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File No: TX-53, 3-2
T-16808
Project No: 13.858.00
Date Completed: 11-16-60

MR. E. I. BRUCE - 7117
Attn: L. F. Miller

Re: Drop Tower Test of Half Scale TX-53 Beer Barrel Nose

Summary of Results

A total of 10 drop tests were made to gather acceleration data on a half scale beer barrel nose which was subjected to simulated impact conditions. Six tests were made by dropping the test vehicle (oriented perpendicular to target) vertically downward onto an angled target to simulate horizontal and vertical impact velocity components on a flat target. Vertical impact velocity components ranged from 38 FPS to 42 FPS and the horizontal impact velocity components varied from 22 FPS to 37 FPS.

Three tests were made on a flat target with the test vehicle impacting perpendicular to it; the vertical velocity component at impact ranged from 39 FPS to 44 FPS and the horizontal component for all tests was zero.

One test was made by dropping the vehicle vertically downward impacting at 30° from vertical onto a flat target. The vertical (or longitudinal) velocity component at impact was 38 FPS and the horizontal (or transverse) velocity was 22 FPS.

The test results showed that the beer barrel nose was capable of mitigating the longitudinal acceleration at impact to less than 100g. The nose assembly was found to stand up very well under the side loads experienced during impacts with a horizontal velocity component.

The nose section fabricated entirely from 6061 AL was somewhat too rigid for optimum performance and the 3003 AL. nose was somewhat too ductile. A good compromise was reached early in the test series by using 6061 AL for the front section of the nose and welding it to the rear section made of 3003 AL.

Reason for Test

This test was requested in a Work Order Authorization dated January 11, 1960 from E. I. Bruce, 7117 to A. W. Roger, 7322. The test was assigned to Division 7323 to be conducted on the 300 drop test tower.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW RECEIVED
DOWNGRADING OR DECLASSIFICATION STAMP
CLASSIFICATION CHANGED TO: U AUTHORITY: R. B. Craner
Emelda Salph 7/23/98
PERSON CHANGING MARKING & DATE RECORD ID: 98SN3075
W C Kayne 7/30/98
PERSON VERIFYING MARKING & DATE DATED: 7/23/98

CENTRAL FILE
ACCOUNTABLE
CAPS
FILE No. TX-53
3-2

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Object of Test

The object of this test was to conduct a series of drop tests on a half scale TX-53 Beer Barrel Nose under various impact velocity conditions and to measure the resulting accelerations.

Previous Tests

Two tests and reports have been completed on full scale 'Beer Barrel' nose sections. On both of these tests the nose of the warhead bottomed out but otherwise performed satisfactorily. These tests are reported in T-17374 and T-17407.

Setup for Test

The test vehicle was a hollow right circular cylinder which had a front adapter plate to which the beer barrel nose was attached with bolts. The tests were made by dropping the test vehicles vertically onto angled concrete targets. The longitudinal axis of the test vehicle was perpendicular to the target surface at impact to simulate impacts with combined horizontal and vertical components of velocity on a horizontal target. Fig. 1 shows a typical test arrangement.

Accelerometers were mounted in the test vehicle at selected locations which are shown in Fig. 2. Also shown is the sign convention established to designate direction of positive acceleration. In Table I is tabulated the accelerometer (by serial nos.) that were used at the various positions within the test vehicle. In Table II is listed the specifications of the accelerometers and Table III shows the drop test condition relative to each test. The longitudinal impact velocity (simulating actual vertical velocity) was parallel to the longitudinal axis of the test vehicle. The transverse impact velocity (simulating actual horizontal velocity) was directed from 180° to 0°. (Refer to Fig. 2).

A C.E.C. type t-114 recording oscillograph (using type 302 galvonometer) was used to record the acceleration signatures.

The drawing no. showing dimensions, details and other information about the half scale beer barrel nose section is N-10603.

Procedure for Test

Each drop test vehicle was oriented normal to the target surface (except test No. 9) and hoisted to the height sufficient to produce the desired impact velocity components. The test vehicle was released from the tower support boom by an explosive cable cutter. For test No. 9 the test vehicle was oriented to impact at 30° from vertical onto a flat target. All drop tests were covered by Fastax high speed motion picture cameras.

Results of Test

Tabulated in Table IV through VI is the acceleration data as read from the acceleration signatures. No record was obtained from test No. 2. The acceleration signatures were read according to SC-4452 (M) para 2.1. The sign convention used to designate direction of positive acceleration is in accordance with the directions shown in Fig. 2.

In Fig. 3 is shown the original acceleration signature from test No. 4 which was made on a flat target. Shown in Fig. 4 is the record from test No. 1 which was made on an angled target. The acceleration signatures from all the other tests were very similar to these that are shown.

Shown in Fig. 5 through 14 are photographs of the beer barrel nose after each test. No photograph was available for test No. 5 but the test was made under exactly the same conditions as tests No. 4 and 6.

These tests indicate that the beer barrel design has possibilities of being adequate to mitigate both longitudinal and transverse acceleration to an acceptable figure in a full scale model. Since the beer barrel nose can be securely bolted to the test vehicle it is superior to the honeycomb nose in withstanding side loads.

C. G. Coalson

C. G. COALSON - 7323-3

Dale Buchanan

7321 Project Engineer: DALE BUCHANAN - 7321-5

Approved By: R. S. HOOPER - 7321-5

CGC:7323-3:mw

Encl: Fig. 1 thru 14
Table I-VI

Copy to:
J. M. Wiesen, 1442
D. S. Bliss, 2344
D. M. Bruce, 7182
E. H. Copeland, 7321
J. R. Harrison, 7523
K. K. Smeltzer, 3421-3
L. C. Horpedahl, W-1, LASL, Attn: S. D. Huffman
R. S. Gauler, GMX -3, LASL, Attn: D. F. Mitchell

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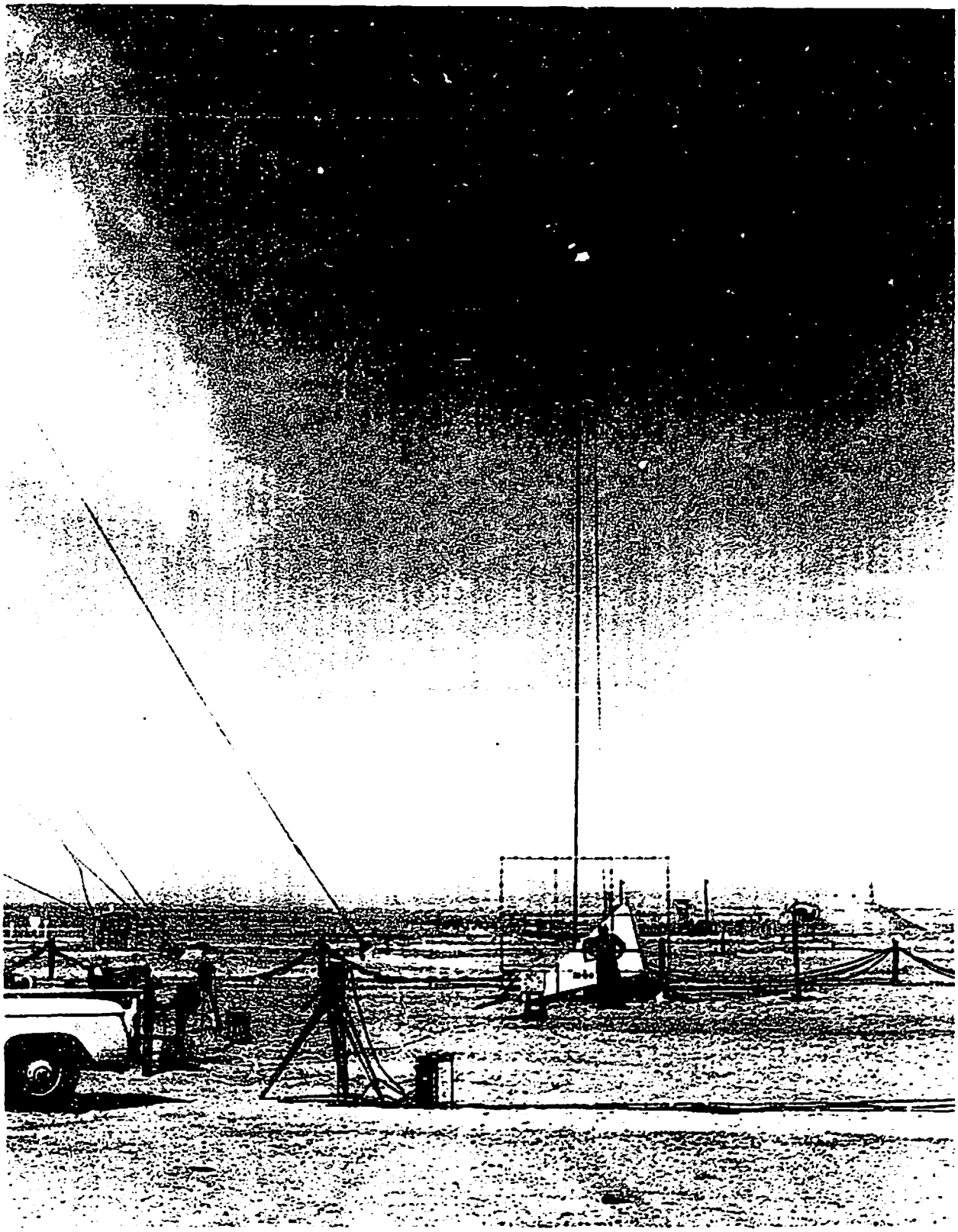

FIGURE 1 - TYPICAL ARRANGEMENT USED FOR DROPPING ON AN ELEVATED TARGET, TEST VEHICLE IS PERPENDICULAR TO TARGET SURFACE -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

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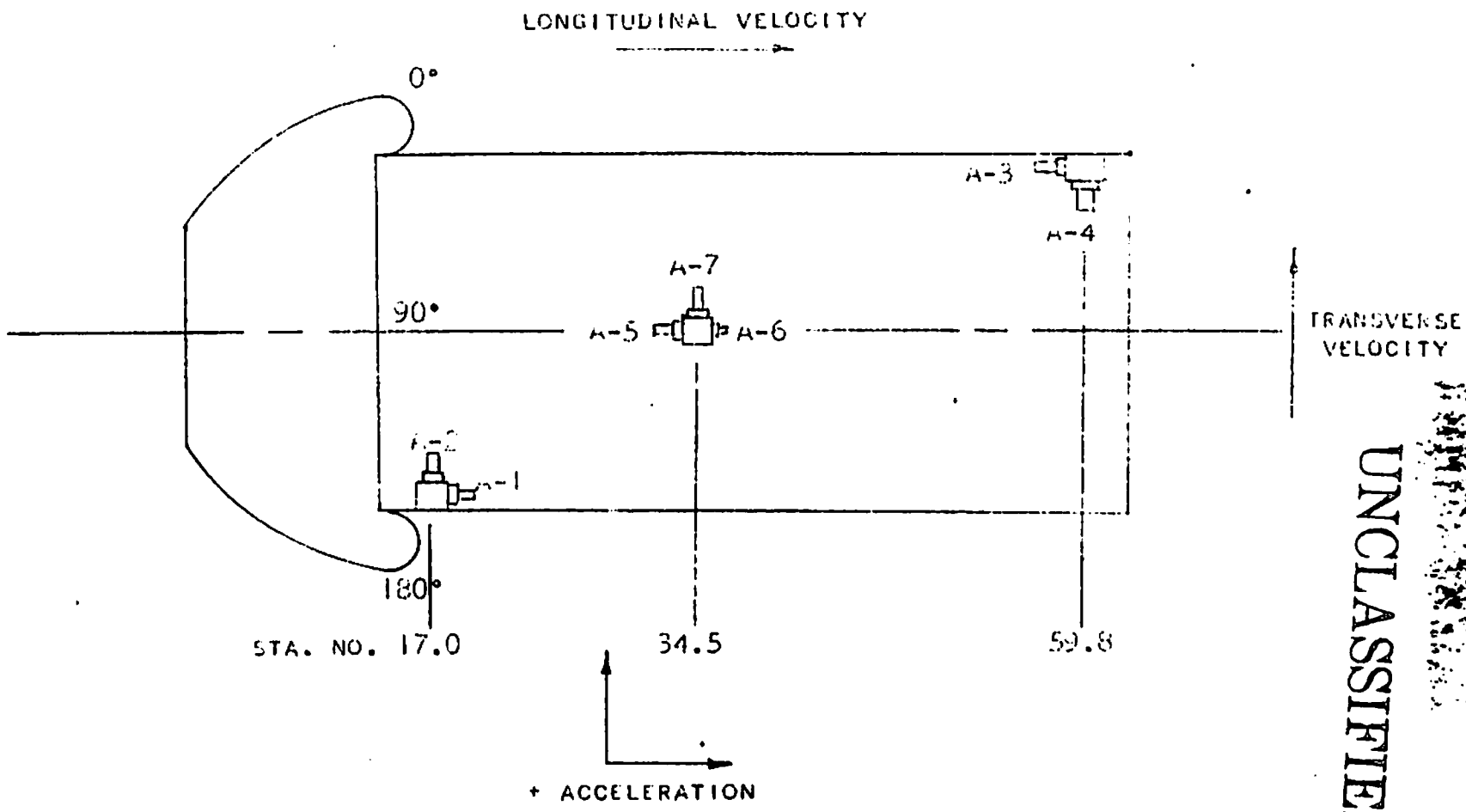

FIGURE 2 - DIAGRAM SHOWING LOCATION AND STATION NUMBERS OF ACCELEROMETERS AND DIRECTION OF POSITIVE ACCELERATION -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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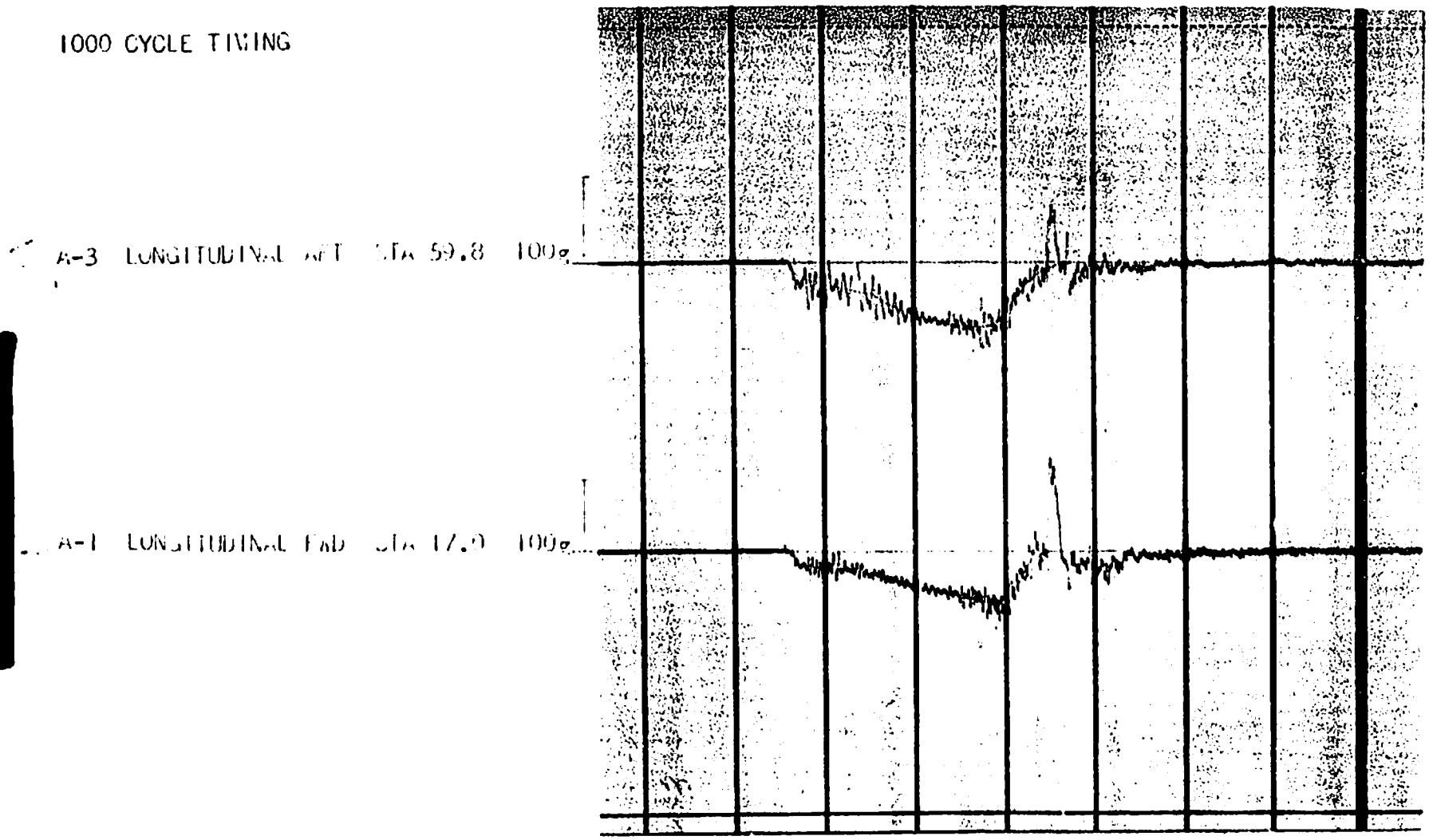

FIGURE 3 - ACCELERATION SIGNATURES FROM TEST NO. 4, LONGITUDINAL VELOCITY = 38.8 FPS, TRANSVERSE VELOCITY = 0, FLAT TARGET -- DROP TOWER TEST OF HALF SCALE TX-53 BLEEK BARREL NOSE

PROJECT NO. T-16006

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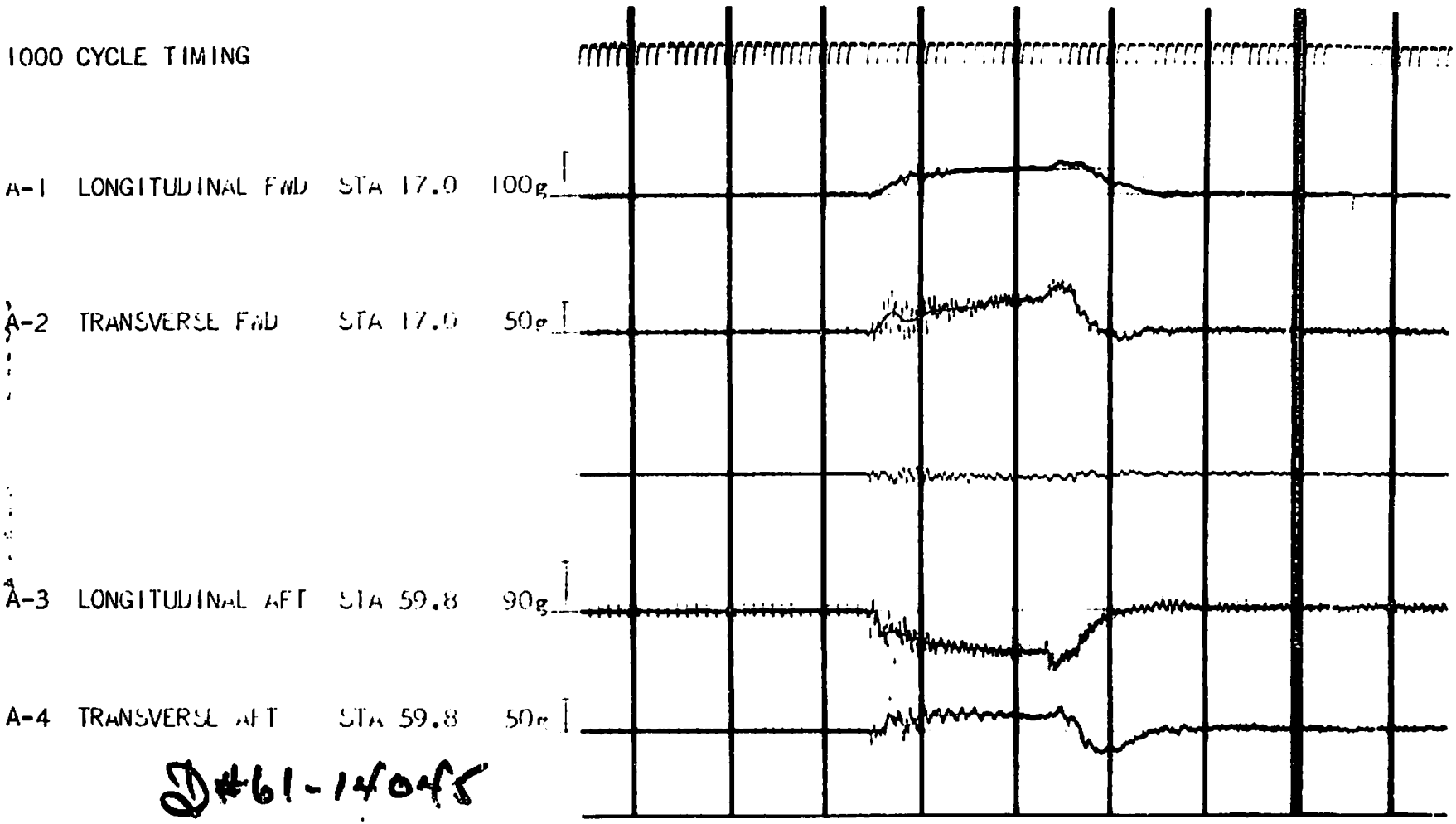

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FIGURE 4 - ACCELERATION SIGNATURES FROM TEST NO. 1, LONGITUDINAL VELOCITY = 42.4 FPS, TRANSVERSE VELOCITY = 37 FPS, TARGET ANGLE = 41° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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FIGURE 5 - TEST VEHICLE AFTER TEST NO. A, 6061 AL., LONGITUDINAL VELOCITY = 42.4 FPS, TRANSVERSE VELOCITY = 37 FPS, TARGET ANGLE = 41° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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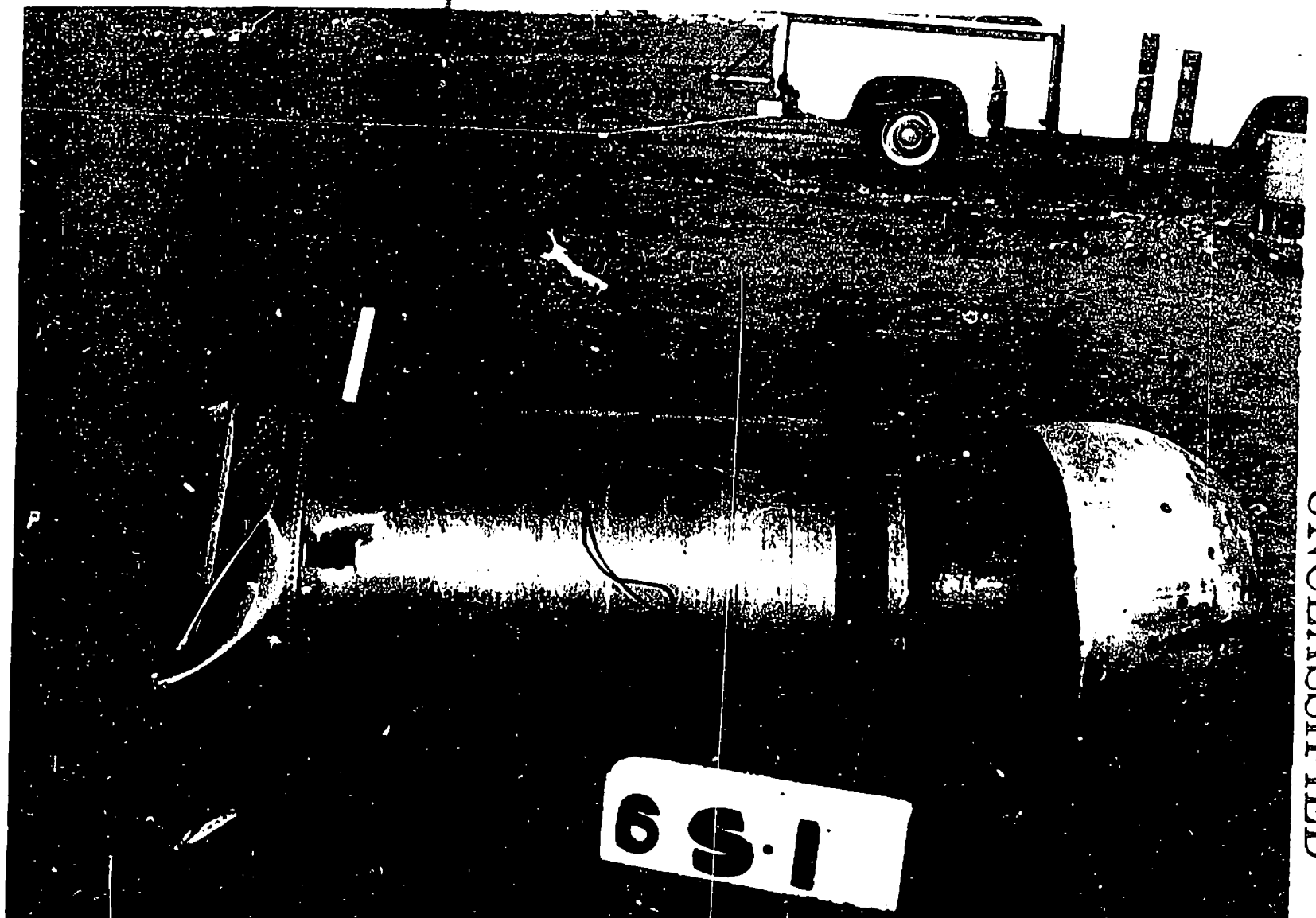

FIGURE 6 - TEST VEHICLE AFTER TEST NO. A, 6061 AL., LONGITUDINAL VELOCITY = 42.4 FPS, TRANSVERSE VELOCITY = 37 FPS, TARGET ANGLE = 41° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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FIGURE 7 - TEST VEHICLE AFTER TEST NO. 1, 3003 AL., LONGITUDINAL VELOCITY = 42.4 FPS, TRANSVERSE VELOCITY = 37 FPS, TARGET ANGLE = 41° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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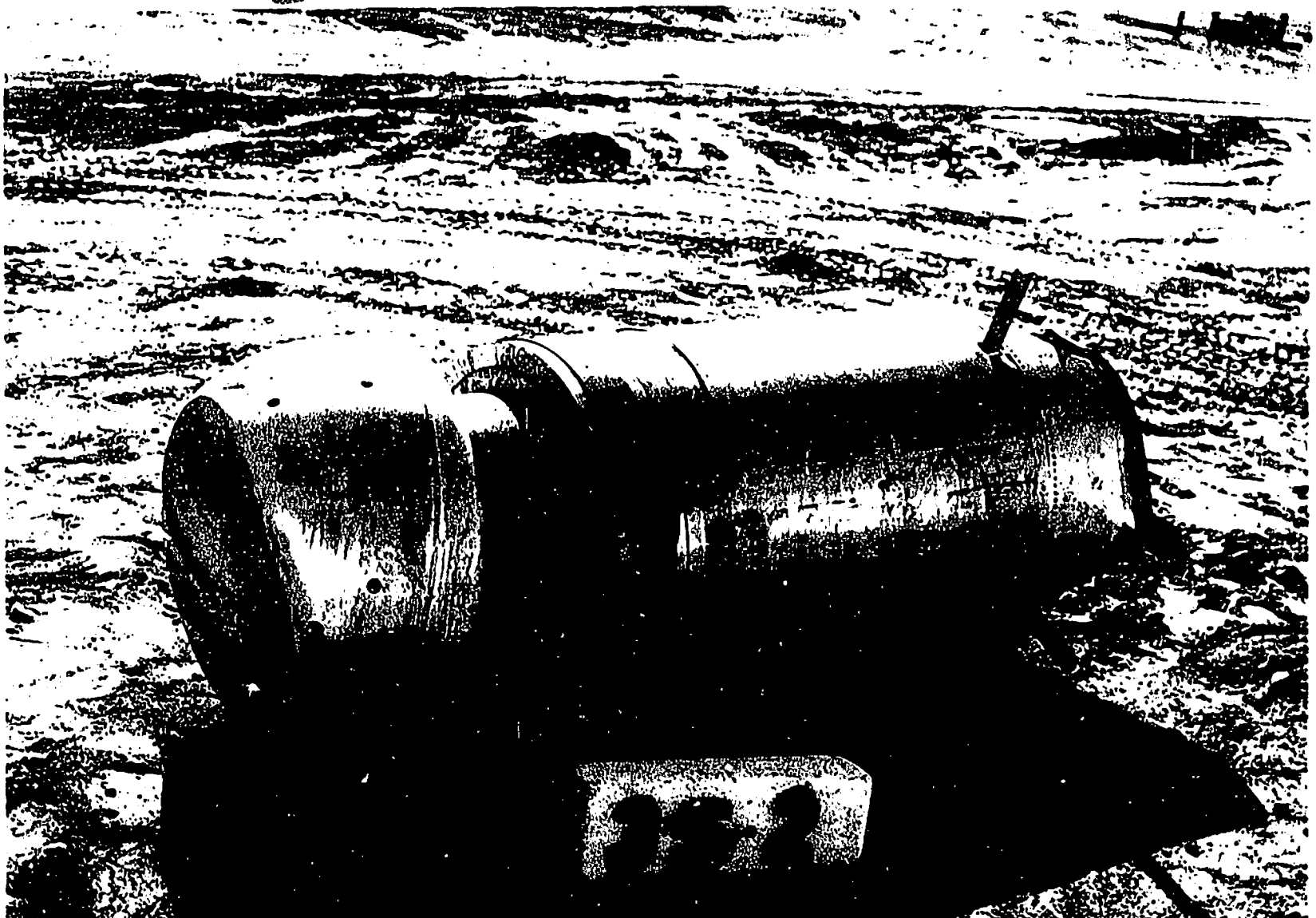

FIGURE 8 - TEST VEHICLE AFTER TEST NO. 2, 3003 AL., LONGITUDINAL VELOCITY = 42.4 FPS, TRANSVERSE VELOCITY = 37 FPS, TARGET ANGLE = 41° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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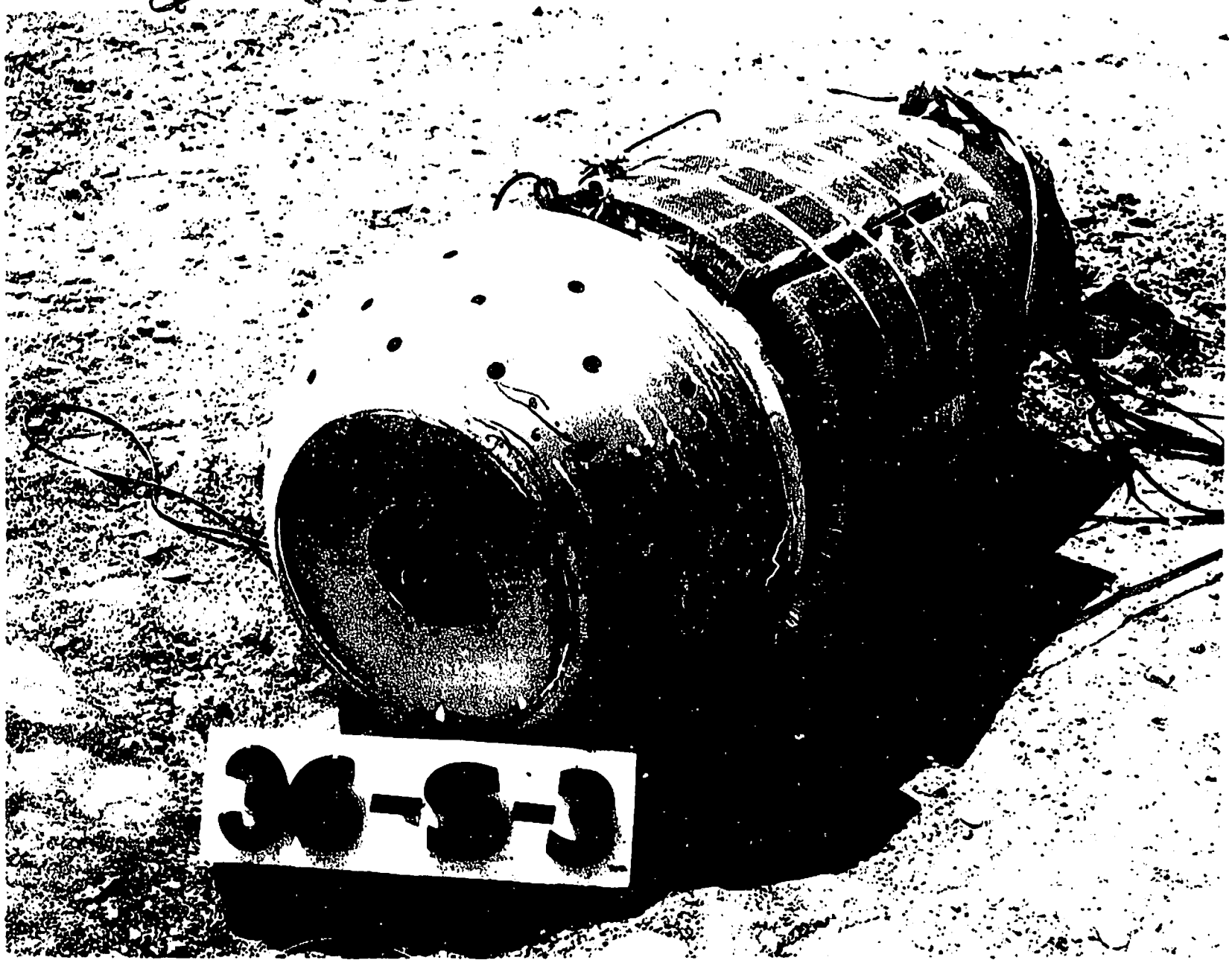

FIGURE 9 - TEST VEHICLE AFTER TEST NO. 3, 3003 AL. AND 6061 AL., LONGITUDINAL VELOCITY = 42.4 FPS, TRANSVERSE VELOCITY = 37 FPS, TARGET ANGLE = 41° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

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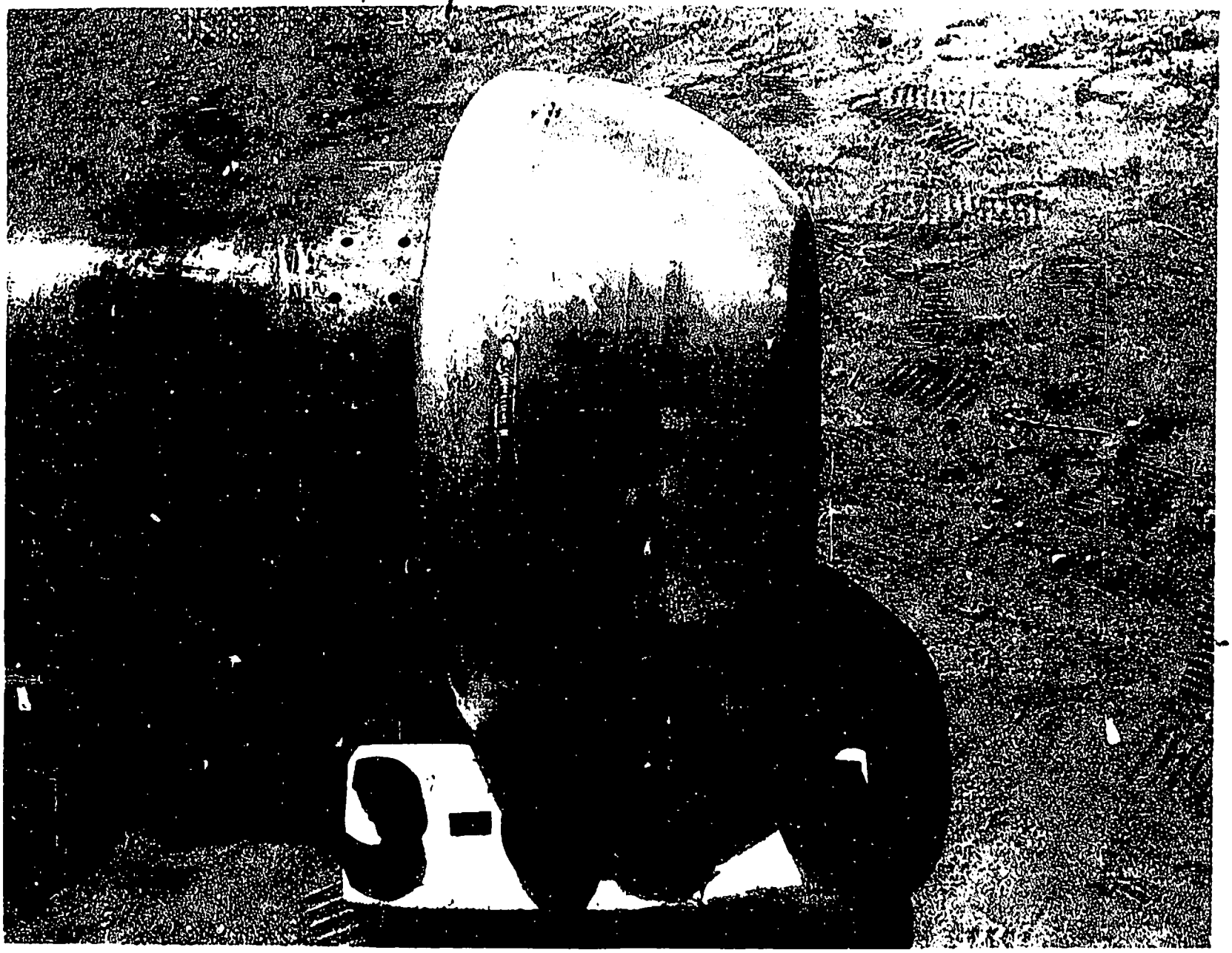

FIGURE 10 - TEST VEHICLE AFTER TEST NO. 4, 3003 AL. AND 6061 AL., LONGITUDINAL VELOCITY = 38.8 FPS, TRANSVERSE VELOCITY = 0, FLAT TARGET -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

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PROJECT NO. T-16808

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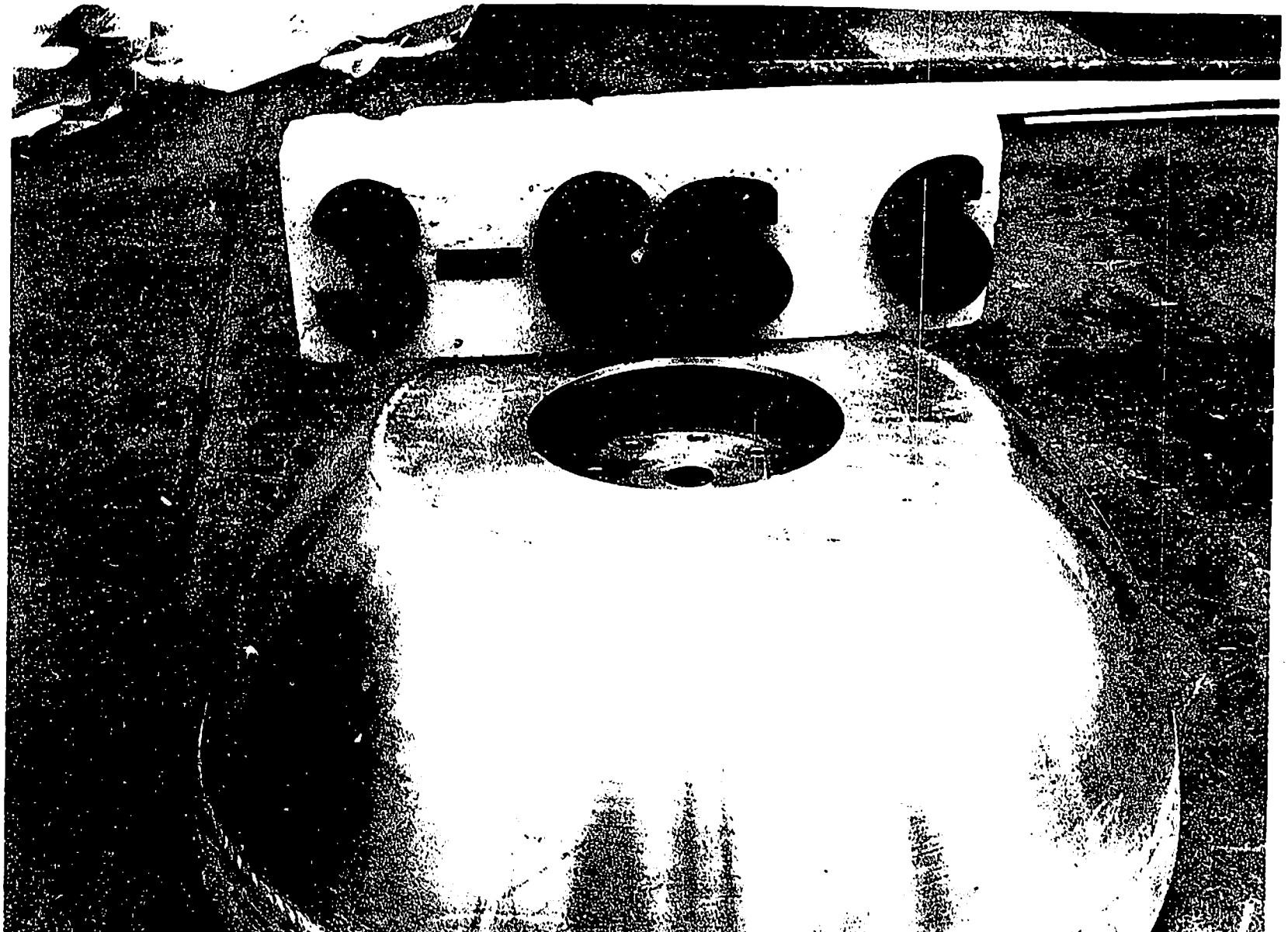

FIGURE 11 - TEST VEHICLE AFTER TEST NO. 6, 3003 AL. AND 6061 AL., LONGITUDINAL VELOCITY = 43.9 FPS, TRANSVERSE VELOCITY = 0, FLAT TARGET -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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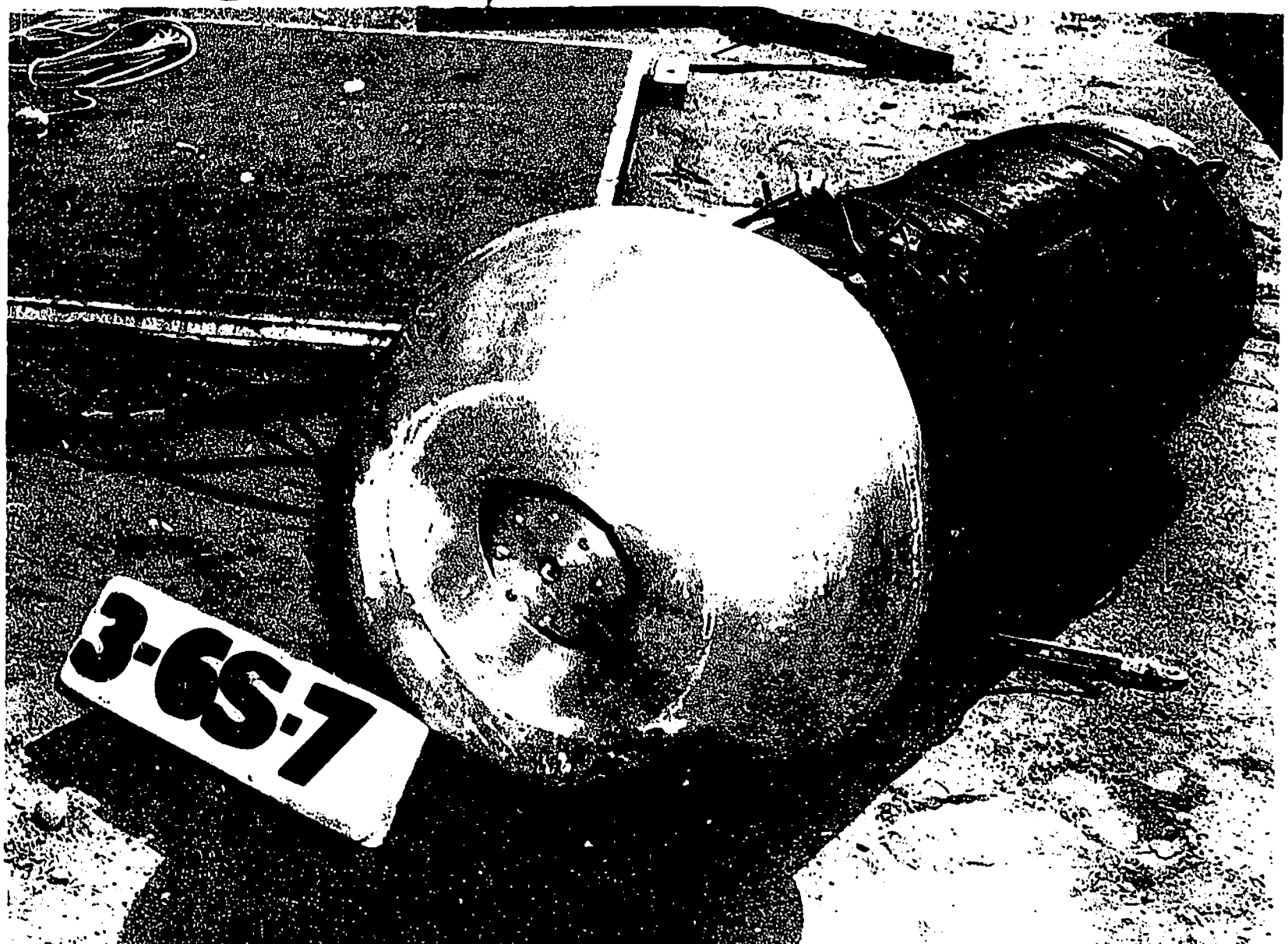

FIGURE 12 - TEST VEHICLE AFTER TEST NO. 7, 3003 AL. AND 6061 AL., LONGITUDINAL VELOCITY = 43.8 FPS, TRANSVERSE VELOCITY = 31.6 FPS, TARGET ANGLE = 35.8° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

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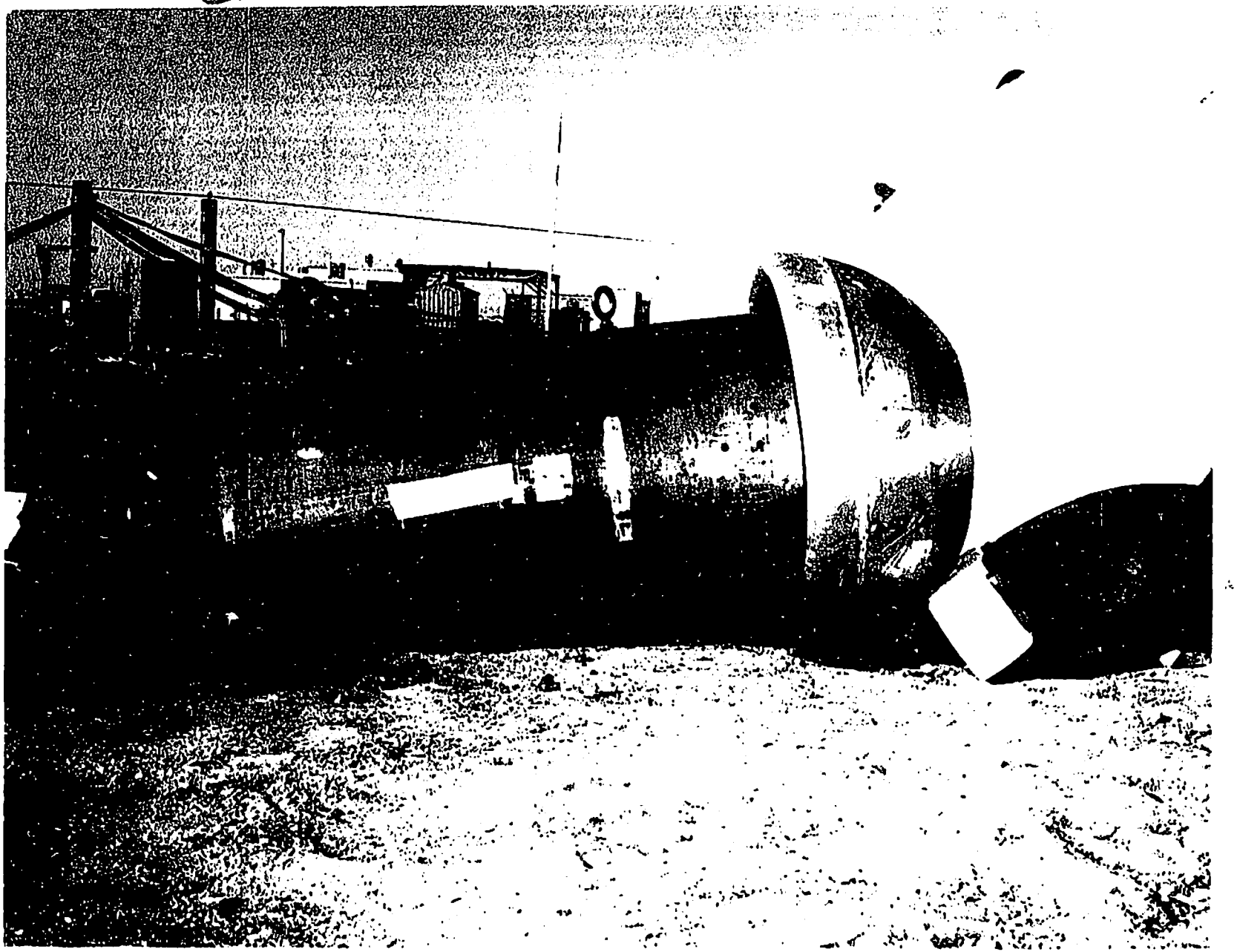

FIGURE 13 - TEST VEHICLE AFTER TEST NO. 8, 3003 AL. AND 6061 AL., LONGITUDINAL VELOCITY = 43.8 FPS, TRANSVERSE VELOCITY = 36.3 FPS, TARGET ANGLE = 40° -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

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FIGURE 14 - TEST VEHICLE AFTER TEST NO. 9, 3003 AL. AND 6061 AL., LONGITUDINAL VELOCITY = 37.9 FPS, TRANSVERSE VELOCITY = 21.7 FPS, FLAT TARGET (VEHICLE IMPACTED ON EDGE OF NOSE) -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16808

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1000 CYCLE TIMING

A-3 LONGITUDINAL AFT STA 59.8 100g

A-1 LONGITUDINAL FWD STA 17.0 100g

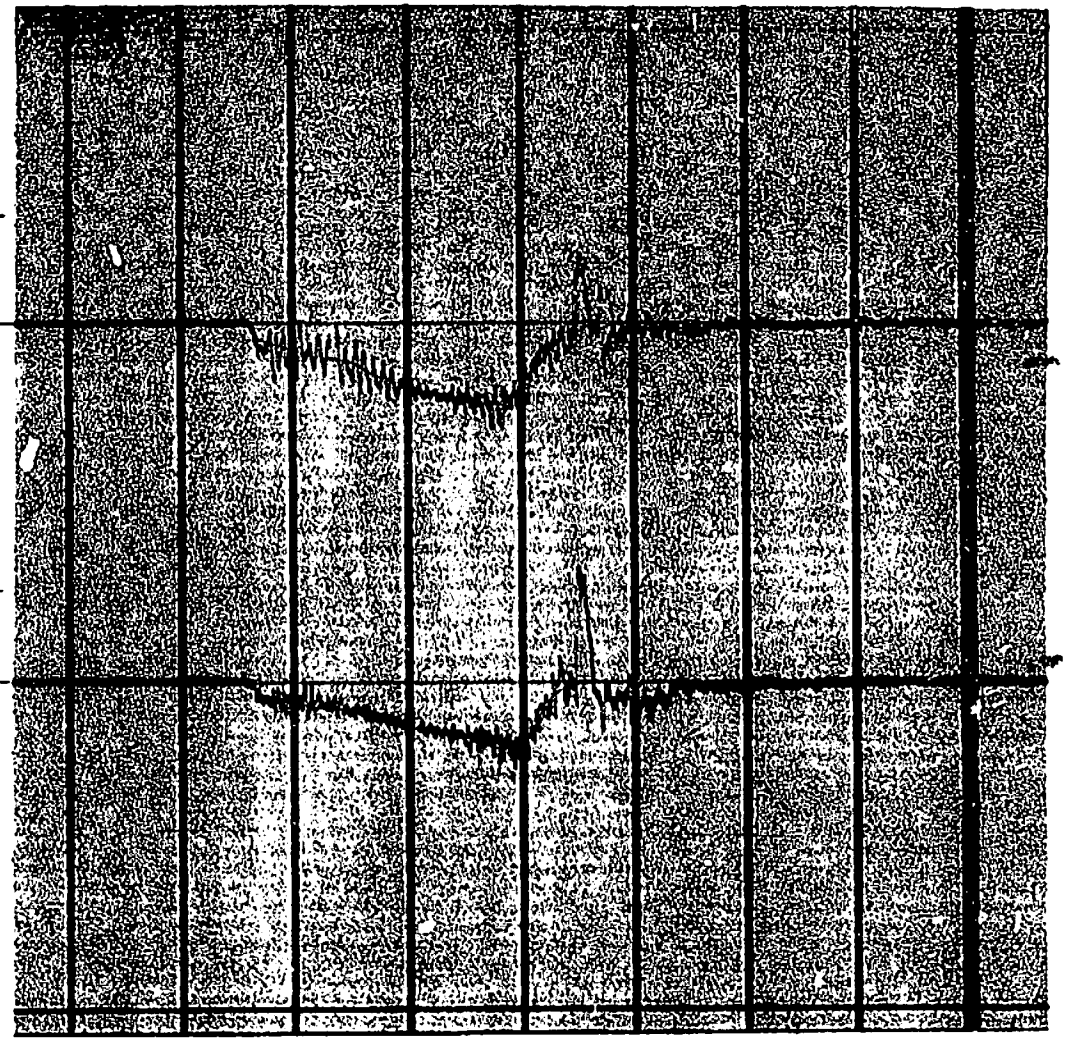

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FIGURE 3 - ACCELERATION SIGNATURES FROM TEST NO. 4, LONGITUDINAL VELOCITY = 38.8 FPS, TRANSVERSE VELOCITY = 0, FLAT TARGET -- DROP TOWER TEST OF HALF SCALE TX-53 BEER BARREL NOSE

PROJECT NO. T-16608

#384

TABLE I

Serial Numbers of Accelerometers Used on Drop Test Vehicles
Drop Tower Test of Half Scale TX-53 Beer Barrel Nose

Gage No.	Station Location	Sensing Direction*	Test No.	Accelerometer Serial No. A	1	2	3	4	5	6	7	8	9
A-1	17.0	Long.		6019	6019	6019	6019						
A-2	17.0	0-180°		3997	3997	3997	3997						
A-3	59.8	Long.		7015	7015	7015	7015	7170	7170	7170	7170	7168	7168
A-4	59.8	0-180°		3351	3351	3351	3351				7176	3997	3997
A-5	34.5	Long.						5382	5382	5382	7015	7406	7406
A-6**	34.5	Long.							5688	5688	5688	5688	5688
A-7	34.5	0-180°									4896		7171

**Crystal accelerometer, Endevco Model No. 2213,
all others were Statham Model No. A5A.
*According to directions shown in Figure 2.

TABLE II

Specifications of Accelerometers Used on Drop Test Vehicles
Drop Tower Test of Half Scale TX-53 Beer Barrel Nose

Serial No.	Statham Model No.	Range (±g's)	Natural Frequency (cps)
3351	A5A-200-350	200	900
3997	A5A-500-350	500	1500
4896	A5A-1000-356	1000	1500
5382	A5A-1000-350	1000	1500
6019	A5A-200-350	200	910
7015	A5A-1000-350	1000	1500
7168	A5A-1000-350	1000	1500
7170	A5A-1000-350	1000	1500
7171	A5A-1000-350	1000	1500
7176	A5A-1000-350	1000	1500
7406	A5A-500-350	500	1500
5688	Endevco Model 2213	3000	50,000

TABLE III

Drop Test Conditions
Drop Tower Test of Half Scale TX-53 Beer Barrel Nose

Test No.	Type of Nose**	Longitudinal Velocity (fps)	Transverse Velocity (fps)*	Target Angle Respect to Ground
A	6	42.4	37	41°
1	3	42.4	37	41°
2	3	42.4	37	41°
3	3-6	42.4	37	41°
4	3-6	38.8	0	0°
5	3-6	38.8	0	0°
6	3-6	43.9	0	0°
7	3-6	43.8	31.6	35.8°
8	3-6	43.8	36.3	40°
9	3-6	37.9***	21.7	0°

*With respect to test vehicle (Refer to Figure 2).
**3 indicates A 3003 AL nose
6 indicates A 6061 AL nose
3-6 indicates 3003 AL back with 6061 AL bottom.
***Test vehicle impacted 30° from vertical to effect an impact on edge of nose. All other vehicles were suspended normal to target surface.

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TABLE IV

Acceleration, Rise Time and Pulse Duration From Tests A, 1, and 2
Drop Tower Test of Half Scale TX-53 Beer Barrel Nose

			Test No. A					Test No. 1					Test No. 3				
			Acceleration (g's)			Time (ms)		Acceleration (g's)			Time (ms)		Acceleration (g's)			Time (ms)	
Gage No.	Location and Station No.	Sensing Direction*	Max (+)	Max (-)	Faired	Rise	Pulse	Max (+)	Max (-)	Faired	Rise	Pulse	Max (+)	Max (-)	Faired	Rise	Pulse
A-1	Fwd Sta 17	Long.	92	-	+72	8.6	25.5	78	-	+78	17.4	28.5	68	0	+61	6.0	27.5
A-2	Fwd Sta 17	0-180°	93	58	+60	14.6	22.2	82	11	+70	17.9	23.0	55	20	+36	13	27
A-3	Aft 59.8	Long.	180	80	+100	5.0	23.5	110	38	+98	18.0	24.5	110	15	+69	7.5	28
A-4	Aft 59.8	0-180°	67	23	+20	3.3	18.5	56	17	+31	18.2	21.0	22	18	+20	4	7.5

*According to directions shown in Figure

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TABLE V

Acceleration, Rise Time and Pulse Duration From Tests 4, 5, and 6
Drop Tower Test of Half Scale TX-53 Beer Barrel Nose

			Test No. 4					Test No. 5					Test No. 6				
			Acceleration (g's)			Time (ms)		Acceleration (g's)			Time (ms)		Acceleration (g's)			Time (ms)	
Gage No.	Location and Station No.	Sensing Direction*	Max (+)	Max (-)	Faired	Rise	Pulse	Max (+)	Max (-)	Faired	Rise	Pulse	Max (+)	Max (-)	Faired	Rise	Pulse
A-3	Aft 59.8	Long.	100	0	+73	17	28	109	10	+60	16	22			Out		
A-4	Aft 59.8	0-180°			Not used					Not used					Not used		
A-5	CG 34.5	Long.	92	0	+70	19	27			Out					Not used		
A-6	CG 34.5	Long.			Not used			91	0	+70	20	29	112	57	+79	12.0	25.0

*According to directions shown in Figure

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T-16808

TABLE VI

Acceleration, Rise Time and Pulse Duration From Tests 7, 8, and 9
Drop Tower Test of Half Scale TX-53 Beer Barrel Nose

Gage No.	Location and Station No.	Sensing Direction*	Test No. 7 (Acceleration (g's) Max (+)	Test No. 7 Max (-)	Test No. 7 Faired	Test No. 7 Time (ms) Rise	Test No. 7 Time (ms) Pulse	Test No. 8 Acceleration (g's) Max (+)	Test No. 8 Max (-)	Test No. 8 Faired	Test No. 8 Time (ms) Rise	Test No. 8 Time (ms) Pulse	Test No. 9 Acceleration (g's) Max (+)	Test No. 9 Max (-)	Test No. 9 Faired	Test No. 9 Time (ms) Rise	Test No. 9 Time (ms) Pulse
A-3	Aft 59.8	Long.	107	-	+89	15.5	26.2	101	8	+88	11.6	27.2	162	40	+69	10.2	25.8
A-4	Aft 59.8	0-180°	81	40	+30	19.0	24.1	50	33	+9	17.4	21.6	90	59	+55	0.8	15.2
A-5	CG 34.5	Long.	117	50	+82	13.6	32.0	90	20	+80	11.8	27.5	60	-	+52	8.0	28.8
A-6	CG 34.5	Long.	160	78	+88	7.8	27.0	180	28	+90	13.9	26.5	108	55	+60	7.9	29.3
A-7	CG 34.5	0-180°	80	35	+45	18.5	23.8	93	52	+20	6.4	25.2	120	49	+48	1.3	18.0

*According to directions shown in Figure

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