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SC-DR-66-177
RS 3410/576
September 1966

Development Report

RESULTS OF TX-61 WEAPON TESTS 101-11 AND 101-17 (U)

R. R. Precit, 1512

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SC-DR-66-177

RESULTS OF TX-61 WEAPON TESTS 101-11 AND 101-17 (Title Unclassified)

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Sandia Laboratory, Albuquerque

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September 1966

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ABSTRACT (U)

This report supplements SC-DR-64-1737, Test Plan for TX-61 Weapons Tests 101-10, -11, and -12. No test plan was written for Test 101-17. This report gives results and conclusions on two air-drops in the ballistic retarded test series of the TX-61. Both tests were successful.

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RESULTS OF TX-61 WEAPON TESTS 101-11 AND 101-17

Introduction

Tests 101-11 and 101-17 were airdrops of the TX-61 weapon retarded ballistic series, made primarily to investigate aircraft separation and parachute performance from an F-104 aircraft at maximum and minimum release speeds. Both tests met their objectives and were successful.

Table I summarizes the release conditions for the tests. A complete tabulation of the conditions and results of the tests is given in Appendix A.

TABLE I

Summary of Test Conditions

	101-11	101-17
Test date	11-18-64	8-12-65
Carrier	F-104	F-104
Carriage	Centerline	Centerline
Altitude (ft above target)	1847	2488
Attitude (deg)	Level	Level
Speed CAS (knots)	732	240

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Test Objectives

The purposes of these tests were:

1. To evaluate parachute operation and aircraft separation from an F-104 at maximum and minimum release speeds.
2. To evaluate MC1839 inertial switch operation.
3. To determine the retarded trajectory.

Summary

Both tests met the objectives. Test 101-11 demonstrated that no problems are encountered in dropping a TX-61 retarded unit from an F-104 at maximum speed, and Test 101-17 demonstrated the same success at a speed well below the minimum tactical release speed for the aircraft. Between the times that these two tests were performed, the nominal time delay on parachute ignition was changed from 0.1 to 0.3 second. Consequently, Test 101-11 had a shorter time than is now used and posed a more critical condition than is now required. Unit 101-17 was dropped with a 0.3-second delay.

Description of Test Vehicles

The configurations dropped in these tests are shown in Figure 1. The serial numbers of the parts used are listed in Appendix B. Table II summarizes the physical characteristics of each unit.

TABLE II

Physical Characteristics of Test Units

	101-11	101-17
Length (in.)	141.0	141.0
Diameter (in.)	12.75	12.75
Weight (lb)	613	596
CG (station)	60.1	59.2
Yaw MI (lb-in.^{2})	652,500	614,500

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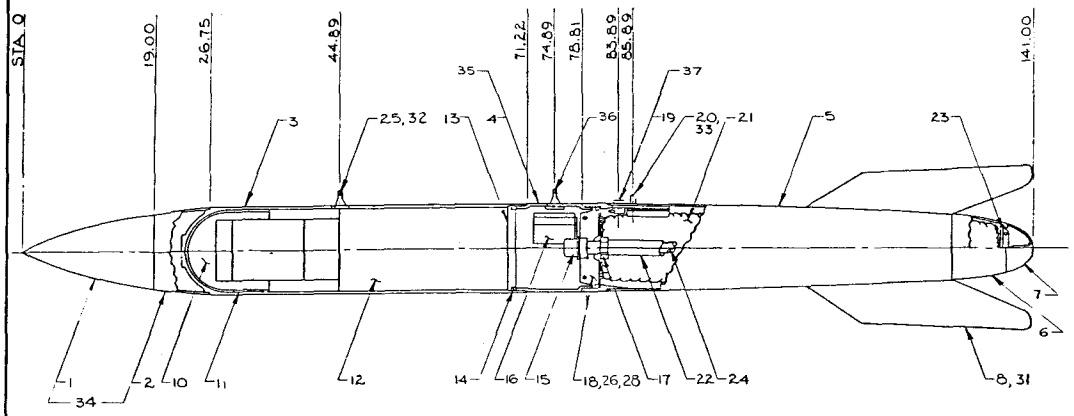

ISS	DESCRIPTION (PREPARED BY)	DATE	CHKR	ENGR
1	DORNEMAN, E.T. 4412-5	2-7-64		
2	101-7 IN TITLE BLOCK WAS 101-8. DORNEMAN, E.T. 4412-5	6-4-64		
3	ADDED 101-10 IN TITLE BLOCK. ALVINO, 4412-5	10-1-64		
4	ADDED 101-11 IN TITLE BLOCK AND NOTES 1, 2 & 3. ALVINO, 4412-5	10-28-64		
5	ADDED: 101-12 THRU 101-5 TEST NOS; ITEMS 26 THRU 33. "VARIATIONS" DELETED: NOTES CHANGED: TITLE; ITEM 9 WAS "GRILL" SOLOMKO, A 2212-5	4-[illegible]-65		
6	ADDED: 101-16 THRU 101-19 TEST NOS.; ITEMS 34 THRU 37. CHANGED: "PORTION" WAS "POSITION" IN TITLE OF ITEM 10. ALVINO, 2212-5	2-27-65		

(ITEMS 1 THRU 25 FOR 101-5, 101-6, AND 101-7)

ITEM	TITLE	NUMBER	ISSUE
1	CASE SECTION, NOSE	192148	2
2	CASE EXTENSION, NOSE	186735	5
3	CASE SECTION, CENTER	180388	6
4	CASE SECTION, PREFLIGHT	192169	3
5	CASE SECTION, REAR	180391	5
6	CASE EXTENSION, REAR	180370	6
7	CAP AND BOLT, REAR	186753	3
8	FIN	186739	3
9	SLEEVE (INSTALLED IN NORMAL POSITION)	------	-
10	FORWARD BALLAST (FORWARD PORTION)	N52816	5
11	SPACER	N52814	2
12	TM PACKAGE	N59546	-
13	COVER PLATE	186732	5
14	RING, EXTERNALLY THREADED	186733	2
15	XMC1835 (GAS GENERATOR)	311784	-
16	JUNCTION BOX, UNIVERSAL (BTS)	N54857	2
17	CUTTER MECHANISM-MODIFIED (8 CUTTERS)	------	-
18	SUPPORT, SHROUD LINE	180372	9
19	CABLE ASSY (P/O)	188923	2
20	PULSE INITIATOR (TEST) #3	N60445	1
21	PARACHUTE, 16'	AF	-
22	TUBE-PLUG (OUTSIDE)	180363	2
23	DEPLOYMENT PLATE	192125	2
24	TUBE, ALUMINUM-INSIDE	180361	3
25	LUG, SUSPENSION	192132	2
26	MOUNTING, 1835	N65368	1
27	RING HALF	N65373	1
28	SUPPORT, SUSPENSION LINE	206102	3
29	INSULATOR, THERMAL	206105	2
30	RING HALF	206104	3
31	FIN-CANTED	194048	2
32	LUG, SUSPENSION	194059	7
33	MC1876 (PHASE II)	311818	7
34	CASE ASSEMBLY	1440102	D
35	CASE SECTION, PREFLIGHT	199030	7
36	LUG, SUSPENSION	199629	2
37	MC1873 (HOUSING & CONNECTOR)		-

VARIATIONS

TEST NO.	CHANGES (ITEM-ISSUE)	DELETIONS (ITEM)	ADDITIONS (ITEM)
101-10	5-11	17	------
101-11	5-12	18	26,27
101-12	5-13	18	28,29,30
101-13	19 (LAB MADE)	8;18;25 (FWD)	31;28,29,30;32 (FWD)
101-14	19 (LAB MADE)	8;17;18;20; 25 (FWD)	31;28,29,30;33; 32 (FWD)
101-15	19 (LAB MADE)	8;18	31;28,29,30
101-16	5-17 6-8 22-9 23-3 24-12	4 8 18 19 25 (FWD) 31 (TOP)	35 31 28,29,30 37 32,36
101-17	5-17 6-8 22-9 23-3 24-12	1, 2 4 8 18 25 (FWD), 31(BOT.)	34 35 31 28, 29, 30 32, 36
101-18	5-17 6-8 22-9 23-3 24-12	4 8 18 25 (FWD) 31 (TOP)	35 31 28, 29, 30 32, 36
101-19	5-13	4 18 25 (FWD)	35 28, 29, 30 32, 36

DWG. CLASSIFICATION LEVEL [redacted]	PART CLASSIFICATION [redacted]	SHEET 1 / ISSUE 6	SHEET INDEX
CLASSIFICATION CATEGORY [redacted]	ORG / DATE / INITIALS: 1513 / 2212	TITLE TX-61 RETARDED (BTS) 101 SERIES	FIRST APPLICATION
	MFG AGENCY APPROVALS	MFG AGENCY NO.	SIZE C / DWG NO. N65292
		SCALE 1/10 / DOC. REF. SYM.	SHEET 1 OF 1

Figure 1. Configuration

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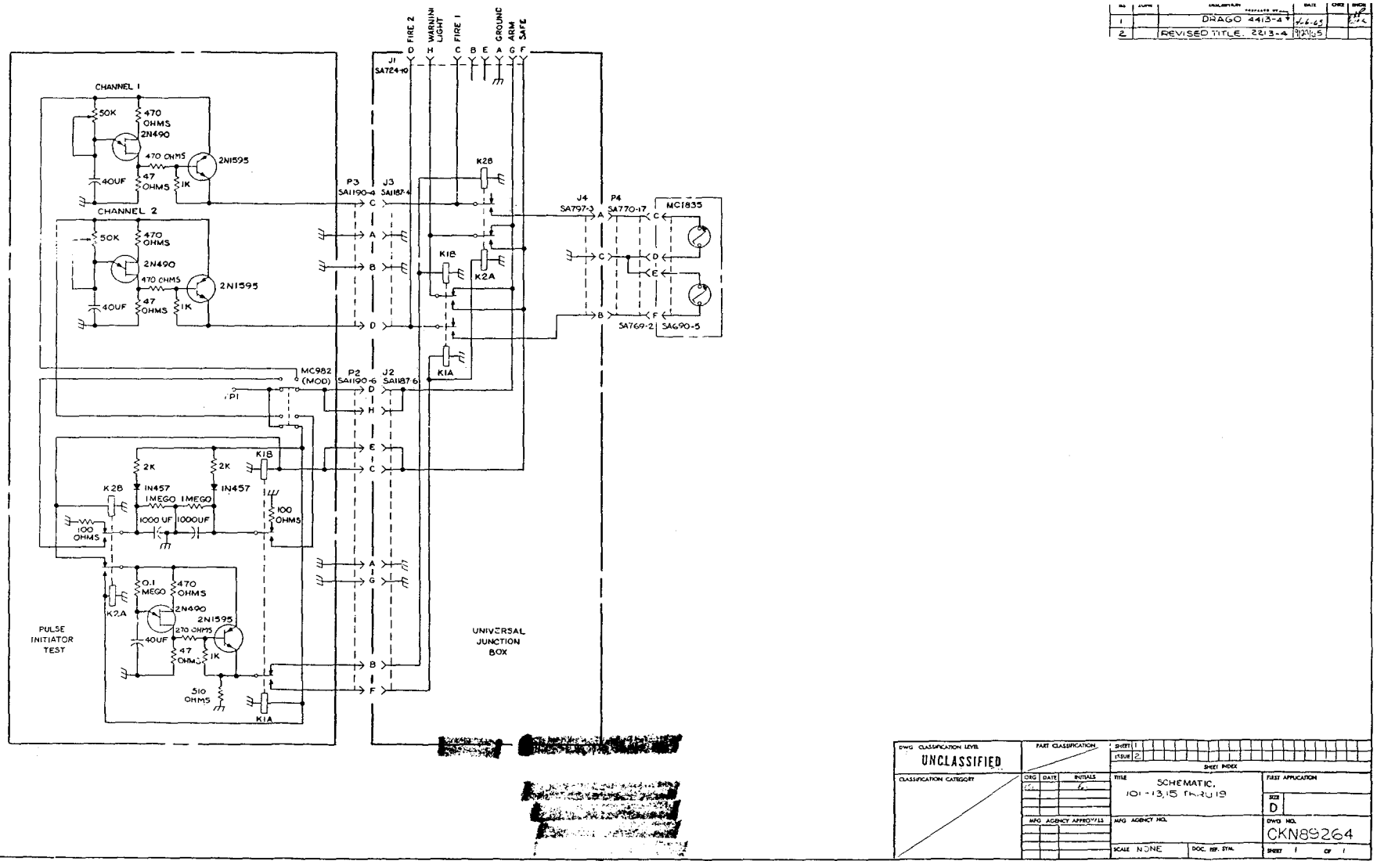

Figure 2. Electrical schematic

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The schematic of the electrical system used on these tests is shown in Figure 2. This system used a pulse initiator, which simulated the action of an MC1876 pulse actuator, to deploy the parachute. The pulse initiator is a solid-state, time-delay device which is adjustable for various parachute delay times. For safety purposes, an MC982 pullout switch was also used. The pulse initiator and the telemetry were interconnected through a junction box located in the preflight section. The MC1839's were housed inside the junction box, and their operation was monitored.

Instrumentation

The instrumentation packages were located in the center case of the units, as shown in Figure 1. The functions monitored during each test are listed in Table III.

TABLE III

Functions Monitored

	101-16	101-18
Roll gyro	Continuous	Continuous
Yaw gyro	±90°	±90°
Pitch gyro	Continuous	Continuous
Long. accel.	±20 g	±20 g
Long. accel.	-40 g to +200 g	-40 g to +75 g
Lateral accel.	±10 g	±10 g
Vertical accel.	±20 g	±20 g
MC1839 No. 1	Open to short	Open to short
MC1839 No. 2	Open to short	Open to short
Fire signal No. 1	0-32 volts	0-32 volts
Fire signal No. 2	0-32 volts	0-32 volts
Arm monitor	0-32 volts	0-32 volts

Test Results

In Test 101-11, the unit was released 1847 feet above the target at a speed of Mach 1.23. A graph of ejection velocity is shown in Figure 3. This unit employed a 0.1-second parachute delay. The separation was good, and parachute operation was satisfactory. Both MC1839 inertial switches operated normally. The parachute sequence, computed from optical data, was:

Event	Time (sec)
Release	0.00
Tail cone off	0.14
Line stretch	0.23
Full inflation	0.35

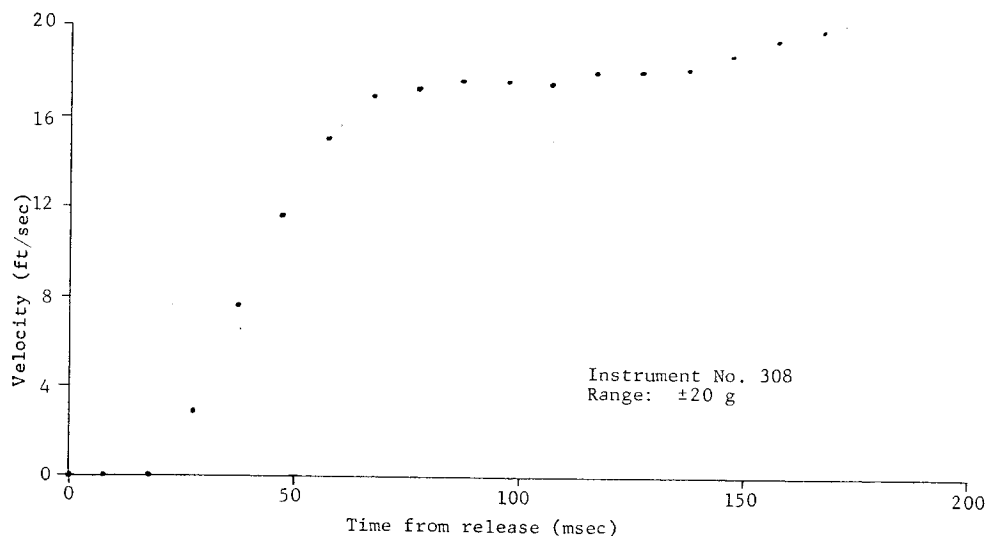

Figure 3. Ejection velocity versus time (Test 101-11)

Figures 4 and 5 are graphs of longitudinal acceleration versus time, based on TM data. Figure 4 also shows MC1839 operation. Figures 6 through 10 are graphs of trajectory data. Figure 11 shows the unit after impact.

In Test 101-17, the unit was released 2488 feet above the target at a speed of Mach 0.42. A graph of ejection velocity is shown in Figure 12. This unit employed the newer 0.3-second delay on the parachute. The separation was good, and parachute operation was satisfactory. The parachute sequence, computed from optical data, was:

Event	Time (sec)
Release	0.00
Tail cone off	0.33
Line stretch	0.50
Full inflation	0.87

The release was made at well below minimum tactical release speed for this aircraft, in order to substantiate the reliability of the MC1839 inertial switches at low g levels. As seen in Figure 13, the switches operated satisfactorily.

Figures 13 and 14 are graphs of longitudinal acceleration versus time, based on TM data. Figures 15 through 24 are graphs of trajectory data. Figure 25 shows the unit after impact.

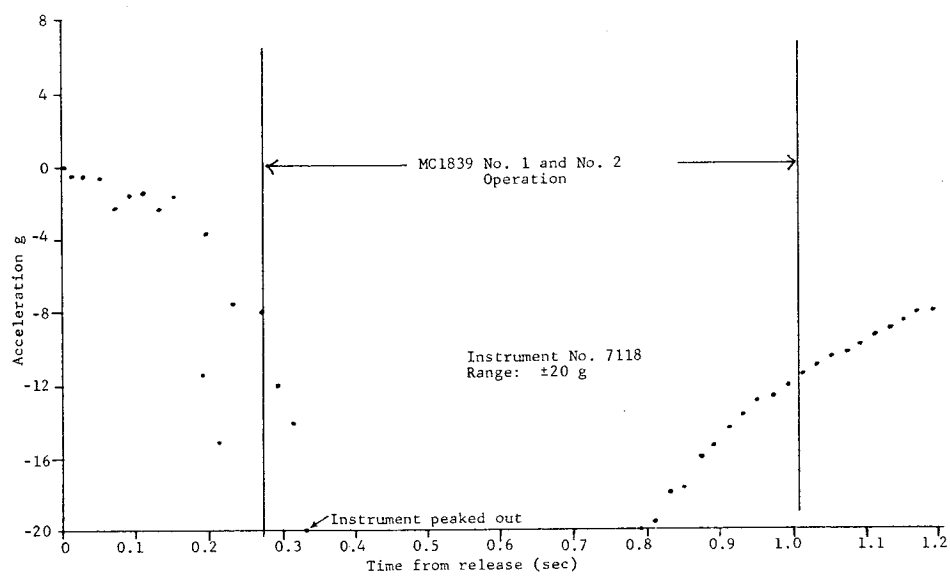

Figure 4. Longitudinal acceleration versus time (Test 101-11)

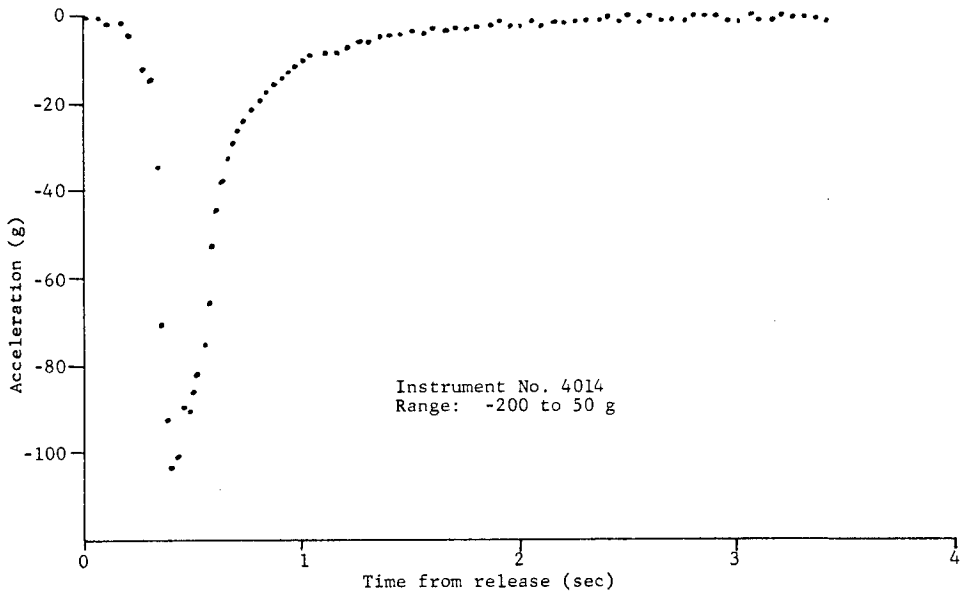

Figure 5. Longitudinal acceleration versus time (Test 101-11)

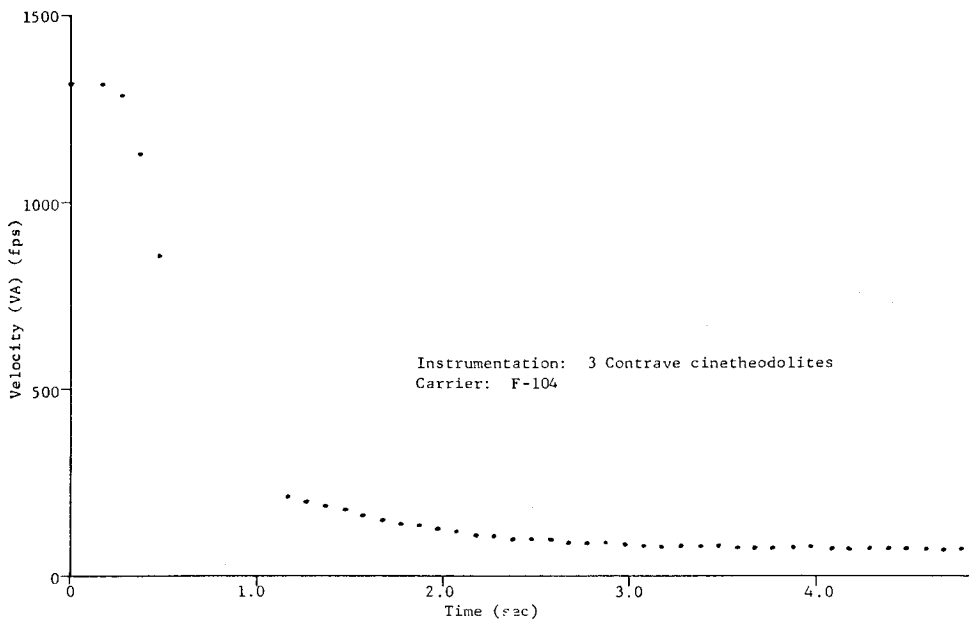

Figure 6. Total velocity (Test 101-11)

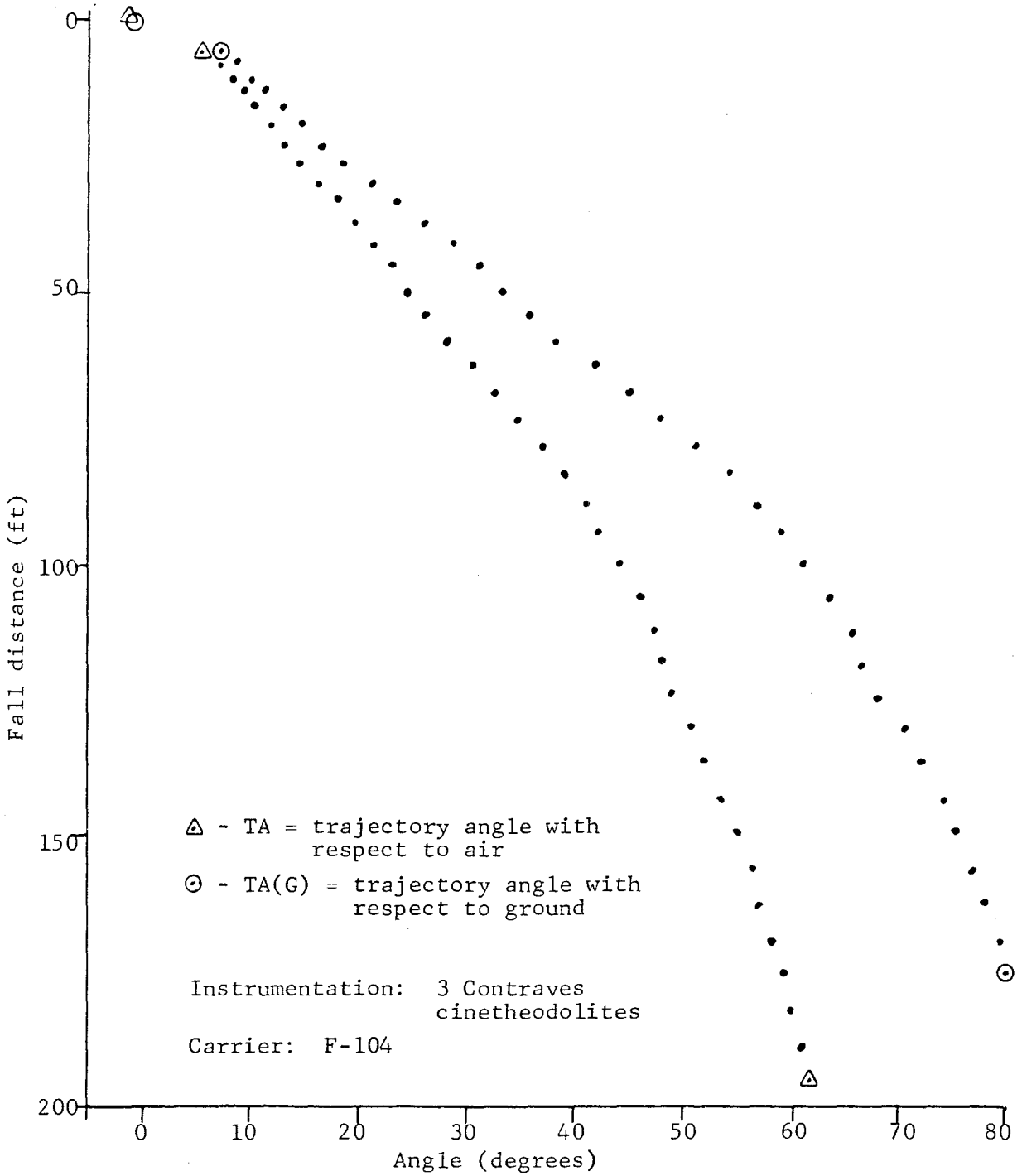

Figure 7. Turnover (Test 101-11)

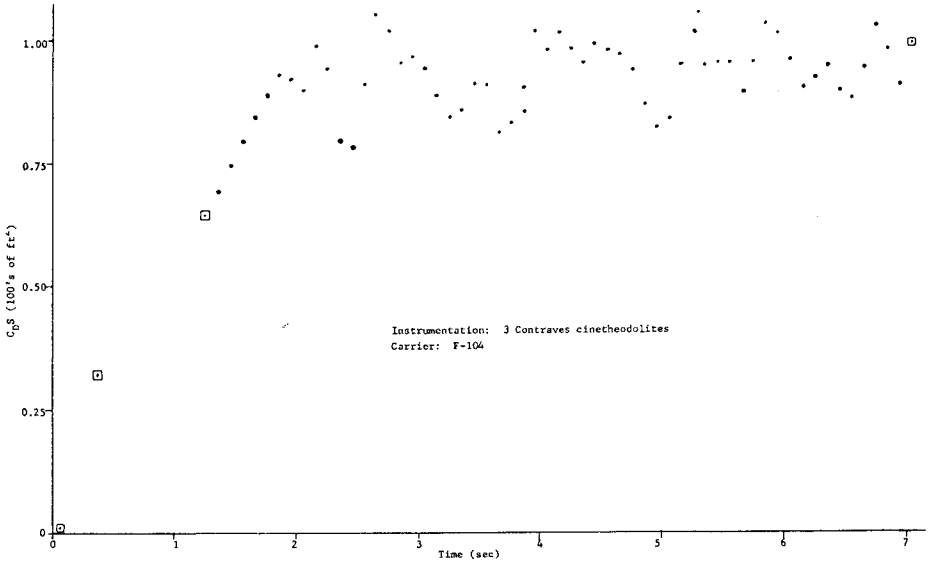

Figure 8. Drag coefficient (Test 101-11)

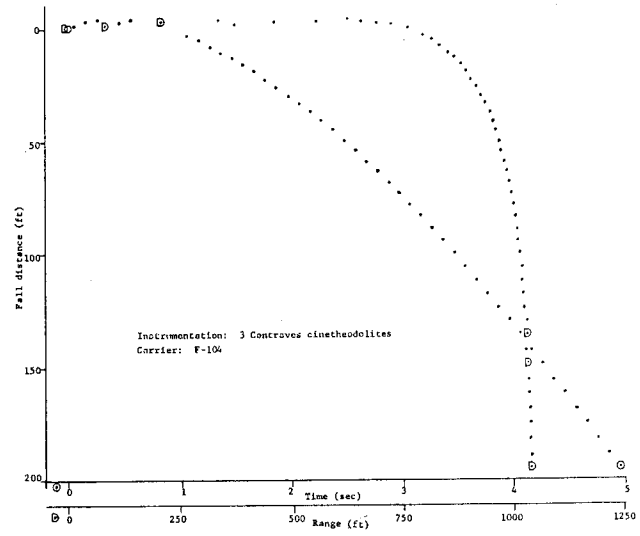

Figure 9. Trajectory (Test 101-11)

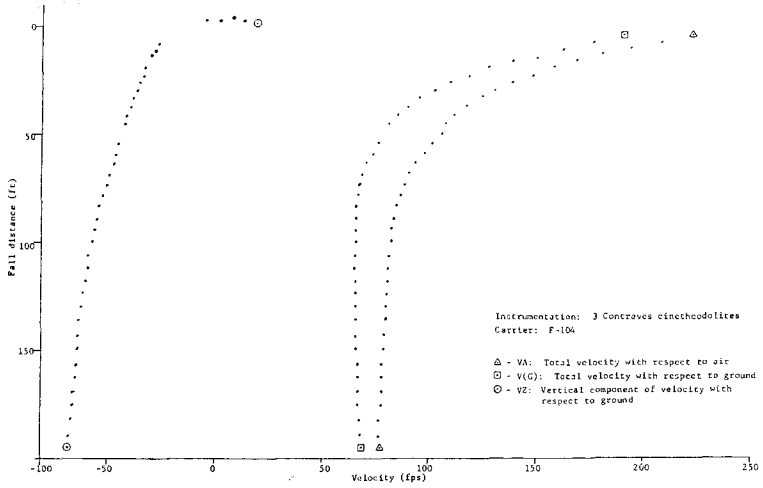

Figure 10. Total and vertical velocity (Test 101-11)

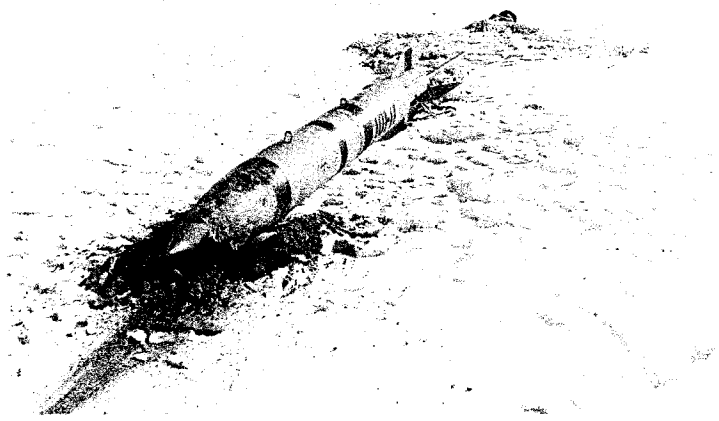

Figure 11. Unit 101-11 after impact

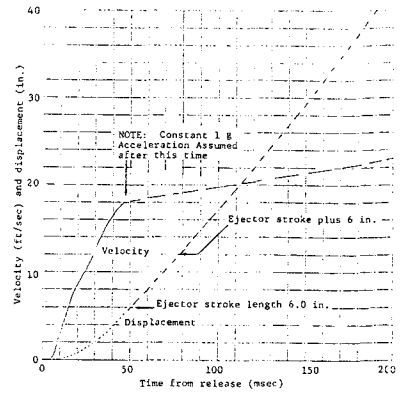

Figure 12. Ejection velocity versus time (Test 101-17)

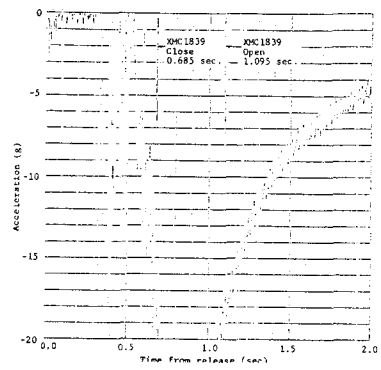

Figure 13. Longitudinal acceleration versus time (Test 101-17)

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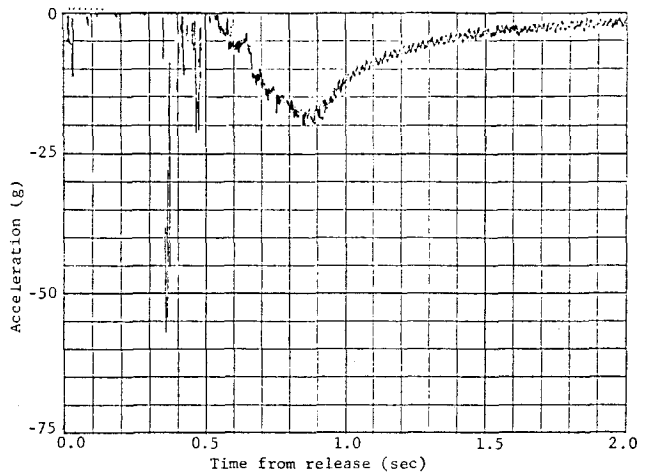
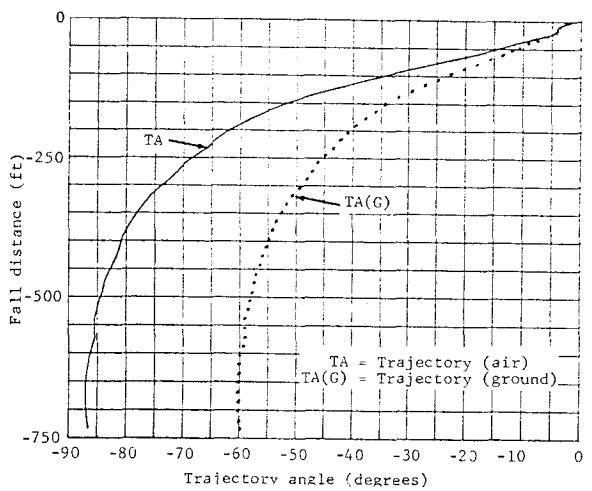


Figure 14.
Longitudinal acceleration versus time (Test 101-17)

Figure 15. Fall distance versus trajectory angle (Test 101-17)



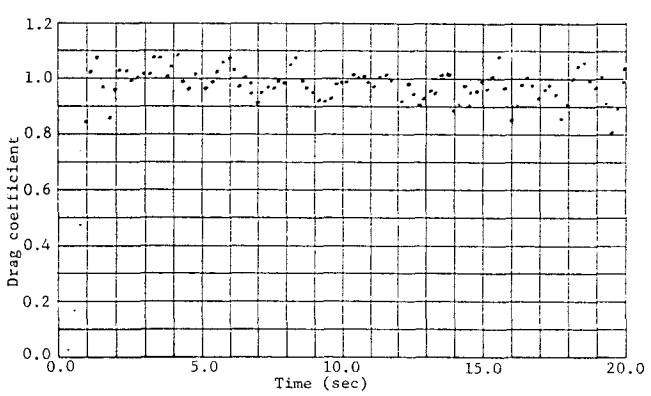


Figure 16.
Drag coefficient versus time (Test 101-17)

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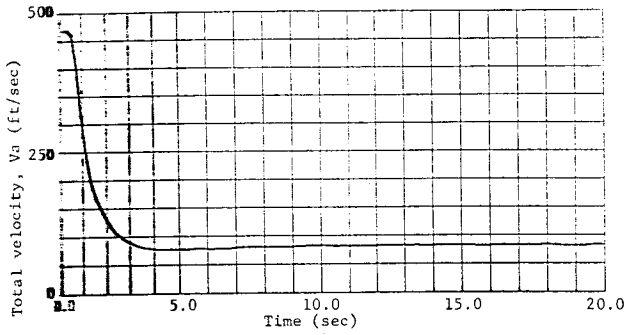

Figure 17. Total velocity versus time (Test 101-17)

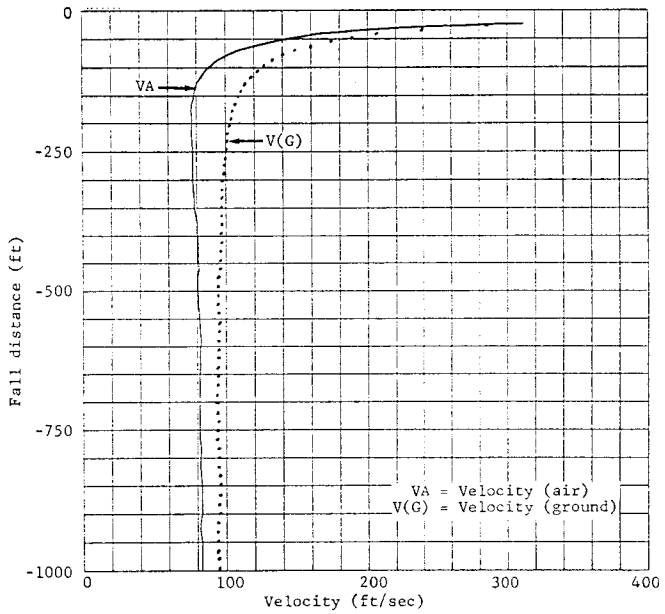

Figure 18. Fall distance versus velocity (Test 101-17)

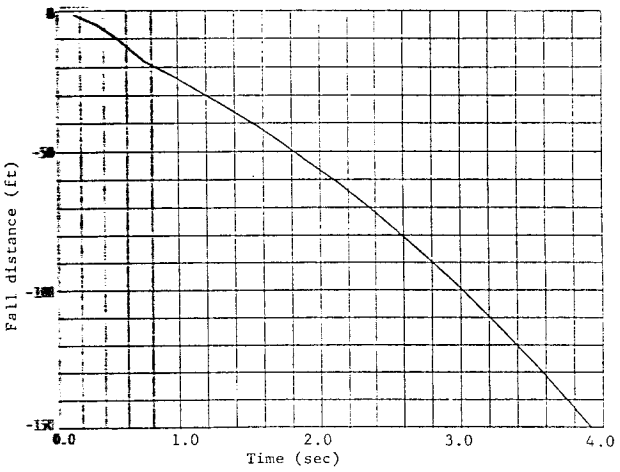

Figure 19. Fall distance versus time (Test 101-17)

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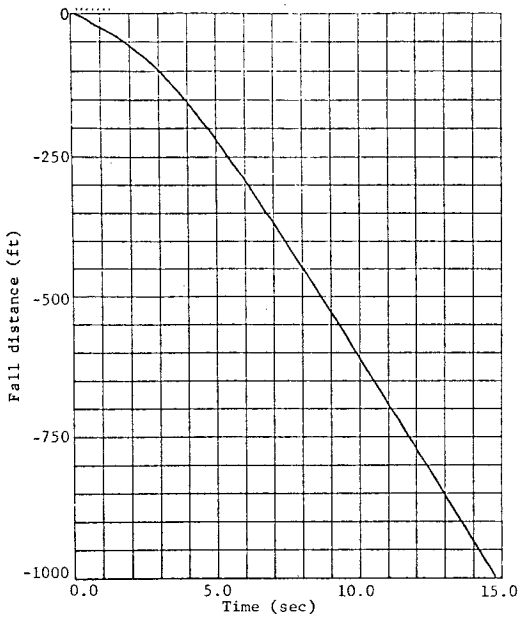

Figure 20. Fall distance versus time (Test 101-17)

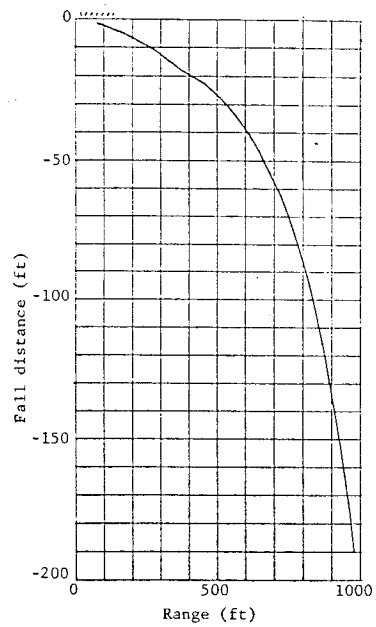

Figure 21. Fall distance versus range (Test 101-17)

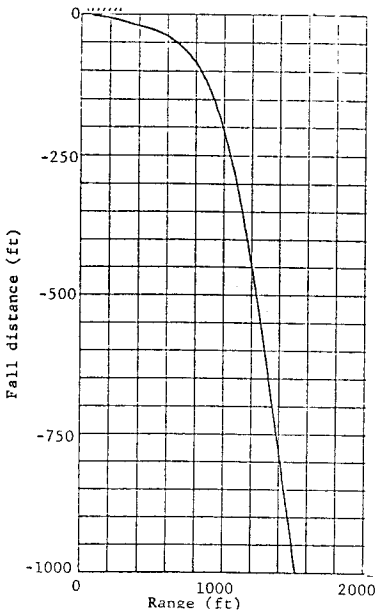

Figure 22. Fall distance versus range (Test 101-17)

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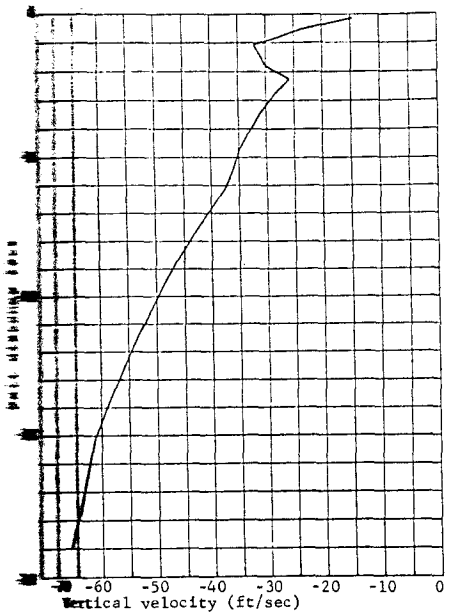

Figure 23. Fall distance versus vertical velocity (Test 101-17)

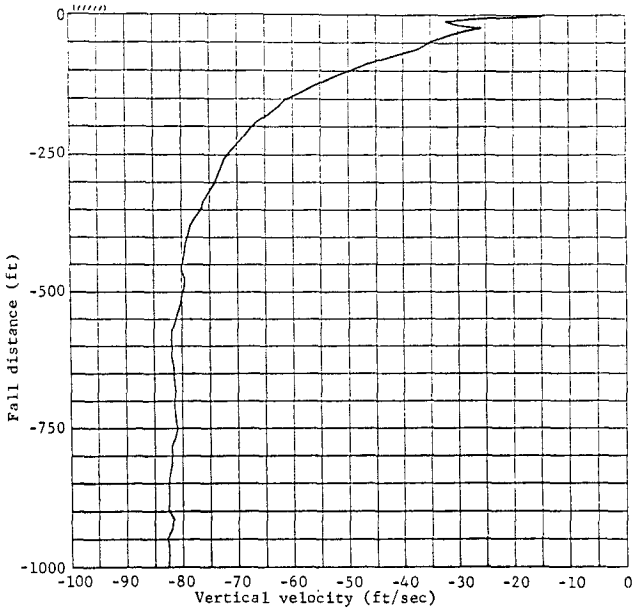

Figure 24. Fall distance versus vertical velocity (Test 101-17)

Figure 25. Unit 101-17 after impact

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APPENDIX A

Test Data Summary

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APPENDIX A

Test Data Summary

	Test Numbers	
	101-11	101-17
Date	11/18/64	8/12/65
Test range	Tonopah	Tonopah
Unit Data:		
Weight (lb)	613	596
CG (station)	60.1	59.2
Yaw MI (lb-in.^{2} x 10^3)	652.5	614.5
Nose	2 AL*	1 AL
Gas-generator charge (gm)	105	90
Release Data:		
Aircraft	F-104	F-104
Weapon location on aircraft	CL**	CL**
Requested altitude above target (ft)	2000	2500
Actual altitude above target (ft)	1847	2488
Target altitude (ft msl)	5331	5331
Requested speed, CAS (knots)	750	350
Actual speed, CAS (knots)	732	240
True air speed (knots)	782	276
Ground speed (knots)	763	301
Mach No.	1.23	0.42
Heading (deg)	348	347
Wind velocity (fps)	33	42
Wind direction (deg)	5	172
Air temperature (°F)	18	61
A/C vertical velocity (fps)	38	3
A/C trajectory angle (TA) (deg)	1.6	0.4
Rack type	Bohannon	Bohannon
Cartridge type and number	44-86	44-86
Ejection velocity (fps)	18	19
Dynamic pressure (Q) (lb/ft^2)	1728	194
Air density (ρ) (lb/ft^3)	0.064	0.058
Maximum pitch angle (deg)	15	3
Parachute Data:		
Deployment device and timer setting	Pi3-0.1	Pi3-0.3
Optical time sequence from release to:		
Tail cone off (sec)	0.14	0.33
Line stretch (sec)	0.23	0.50
Full inflation (sec)	0.35	0.87

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Test Data Summary
(continued)

	Test Numbers	
	101-11	101-17
Parachute Data (cont):		
Electrical time sequence from time base to:		
Time base is	VA†	VA†
Gas generator fire (sec)	0.14	0.31
Line stretch (sec)	0.21	0.48
Maximum g load (sec)	0.37	0.88
Maximum g load value	104	18
Time above 12 g (sec)	0.672	0.270
g level with 250-ms duration	49	13
Actual terminal velocity VA (fps)	79	80
Corrected terminal velocity VA (fps)	80	77
Maximum C_DS (ft^2)	ND	108
Dynamic pressure (Q) at maximum C_DS (lb/ft^2)	ND	35
Average C_DS (ft^2)	94	95
Sequence Data:		
MC1839 closure from time base to:		
Switch 1 (sec)	0.276	0.685
Switch 2 (sec)	0.274	0.685
Total closure time:		
Switch 1 (sec)	0.764	0.413
Switch 2 (sec)	0.766	0.410
Trajectory Data:		
TM time of fall (sec)	26.21	33.15

*2 AL - Two-piece aluminum.

**CL - Centerline.

†VA - Vertical accelerometer movement.

General:
ND - No data
TA - Trajectory angle with respect to air
C_DS - Area drag coefficient (100 sq ft)
Pi3 - Pulse initiator No. 3

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APPENDIX B

Component Serial Numbers

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APPENDIX B

Component Serial Numbers

Description	Serial Number 101-11	Serial Number 101-17
Nose case section	No record	No
Case extension	↓	No
One-piece nose	↓	X0167
Aluminum center case	↓	8
Forward ballast	↓	Field test
Cover plate	↓	-
Ext. thd. ring	↓	-
Preflight section	↓	011
Universal junction box	↓	1006
MC1839 No. 1	↓	0302
MC1839 No. 2	↓	0304
Tail section	↓	007
Pulse initiator	↓	0006
Parachute	↓	56320-26
Inside tube	↓	362
Outside tube	↓	333
Deployment plate	↓	AF new
Shroud support	No record	12 line
MC1835	105 gm	90 gm