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RESULTS OF TX-61 WEAPON TESTS 101-23 through 101-25 (U)

L. A. Suber, 1512

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
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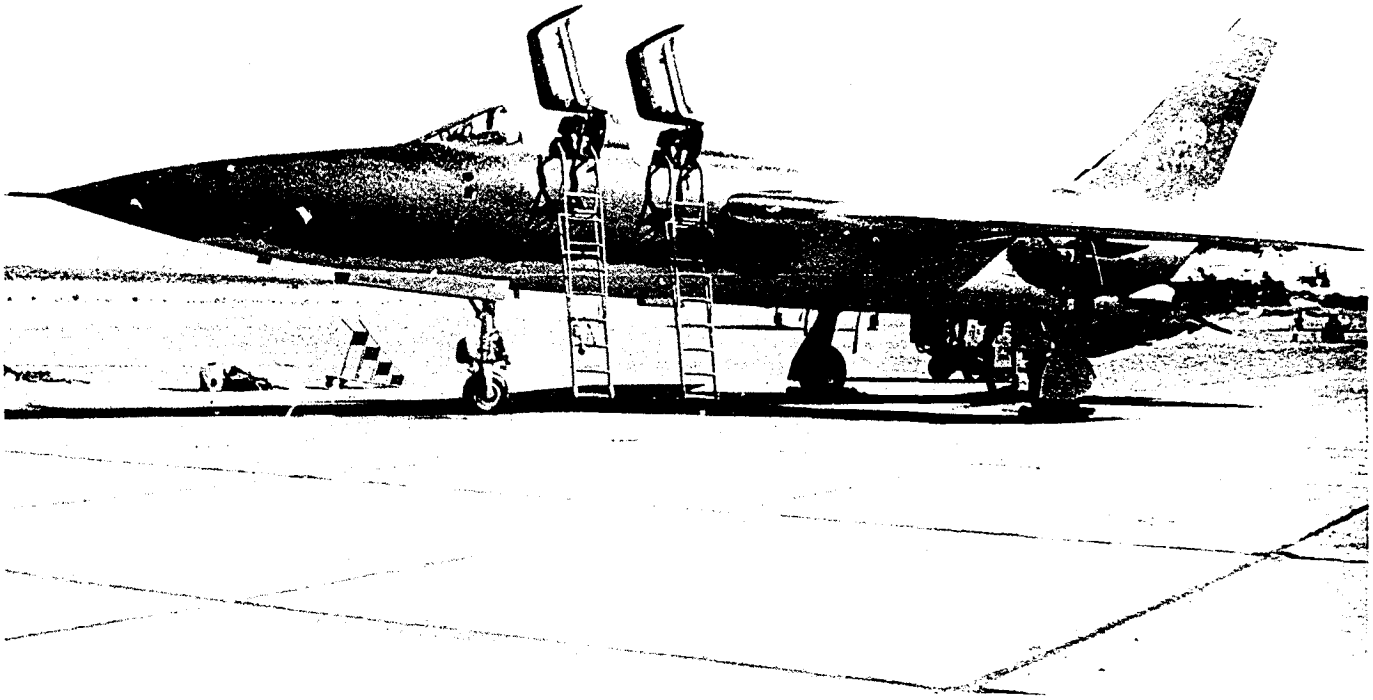
TABLE OF CONTENTS

	Page
Introduction and Objectives	9
Summary of Results	10
Description of Test Vehicles	11
Instrumentation	12
Results	12
APPENDIX A - Data Listing	15
APPENDIX B - Illustrations	19
APPENDIX C - Component Serial Numbers	31



Frontispiece

RESULTS OF TX-61 WEAPON TESTS 101-23 THROUGH 25

Introduction and Objectives

The Military Characteristics of the TX-61 were amended on July 27, 1965 to require compatibility of the TX-61 with the 14-inch suspension outboard pylon of the F-105 aircraft. In order to meet this requirement, three drop tests were scheduled to prove that the TX-61 would separate satisfactorily from this pylon.

The 14-inch suspension lugs of the TX-61 are both located aft of the weapon center of gravity, and this location, combined with the location of the ejector foot of the F-105 outboard rack, gives an unfavorable moment on the weapon at release, causing a tail-down rotation. The possiblity of contact between the weapon and the aircraft pylon or wing after release seemed strong. Therefore, before any weapons were dropped, a computer program was run at Sandia by Division 9325 personnel to determine the motion of the weapon after release. The program covered a great variety of release conditions. Results showed that contact between aircraft and weapon could occur in a few extreme cases. The data from the computer program were presented to Air Force personnel at Nellis AFB, and a joint Air Force-Sandia decision was made to begin a drop program to study separation, the program to commence with release conditions where the program did not predict contact.

The drop program was to consist of three drops at progressively increasing speeds, all in level flight, with ejector cartridges of medium force to be used throughout. The TX-61 vehicles were to be MAT units with no telemetry installed. Film coverage from chase aircraft and ground cameras was to be used to evaluate separation on each drop before the next test was run.

It was also decided to obtain trajectory data on these tests to provide more data on the 17-foot-diameter parachute. The established release conditions were checked with the personnel responsible for the F-105 at the Sacramento Air Material Command (SMAMA) at McClellan AFB, to assure that flight and release at the specified speeds would not cause structural problems in the aircraft wing. SMAMA informed Nellis that the TX-61 at the specified location on the F-105 at maximum aircraft speed (the speed requested for the third drop, contingent upon satisfactory results of the first two releases) might induce dangerous wing flutter. Aircraft speed was therefore restricted by SMAMA personnel to 550 KCAS or 0.9 Mach, whichever was reached first. The conditions for the third test were then revised. Table I shows the original and the revised release conditions. Tests 101-23 and 101-24 were unchanged.

TABLE I

Test	101-23	101-24	101-25	
			Orig.	Revised
Approach altitude ft (AGL)	2000	2000	2000	200
Approach attitude	Level	Level	Level	Level
Release altitude	2000	2000	2000	3500
Release attitude	Level	Level	Level	45° LADD
Release speed (KCAS)	325-375	450-500	Max.	515 KTAS

NOTE: A mixup of units caused 101-24 and 101-25 to be swapped. The actual test conditions are reported in the Results sections of this report.

Summary of Results

All tests were successful in both separation and test unit functions. Film coverage from chase aircraft showed separation to be without interference in all cases. Some wing flutter was observed at release on each test, but AF personnel who reviewed the test films felt that the flutter was not detrimental to the aircraft. Table II presents a summary of the actual release conditions.

TABLE II

Test	101-23	101-24	101-25
Test date	5/24/66	6/1/66	5/26/66
Release altitude (ft AGL)	2372.	2569.	1987.
Release attitude and maneuver	Level	48° LADD	Level
Release speed (knots EAS)	356.	370. (427 KTAS)	496.

There is an obvious discrepancy between the planned release conditions listed for Test 101-25 (ultimately 101-24) in Table I and the actual release conditions for Test 101-24. After the maximum-speed release was prohibited, the decision was made to drop the third unit at some other condition simply to obtain additional data. The condition chosen was a LADD release, with the Air Force supplying the angle and speed, neither of which was to be a stringent requirement since the test was being conducted primarily on a convenience basis. The pilot was thus allowed to drop at a speed considerably different than the planned condition.

Description of Test Vehicles

Mechanical Description

The test units were TX-61 MAT units, which have the TX-61 external contour and physical characteristics. The units consiste of a nose weighted to simulate the TX-61 radar nose; a center case which contained only a ballast system designed to simulate the weight, CG, and MI's of the WR TX-61 center case; a preflight containing a dummy MC1951 spin rocket and a MAT control box; and an afterbody containing the parachute and its deployment system. Figure 1 shows the configuration of the unit, and Appendix C lists the component serial numbers. The position of the MC1876 in the afterbody should be noted. The pylon as it exists on the aircraft is not configured for special weapons. The existing configuration necessitated the reversal of the MC1876 to hook up the pullout to give a vertical pull. Also of note is the skin connector. The outboard pylon of the aircraft did not have aircraft power, so the connector was moved to allow arming on the ground. These modifications would not be made to a WR weapon to make it compatible; rather, all pylons in the field would have to be modified.

Table III presents the physical characteristics of the test units.

TABLE III

Test	Weight	CG Station	Yaw MI
101-23	700.	59.5	ND
101-24	703.	59.5	744,800
101-25	694	59.4	742,100

The variation in unit characteristics was caused by parachute weight variations.

Electrical Description

Only the components necessary to arm and safe the test unit and to time parachute deployment from pullout after release were included. The system is shown schematically in Figure 2. It included an MC1876 pulse battery actuator, reversed in position, to supply power; a special skin connector and cable to allow arming the weapon immediately before takeoff; and a MAT box which contained the circuits to provide selectable parachute deployment delay times. The special connector and cable were necessary because the outboard pylons of the F-105 did not have power for special-weapon applications. The test unit was armed through this connector, using an external power source, and could have been safed in the same manner had a test been aborted, with the unit being returned aboard the aircraft.

Timing was achieved using commercial time-delay relays coupled with external resistors which provided the various times. Arming and safing was provided using relays in the MAT box and the arm-safe features of the MC1876.

Instrumentation

The test units contained no instrumentation. Data on separation were obtained from chase aircraft film and ground cameras, and trajectory data were obtained from ground cameras.

Results

A complete listing of data for all three tests is provided in Appendix A. All trajectory data plots are compiled in Appendix B and are referenced in the text by figure number. Since the units did not contain instrumentation or telemetry, no data on parachute longitudinal acceleration or ejection velocity were obtained.

Common to all the tests was the discrepancy found between the pitch frequency of the TX-61 as used in the computer program and as actually observed in the chase film. The frequency observed was approximately one-half that used in the theoretical predictions, resulting in a more satisfactory orientation at parachute deployment than had been predicted. Also, because of the decreased frequency, the nose of the unit missed contact with the pylon after release by a wider margin than had been predicted; i.e., by the time the unit reached its maximum angle of attack, producing maximum elevation of the nose, the unit had dropped enough to prevent contact of the nose with the pylon. On the basis of observations of the first two drops and the relation of these observations to the theoretical calculations, it is possible to state that a clean separation could be accomplished from the outboard pylon at maximum aircraft speed. This does not, however, alleviate the in-flight flutter problem, which will have to be resolved by the Air Force before a maximum speed separation test will be possible.

The tests were all successful in every respect; separation was clean and the units functioned as intended. The parachute sequences as observed from optical coverage were as follows:

Test	101-23	101-24	101-25
Release	0.00 sec	0.00 sec	0.00 sec
Tail can off	No data	1.34 sec	0.25 sec
Line stretch	0.42 sec	1.49 sec	0.39 sec
Full inflation	0.68 sec	1.82 sec	0.68 sec

The plot of coefficient of drag (C_dS) versus time for Test 101-23 is shown in Figure 3. The variations in the value of C_dS indicated by this plot and the corresponding C_dS curves for 101-24 and 101-25 (Figures 4 and 5) are of doubtful accuracy. The mean values of C_dS are indicated on each curve by the dotted constant-value line.

Trajectory data for the tests are given in Figures 6 through 9 for Test 101-23, Figures 10 through 14 for 101-24, and Figures 15 through 19 for 101-25. Figures 20 through 22 show the test units after impact.

It may be noted from the data that 101-24, dropped in a LADD maneuver, used a 1.3-second parachute delay, so that a free-fall separation from the pylon could be observed.

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APPENDIX A
Data Listing

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APPENDIX A

Data Listing

	101-23	101-24	101-25
Test Date	5-24-66	6-1-66	5/26/66
Unit Data			
Weight (lb)	700.	703.	694.
Center of gravity (station)	59.5	59.5	59.4
Yaw moment of inertia (lb-in.^{2} x 10^3	ND	744.8	742.1
Release Data			
Aircraft	F-105	F-105	F-105
Location on aircraft	Outboard	Outboard	Outboard
Altitude above target (ft)			
Requested	2000.	3100.	2000.
Actual	2372.	2569.	1987.
Target altitude	5353.	5338.	5343.
Velocity			
EAS (knots)	356.	370.	496.
Ground speed (knots)	414.	309.	582.
Mach number	0.60	0.65	0.86
Heading (deg)	347.	343.	347.
Wind			
Velocity (fps)	12.	42.	19.
Direction (deg)	238	187	215
Air temperature (°F)	65.	57.	71.
Aircraft vertical velocity (fps)	3.	722.	-4.
Aircraft trajectory angle (deg)	0.2	48.	-0.2
Rack type	RØR	RØR	RØR
Cartridge (type)	446-863	446-863	446-863
Dynamic pressure (lb/ft^2)	430.	465.	833.
Air density (lb/ft^3)	0.057	0.058	0.057
Parachute Data			
Optical time sequence from release to: (sec)			
Tail cone off	ND	1.342	0.245
Line stretch	0.42	1.488	0.386
Full inflation	0.68	1.816	0.677

NOTE: RØR is Republic Outboard Rack. This is the rack made by Republic Aircraft and used only in the F-105 outboard pylon.

Data Listing (cont)

	101-23	101-24	101-25
Maximum C_dS (ft^2)(initial overshoot) . . .	126.	133.	133.
Dynamic pressure at maximum C_dS (lb/ft^2)	65.	57.	77.
Average C_dS (ft^2)	115.	125.	100.
Trajectory Data			
Terminal velocity (fps)	80.	80.	86.
TM time of fall (sec)	32.5	53.7	25.3
Range (ft)	1432.	3468.	1497.
Drift (ft)	221.	953.	31.
Apogee above target (ft)	NA	3696.	NA

ND - No data

NA - Not applicable to this test

APPENDIX B

Illustrations

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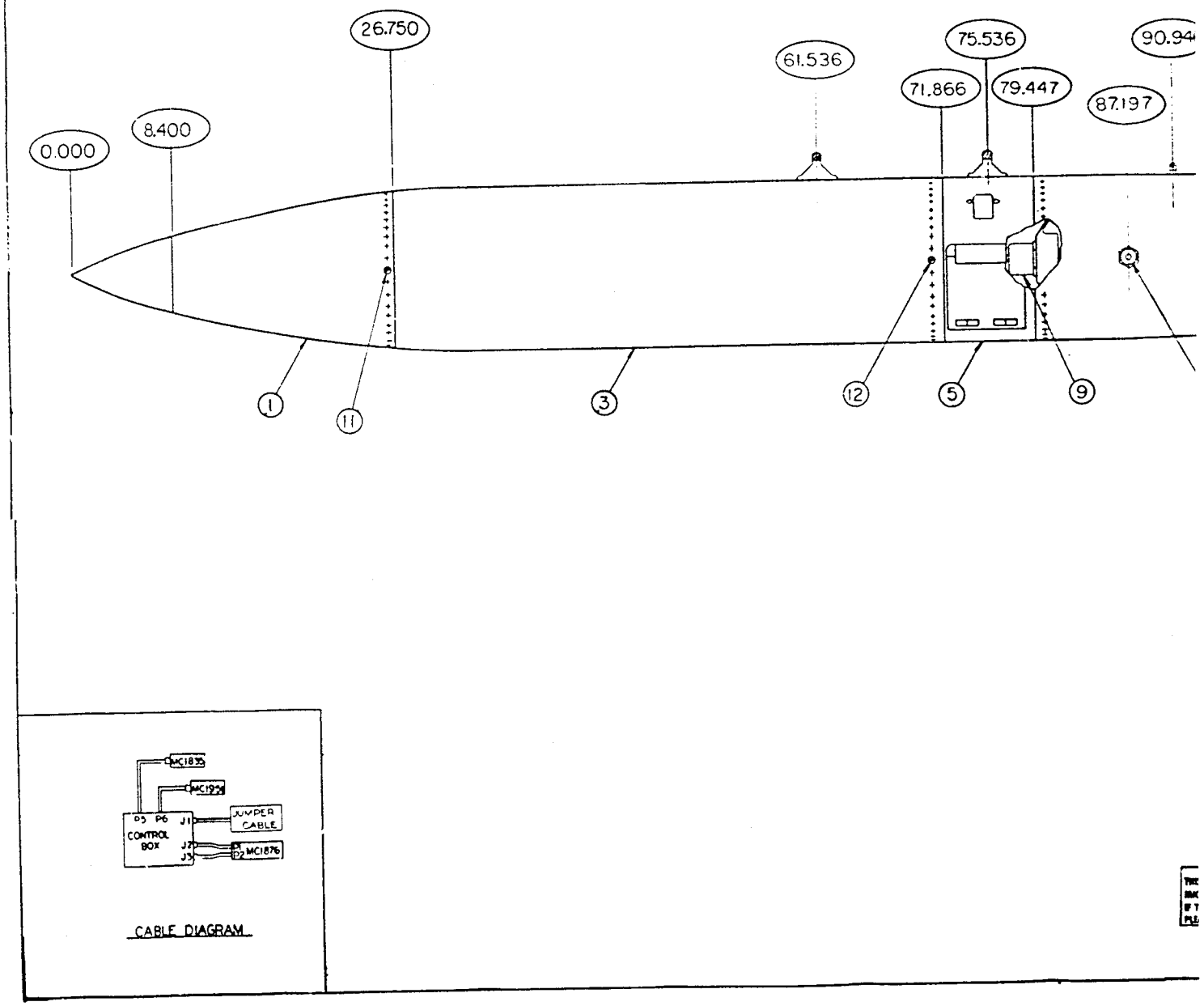
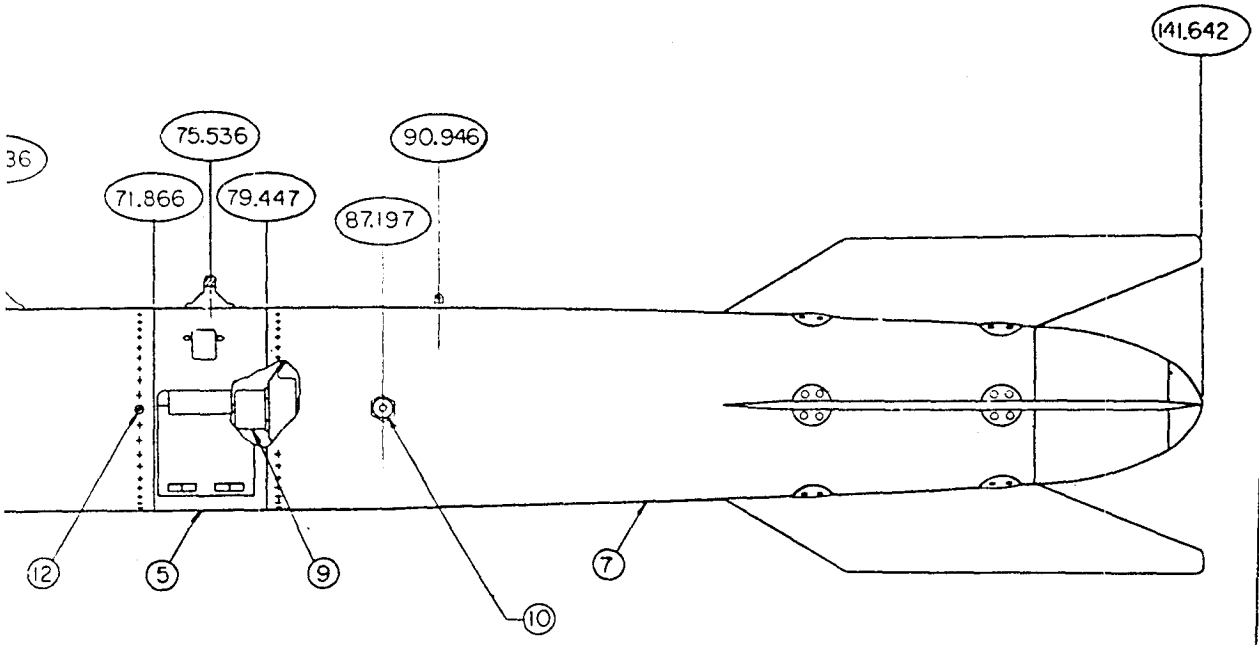


Figure 1. TX-61 MAT assembly

NOTES

1. FOR PAINTING SCHEDULE SEE DWG. M01890, ISSUE 2.
2. M.A.T.-101, -102, AND -103 ARE TO BE USED FOR SEPARATION TESTS FROM THE F106 OUTBOARD 1½" SUSPENSION PYLON. (ITEMS 3, 5 AND 7 ARE TO BE USED ONLY FOR THESE TESTS.



72	194092-00	SCREW, MACHINE			12
36	194091-00	SCREW, MACHINE			11
1	P13355-000	JUMPER CABLE (M.A.T.)			10
1	311754-00	MC1835			9
					8
1	P18297-000	TAIL CASE ASSEMBLY (M.A.T.)			7
					6
1	P18233-000	PREFLIGHT CASE ASSEMBLY (M.A.T.)			5
					4
1	P13351-000	CENTER CASE ASSEMBLY (M.A.T.)			3
					2
1	312248-00	MC1828TRB			1
NO. REQD	DESIGN AGENCY NUMBER	DESCRIPTION	NOTE	SHEET PART	ITEM

LIST OF MATERIAL

M.A.T.-101,102,103

SHEET 1 ISSUE 1 SPLIT PART

CLASSIFICATION CATEGORY

DESIGN AGENCY APPROVALS: DPU | DATE | INITIALS; 1512; 2212

MFG AGENCY APPROVALS

TITLE: TX61 M.A.T. ASSY -13.3 DIA-

MFG AGENCY NUMBER

SIZE E | DWG NUMBER P13356

SCALE 1/4 | SHEET 1 OF 1

DWG CLASSIFICATION LEVEL: UNCLASSIFIED

PART CLASSIFICATION: UNCLASSIFIED

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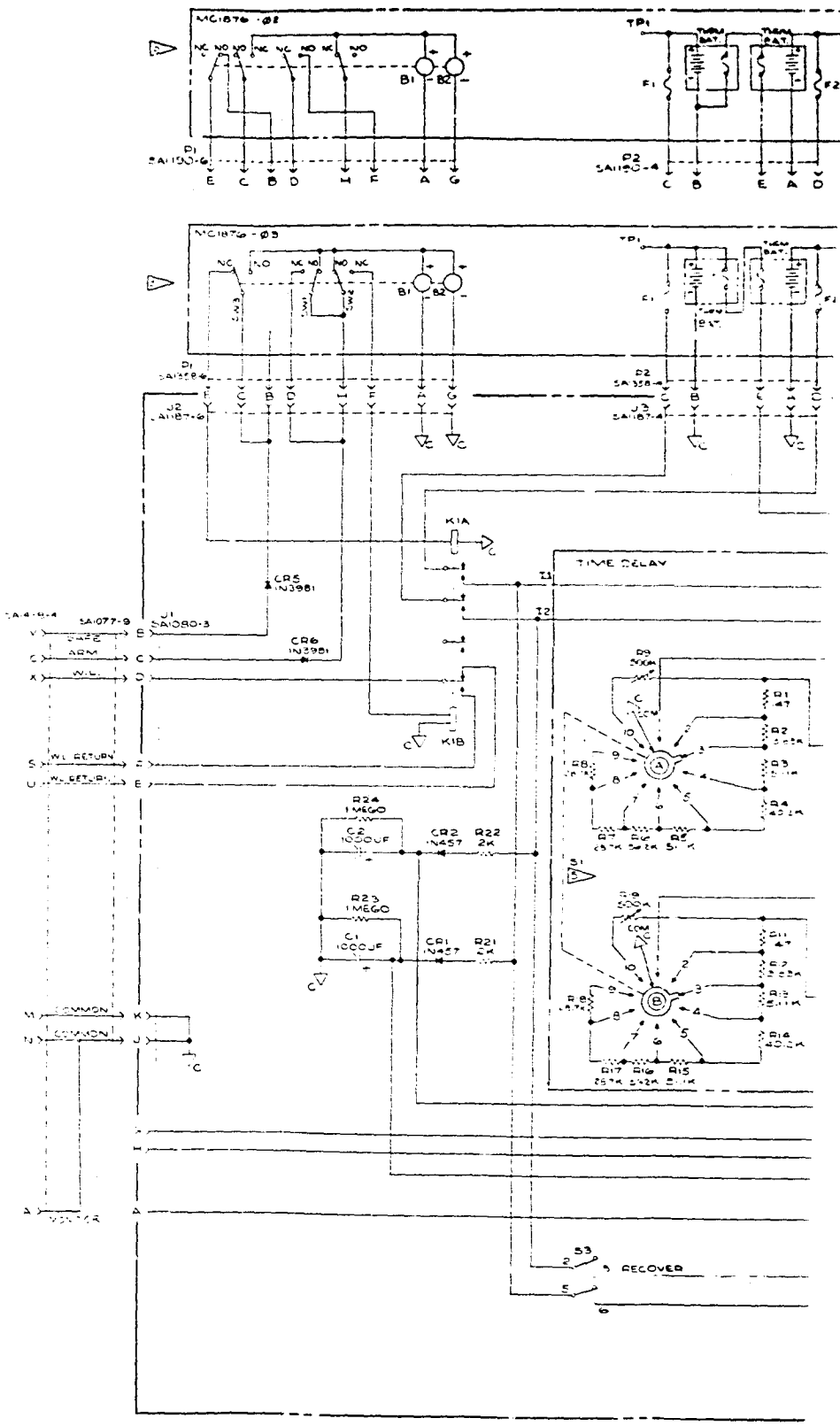
TX-61 MAT assembly


MC1876-02
MC1876-03
TP1
B1
B2
F1
F2
P1
P2
J1
J2
J3
K1A
K1B
CR5
1N3981
CR6
1N3981
TIME DELAY
ARM
W.L.
W.L. RETURN
COMMON
R24
1MEGO
C2
1000UF
CR2
1N457
R22
2K
R23
1MEGO
C1
1000UF
CR1
1N457
R21
2K
S3
RECOVER

[redacted]

NOTES:

1) UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.
2) ∇_C INDICATES CIRCUIT RETURN.
3) THE PHASE 2 MC1876 AND PHASE 1 MC1876 WITH A MODIFIED MONITOR LOOP MAY BE USED INTERCHANGEABLY.
4) K4 AND K5 ARE ADJUSTABLE TIME DELAY RELAYS WITH THE TIME DETERMINED (0.15 - 3.00 SECONDS) BY THE VALUE OF THE RESISTANCE CONNECTED BETWEEN TERMINALS 5 AND 1.
5) THE TIME DELAY (FROM RELEASE TO INITIATION) IS SELECTED BY S1 AS SHOWN IN CHART:

POS'N	TIME DELAY (SEC)
1	0.11
2	0.26
3	0.25
4	0.35
5	0.625
6	1.00
7	1.40
8	1.60
9	1.80
10	ADJUSTABLE (0.26 - 3.0)

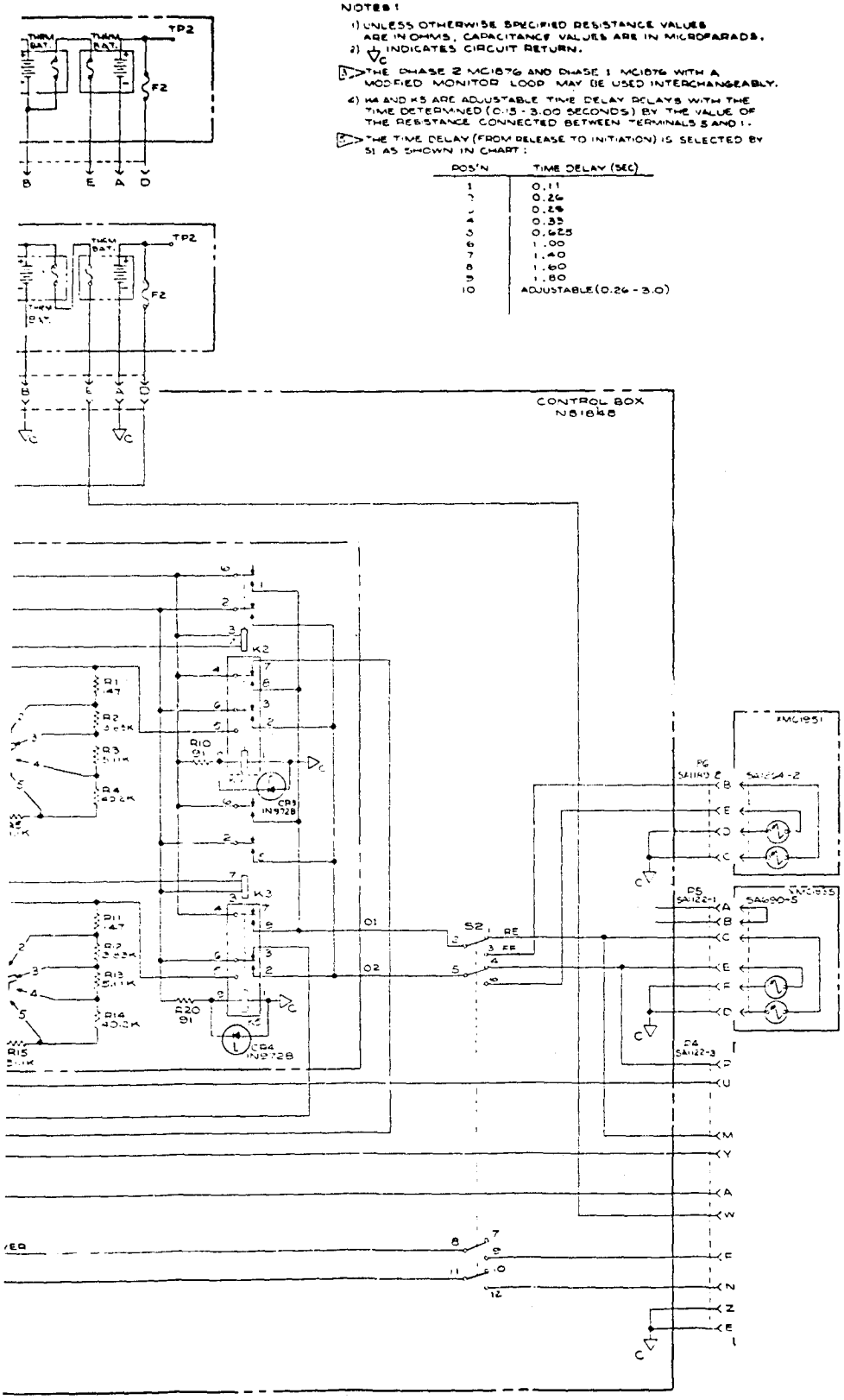


Figure 2.

Schematic, MAT

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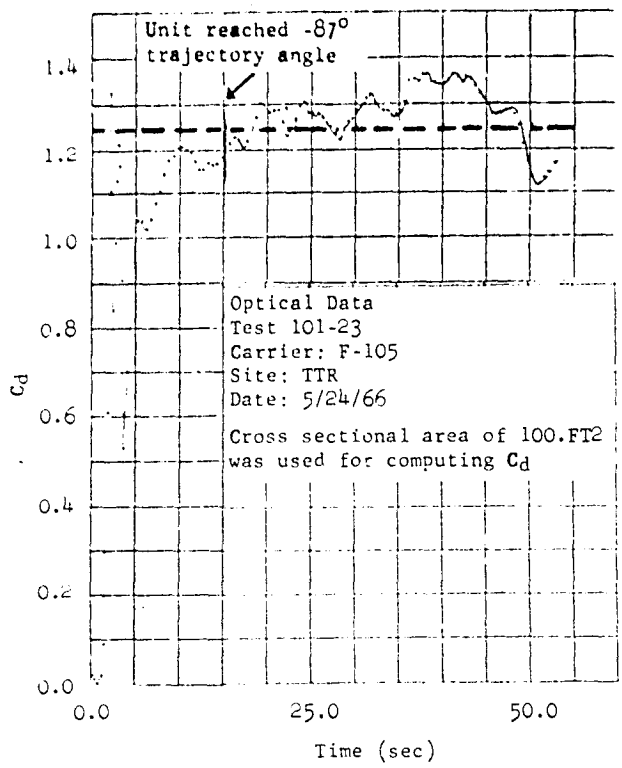
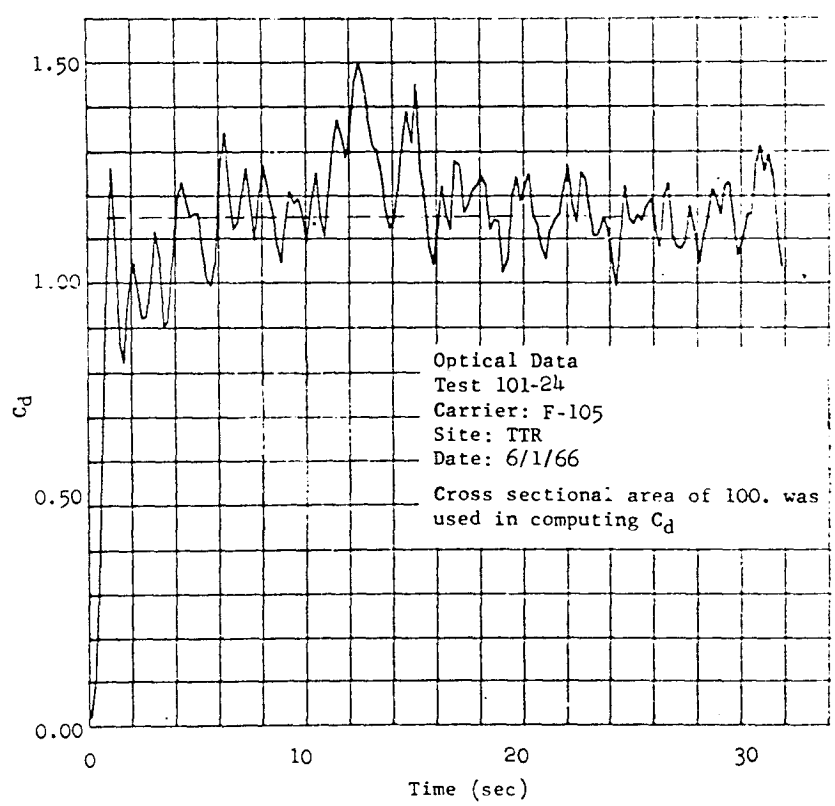


Figure 3.
Drag coefficient vs time

Figure 4.
Drag coefficient vs time



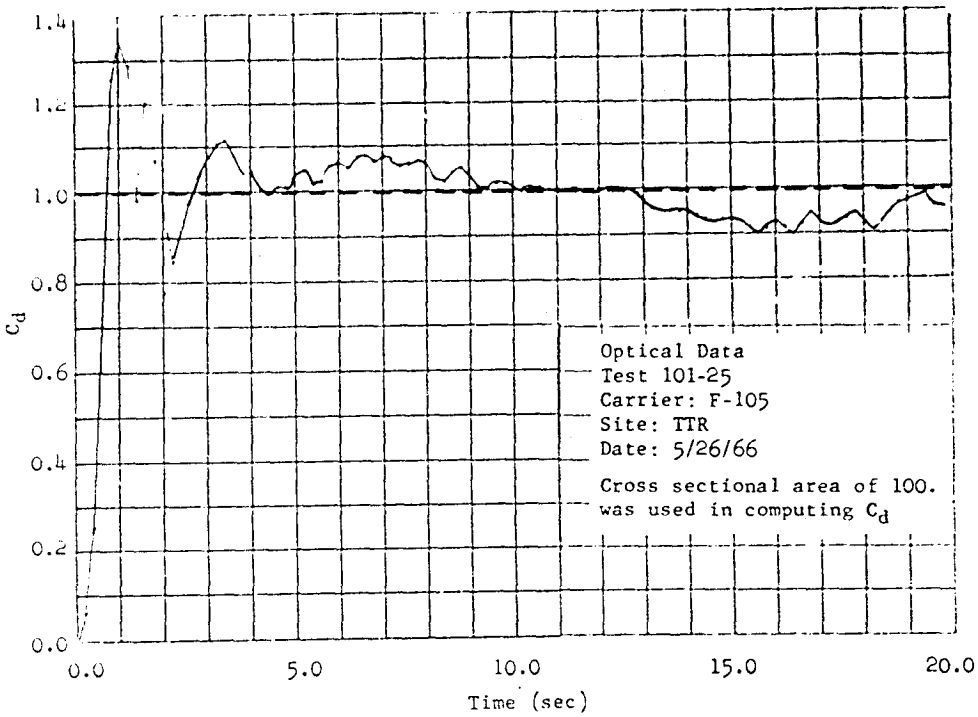


Figure 5. Drag coefficient vs time

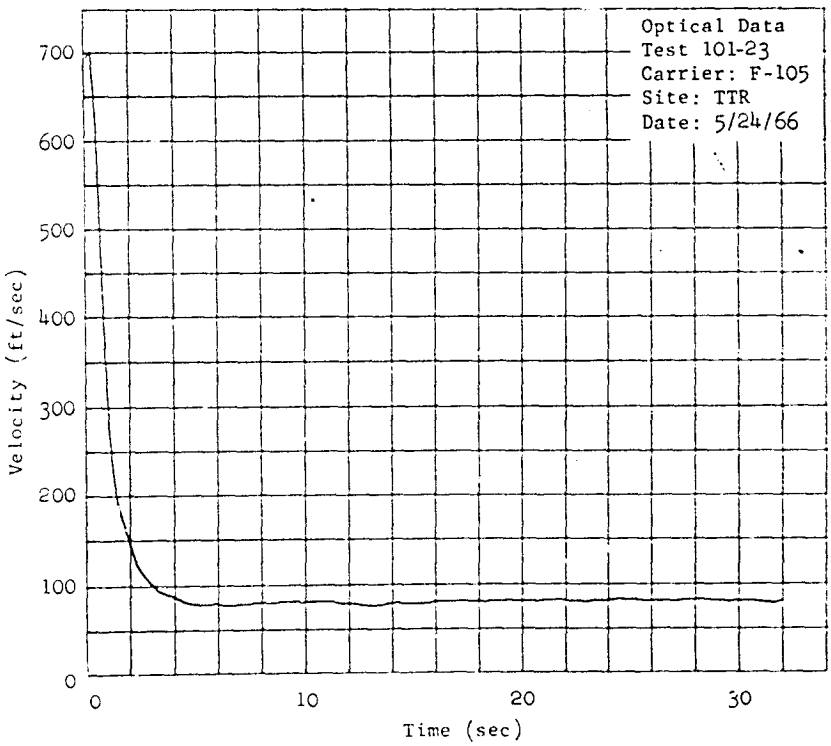


Figure 6. Total velocity (VA) vs time

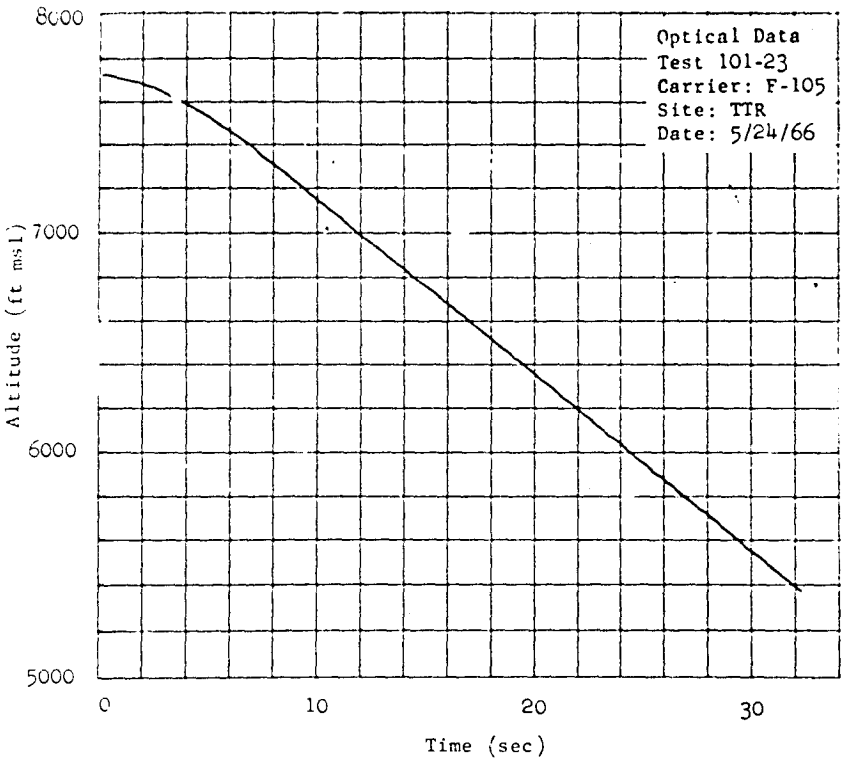
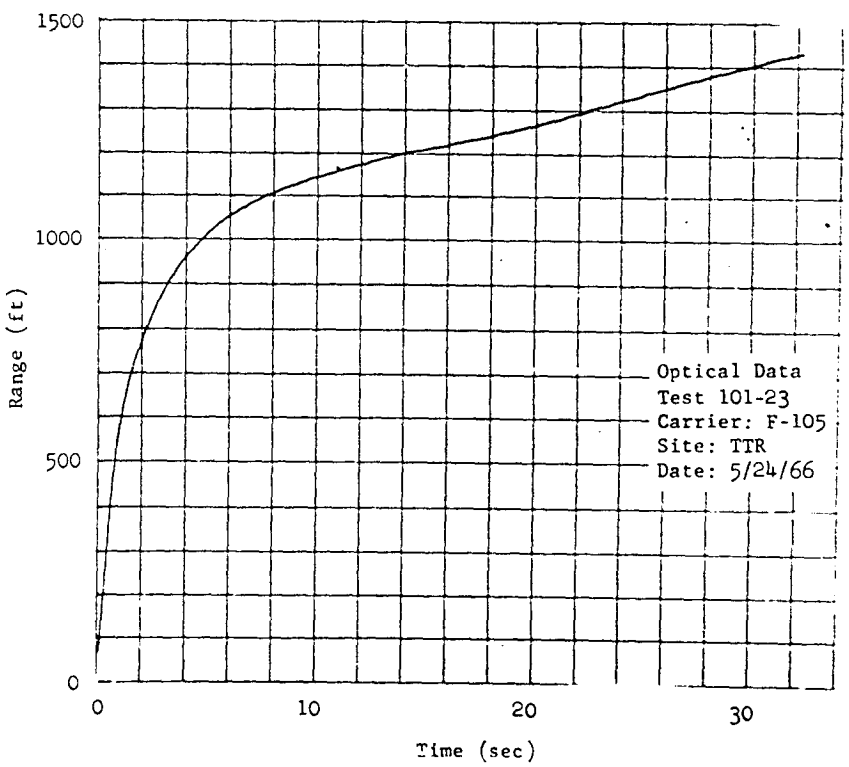


Figure 7.
Altitude vs time

Figure 8.
Range vs time



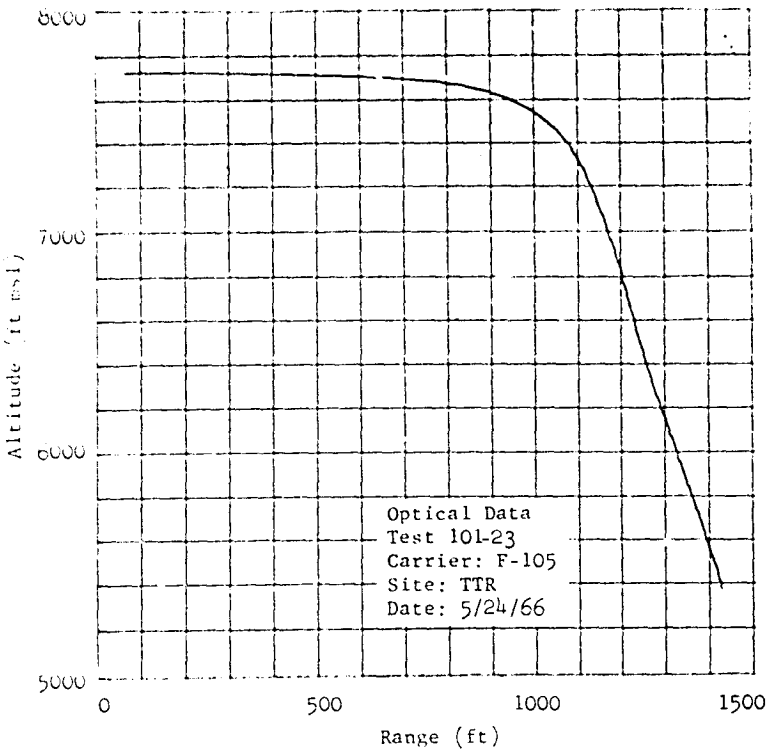


Figure 9. Altitude vs range

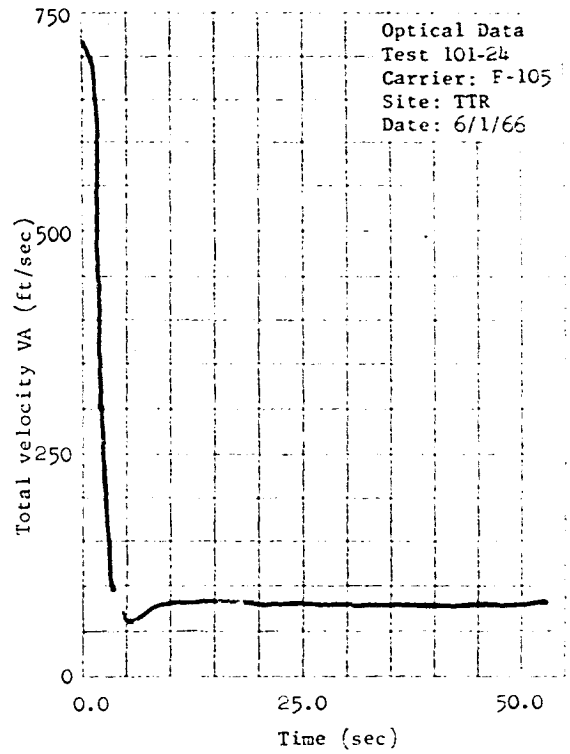


Figure 10. Total velocity vs time

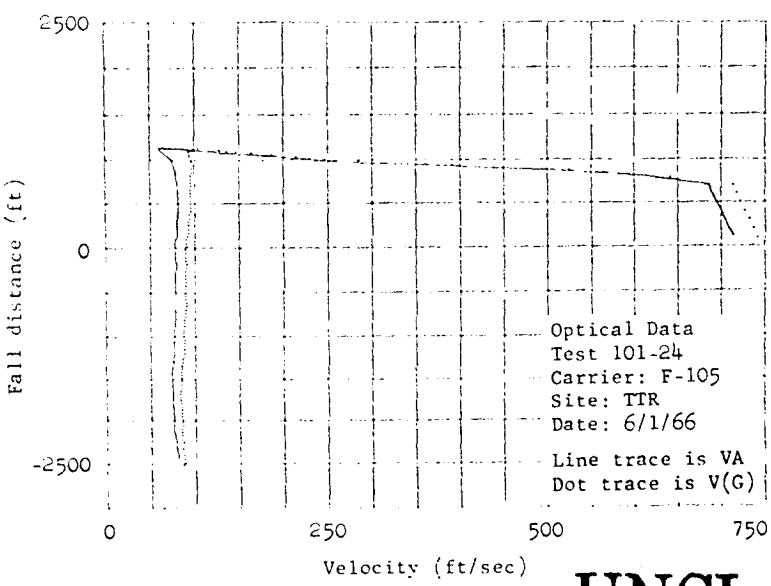


Figure 11. Fall distance vs velocity

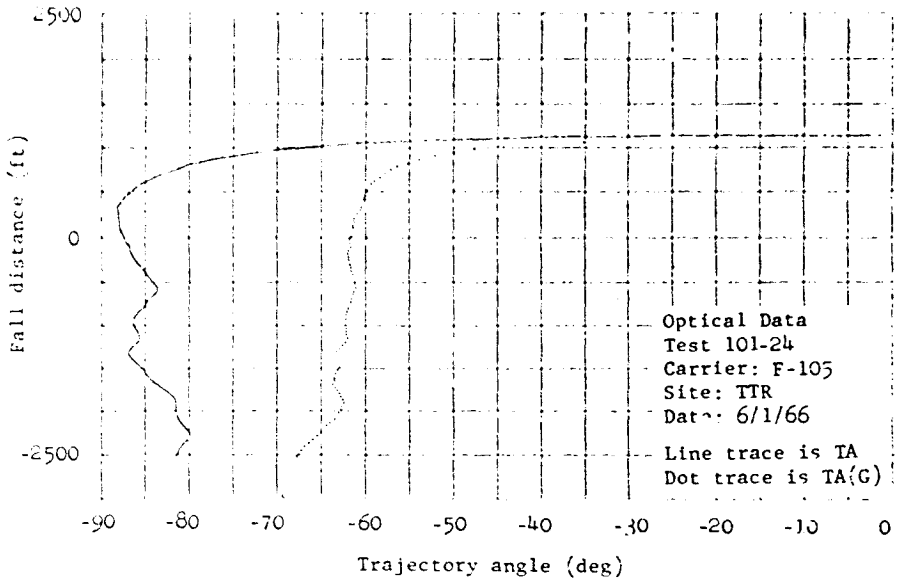


Figure 12. Fall distance vs trajectory angle

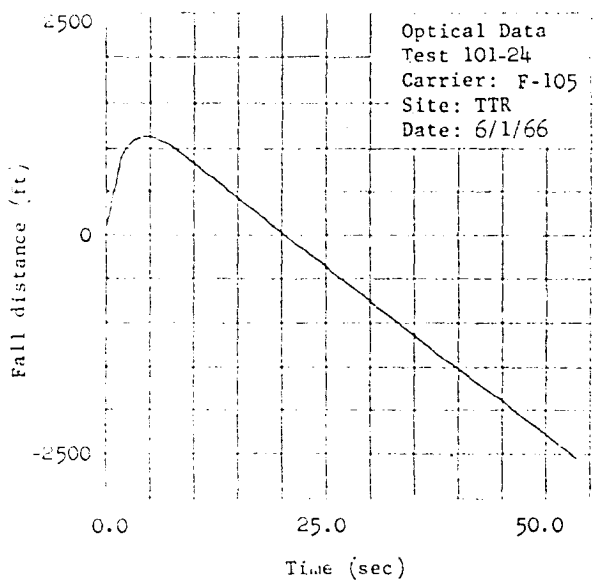


Figure 13. Fall distance vs time

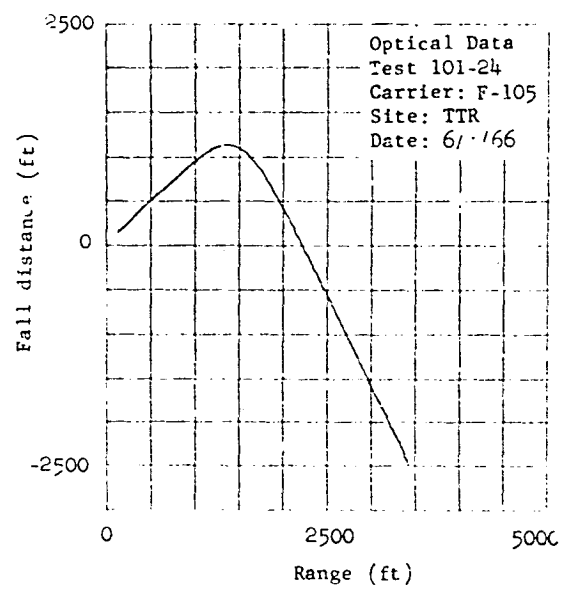


Figure 14. Fall distance vs range

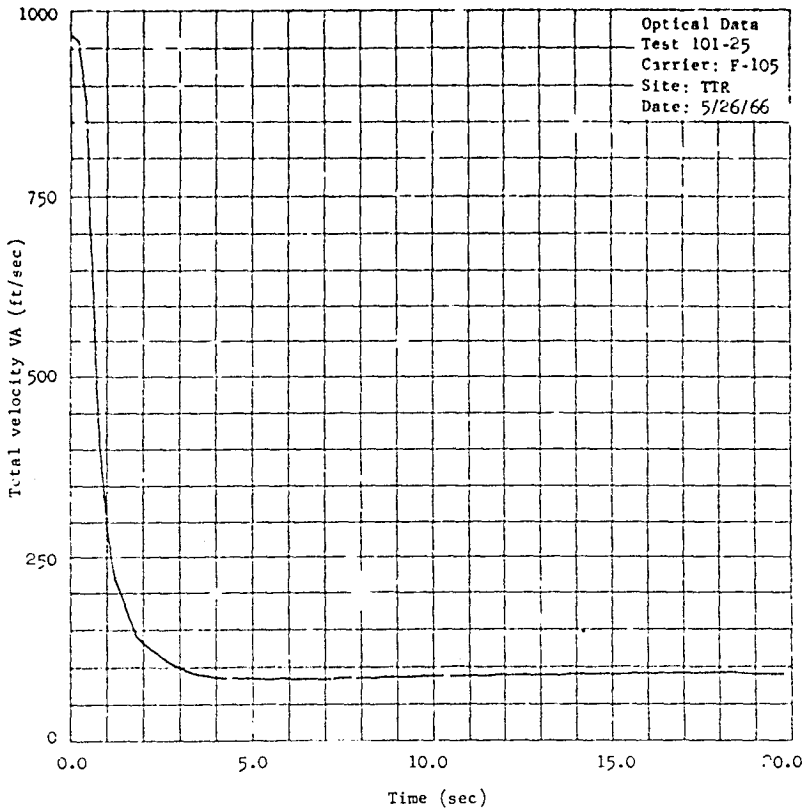
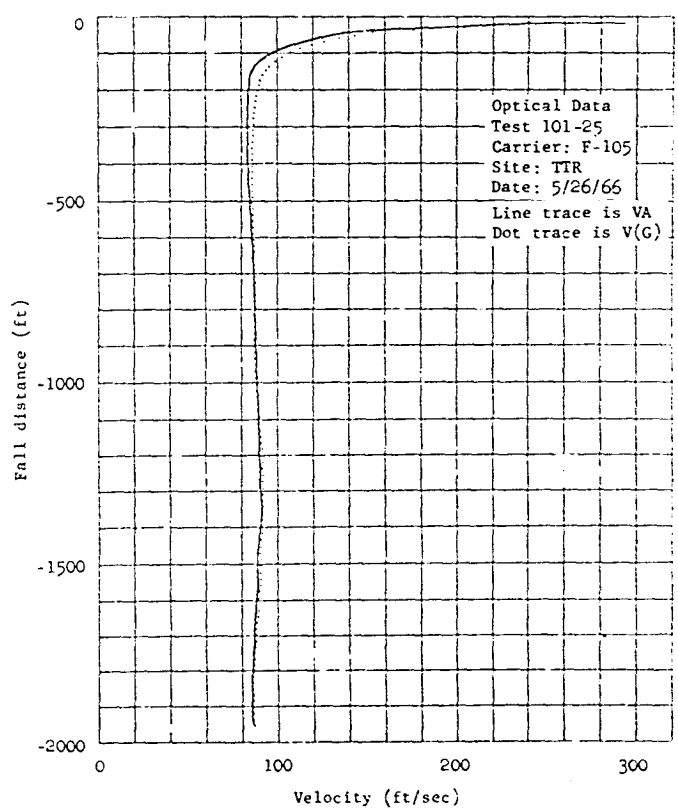


Figure 15.
Total velocity vs time

Figure 16.
Fall distance vs velocity



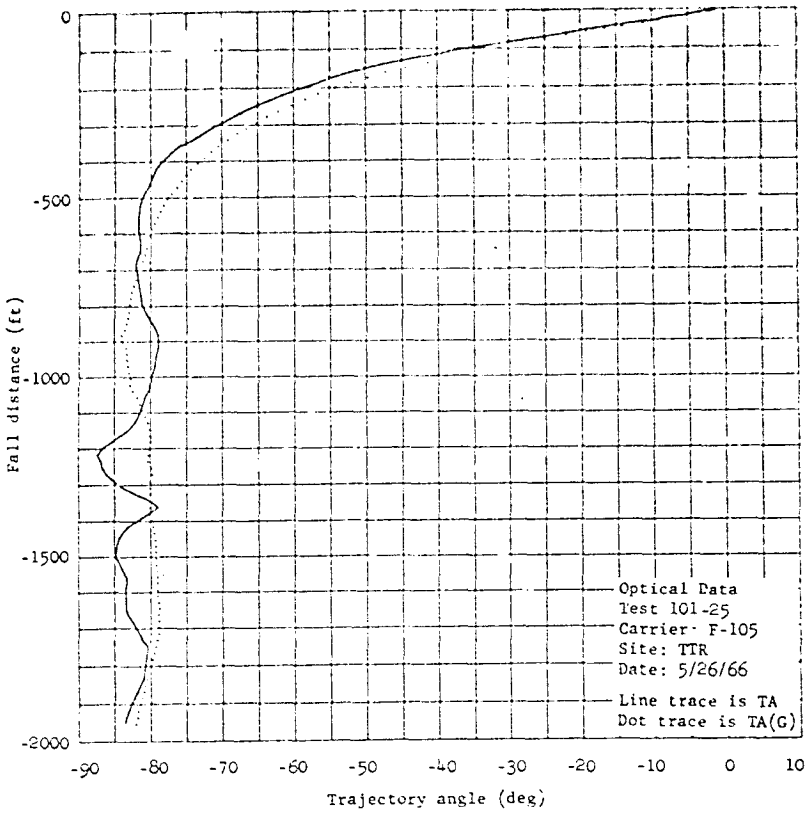


Figure 17.
Fall distance vs trajectory angle

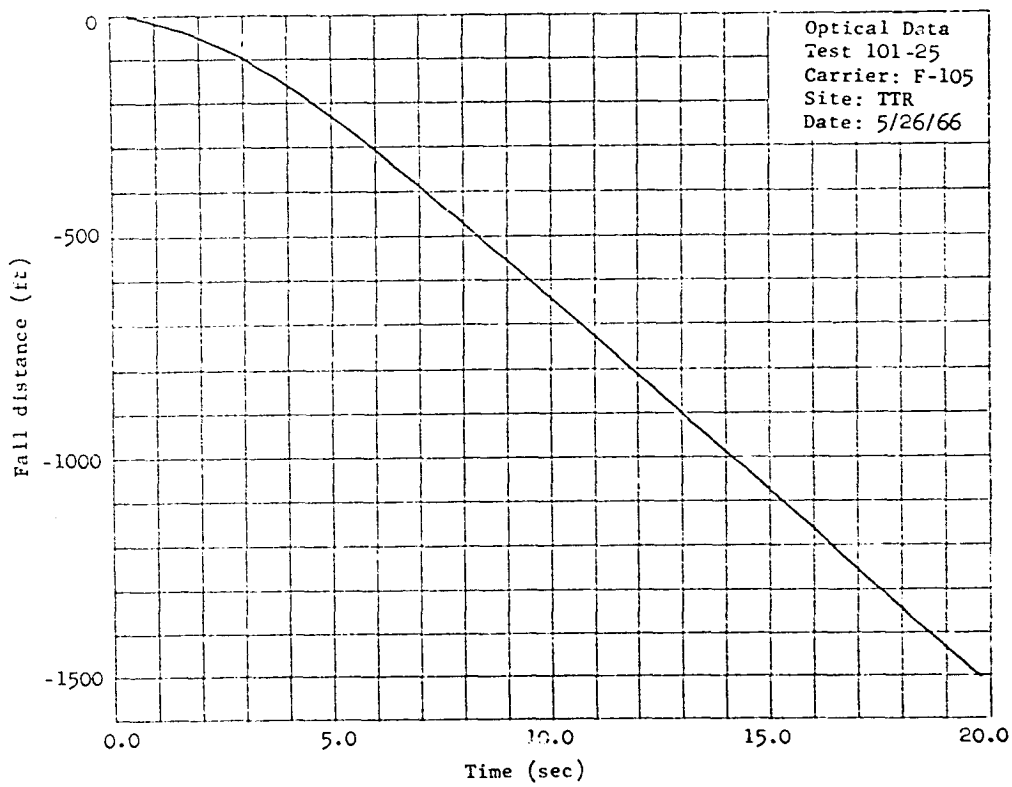


Figure 18.
Fall distance vs time

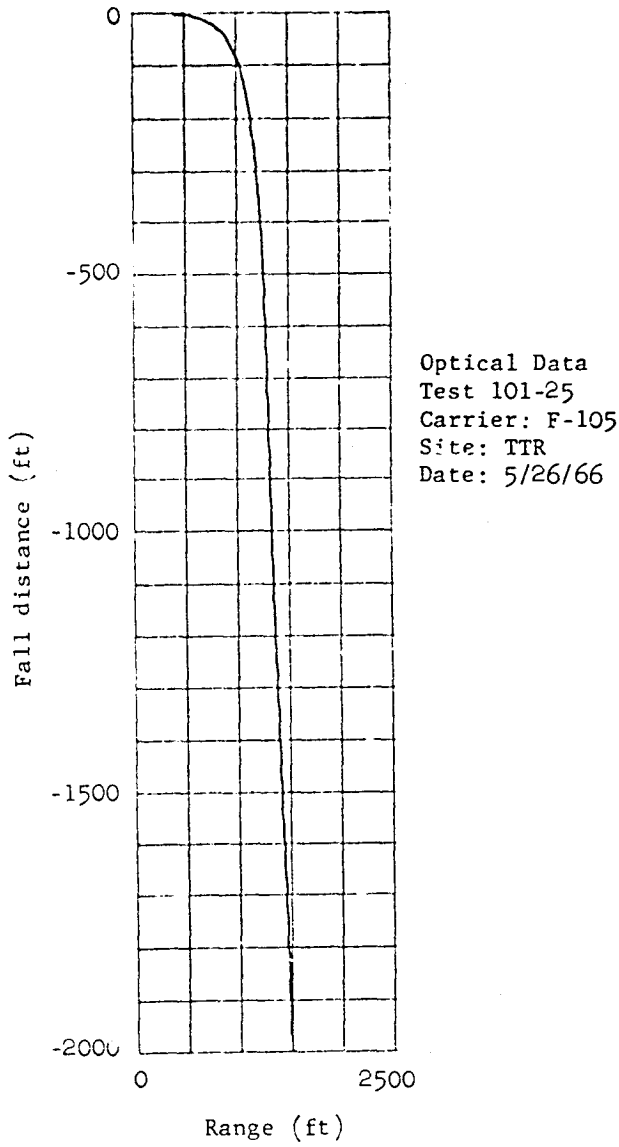


Figure 19. Fall distance vs range

APPENDIX C

Components Serial Numbers

APPENDIX C

Component Serial Numbers

Nomenclature	Dwg No.	101-23 Serial No.	101-24 Serial No.	101-25 Serial No.
Nose, MC1828 TRB	312248	4003	4000	Not recorded
Center case	206276	0420	0418	0549
Type I ballast		No S/N	No S/N	Not used
Type II ballast		Not used	Not used	No S/N
Preflight case	206271	00070	0069	00066
MAT control box	N91554	043	046	Not recorded
MC1951 simulator	P11848	No S/N	No S/N	No S/N
Rear case	260045	P6	15	P45
MC1887 parachute	311829	50655-32-20	50655-33	Not recorded
MC1835	311784	00595	00625	Not recorded
MC1876	311818	X330	Not recorded	Not recorded
Jumper cable	P13355	No S/N	No S/N	No S/N