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Report No. DPS/TR5-5047/1

ELECTRONIC CONTROL AND GUIDANCE DIVISION

REPORT ON

TESTS OF GUN DATA COMPUTER, T29E2 (U)

First Report On Ordnance Project No. TR5-5047

(D A. Project No. 514-03-001)

E. P CASSIDY

JUNE 1959

Aberdeen Proving Ground
Maryland

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U. S. ARMY ORDNANCE
DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

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TESTS OF GUN DATA COMPUTER, T29E2 (U)

First Report on Project No. TR5-5047

Dates of Test: July 1957 to October 1957

ABSTRACT (C)

The Gun Data Computer, T29E2, ~~Serial Number 1,~~ was subjected to accuracy, ruggedness, environmental, mechanical, electrical, reliability, and maintainability tests to determine if it would satisfy engineering requirements. The gun data computer satisfied all engineering requirements except those pertaining to extreme-temperature tests. The Gun Data Computer, ~~T29E2, Serial Number 1,~~ is satisfactory for "user" tests at normal temperature. It is recommended that the gun data computer be modified ~~as detailed in the body of this report~~ before being considered for complete "user" tests.

CONTENTS

1. (U) INTRODUCTION

The Gun Data Computer T29E2, is a modified version of the Gun Data Computer T29E1. Both computers perform the same functions as the Gun Data Computer, T29, which they supersede, by determining values of deflection, quadrant elevation, and fuze time for the 105-mm howitzers, M2 and M2A1. The Gun Data Computer, T29E2, differs from the T29 and T29E1 in that it may also be adapted for use with the 155-mm howitzer, M1A2, by means of four interchangeable units. The operator performs the functions of and replaces the horizontal control operator, vertical control operator, and computer, described in FM6-40, dated January 1951. In addition to the elimination of the foregoing personnel, the computer makes the artillery fire direction center more efficient by reducing computation errors arising from stress and fatigue of personnel, and by permitting the use of less highly trained personnel than could previously be used in fire direction centers.

2. (U) DESCRIPTION OF MATERIEL

The Gun Data Computer, T29E2, is a transportable, electromechanical instrument capable of computing fire control data for the 105-mm howitzers, M2 and M2A1, and a 155-mm howitzer, M1A2. The computer is part of a fire direction system consisting of a power generator, power conversion unit, one, two, three or six computers, one gunnery officer's console, and a plotting board. For a more detailed description of Gun Data Computer, T29E2, see Reference 1.

3. (C) DETAILS OF TEST

3.1 Procedure

3.1.1 Accuracy Tests. The problems used to check the computer accuracy are listed in Appendix A.

Three types of problems were used for both the 105-mm and 155-mm trajectories. The first tw groups, geometry and ballistic problems, were used to check the performance of the computer in computing the effects of nonstandard meteorological and ballistic conditions. All ballistic and meteorological inputs, except the one involved in the particular test problem, were kept to standard conditions during the test. The third group, miscellaneous problems, includes both high and low angle computations in which the effects of nonstandard meteorological and ballistic effects are cumulative.

3.1.2 Ruggedness Tests. The computer, power conversion unit, and ballistic changeover units were mounted securely to the bed of a truck and transported over a 10-mile gravel course. Typical problems were solved before and after the road tests and the results compared with established standards.

3.1.3 Mechanical Tests. Tests were conducted to determine if the input controls would be damaged should their limits be inadvertently exceeded. Through the performance of all tests, frequent visual inspections for mechanical failures were made.

3.1.4 Electrical Tests. The computer was inspected for shock hazards as well as for overload protection devices.

3.1.5 Environmental and Storage Tests

3.1.5.1 High-Temperature Tests. The computer was placed in a test chamber and the temperature raised to /125°F. The computer required approximately two hours to reach a stable temperature of /167°F in the /125°F ambient temperature. The exact time could not be determined because of a generator shutdown for refueling. Operational tests were performed on the computer at /167°F. The air temperature was then raised to /160°F and the computer was stored at this temperature for a period of four hours with the full impact of solar radiation of an intensity of 360 Btu/sq ft/hr.

3.1.5.2 Low-Temperature Tests. The computer was placed in a test chamber and the temperature lowered to -40°F. After an exposure of 72 hours without the benefit of solar radiation, the computer was energized and allowed to warm up for a period of 30 minutes. A test problem was then inserted at 10-minute intervals and all computer outputs recorded for each stage.

At the conclusion of the above test the air temperature was lowered to -80°F for an exposure time of 72 hours. The computer was then allowed to return to room temperature and was checked for malfunctioning and physical damage.

3.1.6 Reliability and Maintainability. Throughout the performance of all tests, a log was kept of computer operation. All failures, replacement of parts, and data pertinent to reliability and maintainability were recorded.

3.2 Results

3.2.1 Accuracy Tests

3.2.1.1 Geometry Problems. The answers obtained by solving the geometry problems with the Gun Data Computer T69A2, Serial Number 1, are shown in Appendix B. The average error in azimuth was approximately two mils for the 105-mm and approximately three mils for the 155-mm trajectories.

3.2.1.2 Ballistic Problems. The average error in quadrant elevation (Q.E.) for the 105-mm low-angle, normal-trajectory ballistic problems was 1.35 mils with approximately 83 per cent of the answers being within specifications. For the 155-mm low-angle, normal-trajectory ballistic problems the average error was 0.68 mil with approximately 94 per cent of the answers being within specifications. The average error for the 105-mm high-angle, normal-trajectory ballistic problems was 1.79 mils with approximately 81 per cent of the answers being within specifications. For the 155-mm high-angle, normal-trajectory ballistic problems the average error was 1.21 mils with approximately 84 per cent of the answers being within specifications. Detailed results are contained in Appendix B.

3.2.1.3 Miscellaneous Problems. The difference between the computer outputs and the correct test directive answers to the problems are listed in Appendix B.

3.2.2 Ruggedness Tests. The answers to a test problem inserted into the computer before and after 10 miles of road testing on the Munson gravel course are contained in Appendix B. None of the changes in answers exceeded the maximum permissible errors.

3.2.3 Environmental and Storage Tests

3.2.3.1 High-Temperature Tests. The computer required approximately two hours to reach a stable temperature of +167°F in a +125°F ambient temperature. The exact time could not be determined because of a generator shutdown for refueling.

The errors in test problem answers, after the computer had stablized for 2 hours in a +125°F ambient temperature, are listed in Appendix B. All seven range errors were greater than 10 meters; four out of seven azimuth answers were greater than 1 mil; three out of seven fuze errors were greater than 1/10 second; all seven Q.E. answers were greater than 1 mil.

After the computer was stored for 4 hours at a +160°F ambient temperature with the full impact of solar radiation of an intensity of 360 Btu/sq ft/hr and then brought back to room temperature, two deficiencies were noted:

a. The paint on the front of the 105-mm fuze unit had blistered in the intense heat.

b. The rear portion of the weight-of-projectile potentiometer had become open-circuited.

3.2.3.2 Low-Temperature Tests. The computer required approximately three hours to reach a stable temperature of +20°F in an ambient temperature of -40°F. This temperature reading was obtained from a thermocouple temperature measuring device placed just inside the rear panel of the computer behind the amplifier bank. The exact time of reaching this stabilizing temperature could not be determined because of a 5-minute generator shutdown for refueling.

The errors in the test problem answers, after the computer was allowed to warm up for 3 hours and 20 minutes in a -40°F ambient temperature, are listed in Appendix B. Six out of seven range answers were greater than 10 meters; four out of seven azimuth answers were greater than 1 mil; two out of seven fuze errors were greater than 1/10 second; three out of seven Q.E. errors were greater than 1 mil.

After the computer had been stored at -73°F for a period of 72 hours and brought back to room temperature, it was found that the plastic sheathing on the cable connecting the meterological panel to the main frame had become brittle and cracked in the extreme cold.

3.2.4 Mechanical Tests. Tests were made to exceed the operating limits of the input controls to determine if the controls would be damaged should the limits be inadvertently exceeded. The results of this test failed to show any damage to the controls.

3.2.5 Electrical Tests. All power and lighting circuits were found to be properly fused.

3.2.6 Reliability and Maintainability. The following failures were noted during the course of the tests:

a. An open wire developed on the 105-mm quadrant elevation unit.

b. The paint on the front of the 105-mm fuze unit had blistered in the intense heat of the high-temperature test.

c. The rear portion of the weight-of-projectile potentiometer had become open-circuited during the high-temperature test.

4. (C) CONCLUSIONS

Gun Data Computer, T29E2, Serial Number 1, satisfied all engineering requirements except those pertaining to extreme-temperature tests.

Gun Data Computer, T29E2 is satisfactory for "user" tests at normal temperatures.

5. (C) RECOMMENDATIONS

Heaters should be installed on all Gun Data Computers, T29E2, intended for extreme cold weather operation.

The existing weight-of-projectile potentiometer should be replaced by one which is more reliable and unaffected by large temperature changes.

A more flexible type sheathing should be used to replace the present plastic sheathing on the cable from the met panel.

Lights on the fuze unit indicator should be placed in a more easily accessible position.

All servos containing limit stops should be equipped with slip clutches.

SUBMITTED:

E. P. CASSIDY
SP3, Ord Corps
Test Director

REVIEWED:

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Chief, Research and Engineering
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SAUL TARAGIN
Chief, Electronic Control and
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APPROVED:

H. A. NOBLE
Assistant Deputy Director
for Engineering Testing
Development and Proof Services

REFERENCES

1. Notes on Development Type Material, FCDD-294, Gun Data Computer, T29E1, Belock Instrument Corporation, College Point, Long Island, New York.

2. FM 6-40 Field Artillery Gunnery dated January 1950.

3. FT, Howitzer, 105-mm, M2A1 and M4, FT 1054-4, dated July 1951.

4. FT, Howitzer, 155-mm, MM and M1, FT 155 Q-2, dated April 1944.

APPENDICES

APPENDIX A
Test Directive

JAGlover/jd/52179

WAR DEPARTMENT
OFFICE OF THE CHIEF OF ORDNANCE
WASHINGTON, D. C.

IN REPLYING REFER TO
No. 00/70 8495

ATTENTION OF
OCDTR

MAY 23 1957

SUBJECT: Test Directive - Gun Data Computer, T29E2 (U)

TO: Commanding General
Aberdeen Proving Ground
Maryland

ATTN: ORDGB-AA-D&PS

1. This pertains to Ordnance Project TR 5-5047 Priority 1C.

2. Objective: To determine whether Gun Data Computer, T29E2 is suitable for submission to the U. S. Army Artillery Board as an item proposed for standardization.

3. Materiel Required:

a. Gun Data Computer, T29E2

b. Power Conversion Unit

c. Dummy Gunnery Officers Console

d. Set of Cabling

e. 3 kw 3 ph 400 cycle Engine Generator.

Items a through d with necessary spare parts will be furnished by Frankford Arsenal. Item e is available at your proving ground.

4. Technical Characteristics: Gun Data Computer, T29E2 has been developed to furnish output data for conducting firing missions with the 105mm Howitzer M2A2, FT 105-H-4 and the 155mm Howitzer M1A2, FT 155-Q-2. One set each of the following interchangeable units are furnished for each weapon:

a. Range Unit

b. Fuze Unit

F. G. #57 57

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c. Main Control and Charge Switch Units

d. Muzzle Velocity Unit

e. Quadrant Elevation Unit.

5. Status: The items listed in paragraph 3 above are expected to be ready for shipment to your proving ground approximately 1 June 1957.

6. Test Procedure:

a. Service Contract: In the event of a major malfunction due to tests being performed, Frankford Arsenal is to be notified immediately. Major repairs will be made by personnel of the contractor, Belock Instrument Company. Your proving ground is authorized to make minor repairs as may be necessary.

b. Reference Materiel:

(1) Test Directive - Gun Data Computer T29E1, Chief of Ordnance to your proving ground, dated 3 November 1954, file OO/4C-23715.
c)413.51//8

(2) Notes on Dev. Type Mat. Gun Data Computer T29E2 (with shipment).

(3) Appendix A, in 4 parts (inclosed).

(4) Appendix B, in 4 parts (inclosed).

c. Engineering: The data listed in references 6b(3) & (4) above were used by the contractor in conducting acceptance tests. (These data should be checked by your proving ground prior to their use in engineering test problems.) Test problems should include intermediate data as well as the data shown in the inclosed appendices.

d. Accuracy:

(1) The accuracy tests are divided into four parts.

(a) Geometry Tests: These tests check the Computer accuracy in solving the Azimuth and Range for the three conditions of the Target Grid System for Field Artillery. In addition, the replot portion of the Computer is fully checked.

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(b) Ballistic Tests: These tests check Computer accuracy in solving for Quadrant Elevation under both normal and abnormal conditions of meteorology, muzzle velocity and projectile weight, for targets both above and below the level of the weapon.

(c) Combined Tests: These tests combine the problems of a and b above and check the Computer accuracy for a "real" problem with extreme abnormalities including the effects of jump, drift and cross wind. Problems are included for both high and low angle fire.

(d) Other Accuracy Tests: These tests check the Computer accuracy for the following items:

1 Percentage Range Correction

2 Percentage Fuze Correction

3 Range Spread

4 Fuze

5 Fuze-type Spots.

Note: When testing the Computer for accuracy, all inputs must be checked for proper settings. Unless otherwise specified, these are the settings for standard conditions using center range and P.D. fuze. Geometric and muzzle velocity settings are zero unless otherwise specified. The operator should check to insure that the proper Main Control Unit, Fuze Unit, Q.E. Unit and Muzzle Velocity Unit are being used to conform to the ballistics of the weapon being tested.

(2) The Geometry Test Problems of Appendix A, Part 1, shall be inserted with the Computer set for standard ballistic and meteorological conditions. The Q.E. and Fuze units are disengaged. The "Survey" position of the Compute Switch is to be used to obtain Range and Azimuth. Upon completion of each problem, the Easting, Northing and Height Replot data is obtained.

(3) The Normal Trajectory Test Problems of Appendix A, Part 2, for the 105mm Howitzer are inserted with the Computer, set for standard ballistic and meteorological conditions. The range may be inserted using either the Observer Distance or Northing inputs. The range will be read from the range output dial. The height is inserted via the Height input unit. The "Survey" position of the Compute Switch is required. The Quadrant Elevation readings will be recorded. Upon completion of these problems, the

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Normal Trajectory Test Problems of Appendix B, Part 1, for the 155mm Howitzer will be inserted. The test will be conducted in a manner similar to that given above. Both Quadrant Elevation and Fuze readings will be recorded.

(4) The Abnormal Effect Trajectory Problems of Appendix A, Part 2, for the 105mm Howitzer will be inserted into the Computer. All ballistic and meteorological effects shall be set at standard conditions except for the particular effect under consideration. When inserting meteorological data, all ten lines of the Meteorological Panel shall have the same setting. Range and height data are inserted as in paragraph 3. The "Survey" position of the Compute Switch is used and the Quadrant Elevation readings are recorded. The Wind Test Problems shall be inserted in such a manner that the Azimuth indication shall be zero mils. For the purposes of this test, a 50 mph Plus Wind shall be considered a Rear Wind and a 50 mph Minus Wind shall be considered to be a Head Wind. The Plus Wind shall be inserted as a 50 mph South Wind on all lines of the Meteorological Panel and the Minus Wind shall be inserted as a 50 mph North Wind on all lines of the Meteorological Panel. Upon completion of these problems, the Abnormal Effect Trajectory Test Problems of Appendix B, Part _, for the 155mm Howitzer will be inserted. The test will be conducted in a manner similar to that given above. Both Quadrant Elevation and Fuze readings will be recorded.

(5) The Combined Effects Trajectory Test Problems of Appendix A, Part 3, for the 105mm Howitzer shall be inserted in the Computer. The "Compute" position of the Compute Switch is required. All ballistic and meteorological effects except those specifically noted shall be set at standard conditions. Range, Azimuth, Fuze and Quadrant Elevation shall be recorded. Upon completion of these problems, the Combined Effects Trajectory Test Problems of Appendix B, Part 3, for the 155mm Howitzer shall be inserted. The test will be conducted in a manner similar to that used above.

(6) The Fuze Test Problems of Appendix A, Part 4, for the 105mm Howitzer shall be inserted in the Computer. Height is set at zero, and all ballistic and meteorological effects are set for standard conditions. Both Fuze and Quadrant Elevation readings will be recorded. Upon completion of these problems, the Fuze Test Problems of Appendix B, Part 4, for the 155mm Howitzer shall be inserted in the Computer. This test shall be conducted in a manner similar to that given above.

(7) A random selection of several problems from each charge listed in F.T. 105-H-4 shall be used to check the 105mm ballistics with respect to Weight of Projectile, Cross Wind, Drift, and Jump. Jump data to be used is for the 105mm Howitzer M2A1 in Carriage M2A2. A random selection

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of several problems from each charge listed in F.T. 155-Q-2 shall be used to check the 155mm ballistics with respect to Drift, Cross Wind and Jump. Jump data to be used is for the 155mm Howitzer M1 and Carriage 155 M2. The percentage Range and Fuze Corrections will both be tested at their maximum values to insure proper operation. The Time Fuze and VT Fuze settings will be tested to insure that a 25 ft. change in height of target is being inserted. The Range Spread settings will be tested at -1C, -½C, +½C and +1C to insure that a Range Change is -100, -50, +50 and +100 meters, respectively.

(8) Accuracy of the Computer Outputs shall be as follows:

Quadrant Elevation - ± 1 mil or the equivalent permissible range error.

Range - ± 10 meters, ± .1% of maximum range or ± ½ probable error, whichever is greatest.

Fuze - ± .1 seconds for low angle fire; ± .2 seconds for high angle fire.

Azimuth - ± 1 mil or the equivalent range error.

Discretion will be used when evaluating the results of tests involving problems with large height of target and/or large abnormal ballistic and meteorological conditions since data on probable error for these circumstances are not available. The Q.E. answers to the problems listed in Appendices A and B, Part 2, which lie between the answer listed and the ENIAC value shall be considered acceptable. In Appendix B, Part 2, neither the Fuze answers or the answers for those problems in the 900 or 1200 mil sections will be used in determining the acceptability of the Gun Data Computer T29E2. It should be noted that the basic meteorological and ballistic settings for the problems of Appendices A and B, Part 2, are to be inserted using the F.A. Voltage Test Set in conjunction with the Computer Null Meter.

e. Stability:

(1) The Computer shall be left in the "Standby" condition for a period of thirty minutes. Any changes in Quadrant Elevation, Range, Fuze or Azimuth shall be noted when the switch is thrown to "Compute" at the end of this time.

(2) The Computer shall remain energized for a period of eight continuous hours during the conduct of the Acceptance Test. The test problem will be inserted at the end of this time and the answers recorded.

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(3) The Computer will be tested for proper shielding of sensitive components by bringing the operators body or some foreign object close to these components when the instrument is in the case during the solution of a problem.

(4) The Computer shall be struck by hand to simulate bumps which it may receive during normal usage. This will be done during the solution of a problem.

f. Interchangeability: The ease and facility with which the units listed, paragraph 4 above, can be inserted and removed is to be determined.

g. Ruggedness: The Computer, Power Conversion Unit and set of Changeover Ballistic Units shall be securely fastened to the body of a truck and the vehicle then driven at moderate speeds over unimproved dirt roads and/or streets for a distance of ten miles. These units shall then be set up indoors, carefully inspected for physical damage, energized and the test problems inserted.

h. Ease of Operation: During the conduct of all tests, ease of setting knobs and reading results shall be noted. All dials shall be inspected for proper range of marking, convenient division and adequate lighting. The number of men required to move the Computer will be noted.

i. Ease of Maintenance: The Computer shall be examined for ease of replacing subassemblies and lights, location and accessibility of test points and cable receptacles.

j. Shock Hazards: Throughout all tests, the Computer and Power Conversion Unit shall be examined for existing shock hazards. In no case will electrical connection between the cases of these units and either side of the power source be permitted.

k. Overload Protection Devices: All handwheels greater than two inches in diameter shall contain clutches to prevent damage to the instrument due to turning the handwheel past the limit stops. (All servos containing limit stops shall have similar protection to prevent damage to the servo motor. All power and lighting circuits shall be properly fused.)

l. Environmental Tests:

(1) Storage: The equipment must be capable of safe storage without permanent impairment due to the effects of extreme temperature. The required temperatures for storage purposes are:

Lower limit - 80°F. for at least 3 days duration

Upper limit - 160°F. for periods of 4 hours a day.

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(2) Operation: The equipment will be tested to insure acceptable performance within a temperature range from 125°F (plus minimum exposure of 4 hours with full impact of solar radiation, 360 BTU/SqFt/Hr) to -40°F (minimum exposure of 3 days without benefit of solar radiation). "Warm up" time required to reach operating temperature is to be recorded. All temperature testing will be continued until the internal temperature of the computer has been stabilized. The time required after energizing the computer for it to reach a condition of efficient and accurate operation is to be determined.

7. Reports: Correspondence and reports pertaining to these tests are Confidential. Memorandum reports will be required at the conclusion of accuracy tests and at the conclusion of ruggedness tests. These reports are to be submitted to the Chief of Ordnance, Attn: ORDTR.

8. Funding: Program Schedule 7040-5400-10 SEA No. 575 and Work Schedule 8040-5400-10-575 SEA No. 575 provide program authority for conducting engineering tests of Computer T29E2.

9. Testing Period: Gun Data Computer T29E2 is to be thoroughly tested as outlined above. Tests are to be completed 3 months from receipt date at your proving ground.

FOR THE CHIEF OF ORDNANCE:

17 1/2 Incls
a/n

William W. Foster
WILLIAM W. FOSTER
Lt Col, Ord Corps
Assistant

APPENDIX A

PART I

GEOMETRY

105 and 155 mm Howitzers

and

NORMAL TRAJECTORIES 105 mm Howitzer

GEOMETRY TEST PROBLEM

ORIGIN SET AT O

PLOT NO.	E	N	H	GEO. REC. COR AZ	DIST	VA	LR	CR	DU	INITIAL AZ	REPLOT E	REPLOT N	REPLOT H
1	0	3350	-9	0	350	20	0	0	0	3700	0	0	2700	0
2	-418	7176	52	250	700	40	200	200	20	7000	0	0	7000	100
3	1036	11410	98	500	1050	60	400	400	40	14500	0	0	14500	200
4	121	330	130	750	1400	80	600	600	60	2700	800	1909	1909	300
5	3492	4905	148	1000	1750	100	800	800	80	8000	800	5657	5657	400
6	6777	10150	152	1250	2100	120	1000	1000	100	14500	800	10253	10253	500
7	-1050	836	141	1500	2450	140	1200	1200	120	2700	1600	2700	0	600
8	4051	2061	117	1750	2800	160	1400	1400	140	8000	1600	8000	0	700
9	10734	3296	78	2000	3150	180	1600	1600	160	14500	1600	14500	0	800
10	-1376	2694	24	2250	3500	200	1800	1800	180	2700	2400	1909	-1909	900
11	3492	134	-245	2500	3850	220	2000	2000	200	8000	2400	5657	-5657	1000
12	8362	-6961	-388	2750	4200	240	-200	-200	-20	14500	2400	10253	-10253	700
13	-1202	1292	-347	3000	4550	260	-400	-400	-40	2700	3200	0	-2700	600
14	-338	3676	437	3250	4900	280	-600	-600	-60	8000	3200	0	-8000	900
15	526	-10058	540	3500	5250	-240	-800	-800	-80	14500	3200	0	-14500	800
16	402	2551	629	3750	5600	-220	-1000	-1000	-100	2700	4000	-1909	-1909	-700
17	-3147	-1450	703	4000	5950	-200	-1200	-1200	-120	8000	4000	-5657	-5657	-600
18	-7770	-2533	765	4250	6300	-180	-1400	-1400	-140	14500	4000	-10253	-10253	-500
19	1668	-2447	815	4500	6650	-160	-1600	-1600	-160	2700	4800	-2700	0	-400
20	-2195	-2053	848	4750	7000	-140	-1800	-1800	-180	8000	4800	-8000	0	-300
21	-8563	-418	870	5000	7350	-120	-2000	-2000	-200	14500	4800	-14500	0	-200
22	5052	-1383	658	5250	7700	-100	0	0	0	2700	5600	-1909	1909	-100
23	-557	-636	528	5500	8050	-80	50	50	5	8000	5600	-5657	5657	-100
24	-3270	-3066	385	5750	8400	-60	100	100	10	14500	5600	-10253	10253	-100
25	3119	-5332	249	6000	8750	-40	-50	-50	-5	2700	6400	-365	2867	-100
26	-2	5542	84	6250	9100	-20	100	-100	-10	14500	6300	-1421	14430	-100

573 480

2867

155 MM GUN-M1 ELEVATION CHECK

SHIMS

I

Φ	R	H	Φ'
200	1952	68	200.3
-200	1588	9993	200.0
-200	2218	9758	199.2
500	1877	719	499.3
-500	3020	9947	500.1
500	3396	9756	499.8
1000	2656	784	999.1
-1000	3170	43	999.5
1000	3504	9605	999.7

II

200	1240	73	199.9
-200	1757	9996	200.0
200	2416	9799	199.8
-500	2662	495	499.4
-500	3514	19	500.4
500	3265	9812	500.4
1000	3268	723	999.9
-1000	3758	10	999.6
1000	3753	9543	999.7

III

200	1579	80	199.8
-200	2098	9996	200.1
200	2555	9772	200.4
500	2571	576	501.1
-500	4194	10	500.1
500	4366	9902	499.8
-1000	3794	823	998.6
1000	4457	9976	999.3
1000	4518	9866	999.4

IV

200	1767	117	199.6
-200	2629	9991	199.9
200	3415	9762	200.0
-500	3079	125	500.5
-500	5205	9979	500.1
500	4952	9832	500.0
1000	4918	807	999.7
-1000	5433	9986	1000.2
1000	5499	9866	1000.3

V

Φ	R	H	Φ'
200	2313	156	199.6
200	3392	1	200.2
-200	4170	9788	200.6
-500	4693	345	499.4
-500	6724	9973	500.0
500	7052	9749	500.2
1000	6540	756	1000.5
-1000	7029	9918	999.2
1000	7076	9627	998.9

VI

200	2890	203	200.5
-200	4265	9987	201.0
200	4868	9518	201.0
-500	6669	771	499.6
-500	8167	9976	499.9
500	8472	9761	499.9
1000	8155	782	999.2
-1000	8600	9985	999.5
1000	8677	9837	999.4

VII

200	3661	299	201.5
-200	5442	9998	202.2
200	6003	9826	202.2
500	8589	754	498.1
-500	9838	9975	498.4
500	9972	9875	498.4
1000	10040	636	1000.7
-1000	10393	9952	999.8
1000	10473	9789	999.6

APPENDIX A

PART 2

ABNORMAL EFFECTS TRAJECTORIES

105 mm Howitzer

Inch, Ordtg 413-5½ 1957

105 MM Q [illegible] ELEVATION CHI K
PLUS MUZZLE VELOCITY

CHARGE V + 50 F/S

Θ	R	H	
200	2963	121	199.8
200	4049	9899	200.9
200	4575	9735	201.2
500	5094	891	502.4
500	7300	9891	502.2
1000	7045	740	1001.8
1000	7421	94	1001.1
1000	7545	9864	999.7

CHARGE VI + 50 F/S

Θ	R	H	
200	2658	287	200.0
200	4400	9897	201.4
200	4953	9885	201.5
500	7017	752	499.5
500	8387	7	498.9
500	8562	9885	498.7
1000	8454	799	999.7
1000	8706	332	999.5
1000	8967	9837	999.5

CHARGE VII + 50 F/S

Θ	R	H	Θ1
200	3111	342	199.0
200	5656	9997	202.5
200	6106	9844	202.6
500	8711	752	498.6
500	10107	7	498.1
500	10241	9865	499.0
1000	10188	799	1000.9
1000	10681	332	999.6
1000	10735	9857	999.5

105MM QUADRANT ELEVATION CHECK

MINUS MUZZLE VELOCITY

CHARGE I - 30 F/S

Φ	R	H	Φ'
200	730	68	201.3
200	1436	9779	200.3
200	2119	9738	197.1
500	1908	335	499.2
500	2800	9919	499.9
1000	3089	9775	501.2
1000	2914	9953	996.6
1000	3051	9832	998.2

CHARGE II - 30 F/S

Φ	R	H	Φ'
200	1187	63	201.2
200	1571	5	200.3
200	2317	9779	198.3
500	1752	460	496.9
500	3372	9941	500.5
500	3681	9728	501.8
1000	2945	760	994.7
1000	3498	9931	1000.1
1000	3553	9783	1000.3

CHARGE V - 50 F/S

Φ	R	H	Φ'
200	1670	161	201.8
200	3260	9971	199.5
200	3752	9833	198.9
500	3398	993	499.6
500	6307	9926	499.4
500	6367	9813	499.0
1000	5899	903	996.7
1000	6495	9918	996.6
1000	6542	9830	996.6

CHARGE VI - 50 F/S

Φ	R	H	Φ'
200	1619	207	200.8
200	4292	9951	200.8
200	4794	9792	200.6
500	6320	784	499.7
500	7682	117	501.1
500	8118	9819	500.7
1000	7826	9825	1000.7
1000	8383	755	1000.7

CHARGE VII - 50 F/S

Φ	R	H	Φ'
200	2952	308	201.5
200	5231	9999	201.9
200	5902	9793	201.8
500	7989	895	997.5
500	9570	9979	998.7
1000	9837	9713	999.0
1000	9754	643	1001.2
1000	10132	9917	1001.2
1000	10158	9864	999.7

I

200	[illegible]	75	200.5
200	1512	9993	200.1
200	2239	9954	199.1
500	1691	963	498.0
500	3123	9960	499.2
500	3302	9987	500.6
1000	2411	996	1002.6
1000	3293	56	1001.2
1000	3473	9959	999.3

II

200	1245	73	200.3
200	1544	9991	200.2
200	2438	9950	199.3
500	2196	990	499.3
500	3569	24	499.4
500	3401	9991	500.2
1000	3354	987	999.0
1000	3912	9957	999.1
1000	3972	9957	998.1

III

200	1366	98	200.7
200	2292	9963	200.3
200	2969	9846	200.4
500	2904	595	501.0
500	4266	15	499.8
500	4618	9989	501.0
1000	4111	702	1004.0
1000	4554	64	1002.0
1000	4652	9884	1001.5

IV

200	2022	95	200.6
200	2505	21	200.3
200	3451	9962	200.1
500	3111	730	501.0
500	5337	9952	499.7
500	5531	9831	499.7
1000	5042	830	999.0
1000	5658	9930	999.5
1000	5774	9126	999.5

V

200	1772	179	199.9
200	3669	9966	199.5
200	4524	9904	199.6
500	4546	904	501.0
500	6134	9941	500.1
500	7241	9979	500.0
1000	6766	913	999.1
1000	7210	9976	1000.0
1000	7419	9949	999.5

VI

200	2662	231	199.6
200	4610	9957	200.1
200	5011	9993	200.2
500	7236	976	501.4
500	8153	9936	499.4
1000	8742	993	1000.1
1000	9281	9861	999.9
1000	9310	9910	999.3

VII

200	3012	324	199.9
200	5653	5	201.3
200	6254	9935	201.9
500	9020	940	499.0
500	10516	9976	499.4
500	10662	9973	999.5
1000	10972	850	1002.1
1000	11186	1955	1000.3
1000	11274	9990	1001.3

105 MM [illegible] ELEVATION. MEA

MINUS 30 MPH WIND

I

Φ	R	H	Φ'
200	762.	74	198.9
300	1453	9992	199.9
400	2196	9978	199.1
500	1662	917	503.4
600	3030	9950	501.0
800	3175	9961	500.1
1000	2965	772	995.0
1000	3154	9987	1000.6

II

200	1234	73	199.9
300	2015	9928	199.7
400	2394	9798	185.4
500	2154	471	499.9
600	3957	16	501.2
800	3766	9910	499.9
1000	3174	709	994.6
1200	3542	154	998.4
1400	3721	9927	998.9

III

200	1353	97	198.8
300	2208	9967	200.0
400	2622	9846	197.1
500	2727	548	502.7
600	4122	6	501.0
800	4453	9780	499.0
1000	3877	668	992.9
1200	4073	365	996.2
1400	4341	9882	997.6

IV

200	1512	129	198.9
300	2462	19	199.7
400	3369	9763	199.4
500	3039	719	501.1
600	5140	9944	501.1
800	5318	9921	499.5
1000	4758	791	997.6
1200	5177	75	999.3
1400	5279	9819	999.3

V

Φ	R	H	Φ
200	2256	150	200.1
300	3290	9951	199.3
400	3787	9830	199.9
500	4333	851	504.5
600	5350	9969	499.9
800	5474	9916	499.3
1000	6157	960	999.6
1200	6611	47	999.3
1400	6721	9924	999.9

VI

200	2507	214	201.2
300	4129	9960	201.5
400	4641	9802	201.2
500	6114	773	494.7
600	7597	9956	497.1
800	7799	9806	497.2
1000	7596	782	996.5
1200	8019	9856	998.5
1400	8043	9806	998.7

VII

200	2973	323	1993
300	5235	9993	202.3
400	5757	9821	201.9
500	7706	910	494.7
600	9212	9954	495.6
800	9417	9795	995.6
1000	9244	674	999.6
1200	9585	9949	999.1
1400	9655	9788	999.0

I

200	1034	53	199.5
200	1491	9912	199.2
200	2001	9851	199.1
500	1671	917	499.4
500	1857	9857	500.4
500	2007	9857	500.1
1000	2015	766	997.2
1000	3161	24	995.7
1000	3387	9905	997.4

II

200	1336	73	199.5
200	1633	19	199.7
200	2404	9771	199.6
500	1920	497	499.4
500	3487	14	500.7
500	3803	9807	500.5
1000	3238	700	999.5
1000	3718	9985	1000.2
1000	3911	9818	1000.4

III

200	1356	97	199.5
200	2216	9967	200.1
200	2632	9845	200.3
500	2371	588	501.6
500	4292	9917	500.1
500	4493	9771	499.5
1000	3957	653	999.5
1000	4364	14	1000.2
1000	4561	9646	1000.6

IV

200	1517	129	199.1
200	2475	19	199.8
200	3392	9761	200.0
500	3463	660	500.4
500	5190	9944	500.3
500	5372	9821	500.0
1000	4856	762	999.1
1000	5294	56	1000.1
1000	5400	9860	1000.3

V

200	1799	176	199.5
200	1921	9858	200.1
200	2013	9946	200.3
500	1926	226	500.1
500	6477	9858	500.3
500	6856	9950	499.8
1000	6117	331	1001.2
1000	6881	9897	997.6
1000	6911	9942	998.6

VI

200	0571	218	199.5
200	4332	9954	200.9
200	4616	9912	200.4
500	6345	521	500.6
500	3677	9110	502.0
500	7119	9830	501.0
1000	7861	965	998.6
1000	8393	9845	999.2
1000	8443	9831	999.2

VII

200	2986	317	200.1
200	5301	9901	201.5
200	5908	9911	201.4
500	3424	658	500.0
500	9547	9969	500.2
500	9764	9802	500.3
1000	9512	896	998.3
1000	9986	16	994.6
1000	10062	9824	996.6

[illegible] ELEVATION CHECK

— 10% AIR DENSITY

I

[illegible]	1134	84	200.4
200	1581	9993	200.1
200	2229	9958	200.4
500	2007	387	499.7
500	2900	53	500.2
500	3235	9827	500.1
1000	2662	301	996.6
1000	3230	61	994.7
1000	3703	9945	995.4

II

200	1244	74	200.3
200	2040	9924	200.0
200	2437	9800	200.0
500	2538	426	499.7
500	3542	26	500.3
500	3869	9818	500.1
1000	3299	747	998.1
1000	3700	195	998.4
1000	3896	9867	998.4

III

200	1364	97	200.1
200	2236	9968	200.2
200	2661	9846	200.4
500	2774	556	500.7
500	4232	18	500.1
500	4583	9792	500.1
1000	4043	718	998.2
1000	4470	80	998.8
1000	4595	9864	998.3

IV

200	1526	130	200.4
200	2787	9971	200.2
200	3438	9762	200.3
500	3923	583	500.0
500	5303	9966	500.1
500	5493	9843	500.2
1000	4981	955	999.0
1000	5655	9955	999.6
1000	5667	9950	999.6

V

200	1763	174	200.0
200	3919	4	200.5
200	3994	9830	200.5
500	4806	904	500.8
500	4729	47	500.3
500	5151	9769	500.3
1000	6446	835	999.6
1000	7461	9996	998.0
1000	7279	9968	997.8

VI

200	3211	180	201.2
200	4966	9979	201.3
200	4924	9824	201.3
500	6525	991	499.6
500	8487	9996	500.8
1000	8466	702	996.9
1000	8738	230	996.9
1000	9005	9729	997.0

VII

200	3080	[illegible]	200.5
200	5692	9999	203.5
200	6108	9844	203.7
500	8765	828	498.5
500	10149	9990	499.8
500	10288	9888	500.0
1000	10322	898	999.9
1000	10833	9993	997.9
1000	10833	9833	997.2

105 MM QUADRANT ELEVATION CHECK

PLUS 59° AIR TEMP.

V

Θ	R	H	Θ'
200	2322	158	200.5
200	3408	+	201.9
200	3933	9876	202.5
500	4480	878	343.4
500	7071	9762	501.8
1000	6548	777	996.3
1000	7012	9985	996.8
1000	7155	9773	1000

VI

200	2645	229	200.6
200	4428	9888	201.6
200	4994	9934	201.1
500	7065	753	502.1
500	8450	13	500.7
500	8628	9691	500.4
1000	8452	799	1000.4
1000	8928	9940	1000.1
1000	8980	9890	1000.1

VII

200	3370	317	200.3
200	5235	72	201.8
200	6396	9730	202.6
500	8758	816	500.4
500	10178	9951	500.2
500	10405	9778	500.1
1000	10216	860	1000.3
1000	10715	9909	999.1
1000	10769	9799	999.0

MINUS 59° AIR TEMP.

V

Θ	R	H	Θ'
200	2284	152	200.9
200	3394	9994	200.9
200	3857	9867	201.6
500	4415	864	498.8
500	6568	9787	999.9
500	6611	9707	999.6
1000	6367	566	999.1
1000	6857	51	999.3
1000	6977	9829	999.4

VI

200	2545	217	202.3
200	4214	9963	202.5
200	4742	9836	201.9
500	6776	787	997.5
500	7618	115	999.0
500	8098	9824	999.6
1000	7854	760	999.1
1000	8294	9976	999.7
1000	8370	9830	999.7

VII

200	3032	326	201.3
200	5364	2	204.0
200	5905	9831	203.7
500	8419	703	997.7
500	9544	9980	998.4
500	9675	9879	998.4
1000	9732	679	999.4
1000	10106	9955	998.7
1000	10184	206	998.6

APPENDIX A

PART 3

COMBINED EFFECTS TRAJECTORIES

105 mm Howitzer

105 MM. LOW ANGLE TEST PROBLEM

COMBINED EFFECTS

(In Linear Distance in Meters)

PROB.	GUN MIN E	GUN MIN N	GUN MIN H	REFERENCE E	REFERENCE N	REFERENCE H	CEP DIST	CEP AZ	CEP EA	ΔR	ΔA	ΔV
1	0	0	0	9[illegible]00	700	274	6315	1316	-50	L 125	R 154	U 82
2	0	0	0	9[illegible]00	700	274	5965	1316	-50	L 125	R 154	U 82
3	0	0	0	9[illegible]00	700	274	5965	1316	-50	L 125	R 154	U 82
4	0	0	0	9[illegible]00	700	274	5965	1316	-50	L 125	R 154	U 82
5	0	0	0	9[illegible]00	700	274	5965	1316	-50	L 125	R 154	U 82
6	0	0	0	9[illegible]00	700	274	5965	1316	-50	L 125	R 154	U 82
7	0	0	0	9[illegible]00	700	274	5965	1316	-50	L 125	R 154	U 82

PROB. NO.	SETTINGS
1	NORMAL
2	MUZZLE VELOCITY CHANGE + 30 F/S
3	SOUTH WIND 40 M/H WEST WIND 30 M/H
4	% STD. AIR DENSITY 110%
5	AIR TEMP. 0°F
6	POWDER TEMP 0°F
7	PROJ WT. .2 SQUARES

TEST ALL CHARGES FOR EACH PROBLEM, ADDING EACH SETTING TO THE PREVIOUS SETTINGS.

105 MM COMBINED EFFECTS

ANSWERS TO LOW-ANGLE TEST PROBLEMS

	NORMALS				MV				MV WIND			
Chg	R	AZ	F	QE	R	AZ	F	QE	R	AZ	F	QE
1	2986	645	19.3	536	2986	647	18.6	471	2986	647	18.5	461
2	2989	648	16.7	422	2989	649	16.4	381	2989	649	16.3	375
3	2993	649	14.7	340	2993	649	14.5	313	2993	649	14.5	310
4	2997	650	12.7	269	2997	651	12.7	252	2997	650	12.7	250
5	6004	3848	25.1	435	6004	3848	24.9	410	6004	3848	25.3	441
6	6007	3849	21.9	331	6007	3849	21.9	322	6007	3848	22.0	352
7	6007	3850	19.2	247	6007	3851	19.2	240	6007	3850	19.2	255

	MV, WIND, DENS.				MV, WIND DENS., A.T.				MV, WIND, DENS., A.T., P.T.			
Chg.	R	AZ	F	QE	R	AZ	F	QE	R	AZ	E	QE
1	2986	647	18.6	466	2986	647	18.6	466	2986	647	18.7	482
2	2989	648	16.8	379	2989	648	16.4	380	2989	648	16.4	392
3	2993	649	14.5	312	2993	649	14.5	312	2993	649	14.6	323
4	2997	650	12.7	252	2997	650	12.7	252	2997	650	12.7	260
5	6004	3848	25.4	454	6004	3847	25.7	468	6004	3847	26.0	494
6	6007	3848	22.2	363	6007	3848	22.3	388	6007	3848	22.4	401
7	6007	3850	19.3	267	6007	3850	19.4	276	6007	3850	19.4	285

MV, WIND, DENS., A.T., P.T., WT.

Chg.	R	AZ	F	QE
1	2986	647	18.8	489
2	2989	648	16.5	399
3	2993	649	14.6	327
4	2997	650	12.7	262
5	6004	3846	26.1	500
6	6007	3849	22.4	403
7	6007	3850	19.4	285

[illegible] 120 MM HIGH PRESSURE TEST FIRINGS

[illegible] CORRECTED EFFECTS

ALL CHARGES DETERMINED AT 70 DEGREES

ROUND	REFERENCE					DEV	DEV	DEV	RANGE	DEFLECTION	DEVIATION
	A	B	C	E	F	M	FPS	AZ	VR			
1	0	0	0	0	2975	91	0	0	0	0	0	0
2	0	0	0	0	2979	91	0	0	0	0	0	0
3	0	0	0	0	2976	91	0	0	0	0	0	0
4	0	0	0	0	2982	91	0	0	0	0	0	0
5	0	0	0	0	2984	91	0	0	0	0	0	0
6	0	0	0	0	2983	91	0	0	0	0	0	0
7	0	0	0	0	2983	91	0	0	0	0	0	0

ITEM NO. SETTINGS.

1 NORMAL

2 MUZZLE VELOCITY CHANGE -30 F/S

3 HEAD WIND 50 M/H WIND 20 M/H

4 % STD AIR DENSITY 90 %

5 AIR TEMP 118°F

6 POWDER TEMP 120°F

7 PROJ WT 1 SQUARE

SET ALL CHANGES FOR EACH PROBLEM, ADDING EACH SETTING TO THE PREVIOUS SETTING

ICS COMBINED EFFECTS

ANSWERS TO HIGH ALTITUDE TEST PROBLEM

NORMALS					MV				MV. WIND			
Chg.	R	AZ	E	QE	R	AZ	E	QE	R	AZ	E	QE
1	2986	6361	33.9	1069	2986	6312	28.9	961	2986	6370	26.7	913
2	2985	6343	39.4	1175	2986	6351	35.3	1125	2986	6348	33.0	1041
3	3991	6356	41.2	1093	3990	6345	36.7	1027	3990	6352	33.8	975
4	4994	6359	45.4	1074	4994	6366	40.9	1013	4994	6364	37.7	958
5	5997	6349	50.0	1130	5998	6355	50.1	1095	5998	6355	45.4	1041
6	6995	6344	62.0	1164	6996	6346	51.9	1151	6995	6344	52.5	1090
7	7989	6340	72.6	1196	7990	6341	62.3	1187	7988	6332	59.7	1131

MV, WIND. DENS.

Chg.	R	AZ	E	QE								
1	2985	6367	27.6	920	2985	6367	27.8	924	2985	6361	30.1	990
2	2986	6345	37.9	1103	2986	6346	33.7	1103	2986	6340	35.6	1131
3	3990	6360	35.0	1000	3990	6360	35.1	996	3990	6354	37.3	1039
4	4994	6361	39.2	986	4994	6361	39.2	995	4994	6357	41.7	1026
5	5998	6351	47.7	1065	5998	6351	47.5	1065	5998	6345	50.2	1094
6	6993	6339	55.3	1115	6993	6339	58.6	1141	6993	6330	60.5	1154
7	7984	6326	64.0	1160	7984	6323	66.9	1176	7984	6323	68.7	1185

MV, WIND. DENS., A.T., [illegible], WT.

Chg.	R	AZ	E	QE
1	2985	6359	31.0	1007
2	2984	6338	36.5	1141
3	3989	6352	38.1	1051
4	4993	6354	42.3	1035
5	5995	6344	50.7	1101
6	6990	6330	60.3	1155
7	7980	6322	68.3	1185

APPENDIX A

PART 4

FUZE

105 mm Howitzer

105 , M FUZE CHECK

RANGE IN YDS. & IN MILS F IN SECONDS

I

R	Θ	F	F'
[illegible]	[illegible]	[illegible]	6.0
1829	256.0	10.2	10.2
[illegible]	[illegible]	[illegible]	13.3
[illegible]	[illegible]	[illegible]	14.7
[illegible]	[illegible]	[illegible]	19.2
[illegible]	[illegible]	[illegible]	
[illegible]	935.3	31.6	31.6
[illegible]	[illegible]	[illegible]	33.5
2743	1077	36.0	36.1

II

1524	244.6	9.3	9.3
2286	378.7	11.7	11.9
2743	548.0	14.7	14.8
[illegible]	434.2	17.0	18.0
3962	524.5	21.0	21.0
4115	880.6	33.5	33.4
3658	1021.7	38.9	37.0
3200	1029.8	39.2	39.2

III

2102	262.8	9.7	9.7
2286	282.8	10.7	10.7
1943	275.2	13.1	13.1
[illegible]	353.5	15.7	15.8
3658	468.0	18.7	18.7
4115	450.5	22.0	22.0
4663	992.6	37.7	37.6
4572	961.7	38.6	38.5
4115	1074.6	41.4	41.4
3658	1160.5	45.2	43.1

IV

R	Θ	F	F'
2743	[illegible]	11.5	11.5
[illegible]	374.1	[illegible]	13.7
[illegible]	[illegible]	16.0	16.0
4115	[illegible]	18.5	18.5
4572	460.6	21.3	21.2
5029	4754	[illegible]	24.4
5121	490.[illegible]	25.1	25.0
5486	[illegible]	[illegible]	41.4
[illegible]	1095.5	46.1	45.8
4572	1145.7	47.1	47.4

V

5058	318.0	13.6	13.6
4115	351.1	15.2	15.6
4572	386.4	17.6	17.6
5029	340.2	19.5	19.8
5486	365.3	22.1	22.1
5944	410.9	24.6	24.6
6401	463.1	27.9	27.5
6858	496.9	29.8	29.3
7315	913.2	48.5	48.3
6858	1020.0	51.4	51.2
6401	1065.9	53.3	53.2
5944	1140.2	54.8	54.7

VI

R	Θ	F	F'
4115	1946	16.9	13.9
4572	321.5	15.7	15.7
5029	299.7	17.6	17.5
5486	379.3	19.5	19.4
5944	310.6	21.5	21.5
6401	342.9	23.6	23.6
6858	373.7	25.8	25.9
7315	418.6	28.2	28.2
7772	461.8	30.5	30.8
8230	514.3	33.6	33.7
9144	936.0	64.2	52.8
8687	952.2	65.4	56.3
8230	1046.7	66.3	58.5
7772	1096.2	60.3	60.2
7315	1137.4	61.7	61.7

XII

5486	202.7	17.2	17.2
5944	227.2	19.0	18.9
6401	253.1	20.8	20.8
6858	279.5	22.7	22.7
7315	307.7	24.7	24.6
7772	332.5	26.7	26.7
8230	364.1	28.8	28.8
8687	402.0	31.1	31.1
9144	458.8	33.6	33.5
9601	488.4	36.2	36.1
10058	526.5	39.1	39.0
10973	968.5	60.2	60.0
10516	952.0	63.4	63.2
10058	1034.8	66.6	65.4
9601	1078.5	67.2	67.0
9144	1116.7	68.3	68.4
8687	1151.3	69.8	69.6

APPENDIX B

PART 1

NORMAL TRAJECTORIES

155 mm Howitzer

155 MM GUN CONFIDENTIAL ON ANGLE NORMALS

I.

Φ	R	M	t	θ'	F'
100	1091	69	6.0	200	6.1
200	1967	0	9.16	200	9.3
200	3928	9779	13.0	200	12.2
150	1697	319	9.0	349	9.2
350	3598	0	13.99	350	14.2
350	3413	9755	17.0	350	17.3
500	3099	436	12.0	500	12.2
500	3917	0	19.45	501	19.8
500	4719	9738	22.0	501	22.4
900	2999	375	29.0	945	29.8
900	3779	0	31.56	900	32.0
900	3946	9776	33.0	900	33.5
1050	2816	925	29.0	1048	29.2
1050	3400	0	34.95	1050	35.4
1050	3492	9823	36.0	1050	36.9
1200	2931	833	32.0	1200	32.0
1200	2694	0	37.45	1200	37.5
1200	2730	9905	38.0	1200	38.0

II.

Φ	R	M	t	θ'	F'
200	1564	76	7.0	200	7.1
200	2042	0	9.32	200	9.4
200	2834	9764	13.0	199	13.2
350	2324	256	11.0	350	11.2
350	3273	0	15.98	350	16.1
350	3701	9809	18.0	350	18.3
500	2744	539	14.0	500	14.3
500	4176	0	21.92	500	22.4
500	4537	9763	24.0	500	24.4
900	4740	0	37.49	899	36.0
900	4919	9738	37.0	899	37.6
1050	3928	857	34.0	1051	34.5
1050	4252	0	39.29	1051	39.9
1050	4320	9868	40.0	1051	40.6
1200	2995	888	37.0	1200	37.0
1200	3363	0	42.07	1200	42.1
1200	3428	9814	43.0	1200	43.0

III

Φ	R	M	t	θ'	F'
200	2037	97	8.0	200	8.1
200	2632	0	10.5	200	10.7
200	3414	9766	14.0	199	14.2
350	3015	346	11.0	350	12.2
350	4091	0	17.91	350	18.3
350	4611	9804	20.0	456	20.4
500	3540	690	16.0	501	16.3
500	4332	0	24.87	500	25.4
500	5128	9730	27.0	500	27.5
900	4309	763	35.0	899	35.1
900	5114	0	40.2	899	40.8
900	5918	9748	41.0	899	41.6
1050	4960	948	40.0	1052	40.7
1050	5226	9678	44.0	1051	45.3
1050	5586	0	44.5	1051	43.7
1200	3968	739	41.0	1200	44.1
1200	4352	0	47.59	1200	47.7
1200	4393	9910	48.0	1200	48.1

IV.

Φ	R	M	t	θ'	F'
200	2329	159	8.0	200	8.2
200	3442	0	12.07	200	12.3
200	4213	9791	15.0	200	15.3
350	3315	501	12.0	350	12.3
350	5428	0	20.55	350	21.0
350	6006	9735	23.0	350	23.5
500	5217	713	21.0	500	21.5
500	6810	0	28.45	500	29.1
500	7187	9783	30.0	500	30.7
900	7145	770	42.0	895	42.6
900	7721	0	45.92	898	46.8
900	7876	9765	47.0	899	47.9
1050	6474	837	47.0	1051	48.0
1050	6928	0	50.82	1051	51.9
1050	6948	9958	51.0	1051	52.1
1200	5172	778	51.0	1200	51.1
1200	5454	0	54.3	1200	54.4
1200	5516	9825	55.0	1200	55.1

CONFIDENTIAL

[illegible]

V

G	K	H	C	G'	F'
200	[illegible]	[illegible]	8.6	200	9.2
200	6314	0	[illegible]	200	14.1
200	[illegible]	[illegible]	17.0	200	17.4
350	[illegible]	544	15.0	350	15.4
350	[illegible]	0	23.11	350	23.7
350	[illegible]	9778	[illegible]	350	25.6
500	1570	912	24.0	500	24.6
500	3832	0	31.9	500	32.7
500	[illegible]	9751	[illegible]	500	32.6
900	[illegible]	810	48.6	895	48.4
900	[illegible]	0	51.64	898	52.7
900	9259	9514	52.0	898	53.0
1050	9241	710	54.6	1051	55.3
1050	9857	0	[illegible]	1051	58.6
1050	[illegible]	9104	[illegible]	1051	59.4
1200	6518	920	58.0	1200	58.1
1200	6807	0	61.1	1200	61.7
1200	6807	4749	62.0	1200	62.1

VI

G	K	H	C	G'	F'
200	4110	291	11.0	199	11.3
200	5754	0	16.38	200	16.9
200	6513	9165	19.0	200	19.6
350	5764	823	17.0	351	17.5
350	8475	0	26.74	350	27.5
350	8800	9834	28.0	350	28.8
500	9195	802	31.0	500	31.8
500	10497	0	36.41	500	37.4
500	10633	9899	37.0	500	38.0
900	11431	905	55.0	892	56.0
900	12029	0	58.6	897	60.0
900	12094	9894	59.0	898	60.5
1050	10497	865	62.0	1052	64.0
1050	10914	0	65.04	1052	67.0
1050	11034	9730	66.0	1052	67.8
1200	8345	698	67.0	1200	67.2
1200	8575	0	69.35	1200	69.4
1200	8638	9796	70.0	1200	70.1

VII

G	K	H	C	G'	F'
200	[illegible]	[illegible]	12.0	198	12.4
200	7825	0	[illegible]	200	20.0
200	[illegible]	9528	22.0	[illegible]	22.7
350	[illegible]	522	28.0	352	28.7
350	[illegible]	0	30.78	350	31.7
350	[illegible]	9718	32.0	350	33.0
500	[illegible]	721	36.0	499	37.1
500	[illegible]	0	41.31	500	42.6
500	[illegible]	9465	42.0	500	[illegible]
900	[illegible]	706	63.0	899	64.4
900	14754	0	[illegible]	[illegible]	67.6
900	14721	9969	[illegible]	898	67.7
1050	13117	708	71.0	1052	73.3
1050	[illegible]	0	73.54	1051	75.7
1050	13513	9800	74.0	1051	76.2
1200	10373	667	76.0	1200	75.7
1200	10677	0	78.12	1200	78.0
1200	10656	9125	79.0	1200	78.9

APPENDIX B

PART 2

ABNORMAL EFFECTS TRAJECTORIES

155 mm Howitzer

155 MM QUADRANT ELEVATION CHECK

MUZZLE VELOCITY PLUS 30 ft/sec.

		I						III			
Θ	R	H	T	Θ'	T'	Θ	R	H	T	Θ'	T'
231.1	1033	118	5.0	229	5.3	209.6	1487	195	7.0	208	7.4
231.1	1988	0	9.80	231	10.4	209.6	2928	0	11.35	209	11.9
231.1	2792	9719	14.0	234	14.8	209.6	3795	9739	15.0	210	15.8
377.4	1564	300	8.0	376	8.5	341.7	2500	396	10.0	340	10.5
377.4	2976	0	15.66	377	16.7	341.7	4873	0	18.11	342	19.1
377.4	3566	9618	19.0	378	20.2	341.7	4792	9820	20.0	342	21.1
471.5	1864	452	10.0	472	10.6	455.9	3070	672	18.0	455	13.7
471.5	3470	0	19.23	472	20.5	456.0	5340	0	28.58	455	29.9
471.5	3929	9710	22.0	471	23.4	456.0	5629	9832	25.0	455	26.4
922.6	3213	933	26.0	963	29.1	922.0	5618	904	37.0	924	39.1
922.6	4054	0	33.45	923	35.5	922.0	6302	0	42.17	920	44.3
922.6	4222	9746	35.0	922	37.0	922.0	6409	9834	43.0	920	45.2
1101.5	2907	958	31.0	1095	32.4	1031.5	5317	848	41.0	1034	43.3
1101.5	3461	0	37.95	1100	39.5	1031.5	5817	0	45.39	1033	48.0
1101.5	3589	9716	39.0	1100	41.1	1031.5	5884	9870	46.0	1033	48.6
1191.9	2550	926	33.0	1185	34.1	1169.5	4539	732	45.0	1164	46.9
1191.9	2964	0	38.88	1192	40.7	1164.5	4846	0	48.48	1165	50.9
1191.9	3040	9791	40.0	1192	41.9	1164.5	4890	9882	49.0	1165	51.5

		II			
227.1	1390	142	6.0	225	6.3
227.1	2459	0	10.88	227	11.4
227.1	3137	9787	14.0	228	14.8
340.0	1996	305	9.0	338	9.5
340.0	3938	0	15.93	340	16.9
340.0	4050	9723	19.0	341	20.1
487.8	2474	601	12.0	488	12.7
487.8	4415	0	22.24	488	23.6
487.8	4734	9799	24.0	487	25.4
933.1	4803	873	32.0	939	34.1
933.1	4993	0	37.73	933	39.9
933.1	6142	9768	39.0	932	41.2
1079.3	3981	772	37.0	1078	39.0
1079.3	4406	0	41.40	1080	43.8
1079.3	4462	9882	42.0	1080	44.4
1157.9	3506	889	38.0	1154	39.5
1157.9	3915	0	42.99	1158	45.1
1157.9	4000	9783	44.00	1159	46.2

155 MM QUADRANT ELEVATION CHECK

MUZZLE VELOCITY PLUS 50 FT/SEC

IX

Φ	R	H	T	Φ'	T'
219.6	2916	213	8.0	213	8.5
219.6	3142	0	13.45	219	19.3
219.6	4626	9806	16.0	214	17.0
355.2	3429	567	12.0	345	12.8
355.2	5896	0	21.66	355	23.1
355.2	6461	9736	24.0	355	25.5
799.8	5920	866	21.0	502	22.4
799.8	7363	0	29.55	499	31.5
799.8	7677	9790	31.0	493	33.0
911.6	7644	854	44.0	914	47.2
911.6	8261	0	48.16	909	51.2
911.6	8382	9811	49.0	908	52.0
1059.9	7008	724	50.0	1061	53.6
1059.9	7382	0	53.12	1060	56.8
1059.9	7484	9783	54.0	1060	57.7
1197.6	5597	829	53.0	1196	55.5
1197.6	5901	0	56.90	1198	59.2
1197.6	5953	9844	57.0	1198	59.8

VI

Φ	R	H	T	Φ'	T'
209.2	3890	379	10.0	206	10.6
209.2	6207	0	17.51	209	18.5
209.2	6925	9766	20.0	209	21.0
334.7	5082	873	14.0	335	14.8
334.7	8536	0	26.32	335	27.6
334.7	8975	9777	28.0	334	29.3
462.7	8960	806	29.0	463	30.4
462.7	10398	0	34.78	463	36.9
462.7	10689	9796	36.0	463	37.7
911.2	11844	845	57.0	906	59.6
911.2	12379	0	60.25	909	63.0
911.2	12499	9795	61.0	909	63.8
1049.4	10923	884	63.0	1047	66.6
1049.4	11349	0	66.10	1046	69.6
1049.4	11468	9736	67.0	1046	70.4
1194.3	8730	772	68.0	1194	69.9
1194.3	8997	0	70.55	1195	72.4
1194.3	9030	9862	71.0	1195	72.8

V

Φ	R	H	T	Φ'	T'
214.6	2692	282	80	213	8.4
214.6	4800	0	15.10	215	15.8
214.6	5611	9752	18.0	215	18.8
362.5	4069	738	13.0	363	13.7
362.5	7149	0	24.97	363	25.6
362.5	7334	9812	26.0	362	27.2
479.3	6767	861	24.0	480	25.2
479.3	8565	0	31.46	479	33.0
479.3	8920	9763	33.0	479	34.6
900.7	9393	879	49.0	901	51.5
900.7	10010	0	52.87	899	55.4
900.7	10184	9723	54.0	899	56.6
1046.5	8614	883	55.0	1049	58.0
1046.5	9068	0	58.99	1048	61.6
1046.5	9133	(674 9326)	59.0	1043	62.1
1176.7	6922		60.0	1196	61.8
1196.7	7157	0	62.97	1197	64.4
1196.7	7206	9850	63.0	1197	65.0

XII

Φ	R	H	T	Φ'	T'
210.6	4967	529	11.0	206	11.7
210.6	8054	0	20.64	211	21.9
210.6	8736	9748	23.0	211	24.3
347.0	8879	842	24.0	349	25.3
347.0	10990	0	31.17	347	32.8
347.0	11056	9875	32.0	347	33.6
498.3	11970	866	37.0	498	38.9
498.3	13159	0	41.92	498	44.1
498.3	13409	9786	43.0	498	45.2
915.0	14583	799	65.0	911	68.0
915.0	15042	0	67.82	913	71.1
915.0	15070	9748	68.0	913	71.2
1063.3	13360	680	73.0	1064	77.1
1063.3	13693	0	75.23	1064	79.3
1063.3	13792	9763	76.0	1064	80.0
1183.7	11082	687	77.0	1184	79.4
1183.7	11998	0	79.18	1185	81.8
1183.7	11379	9739	80.0	1185	82.6

105MM QUADRANT ELEVATION CHECK

MUZZLE VELOCITY MINUS 30 FT/SEC

		I					III				
Φ	R	H	T	Φ'	T'	Φ	R	H	T	Φ'	T'
231.1	760	99	4.0	235	3.9	231.6	1720	139	9.1	211	6.9
231.1	1677	0	5.78	231	8.7	231.6	2578	0	12.62	210	10.9
231.1	2561	9759	13.0	229	12.6	231.6	3336	9779	14.9	206	13.7
377.4	1251	258	7.0	378	6.8	377.4	2114	351	9.0	343	8.8
377.4	2220	0	8.37	377	14.0	377.4	3562	0	16.77	341	16.7
377.4	2952	9756	17.8	377	16.5	377.4	4288	9816	19.0	341	18.7
472.5	1544	382	7.0	470	8.7	472.5	2665	694	12.0	456	11.2
472.5	2743	0	11.66	472	17.2	472.5	4725	0	22.12	455	21.8
472.5	3235	9777	20.0	473	19.4	472.5	5087	9786	24.0	454	23.6
						922.0	4880	903	34.0	887	31.8
922.6	3455	0	32.77	924	29.2	922.0	5595	0	39.59	922	38.2
922.6	3581	9814	33.0	926	31.1	922.0	5766	9732	41.0	923	40.2
1101.5	2430	869	29.0	1102	27.0	1031.5	4306	841	40.0	1109	39.2
1101.5	2949	0	34.45	1100	33.2	1031.5	4732	0	44.45	1106	43.9
1101.5	3070	1727	36.0	1100	34.7	1031.5	4783	9686	45.0	1106	43.9
1191.4	2043	9456	27.0	1201	28.4	1169.5	3918	876	41.0	1169	40.1
1191.4	2529	0	35.71	1192	34.3	1169.5	4303	0	45.54	1165	44.2
1191.4	2606	9790	37.0	1191	35.4	1169.5	4341	9901	46.0	1165	44.7

		II			
227.1	1287	118	6.0	229	5.8
227.1	2119	0	10.03	227	9.8
227.1	2909	9734	14.0	225	13.6
340.0	1650	265	8.0	341	7.8
340.0	2971	0	14.77	340	14.4
340.0	3574	9723	18.0	339	17.6
487.8	2110	519	11.0	488	10.8
487.8	3825	0	20.64	488	20.2
487.8	4226	9742	23.0	489	22.5
933.1	4343	0	35.02	933	34.1
933.1	4447	9841	36.0	933	35.1
1079.3	3330	863	33.0	1084	32.3
1079.3	3833	0	38.45	1079	37.4
1079.3	3879	9905	39.0	1079	37.9
1157.9	3022	820	35.0	1165	34.3
1157.9	3408	0	39.92	1158	38.6
1157.9	3487	9794	41.0	1158	39.6

IESWN QUADRANT ELEVATION CHECK

MUZZLE VELOCITY ABOUT 50 FT/SEC

IX

Φ	R	H	T	Φ'	T'
219.6	1150	183	2.6	216	6.8
219.6	3249	0	13.32	215	12.0
219.6	4269	9721	16.0	213	15.6
355.2	2854	480	11.0	355	10.7
355.2	5040	0	19.92	354	19.4
355.2	5516	9783	22.0	354	21.9
499.8	3421	905	14.0	498	13.6
499.8	6807	0	27.20	499	26.5
499.8	6676	9756	28.0	500	28.2
911.6	6460	823	40.0	881	37.2
911.6	7166	0	44.33	910	42.9
911.6	7158	9860	46.0	912	43.6
1059.9	5808	817	45.0	1057	43.3
1059.4	6308	0	48.89	1059	47.2
1059.4	6431	9742	50.0	1059	48.3
1197.6	4716	877	49.6	1199	45.9
1197.6	5049	0	51.93	1198	49.9
1197.6	5137	9741	53.1	1197	50.9

X

Φ	R	H	T	Φ'	T'
219.6	2599	246	8.0	215	7.9
219.6	4358	0	14.24	215	14.2
219.6	5117	9778	17.0	214	17.0
362.5	3593	666	12.0	364	12.0
362.5	6574	0	23.28	363	23.3
362.5	7000	9797	25.0	363	25.0
479.3	5753	913	21.0	480	21.0
479.3	7898	0	30.00	479	30.0
479.3	8124	9855	31.0	479	31.0
900.7	8655	750	47.0	893	46.3
900.7	9188	0	50.54	900	50.1
900.7	9272	9869	51.0	901	50.7
1046.5	7827	903	52.0	1047	51.7
1046.5	8303	0	55.75	1048	55.5
1046.5	8333	9937	56	1048	55.8
1196.7	6318	672	57.0	1197	55.6
1196.7	6557	0	59.58	1197	58.1
1196.7	6594	9887	60.0	1197	58.5

XI

Φ	R	H	T	Φ'	T'
209.2	3361	391	9.0	209	8.9
209.2	5684	0	16.58	209	16.7
209.2	6379	9782	19.0	209	19.1
334.7	4502	799	13.0	337	13.0
334.7	7926	0	25.02	335	25.3
334.7	8416	9761	27.0	335	27.2
462.7	8195	826	27.0	462	27.1
462.7	9722	0	38.35	463	33.6
462.7	10113	9731	35.0	463	35.2
911.2	11092	753	55.0	905	54.8
911.2	11578	0	57.99	901	58.1
911.2	11737	9732	59.0	910	59.2
1044.4	10244	721	61.0	1047	61.5
1044.4	10597	0	68.60	1046	64.0
1044.4	10699	9887	64.0	1046	64.4
1194.3	8099	850	65.0	1194	63.8
1194.3	8389	0	67.91	1195	66.7
1194.3	8398	9972	68.0	1195	66.8

VII

Φ	R	H	T	Φ'	T'
210.6	4737	478	11.0	210	11.0
210.6	7494	0	19.73	211	19.9
210.6	8149	9768	22.0	210	22.2
347.0	8402	863	22.0	350	22.1
347.0	10194	0	29.96	347	30.3
347.0	10469	9849	31.0	347	31.3
498.3	11121	912	35.0	497	35.4
498.3	12446	0	40.46	498	41.0
498.3	12572	9877	41.0	498	41.5
915.0	13799	720	63.0	910	63.1
915.0	14221	0	66.57	913	65.9
915.0	14289	9878	66.0	913	66.4
1063.3	12525	804	70.0	1064	70.6
1063.3	12876	0	72.67	1064	73.2
1063.3	12918	9898	73.0	1064	73.6
1183.7	10396	771	74.0	1184	72.7
1183.7	10648	0	76.46	1185	75.3
1183.7	10700	9829	77.0	1185	75.8

155 MM GUN ADVANCE ELEVATION CHECK

PLUS 50 MPH WIND(S)

I

Φ	R	H	T	Φ'	t'
231.1	1184	100	4.0	231	4.1
231.1	1843	0	9.40	231	9.5
231.1	2318	9775	180	231	13.5
377.9	1507	276	7.0	377	8.2
377.9	2774	0	18.02	377	18.5
377.9	3211	7747	18.0	378	18.5
471.5	1777	915	10.0	472	10.2
471.5	3245	0	19.47	472	19.1
471.5	3904	9767	21.0	474	21.7
922.6	3844	0	32.18	922	33.4
922.6	4046	9709	34.0	923	35.3
1101.5	2770	867	30.0	1097	30.9
1101.5	3296	0	36.02	1101	37.5
1101.5	3829	9533	37.0	1101	38.6
1191.4	2449	827	32.0	1188	32.8
1191.4	2840	0	37.41	1192	38.9
1191.4	2953	9709	3.90	1192	40.6

II

Φ	R	H	T	Φ'	t'
22.7	1844	130	6.0	227	6.1
22.7	2303	0	10.44	227	10.7
22.7	3049	9761	14.0	227	14.3
340.0	1983	280	7.0	340	9.2
340.0	3234	0	15.37	340	15.8
340.0	3753	9774	18.0	341	18.5
487.8	2401	555	12.0	488	12.3
487.8	4175	0	21.97	488	22.2
487.8	4451	9832	23.0	488	23.8
933.1	4116	810	31.0	931	32.1
933.1	4786	0	36.96	932	38.0
933.1	4970	9726	38.0	931	39.6
1079.3	3742	836	35.0	1079	36.9
1079.3	4241	0	40.02	1080	42.0
1079.3	4336	9811	41.0	1080	43.0
1157.9	3400	792	37.0	1156	38.3
1157.9	3785	0	41.51	1158	43.4
1157.9	3826	9033	42.0	1158	44.0

III

Φ	R	H	T	Φ'	t'
209.6	1538	147	6.0	210	6.1
209.6	2764	0	11.80	210	11.9
209.6	3479	9799	14.0	209	14.9
341.7	2437	370	10.0	341	10.2
341.7	4165	0	17.86	342	18.1
341.7	4701	9768	20.0	342	20.6
455.0	2776	640	12.0	455	12.3
455.0	6106	0	22.90	455	23.7
455.0	5535	9781	25.0	456	25.9
922.0	5027	848	36.0	921	37.9
922.0	6105	0	40.97	920	42.7
922.0	6242	9799	42.0	919	43.8
1031.5	5172	774	48.0	1039	+2.0
1031.5	5654	0	44.10	1033	46.4
1031.5	5758	9812	45.0	1033	47.4
1164.5	4363	829	43.0	1164	44.9
1164.5	4742	0	47.10	1165	49.6
1164.5	4829	9900	48.0	1166	50.6

IV

Φ	R	H	T	Φ'	t'
214.6	2058	204	7.0	215	7.2
214.6	3715	0	12.96	215	13.4
214.6	4525	9769	16.0	214	16.6
355.2	3060	535	11.0	356	11.9
355.2	5600	0	20.98	355	21.6
355.2	6105	9775	23.0	356	24.0
499.8	4827	881	19.0	500	19.7
499.8	7020	0	28.58	500	29.9
499.8	7332	9800	31.0	500	31.9
911.6	7234	888	42.0	915	44.3
911.6	7920	0	46.61	911	49.6
911.6	7993	9893	47.0	911	49.5
1059.4	6696	729	48.0	1061	50.9
1059.4	7100	0	51.26	1061	54.9
1059.4	7190	9823	52.0	1061	55.5
1197.6	5408	806	51.0	1195	55.2
1197.6	5731	0	54.41	1197	57.1
1197.6	5784	9853	55.0	1197	57.8

155 MM GUN GRANT ELEVATION CHART

PLUS 50 MPH WIND

V

Θ	R	H	T	Θ'	T'	Θ	R	H	T	Θ'	T'
214.6	3999	260	9.00	215	9.5	210.6	4919	508	11.0	211	11.5
214.6	4822	0	10.91	214	10.9	210.6	7994	0	20.18	211	21.0
214.6	5726	9737	18.0	214	19.2	210.6	8526	9818	22.0	211	23.2
362.5	4399	711	14.0	364	14.9	342.0	5707	8641	23.0	341	24.7
362.5	7286	0	24.37	363	26.2	342.0	10966	0	30.69	341	33.3
362.5	7717	9801	26.0	364	28.0	342.0	11331	9808	32.0	342	34.1
479.3	6811	858	24.0	480	25.7	498.3	12239	781	32.0	497	34.3
479.3	8752	0	31.38	478	33.8	498.3	13246	0	41.49	497	45.9
479.3	914	9752	35.0	478	37.6	498.3	13713	9802	42.0	497	46.0
980.7	9582	780	49.0	894	52.2	915.0	15121	695	65.0	908	71.1
980.7	10159	0	52.44	892	55.9	915.0	15529	0	67.25	910	73.5
980.7	10251	9864	53.0	892	56.5	915.0	15654	9782	69.0	910	75.5
1046.5	8739	713	55.0	1047	59.4	1063.3	13762	752	72.0	1066	80.5
1046.5	9188	0	57.82	1047	62.5	1063.3	14144	0	74.45	1066	82.5
1046.5	9213	9951	58.0	1047	62.7	1063.3	14195	9830	75.0	1066	84.2
1196.7	7035	697	59.0	1197	63.9	1183.7	11534	717	76.0	1199	84.0
1196.7	7302	0	61.59	1199	66.4	1183.7	11795	0	78.26	1185	87.0
1196.7	7343	9886	62.0	1199	65.2	1182.7	11817	9764	77.0	1185	87.0

VI

209.2	3852	359	10.1	208	10.5
209.2	6149	0	17.05	209	10.5
209.2	7036	9725	20.0	207	21.4
334.7	5046	840	14.0	337	14.5
334.7	8632	0	25.96	335	28.0
334.7	9202	9731	28.0	336	30.2
462.7	8902	873	28.0	463	30.2
462.7	10626	0	34.49	463	37.4
462.7	11012	9748	36.0	463	39.1
911.2	12214	734	57.0	904	61.6
911.2	12712	0	69.82	909	69.7
911.2	12743	9951	60.0	907	64.7
1049.4	11292	711	63.0	1049	69.5
1049.4	11662	0	65.49	1048	72.1
1049.4	11735	9851	66.0	1048	72.6
1194.3	9013	828	670	1193	72.9
1194.3	9322	0	69.76	1194	75.9
1194.3	9348	9925	70.0	1194	75.7

155 MM QUADRANT ELEVATION CHECK

MINOR 50 MPH WIND

I

Θ	R	H	T	Θ'	T'
231.1	1178	99	6.0	230	6.1
231.1	1916	0	9.38	231	9.5
231.1	2474	9775	13.0	230	13.1
377.4	1491	274	8.0	377	8.1
377.4	2114	0	15.00	378	15.1
377.4	3218	1743	18.0	377	18.1
471.5	1774	412	10.0	472	10.1
471.5	3158	0	18.43	472	18.5
471.5	3560	9743	21.0	470	21.0
922.6	3649	0	32.06	922	31.6
922.6	3744	9853	33.0	929	32.3
1101.5	2635	646	33.0	1100	29.9
1101.5	3095	0	35.69	1099	35.0
1101.5	3179	9806	37.0	1100	36.0
1191.4	2299	804	32.0	1196	31.3
1191.4	2631	0	37.27	1192	35.9
1191.4	2676	9870	38.0	1192	36.5

II

Θ	R	H	T	Θ'	T'
227.1	1383	130	6.0	226	6.1
227.1	2268	0	10.42	227	10.5
227.1	2995	9761	14.0	226	14.1
340.0	1111	279	9.0	340	9.1
340.0	3165	0	15.34	340	15.5
340.0	3670	9772	18.0	339	18.1
497.8	2365	551	12.00	497	12.1
497.8	4054	0	21.41	497	21.5
497.8	4326	9826	23.0	496	23.0
933.1	4535	0	36.33	932	35.8
933.1	4607	9884	37.0	933	36.5
1079.3	3548	810	35.0	1082	34.5
1079.3	3979	0	39.87	1079	39.0
1079.3	4076	9784	41.0	1079	40.0
1157.9	3116	915	36.0	1164	35.9
1157.9	3517	0	41.36	1159	40.0
1157.9	3563	9875	42.0	1158	40.6

III

Θ	R	H	T	Θ'	T'
209.6	1523	146	6.0	209	6.1
209.6	2114	0	10.97	210	11.0
209.6	3410	9797	14.0	209	14.0
341.7	2002	366	10.0	341	10.1
341.7	4053	0	17.41	342	17.6
341.7	4578	9762	20.0	341	20.0
455.1	2731	684	12.0	455	12.1
456.0	4940	0	22.71	455	22.9
455.1	5464	9790	25.0	454	25.0
922.0	5181	815	36.0	913	35.1
922.0	5772	0	40.79	922	40.2
922.0	5916	9764	42.0	923	41.9
1031.5	4772	704	39.0	1033	38.9
1031.5	5308	0	43.92	1032	43.1
1031.5	5468	9774	45.0	1032	44.1
1164.5	4073	81	43.0	1167	41.8
1164.5	4396	0	46.91	1165	45.2
1164.5	4421	9760	48.0	1165	46.2

IV

Θ	R	H	T	Θ'	T'
214.6	3004	198	7.0	214	7.0
214.6	3526	0	12.76	215	12.7
214.6	4337	9754	16.0	214	15.8
355.2	2967	516	11.0	354	11.0
355.2	5272	0	20.57	355	20.9
355.2	5820	9737	23.0	354	22.7
499.8	4197	919	17.0	499	16.9
499.8	6581	0	29.11	500	27.8
499.8	6967	9735	30.0	500	29.6
911.6	6940	789	42.0	907	41.1
911.6	7387	0	46.02	913	45.3
911.6	7517	9787	47.0	919	46.3
1059.4	6163	829	47.0	1059	46.0
1059.4	6580	0	50.83	1059	49.6
1059.4	6704	9722	52.0	1059	50.7
1197.6	4972	715	51.0	1200	48.8
1197.6	5212	0	54.07	1198	51.9
1197.6	5286	9760	55.0	1199	52.2

155 MM QUADRANT CONFIDENTIAL ON CHECK

MINUS 50 MPH WIND

V

σ	R	M	T	σ'	T'	σ	R	M	T	σ'	T'
214.6	2515	258	8.0	214	7.9	210.6	4787	501	11.0	206	11.2
214.6	4263	0	14.30	215	14.3	210.6	7560	0	20.20	211	20.2
214.6	5016	9798	17.0	214	16.6	210.6	8097	9817	22.0	210	21.9
362.5	3583	473	13.0	362	12.8	347.0	8177	844	23.0	350	22.9
362.5	6461	0	23.46	362	22.9	347.0	10085	0	30.48	347	29.8
362.5	6812	1819	25.0	361	24.3	347.0	10449	9772	32.0	346	31.2
478.2	5986	868	22.0	479	21.5	498.3	11053	846	36.0	498	35.1
478.2	7726	0	30.16	480	29.3	498.3	12153	0	40.93	498	39.7
478.3	8119	9725	32.0	480	31.0	498.2	12341	9793	42.0	498	40.7
900.7	8451	848	47.0	893	45.0	915.0	13260	875	63.0	910	60.0
900.7	9018	0	50.89	903	49.2	915.0	13726	0	66.15	914	63.0
900.7	9175	9737	52.0	905	50.3	915.0	13844	9758	67.0	915	63.8
1046.5	7750	836	53.0	1049	51.2	1063.3	12100	729	71.0	1063	67.3
1046.5	8154	0	56.92	1048	54.4	1063.3	12280	0	73.48	1062	69.3
1046.5	8220	9850	57.0	1048	55.0	1062.3	12442	0	74.0	1062	69.7
1196.7	6090	894	57.0	1204	54.2	1183.7	9926	733	75.0	1185	69.9
1196.7	6379	0	60.93	1202	56.9	1183.7	10130	0	77.35	1185	70.5
1196.7	6425	9845	61.0	1201	57.9	1183.7	10183	9776	78.0	1185	70.9

VI

209.2	3724	348	10.0	207	10.1
209.2	5755	0	17.02	210	16.9
209.2	6289	9823	19.0	209	18.9
339.7	4792	816	14.0	336	14.0
339.7	7852	0	25.55	339	25.0
339.7	8205	9815	27.0	339	26.3
462.7	7957	877	27.0	463	26.4
462.7	9515	0	33.71	463	32.7
462.7	9799	9790	35.0	462	33.9
911.2	10714	868	55.0	909	52.5
911.2	11231	0	58.44	912	56.1
911.2	11311	9852	59.0	912	56.7
1044.4	9863	890	61.0	1045	58.5
1044.4	10261	0	64.21	1045	61.9
1044.4	10355	9774	65.0	1044	62.1
1194.3	7792	790	66.0	1197	61.2
1194.3	8055	9902	69.0	1196	63.6

155MM QUADRANT ELEVATION C ICR

DENSITY PLUS 10%

I

Φ	R	H	T	Φ'	T'
231.1	1917	107	5.0	230	5.1
231.1	1920	0	9.38	231	9.5
231.1	2944	9775	13.0	230	13.1
377.4	1213	274	7.0	376	7.1
377.4	2124	0	14.97	377	15.2
377.4	3232	9742	18.0	377	18.2
471.5	1609	415	9.0	471	9.1
471.5	3175	0	18.41	472	18.6
471.5	3586	9741	21.0	472	21.2
922.6	3706	0	32.10	929	32.2
922.6	3912	9682	34.0	925	34.2
1101.5	2603	950	29.0	1098	28.9
1101.5	3164	0	35.83	1100	35.8
1101.5	3256	9796	37.0	1100	37.0
1171.4	2292	917	31.0	1193	31.0
1171.4	2709	0	37.20	1192	37.0
1171.4	2825	9672	39.0	1192	38.6

III

Φ	R	H	T	Φ'	T'
209.6	1527	106	6.	209	6.1
209.6	2725	0	10.97	210	11.1
209.6	3427	9797	14.0	209	14.1
341.7	2411	366	10.0	341	10.1
341.7	4076	0	17.41	342	17.7
341.7	4607	9763	20.0	341	20.2
455.0	2742	633	12.0	455	12.2
455.0	4971	0	22.78	455	23.0
455.0	5403	9739	25.0	454	25.2
922.0	5250	796	36.0	913	35.7
922.0	5847	0	40.69	923	40.9
922.0	6008	9742	42.0	924	42.2
1031.5	4873	881	39.0	1032	39.1
1031.5	5397	0	43.80	1033	44.0
1031.5	5524	9751	45.0	1033	45.2
1164.5	4175	757	45.0	1166	42.8
1164.5	4494	0	46.77	1165	46.6
1164.5	4595	9728	48.0	1165	47.5

II

Φ	R	H	T	Φ'	T'
227.1	1236	120	6.	226	6.1
227.1	2277	0	10.42	227	10.5
227.1	3006	9760	14.0	226	14.1
340.0	1916	278	9.0	339	9.1
340.0	3176	0	15.32	340	15.5
340.0	3687	9771	18.0	340	18.2
497.3	2373	550	12.0	498	12.2
497.3	4072	0	21.33	498	21.6
497.3	4354	9824	23.0	497	23.2
933.1	3878	895	30.0	917	29.5
933.1	4600	0	36.25	934	36.4
933.1	4683	9870	37.0	934	37.2
1077.3	3617	793	35.0	1082	35.3
1077.3	4058	0	39.78	1080	40.0
1077.3	4168	9767	41.0	1079	41.1
1167.9	3190	816	34.0	1162	36.2
1157.9	3607	0	41.25	1159	41.2
1157.9	3662	9854	42.0	1158	41.9

IV

Φ	R	H	T	Φ'	T'
214.6	2035	202	7.0	213	7.1
214.6	3626	0	12.89	214	13.1
214.6	4425	9764	16.0	214	16.2
355.2	3013	526	11.0	354	11.2
355.2	5418	0	20.76	355	21.0
355.2	5936	9758	23.0	355	23.2
499.8	4491	9000	18.0	500	18.2
499.8	6751	0	2831	499	28.6
499.8	7099	9764	30.0	499	30.2
911.6	6959	794	42.0	902	41.7
911.6	7529	0	46.60	912	46.2
911.6	7658	9797	47.0	913	47.2
1059.4	6292	825	47.0	1059	47.1
1059.4	6722	0	50.78	1060	51.0
1059.4	6857	9711	52.0	1061	52.2
1197.6	5039	897	50.0	1198	49.4
1197.6	5370	0	53.89	1198	53.2
1197.6	5460	9725	55.0	1199	54.3

155 MM QUADRANT ELEVATION CHART

DENSITY PLUS 10%

IV						V					
R	M	T	Φ	T'		R	M	T	Φ'	T'	
2096	2910	247	9.0	214	9.1	2087	481	11.8	210	11.1	
2096	5900	0	16.56	209	16.8	2087	0	19.85	211	20.0	
2096	5170	7915	17.0	214	17.2	2087	9782	22.0	210	22.1	
3045	8921	624	13.0	362	13.2	3427.0	875	23.0	350	22.0	
3045	4723	0	34.47	362	33.0	3427.0	0	30.37	347	30.1	
3045	7048	1941	25.0	362	25.2	3427.0	9524	31.6	347	31.6	
4113	6951	902	22.8	460	22.3	4098	770	34.8	497	36.0	
4113	8059	0	38.51	471	38.7	4098	0	46.51	498	46.4	
4113	9217	7778	33.0	471	32.2	4098	9707	41.0	498	40.1	
4107	8784	915	43.0	473	46.6	4096	698	63.0	909	61.9	
4107	9295	0	51.21	701	51.2	4150	0	65.46	913	64.5	
4107	7464	7913	52.0	461	52.0	4150	9647	66.0	914	65.1	
1044.5	8005	677	52.0	1048	53.2	10423	759	70.0	1054	69.3	
1044.5	8455	0	56.61	1045	56.7	10423	0	72.51	1059	71.6	
1044.5	8502	9100	57.0	1048	57.1	10423	9852	73.0	1064	72.0	
1196.7	6353	812	57.0	1198	56.1	11837	707	77.0	1184	71.3	
1196.7	6663	0	60.43	1198	59.3	11837	0	76.27	1185	73.0	
1196.7	6715	7849	61.0	1196	59.9	11837	9771	77.0	1185	74.3	

IV					
2093.2	2910	355	9.0	207	9.1
2093.2	5900	0	16.26	209	17.1
2093.2	5406	7895	18.0	209	19.2
3347	4895	805	14.0	336	19.1
3347	8013	0	35.43	335	25.6
3347	5414	9801	27.0	335	27.1
4627	8148	867	23.0	462	27.2
4627	9770	0	33.67	462	33.8
4627	10073	7754	35.0	462	35.1
9112	11029	526	55.0	905	54.5
9112	11555	0	58.33	910	58.1
9112	11657	9925	59.0	911	58.7
1044.4	10188	818	61.0	1047	61.1
1044.4	10538	0	63.97	1046	63.9
1044.4	10709	9705	65.0	1046	64.8
1194.3	8148	658	66.0	1196	64.5
1194.3	8364	0	68.24	1195	66.5
1194.3	8934	9772	69.0	1195	67.2

125 MM QUADRANT [illegible] CURVE

DENSITY MINUS 10%

I

θ	R	H	T	θ'	T'
231.1	1919	108	5.0	231	5.1
231.1	1839	0	9.41	231	9.6
231.1	2692	9671	14.00	231	14.3
377.4	1520	276	7.0	377	7.1
377.4	2764	0	15.58	377	15.9
377.4	3274	9796	18.0	378	18.4
471.5	1619	419	9.0	472	9.2
471.5	3229	0	18.49	472	19.0
471.5	3638	9749	21.0	473	21.5
922.6	2550	9514	24.0	967	26.0
922.6	3794	0	32.23	929	33.0
922.6	3985	9714	34.0	923	39.8
1101.5	2726	877	30.0	1098	30.9
1101.5	3240	0	36.80	1100	36.8
1101.5	3337	9656	39.0	1100	38.8
1191.4	2899	841	32.0	1190	32.2
1191.4	2779	0	37.99	1192	38.0
1191.4	2881	9723	39.0	1192	39.5

III

θ	R	H	T	θ'	T'
209.6	1836	197	6.0	210	6.1
209.6	2762	0	11.01	210	11.2
209.6	3970	9799	14.0	209	14.3
341.7	2932	371	10.0	342	10.2
341.7	4156	0	17.58	342	18.1
341.7	4684	9779	20.0	341	20.6
455.0	2770	642	12.0	457	12.3
455.0	5091	0	22.93	455	23.6
455.0	5510	9764	25.0	455	25.8
922.0	5367	870	36.0	926	37.2
922.0	6044	0	41.88	922	42.3
922.0	6168	9820	42.0	922	43.3
1031.5	5098	802	40.0	1035	41.4
1031.5	6580	0	44.24	1033	45.8
1031.5	5665	9840	45.0	1033	46.5
1164.5	4275	866	43.0	1166	44.0
1164.5	4653	0	47.27	1165	48.5
1164.5	4716	9837	48.0	1165	49.3

II

θ	R	H	T	θ'	T'
227.1	1342	130	6.0	227	6.1
227.1	2300	0	10.45	227	10.7
227.1	3041	9761	14.0	226	14.3
340.0	1930	281	9.0	340	9.2
340.0	3327	0	15.39	340	15.8
340.0	3739	9775	18.0	340	18.5
487.8	2395	557	12.0	488	12.3
487.8	4159	0	21.50	488	22.1
487.8	4427	9835	23.0	488	23.6
933.1	4068	8225	31.0	930	31.7
933.1	4730	0	36.64	933	37.5
933.1	4899	9740	38.0	933	39.1
1079.3	3684	854	35.0	1079	35.8
1079.3	4174	0	40.11	1080	41.2
1079.3	4257	9829	41.0	1080	42.2
1157.9	3333	8134	37.0	1157	37.6
1157.9	3712	0	41.62	1158	42.5
1157.9	3822	9723	43.0	1159	44.0

IV

θ	R	H	T	θ'	T'
214.6	2051	204	7.0	215	7.2
214.6	3691	0	12.95	215	13.3
214.6	4996	9768	16.0	214	16.5
355.2	3096	534	11.0	356	11.3
355.2	5558	0	20.91	355	21.6
355.2	6060	9773	23.0	355	23.8
499.8	4800	881	19.0	500	19.6
499.8	6969	0	28.57	499	29.6
999.8	7278	9798	30.0	499	31.1
911.6	7153	911	42.0	917	43.9
911.6	7839	0	46.61	911	48.4
911.6	8049	9692	48.0	910	49.7
1059.4	6592	767	48.0	1063	50.1
1059.4	7001	0	51.41	1061	53.5
1059.4	7070	9859	52.0	1061	54.1
1197.6	5282	863	51.0	1198	52.1
1197.6	5608	0	54.64	1198	55.9
1197.6	5681	9908	55.0	1198	56.2

155 A A QUADRANT ELEVATION CHECK

DENSITY MINUS 10%

V

Θ	R	H	T	Θ'	T'
214.2	2740	254	9.0	214	9.3
214.2	4692	0	14.74	215	15.3
214.2	5282	9817	17.0	214	17.6
362.5	4000	707	13.0	363	13.4
362.5	6992	0	24,02	362	25.0
362.5	7496	9768	26.0	362	27.0
477.3	6464	883	23.0	479	23.9
477.3	8416	0	30.96	479	32.3
477.3	8669	9844	32.0	479	33.4
700.7	9360	719	49.0	701	51.3
700.7	9871	0	52.15	700	54.6
700.7	10006	9796	53.0	699	55.4
1046.5	8579	684	55.0	1049	57.2
1046.5	8935	0	57.69	1049	60.6
1046.5	8975	9917	58.0	1049	60.9
1196.7	6804	723	59.0	1196	60.5
1196.7	7064	0	61.67	1197	63.4
1196.7	7094	9908	62.0	1197	63.8

XII

Θ	R	H	T	Θ'	T'
206	4952	518	11.0	206	11.6
211.6	8066	0	20.52	211	21.9
211.6	8776	9737	23.0	211	24.5
347.0	8737	836	24.0	349	25.5
347.0	10933	0	31.71	347	33.2
347.0	11166	9869	32.0	347	34.1
498.2	12102	8"	37.0	498	39.5
498.2	12334		41.15	498	44.2
498.3	13587	9770	42.0	498	45.9
915.3	14828	872	65.0	912	69.6
915.3	15346	0	68.07	913	72.9
915.3	15494	9732	69.0	913	73.9
1063.3	13586	772	73.0	1065	79.0
1062.3	13923	0	75.52	1064	81.6
1063.3	13984	9852	76.0	1064	82.1
1183.7	11276	802	77.0	1184	81.4
1183.7	11539	0	79.52	1185	84.2
1183.7	11586	9848	80.0	1185	84.7

II

Θ	R	H	T	Θ'	T'
209.2	3844	359	10.0	208	10.5
209.2	6103	0	17.24	209	18.1
209.2	6909	9740	20.0	209	21.0
334.7	4994	849	14.0	336	14.6
334.7	8469	0	26.04	335	27.4
334.7	8993	9742	28.0	334	29.4
462.7	8714	879	28.0	463	29.4
462.7	10377	0	34.50	462	36.3
462.7	10744	9748	36.0	463	37.9
911.2	11938	779	57.0	907	60.2
911.2	12444	0	59.98	908	63.4
911.2	12612	9720	61.0	909	64.5
1044.2	11007	808	63.0	1047	67.2
1044.2	11406	0	65.82	1047	70.1
1044.2	11430	9947	66.0	1047	70.2
1194.3	8804	705	68.0	1194	70.5
1194.3	9044	0	70.31	1195	72.9
1194.3	9118	9786	71.0	1195	73.6

155 MM QUADRANT ELEVATION CHECK

AIR TEMPERATURE PLUS 59° F

I

Φ	R	M	T	Φ'	T'
2[illegible].1	9[illegible]	108	5.0	27[illegible]	5.1
231.1	1827	0	9.39	231	9.5
231.1	2493	9775	12.00	230	13.2
377.4	1816	276	7.0	377	7.1
377.4	2739	0	15.01	378	15.3
377.4	3248	9743	18.0	377	18.3
471.5	1612	417	9.0	472	9.2
471.5	2195	0	10.99	472	18.8
471.5	3606	9744	21.0	472	21.3
922.4	3782	0	32.09	922	32.5
923.6	3463	9695	34.0	923	34.4
1101.5	2709	868	30.0	1097	30.1
1101.5	2195	0	35.93	1100	36.2
1100.5	3282	9814	37.00	1100	37.3
1191.4	2377	812	32.0	1191	32.0
1191.4	2728	0	37.31	1191	37.4
1191.4	2849	9693	39.0	1191	39.0

II

227.1	1338	130	6.0	227	6.1
227.1	2283	0	10.43	227	10.6
227.1	3019	9761	14.0	226	14.2
349.5	1921	279	9.0	340	9.2
340.0	3194	0	15.35	340	15.6
340.0	3706	9772	18.0	340	18.3
487.8	2381	552	12.0	484	12.2
487.8	4105	0	21.92	488	21.8
487.8	4381	9828	23.0	488	23.9
933.1	4651	0	36.36	932	36.8
933.1	4729	9889	37.0	933	37.4
1079.3	3644	816	35.0	1079	35.4
1079.3	4106	0	39.91	1079	40.4
1079.3	4205	9791	41.0	1079	41.5
1157.9	3296	770	37.0	1158	37.2
1157.9	3648	0	41.40	1158	41.7
1157.9	3696	9882	42.0	1158	42.3

III

Φ	R	M	T	Φ'	T'
208.6	1581	197	6.0	209	6.1
208.6	3701	0	10.98	210	11.2
208.6	4696	9778	14.0	209	14.2
340.7	2020	369	10.0	341	10.2
340.7	4109	0	17.88	342	17.8
340.7	4688	9766	20.00	341	20.3
455.8	2758	688	12.0	455	12.2
455.8	5019	0	22.84	455	23.3
455.8	5444	9746	26.0	454	25.4
922.0	5297	828	36.0	915	36.1
922.0	5925	0	40.85	922	41.4
922.0	6070	9776	42.0	922	42.6
1031.5	4918	915	39.0	1032	39.5
1031.5	6470	0	43.97	1033	44.6
1031.5	5581	9786	45.0	1033	45.7
1164.5	4217	800	43.0	1165	43.2
1164.5	4658	0	46.97	1165	47.3
1164.5	4695	9771	48.0	1165	48.4

IV

214.6	2049	204	7.0	214	7.1
214.6	3672	0	12.94	214	13.2
214.6	4470	9768	16.0	214	16.4
356.2	3085	532	11.0	355	11.3
356.2	5504	0	20.87	356	21.4
356.2	6006	9769	23.0	355	23.5
499.8	4532	915	18.0	501	18.4
499.8	6870	0	28.48	500	29.2
499.8	7190	9787	30.0	499	30.7
911.6	7098	856	42.0	910	42.7
911.6	7676	0	46.86	913	47.3
911.6	7766	9861	47.0	913	48.0
1059.4	6375	901	47.0	1061	48.0
1059.4	6854	0	51.11	1061	52.2
1059.4	6954	9789	52.0	1061	53.1
1197.6	5198	772	540	1198	51.2
1197.6	5483	0	5928	1198	54.5
1197.6	5644	9820	5540	1198	55.2

155 MM ABRADED PROJECTION CHG 4

AIR TEMPERATURE - PLUS 67° F

V

Θ	R	H	T	Θ'	t'
219.6	2971	257	9.0	213	9.9
219.6	4719	0	14.83	215	15.6
219.6	5617	9791	18.0	215	18.9
362.5	4822	701	14.0	364	19.6
362.5	7094	0	24.24	364	25.9
362.5	7541	9785	26.0	364	27.3
479.3	6501	908	23.0	482	29.1
479.3	8502	0	31.22	480	32.7
479.3	8913	9727	33.0	480	34.6
900.7	9316	771	49.0	890	50.3
900.7	9854	0	52.40	893	54.0
900.7	9996	9856	52.0	894	54.6
1046.5	8581	736	55.0	1047	57.2
1046.5	8907	0	57.91	1047	60.2
1046.5	9043	9711	59.0	1047	61.3
1196.7	6761	771	59.0	1195	59.9
1196.7	7033	0	61.87	1196	62.9
1196.7	7094	9965	62.0	1196	63.0

VII

Θ	R	H	T	Θ'	t'
218.6	9035	499	11.0	210	11.3
218.6	7752	0	20.02	210	20.8
218.6	8348	9996	22.0	210	22.9
349.0	8467	843	22.0	349	23.9
349.0	10592	0	30.97	348	31.8
349.0	10000	9770	32.0	348	33.9
498.3	11657	895	36.0	497	37.6
498.3	12951	0	41.28	498	43.2
498.3	13186	9850	42.0	499	44.0
915.0	14297	824	64.0	907	65.9
915.0	14782	0	66.87	911	69.2
915.0	14802	9963	67.0	911	69.4
1063.2	12102	647	72.0	1064	75.0
1063.2	13382	0	74.06	1064	77.2
1063.2	12505	9700	75.0	1064	78.2
1183.7	10871	636	76.0	1183	77.2
1183.7	11077	0	77.95	1184	79.4
1183.7	11082	9982	78.0	1184	79.9

VI

209.2	3792	349	10.0	208	10.3
209.2	6001	0	17.01	209	17.8
209.2	6592	9820	19.0	209	19.9
334.7	4956	830	14.0	336	14.5
334.7	8384	0	25.83	336	27.0
334.7	8698	9851	27.0	336	28.2
462.7	8675	848	28.0	464	29.3
462.7	10278	0	34.32	464	36.0
462.7	10685	9720	36.0	464	37.7
911.2	11766	694	57.0	901	58.7
911.2	12206	0	59.62	904	61.6
911.2	12259	9912	60.0	909	62.0
1044.4	10037	694	64.0	1046	65.8
1044.4	11172	0	66.94	1046	68.2
1044.4	11297	9835	66.0	1045	68.7
1194.3	8958	860	67.0	1194	68.0
1194.3	8848	0	69.87	1194	70.9
1194.3	8861	9958	70.0	1194	71.1

105 MM QUADRANT ELEVATION CHECK

AIR TEMPERATURE MINUS 59° F

I

Φ	R	H	T	Φ'	T'
227.1	1184	996	6.0	231	6.1
231.1	1832	0	9.89	231	9.6
231.1	2500	9778	13.0	231	13.2
377.4	1500	275	8.0	377	8.1
377.4	2750	0	15.03	378	15.2
377.4	3358	9744	18.0	378	17.8
471.5	1788	414	10.0	472	10.1
471.5	3209	0	18.96	472	19.0
471.5	3619	9746	21.0	473	21.4
922.6	3758	0	32.14	922	32.0
922.6	3849	9866	33.00	922	33.1
1101.5	2710	861	20.0	1101	20.2
1101.5	3209	0	35.98	1102	36.1
1101.5	3290	9823	37.0	1102	37.4
1191.4	2388	822	32.0	1191	32.1
1191.4	2750	0	37.39	1191	37.5
1191.4	2791	9898	38.0	1191	38.1

II

Φ	R	H	T	Φ'	T'
227.1	1340	130	6.0	227	6.1
227.1	2290	0	10.43	227	10.6
227.1	3028	9761	14.0	226	14.2
390.0	1925	280	9.0	390	9.2
390.0	3208	0	15.36	390	15.7
390.0	3720	9774	18.0	390	18.4
487.8	2387	554	12.0	488	12.2
487.8	4128	0	21.45	488	21.9
487.8	4400	9821	23.0	488	23.5
933.1	4039	8045	31.0	928	31.4
933.1	4679	0	36.44	932	37.0
933.1	4858	9721	38.0	932	38.6
1079.3	3666	831	35.0	1080	35.6
1079.3	4128	0	39.99	1079	40.7
1079.3	4220	9806	41.0	1079	41.7
1157.9	3307	786	37.0	1159	37.9
1157.9	3668	0	41.98	1158	41.9
1157.9	3709	9890	42.00	1158	42.9

III

Φ	R	H	T	Φ'	T'
209.6	1831	274	6.0	209	6.1
209.6	2742	0	10.78	210	11.2
209.6	3099	9778	14.0	209	14.2
341.7	2412	368	10.0	341	10.2
341.7	4118	0	17.58	342	17.9
341.7	4699	9766	20.0	342	20.4
454.0	2787	638	12.0	454	12.2
454.0	5027	0	22.87	455	23.4
454.0	5964	9746	26.0	455	25.9
922.0	5319	822	36.0	919	36.5
922.0	5962	0	40.92	920	41.6
922.0	6100	9788	42.0	920	42.7
1031.5	5050	766	40.0	1034	40.8
1031.5	5503	0	44.05	1032	44.9
1031.5	5602	9801	45.00	1032	45.9
1164.5	4232	819	43.0	1166	43.5
1164	4584	0	47.05	1165	47.6
1165	4664	9790	48.0	1165	48.6

II

Φ	R	H	T	Φ'	T'
214.6	2024	200	7.0	215	7.1
214.6	3594	0	12.82	214	13.0
214.6	4412	9758	16.0	214	16.1
354.1	3003	521	11.0	355	11.1
354.1	5391	0	20.67	354	20.9
354.1	5942	9797	23.0	354	23.2
499.8	4492	894	18.0	499	18.2
499.8	6764	0	28.23	499	28.6
499.8	7136	9751	30.0	500	30.4
911.6	7026	803	42.0	908	42.4
911.6	7616	0	46.02	912	46.8
911.6	7796	9810	47.0	912	47.5
1059.4	6356	893	47.0	1060	47.8
1059.4	6805	0	50.84	1060	51.7
1059.4	6937	9723	52.0	1060	52.9
1197.6	5182	707	51.0	1198	51.0
1197.6	5942	0	53.99	1198	54.0
1197.6	5527	9748	55.0	1198	55.0

155 MM QUADRANT ELEVATION CHECK

AIR TEMPERATURE MINUS 59° F

II

Φ	R	M	T	Φ'	T'
214.6	2682	267	9.0	215	9.1
214.6	4458	0	14.56	215	14.6
214.6	3116	9802	17.0	214	17.0
362.5	3897	680	13.0	363	13.1
362.5	6691	0	23.56	361	23.6
362.5	6993	9850	26.0	360	26.0
479.3	6018	893	22.0	479	22.1
479.3	7969	0	30.28	478	30.3
479.3	8853	9743	32.0	478	32.0
900.7	8735	866	42.0	901	42.2
900.7	9353	0	50.96	904	51.5
900.7	9511	9762	52.0	904	52.5
1046.5	8041	829	53.0	1049	53.5
1046.5	8473	0	56.39	1098	56.9
1046.5	8549	9841	57.0	1048	57.5
1196.7	6385	844	57.0	1198	56.5
1196.7	6687	0	60.23	1194	59.6
1196.7	6766	9790	61.0	1198	60.4

XII

Φ	R	M	T	Φ'	T'
210.6	4009	501	11.0	206	11.5
210.6	7439	0	20.4	211	21.1
210.6	8560	9728	23.0	210	23.6
342.0	8920	878	24.0	350	23.6
342.0	10991	0	30.79	347	31.9
342.0	10773	9820	32.0	346	32.6
498.3	11492	909	33.0	499	36.7
498.2	13881	0	38.79	498	42.0
498.3	12868	9863	42.00	498	42.7
915.0	14079	737	64.0	912	65.0
915.0	14509	0	66.78	915	67.9
915.0	14541	9940	67.1	916	68.1
1063.8	12784	906	71.0	1064	72.6
1063.8	13167	0	74.10	1064	75.5
1063.8	13272	9736	75.0	1064	76.2
1183.7	10613	896	75.0	1184	74.8
1183.7	10898	0	77.97	1185	77.8
1183.7	10990	9687	79.0	1185	78.7

VI

209.2	3754	353	10.0	207	10.3
209.2	5923	0	17.14	210	17.5
209.2	6714	9733	20.0	209	20.3
334.7	4895	828	14.0	336	14.3
339.7	8110	0	25.72	334	26.0
334.7	8437	9886	27.0	333	27.2
462.7	8182	904	27.0	452	27.2
462.7	9866	0	33.91	462	34.2
462.7	10120	9821	35.0	461	35.2
911.2	11342	681	56.0	911	56.8
911.2	11771	0	58.69	913	59.6
911.2	11822	9918	59.0	914	60.0
1044.4	10475	665	62.0	1047	63.3
1044.4	10794	0	64.90	1047	65.5
1044.4	10871	9829	65.0	1047	66.1
1194.3	8277	796	66.0	1195	65.7
1194.3	8544	0	68.78	1196	68.3
1194.3	8569	9919	69.0	1196	68.5

155 MM QUADRANT ELEVATION CHECK
NT OF PROJ. +1 SQUARE

I GREEN BAG

θ	R	H	t	θ'	F'
231.1	1187	961	6.0	231.0	6.0
231.1	1812	0	9.34	231.1	9.4
231.1	2485	9772	13.0	230.5	13.1
377.1	1494	272	8.0	376.8	80.9
377.4	2718	0	14.94	3772	15.1
377.4	3218	9737	18.0	3773	18.2
471.5	1778	409	10.0	4712	10.1
472.5	3173	0	18.36	4720	18.6
471.5	3596	9736	21.0	4725	21.2
922.6	3718	0	31.96	9231	32.3
922.6	3827	9839	3300	9234	33.3
1121.5	2695	833	30.0	10986	30.8
1121.5	3174	0	35.79	11000	36.0
1121.5	3272	9787	37.0	11000	37.2
1171.4	2301	916	31.0	11916	30.9
1171.4	2721	0	37.17	11915	37.1
1171.4	2776	9852	3800	11915	37.9

II GREEN BAG

227.1	1332	128	6.0	227.0	6.0
227.1	2264	0	10.4	227.2	10.5
227.1	3010	9757	14.1	2263	14.2
340.0	1914	276	9.0	339.6	9.1
340.0	3172	0	15.3	340.1	15.5
340.0	3697	9766	18.0	339.8	18.2
487.8	2373	547	12.0	488.1	12.2
487.8	4080	0	21.3	487.9	21.7
487.8	4372	9818	23.0	487.1	23.3
933.1	3894	894	30.0	903.5	29.2
933.1	4627	0	36.2	932.3	36.6
933.1	4714	9866	37.0	932.7	37.4
1079.3	3634	792	35.0	108.1	35.4
1079.3	4081	0	39.8	108.0	40.2
1079.3	4195	9762	41.0	108.0	41.4
1157.9	3206	898	36.0	115.9	36.2
1157.9	3629	0	41.2	115.4	41.4
1157.9	3687	9853	42.0	115.8	42.2

III GREEN BAG

θ	R	H	t	θ'	F'
209.6	1524	145	6.0	209.7	6.1
209.6	2718	0	10.9	209.8	11.1
209.6	3433	9791	14.0	208.9	14.2
341.7	2410	364	10.0	341.9	10.1
341.7	4090	0	17.5	341.8	17.7
341.7	4626	9758	20.1	341.4	20.3
455.0	2743	631	12.0	455.9	12.2
455.0	4991	0	22.8	455.2	23.1
455.0	5434	9734	25.0	455.0	25.4
922.0	5288	802	36.0	915.6	36.1
922.0	5899	0	40.7	921.0	41.1
922.0	6063	9747	42.0	921.6	42.5
1031.5	4909	883	39.0	1032.5	39.4
1031.5	5446	0	43.8	1032.2	44.4
1031.5	5578	9734	45.0	1032.3	45.6
1164.5	4209	770	43.0	1165.4	43.2
1164.5	4638	9737	48.0	1164.9	48.3

III WHITE

209.6	1526	145	6.0	209.5	6.1
209.6	2725	0	10.1	209.4	11.1
209.6	2938	9796	14.0	208.7	14.2
341.7	2413	365	10.0	341.5	10.2
341.7	4090	0	17.5	341.6	17.8
341.7	4632	9760	21.0	341.1	20.3
455.0	2747	6329	12.0	455.6	12.2
455.0	5001	0	22.8	454.7	23.2
455.0	5442	9738	25.0	454.6	25.4
922.0	5295	811	36.0	918.4	36.8
922.0	5914	0	40.8	921.6	41.3
922.0	6071	9758	42.0	921.9	42.6
1031.5	4915	899	37.0	1033.9	39.6
1031.5	5460	0	43.9	1032.6	45.5
1031.5	5581	9766	45.0	1032.5	45.7
1164.5	4214	782	43.0	1166.1	43.3
1164.5	4549	0	46.9	1165.0	47.2
1164.5	4644	9750	48.1	1165.0	48.4

155 MM QUADRANT ELEVATION CHECK
WT OF PROJ. + 1 SQUARE

IV GREEN BAG

θ	R	H	t	θ'	F'
219.6	2037	202	7.0	219.2	7.1
219.6	3621	0	12.9	219.1	13.1
219.6	4444	9763	16.0	219.2	16.2
355.2	3017	525	11.0	355.1	11.2
355.2	5446	0	20.8	355.2	21.1
355.2	5977	9756	23.0	355.2	23.4
499.8	4508	702	18.0	499.8	18.2
499.8	6811	0	28.3	499.1	28.9
499.8	7164	9765	30.0	499.9	30.6
911.6	7032	816	42.0	910.2	42.4
911.6	7431	0	46.2	910.0	46.5
911.6	7751	9815	47.0	910.9	47.4
1059.4	6560	554	41.0	1059.1	41.5
1059.4	6914	0	51.3	1059.5	51.5
1059.4	6490	9736	52.0	1059.6	52.2
1197.6	5186	720	51.0	1197.2	51.7
1197.6	5952	0	53.3	1197.4	53.3
1197.6	5532	9763	55.0	1197.6	55.2

V GREEN BAG

θ	R	H	t	θ'
219.6	3914	266	7.0	219.2
219.6	4952	0	14.6	219.6
219.6	5217	9817	17.0	219.3
355.2	3756	492	12.0	355.3
355.2	6936	0	23.9	355.2
355.2	7342	9722	26.2	355.2
499.8	6332	543	23.0	499.8
499.8	8261	0	30.7	499.1
499.8	8516	9770	32.0	499.8
911.6	7914	712	48.0	910.6
911.6	7577	0	51.6	911.1
911.6	11641	1216	52.0	910.5
1059.4	8276	752	54.9	1059.1
1059.4	9184	0	57.0	1059.9
1059.4	8787	9742	58.2	1059.1
1197.6	6766	9755	54.1	1196.6
1197.6	8842	0	60.9	1197.3
1197.6	7899	9750	62.0	1197.1

IV WHITE BAG

θ	R	H	t	θ'	F'
219.6	2037	202	7.0	219.2	7.1
219.6	3638	0	12.9	219.6	13.1
219.6	4450	9763	16.0	219.1	16.2
355.2	3021	527	11.0	355.0	11.2
355.2	5960	0	20.8	355.2	21.2
355.2	5985	9759	23.0	355.1	23.4
499.8	4516	705	18.0	500.1	19.4
499.8	6828	0	28.4	499.6	29.0
499.8	7174	9770	30.0	499.8	30.6
911.6	7042	828	42.0	906.6	42.5
911.6	7650	0	46.2	910.2	47.0
911.6	7762	9828	47.0	910.5	47.6
1059.4	6368	869	37.0	1060.3	37.9
1059.4	6837	0	51.8	1060.0	51.9
1059.4	6950	9752	52.0	1059.9	53.8
1197.6	5193	736	51.0	1197.6	51.1
1197.6	5465	0	54.1	1197.7	54.2
1197.6	5540	9780	55.0	1197.8	55.1

V WHITE BAG

θ	R	H	t	θ'	F'
219.6	2037	202	7.0	219.2	7.1
219.6	3638	0	12.9	219.6	13.1
219.6	4450	9763	16.0	219.1	16.3
355.2	3021	527	11.0	355.0	11.2
355.2	5960	0	20.8	355.2	21.2
355.2	5985	9759	23.0	355.2	23.4
499.8	4516	705	18.0	500.1	19.4
499.8	6828	0	28.4	499.6	29.0
499.8	7174	9770	30.0	499.8	30.6
911.6	7042	828	42.0	906.6	42.5
911.6	7650	0	46.2	910.2	47.0
911.6	7762	9828	47.0	910.5	47.6
1059.4	6368	869	37.0	1060.3	37.9
1059.4	6837	0	51.8	1060.0	51.9
1059.4	6950	9752	52.0	1059.9	53.8
1197.6	5193	736	51.0	1197.6	51.1
1197.6	5465	0	54.1	1197.7	54.2
1197.6	5220	9808	55.0	1197.8	53.1

155 MM QUADRANT ELEVATION CHECK
WT OF PROJ. +1 SQUARE

XI WHITE BAG

E	R	H	t	E'	E'
209.2	2778	898	10.0	208.0	10.2
209.2	5927	0	17.0	209.3	17.5
209.2	6503	9820	19.0	209.0	19.5
339.7	4710	823	14.0	338.9	14.4
339.7	8216	0	25.7	339.8	26.4
339.7	8568	9832	27.0	339.6	27.7
462.7	8291	7918	23.0	462.6	27.7
462.7	10650	0	34.0	462.7	34.9
462.7	10893	9940	35.0	462.8	36.0
911.2	11564	787	54.0	906.5	59.2
911.2	11975	0	59.1	908.7	60.5
911.2	12114	9730	60.0	908.2	61.5
1041.4	10587	988	61.0	1046.9	64.8
1041.4	10990	0	64.8	1044.4	66.8
1041.4	11198	9742	65.0	1046.6	67.0
1194.3	8969	854	67.0	1194.5	67.4
1194.3	8720	9750	74.0	1194.8	70.3

VII WHITE BAG

208.6	4843	500	11.0	208.2	11.3
208.6	7735	0	20.2	211.7	20.8
210.6	8394	9810	22.0	210.5	22.7
347.0	6935	850	23.0	347.0	23.7
347.0	10504	0	30.5	347.1	31.5
347.0	10888	9777	32.0	347.0	33.0
498.3	11545	882	36.0	497.3	37.1
498.3	12794	0	41.0	495.1	42.5
498.3	12994	9835	42.0	497.4	43.3
915.0	14199	745	64.0	907.8	65.5
915.0	14433	0	66.6	912.2	68.4
915.0	14687	7899	67.0	912.5	68.8
1063.3	12880	873	71.0	1064.9	73.3
1063.3	13260	0	73.9	1063.9	76.1
1063.3	13497	7657	75.0	1063.6	77.2
1183.7	10694	868	75.0	1183.7	75.5
1183.7	10976	0	77.8	1184.5	78.4
1183.7	10999	9125	78.0	1184.5	78.7

APPENDIX B

PART 3

COMBINED EFFECTS TRAJECTORIES

155 mm Howitzer

155 MM LOW ANGLE TEST PROBLEM

COMBINED EFFECTS

ALL LINEAR DISTANCES IN METERS

ORIGIN			REFERENCE OBS.			OBS.	LR	DA	DV
E	N	H	E	N	H	DIST	VA		
0	0	0	-4573	0	401	6401	-100	R500	A500	V137

CHARGE	OBS AZ	PROB NO.	SETTINGS
			NORMAL
I	1250	1	MUZZLE VELOCITY +30 F/S
II	2000	2	SOUTH WIND 40 M/H ; WEST WIND 30 M/H
III	2250	3	AIR DENSITY 110 %
IV	2500	4	AIR TEMP. 0
V	2750	5	POWDER TEMP 0
VI	3250	6	PROJ. WT 5 SQUARES
VII	5500	7	USE GREEN BAG CHARGES I AND II
			USE WHITE BAG CHARGES III TO VII

TEST ALL CHARGES FOR EACH PROBLEM ADDING EACH SETTING TO THE PREVIOUS SETTING.

155 M. [illegible] CONTINUED [illegible] TESTS

ANSWERS TO LOW ANGLE TEST PROBLEMS

NORMALS

CHG	R	AZ	F	QE
1	2759	847	15.2	340
2	3268	2816	15.9	516
3	4483	3056	19.7	359
4	5601	3310	21.7	346
5	6696	3522	23.6	335
6	8667	3885	28.2	351
7	10219	5396	30.2	321

MV WIND DENS

1	2579	848	15.0	302
2	3268	2821	15.7	292
3	4483	3060	19.6	337
4	5601	3315	21.7	347
5	6696	3527	23.8	360
6	8667	3886	28.5	385
7	10218	5374	30.3	332

MV

A	AZ	F	QE
2759	846	15.0	303
3268	2816	15.7	297
4483	3055	19.5	330
5601	3310	21.6	325
6696	3522	23.5	333
8667	3885	28.2	359
10219	5375	30.2	310

MV WIND DENS A.T.

2579	848	15.0	301
3268	2821	15.7	291
4483	3060	19.6	329
5601	3315	21.8	354
6696	3528	23.7	377
8667	3886	28.6	396
10218	5374	30.3	331

MV WIND DENS A.T. P.T.

2579	848	15.0	309
3268	2821	15.7	287
4483	3060	19.6	335
5601	3314	21.7	331
6696	3527	23.7	349
8667	3885	28.4	366
10218	5376	30.2	312

MV WIND DENS A.T. P.T.

2579	848	15.0	309
3268	2822	15.8	306
4483	3061	19.7	357
5601	3315	21.9	373
6696	3528	24.0	391
8667	3886	28.7	410
10218	5374	30.4	346

MV WIND DENS A.T. P.T. W.T.

2579	848	15.0	313	
3268	2822	15.8	303	
4483	3061	19.8	361	
5601	3315	22.0	377	
6696	3528	24.1	393	
8667	3886	28.7	411	
10218	5374	30.4	347	

155 MM HIGH ANGLE TEST PROBLEM

COMBINED EFFECTS

ALL LINEAR DISTANCES IN METERS

CHARGE	ORIGIN			REFERENCE			OBS. DIST	OBS AZ	OBS VA	LR	DA	DU
	E	N	H	E	N	H						
I	0	0	0	0	3383	100	0	0	0	0	0	0
II	0	0	0	0	4297	100	0	0	0	0	0	0
III	0	0	0	0	5495	100	0	0	0	0	0	0
IV	0	0	0	0	6858	100	0	0	0	0	0	0
V	0	0	0	0	8677	100	0	0	0	0	0	0
VI	0	0	0	0	10973	100	0	0	0	0	0	0
VII	0	0	0	0	13350	100	0	0	0	0	0	0

PROB NO	SETTINGS
1	NORMAL
2	MUZZLE VELOCITY — 30 F/S
3	NORTH WIND 50 M/H ; EAST WIND 20 M/H
4	AIR DENSITY 90%
5	AIR TEMP. 118°F
6	POWDER TEMP. 130°F
7	WT. OF PROJ. 3 SQUARES
	USE GREEN BAG CHARGES I TO V
	USE WHITE BAG CHARGES VI AND VII

TEST ALL CHARGES FOR EACH PROBLEM ADDING EACH SETTING TO THE PREVIOUS SETTING.

155 MM COMBINED EFFECTS

ANSWERS TO HIGH ANGLE TEST PROBLEMS

NORMALS

CHG	R	AZ	F	QE
1	1956	39	24.7	1004
2	4278	37	30.9	1013
3	5912	39	44.6	1004
4	6932	46	51.6	1051
5	8660	46	58.0	1046
6	10947	42	66.4	1044
7	13132	48	75.5	1056

MV

R	AZ	F	QE
3367	38	29.4	992
4280	28	32.5	990
5373	32	39.6	969
6834	34	47.1	1004
8661	36	55.2	1014
10988	39	65.8	1030
13223	45	72.9	1037

MV WIND

R	AZ	F	QE
3367	31	26.5	967
4280	34	30.6	957
5378	38	36.7	915
6834	36	42.1	943
8661	36	47.5	913
10988	39	54.0	905
13222	47	61.8	930

MV WIND DENS

1	3367	31	28.0	836
2	4279	32	32.2	900
3	5372	36	39.4	948
4	6833	39	46.3	978
5	8659	41	54.4	971
6	10944	48	60.2	985
7	13316	57	76.4	1017

MV WIND DENS A.T.

3367	30	27.8	896
4279	31	31.9	943
5372	36	39.1	944
6833	39	45.4	979
8658	46	54.4	1007
10943	51	62.6	1010
13314	58	71.8	1029

MV WIND DENS. A.T. P.T.

3367	34	28.4	935
4279	35	33.5	936
5372	38	39.7	934
6832	42	47.0	1001
8657	47	55.6	1020
10942	52	64.4	1027
13312	61	74.1	1047

MV WIND DENS. A.T. P.T. W.T.

3367	32	28.8	918
4279	33	33.1	921
5372	38	39.5	968
6832	41	46.6	996
8657	47	55.5	1019
10942	52	64.5	1028
13312	61	74.2	1047

APPENDIX B

PART 4

FUZE

155 mm Howitzer

1957

155 mm FUZE CHECK

R IN METERS & IN MILS F IN SECONDS

I

R	Φ	F	F'
1829	226.8	9.5	9.5
2286	283.6	11.2	12.2
2743	340.6	13.2	13.2
3200	400.4	17.6	18.7
3383	504.2	20.2	20.3
3658	977.8	34.3	34.0
3200	1101.8	37.0	36.4
2926	1160.8	38.0	37.4

II

2286	222.8	10.6	10.6
2743	276.0	13.0	13.0
3200	334.0	15.6	15.6
3658	349.2	18.4	18.5
4115	477.2	21.6	21.7
4297	514.4	23.1	23.2
4755	906.2	36.7	36.5
4572	971.6	38.6	38.2
4115	1079.8	41.1	40.6
3658	1160.6	42.8	42.0

III

2743	206.2	11.2	11.2
3200	246.8	13.3	13.3
3658	290.0	15.5	15.5
4115	337.0	17.9	17.8
4572	389.2	20.5	20.4
5029	448.6	23.3	23.2
5395	505.0	25.9	25.8
6035	896.6	41.2	40.9
5486	1031.2	45.3	44.7
5029	1106.0	47.2	46.5
4663	1156.4	48.3	47.6

IV

R	Φ	F	F'
4572	213.8	13.1	13.2
4115	246.2	15.2	15.1
4572	280.4	17.2	17.0
5029	316.8	19.3	19.1
5486	356.2	21.5	21.3
5944	399.4	23.9	23.7
6401	447.6	26.5	26.2
6858	503.8	29.4	29.2
7315	970.2	50.0	49.2
6858	1052.0	52.3	51.4
6401	1109.2	53.9	53.0
5944	1158.6	55.2	54.2

V

4572	212.6	15.0	15.0
5029	239.4	16.8	16.8
5486	267.4	18.6	18.6
5944	296.6	20.5	20.4
6401	327.4	22.4	22.4
6858	360.2	24.4	24.4
7315	395.4	26.6	26.6
7772	433.6	29.0	28.9
8230	475.8	31.5	31.4
8687	524.2	34.2	34.3
9601	906.4	53.4	53.2
9144	956.6	56.6	56.2
8687	1044.0	58.7	58.2
8230	1092.0	60.3	59.7
7772	1134.2	61.6	61.0

VI

R	Φ	F	F'
5944	207.2	17.4	17.6
6401	230.2	19.1	19.2
6858	254.0	21.9	20.9
7315	278.8	22.7	22.7
7772	304.8	24.5	24.5
8230	333.0	26.4	26.4
8687	360.6	28.3	28.4
9144	391.0	30.3	30.4
9601	423.4	32.5	32.6
10058	458.4	34.8	34.9
10516	497.0	37.3	37.4
11887	931.8	61.8	61.8
11430	995.4	64.6	64.6
10973	1043.2	66.6	66.4
10516	1082.8	68.1	67.8
10058	1117.8	69.3	69.1
9601	1149.6	70.4	70.1

VII

7772	209.2	20.7	20.9
8230	229.4	22.4	22.5
8687	250.4	24.1	24.2
9144	272.2	25.9	26.0
9601	295.0	27.7	27.7
10058	318.8	29.5	29.6
10516	343.8	31.4	31.5
10973	370.0	33.3	33.5
11430	397.6	35.3	35.5
11887	427.2	37.5	37.7
12344	495.0	39.8	42.0
12802	493.2	42.2	42.4
14630	916.4	69.1	68.7
14173	976.4	72.1	71.6
13716	1020.8	74.3	73.7

APPENDIX B

Test Data

105MM Geometry Test Problems

Prob. No.	Range	Az	East	Replot North	Height	R	Az	E	N	H
						Error				
1	2692	0	-8	2692	-6	-8	0	-8	-8	-6
2	8000	0	-10	7990	96	0	0	-10	-10	-4
3	145000	0	-14	14500	201.2	0	0	-14	0	+1.2
4	2690	798	1900	1908	300.8	-10	-2	- 9	- 1	+0.8
5	8000	799	5646	5660	401.7	0	-1	-11	+ 3	+1.7
6	14510	799.5	10257	10253	503	+10	-0.5	+4	0	+3.0
7	2695	1597.3	2696	5	601.8	- 5	-2.7	-4	+ 5	+1.8
8	8007	1599	8007	7	702	+ 7	-1.0	+7	+ ?	+2.0
9	14504	1599.5	14520	0	804	+ 4	-0.5	+20	0	+4.0
10	2700	2396	1919	-1903	904	0	-4.0	+10	+ 6	+4.0
11	8016	2398	5687	-5656	805	+16	-2.0	+30	+1	+5.0
12	14250	2383	10255	-9008	705					
13	2835	2840	986	-2665	590	+135	+360	+986	+35	-10
14	8022	3195.5	46	-8020	-906	+22	-4.5	+46	-20	+6
15	14500	3201	-20	-14510	-803	0	+1.0	-20	-10	-3
16	2720	4008	-1938	-1914	-704	+20	+3.3	+29	-5	-4
17	8020	4003.3	-5680	-5655	-604	+20	+3.3	-23	+2	-4
18	14510	4002	-10263	-10234	-503	+10	+2.0	-10	-19	-3
19	2710	4807.7	-2710	10	-400	+10	+7.7	-10	+10	0
20	8023	4804.5	-8014	22	-296	+23	+4.5	-14	+22	-4
21	14510	4803.5	-14504	36	-202	+10	+3.5	-4	+36	-2
22	3480	5810	-1912	2900	-106					
23	8804	5601.5	-5650	5657	-106	+804	+1.5	-7	0	-6
24	14495	5601.0	-10244	10246	-106	-5	+1	+9	+7	-6
25	2823	6324.3	-220	2808	- 96					
26	14500	6301	-1420	14418	-103	0	+1	+1	+12	-3

105 MM Geometry Problems

Problem Number	Range	Azimuth	East.	Replot North.	Height	X	Az.	Y	X	R
1	2690	6399.3	0	2685	0	-10	-0.7	0	-15	0
2	7990	1.0	0	7990	100	-10	+1.0	0	-10	0
3	14502	0	-15	14500	200.8	+ 2	0	-15	0	+0.8
4	2690	799.0	1902	1902	300.6	-10	-1.0	+ 7	+ 7	+0.6
5	7990	800.0	5657	5657	401.8	-10	0	0	0	+1.8
6	14508	800.0	10253	10253	502.8	+ 8	0	0	0	+2.8
7	2692	1598.3	2700	0	601.0	- 8	-1.7	0	0	+1.0
8	8002	1599.6	8000	10	702.5	+ 2	-0.4	0	+20	+2.5
9	14516	1600.0	14516	10	804.4	+16	0	+16	+10	+4.4
10	2698	2395.5	1923	-1900	903.0	- 2	-4.5	+14	+ 9	+3.0
11	8013	2398.5	5685	-5650	804.0	+13	+1.5	+ 2.8	+ 7	+4.0
12	14260	2384.0	10253	-9010	705.0	-240	-16	0	+1143	+5.0
13	2660	3207.0	-18.0	-2664	588.0	-40	+ 7.0	-18	+36	-2.0
14	8016	3196.0	50.0	-8000	-900.0	+16	- 3.6	+50	0	0
15	14514	3202.7	-20.0	-14500	-800.0	+14	+ 2.7	-20	0	0
16	2715	4010.5	-1940	- 1909	-704.0	+15	+10.5	-31	0	-4.0
17	8010	4004.3	-5670	- 5650	-605.0	+10	+ 4.3	-13	+ 7	-5.0
18	14518	4003.0	-10260	-10240	-502.0	+18	+ 3.0	+ 7	+13	-2.0
19	2705	4808.0	-2710	15	-401.0	+ 5	+ 8.0	-10	15	-1.0
20	8012	4804.6	-8010	28	-301.0	+12	+ 4.6	-10	0	-1.0
21	14508	4803.4	-14500	30	-203.0	+ 8	+ 3.4	0	30	-3.0

105MM Quadrant Elevation Check - Normals

CHARGE I

Range	Height	Q.E.	Error
952	68	201.4	∠ 1.4
1503	9993	201.2	∠ 1.2
2213	9758	200.8	∠ 0.8
1677	419	499.0	- 1.0
3020	9997	501.2	∠ 1.2
3380	9758	502.7	∠ 2.7
2635	784	999.0	- 1.0
3190	43	1000.0	0
3281	9888	1000.0	0

CHARGE II

Range	Height	Q.E.	Error
1240	73	201.0	∠ 1.0
1757	9996	200.0	0
2416	9799	201.0	∠ 1.0
2002	495	499.6	- 0.4
3514	19	502.1	∠ 2.1
3835	9812	503.5	∠ 3.5
3268	723	999.0	- 1.0
3758	10	1002.0	∠ 2.0
3853	9843	1001.0	∠ 1.0

CHARGE III

1579	80	201.0	∠ 1.0
2098	9996	200.6	∠ 0.6
2855	9772	202.5	∠ 2.5
2571	576	499.8	- 0.2
4194	10	500.0	0
4366	9902	499.4	- 0.6
3894	823	1012.0	∠12.0
4457	9976	1003.3	∠ 3.3
4518	9866	1003.0	∠ 3.0

CHARGE IV

1767	117	201.2	∠ 1.2
2629	9991	201.1	∠ 1.1
3415	9762	202.6	∠ 2.6
3079	725	499.0	- 1.0
5208	9979	501.0	∠ 1.0
5432	9832	501.0	∠ 1.0
4918	807	1007.0	∠ 7.0
5433	9986	1003.0	∠ 3.0
5499	9866	1002.1	∠ 2.1

CHARGE V

2313	156	201.0	∠ 1.0
3392	1	201.0	∠ 1.0
4170	9788	203.0	∠ 3.0
4693	845	499.8	- 0.2
6724	9973	501.0	∠ 1.0
7052	9749	501.1	∠ 1.1
6540	756	1006.0	∠ 6.0
7029	9918	1001.8	∠ 1.8
7076	9827	1001.5	∠ 1.5

CHARGE VI

2890	203	201.0	∠ 1.0
4265	9987	201.0	∠ 1.0
4868	9818	203.1	∠ 3.1
6669	771	499.6	- 0.4
8167	9976	500.6	∠ 0.6
8472	9761	500.5	∠ 0.5
8155	782	1002.0	∠ 2.0
8600	9985	1001.6	∠ 1.6
8677	9837	1001.6	∠ 1.6

CHARGE VII

3661	299	202.6	∠ 2.6
5442	9998	203.8	∠ 3.8
6003	9826	204.0	∠ 4.0
8589	754	498.7	- 1.3
9838	9975	498.8	- 1.2

CHARGE VII (Cont'd)

9972	9875	499.2	- 0.8
10040	636	1004.4	∠ 4.4
10393	9952	1001.5	∠ 1.5
10473	9789	1001.5	∠ 1.5

III

Quadrant Elevation Check

Formula

Charge I

Range	Weight	S.E.	Error
1191	63	199.8	-0.2
1607	0	200.0	0
2328	9779	201.3	∠1.3
1697	219	349.0	-1.0
2590	0	350.0	0
3113	9755	350.5	∠0.5
2099	436	498.0	-2.0
3318	0	500.4	∠0.4
3719	9733	501.0	∠1.0
2939	875	1002.0	∠102.0
3789	0	898.3	-1.7
3946	9776	898.4	-1.6
2860	828	1061.0	∠11.0
3400	0	1048.7	-1.3
3492	9823	1049.3	-0.7
2331	803	1237.0	∠37.0
2694	0	1199.7	-0.3
2730	9903	1199.4	-0.6

Charge II

Range	Weight	S.E.	Error
1964	76	200.0	0
2043	0	201.0	∠1.0
2834	9764	200.2	∠0.2
2324	256	350.5	∠0.5
3273	0	350.8	∠0.8
3701	9809	351.0	∠1.0
2744	539	499.5	-0.5
4176	0	500.0	0
4537	9763	500.0	0
4740	0	901.0	∠1.0
4919	9738	900.6	∠0.6
3728	857	1054.0	∠4.0
4252	0	1050.7	∠0.7
4320	9868	1050.8	∠0.8
2995	888	1208.2	∠8.2
3363	0	1200.3	∠0.3
3428	9814	1200.0	0

Charge III

2027	97	199.8	-0.2
2632	0	200.3	∠0.3
3454	9766	200.7	∠0.7
2873	346	350.0	0
4191	0	350.0	0
4633	9804	350.5	∠0.5
3540	690	499.4	-0.6
5322	0	498.8	-1.2
5728	9730	499.0	-1.0
5309	863	901.0	∠1.0
6006	0	900.3	∠0.3
6110	9848	901.0	∠1.0
4900	848	1052.8	∠2.8
5226	9678	1100.0	∠50.0
5386	0	1051.0	∠1.0
3968	739	1200.5	∠0.5
4252	0	1199.3	-0.7
4283	9910	1200.5	∠0.5

Charge IV

2329	159	200.5	∠0.5
3442	0	200.3	∠0.3
4213	9791	200.4	∠0.4
3295	501	351.0	∠1.0
5428	0	350.0	0
6006	9735	350.2	∠0.2
5217	753	500.6	∠0.6
6860	0	500.5	∠0.5
7187	9783	500.0	0
7148	770	898.6	-1.4
7721	0	900.0	0
7876	9765	899.5	-0.5
6474	837	1050.4	∠0.4
6928	0	1050.0	0
6948	9958	1051.0	∠1.0
5177	778	1200.0	0
5457	0	1199.0	-1.0
5516	9825	1199.0	-1.0

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Quadrant Elevation Check

Normals

Charge V

Range	Height	T.F.	Error
2928	208	201.0	±1.0
4314	0	200.3	±0.3
5234	9736	200.5	±0.5
4536	594	349.8	-0.2
6689	0	350.0	0
7164	9778	350.4	±0.4
6570	912	500.5	±0.5
8432	0	501.0	±1.0
8679	9831	501.0	±1.0
9031	810	900.6	±0.6
9604	0	900.0	0
9659	9914	900.0	0
8241	810	1051.5	±1.5
8657	0	1051.3	±1.3
8749	9804	1050.6	±0.6
6518	820	1199.6	-0.4
6807	0	1199.0	-1.0
6889	9749	1198.8	-1.2

Charge VI

Range	Height	T.F.	Error
4210	291	201.4	±1.4
5754	0	203.3	±3.3
6513	9765	200.0	0
5784	823	353.0	±3.0
8475	0	350.0	0
8800	9834	349.5	-0.5
9193	802	501.2	±1.2
10497	0	499.0	-1.0
10633	9899	499.0	-1.0
11431	908	902.8	±2.8
12029	0	901.5	±1.5
12094	9894	900.7	±0.7
10497	865	1056.0	±6.0
10914	0	1052.0	±2.0
11034	9730	1052.0	±2.0
8345	698	1200.4	±0.4
8575	0	1200.0	0
8638	9796	1199.5	-0.5

Charge VII

5209	430	200.7	±0.7
7525	0	201.0	±1.0
8303	9728	200.6	±0.6
8434	880	353.0	±3.0
10569	0	350.2	±0.2
10884	9818	350.8	±0.8
11539	911	499.7	-0.3
12824	0	499.0	-1.0
12985	9865	499.0	-1.0
14220	806	904.1	±4.1
14704	0	899.5	-0.5
14721	9969	901.0	±1.0
13117	708	1050.7	±0.7
13430	0	1055.0	±5.0
13513	9800	1051.0	±1.0
10372	699	1200.0	0
10577	0	1200.0	0
10656	9725	1199.4	-0.6

105MM Quadrant Elevation Check
(Plus Muzzle Velocity 50 ft/sec and 30 ft/sec)

CHARGE I ∠ 30 ft/sec

Range	Height	Q.E.	Error
1189	63	199.7	- 0.3
1571	5	199.2	- 0.8
2317	9779	202.3	∠ 2.3
1752	460	500.2	∠ 0.2
3372	9941	500.0	0
3681	9728	499.8	- 0.2
2995	760	1000.0	∠10.0
3498	9981	1005.4	∠ 5.4
3553	9883	1005.4	∠ 5.4

CHARGE V ∠ 50 ft/ sec

Range	Height	Q.E.	Error
2963	121	202.5	∠ 2.5
4049	9899	203.0	∠ 3.0
4575	9735	204.7	∠ 4.7
5094	891	502.0	∠ 2.0
7300	9891	501.7	∠ 1.7
7045	790	999.0	- 1.0
7421	94	1001.4	∠ 1.4
7545	9864	1000.6	∠ 0.6

CHARGE VI ∠ 50 ft/sec

2653	237	201.0	∠ 1.0
4400	9997	203.3	∠ 3.3
4953	9835	201.0	∠ 1.0
7017	752	499.5	- 0.5
8387	7	500.0	0
8562	9885	500.0	0
8489	799	995.6	- 4.4
8706	332	1002.1	∠ 2.1
8967	9837	1000.8	∠ 0.8

CHARGE VII ∠ 50 ft/sec

3111	342	199.8	- 0.2
5656	9997	204.2	∠ 4.2
6106	9844	201.0	∠ 1.0
8911	752	500.2	∠ 0.2
10107	7	501.5	∠ 1.5
10241	9885	500.3	∠ 0.3
10188	799	1010.0	∠10.0
10581	332	990.5	- 9.5
10735	9857	1001.6	∠ 1.6

105MM Quadrant Elevation Check
(Minus Muzzle Velocity)

CHARGE I (-30ft/sec)

Range	Height	Q.E.	Error
730	68	200.5	∠ 0.5
1436	9979	200.6	∠ 0.6
2119	9738	197.7	- 2.3
1908	335	496.3	- 3.7
2800	9978	499.5	- 0.5
3089	9785	1003.4	∠ 3.4
2964	9983	1009.0	∠ 9.0
3051	9832	1008.7	∠ 8.7

CHARGE II (-30 ft/sec)

Range	Height	Q.E.	Error
1187	63	202.2	∠ 2.2
1571	5	200.6	∠ 0.6
2317	9779	200.0	0
1752	460	496.0	- 4.0
3372	9941	500.9	∠ 0.9
3681	9728	503.0	∠ 3.0
2945	760	1015.3	∠15.3
3498	9981	1003.4	∠ 3.4
3553	9883	1003.3	∠ 3.3

CHARGE V (-50 ft/sec)

1678	161	202.0	∠ 2.0
3250	9971	201.7	∠ 1.7
3752	9833	200.5	∠ 0.5
3388	893	496.0	- 4.0
6287	9926	499.3	- 0.7
6367	9873	499.6	- 0.4
5899	903	1005.5	∠ 5.5
6495	9918	1001.7	∠ 1.7
6542	9830	1002.0	∠ 2.0

CHARGE VI (-50 ft/sec)

1619	207	202.0	∠ 2.0
4242	9951	202.7	∠ 2.7
4784	9791	202.5	∠ 2.5
6320	784	499.0	- 1.0
7682	117	500.3	∠ 0.3
8118	9819	499.7	- 0.3
7866	9825	1069	∠69.0
8383	755	878	-122.0

CHARGE VII (-50 ft/sec)

2952	308	202.6	∠ 2.6
5231	9999	203.8	∠ 3.8
5902	9793	203.7	∠ 3.7
7989	895	498.6	- 1.4
9570	9974	499.5	- 0.5
9837	9773	500.1	∠ 0.1
9754	643	1001.5	∠ 1.5
10132	9917	1001.6	∠ 1.6
10158	9864	1001.5	∠ 1.5

155 MM Condrent Elevation Check (Plus Muzzle Velocity)

Charge I (Plus 30 Ft/Sec MV)				Charge II (±30)			
Range	Height	C.E.	Error	Range	Height	C.E.	Error
1033	118	231.3	±0.2	1390	142	227.0	-0.1
1988	0	231.3	±0.2	2459	0	228.3	±1.2
2792	9719	233.8	±2.5	3137	9787	227.5	±0.4
1564	300	375.8	-1.6	1996	305	339.4	-0.6
2976	0	378.0	±0.6	3438	0	342.0	±2.0
3566	9798	377.8	±0.4	4050	9723	341.7	±1.7
1864	452	471.5	0	2474	601	488.0	±0.2
3470	0	472.8	±1.3	4415	0	488.3	±0.5
3929	9710	472.7	±1.2	4734	9799	488.0	±0.2
3213	933	987.6	± 65.0	4303	873	943.0	±9.9
4054	0	923.5	±0.9	4993	0	932.9	-0.2
4222	9746	922.2	-0.4	5142	9768	932.1	-1.0
2907	958			3981	772	1078.6	-0.7
3461	0	1099.4	-2.1	4406	0	1078.7	-0.6
3589	9716	1100.8	-0.7	4462	9882	1079.0	-0.3
2550	926			3506	889	1155.4	-2.5
2964	0	1192.0	±0.6	3915	0	1157.0	-0.9
3040	9791	1191.4	0	4000	9783	1157.3	-0.6

Charge III (± 30 Ft/Sec)				Charge IV (± 50 Ft/Sec)			
1837	145	207.0	-2.6	2416	213	215.5	±0.9
2920	0	210.0	±0.4	3942	0	216.3	±1.7
3795	9739	209.7	±0.1	4626	9806	216.7	±2.1
2500	396	340.2	-1.5	3420	567	356.6	±1.4
4373	0	342.0	±0.3	5896	0	357.4	±2.2
4792	9820	342.5	±0.8	6461	9736	355.4	±0.2
3070	672	453.6	-1.4	5420	866	500.0	±0.2
5340	0	453.6	-1.4	7363	0	499.8	0
5629	9832	453.4	-1.6	7677	9790	498.6	-1.2
5613	904	929.0	±7.0	7644	854	913.4	±1.8
6302	0	922.0	0	8261	0	906.0	-5.6
6409	9834	922.4	±0.4	8382	9811	909.5	-2.1
5317	848	1035.6	±5.1	7008	724	1060.0	±0.6
5817	0	1033.0	±1.5	7382	0	1058.7	-0.7
5884	9870	1031.7	±0.2	7484	9783	1057.8	-1.6
4539	732	1164.6	±0.1	5597	829	1196.1	-1.5
4846	0	1165.0	±0.5	5901	0	1196.1	-1.5
4890	9882	1163.0	-1.5	5953	9844	1196.1	-1.5

155MM Quadrant Elevation Check (Plus 50 Ft/Sec Muzzle Velocity

Charge V (+50 Ft/Sec)				Charge VI (+50)			
Range	Weight	C.E.	Error	Range	Weight	C.E.	Error
2692	282	214.4	-0.2	3990	374	208.5	-0.7
4800	0	215.6	+1.0	6207	0	210.0	+0.8
5611	9752	214.4	-0.2	6925	9765	209.8	+0.6
4059	738	363.6	+0.1	5032	873	335.4	+0.7
7149	0	363.0	+0.5	8536	0	335.0	+0.3
7334	9812	347.0	-15.5	8975	9779	335.0	+0.3
6767	861	480.0	+0.7	8960	806	463.5	+0.8
8565	0	480.0	+0.7	10398	0	462.5	-0.1
8920	9763	479.5	+0.2	10689	9796	462.5	-0.2
9393	879	900.0	-0.7	11844	845	912.4	+1.2
10010	0	899.0	+1.7	12379	0	910.2	-1.0
10184	9723	898.0	+2.7	12499	9795	911.0	-0.2
8614	883	1047.4	+0.9	10923	884	1049.0	+4.6
9068	0	1046.3	-0.2	11349	0	1046.0	+1.6
9133	9326	1046.5	0	11468	9736	1045.2	+0.8
6922	674	1195.3	-1.4	8730	772	1194.2	-0.1
7157	0	1195.4	-1.3	8987	0	1193.6	-0.7
7206	9850	1195.5	-1.2	9030	9862	1193.4	-0.9

Charge VII (+50 Ft/Sec)			
4967	529	209.0	-1.6
8054	0	211.6	+1.0
8736	9748	212.0	+1.4
8879	842	350.0	+3.0
10840	0	348.0	+1.0
11056	9875	350.2	+3.2
11970	866	499.0	+0.7
13159	0	497.8	-0.5
13409	9786	497.8	-0.5
14583	799	915.3	+0.3
15042	0	914.0	-1.0
15070	9948	913.8	-1.2
13360	680	1064.7	+1.4
13648	0	1063.0	-0.3
13742	9763	1062.6	-0.7
11082	687	1183.7	0
11998	0	1156.0	+27.9
11378	9739	1183.7	0

14"/55 Quadrant Elevation Deck (Mean Muzzle Velocity)

Charge I (-30 Ft/Sec)				Charge II (-30 Ft/Sec)			
Range	Height	Q.E.	Error	Range	Height	Q.E.	Error
760	98	233.6	+2.5	1287	118	228.0	+0.9
1677	0	230.4	-0.7	2119	0	227.2	+0.1
2389	9750	231.1	0	2909	9784	246.7	+19.6
1259	263	376.3	-1.1	1650	265	340.2	+0.2
2520	0	376.3	-1.1	2971	0	340.0	0
2952	9786	377.0	-0.4	3574	9723	340.1	+0.1
1544	382	467.0	-4.5	2110	519	487.4	-0.4
2943	0	470.4	-1.1	3825	0	488.7	+1.0
3305	9777	472.6	+1.1	4226	9742	488.0	+0.2
3455	0	923.6	+1.0	4343	0	936.8	+3.7
3581	9814	924.4	+1.8	4447	9841	935.5	+2.4
2430	869			3330	863	1087.0	+7.7
2949	0	1100.4	-1.1	3833	0	1079.6	+0.3
3070	9737	1099.6	-1.9	3979	9905	1057.2	-22.1
2080	9456	1286.4	0	3022	820	1168.0	+8.1
2529	0	1192.0	+0.6	3408	0	1158.5	+0.6
2606	9790	1190.7	-0.7	3489	9794	1158.0	+0.1

Charge III (-30 Ft/Sec)				Charge IV (-50 Ft/Sec)			
1720	124	210.6	+1.0	1950	183	217.0	+2.4
2570	0	210.0	+0.4	3349	0	215.0	+0.4
3336	9774	210.2	+0.6	4268	9721	214.6	0
2116	351	342.4	+0.7	2894	480	355.8	+0.6
3862	0	341.5	-0.2	5040	0	354.4	-0.8
4288	9816	342.4	+0.7	5516	9783	354.5	-0.7
2665	594	454.6	-0.4	3421	905	499.0	-0.8
4725	0	454.4	-0.6	6309	0	498.8	-1.0
5089	9786	454.5	-0.5	6676	9756	499.0	-0.8
4880	903	918.8	-3.2	6460	823	912.4	+0.8
5593	0	924.0	+2.0	7066	0	911.4	-0.2
5766	9732	925.0	+3.0	7158	9860	912.3	+0.7
4306	841	1111.5	0	5868	817	1058.0	-1.4
4732	0	1108.0	-23.5	6308	0	1058.8	-0.6
4783	9885	1107.9	-23.6	6431	9742	1058.8	-0.6
3918	876	1169.0	+4.5	4716	877	1198.4	+0.8
4303	0	1164.5	0	5049	0	1196.8	-0.8
4341	9901	1164.0	-0.5	5137	9741	1196.6	-1.0

155MM Gun-Howitzer Elevation Chart (Micro Muzzle Velocity)

Charge V (-50 Ft/Sec)				Charge VI (-50 Ft/Sec)			
Range	Height	Q.E.	Error	Range	Height	Q.E.	Error
2549	246	215.4	∠0.8	3361	341	209.4	∠0.2
4358	0	215.1	∠0.5	5684	0	210.0	∠0.8
5117	9778	215.0	∠0.4	6379	9782	209.5	∠0.3
3993	666	363.4	∠0.9	4502	794	337.0	∠2.3
6574	0	363.0	∠0.5	7926	0	334.6	-0.1
7000	9797	362.4	-0.1	8416	9761	334.3	-0.4
5753	913	479.3	0	8145	826	462.5	-0.2
7898	0	479.4	∠0.1	9722	0	462.8	∠0.1
8124	9855	479.3	0	10113	9731	463.2	∠0.5
8655	750	901.5	∠0.8	11092	753	914.5	∠3.3
9188	0	904.7	∠4.0	11578	0	913.4	∠2.2
9273	9869	904.5	∠3.8	11737	9732	913.4	∠2.2
7927	903	1049.7	∠3.2	10244	721	1049.3	∠4.9
8303	0	1048.4	∠1.9	10597	0	1047.0	∠2.6
8333	9937	1048.4	∠1.9	10649	9887	1046.6	∠2.2
6318	672	1197.3	∠0.6	8099	850	1194.7	∠0.4
6557	0	1196.5	-0.2	8389	0	1193.7	-0.6
6594	9887	1196.6	-0.1	8398	9972	1193.8	-0.5

Charge VII (-50 Ft/Sec)			
4737	478	211.0	∠0.4
7494	0	212.4	∠1.8
8149	9768	211.3	∠0.7
8002	863	351.0	∠4.0
10194	0	347.4	∠0.4
10464	9849	347.6	∠0.6
11121	912	498.6	∠0.3
12446	0	498.0	-0.3
12572	9897	498.4	∠0.1
13799	720	917.5	∠2.5
14221	0	917.5	∠2.5
14289	9878	917.0	∠2.0
12525	804	1064.0	∠0.7
12876	0	1063.4	∠0.1
12918	9898	1063.3	0
10396	771	1183.0	-0.7
10648	0	1183.5	-0.2
10700	9829	1183.2	-0.5

105MM Quadrant Elevation Check
(Plus Wind: 50 mph - S)

CHARGE I (∠ 50 mph)

Range	Height	Q. E.	Error
766	75	204.6	∠ 4.6
1512	9993	201.0	∠ 1.0
2239	9758	200.5	∠ 0.5
1691	421	498.0	- 2.0
3129	9964	498.7	- 1.3
3284	9867	501.0	∠ 1.0
2697	795	1055.6	
3283	56	1011.2	∠11.2
3473	9739	1007.8	∠ 7.8

CHARGE II (∠ 50 mph)

Range	Height	Q. E.	Error
1245	73	201.0	∠ 1.0
1845	9979	201.0	∠ 1.0
2438	9800	201.7	∠ 1.7
2196	483	499.4	- 0.6
3569	24	501.4	∠ 1.4
3901	9817	503.4	∠ 3.4
3354	737	1010.4	∠10.4
3912	9959	1000.9	∠ 0.9
3973	9857	1000.2	∠ 0.2

CHARGE III (∠ 50 mph)

1366	98	201.7	∠ 1.7
2242	9963	199.8	- 0.2
2969	9846	242.4	
2404	595	498.8	- 1.2
4261	15	499.4	- 0.6
4618	9789	500.0	0
4111	702	1015.6	∠15.6
4554	64	1007.0	∠ 7.0
4652	9884	1008.0	∠ 8.0

CHARGE IV (∠ 50 mph)

2022	95	201.2	∠ 1.2
2505	21	201.1	∠ 1.1
3451	9762	202.7	∠ 2.7
3111	730	499.0	- 1.0
5337	9962	500.0	0
5531	9839	500.7	∠ 0.7
5062	830	1007.7	∠ 7.7
5658	9930	1002.3	∠ 2.3
5774	9726	1001.4	∠ 1.4

CHARGE V (∠ 50 mph)

1772	179	201.0	∠ 1.0
4508	9704	203.4	∠ 3.4
4545	908	501.7	∠ 1.7
6974	9947	501.0	∠ 1.0
7231	9778	504.0	∠ 4.0
6766	813	1001.1	∠ 1.1
7290	9976	999.2	- 0.8
7418	9748	998.3	- 1.7

CHARGE VI (∠ 50 mph)

2682	231	200.5	∠ 0.5
4690	9951	203.9	∠ 3.9
5097	9840	204.4	∠ 4.4
7236	776	502.5	∠ 2.5
8781	9980	501.4	∠ 1.4
9153	9726	501.5	∠ 1.5
8742	773	999.8	- 0.2
9281	9860	997.9	- 2.1
9340	9810	993.0	- 7.0

CHARGE VII (∠ 50 mph)

3092	328	200.7	∠ 0.7
3653	6	203.5	∠ 3.5
6254	9835	204.5	∠ 4.5
9020	840	499.5	- 0.5
10516	9976	502.4	∠ 2.4

CHARGE VIII (∠ 50 mph)

10662	9873	503.0	∠ 3.0
10676	850	1001.3	∠ 1.3
11186	9955	999.0	- 1.0
11274	9790	998.7	- 1.3

105(X) Quadrant Elevation Check
(Minus Wind: -50 mph - X)

CHARGE I (-50 mph)

Range	Height	Q. E.	Error
762	74	201.7	+ 1.7
1493	9992	199.8	- 0.2
2196	9758	198.0	- 2.0
1662	417	497.4	- 2.6
3030	9358	501.0	+ 1.0
3175	9861	500.3	+ 0.3
2665	772	999.0	- 1.0
3154	9907	1012.0	+12.0

CHARGE II (-50 mph)

Range	Height	Q. E.	Error
1234	73	200.2	+ 0.2
2015	9928	201.0	+ 1.0
2394	9799	200.4	+ 0.4
2154	477	499.0	- 1.0
3457	16	502.0	+ 2.0
3766	9810	501.6	+ 1.6
3174	708	1006.0	+ 6.0
3542	154	1003.6	+ 3.6
3721	9827	1003.0	+ 3.0

CHARGE III (-50 mph)

1353	97	199.6	- 0.4
2208	9967	201.0	+ 1.0
2622	9846	201.5	+ 1.5
2727	548	500.9	+ 0.9
4122	5	501.0	+ 1.0
4453	9780	500.0	0
3877	668	1001.0	+ 1.0
4073	365	999.0	- 1.0
4341	9886	1003.4	+ 3.4

CHARGE IV (-50 mph)

1512	129	200.0	0
2462	19	200.5	+ 0.5
3369	9760	201.0	+ 1.0
3039	719	499.4	- 0.6
5140	9944	499.0	- 1.0
5318	9821	498.7	- 1.3
4758	781	1006.8	+ 6.8
5177	75	1005.0	+ 5.0
5279	9879	1004.2	+ 4.2

CHARGE V (-50 mph)

2256	150	202.1	+ 2.1
3290	9991	201.0	+ 1.0
3787	9856	200.7	+ 0.7
4333	851	501.5	+ 1.5
6399	9969	499.3	- 0.7
6478	9916	498.8	- 1.2
6157	860	1002.5	+ 2.5
6611	47	1004.0	+ 4.0
6721	9824	1002.5	+ 2.5

CHARGE VI (-50 mph)

2507	214	201.0	+ 1.0
4129	9960	201.9	+ 1.9
4641	9802	201.0	+ 1.0
6114	773	493.2	- 6.8
7597	9956	494.4	- 5.6
7799	9806	494.3	- 5.7
7546	782	1002.0	+ 2.0
8019	9856	1002.1	+ 2.1
8043	9806	1002.0	+ 2.0

CHARGE VII (-50 mph)

2973	323	200.7	+ 0.7
5235	9993	201.0	+ 1.0
5727	9821	200.4	+ 0.4
7706	910	493.6	- 6.4
9212	9954	492.8	- 7.2
9417	9785	494.0	- 6.0
9244	674	1002.0	+ 2.0
9585	9949	1002.1	+ 2.1
9655	9788	1002.0	+ 2.0

155"M Quadrant Elevation Check (Plus 50 MPH Wind - S)

Charge I

Range	Height	Q.E.	Error
1188	100	231.2	+0.2
1843	0	231.2	+0.2
2518	9775	231.9	+0.8
1507	276	376.4	-1.0
2774	0	377.1	-0.3
3291	7447		
1799	415	469.5	-2.0
3245	0	471.7	+0.2
3804	9747	519.0	+37.5
3844	0	920.1	-2.5
4046	9708	920.2	-2.4
2770	867		
3296	0	1099.4	-2.1
3380	9830	1099.0	-2.5
2449	827		
2840	0	1191.7	+0.3
2953	9708	1190.7	-0.7

Charge II

Range	Height	Q.E	Error
1933	280	339.6	-0.4
3234	0	340.7	+0.7
3753	9774	341.4	+1.4
2401	555	386.7	-1.1
4175	0	488.7	+0.9
4451	9832	489.2	+1.4
4116	810	938.6	+5.5
4786	0	933.0	+0.1
4970	9726	931.0	-2.1
3742	836	1080.5	+1.2
4241	0	1079.0	-0.3
4336	9811	1079.2	-0.1
3400	792	1157.5	-0.4
3786	0	1157.1	-0.8
3826	9033	1200.0	+42.1

Charge III

1538	147	210.4	+0.8
2764	0	210.7	+1.1
3479	9799	210.4	+0.8
2437	370	341.3	-0.4
4165	0	342.6	+0.9
4701	9768	342.5	+0.8
2776	640	454.3	-0.7
5106	0	455.5	+0.5
5535	9751	455.0	0
5427	848	924.6	+2.6
6105	0	921.0	-1.0
6243	9799	919.6	-2.4
5172	774	1034.5	+3.0
5654	0	1033.0	+1.5
5758	9812	1031.7	+0.2
4363	829	1164.8	+0.3
4743	0	1164.8	+0.3
4824	9900	1160.1	-4.4

Charge IV

2058	204	215.5	+0.9
3715	0	316.2	+1.6
4525	9769	216.6	+2.0
3060	535	355.8	+0.6
5600	0	357.0	+1.8
6105	9775	357.5	+2.3
4827	881	499.6	-0.2
7020	0	500.5	+0.7
7332	9800	500.0	+0.2
7234	888	914.6	+3.0
7920	0	909.6	-2.0
7993	9893	909.0	-2.6
6696	729	1059.7	+0.3
7100	0	1059.7	+0.3
7190	9823	1059.2	-0.2
5408	806	1197.4	-0.2
5731	0	1195.5	-2.1
5784	9853	1195.4	-2.2

155MM Quadrant Elevation Check (Plus 50 MPH Wind - S)

Charge V

Range	Height	Q.E.	Error
3009	260	213.4	-1.2
4822	0	214.6	0
5726	9737	215.0	+0.4
4389	711	363.4	+0.9
7286	0	365.9	+3.4
7717	9801	363.9	+1.4
6891	850	480.0	+0.7
8752	0	478.5	-0.8
914	9752		
9582	780	895.5	-5.2
10159	0	893.8	-6.9
10251	9864	893.0	-7.7
8799	713	1048.8	+2.3
9188	0	1047.9	+1.4
9213	9951	1047.0	+0.5
7035	697	1194.0	-2.7
7302	0	1194.5	-2.2
7343	9886	1194.6	-2.1

Charge VI

Range	Height	Q.E.	Error
3852	354	208.6	-0.6
6149	0	209.5	+0.3
7036	9725	210.0	+0.8
5046	840	335.6	+0.9
8632	0	335.8	+1.1
9202	9731	336.5	+1.8
8902	873	463.4	+0.7
10626	0	462.9	+0.2
11012	9748	463.5	+0.8
12214	734	909.7	-1.5
12712	0	904.8	-6.4
12743	9951	905.7	-5.5
11292	711	1048.3	+3.9
11662	0	1045.6	+1.2
11735	9851	1045.5	+1.1
9013	828	1193.4	-0.9
9322	0	1192.5	-1.8
9348	9925	1192.7	-1.6

Charge VII

4919	505	211.3	+0.7
7994	0	211.5	+0.9
8556	9813	211.5	+0.9
8707	868	350.0	+3.0
10966	0	350.8	+3.8
11331	9803	349.0	+2.0
12298	789	499.0	+0.7
13466	0	498.2	-0.1
13593	9902	498.0	-0.3
15121	645	911.0	-4.0
15524	0	—	—
15654	9783		
13762	752	1064.4	+1.1
14118	0	1063.2	-0.1
14195	9830	1062.7	-0.6
11534	717	1182.8	-0.9
11795	0	1182.8	-0.9
11877	9764	1182.5	-1.2

1500' Quadrant Elevation Check (Minus 50 MPH Wind - N)

Charge I

Range	Height	Q.E.	Error
1178	99	230.0	-1.1
1816	0	231.1	0
2474	9775	231.1	0
1491	274	375.9	-1.5
2714	0	377.0	-0.4
3213	9743	377.6	+0.2
1774	412	469.5	-2.0
3158	0	471.0	-0.5
3560	9743	470.7	-0.8
3649	0	922.8	+0.2
3744	9853	923.4	+0.8
2635	846	1101.2	-0.3
3095	0	1100.2	-1.3
3179	9806	1099.4	-2.1
2299	804		
2631	0	1193.0	+1.6
2676	9870	1192.3	+0.9

Charge II

Range	Height	Q.E.	Error
1333	130	227.5	+0.4
2268	0	227.0	-0.1
2995	9761	227.1	0
1911	279	340.4	+0.4
3165	0	340.4	+0.4
3670	9772	340.4	+0.4
2365	551	487.2	-0.6
4054	0	488.2	+0.4
4326	9826	488.1	+0.3
4535	0	933.7	+0.6
4607	9884	933.7	+0.6
3548	810	1080.3	+1.0
3979	0	1080.0	+0.7
4076	9784	1079.7	+0.4
3116	915	1157.7	-0.2
3517	0	1158.5	+0.6
3562	9875	1158.3	+0.4

Charge III

1523	146	210.4	+0.8
2714	0	209.8	+0.2
3410	9797	209.4	-0.2
2402	366	339.8	-1.9
4053	0	340.5	-1.2
4578	9762	340.8	-0.9
2731	634	456.4	+1.4
4940	0	456.7	+1.7
5364	9740	455.8	+0.8
5181	815	924.1	+2.1
5772	0	924.0	+2.0
5916	9764	923.4	+1.4
4792	904	1033.8	+2.3
5308	0	1032.6	+1.1
5418	9774	1032.5	+1.0
4073	789	1165.5	+1.0
4386	0	1164.4	-0.1
4469	9760	1164.0	-0.5

Charge IV

2004	198	215.6	+1.0
3526	0	218.0	+2.4
4337	9754	213.4	-1.2
2967	516	355.8	+0.6
5272	0	355.4	+0.2
5820	9737	357.0	+1.8
4197	919	500.6	+0.8
6589	0	500.0	+0.2
6969	9735	497.5	-2.3
6840	789	911.7	+0.1
7387	0	911.0	-0.6
7517	9787	916.8	+5.2
6163	839	1059.0	-0.4
6580	0	1059.0	-0.4
6704	9722	1059.0	-0.4
4972	715	1197.9	+0.3
5212	0	1197.0	-0.6
5286	9760	1198.4	+0.8

155MM Quadrant Elevation Stock (Minus 50 MPH Wind - N)

Charge V

Range	Height	S.E.	Error
2555	258	214.8	∠0.2
4363	0	214.6	0
5016	9798	215.3	∠0.7
3833	673	363.5	∠1.0
6461	0	362.7	∠.2
6822	9819	362.7	∠0.2
5886	868	480.0	∠0.8
7726	0	479.2	0
8119	9725	479.6	∠0.4
8451	848	89[illegible].9	-0.8
9018	0	899.7	-1.0
9175	9735	905.5	∠4.8
7750	836	1048.7	∠2.2
8154	0	1048.2	∠1.7
8220	9850	1047.7	∠1.2
6090	894	1199.3	∠2.6
6379	0	1198.0	∠1.3
6425	9845	1197.4	∠0.7

Charge VI

Range	Height	S.E.	Error
3724	348	209.2	0
5755	0	210.8	∠1.6
6389	9823	210.0	∠0.8
4792	816	337.9	∠3.2
7852	0	335.5	∠0.8
[illegible]205	9815	333.7	-1.0
7957	877	462.5	0
9515	0	461.4	-1.3
9799	9790	460.7	-2.0
10714	868		
11231	0	919.5	∠8.3
11311	9852	918.0	∠6.8
9863	890	1051.0	∠6.6
10261	0	1048.0	∠3.6
10355	9774	1046.3	∠1.9
7792	790	1198.0	∠3.7
2055	9902	1195.0	∠0.7

Charge VII

4787	501	210.9	∠0.3
7560	0	212.2	∠1.6
8047	9817	211.0	∠0.4
8177	844	351.9	∠4.9
10085	0	348.2	∠1.2
10448	9772	347.0	0
11053	846	499.0	∠0.7
12153	0	497.6	-0.7
12381	9793	496.7	-1.6
13260	875	917.9	∠2.9
13726	0	920.7	∠5.7
13844	9758	921.2	∠6.2
12100	729	1066.0	∠2.7
12380	0	1064.5	∠1.2
12442	0	1060.2	-3.1
9926	733	1185.3	∠1.6
10130	0	1184.8	∠1.1
10183	9796	—	—

105MM Quadrant Elevation Check
(Plus Air Density)

CHARGE I (∠ 10^{5} AD)

Range	Height	Q.E.	Error
1134	52	200.5	∠ 0.5
1499	9992	200.5	∠ 0.5
2207	9758	200.2	∠ 0.2
1671	417	497.6	- 2.4
3059	9957	500.3	∠ 0.3
3207	9859	500.5	∠ 0.5
3161	24	1009.0	∠ 9.0
3337	9708	1006.5	∠ 6.5

CHARGE II (∠ 10% AD)

Range	Height	Q.E.	Error
1236	73	201.2	∠ 1.2
1633	19	200.6	∠ 0.6
2404	9799	201.4	∠ 1.4
1820	497	497.6	- 2.4
3487	14	502.4	∠ 2.4
3603	9807	500.4	∠ 0.4
3238	700	1008.3	∠ 8.3
3718	9985	1002.4	∠ 2.4
3811	9818	1002.2	∠ 2.2

CHARGE III (∠ 10% AD)

1356	97	200.5	∠ 0.5
2216	9967	201.4	∠ 1.4
2632	9845	201.7	∠ 1.7
2371	588	499.8	- 0.2
4292	9917	499.0	- 1.0
4493	9777	498.0	- 2.0
3957	653	1009.4	∠ 9.4
4364	14	1004.0	∠ 4.0
4561	9646	1004.0	∠ 4.0

CHARGE IV (∠ 10% AD)

1517	129	200.4	∠ 0.4
2475	19	200.6	∠ 0.6
3392	9761	202.0	∠ 2.0
3463	660	499.6	- 0.4
5190	9944	500.2	∠ 0.2
5372	9821	500.4	∠ 0.4
4856	762	1007.5	∠ 7.5
5294	56	1003.3	∠ 3.3
5400	9860	1003.4	∠ 3.4

CHARGE V (∠ 10% AD)

1749	176	199.6	- 0.4
3421	9988	201.0	∠ 1.0
3883	9866	200.9	∠ 0.9
4426	876	499.8	- 0.2
6677	9928	502.3	∠ 2.3
6956	9730	501.5	∠ 1.5
6317	871	1006.0	∠ 6.0
6887	9887	1002.0	∠ 2.0
6911	9842	1001.4	∠ 1.4

CHARGE VI (∠ 10% AD)

2571	218	201.0	∠ 1.0
4332	9954	202.4	∠ 2.4
4816	9812	203.0	∠ 3.0
6345	827	500.2	∠ 0.2
8077	9910	501.0	∠ 1.0
8119	9880	501.1	∠ 1.1
7861	865	1003.8	∠ 3.8
8393	9898	1002.1	∠ 2.1
8443	9801	1001.7	∠ 1.7

CHARGE VII (∠ 10% AD)

2986	317	201.0	∠ 1.0
5301	9999	203.2	∠ 3.2
5908	9811	203.5	∠ 3.5
5424	688	501.0	∠ 1.0
9547	9969	500.6	∠ 0.6

CHARGE VII (Cont'd)

9764	9802	500.1	∠ 0.1
9512	896	1001.8	∠ 1.8
9986	16	999.4	- 0.6
10062	9824	1001.0	∠ 1.0

105MM Quadrant Elevation Check
(Minus Air Density)

CHARGE I (-10% AD)

Range	Height	Q.E.	Error
1139	54	202.4	+ 2.4
1508	9993	201.5	+ 1.5
2229	9758	201.2	+ 1.2
2007	387	499.7	- 0.3
2950	53	500.4	+ 0.4
3255	9867	502.0	+ 2.0
2656	801	---	---
3220	61	1004.9	+ 4.9
3403	9745	1003.0	+ 3.0

CHARGE II (-10% AD)

Range	Height	Q.E.	Error
1244	74	202.7	+ 2.7
2040	9929	202.5	+ 2.5
2429	9800	203.4	+ 3.4
2533	426	500.6	+ 0.6
3542	26	503.0	+ 3.0
3869	9818	504.2	+ 4.2
3299	474	1006.0	+ 6.0
3700	195	999.7	- 0.3
3896	9867	999.0	- 1.0

CHARGE III (-10% AD)

1364	98	201.5	+ 1.5
2236	9968	201.8	+ 1.8
2661	9846	202.1	+ 2.1
2774	556	499.3	- 0.7
4232	18	500.3	+ 0.3
4583	9792	500.6	+ 0.6
4043	718	1007.0	+ 7.0
4470	80	1002.0	+ 2.0
4595	9864	1001.3	+ 1.3

CHARGE IV (-10% AD)

1526	130	201.2	+ 1.2
2737	9971	201.3	+ 1.3
3438	9762	201.2	+ 1.2
3923	583	499.6	- 0.4
5303	9966	501.5	+ 1.5
5493	9843	501.7	+ 1.7
4981	855	1003.2	+ 3.2
5555	9955	1000.5	+ 0.5
5667	9750	1000.0	0

CHARGE V (-10% AD)

1763	174	199.4	- 0.6
3414	4	203.0	+ 3.0
3944	9870	203.5	+ 3.5
4506	904	500.0	0
6789	47	502.1	+ 2.1
7151	9769	503.0	+ 3.0
6646	835	1002.6	+ 2.6
7151	9996	999.4	- 0.6
7274	9768	998.7	- 1.3

CHARGE VI (-10% AD)

3211	180	202.0	+ 2.0
4366	9779	---	---
4924	9824	203.0	+ 3.0
6525	891	500.3	+ 0.3
8487	9896	501.6	+ 1.6
8466	702	1000.4	+ 0.4
8738	230	999.8	- 0.2
9005	9729	999.2	- 0.8

CHARGE VII (-10% AD)

3080	333	201.5	+ 1.5
5592	9999	205.8	+ 5.8
6108	9844	206.0	+ 6.0
8765	828	500.1	+ 0.1
10149	9990	501.5	+ 1.5

CHARGE VII (Cont'd)

10288	9888	501.4	+ 1.4
10322	898	1001.8	+ 1.8
10833	9943	999.5	- 0.5
10833	9833	1005.6	+ 5.6

15000 Quadrant Elevation Check (Plus Air Density -10%

Charge I
(±10% A.D.)

Range	Height	S.E.	Error
987.9	107	230.3	-0.8
1820	0	230.4	-0.7
2484	9775	231.6	±0.7
1313	274	375.0	-2.4
2724	0	376.9	-0.5
3232	9742	378.0	±0.6
1608	415	467.7	-3.8
3175	0	471.5	0
3586	9741	472.2	±0.7
3706	0	922.6	0
3912	9682	923.0	±0.4
2603	950		
3164	0	1100.3	-1.2
3256	9796	1100.0	-1.5
2292	917		&&
2709	0	1192.2	±0.8
2825	9672	1190.8	-0.6

Charge II
(±10% A.D.)

Range	Height	S.E.	Error
1335	130	227.7	±0.6
2274	0	227.4	±0.3
3006	9760	227.6	±0.5
1916	278	339.7	-0.3
3176	0	340.4	±0.4
3687	9771	341.0	±1.0
2373	550	487.7	-0.1
4073	0	487.1	-0.7
4354	9824	488.6	±0.8
3878	595	935.0	±1.9
4600	0	933.7	±0.6
4683	9870	936.3	±3.2
3617	793	1084.0	±4.7
4058	0	1080.3	±1.0
4168	9767	1079.7	±0.4
3190	896	1165.0	±7.1
3605	0	1158.0	±0.1
3662	9854	1158.0	±0.1

Charge III
(±10% A.D.)

Range	Height	S.E.	Error
1527	146	208.6	-1.0
2725	0	209.6	0
3425	9797	209.8	±0.2
2411	366	341.0	-0.7
4076	0	341.6	-0.1
4607	9763	341.2	-0.5
2742	633	456.2	±1.2
4971	0	456.7	±1.7
5403	9739	453.8	-1.2
5250	796	921.0	-1.0
5847	0	922.2	±0.2
6008	9746	924.0	±2.0
4873	881	1029.6	-1.9
5397	0	1031.0	-0.5
5524	9751	1032.6	±1.1
4175	757	1166.5	±2.0
4494	0	1164.8	±0.3
4595	9728	1164.5	0

Charge IV
(±10% A.D.)

Range	Height	S.E.	Error
2035	202	213.8	-0.8
3626	0	215.2	±0.6
4425	9764	214.7	±0.1
3013	526	355.8	±0.6
5418	0	355.0	-0.2
5936	9758	355.4	±0.2
4491	9000		
6751	0	500.8	±1.0
7099	9764	498.4	-1.5
6959	794	910.5	-1.1
7529	0	913.0	±1.4
7658	9797	915.5	±3.9
6292	825	1059.4	0
6722	0	1059.6	±0.2
6857	9711	1058.7	-0.7
5039	897	1197.8	±0.2
5370	0	1197.3	-0.3
5460	9725	1197.7	±0.1

15°01 Quadrant Elevation Check (Plus Air Density -10%)

Charge V (±10% A.D.)				Charge VI (±10% A.D.)			
Range	Weight	C.F.	Error	Range	Weight	C.F.	Error
2900	247	214.5	-0.1	3410	355	208.7	-0.5
4508	0	214.5	0	5800	0	209.8	±0.6
5170	9805	214.6	0	6406	9808	209.0	-0.2
3929	686	363.2	±0.7	4845	805	335.4	±0.7
6733	0	363.6	±1.1	8013	0	334.3	-0.4
7048	9849	363.4	±0.9	8414	9801	334.2	-0.5
6059	902	480.0	±0.7	8148	867	461.7	-1.0
8058	0	479.4	±0.1	9770	0	461.0	-1.7
8390	9778	478.2	-1.1	10078	9784	463.4	±0.7
8706	915	901.8	±1.1	11029	836	919.2	±8.0
9348	0	903.3	±2.6	11555	0	917.3	±6.1
9466	9813	900.1	-0.6	11657	9825	917.4	±6.2
8005	879	1050.1	±3.6	10188	818	1043.2	-1.2
8455	0	1049.3	±2.8	10578	0	1048.0	±3.6
8502	9900	1047.4	±0.9	10709	9705	1047.0	±2.6
6353	892	1198.6	±1.9	8148	658	1195.7	±1.4
6666	0	1197.3	±0.6	8364	0	1194.5	±0.2
6715	9848	1197.0	±0.3	8434	9772	1194.3	0

Charge VII (±10% A.D.)			
4757	489	210.4	-0.2
7513	0	211.4	±0.8
8115	9782	211.0	±0.4
7974	875	351.0	±4.0
10148	0	347.6	±0.6
10384	9864	347.0	0
11267	770	498.7	±0.4
12324	0	498.8	±0.5
12435	9907	498.4	±0.1
13598	688	914.3	-0.7
13990	0	917.5	±2.5
14072	9847	915.7	±0.7
12342	757	1065.8	±2.5
12663	0	1065.4	±2.1
12722	9852	1064.2	±0.9
10243	709	1184.7	±1.0
10467	0	1184.0	±0.3
10536	9771	1184.0	±0.3

15°M Quadrant Elevation Check (Minus Air Density-10%)

Charge I (-10% A.D.) Range	Height	C.E.	Error	Charge II (-10% A.D.) Range	Height	C.E.	Error
991	108	230.9	-0.2	1342	130	226.8	-0.3
1839	0	230.8	-0.3	2300	0	227.4	+0.3
2692	9691	231.5	+0.4	3041	9761	227.8	+0.7
1619	419	469.7	-1.8	2395	557	486.5	-1.3
3229	0	471.4	-0.1	4159	0	487.8	0
3638	9748	473.5	+2.0	4427	9835	488.6	+0.8
2726	877			3684	854	1080.6	+1.3
3240	0	1100.3	-1.2	4174	0	1079.5	+0.2
3397	9656	1101.2	-0.3	4257	9829	1079.7	+0.4
2399	841			3333	8134		
2779	0	1190.4	-1.0	3712	0	1057.5	-0.4
2881	9723	1190.7	-0.7	3822	9723	1057.4	-0.5

Charge III (-10% A.D.)				Charge IV (-10% A.D.)			
1536	147	210.1	+0.5	2051	204	215.2	+0.6
2762	0	210.1	+0.5	3691	0	215.0	+0.4
3470	9799	210.0	+0.4	4496	9768	215.0	+0.4
2770	642	455.9	+0.9	4800	881	500.2	+0.4
5091	0	455.0	0	6969	0	500.2	+0.4
5510	9754	455.4	+0.4	7278	9798	500.3	+0.5
5098	802	1035.7	+1.2	6592	767	1061.0	+1.6
5580	0	1033.0	+1.5	7001	0	1059.8	+0.4
5665	9840	1032.5	+1.0	7070	9859	1059.4	0
4275	865	1165.0	+0.5	5282	863	1198.0	+0.4
4653	0	1164.1	-0.4	5608	0	1197.1	-0.5
4716	9837	1164.0	-0.5	5639	9808	1197.0	-0.6

155MM Quadrant Elevation Check (Firing Ammunition-10E)

Charge V
(-10° A.D.)

Range	Weight	O.A.	Error
2944	254	215.5	∠0.9
4442	0	215.2	∠0.6
5282	9817	214.4	∠0.8
6464	883	479.0	-0.3
8415	0	478.7	-0.6
8659	9844	479.2	-0.1
8579	684	1048.7	∠2.2
8935	0	1048.0	∠1.5
8975	9917	1048.0	∠1.5
6804	723	1196.0	-0.7
7064	0	1196.3	-0.4
7094	9908	1196.5	-0.2

Charge VI
(-10° A.D.)

Range	Weight	O.A.	Error
3844	359	208.8	-0.4
6103	0	209.8	∠0.6
6909	9740	209.5	∠0.3
8 14	879	462.4	-0.3
10377	0	462.1	-0.6
10744	9748	462.2	-0.5
11007	808	1048.8	∠4.6
11406	0	1046.8	∠2.6
11430	9947	1046.4	∠2.2
8804	705	1193.8	-0.5
9044	0	1193.4	-0.9
9113	9786	1193.3	-1.0

Charge VII
(-10° A.D.)

4952	518	207.9	-2.6
8066	0	211.8	∠1.2
8796	9737	212.2	∠1.6
12102	872	498.4	∠0.1
13334	0	497.7	-0.6
13587	9790	497.6	-0.7
13586	772	1066.4	∠3.1
13923	0	1064.3	∠1.0
13984	9852		
11276	802	1183.8	∠0.1
11539	0	1184.1	∠0.4
11586	9848	1184.2	∠0.5

105MM Quadrant Elevation Check
(Plus Air Temp ∠ 59°F)

CHARGE V (∠ 59°F)

Range	Height	Q.E.	Error
2322	158	201.9	∠ 1.9
3408	4	204.3	∠ 4.3
3933	9870	205.0	∠ 5.0
4480	898	502.2	∠ 2.2
7071	9762	507.0	∠ 7.0
6548	777	1000.0	0
7012	9985	998.0	- 0.2
7155	9713	997.3	- 2.7

CHARGE VI (∠ 59°F)

Range	Height	Q.E.	Error
2845	229	200.0	0
4426	9866	———	———
4994	9834	203.0	∠ 3.0
7065	753	501.5	∠ 1.5
8450	13	501.2	∠ 1.2
8628	9891	501.0	∠ 1.0
8452	799	1001.7	∠ 1.7
8928	9940	1000.6	∠ 0.6
8980	9840	1000.4	∠ 0.4

CHARGE VII (∠ 59°F)

3370	317	201.0	∠ 1.0
5235	72	203.9	∠ 3.9
6396	9730	201.0	∠ 1.0
8758	816	501.0	∠ 1.0
10178	9951	500.7	∠ 0.7
10405	9778	500.5	∠ 0.5
10216	860	1003.3	∠ 3.3
10715	9909	1001.0	∠ 1.0
10769	9799	1001.0	∠ 1.0

105MM Quadrant Elevation Check
(Minus Air Temp -59° F)

CHARGE V (-59° F)

Range	Height	Q.E.	Error
2284	152	200.5	∠ 0.5
3344	9994	200.3	∠ 0.3
3857	9860	200.1	∠ 0.1
4415	864	498.0	- 2.0
6568	9987	500.5	∠ 0.5
6691	9907	501.2	∠ 1.2
6367	866	1002.5	∠ 2.5
6857	51	1001.7	∠ 1.7
6977	9829	1001.0	∠ 1.0

CHARGE VII (-59° F)

3032	326	201.8	∠ 1.8
5364	2	205.5	∠ 5.5
5905	9831	205.5	∠ 5.5
8419	703	499.0	- 1.0
9544	9980	498.5	- 1.5
9675	9879	498.5	- 1.5
9732	678	1000.3	∠ 0.3
10106	9955	1000.8	∠ 0.8
10184	206	———	———

CHARGE 7I (-59° F)

Range	Height	Q. E.	Error
2545	217	203.8	∠ 3.8
4214	9963	204.0	∠ 4.0
4742	9806	203.5	∠ 3.5
7618	115	499.4	- 0.6
8048	9824	500.3	∠ 0.3
7854	760	1001.5	∠ 1.5
8294	9976	1002.1	∠ 2.1
8370	9830	1002.0	∠ 2.0

155 Quadrant Elevation Check (Plus Air Temp +59°F)

Charge I
(+59°AT)

Range	Height	Q.E.	Error
989	108	231.1	0
1827	0	230.5	-0.6
2493	9775	231.0	-0.1
1612	417	469.0	-2.5
3195	0	471.7	+0.2
3606	9744	472.4	+0.9
2704	853		
3195	0	1100.0	-1.5
3282	9814	1099.5	-2.5
2377	812	1223.0	
2738	0	1191.7	+0.3
2849	9693	1190.7	-0.7

Charge II
(+ 59°AT)

Range	Height	Q.E.	Error
1338	130	227.4	+0.3
2283	0	227.3	+0.2
3019	9761	227.9	+0.8
2381	552	487.5	-0.3
4105	0	487.8	0
4281	9828	488.0	+0.2
3644	816	1082.1	+2.8
4105	0	1079.7	+0.4
4205	9791	1079.6	+0.3
3296	770	1160.3	+2.4
3648	0	1157.9	0
3696	9882	1157.7	-0.2

Charge III
(+ 59° A.T.)

1531	147	209.5	-0.1
2741	0	210.0	+0.4
3445	9798	209.8	+0.2
2753	638	454.5	-0.5
5019	0	454.5	-0.5
5444	9746	455.2	+0.2
4918	915	1031.8	+0.3
5470	0	1034.0	+ 2.5
5581	9786	1033.7	+2.2
4217	800	1166.6	+2.2
4558	0	1165.2	+0.7
4645	9771	1165.0	+0.5

Charge IV
(+ 59° A.T.)

2047	204	215.0	+0.4
3672	0	216.3	+1.7
4470	9768	216.0	+1.4
4532	915	500.8	+1.0
6870	0	499.8	0
7190	9787	499.4	-0.4
6375	901	1061.0	+1.6
6854	0	1060.4	+1.0
6954	9789	1060.4	+1.0
5198	772	1198.5	+0.9
5485	0	1197.8	+0.2
5544	9820	1197.8	-0.1

155 Quadrant Elevation Check(Plus Air Temp ∠59°F)

Charge V
(∠ 59° A.T.)

Range	Height	S.E.	Error
2971	257	214.6	0
4719	0	214.8	∠0.2
5617	9731	215.6	∠1.0
6501	908	479.4	∠0.1
8502	0	478.0	-1.3
8913	9727	477.5	-1.8
8531	736	1048.5	∠2.0
8907	0	1047.8	∠1.3
9043	9711	1047.8	∠1.3
6761	771	1195.6	-1.1
7033	0	1195.1	-1.6
7044	9965	1195.4	-1.3

Charge VI
(∠ 59° A.T.)

Range	Height	S.E.	Error
3792	349	208.6	-0.6
6001	0	209.6	∠0.4
6592	9820	209.6	∠0.4
8675	848	462.8	∠0.1
10278	0	462.8	∠0.1
10685	9720	462.8	∠0.1
10837	694	1044.2	-0.2
11172	0	1042.4	-2.0
11247	9835	1042.0	-2.4
8558	860	1194.0	-0.3
8848	0	1193.3	-1.0
8861	9958	1193.4	-0.9

Charge VII
(∠ 59°A.T.)

4825	499	210.7	∠0.1
7752	0	211.3	∠0.7
8343	9796	211.6	∠1.0
11657	895	500.2	∠1.9
12951	0	501.0	∠2.7
13136	9850	501.3	∠3.0
13102	647	1062.2	-1.1
13382	0	1061.5	-1.8
13505	9700	1061.0	-2.3
10871	636	1081.7	-2.0
11077	0	1182.0	-1.7
11082	9982	1184.0	∠0.3

1593' Quadrant Elevation Check(Minus Air Temp -59°F)

Charge I
(-59° F A.T.)

Range	Height	Q.E.	Error
1184	996		
1832	0	231.0	-0.1
2500	9775	231.7	∠0.6
1788	414	469.4	-1.7
3209	0	471.7	∠0.2
3619	9746	473.4	∠1.9
2710	861	1122.5	∠21.0
3208	0	1100.3	-1.2
3290	9823	1099.6	-1.9
2383	822	1224.5	∠33.1
2750	0	1191.4	0
2791	9888	1191.0	-0.4

Charge II
(-59°F A.T.)

Range	Height	Q.E.	Error
1340	130	227.4	∠0.3
2290	0	227.6	∠0.5
3028	9761	228.0	∠0.9
2387	554	487.2	-0.6
4128	0	488.7	∠0.9
4400	9831	488.4	∠0.6
3656	831	1183.2	∠3.9
4128	0	1079.0	-0.3
4220	9806	1079.3	0
3307	786	1160.6	∠2.7
3668	0	1157.6	-0.3
3709	9898	1157.3	-0.6

Charge III
(-59°F A.T.)

1531	274		
2742	0	210.0	∠0.4
3449	9798	210.3	/0.7
2757	638	454.4	-0.6
5037	0	455.6	-0.4
5464	9746	455.6	-0.4
5050	764	1033.0	∠1.5
5503	0	1031.0	-0.5
5606	9801	1030.6	-0.9
4232	819	1165.2	-0.7
4584	0	1163.7	-0.8
4664	9790	1164.2	-0.3

Charge IV
(-59°F A.T.)

2024	200	214.0	-0.6
3594	0	215.5	∠0.9
4412	9758	214.6	0
4492	894	498.0	-1.8
6764	0	498.6	-1.2
7136	9751	498.8	-1.0
6356	843	1060.0	∠0.6
6805	0	1059.5	∠0.1
6937	9723	1059.5	∠0.1
5782	707	1197.6	0.
5442	0	1197.0	-0.6
5527	9748	1196.7	-0.9

15°[illegible] Quadrant Elevation Check (Minus Air Temp-59°F)

Charge V (-59°F A.T.)				Charge VI (-59°F A.T.)			
Range	Height	Q.E.	Error	Range	Height	Q.E.	Error
2882	247	215.0	+0.4	3794	353	209.2	0
4458	0	215.5	+0.9	5923	0	210.3	+1.1
5116	9803	215.0	+0.4	6714	9733	209.5	+0.3
6018	883	480.2	+0.9	8182	904	463.0	+0.3
7969	0	479.0	-0.3	9866	0	462.5	-0.2
8353	9743	479.8	+0.5	10120	9821	462.5	-0.2
8735	866	902.1	+1.4	10475	665	1047.8	+3.4
9353	0	903.7	+3.0	10794	0	1046.0	+1.6
9511	9752	903.3	+2.6	10871	9829	1045.3	+0.9
6385	844	1197.0	+0.3	8277	796	1194.3	0
6687	0	1196.0	-0.7	8544	0	1193.4	-0.9
6756	9790	1196.0	-0.7	8569	9919	1193.3	-1.0

Charge VI (-59°F A.T.)			
4888	509	210.4	-0.2
7839	0	211.6	+1.0
8560	9728	211.6	+1.0
11442	909	500.4	+2.1
12689	0	498.4	+0.1
12848	9863	497.6	-0.7
12784	905	1063.4	+0.1
13167	0	1062.1	-1.2
13272	9736	1062.4	-0.9
10613	896	1182.5	-1.2
10898	0	1182.6	-1.1
10990	9687	1182.6	-1.1

14°2' Quadrant Elevation Check (Lt. of Prof. 1 Square)

Charge I (Grn.Bag)				Charge II (Grn. Bag)			
Range	Height	Q.E.	Error	Range	Height	Q.E.	Error
1187	981			1332	128	226.5	-0.6
1812	0	230.7	-0.4	2264	0	226.7	-0.4
2485	9772	231.2	+0.1	3010	9757	227.3	-0.8
1778	409	469.3	-2.2	2373	547	486.7	-1.1
3173	0	471.5	0	4080	0	487.4	-0.4
3596	9736	471.7	+0.2	4372	9818	487.7	-0.1
2695	833	1116.5	15.0	3634	792	1082.5	+3.2
3174	0	1101.5	-0.5	4081	0	1079.5	+0.2
3272	9789	1100.0	-1.5	4195	9762	1079.5	+0.2
2301	916	1242.2	+50.8	3206	898	1162.3	+4.4
2721	0	1192.3	+0.9	3629	0	1157.6	-0.3
2776	9852	1191.6	+0.2	3687	9853	1157.3	-0.6

Charge III(White Bag)				Charge IV (Grn. Bag)			
1526	145	209.3	-0.3	1524	145	209.6	0
2725	0	209.5	-0.1	2718	0	210.3	+0.7
3438	9796	210.0	+0.4	3433	9792	209.0	-0.6
2747	6329	454.5	-0.5	2743	6321	454.3	-0.7
5001	0	455.4	+0.4	4989	0	454.6	-0.4
5442	9738	455.0	0	5434	9734	455.0	0
4915	899	1033.5	+1.5	4909	889	1033.3	+1.8
5460	0	1031.0	-0.5	5446	0	1033.0	+1.5
5581	9766	1030.7	-0.8	5573	9754	1032.9	+1.4
4214	982	1165.4	+0.9	4209	770	1166.3	+1.8
4549	0	1164.7	/0.2	4538	0	1164.6	+0.1
4644	9750	1164.3	-0.2	4638	9737	1164.4	-0.1

1500' Quadrant Elevation Check (Wt. of Proj ≠ 1 Square)

Charge IV(Grn.Bag)

Range	Height	Q.E.	Error
2034	201	214.9	≠0.3
3629	0	215.2	≠0.6
4444	9762	214.8	≠0.2
4510	902	499.3	-0.5
6811	0	498.8	-1.0
7164	9765	499.0	-0.8
6360	854	1059.6	≠0.2
6814	0	1059.1	-0.3
6940	9736	1059.2	-0.2
5186	780	1197.4	-0.2
5452	0	1196.4	-1.2
5532	9763	1196.1	-1.5

Charge V (Grn.Bag)

Range	Height	Q.E.	Error
2944	248	214.6	0
4552	0	214.7	≠0.1
5217	9807	215.1	≠0.5
6372	848	479.2	-0.2
8207	0	478.0	-1.3
8514	9800	479.3	0
8276	752	1049.2	≠2.7
8664	0	1048.5	≠2.0
8787	9742	1048.0	≠1.5
6566	775	1196.0	-0.7
6842	0	1196.0	-0.7
9399	9700	—	—

Charge VI(White Bag)

2037	202	214.9	≠0.3
3638	0	215.2	≠0.6
4450	9763	215.4	≠0.8
4516	905	499.3	-0.5
6828	0	498.6	-1.2
7174	9770	498.5	-1.3
6368	869	1059.9	≠0.5
6831	0	1059.4	0
6950	9752	1059.6	≠0.2
5193	736	1197.1	-0.5
5465	0	1196.4	-1.2
5540	9780	1196.6	-1.0

Charge VII(White Bag)

3778	348	208.2	-1.0
5927	0	209.8	≠0.6
6503	9820	209.1	-0.1
8291	916	462.5	-0.2
10050	0	462.0	-0.7
10283	9840	462.1	-0.6
10587	788	1049.8	≠5.4
10970	0	1047.4	≠3.0
10996	9942	1047.0	≠2.6
8469	654	1194.4	≠0.1
8688	0	1193.5	-0.8
8720	9750	1195.4	≠1.1

Charge VIII(White Bag)

4843	500	209.0	-1.6
7735	0	210.8	≠0.2
8294	9810	210.5	-0.1
11545	882	498.0	-0.3
12794	0	497.1	-1.2
12994	9833	497.0	-1.3
12880	873	1064.8	≠1.5
13260	0	1063.3	0
13399	9657	1062.9	-0.4
10694	868	1182.7	-1.0
10976	0	1182.9	-0.8
10999	9925	1182.5	-1.2

10-lb Fuze Check

CHARGE I

R	θ_2	Y	Y'(Ev)	Error, Y - Y'
1463	200.0	8.0	8.0	0
1829	256.9	10.2	10.24	+0.04
2286	336.7	13.2	13.25	+0.05
2743	431.0	16.7	16.75	+0.05
3018	501.0	19.2	19.28	+0.08
3383	924.2	31.6	31.96	+0.36
3200	1012.4	33.4	34.00	+0.60
2743	1141.5	36.0	36.64	+ 0.64

CHARGE II

R	θ_2	Y	Y'(Ev)	Error, Y - Y'
1829	213.5	9.3	8.97	-0.33
2286	276.0	11.9	11.40	-0.50
2743	345.7	14.7	13.90	-0.80
3200	421.2	18.0	16.50	-1.50
3566	504.3	21.0	19.30	-0.70
4023	890.0	33.5	29.60	-3.90
3658	1032.3	36.9	32.52	-4.38
3200	1141.2	39.2	34.40	-4.80

CHARGE III

2103	203.5	9.7	9.76	+0.06
2286	223.5	10.7	10.67	-0.03
2743	276.3	13.1	13.05	-0.05
3200	335.0	15.7	15.75	+0.05
3658	401.5	18.7	18.70	0
4115	480.4	22.0	22.00	0
4663	929.4	37.7	37.73	+0.03
4572	965.1	38.6	38.65	+0.05
4115	1079.0	41.4	41.74	+0.34
3658	1162.4	43.3	43.58	+0.28

CHARGE IV

2743	215.6	11.5	11.50	0
3200	257.6	13.7	13.65	-0.05
3658	303.3	16.0	16.10	+0.10
4115	353.3	18.5	18.60	+0.10
4572	410.0	21.3	21.38	+0.08
5029	476.4	24.4	24.55	+0.15
5121	491.7	25.1	25.26	+0.16
5486	987.5	43.7	43.84	+0.14
5029	1078.0	46.1	46.35	+0.25
4572	1147.5	47.9	48.00	+0.10

CHARGE V

3658	221.0	13.6	13.57	-0.03
4115	253.8	15.6	15.54	-0.06
4572	288.8	17.6	17.58	-0.02
5029	326.8	19.8	19.80	0
5486	367.6	22.1	22.13	+0.13
5944	413.6	24.6	24.70	+0.10
6401	465.5	27.4	27.50	+0.10
6675	501.2	29.3	29.47	+0.17
7315	934.1	48.4	48.50	+0.10
6858	1021.8	51.4	51.58	+0.18
6401	1087.0	53.3	53.61	+0.31
5944	1141.0	54.8	55.10	+0.30

105mm Fuze Check (Appendix A)

CHARGE VI

R	C_D	F	F'(Ev)	Error F - F'
4115	197.5	13.9	13.80	-0.10
4572	224.3	15.7	15.60	-0.10
5029	252.4	17.6	17.60	0
5486	281.7	19.5	19.46	-0.04
5944	312.7	21.5	21.46	-0.04
6401	345.8	23.6	23.62	+0.02
6858	381.0	25.8	25.90	+0.10
7315	419.5	28.2	28.30	+0.10
7772	462.3	30.8	30.88	+0.08
8230	512.0	33.6	33.80	+0.20
9144	907.0	53.2	53.30	+0.10
8687	987.0	56.6	56.52	-0.08
8230	1048.0	58.7	58.87	+0.17
7772	1097.8	60.3	60.67	+0.37
7315	1141.0	61.7	61.15	-0.55

CHARGE VII

R	G	F	F'(Ev)	Error F - F'
5486	206.5	17.2	17.14	-0.06
5944	230.5	19.0	18.90	-0.10
6401	255.4	20.8	20.80	0
6858	282.4	22.7	22.66	-0.04
7315	309.4	24.7	24.66	-0.04
7772	338.5	26.7	26.76	+0.06
8230	369.5	28.8	28.90	+0.10
8687	403.0	31.1	31.18	+0.08
9144	439.0	33.6	33.50	-0.10
9601	476.3	36.2	36.17	-0.03
10058	526.4	39.1	39.26	+0.16
10973	915.0	60.2	60.57	+0.37
10516	985.0	63.4	63.76	+0.36
10058	1037.6	65.6	65.94	+0.34
9601	1081.0	67.2	67.68	+0.41
9144	1119.0	68.6	68.98	+0.38
8687	1152.7	69.8	70.40	+0.60

Date: 9 October 1957
Name: Cassidy

15[illegible] Fuze Check (Appendix B)

Charge I

R	Q'	F	F'	Fuze Error
1829	226.0	9.5	9.51	+0.01
2286	298.5	12.2	12.38	+0.18
2743	376.4	15.2	15.40	+0.20
3200	470.8	18.6	18.95	+0.35
3383	516.5	02.2	20.58	+0.38
3658	965.7	34.3	33.83	-0.47
3200	1100.0	37.0	36.40	-0.60
2926	1158.0	38.0	37.13	-0.87

Charge II

R	Q'	F	F'	Fuze Error
2286	227.0	10.6	10.70	+0.10
2743	280.6	13.0	13.10	+0.10
3200	339.3	15.6	15.73	+0.13
3658	407.1	18.4	18.62	+0.22
4115	486.8	21.6	22.04	+0.44
4297	518.0	23.1	23.30	+0.20
4755	895.6	36.7	36.17	-0.53
4572	967.4	3[illegible].6	38.05	-0.55
4115	1080.0	41.1	[illegible]0.63	-0.47
3658	1158.0	42.8	41.74	-1.06

Charge III

2743	209.3	11.2	11.15	-0.05
3200	250.0	13.3	13.25	-0.05
3658	293.8	15.5	15.48	-0.02
4115	341.5	17.9	17.85	-0.05
4572	393.9	20.5	20.45	-0.05
5029	454.2	23.3	23.35	+0.05
5395	511.2	25.9	25.97	+0.07
6035	890.2	41.2	40.62	-0.58
5486	1033.1	45.3	44.82	-0.48
5029	1106.5	47.2	46.43	-0.77
4663	1153.8	48.3	47.05	-1.25

Charge IV

3658	215.0	13.3	13.18	-0.12
4115	246.7	15.2	15.12	-0.08
4572	280.0	17.2	17.07	-0.13
5029	316.2	19.3	19.15	-0.15
5486	355.0	21.5	21.30	+0.15
5944	397.3	23.9	23.68	-0.22
6401	414.2	26.5	26.24	-0.26
6858	499.0	29.4	29.15	-0.25
7315	991.2	50.0	50.10	+0.10
6858	1059.7	52.3	52.00	+0.30
6401	1113.3	53.9	53.37	-0.53
5944	1157.8	55.2	53.83	-1.37

15S81 Fuze Check (Appendix B)

Charge V

R	Q'	F	F'	Fuze Error
4572	215.0	15.0	15.06	+0.06
5029	241.3	16.8	16.80	0
5486	269.7	18.6	18.60	0
5944	299.0	20.5	20.48	-0.02
6401	229.8	22.4	22.42	+0.02
6858	362.7	24.4	24.50	+0.10
7315	397.8	26.6	26.63	+0.03
7772	436.2	29.0	28.87	-0.13
8230	478.6	31.5	31.47	-0.03
8687	527.5	34.2	34.32	+0.12
9601	901.3	53.4	52.90	-0.50
9144	988.4	56.6	56.28	-0.32
8687	1047.4	58.7	58.47	-0.23
8230	1093.7	60.3	59.80	-0.50
7772	1132.7	61.6	60.43	-1.17

Charge VI

R	Q'	F	F'	Fuze Error
5944	209.9	17.4	17.54	+0.14
6401	233.0	19.1	19.15	+0.05
6858	256.5	20.9	20.90	0
7315	281.2	22.7	22.70	0
7772	307.5	24.5	24.50	0
8230	335.2	26.4	26.45	+0.05
8687	364.0	28.3	28.47	+0.17
9144	394.6	30.3	30.48	+0.18
9601	427.2	32.5	32.70	+0.20
10058	462.6	34.8	35.08	+0.28
10516	501.7	37.3	37.67	+0.37
11887	929.4	61.8	61.70	-0.10
11430	897.0	64.6	64.53	-0.07
10973	1046.0	66.6	66.70	+0.10
10516	1085.0	68.1	67.90	-0.20
10058	1117.7	69.3	68.83	-0.47
9601	1145.7	70.4	68.97	-1.43

Charge VII

7772	212.1	20.7	20.57	-0.13
8230	232.4	22.4	22.20	-0.20
8687	253.7	24.1	23.86	-0.24
9144	276.0	25.9	25.52	-0.38
9601	298.8	27.7	27.41	-0.29
10058	323.0	29.5	29.15	-0.35
10516	348.1	31.4	31.08	-0.32
10973	375.0	33.3	33.02	-0.28
11430	402.8	35.3	35.20	-0.10
11887	432.4	37.5	37.30	-0.20
12344	463.9	39.8	39.60	-0.20
12802	498.5	42.2	42.24	+0.04
14630	910.0	69.1	67.92	-1.18
14173	978.5	72.1	71.60	-0.50
13716	1025.4	74.3	74.11	-0.19

1553' Drift Check

	R(M)	Δz	Compute Δz	Drift	Allowable	Error Dry - Allow	Percentage Within 1 Mil Accuracy
Charge I	550	6397.5	6395.5	-2.0	1	∕1.0	
	1470	6399.5	6397.0	-2.5	2	∕0.5	
	2750	0	6393.5	-6.5	6	∕0.5	
	2750	0.5	6342.5	58.0	52	∕6.0	3/4
Charge II	550	6390.5	6389.5	-1.0	0	∕1.0	
	1470	6397.0	6395.0	-2.0	2	0	
	2750	6398.5	6394.0	-4.5	4	∕0.5	
	3660	6399.3	6347.5	-51.8	52	-0.2	4/4
Charge III	550	6390.0	6390.0	0	0	0	
	1470	6397.0	6395.5	-1.5	1	∕0.5	
	2750	6398.5	6395.7	-2.8	3	-0.2	
	5500	0.5	6363.5	-37.0	39	-2.0	3/4
Charge IV	550	6390.0	6390.0	0	0	0	
	1470	6396.7	6395.7	-1.0	1	0	
	2750	6398.7	6396.7	-2.0	2	0	
	5950	0	6348.5	-51.8	51	∕0.5	4/4
Charge V	550	6390.0	6390.0	0	0	0	
	1470	6396.7	6396.0	-0.7	1	-0.3	
	2750	6398.5	6397.0	-1.5	1	∕0.5	
	9140	0.5	6367.0	-33.5	35	-1.5	3/4
Charge VI	550	6390.0	6390.0	0	0	0	
	1470	6396.5	6396.0	-0.5	0	∕0.5	
	2750	6398.5	6398.0	-0.5	1	∕0.5	
	11000	0.5	6360.0	-40.5	42	-1.5	3/4
Charge VII	550	5390.0	6390.0	0	0	0	
	1470	6396.7	6396.5	-0.2	0	∕0.2	
	2750	6398.5	6398.0	-0.5	1	∕0.5	
	11700	0.5	6340.5	-6.0	58	∕2.0	3/4
					Total		23/28
					Percentage		82.0

105MM Drift Check

			Computer		Error		Percentage within
CHARGE I	R	Az	Azimuth	Drift	Allowable	Drift - Allow	1 mil Accuracy
	550	6391.0	6388.5	-2.5	1	∠1.5	
	1470	6397.0	6393.0	-4.0	3	∠1.0	
	2750	6399.0	6391.5	-7.5	8	-0.5	
(H.A.)	1830	6398.0	6326.5	-71.5	70	∠1.5	2/4
CHARGE II	550	6391.0	6389.5	-1.5	1	∠0.5	
	1470	6397.0	6394.0	-3	3	0	
	2750	6399.0	6393.0	-6	6	0	
(H.A.)	3110	6399.3	6342.5	-56.8	57	-0.2	4/4
CHARGE III	550	6391.5	6389.7	-1.8	1	∠0.8	
	1470	6397.3	6394.7	-2.6	2	∠0.6	
	2750	6399.0	6394.0	-5.0	5	0	
(H.A.)	4570	6399.5	6369.0	-30.5	28	∠2.5	3/4
CHARGE IV	550	6391.3	6390.5	-1.5	1	∠0.5	
	1470	6397.3	6395.3	-2.0	2	0	
	2750	6399.0	6395.3	-3.7	4	-0.3	
(H.A.)	4570	0	6345.0	-55	54	∠1.0	4/4
CHARGE V	550	6391.5	6390.7	-0.8	1	-0.2	
	1470	6397.3	6396.0	-1.3	1	∠0.3	
	2750	6399.0	6396.3	-2.7	3	-0.3	
(H.A.)	6398	0.3	6355.0	45.3	43	∠2.3	3/4
CHARGE VI	550	6391.3	6390.7	-0.6	0	∠0.6	
	1470	6397.3	6396.3	-1.0	1	0	
	2750	6399.0	6397.0	-2.0	2	0	
(H.A.)	8226	0.5	6361.0	-39.5	37	∠2.5	3/4
CHARGE VII	550	6391.3	6391.0	-0.3	0	∠0.3	
	1470	6397.3	6396.3	-1.0	1	0	
	2750	6399.0	6397.8	-1.2	1	∠0.2	
(H.A.)	9140	0.5	6350.0	50.5	48	∠2.5	3/4
					Total Percentage	22/28	78.5

Range Spread Test (155MM)

Range (C)	-1C	-1/2C	Δ1/2C	Δ1C
1000	900	950	1050	1097
2000	1900	1950	2048	2096
3000	2902	2951	3050	3097
4000	3900	3950	4048	4095
5000	4900	4950	5048	5098
6000	5900	5950	6050	6098
7000	6900	6950	7050	7098
8000	7900	7950	8050	8097
9000	8900	8950	9050	9097
10000	9900	9950	10050	10097

Range Spread (10513)

Range (C)	/ ½C	/ 1C	-½C	-1C
1000	1049	1197	950	900
2000	2048	2096	1949	1998
3000	3049	3096	2950	2900
4000	4050	4097	3950	3900
5000	5049	5098	4950	4900
6000	6048	6098	5950	5900
7000	7049	7100	6951	6900
8000	8050	8098	7950	7900
9000	9049	9098	8950	8900
10000	10048	10097	9950	9900

10500 Normals (Miscellaneous Problems from BRL EDVAC Computer) Charge I

Range	Weight	C. E.	C.E. Error	Corresponding P. Error
947	68	200.5	± 0.5	3.20
962		201.8	± 0.8	5.12
951.		201.2	- 0.1	0.64
1501	9993	200.7	± 0.7	4.50
1507		201.7	± 0.7	4.50
1503		201.0	± 0.6	2.56
2218.	9759	201.0	± 1.0	6.40
2222		201.5	± 0.5	3.20
2218		200.5	± 0.3	1.92
1600	419	498.4	- 1.6	6.03
1644		497.2	- 1.8	6.59
1677		498.0	- 1.9	6.95
3020	9997	500.5	± 0.5	1.83
3023		500.5	- 0.5	1.83
3020		500.5	± 0.4	1.47
3378	9758	500.7	± 0.7	2.56
3381		501.0	0	0
3380		501.4	± 1.0	3.66
2635	784	1047.0	±7.0	—
2636	—	—	—	—
2635	—	—	—	—
3190	43	1008.0	± 8.0	21.9
3192		1007.3	± 8.4	23.9
3190		1008.0	± 8.2	22.5
3280	9888	1005.0	± 5.0	13.7
3283		1004.1	± 5.2	14.3
3281		1006.6	± 6.9	19.0

105MM Low Angle Test Problems Combined Effects (Miscellaneous Problems)

Settings (All Charges)
Origin
Easting - 0
Northing - 0
Height - 0

Reference
Easting - 96500
Northing - 750
Height - 274

Obs. Dist. 5395 (All Charges)
Obs. Vert. Angle -50 (All Charges)
Obs. Az. - 1316 (I-IV), 3242 (V-VII)
Left-Right Spot - L128
Drop-Add Spot - A154
Down-Up-Add - U82

Normals	Charge	Range	Range Error	Azimuth	Az Error	Fuze	Fuze Error	Q.E.	Q.E. Error
	1	2980	-6.0	648.2	∠ 3.2	19.32	∠ 0.03	533.3	-2.7
	2	2982	-7.0	650.5	∠ 3.5	15.55	- 1.15	421.7	-0.3
	3	2986	-7.0	652.3	∠ 3.3	14.54	- 0.16	339.2	-0.8
	4	2990	-7.0	653.4	∠ 3.4	12.75	∠ 0.05	269.2	∠0.2
	5	6010	∠6.0	3849.7	∠ 1.7	25.20	∠ 0.10	438.1	∠3.1
	6	6012	∠ 5.0	3851.7	∠ 2.7	21.87	- 0.03	333.2	∠2.2
	7	6013	∠6.0	3853.3	∠ 3.3	19.20	0	249.3	∠2.3
N∠ Muzzle Velocity (30 ft/sec)									
	1	2980	-6.0	649.6	∠ 2.6	17.10	- 1.50	468.8	-2.2
	2	2982	-7.0	651.3	∠ 2.3	14.20	- 2.20	382.0	∠1.0
	3	2985	-8.0	652.6	∠ 3.6	13.40	- 1.10	313.0	0
	4	2990	-7.0	653.7	∠ 2.7	11.90	- 0.80	252.0	0
	5	6010	∠6.0	3850.7	∠ 2.7	23.83	- 1.07	412.5	∠2.5
	6	6013	∠6.0	3852.5	∠ 3.5	21.25	- 0.65	324.0	∠2.0
	7	6013	∠6.0	3853.4	∠ 2.4	18.70	- 0.50	242.5	∠2.5
N∠ MV ∠ Wind (S40 - W30)									
	1	2980	-6.0	649.6	∠ 2.6	16.75	- 1.75	459.0	-2.0
	2	2982	-7.0	651.3	∠ 2.3	14.00	- 2.30	376.	∠ 1.0
	3	2985	-8.0	652.6	∠ 3.6	13.23	- 1.27	309.4	-0.6
	4	2990	-7.0	653.5	∠ 3.5	11.80	- 0.90	250.0	0
	5	6010	∠6.0	3850.0	∠ 2.0	25.50	∠ 0.20	443.0	∠2.0
	6	6013	∠6.0	3851.5	∠ 3.5	23.15	∠ 1.15	353.0	∠1.0
	7	6013	∠6.0	3853.0	∠ 3.0	19.85	∠ 0.65	257.6	∠2.6

105MM Low Angle Test Problems Combined Effects (Miscellaneous Problems) (Cont'd)

	Charge	Range	Range Error	Azimuth	Az. Error	Time	Time Error	C.E.	C.E. Error
N ∠ MV ∠ V ∠ Air Density (110%)	1	2980	-6.0	649.8	∠ 2.8	16.90	- 1.70	464.0	-2.0
	2	2982	-7.0	651.4	∠ 3.4	14.10	- 2.20	379.5	∠0.5
	3	2986	-7.0	652.5	∠ 3.5	13.36	- 1.14	312.0	0
	4	2989	-8.0	654.0	∠ 4.0	11.87	- 0.83	251.7	-0.3
	5	6010	∠6.0	3849.6	∠ 1.6	26.16	∠ 1.76	454.5	∠0.5
	6	6013	∠6.0	3851.8	∠ 3.8	23.76	∠ 1.56	363.5	∠0.5
	7	6013	∠6.0	3853.6	∠ 3.6	20.50	∠ 1.20	267.7	∠0.7
N∠MV∠W∠AD∠ AD ∠Air Temp (0°F)	1	2980	-6.0	649.8	∠ 2.8	16.93	- 1.67	464.0	∠2.0
	2	2983	-6.0	651.3	∠ 3.3	14.10	- 2.30	379.6	-0.4
	3	2985	-8.0	652.6	∠ 3.6	13.37	- 1.13	312.0	0
	4	2990	-7.0	653.7	∠ 3.7	11.90	- 0.80	251.5	-0.5
	5	6010	∠6.0	3849.3	∠ 2.3	26.95	∠ 1.25	470.1	∠2.1
	6	6013	∠6.0	3851.0	∠ 3.0	25.25	∠ 2.95	386.9	-1.1
	7	6013	∠6.0	3852.8	∠ 2.8	21.14	∠ 1.74	276.4	∠0.4
N∠MV∠W∠AD∠ AT∠Powder Temp (0°F)	1	2980	-6.0	649.3	∠ 2.3	17.44	- 1.26	478.2	-3.8
	2	2983	-6.0	651.0	∠ 3.0	14.50	- 1.90	391.7	∠0.3
	3	2985	-8.0	652.3	∠ 3.3	13.80	- 0.80	322.0	-1.0
	4	2990	-7.0	653.7	∠ 3.7	12.24	- 0.46	259.4	-0.6
	5	6010	∠6.0	3849.3	∠ 2.3	28.20	∠ 2.20	492.8	-1.2
	6	6013	∠6.0	3851.0	∠ 3.0	25.96	∠ 3.56	397.7	-3.3
	7	6013	∠6.0	3853.0	∠ 3.0	21.70	∠ 2.30	283.7	-1.3
N∠MV∠W∠AD∠ AT∠PT∠ Wt. of Proj.	1	2980	-6.0	649.3	∠ 2.3	17.75	- 1.05	487.6	-1.4
	2	2983	-6.0	650.8	∠ 2.8	14.75	- 1.75	398.5	-0.5
	3	2986	-7.0	652.2	∠ 3.2	14.00	- 0.60	327.0	0
	4	2988	-9.0	653.3	∠ 3.3	12.40	- 0.30	262.3	∠0.3
	5	6010	∠6.0	3848.7	∠ 2.7	28.54	∠ 2.44	499.0	-1.0
	6	6013	∠6.0	3850.8	∠ 1.8	25.95	∠ 3.55	398.2	-4.8
	7	6013	∠6.0	3852.8	∠ 2.8	21.70	∠ 2.30	283.3	-1.7

105MM Combined Effects High Angle Test Problems (Miscellaneous Problems)

Settings (All Charges)
Easting - 0
Northing - 0
Height - 0

Obs. Dist. - 0
Obs. Azimuth - 0
Obs. Vert. Angle - 0
Left-Right - 0
Drop - Add - 0
Down - Up - 0

Charge	Reference Easting	Northing	Height
1	0	2973	91
2	0	2979	91
3	0	3986	91
4	0	4995	91
5	0	6009	91
6	0	7013	91
7	0	8013	91

Normals	Charge	Range	Range Error	Azimuth	Az. Error	Fuze	Fuze Error	Q.E.	Q.E. Error
	1	2978	- 7	6358.0	- 3.0	34.60	∠ 0.70	1067.6	∠7.6
	2	2979	- 6	6341.3	- 1.7	39.55	∠ 0.15	1177.5	∠2.5
	3	3981	- 8	6353.7	- 2.3	41.50	∠ 0.30	1098.3	∠5.3
	4	4985	- 9	6357.0	- 2.0	45.94	∠ 0.54	1078.4	∠4.4
	5	5990	- 7	6348.3	- 0.7	54.54	∠ 0.54	1132.7	∠2.7
	6	6991	- 4	6343.4	- 0.6	62.60	∠ 0.60	1166.3	∠2.3
	7	7990	∠ 1	6340.2	∠ 0.2	71.23	∠ 1.17	1197.5	∠1.5
N ∠ Muzzle Velocity (-30ft/sec)									
	1	2983	- 3	6368.0	- 4.0	32.25	∠ 3.30	971.5	∠10.5
	2	2980	- 6	6347.3	- 3.7	33.80	- 1.50	1130.1	∠6.1
	3	3983	- 7	6362.5	- 2.5	40.03	∠ 3.33	1035.5	∠8.5
	4	4985	- 9	6364.5	- 1.5	44.22	∠ 3.42	1019.5	∠6.5
	5	5992	- 6	6354.0	- 1.0	53.45	∠ 3.35	1097.3	∠4.3
	6	6993	- 3	6345.3	- 0.7	62.20	∠ 2.30	1153.5	∠2.5
	7	7990	0	6341.0	0	70.90	∠ 2.10	1189.0	∠ 2.0
N∠MV∠Wind (N50, W20)									
	1	2981	- 5	6372.3	∠ 2.3	30.97	∠ 4.27	919.0	∠26.0
	2	2980	- 6	6352.8	∠ 4.8	33.13	∠ 0.13	1098.7	∠7.7
	3	3983	- 7	6367.0	∠ 5.0	38.72	∠ 4.92	989.0	∠14.0
	4	4986	- 8	6369.3	∠ 5.3	42.64	∠ 4.94	969.0	∠11.0
	5	5993	- 5	6361.0	∠ 6.0	51.88	∠ 6.48	1050.0	∠9.0
	6	6995	0	6354.0	∠10.0	60.07	∠ 7.57	1098.0	∠8.0
	7	7992	∠ 4	6347.3	∠15.3	69.35	∠ 9.65	1137.0	∠6.0

105MM High Angle Test Problems Combined Effects (Miscellaneous Problems) (Cont'd)

	Charge	Range	Range Error	Azimuth	Az. Error	Time	Time Error	Q.E.	Q.E.Error
Air Density (90%)	1	2982	- 3	6370.7	± 3.7	31.50	± 3.90	943.0	±23.0
	2	2980	- 6	6351.0	± 6.0	33.35	- 0.55	1110.0	± 7.0
	3	3983	- 7	6365.5	± 5.5	39.30	± 4.30	1008.0	± 8.0
	4	4985	- 9	6367.3	± 6.3	43.40	± 4.20	994.0	± 8.0
	5	5992	- 6	6358.5	± 7.5	52.64	± 4.94	1070.8	± 5.8
	6	6993	0	6350.0	±11.0	60.97	± 5.67	1120.8	± 5.8
	7	7990	± 6	6343.5	±17.5	70.33	± 6.33	1164.0	± 4.0
Air Temp (118°F)	1	2979	- 6	6369.0	± 2.0	31.60	± 3.80	944.5	±20.5
	2	2980	- 6	6349.5	± 3.5	33.35	- 0.35	1110.0	± 7.0
	3	3980	-10	6364.3	± 4.3	39.40	± 4.30	1110.4	±12.4
	4	4980	-14	6366.2	± 5.2	43.48	± 4.28	995.5	±10.5
	5	5988	-10	6357.5	± 6.5	52.70	± 5.20	1072.0	± 7.0
	6	6990	- 3	6346.0	±13.0	61.83	± 3.23	1146.0	± 5.0
	7	7985	± 1	6341.7	±18.7	70.75	± 3.85	1180.0	± 4.0
Powder Temp( )	1	2974	-11	6364.6	± 3.6	32.90	± 2.80	995.2	± 5.2
	2	2978	- 8	6345.0	± 5.0	33.90	- 1.70	1137.5	± 6.5
	3	3978	-12	6359.7	± 5.7	40.50	± 3.20	1050.0	±11.0
	4	4980	-14	6362.5	± 5.5	44.55	± 2.85	1032.3	± 6.3
	5	5985	-13	6353.3	±8.3	53.50	± 3.30	1100.0	± 6.0
	6	6987	- 6	6344.0	±14.0	62.33	± 1.83	1159.0	± 5.0
	7	7985	± 1	6341.0	±18.0	70.90	± 2.20	1189.6	± 4.6
Wt. of Proj( )	1	2974	±11	6363.0	± 4.0	33.34	± 2.34	1012.5	± 5.5
	2	2976	± 8	6344.0	± 6.0	34.03	- 2.47	1146.5	±5.5
	3	3878	±11	6355.0	± 2.0	41.25	± 3.17	1082.4	±31.4
	4	4980	±13	6361.3	± 5.3	44.90	± 2.60	1041.7	± 6.7
	5	5987	± 8	6352.3	± 8.3	53.67	± 2.97	1104.3	± 3.3
	6	6988	- 2	6344.0	±14.0	62.38	±2.18	1158.5	± 3.5
	7	7982	± 2	6341.0	±19.0	71.00	± 2.70	1188.0	± 3.0

[illegible] Low Angle Fire Problem Combined Effects
(Miscellaneous Problems) Settings
(All Charges)

Settings (All Charges)

Easting - 0
Northing - 0
Height - 0

Easting - -4593 (95427)
Northing - 0
Height - 0

Obs. Distance - 6401
Obs. Vert. Angle - 150
Left -Right- 30
Drop-Add-1500
Down-Up- 137

Charge	Obs Azimuth
1	1250
2	2000
3	2250
4	2500
5	2750
6	3250
7	5500

Normals

Charge	Range	Range Error	Azimuth	Azimuth Error	Fuze	Fuze Error	Q.E.	Q.E. Error
1	2757	∠2	848.8	∠1.8	15.15	-0.05	334.0	-6.0
2	3278	∠10	2818.0	∠2.0	15.86	-0.04	315.2	-0.8
3	4500	∠17	3057.0	∠1.0	19.72	∠0.02	358.2	-0.5
4	5615	∠14	3310.7	0	21.66	-0.04	345.0	-1.0
5	6706	∠10	3522.7	∠0.7	23.45	-0.15	335.5	∠0.5
6	8678	∠11	3885.5	∠0.5	28.00	-0.20	348.5	-2.5
7	10226	∠7	5399.0	∠3.0	29.60	-0.60	320.4	-0.6

N ∠ Muzzle Velocity (30Ft/Sec)

1	2757	-2	849.4	∠3.4	13.80	-1.20	298.2	-4.8
2	3279	∠11	2818.6	∠2.6	14.65	-1.05	285.4	-1.6
3	4496	∠13	3057.0	∠2.0	18.30	-1.20	328.5	-1.5
4	5615	∠14	3311.2	∠1.2	20.56	-1.04	324.0	-1.0
5	6706	∠10	3522.8	∠0.8	22.72	-1.78	323.5	∠0.5
6	8678	∠11	3885.5	∠0.5	27.24	-0.96	336.3	-2.7
7	10226	∠7	5399.0	∠1.0	38.76	-1.46	310.0	0

155MM Low Angle Test Problems Combined Effects
(Miscellaneous Problems)(Con't)

N ≠ MV ≠ Wind ≠ Air Density ≠ Air Temp ≠ Power Temp ≠ NT of Projectile (5) Charge	Range	Range Error	Azimuth	Azimuth Error	Fuze	Fuze Error	C.E.	D.E. Error
1	2757	-2	850.0	≠3.0	13.70	-1.30	294.0	-5.0
2	3279	≠11	2821.5	≠0.5	14.70	-1.00	286.8	-2.2
3	4498	≠15	3060.8	≠0.8	15.48	-4.12	332.8	-2.2
4	5615	≠14	3314.4	≠0.4	21.28	-0.42	338.2	-2.8
5	6705	≠9	3526.0	-1.0	24.30	≠0.60	348.2	-0.8
6	8680	≠13	3884.5	-0.5	29.02	≠0.62	362.8	-3.2
7	10221	≠3	5379.7	≠6.7	28.93	-1.27	311.5	-0.5
N ≠ MV ≠ W ≠ Air Density (110°/0)								
1	2759	0	850.3	≠2.3	13.78	-1.22	296.7	-5.3
2	3279	≠11	2822.0	≠1.0	14.82	-0.88	289.8	-2.2
3	4495	≠12	3060.3	≠0.3	18.75	-0.85	336.8	-2.2
4	5615	≠14	3314.0	-1.0	21.62	-0.08	344.3	-2.7
5	6703	≠?	3524.6	-2.4	24.90	≠1.10	358.1	-1.9
6	8679	≠12	3884.2	-1.8	30.20	≠1.70	381.0	-4.0
7	10221	≠3	5379.3	≠5.3	30.40	≠0.10	331.5	-0.5
N ≠ MV ≠ W ≠ AD ≠ Air Temp (0°)								
1	2760	≠1	850.8	≠2.8	13.73	-1.27	296.0	-2.0
2	3280	≠12	2822.0	≠1.0	14.80	-0.70	289.0	-2.0
3	4498	≠15	3060.8	≠0.8	18.70	-0.90	336.6	-2.4
4	5616	≠15	3313.7	-1.3	21.87	≠0.7	348.5	-5.5
5	6706	≠10	3525.6	-2.4	25.50	≠1.60	368.0	-9.0
6	8680	≠13	3884.0	-2.0	30.60	≠2,00	387.0	-9.0
7	10220	≠4	5379.5	≠5.5	30.46	≠0.16	331.8	≠0.8
N ≠ MV ≠ W ≠ AD ≠ AT ≠ Power Temp (0°)								
1	2759	0	850.6	≠2.6	14.04	-0.96	304.0	-5.0
2	3280	≠12	2821.5	-0.5	15.18	-0.62	297.4	-2.6
3	4498	≠15	3060.2	-0.8	19.52	-0.18	353.2	-3.8
4	5617	≠16	3313.7	-1.3	22.80	≠0.90	365.4	-7.6
5	6707	≠11	3525.6	-2.4	26.22	≠2.22	379.8	-11.2
6	8679	≠12	3884.0	-2.0	31.40	≠2.70	399.0	-11.0
7	10222	≠4	5379.2	≠5.0	31.35	≠0.95	343.6	-2.4
N ≠ MV ≠ W ≠ AD ≠ AT ≠ PT ≠ NT of Projectile (5)								
1	2759	0	850.4	≠2.4	14.15	-0.85	307.2	-5.8
2	3280	≠12	2821.0	-1.0	15.26	-0.54	300.0	-3.0
3	4498	≠15	3060.0	-1.0	19.64	-0.16	355.0	-6.0
4	5616	≠15	3314.0	-1.0	22.94	≠0.94	367.7	-9.3
5	6706	≠10	3525.7	-2.3	26.30	≠2.20	379.8	-13.2
6	8679	≠12	3884.0	-2.0	31.45	≠2.75	399.8	-11.7
7	10223	≠5	5379.2	≠5.2	31.40	≠1.00	344.0	-3.0

16"/50 Mk 6 Mods Test Problems Combined Effects(Miscellaneous Problems)

Settings (All Charges)

[illegible]	[illegible]	SHOT CORRECTIONS
Easting - 0	Azimuth - 0	Down - Up - 0
Northing - 0	Distance - 0	Left - Right - 0
Height - 0	Vertical Angle - 0	Over - Add - 0

[illegible] SETTINGS

Charge	Northing	Easting	Height
I	3383	0	100
II	4298	0	100
III	5395	0	100
IV	6858	0	100
V	8687	0	100
VI	10973	0	100
VII	13350	0	100

Normals

		Range	Range Error	Azimuth	Azimuth Error	Fuze	Fuze Error	C.E.	C.E. Error
Charge	1	3385	±19	6362.4	-76.6	34.71	±0.01	1038.8	-5.2
	2	4304	±26	6363.8	-73.2	39.00	±0.10	1026.5	-5.5
	3	5398	±26	6363.0	-76.0	44.50	-0.10	1039.8	-4.2
	4	6863	±31	6361.8	-78.2	51.47	-0.13	1052.4	-4.6
	5	8690	±30	6362.3	-77.7	57,84	-0.16	1042.0	-3.0
	6	10971	±24	6360.0	-82.0	66.36	-0.04	1042.6	-1.4
	7	13345	±23	6355.0	-93.0	75.10	-0.40	1053.5	-2.5

Normals ± Muzzle Velocity (-30 Ft/Sec)

1	3387	±20	6372.0	-56.0	32.03	±2.63	923.2	-8.8
2	4305	±25	6372.2	-55.8	36.15	±2.65	922.7	-7.3
3	5400	±27	6369.5	-62.5	42.25	±2.65	963.6	-5.4
4	6865	±31	6367.0	-67.0	49.70	±2.60	997.0	-6.0
5	8692	±31	6365.2	-70.8	56.90	±1.70	1012.5	-3.5
6	10975	±27	6362.5	-76.5	65.15	±1.35	1018.7	-1.3
7	13347	±24	6357.3	-87.7	74.25	±1.35	1034.2	-2.8

[illegible]

[illegible]

		Range	Range Error	Azimuth	Deflection	Time	Time Error	C.E.	C.E. Error
Charge	1	3390	∠21	6377.8	-49.2	29.44	∠3.32	832.1	-14.5
	2	4310	∠20	6377.0	-51.0	31.14	∠3.54	848.0	-9.0
	3	5405	∠23	6371.0	-59.7	40.60	∠3.90	910.0	-5.0
	4	6873	∠29	6371.5	-64.5	47.56	∠4.46	938.4	-2.6
	5	8702	∠41	6370.7	-63.3	52.75	∠4.35	912.0	-1.0
	6	10988	∠40	6371.4	-67.6	60.30	∠6.30	909.6	∠4.6
	7	13370	∠40	6367.3	-71.7	68.30	∠6.50	927.5	-2.5

N ∠ MV ∠ Air Density (90°/)

1	3390	∠27	6374.3	-56.7	[illegible]	∠3.40	858.7	-7.3
2	4308	∠29	6371.0	-58.0	35.43	∠3.23	893.4	-6.6
3	5403	∠31	6371.0	-65.0	41.70	∠3.30	913.0	-5.0
4	6872	∠39	6369.0	-80.0	48.82	∠3.52	972.6	-5.4
5	8700	∠41	6368.7	-72.3	54.90	∠3.50	966.5	-4.5
6	10988	∠44	6365.5	-82.5	63.56	∠3.36	984.8	-0.2
7	13363	∠47	6359.3	-97.7	73.10	∠2.70	1014.0	-3.0

N ∠ MV ∠ W ∠ A.T. ∠ Air Temp (118°F)

1	3386	∠19	6373.0	-57.0	31.00	∠3.20	883.7	-6.3
2	4305	∠26	6373.3	-58.0	35.20	∠3.30	887.6	-5.4
3	5400	∠28	6370.4	-65.6	41.52	∠3.42	939.0	-5.0
4	6866	∠33	6368.0	-71.0	48.92	∠3.52	974.7	-4.3
5	8696	∠38	6365.3	-100.0	56.46	∠2.06	1004.4	-2.6
6	10980	∠37	6362.8	-88.2	64.78	∠2.18	1011.0	∠1.0
7	13357	∠43	6358.0	-100.0	73.90	∠2.10	1026.7	-2.3

N ∠ MV ∠ W ∠ A.D. ∠ AT ∠ Power Temp (130°F)

1	3386	∠19	6370.0	-64.0	32.25	∠2.85	931.0	-4.0
2	4306	∠27	6370.6	-64.4	36.47	∠2.67	931.2	-4.8
3	5400	∠28	6368.2	-69.8	42.47	∠2.57	970.3	-3.7
4	6867	∠35	6366.3	-75.7	49.65	∠2.65	997.2	-3.8
5	8694	∠37	6364.0	-83.0	57.02	∠1.42	1018.0	-2.0
6	10977	∠35	6361.2	-90.8	65.63	∠1.23	1028.3	∠1.3
7	13355	∠43	6355.6	-105.4	74.75	∠0.65	1045.2	-1.8

N ∠ MV ∠ W ∠ A.D ∠ At ∠ PT ∠ Wt of Proj (3)

1	3385	∠18	6369.0	-63.0	36.54	∠7.74	945.2	∠27.2	Grn Bag
2	4303	∠24	6369.5	-63.5	36.90	∠3.80	946.3	∠25.3	" "
3	5398	∠26	6367.4	-70.6	42.80	∠3.30	981.0	∠13.0	" "
4	6866	∠34	6365.6	-75.4	50.00	∠3.40	1005.6	∠9.6	" "
5	8694	∠37	6364.0	-83.0	57.15	∠1.65	1020.4	∠1.4	" "
6	10975	∠33	6361.3	-90.7	65.64	∠1.15	1028.3	∠0.3	White Bag
7	13352	∠40	6355.5	-105.5	74.73	∠0.53	1045.6	-1.4	" "

APPENDIX C

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