UNCLASSIFIED

SC-DR-66-139
RS 3410/567
May 1966

Development Report

RESULTS OF TX-61 WEAPON TESTS 101-12, -14, AND -19 (U)

R. R. Precit, 1512

[redacted]

[redacted]

~~This memorandum is not to be reproduced without the express written permission of SANDIA CORPORATION.~~

[redacted]

[redacted]

RECORD COPY
Do Not Take From This Room

UNCLASSIFIED

SANDIA CORPORATION

PRIME CONTRACTOR TO THE U.S. ATOMIC ENERGY COMMISSION | ALBUQUERQUE, NEW MEXICO; LIVERMORE, CALIFORNIA; TONOPAH, NEVADA

[redacted]

9/25/97 8 UNCL
RBCLaner
9/29/97
WCLayne UNCLASSIFIED

SC-DR-66-139

RESULTS OF TX-61 WEAPON TESTS 101-12, -14, AND -19 (Title Unclassified)

[redacted]
RS 3410/567

R. R. Precit, 1512
Sandia Laboratory, Albuquerque

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DOWNGRADING OR DECLASSIFICATION STAMP
CLASSIFICATION CHANGED TO U | AUTHORITY W. C. Layne
Emelda Selph 10/22/97
PERSON CHANGING MARKING & DATE | RECORD ID 97SN3723
Carmela Gallegos 10/23/97
PERSON VERIFYING MARKING & DATE | DATED 09/29/97

May 1966

Approved by: D M Olson
MRM D. M. Olson, 1510
e.1.c.

ABSTRACT (U)

This report supplements SC-DR-64-1737, Test Plan for TX-61 Weapon Tests 101-10, -11, -12, and SC-DR-65-226, Test Plan for TX-61 Weapon Tests 101-13, -14, -15. Test 101-19 was an addition, and no test plan was written. The three ballistic retarded air drops were successful and led to establishment of a new parachute deployment delay time.

[redacted]

[redacted]

[redacted]

@@@ UNCLASSIFIED

[redacted]

DISTRIBUTION:

1/24A - Director, Air Force Weapons Laboratory (AFWL),
Attn: WLIL (M. F. Canova), Kirtland Air Force Base, New Mexico

2/24A - Hq., FC/DASA, Sandia Base, Albuquerque, New Mexico,
Attn: Adj. General
For: Major R. E. Caudle, FC/DD-3

3-5/24A - M. R. Madsen, 1512
6/24A - C. L. Carpenter, 1513
7/24A - J. T. Risse, 1542
8/24A - R. W. DeVore, 2110
9/24A - J. M. Wiesen, 2150
10/24A - W. V. Hereford, 7215
11-13/24A - H. S. North, 7216
14/24A - I. M. Moore, 7510
15/24A - R. C. Maydew, 9320 [redacted]
Attn: W. R. Barton, 9324
16/24A - B. F. Hefley, 8232
17/24A - B. R. Allen, 3421
18/24A - M. G. Randle, 3428-1
19/24A - W. F. Carstens, 3410
Attn: J. R. Shunny, 3412
20-24/24A - C. H. Sproul, 3415-3

[redacted]

TABLE OF CONTENTS

	Page
Introduction	5
Test Objectives	6
Summary	6
Description of Test Vehicles	6
Instrumentation	7
Test Results	8
APPENDIX A - Test Data Summary	11
APPENDIX B - Component Serial Numbers	15

[redacted]

UNCLASSIFIED

RESULTS OF TX-61 WEAPON TESTS 101-12, -14, AND -19

Introduction

These three tests were airdrops of the TX-61 weapon retarded ballistic series, made primarily to investigate aircraft separation characteristics of a retarded TX-61 from an F-4C aircraft at supersonic speed. An earlier drop (206-4) had indicated that a 0.1-second parachute delay at supersonic speed on this aircraft caused some deflection of the aircraft's horizontal stabilizer when the parachute opened. Therefore on the present drops the parachute opening was delayed 10, 1.5, and 0.3 seconds respectively, to permit investigation of this problem. None of the tests revealed any separation problem. Consequently, a minimum delay time of 0.3 second was established. Table I summarizes the release conditions for the tests. For a complete tabulation of the conditions and results of the tests see Appendix A.

TABLE I

Summary of Test Conditions

	101-14	101-12	101-19
Test Date	3/18/65	4/23/65	5/25/65
Carrier	F-4C	F-4C	F-4C
Carriage	CL	CL	CL
Altitude (ft above target)	3096	3181	2861
Attitude (deg)	Level	Level	Level
Speed (knots CAS)	738	720	711
Speed (mach)	1.27	1.24	1.22

UNCLASSIFIED

[redacted]

Test Objectives

1. To evaluate parachute operation and aircraft separation from an F-4C aircraft at supersonic speed.

2. To evaluate MC1839 inertial switch operation.

3. To determine the retarded trajectory.

Summary

All three tests met the objectives. Data obtained allowed establishment of a parachute deployment delay time of 0.3 second.

Test 101-14 demonstrated satisfactory F-4C aircraft separation with a 10-second parachute delay at supersonic speed. The parachute performed satisfactorily. The outer deployment tube was not retained with the unit because there were no cutters installed. There were no MC1839 inertial switches aboard this unit.

Test 101-12 demonstrated satisfactory F-4C aircraft separation with a 1.5-second parachute delay at supersonic speed. The parachute performed satisfactorily, but the tail cone and bag were not retained with the unit as intended. The MC1839 inertial switches operated satisfactory.

Test 101-19 demonstrated satisfactory F-4C aircraft separation with a 0.3-second parachute delay at supersonic speed. The parachute and deployment system performed satisfactorily, as did the MC1839 inertial switches.

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

	101-14	101-12	101-19
Length (in.)	141.0	141.0	141.0
Diameter (in.)	12.75	12.75	12.75
Weight (lb)	610	607	608.0
CG (station)	59.80	59.90	59.90
Yaw MI (lb-in.^{2})	650,500	647,600	657,600

The schematic of the electrical system used on Test 101-14 is shown in Figure 2. This system used an MC1876 for safing and arming the unit, together with a junction box. An MC1262 thermal battery was initiated at release by the MC1876, as was an MC1356 escapement timer. At 10 seconds the MC1356 operated, transferring the voltage from the MC1262 to the MC1835 gas generator, which in turn deployed the parachute.

The schematic of the electrical system used on tests 101-12 and 101-19 is shown in Figure 3. 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

	101-14	101-12, -19
Roll gyro	Continuous	Continuous
Yaw gyro	±90°	±90°
Pitch gyro	Continuous	Continuous
Long. accel.	±20 g	±20 g
Long. accel.	-45 g to +75 g	-40 g to +200 g
Lateral accel.	None	±10 g
Vertical accel.	±20 g	±20 g
Vertical accel.	±10 g	None
MC1839 No. 1	None	Open to short
MC1839 No. 2	None	Open to short
Fire signal No. 1	None	0-32 volts
Fire signal No. 2	None	0-32 volts
Arm monitor	None	0-32 volts
Pulse battery No. 1	0-32 volts	None
Pulse battery No. 2	0-32 volts	None
Main battery (MC1262)	0-32 volts	None

UNCLASSIFIED

UNCLASSIFIED

Test Results

In Test 101-14, the unit was released at an altitude of 3096 feet above the target at a speed of Mach 1.27. A graph of ejection velocity is shown in Figure 4. The release was level and aircraft separation good. The parachute was delayed 10 seconds to insure that deployment would have no effect on the aircraft. Consequently, the data received from this test are similar to free-fall data for 10 seconds, and to retarded data thereafter. However, it was decided that the data would be presented in free-fall format throughout; this explains why the data appear different from regular free-fall or retarded data. Even though the unit was spinning, because of the canted fins, the parachute deployment was good. The outer tube was not retained with the unit because no cutters were installed. The decision to leave the cutters out was made because of a cutter problem on a previous unit. The parachute sequence, computed from optical data, was as follows:

Event	Time (sec.) 10 second delay
Release	0.00
Tail cone off	10.12
Line stretch	10.24
Full inflation	14.78

Figure 5 is a graph of the longitudinal acceleration versus time, based on TM data. Figures 6 through 12 are graphs of the trajectory data obtained. Figure 13 shows the unit after impact.

In Test 101-12, the unit was released at an altitude of 3181 feet above the target, at a speed of Mach 1.24. A graph of ejection velocity is shown in Figure 14. The release was level and separation good. Using data obtained from Test 101-14, the parachute delay time was reduced to 1.5 seconds to determine if parachute deployment with this time delay would have any effect on the aircraft. It had no effect, and separation and parachute deployment were good. The outer deployment tube remained with the unit, but the tail cone and bag ripped off. The parachute sequence, computed from optical data, was as follows:

Event	Time (sec.) 1.5 second delay
Release	0.00
Tail cone off	1.57
Line stretch	1.67
Full inflation	1.82

UNCLASSIFIED

Figure 15 is a graph of the longitudinal acceleration versus time, based on TM data. Figures 16 through 23 are graphs of the trajectory data obtained. Figure 24 shows the unit after impact.

In Test 101-19 the unit was released at an altitude of 2861 feet above the target, at a speed of Mach 1.22. A graph of ejection velocity is shown in Figure 25. Analysis of data from Tests 101-14 and 101-12 indicated that there was sufficient clearance between the unit and aircraft at 0.3 second to allow good separation. Also, at a time interval of 0.25 to 0.40 second, the attitude of the weapon is closely parallel to that of the aircraft, making this an ideal time for parachute deployment. Test 101-19 was a regular retarded drop with parachute delay set for a nominal 0.3 second. Aircraft separation and parachute deployment were good. No deflection of the aircraft's horizontal stabilizer was observed on this or the two previous tests. The time-to-fire of the gas generator was recorded as 0.38 second. While this was 0.08 second longer than planned, it is judged from film records that good separation can be obtained down to 0.25 second delay time. The success of this test indicated that a nominal 0.3-second parachute delay is acceptable on the F-4C aircraft. The parachute sequence, computed from optical data, was as follows:

Event	Time (sec.) 0.3 second delay
Release	0.00
Tail cone off	0.40
Line stretch	0.53
Full inflation	0.80

Figure 26 is a graph of the longitudinal acceleration versus time, based on TM data. Figures 27 through 33 are graphs of the trajectory data obtained. Figure 34 shows the unit after impact.

UNCLASSIFIED

APPENDIX A

TEST DATA SUMMARY

UNCLASSIFIED

[redacted]

APPENDIX A

Test Data Summary

	Serial Number		
	101-14	101-12	101-19
Date	3/18/65	4/23/65	5/25/65
Test range	Tonopah	Tonopah	Tonopah
Weight (lb)	610	607	608
CG (Sta. No. in.)	59.8	59.9	59.9
Yaw MI (lb-in.^{2} x 10^3)	647.60	650.50	657.60
Nose	2A1*	2A1*	2A1*
Gas gen. charge (grams)	90	105	90
Aircraft	F-4C	F-4C	F-4C
Weapon location on aircraft	CL$^{\pm}$	CL$^{\pm}$	CL$^{\pm}$
Requested altitude above target (ft)	2500	3000	2500
Actual altitude above target (ft)	3096	3181	2861
Target altitude (ft msl)	5331	5331	5331
Requested speed, CAS (knots)	750	725	750
Actual speed, CAS (knots)	738	720	711
True air speed (knots)	810	700	793
Ground speed (knots)	801	788	778
Mach No.	1.27	1.24	1.22
Heading (degrees)	346	347	347
Wind velocity (fps)	25	20	29
Wind direction (degrees)	291	7	317
Air temperature (°F)	19	34	45
A/C vertical velocity (fps)	26	55	38
A/C trajectory angle (TA) (degrees)	1.1	2.3	1.6
Rack type	AREO-274	AREO-274	AREO-274
Cartridge type and number	75-M2	51	51
Ejection velocity (fps)	14	12	14
Dynamic pressure (Q) (lb/ft^2)	1761	1680	1621
Air density (ρ) (lb/ft^3)	0.061	0.059	0.058
Maximum pitch angle (degrees)	-12	-11	-7

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED

	Serial Number		
	101-14	101-12	101-19
Deployment device and timer setting	$^{\phi}$56-10	$^{\theta}$PI-1.5	PI-.3
Optical time sequence from release to:			
Tail cone off (seconds)	10.12	1.57	0.40
Line stretch (seconds)	10.24	1.67	0.53
Full inflation (seconds)	14.78	1.82	0.80
Electrical time sequence from time base to:			
Time base (seconds)	VA	VA†	VA
Gas generator fire (seconds)	10.110	1.550	0.38
Electrical time sequence from time base to:			
Line stretch (seconds)	10.250	1.68	0.53
Maximum g load (seconds)	10.320	1.77	0.68
Maximum g load value	47	98	102
Time above 12 g (seconds)	0.310	0.680	0.612
g level with 250 ms duration	14	48	42
Actual terminal velocity VA (fps)	76	78	77
Corrected terminal velocity VA (fps)	76	74	78
Maximum C_DS (ft^2)	94	111	131
Dynamic pressure (Q) at maximum C_DS	26	103	42
Average C_DS (ft^2)	102	101	108
MC1839 closure from time base to:			
Switch 1 (second)	NA	1.685	0.530
Switch 2 (second)	NA	1.685	0.530
Total closure time (seconds):			
Switch 1	NA	0.780	0.800
Switch 2	NA	0.772	0.800
TM time of fall (seconds)	NA	45.030	39.670

*2Al - 2-piece aluminum
$^{\pm}$CL - Centerline
†VA - Vertical accelerometer movement
NA - Not applicable
$^{\phi}$56 - MC1356 timer
$^{\theta}$PI - Pulse initiator

UNCLASSIFIED

[redacted]

[redacted]

APPENDIX B

COMPONENT SERIAL NUMBERS

[redacted]

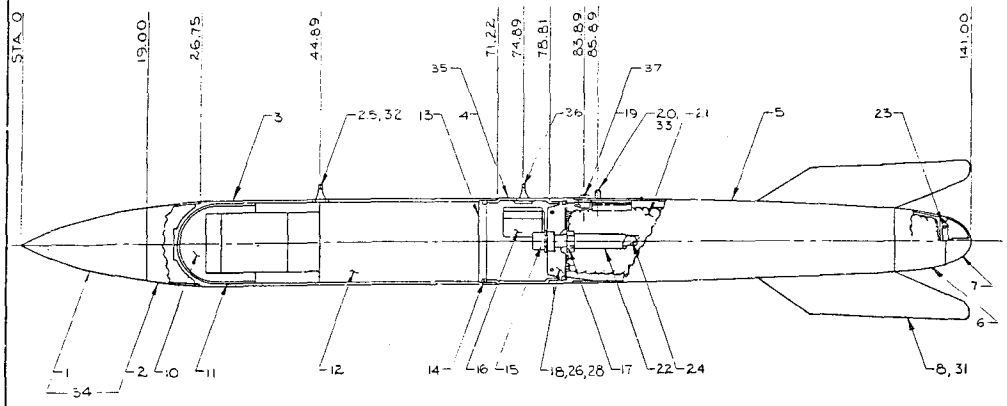
[redacted]

APPENDIX B

Component Serial Numbers

Description	Serial Number 101-14	101-12	101-19
Nose case section	BBNX-116-L3	No. 3	-
Case extension	BBNX-124-J3	X115	-
Aluminum center case	16	8	8
Forward ballast	12	-	-
Cover plate	-	16373	-
Ext. thread ring	-	2	-
Preflight section	X313	X25	X25
Junction box	UJB-1002	UJB-1016	UJB-1016
MC1839 No. 1	None	SCD-0154-J4	SCD-0189-J4
MC1839 No. 2	None	SCD-0155-J4	SCD-0182-J4
Tail section	071	067	083
Pulse initiator	None	0008	00022
Parachute (16 ft dia.)	56320 No. 4	56320-21	56320-25
Inside tube	-	-	-
Outside tube	-	-	-
Shroud support	No. 7	No. 1	-
MC1835	UCB-	UCB-00340-C4	UCB-00435-C5
MC1876	BBN-209-I4	None	None
MC1356	-	None	None

[redacted]



ISS	DESCRIPTION	DATE	CHKD	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 & 5. 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			
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	8-27-65		

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

ITEM	TITLE	NUMBER	ISSUE
1	CASE SECTION, NOSE	15,148	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	186730	3
9	SLEEVE (INSTALLED IN NORMAL POSITION)	------	-
10	FORWARD BALLAST (FORWARD PORTION)	N52816	5
11	SPACER	N52814	2
12	TM PACKAGE	N55546	-
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	5-11	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 19 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
1515		
2212		

MFG AGENCY APPROVALS

TITLE: TX-61 RETARDED (BTS) 101 SERIES

FIRST APPLICATION

SIZE C

MFG AGENCY NO.

DWG NO. N65292

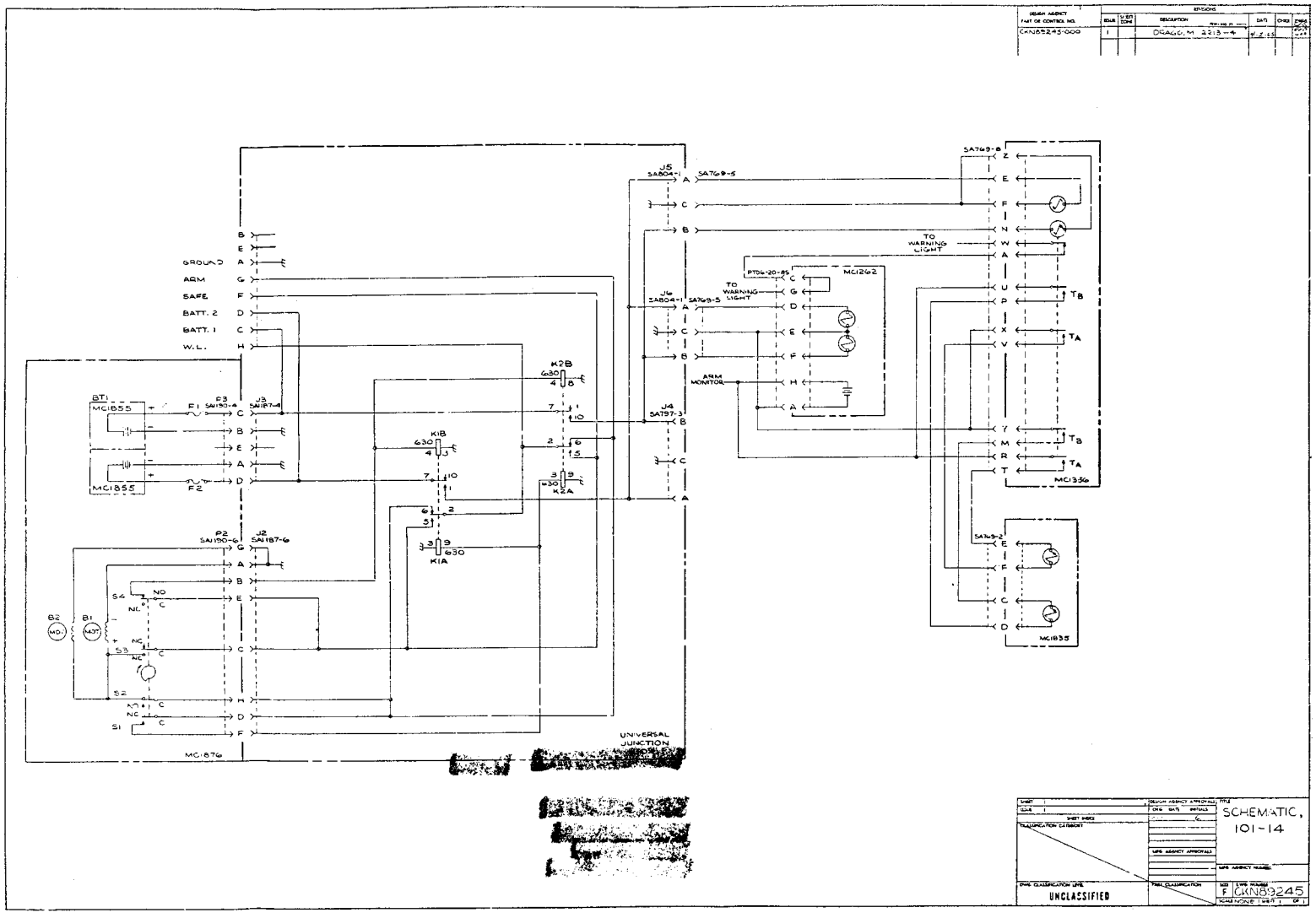
SCALE 1/10

DOC. REF. SYM.

SHEET 1 OF 1

Figure 1

UNCLASSIFIED



GROUND
ARM
SAFE
BATT. 2
BATT. 1
W.L.
BT1
MC1855
MC1855
F1
F2
P3
SA190-4
J3
SA187-4
P2
SA190-6
J2
SA187-6
K1B
K1A
K2B
K2A
630
J5
SA804-1
SA769-5
J6
SA804-1
SA769-5
J4
SA797-3
TO WARNING LIGHT
PT06-20-85
MC1262
ARM MONITOR
SA769-8
TO WARNING LIGHT
MC1356
SA769-2
MC1835
B2
B1
MOT
S1
S2
S3
S4
MC1876
UNIVERSAL JUNCTION
SCHEMATIC, 101-14
UNCLASSIFIED
F
CKN89245

Figure 2

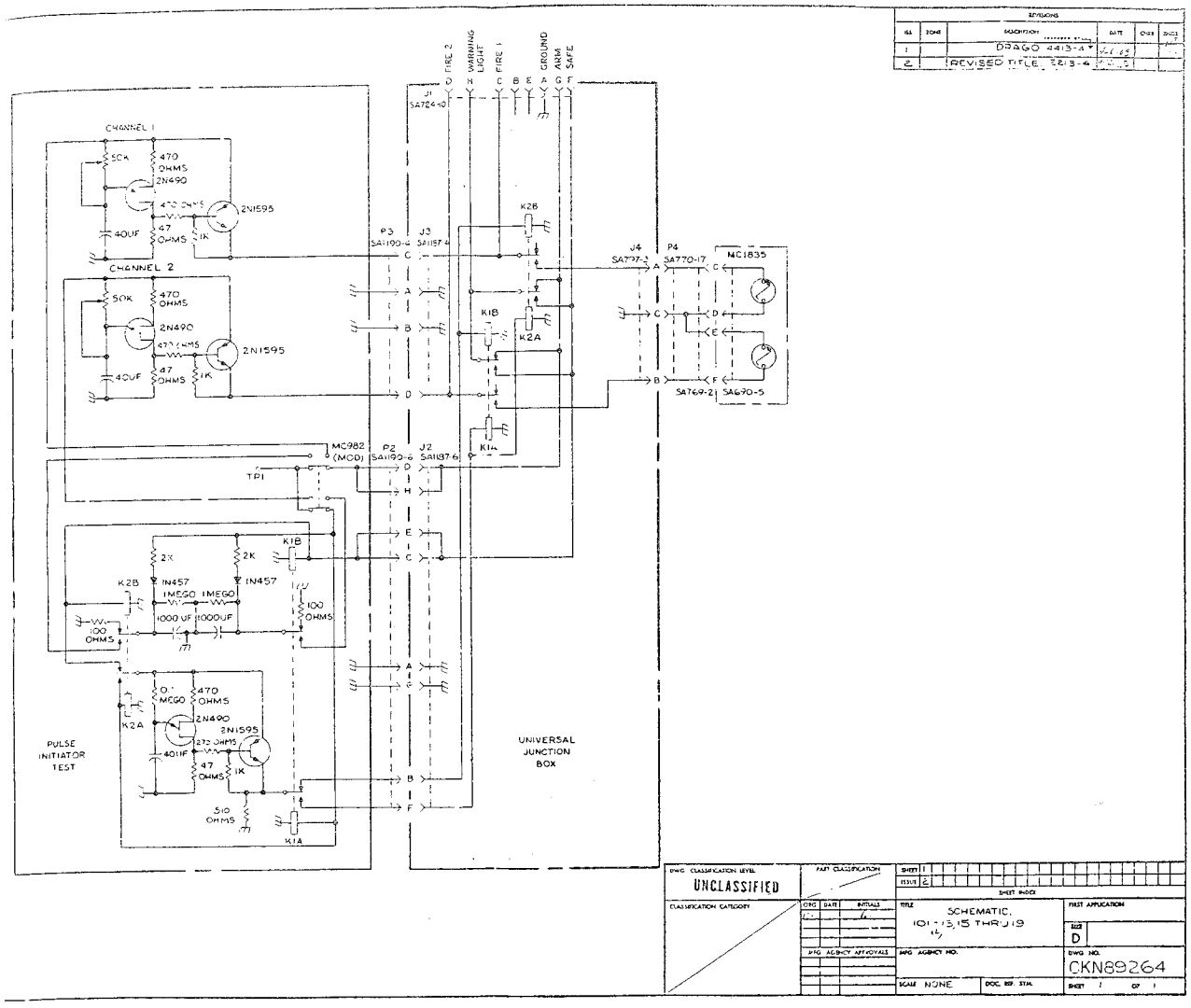


Figure 3

UNCLASSIFIED

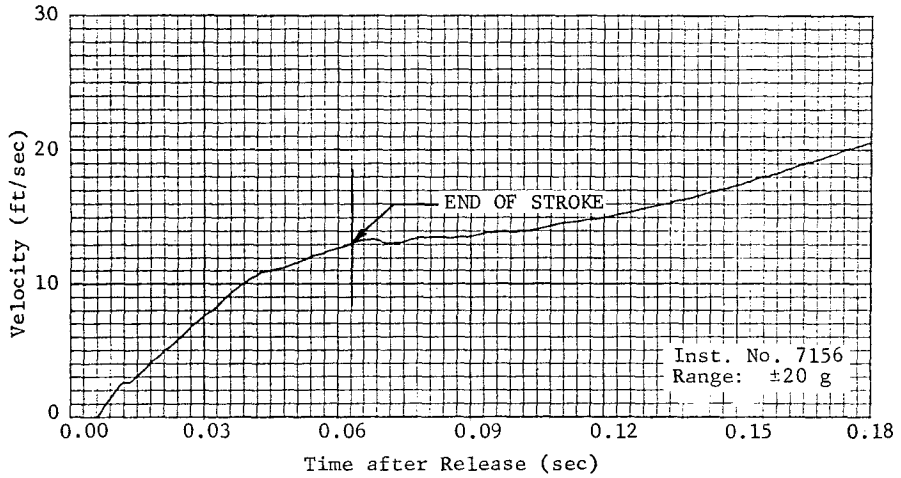


Figure 4. Ejection velocity versus time (Unit 101-14)

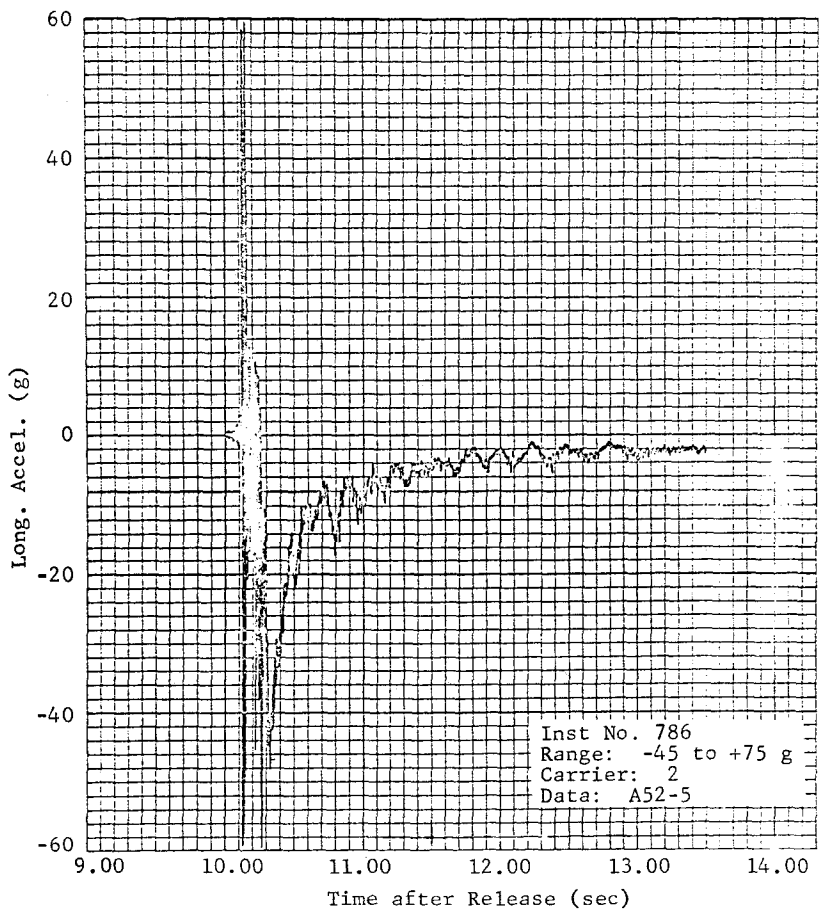


Figure 5. Longitudinal acceleration versus time (Unit 101-14)

UNCLASSIFIED

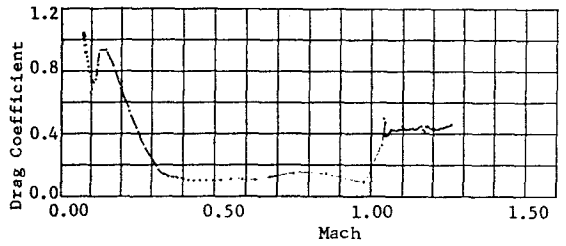


Figure 6. Drag coefficient versus mach number (Unit 101-14)

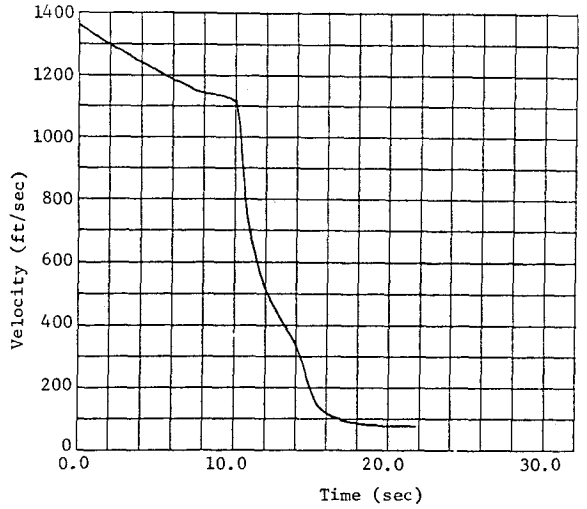


Figure 7. Total velocity (VA) versus time (Unit 101-14)

Optical Data
Carrier: F4C
Site: Tonopah
Date: 3/18/65
(Same data for Figs. 6 thru 12)

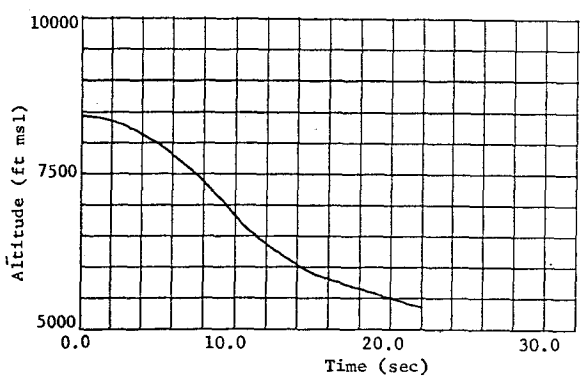


Figure 8. Altitude versus time (Unit 101-14)

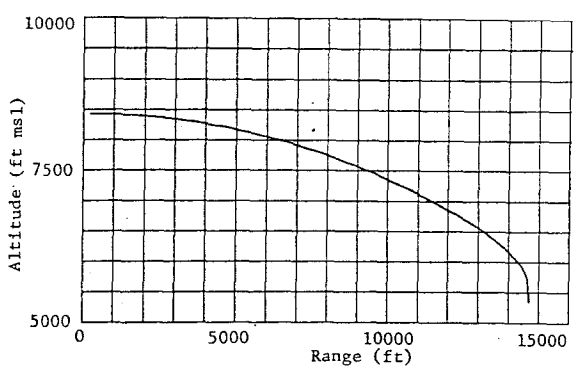


Figure 9. Altitude versus range (Unit 101-14)

UNCLASSIFIED

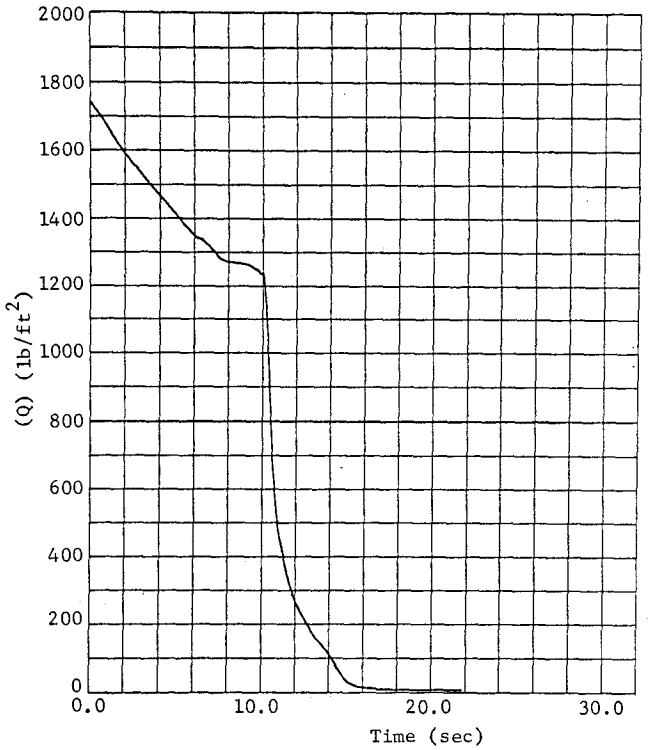


Figure 10. Dynamic pressure versus time (Unit 101-14)

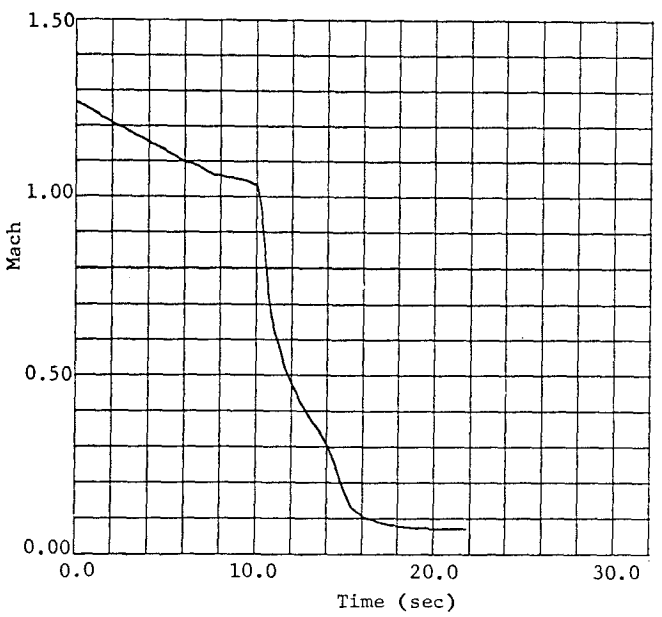


Figure 11. Mach number versus time (Unit 101-14)

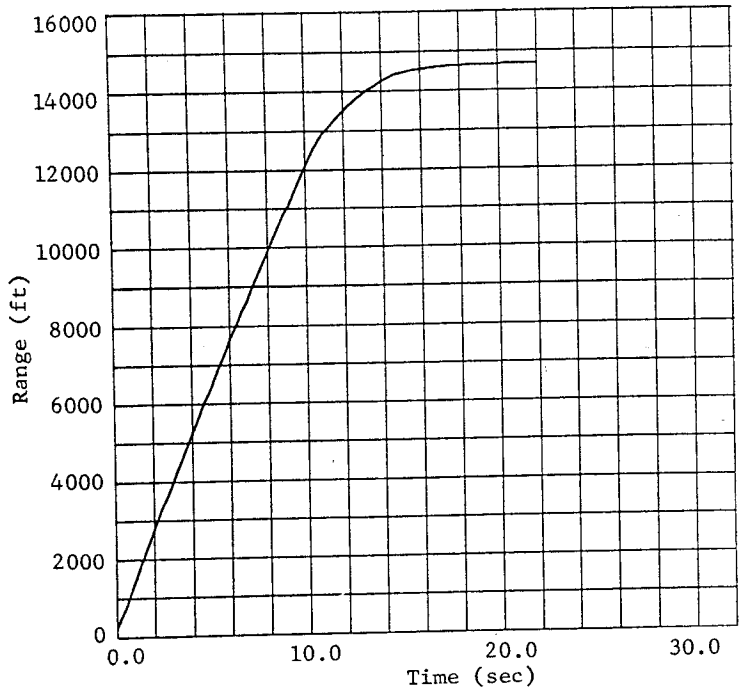


Figure 12. Range versus time (Unit 101-14)

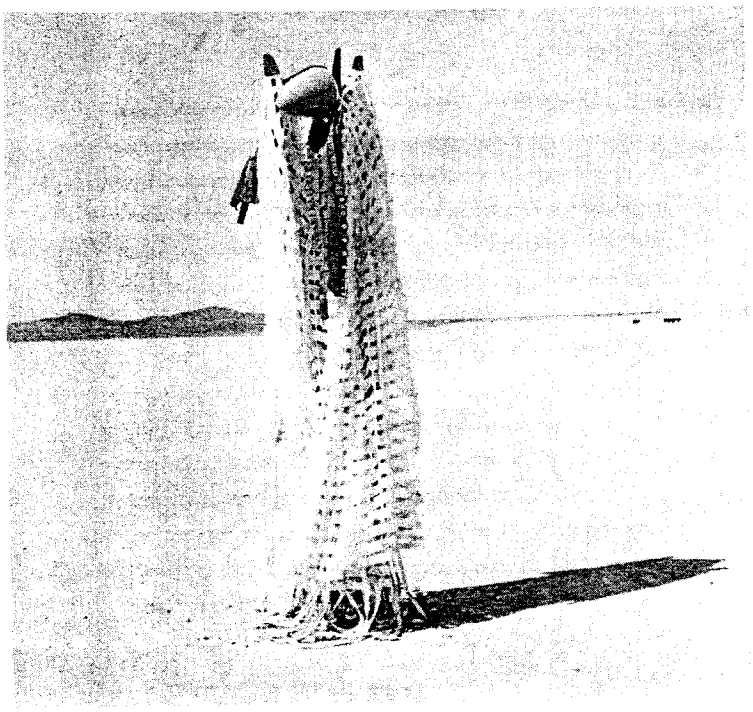


Figure 13. Unit 101-14 after impact

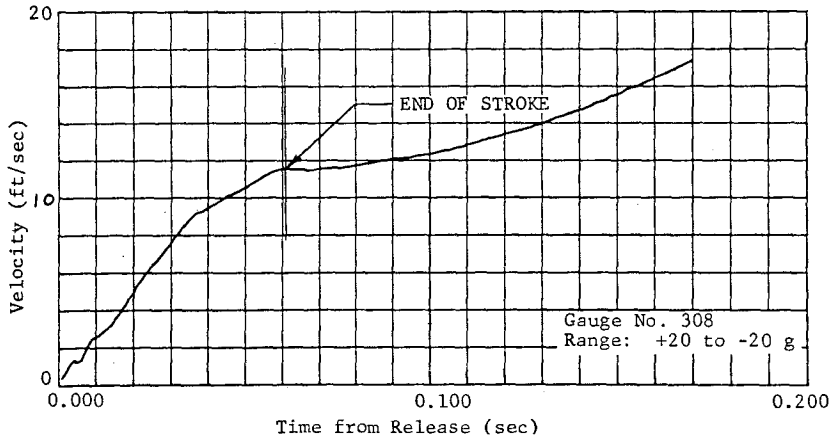


Figure 14. Ejection velocity versus time (Unit 101-12)

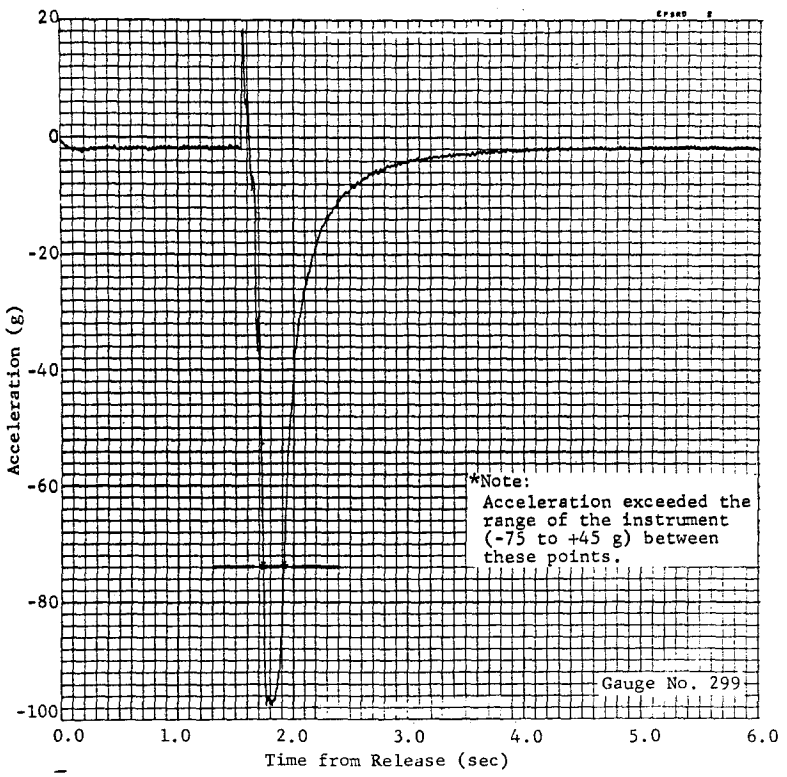


Figure 15. Longitudinal acceleration versus time (Unit 101-12)

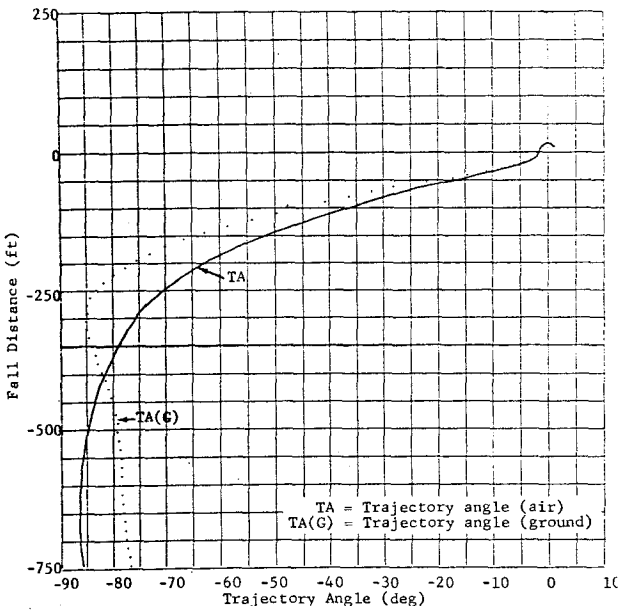


Figure 16. Fall distance versus trajectory angle (Unit 101-12)

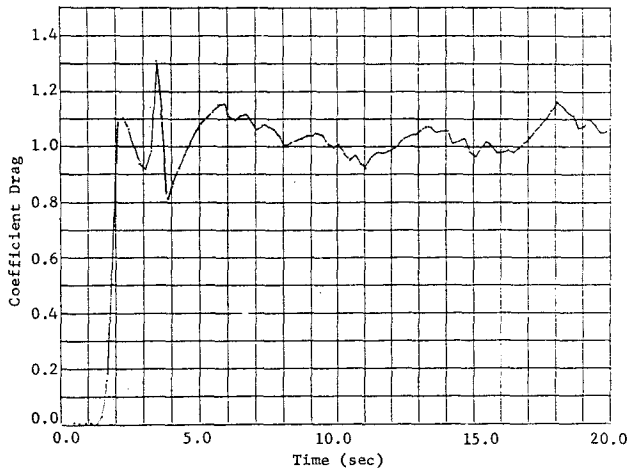


Figure 17. Drag coefficient versus time (Unit 101-12)

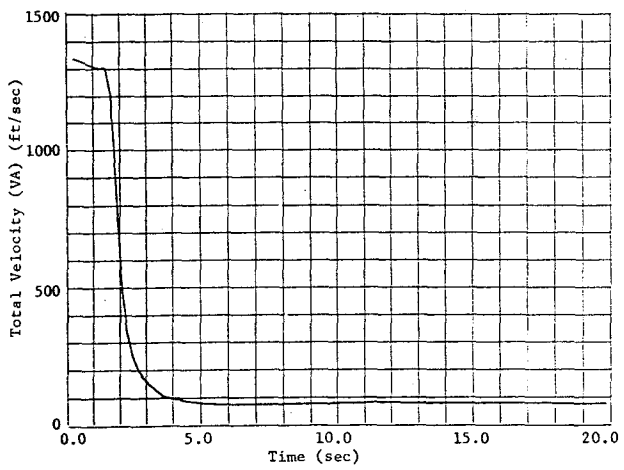


Figure 18. Total velocity versus time (Unit 101-12)

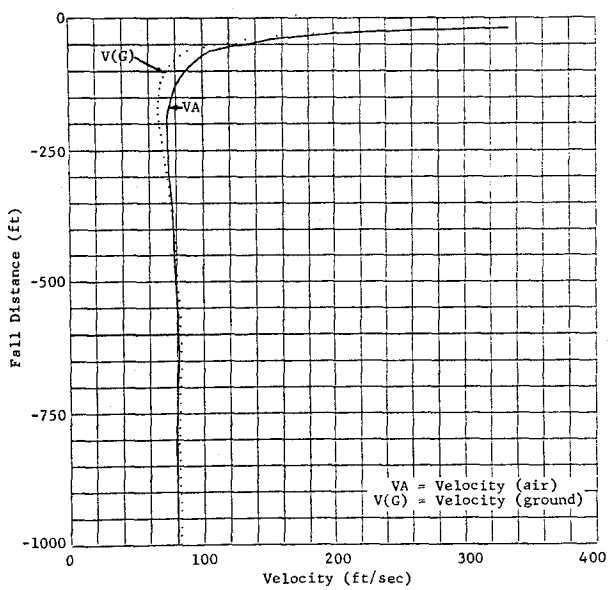


Figure 19. Fall distance versus velocity (Unit 101-12)

Optical Data
Carrier: F4C
Site: Tonopah
Date: 4/23/65
(Same data for Figs. 16 thru 23)

[redacted]

UNCLASSIFIED

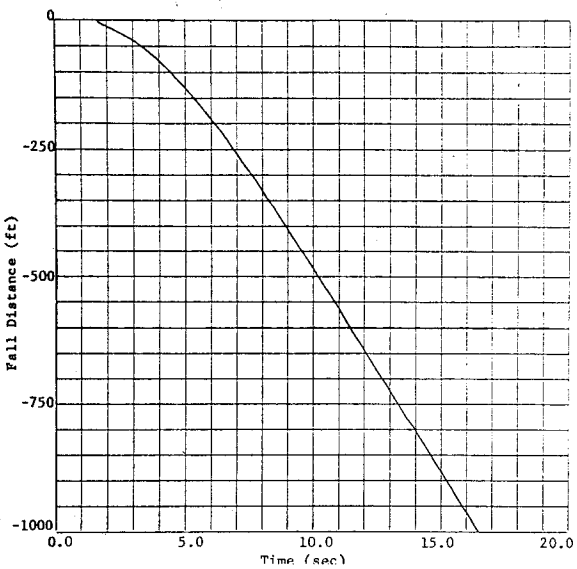


Figure 20. Fall distance versus time (Unit 101-12)

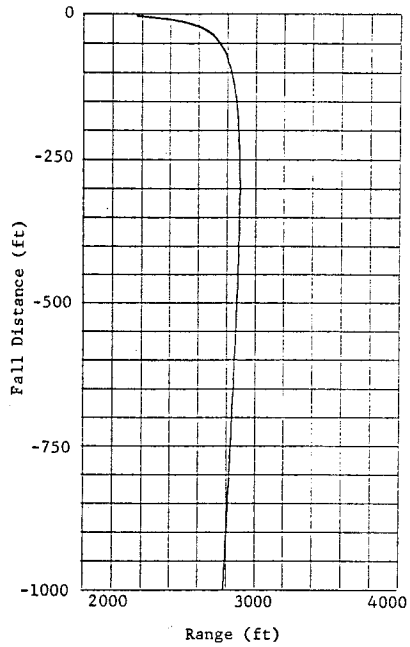


Figure 21. Fall distance versus range (Unit 101-12)

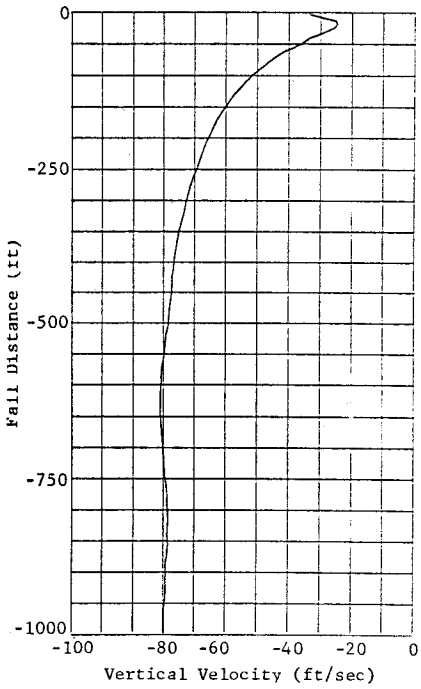


Figure 22. Fall distance versus vertical velocity (Unit 101-12)

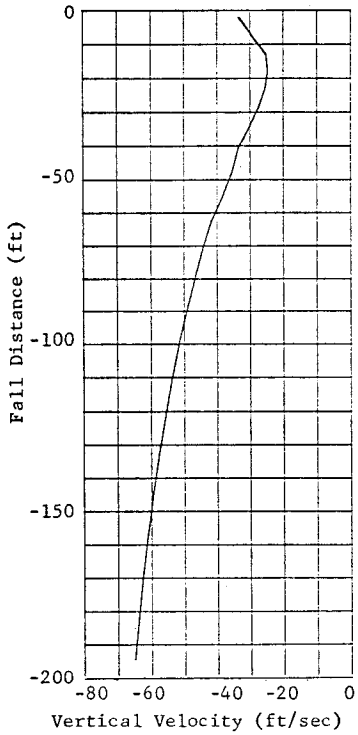


Figure 23. Fall distance versus vertical velocity (Unit 101-12)

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED

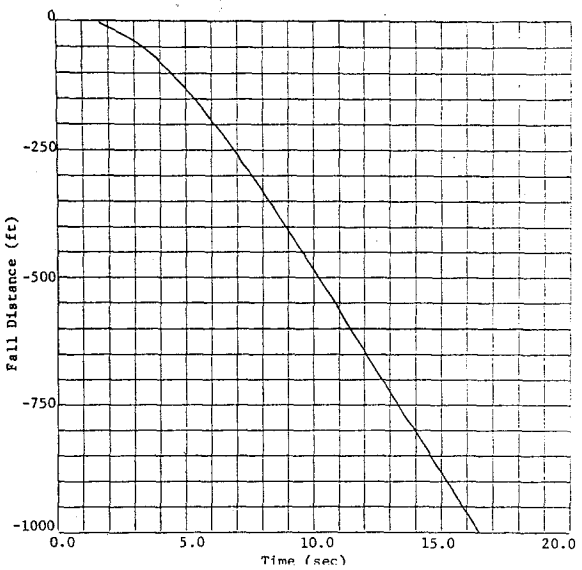


Figure 20. Fall distance versus time (Unit 101-12)

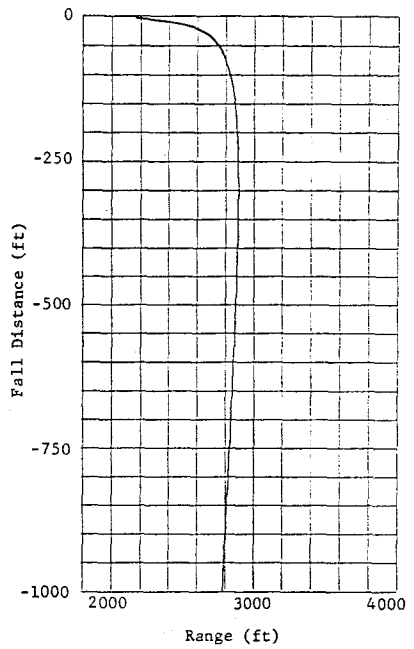


Figure 21. Fall distance versus range (Unit 101-12)

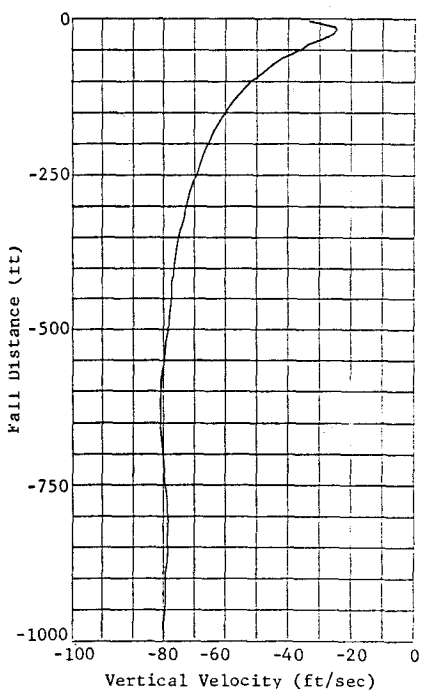


Figure 22. Fall distance versus vertical velocity (Unit 101-12)

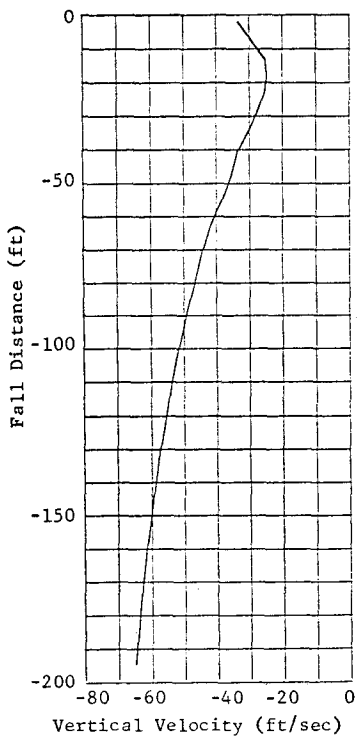


Figure 23. Fall distance versus vertical velocity (Unit 101-12)

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED

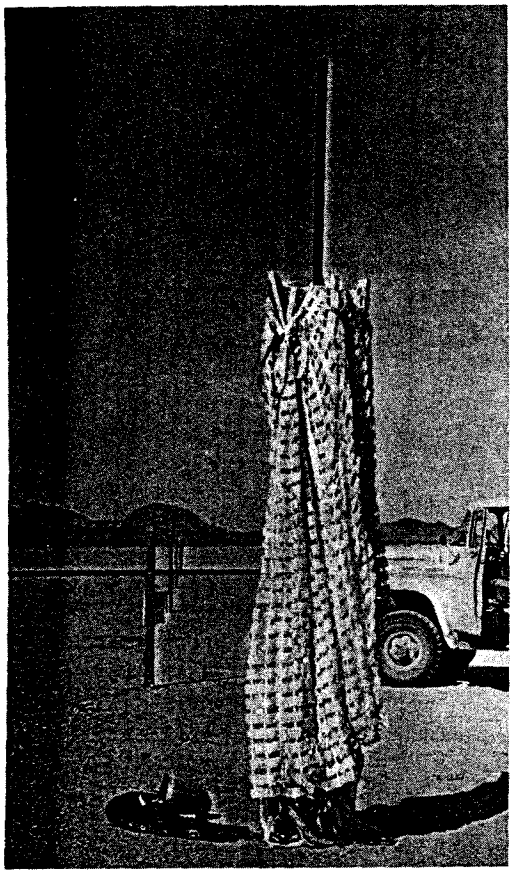


Figure 24. Unit 101-12 after impact

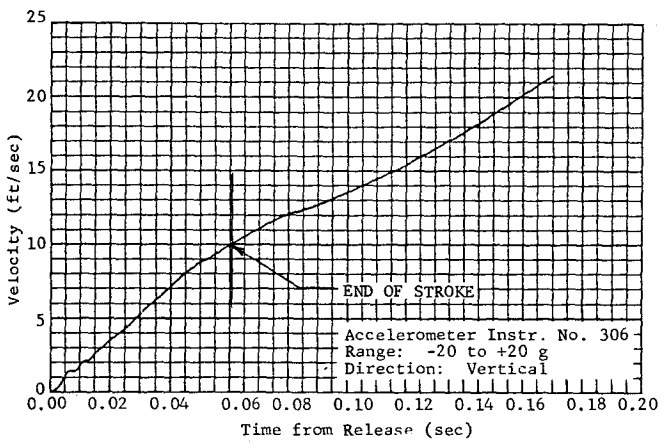


Figure 25. Ejection velocity versus time (Unit 101-19)

UNCLASSIFIED

[redacted]

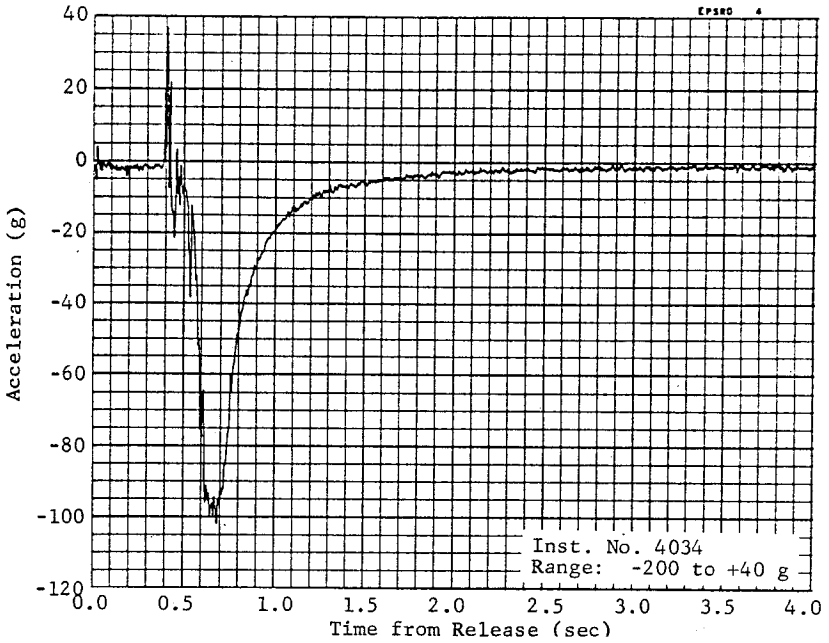


Figure 26. Longitudinal acceleration versus time (Unit 101-19)

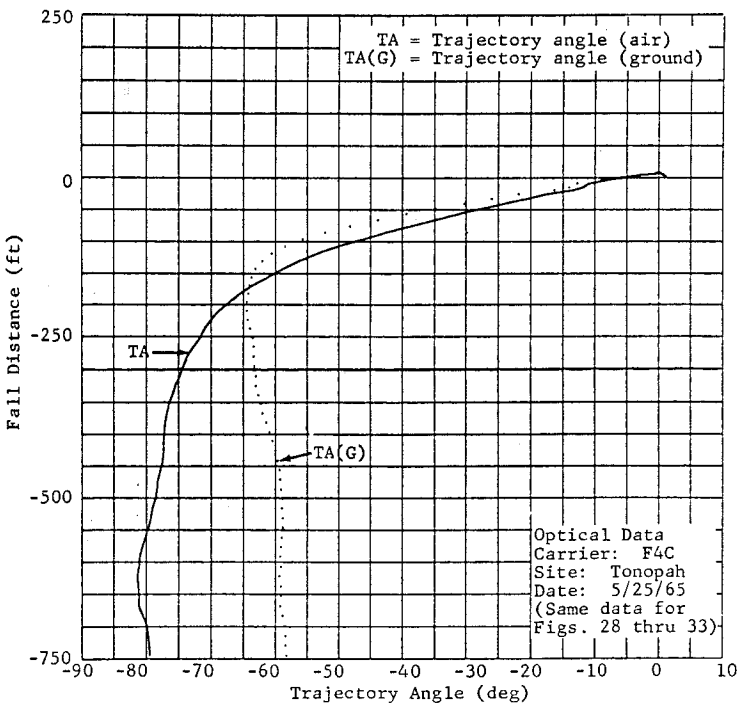


Figure 27. Fall distance versus trajectory angle (Unit 101-19)

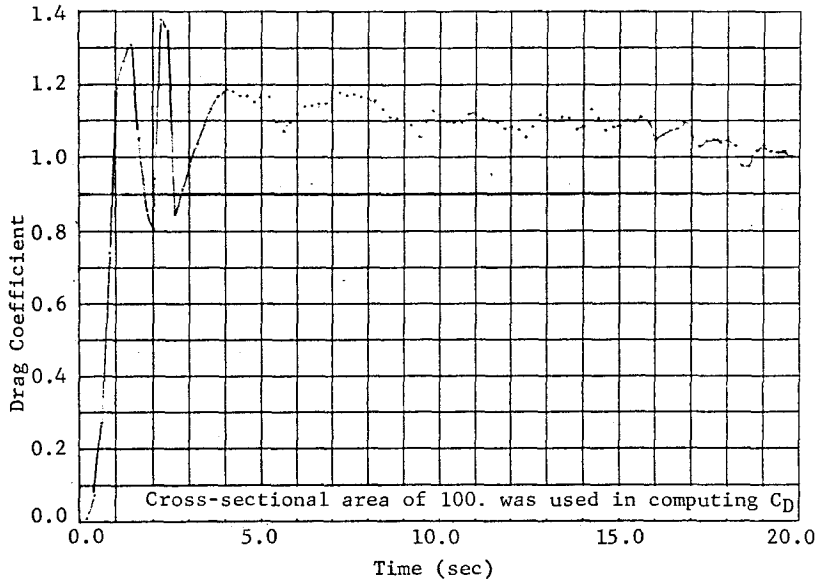


Figure 28. Drag coefficient versus time (Unit 101-19)

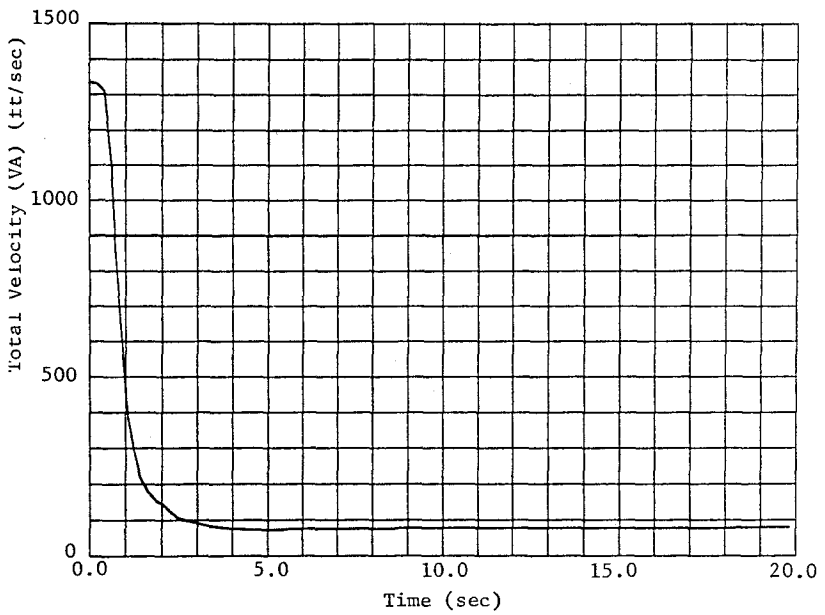


Figure 29. Total velocity versus time (Unit 101-19)

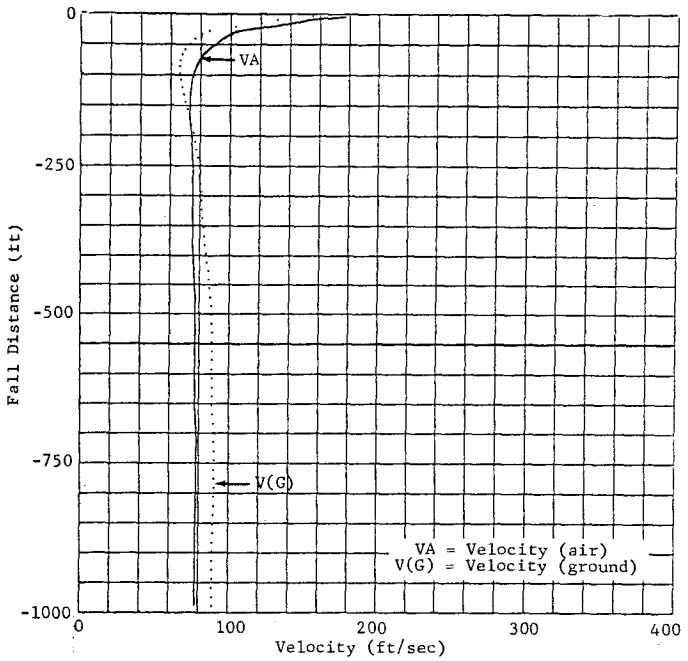


Figure 30. Fall distance versus velocity (Unit 101-19)

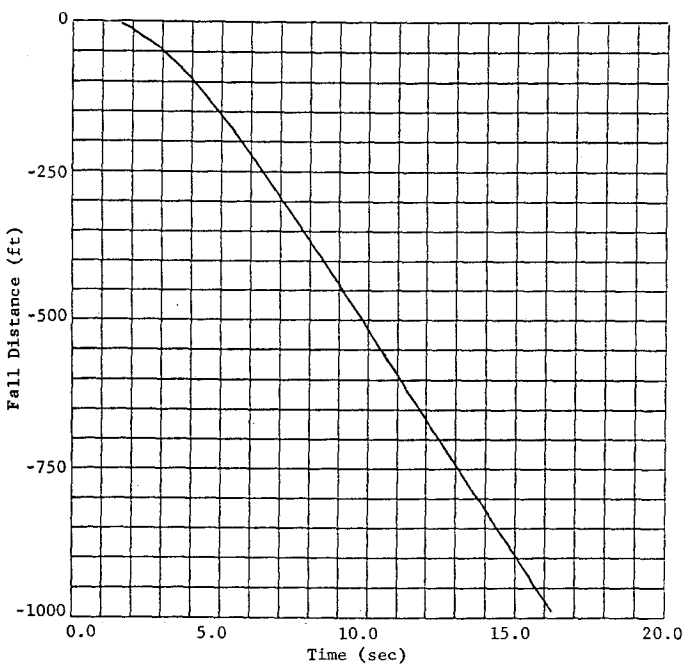


Figure 31. Fall distance versus time (Unit 101-19)

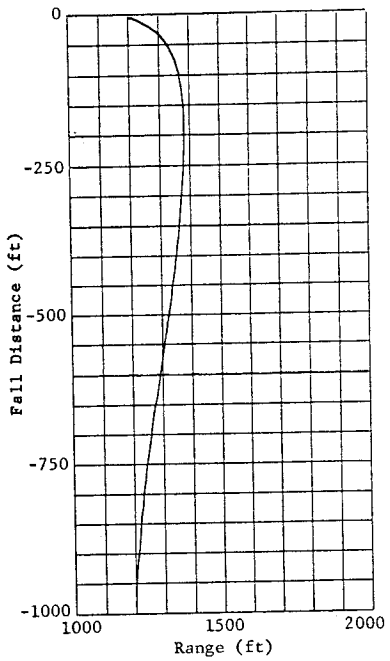


Figure 32. Fall distance versus range (Unit 101-19)

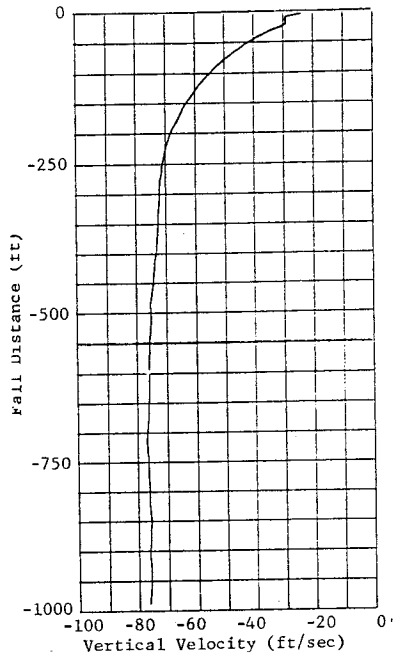


Figure 33. Fall distance versus vertical velocity (Unit 101-19)

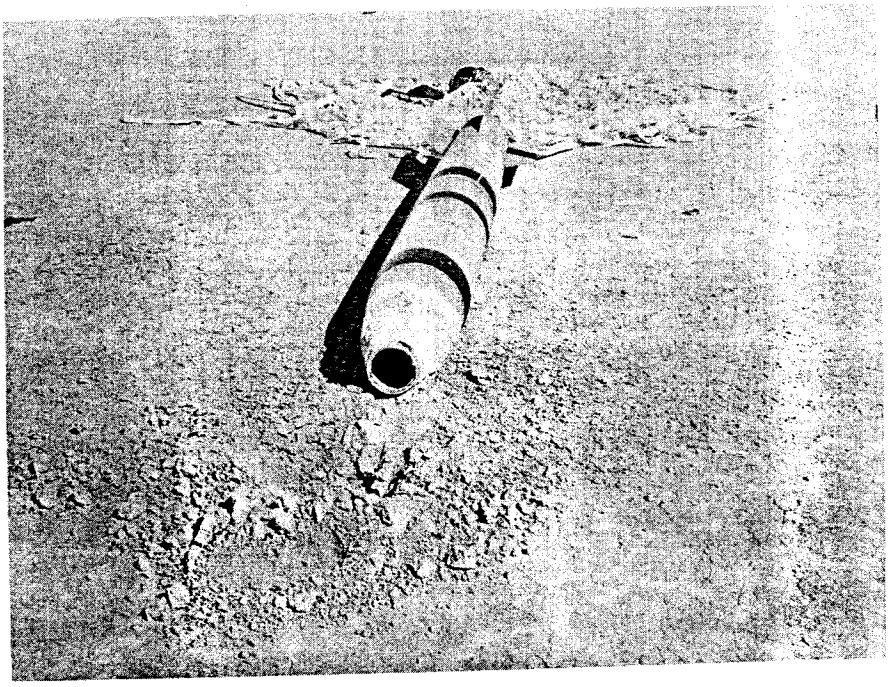


Figure 34. Unit 101-19 after impact