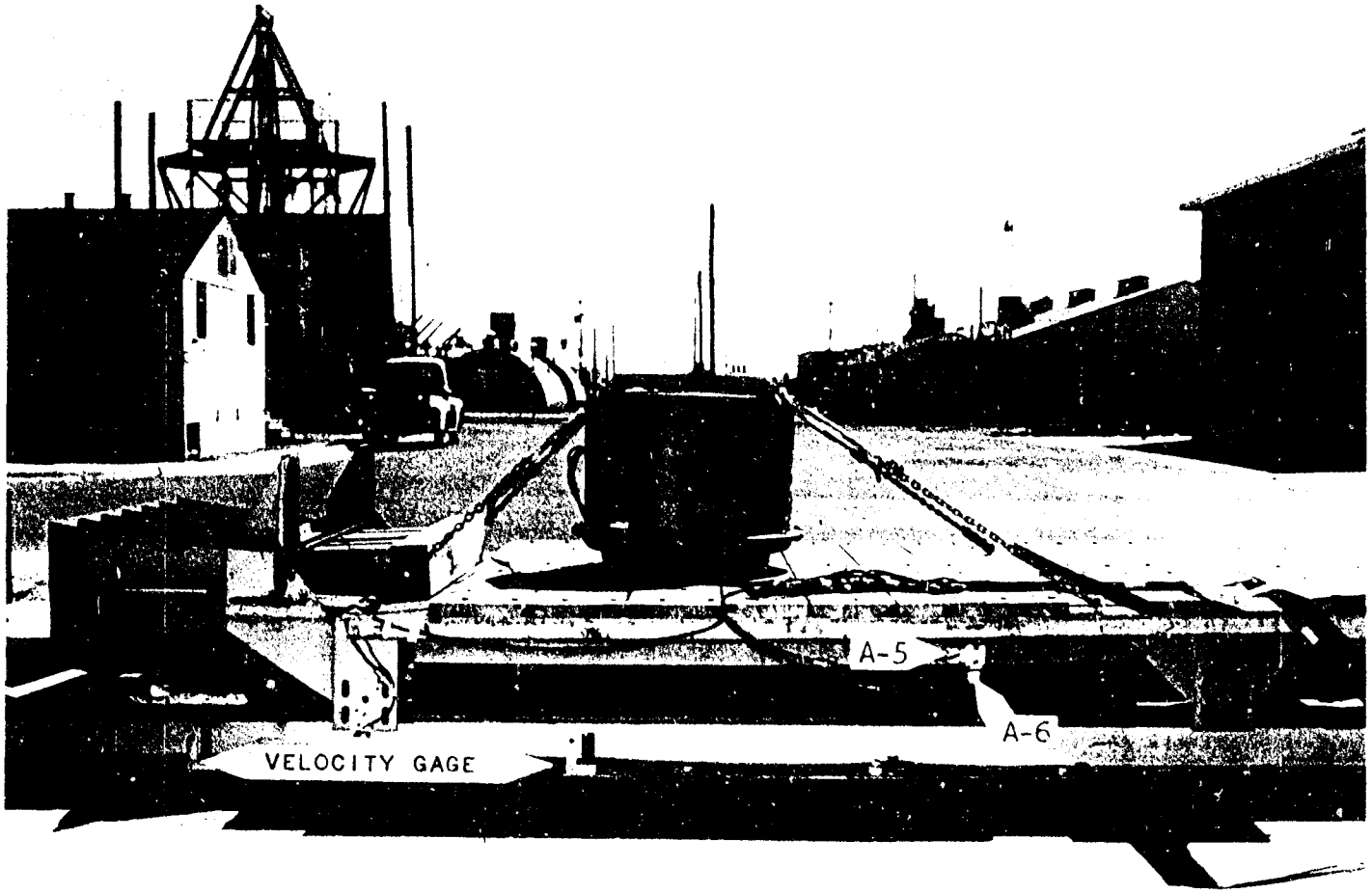

FIG. 2 - H-194/303 CONTAINER TIED DOWN ON RAMP DOLLY
RAMP AND DROP TEST OF THE H-194/303 WITH THE MC-383A

REF. SYM: [illegible]
PROJECT NO. TM-[illegible]

#66403

#1607

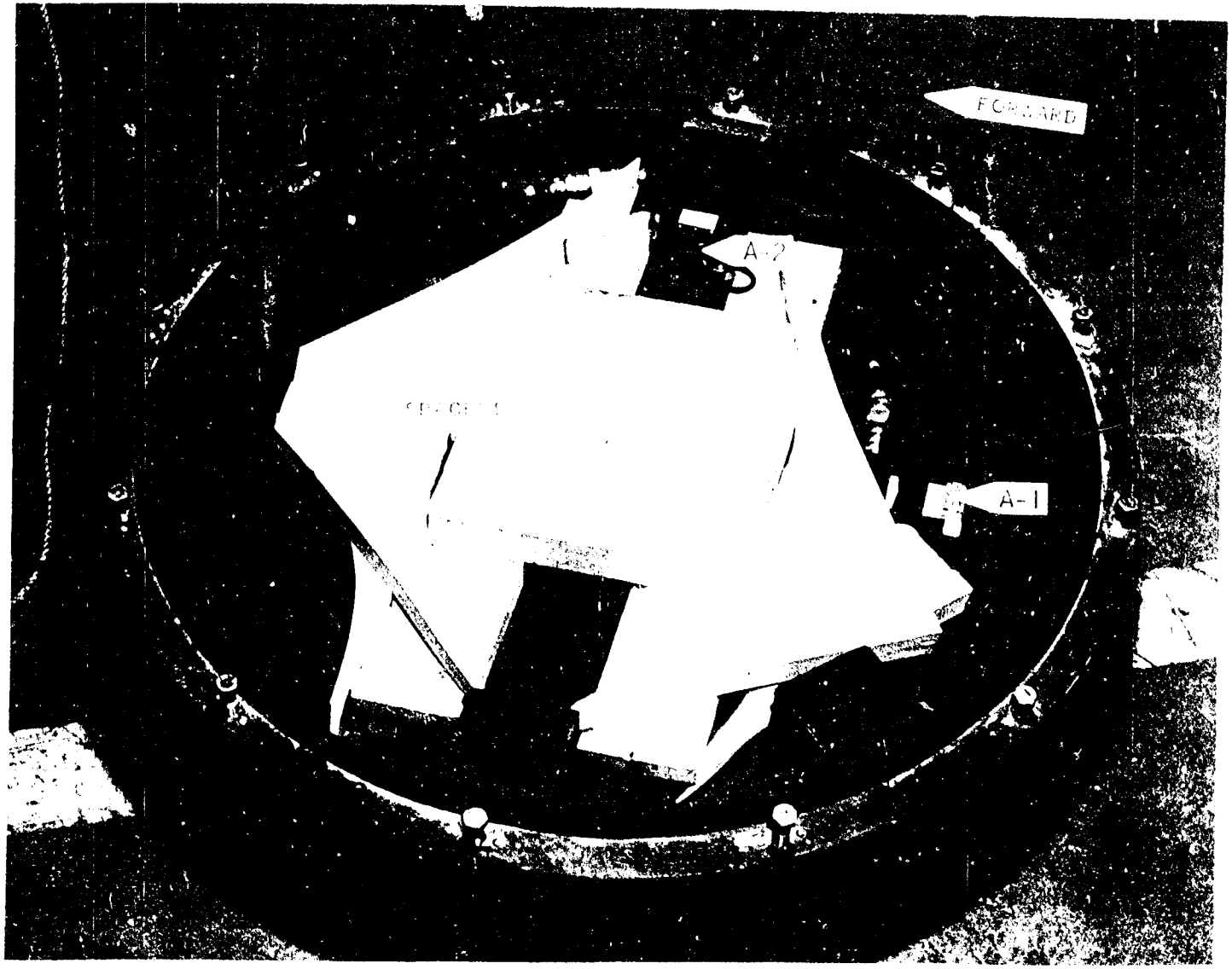

FIG. [illegible] - BASE OF [illegible] CONTAINER WITH ACCELEROMETERS AND SPACERS

#16700

#1608

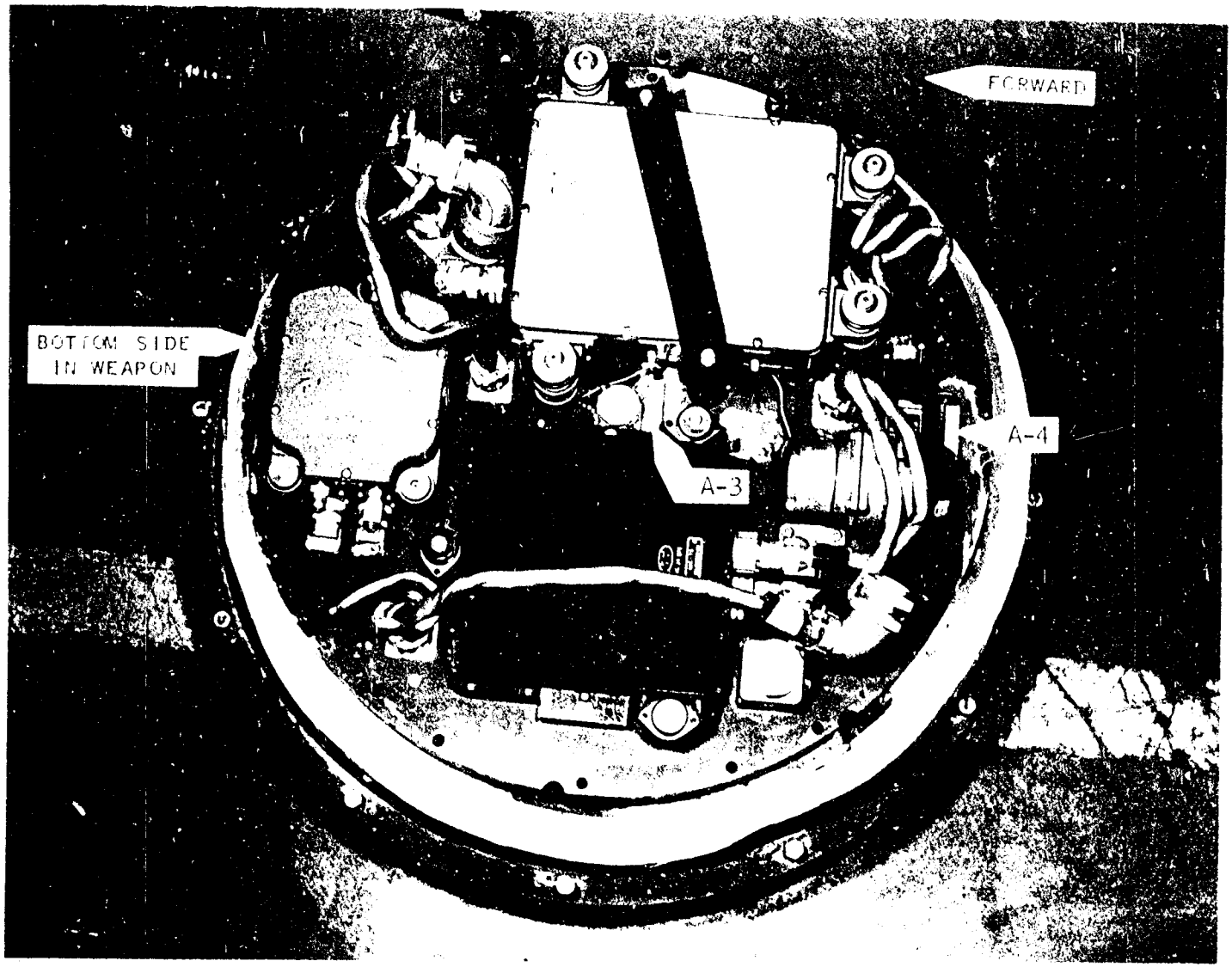

FIG. 4 - COMPONENTS AND ACCELEROMETERS ON MC-3[illegible]5 FUZE PLATE
RAMP [illegible] DROP TEST [illegible]

#1609

#66 for 2

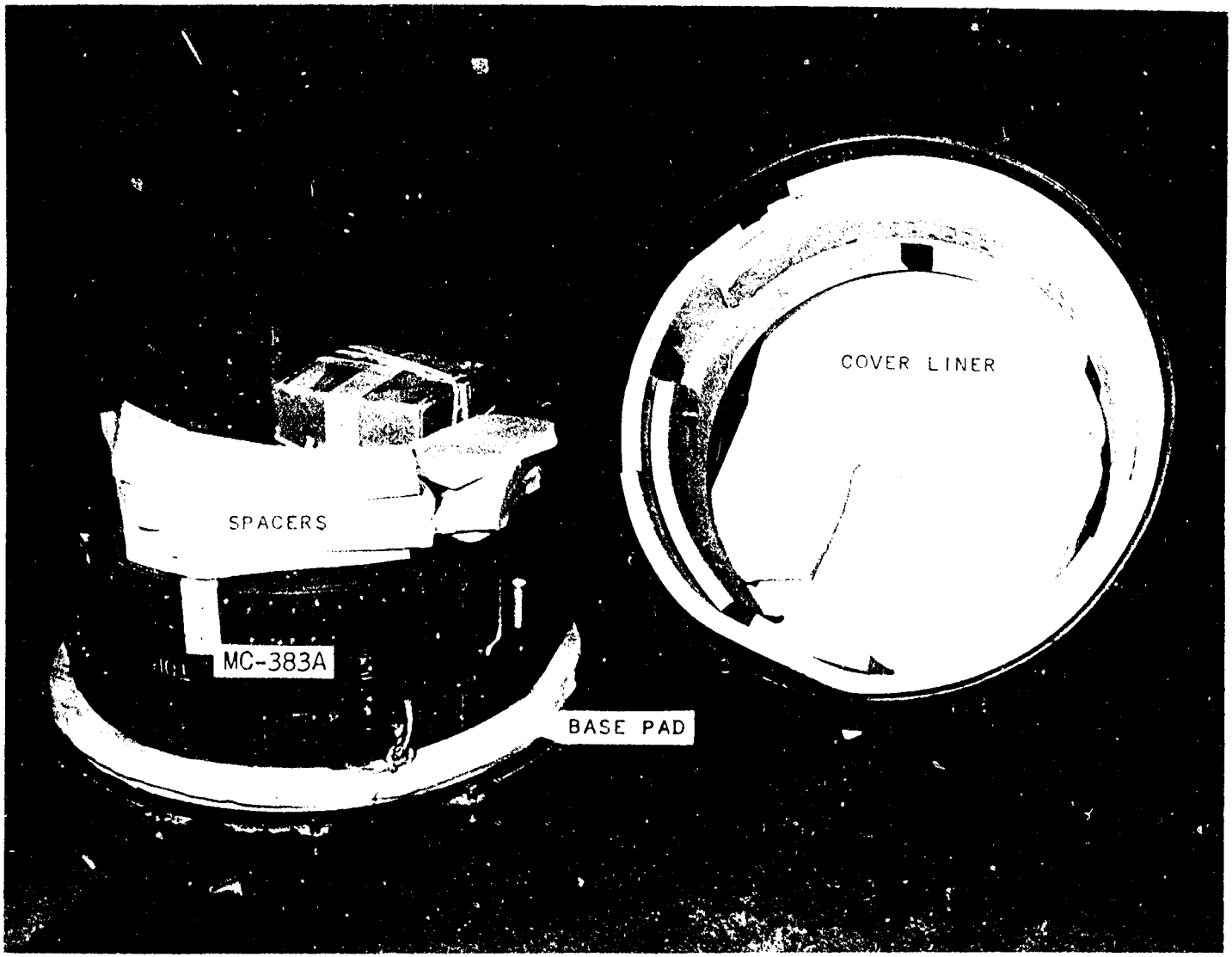

FIG. 5 - MC-383A CARTRIDGE SUBASSEMBLY ON H-194/[illegible] CONTAINER [illegible] AND ENSOLITE CONTAINER LINER.
RAMP [illegible] DROP TEST OF [illegible] WITH THE MC-[illegible]

#66401

#1610

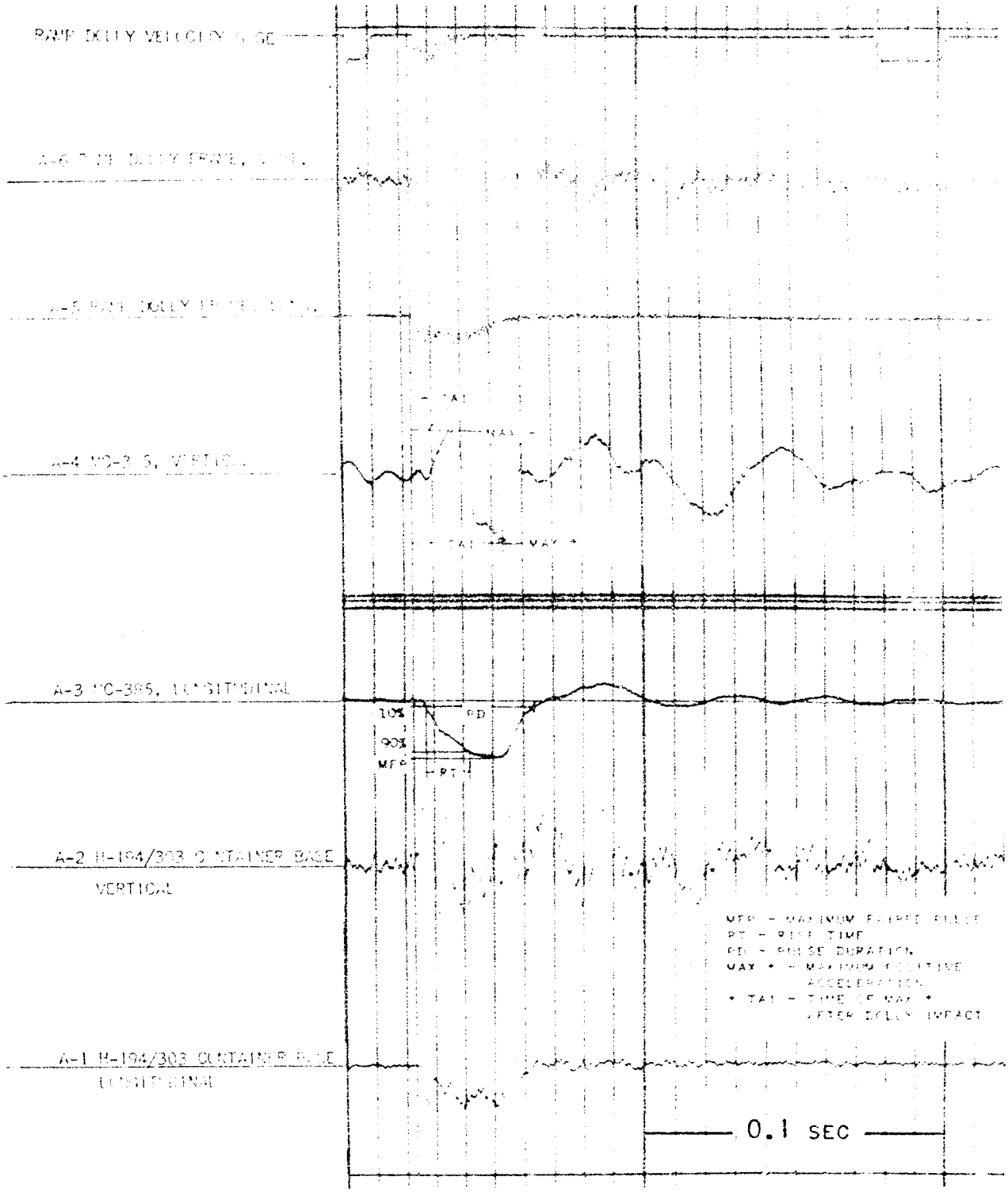

FIG. 6 - RAMP TEST ACCELERATION RECORD RUN 6 - 7.1 MPH
RAMP AND DROP TEST OF THE H-194/303 WITH THE MC-385A

REF. SYM: 1612-247
PROJECT NO. TM-318

[redacted]

A-4 MC-385, EDGE - VERT.

A-3 MC-385, CENTER - LONG.

A-2 H-194/303 BASE - VERT.

A-1 H-194/303 BASE - LONG.

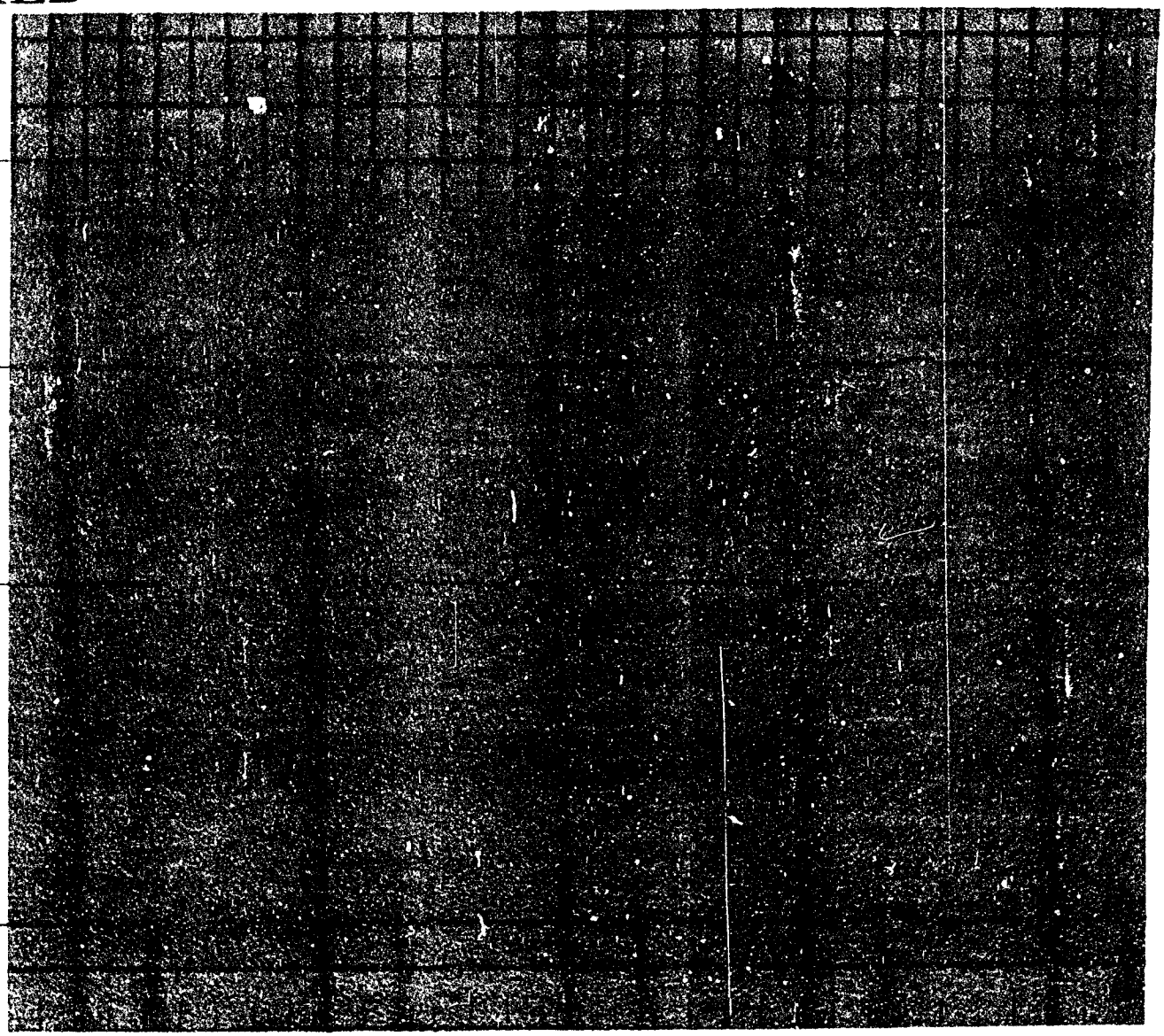

FIG. 7 - DROP TEST ACCELERATION RECORD (DROP 14 - 12 INCHES)
RAMP AND DROP TEST OF THE H-194/303 WITH THE MC-383A

[redacted]

REF. SYM: 1612(247)
PROJECT NO. TM-318

#1612

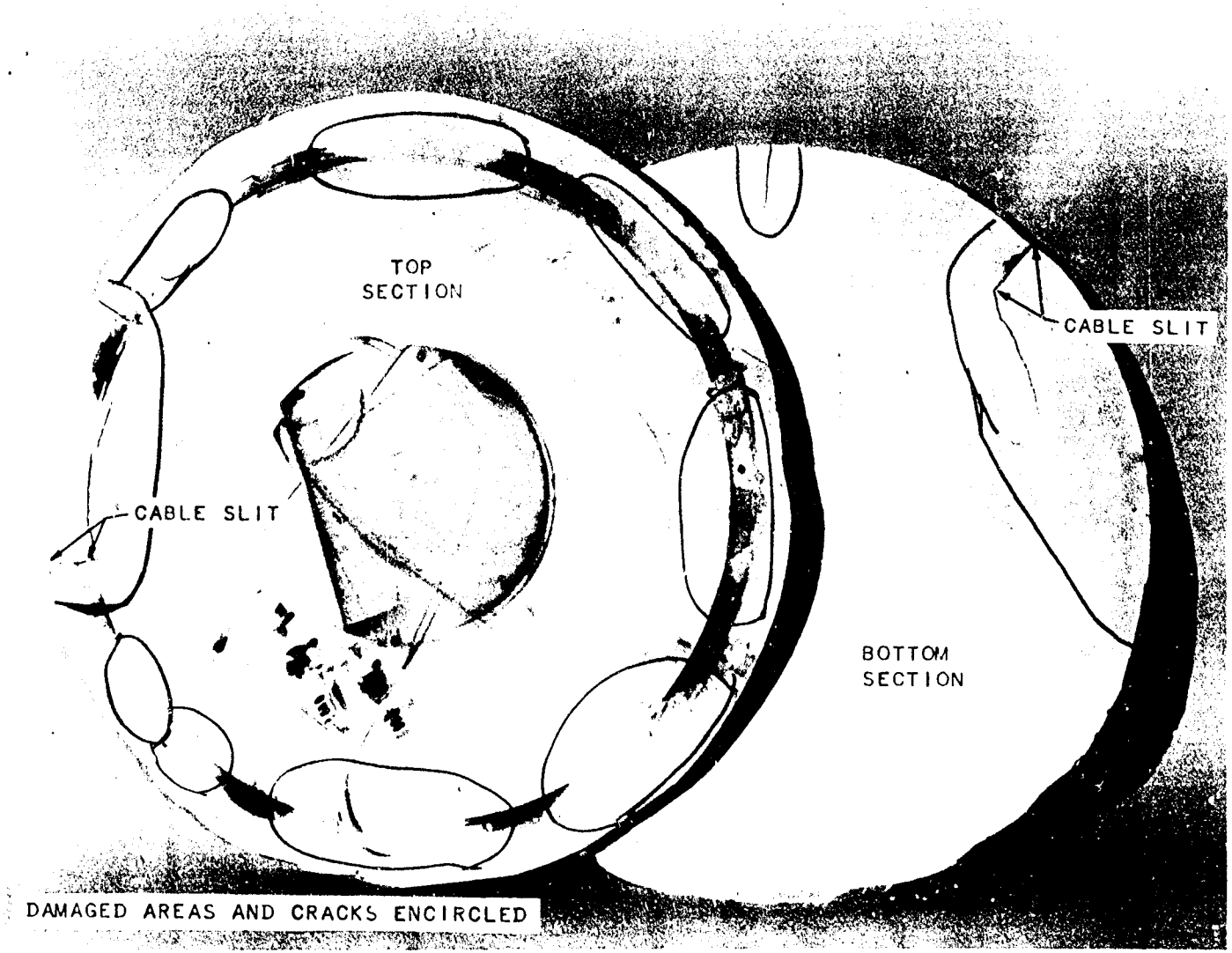

FIG. 8 - SECTIONS OF ENSOLITE BASE PAD DAMAGED DURING DROP TESTS AT -40°F
RAMP AND DROP TEST OF THE H-194/303 WITH THE MC-383A

REF. SYM: 1612(24/
PROJECT NO. TM-31

#66399

#1613

TABLE I

COMPONENTS OF CONTAINER AND FUZE TESTED

RAMP AND DROP TEST OF H-194/303 WITH THE MC-383A

Component	Drawing No.	Serial No.
H-194/303 Container Base	119129-01	None
H-194 Container Cover	115477-00	AK-1060-F4
H-194 Container Cover Ring	119128-00	None
MC-73 Timer	113800	CC-2172-G3
MC-273 Arming Baroswitch	115550	AH-1688-B4
MC-372 Pull-Out Switch Ass'y	118637	AA-1050-D4
MC-382 Arming Control Box	119682-70	AA-1028-E4
MC-384 Safing-Switch	120689-70	AA-1070-F4
MC-385 Fuze Plate	120067-70	AS-1047-G4
MC-394 Fuzing Baroswitch	119848-70	AH-26274-A4D4
MC-435 Fuze Support	119935TX-70	AA-1050-E4

[redacted]

Ref. Sym: 1612 (247)
Project No. TM-318

TABLE II

ACCELEROMETER DATA AND LOCATIONS

RAMP AND DROP TEST OF H-194/303 WITH THE MC-383A

Gage No.	Location	Direction	Serial No.	Model No.	Nat. Freq. (cps)	Fig. Ref.
1	H-194/303 Container Base	Longitudinal	648	A5A-50-300	500	3
2	H-194/303 Container Base	Vertical	2190	A5A-100-300	760	3
3	MC-385 Fuze Plate, Center of Top Surface	Longitudinal	1296	F-50-300	565	4
4	MC-385 Fuze Plate, Aft Edge of Top Surface (Bottom Edge in Weapon)	Vertical	1299	F-100-300	690	4
5	Ramp Dolly Frame	Longitudinal	627	A5A-100-300	800	2
6	Ramp Dolly Frame	Vertical	280	A5A-50-240	600	2

[redacted]

[redacted]

Ref. Sym: 1612 (247)
Project No. TM-318

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TABLE III

RAMP TEST ACCELERATION DATA

RAMP AND DROP TEST OF THE H-194/303 WITH THE MC-383A

Gage No.	Location	Direction	Faired Shock Pulse Max. Accel. (g)	Rise Time (ms)	Pulse Duration (ms)	Maximum Accelerations Pos.(+) Accel. (g)	Time After Impact** (ms)	Neg.(-) Accel. (g)	Time After Impact** (ms)	Assoc. Freq. (cps)
			Run 1 -- 5.1 mph							
1	H-194/303 Base	Longitudinal	-8.0	5	47			8.7	31	
2	H-194/303 Base	Vertical				3.4	33	3.8	52	*450
3	MC-385 Center	Longitudinal	-8.2	10	46			8.2	19	
4	MC-385 Edge	Vertical				4.9	80	1.6	66	
5	Ramp Dolly	Longitudinal	-8.6	13	47			10.6	23	
6	Ramp Dolly	Vertical				3.5 (F)	73	1.3 (F)	50	*26
6						4.2	48	4.6	49	750
			Run 2 -- 5.7 mph							
1	H-194/303 Base	Longitudinal	-9.8	2	43			12.7	16	
2	H-194/303 Base	Vertical				5.4	14	4.7	36	*450 on *35
3	MC-385 Center	Longitudinal	-10.4	11	43			10.5	18	
4	MC-385 Edge	Vertical				5.4	21	3.0	13	
5	Ramp Dolly	Longitudinal	-11.5	1	41			18.7	3	
6	Ramp Dolly	Vertical				7.8	17	7.1	14	*750
			Run 3 -- 6.1 mph							
1	H-194/303 Base	Longitudinal	-10.3	29	47			11.3	42	
2	H-194/303 Base	Vertical				4.8	16	4.7	53	300-400 on *30
3	MC-385 Center	Longitudinal	-9.7	36	51			9.7	46	
4	MC-385 Edge	Vertical				3.4	23	3.4	39	
5	Ramp Dolly	Longitudinal	-13.9	31	47			15.7	35	
6	Ramp Dolly	Vertical				8.1	143	5.6	16	650-800 on *50

Gage No.	Location	Direction	Faired Shock Pulse Max. Accel. (g)	Rise Time (ms)	Pulse Duration (ms)	Maximum Accelerations Pos.(+) Accel. (g)	Time After Impact** (ms)	Neg.(-) Accel. (g)	Time After Impact** (ms)	Assoc. Freq. (cps)
			Run 4 -- 6.5 mph							
1	H-194/303 Base	Longitudinal	-12.9	15	36			17.2	17	
2	H-194/303 Base	Vertical				8.6	12	8.9	46	400-500 on *50
3	MC-385 Center	Longitudinal	-14.8	16	39			14.8	29	
4	MC-385 Edge	Vertical				8.1	31	4.7	13	
5	Ramp Dolly	Longitudinal	-14.8	3	36			18.8	4	
6	Ramp Dolly	Vertical				10.8	20	10.6	6	*750
			Run 6 -- 7.1 mph							
1	H-194/303 Base	Longitudinal	-14.9	7	34			18.9	16	
2	H-194/303 Base	Vertical				9.6	12	9.2	45	400-500 on *50
3	MC-385 Center	Longitudinal	-16.8	15	37			16.8	27	
4	MC-385 Edge	Vertical				10.5	30	5.6	13	
5	Ramp Dolly	Longitudinal	-16.5	2	35			21.3	15	
6	Ramp Dolly	Vertical				15.1	19	12.8	5	650-800
			Run 7 -- 6.3 mph							
1	H-194/303 Base	Longitudinal	-18.4	19	38			23.5	28	
2	H-194/303 Base	Vertical				17.7	58	21.4	53	*450
3	MC-385 Center	Longitudinal	-17.9	22	41			17.9	34	
4	MC-385 Edge	Vertical				12.4	33	8.7	14	
5	Ramp Dolly	Longitudinal	-18.5	1	31			28.5	4	
6	Ramp Dolly	Vertical				18.6	23	18.5	6	*800

* - Approximate value.
** - Time maximum acceleration occurred after initial ramp dolly impact.
(F) - Faired value.

Positive accelerations are directed forward, with respect to the ramp dolly, (forward bottom of MC-383A in weapon) and upward, and negative are opposite.

Accelerations at frequencies above 400 cps are generally attenuated by the accelerometers, so values shown may be lower than the actual values for accelerations in this frequency range.

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TABLE IV

DROP TEST ACCELERATION DATA

RAMP AND DROP TEST OF THE H-194/303 WITH THE MC-383A

Gage No.	Location	Direction	Faired Shock Pulse Max. Accel. (g)	Faired Shock Pulse Rise Time (ms)	Faired Shock Pulse Pulse Duration (ms)	Maximum Accelerations Pos.(+) Accel. (g)	Maximum Accelerations Neg.(-) Accel. (g)	Maximum Accelerations Assoc. Freq. (cps)	Faired Shock Pulse Max. Accel. (g)	Faired Shock Pulse Rise Time (ms)	Faired Shock Pulse Pulse Duration (ms)	Maximum Accelerations Pos.(+) Accel. (g)	Maximum Accelerations Neg.(-) Accel. (g)	Maximum Accelerations Assoc. Freq. (cps)
			Drop 2 -- 4 Inches						Drop 20 -- 12 Inches (Container and Contents at -40°F)					
1	H-194/303 Base	Longitudinal				15 g or greater		500+				23.8	39.5	500+
2	H-194/303 Base	Vertical				25 g or greater		500+				91.0	32.5	500+
3	MC-385 Center	Longitudinal	-1.9	4	15		2.3		-12.2	2	5		12.2	
4	MC-385 Edge	Vertical	+19.5	5	17	20.0			+71.9	4	11	71.9		
			Drop 12 -- 4 Inches						Drop 23 -- 12 Inches (Felt Base Pad on Container)					
1	H-194/303 Base	Longitudinal				19.6	29.6	500+				30 g or greater		500+
2	H-194/303 Base	Vertical				84.0	19.5	500+				40 g or greater		500+
3	MC-385 Center	Longitudinal	-1.9	4	15		2.2					3.6	5.4	
4	MC-385 Edge	Vertical	+21.2	5	17	22.0			+65.4	5	12	65.4		
			Drop 13 - 12 Inches						Drop 24 -- 12 Inches (Felt Base Pad on Container)					
1	H-194/303 Base	Longitudinal				54.0	60.9	500+				25 g or greater		500+
2	H-194/303 Base	Vertical				128.8	91.3	500+				30 g or greater		500+
3	MC-385 Center	Longitudinal	-1.3	*4	*8		2.3					2.2	2.2	
4	MC-385 Edge	Vertical	+37.0	5	17	38.7			+69.9	4	11	69.9		
			Drop 14 -- 12 Inches											
1	H-194/303 Base	Longitudinal				47.1	42.2	500+						
2	H-194/303 Base	Vertical				106.5	74.3	400+						
3	MC-385 Center	Longitudinal	-5.6	4	16		6.2							
4	MC-385 Edge	Vertical	+30.3	5	17	31.7								

+ Frequency higher than value shown
* Approximate value.

Positive accelerations are directed upward and toward the bottom (in weapon) of the MC-383A (longitudinal).

Accelerations at frequencies above 400 cps are generally attenuated by the accelerometers, so values shown may be lower than the actual values for accelerations in this frequency range.