DNA 3777F

PHOTOGRAMMETRY OF THE SHOCK FRONT TRAJECTORIES ON DIPOLE WEST SHOTS 8, 9, 10, AND 11

University of Victoria
British Columbia, Canada V8W 2Y2

General Electric Company—TEMPO
DASIAC
816 State Street
Santa Barbara, California 93102

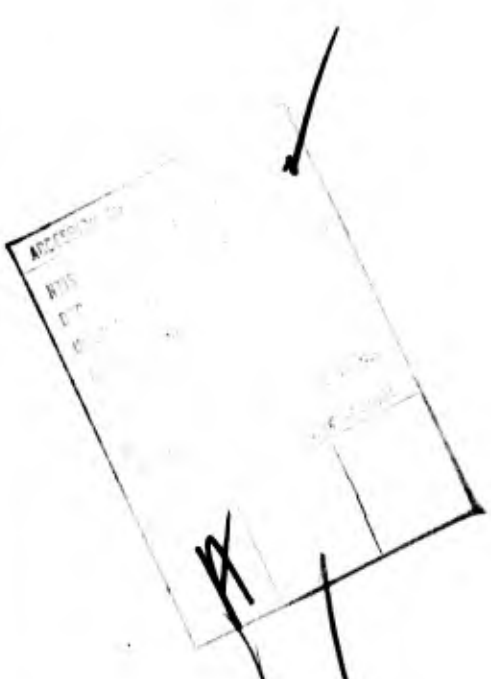
July 1975

Final Report

CONTRACT No. DNA 001-74-C-0285

THIS WORK SPONSORED BY THE DEFENSE NUCLEAR AGENCY
UNDER SUBTASK N99QAXAA110-25.

Prepared for
Director
DEFENSE NUCLEAR AGENCY
Washington, D. C. 20305



Destroy this report when it is no longer needed. Do not return to sender.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: DNA 3777F	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): PHOTOGRAMMETRY OF THE SHOCK FRONT TRAJECTORIES ON DIPOLE WEST SHOTS 8, 9, 10, AND 11.	5. TYPE OF REPORT & PERIOD COVERED: Final Report.
	6. PERFORMING ORG. REPORT NUMBER: UVIC PF-1-75
7. AUTHOR(s): J. M. Dewey, D. F. Classen, D. J. McMillin	8. CONTRACT OR GRANT NUMBER(s): DNA 001-74-C-0285
9. PERFORMING ORGANIZATION NAME AND ADDRESS: University of Victoria, British Columbia, Canada V8W 2Y2	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: NWED Subtask N99QAXAA110-25
11. CONTROLLING OFFICE NAME AND ADDRESS: Director, Defense Nuclear Agency, Washington, D.C. 20305	12. REPORT DATE: Jul[illegible]75
	13. NUMBER OF PAGES: 192
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): General Electric Company-TEMPO, DASIAC, 816 State Street, Santa Barbara, California 93102	15. SECURITY CLASS (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

191p.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

DNA-NWED-QAXA A110

18. SUPPLEMENTARY NOTES

This work sponsored by the Defense Nuclear Agency under Subtask N99QAXAA110-25.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dipole West
Photogrammetry
Shock Waves
Triple Point

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the photogrammetry of shock waves produced by the simultaneous detonation of two spherical 1080 lb Pentolite charges. Four experiments were carried out. In two of the experiments one of the charges was at 25 ft above the ground and the second charge at a further height of 50 ft above the first. In the other two experiments the corresponding distances were 15 ft and 30 ft. For each charge configuration, one experiment was carried out over smooth ground and another over rough ground. In each experiment photogrammetrical measurements were made of the trajectories

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

346 420

20. ABSTRACT (Continued).

of the primary spherical shock from the bottom charge; of the Mach stem shock along the ground surface, and of the Mach stem shock produced along the ideal reflecting plane between the two charges. Comparisons of the shock strengths of the Mach stems along the ground and close to the ideal reflecting plane, indicated an energy loss in the shock front of approximately 10% over the smooth ground and of approximately 40% over the rough ground. The trajectories of the triple points formed by the junction of the primary shocks, reflected shocks and Mach stems, also show a marked difference for the rough ground compared with the smooth ground, and the smooth ground compared with the ideal reflecting plane.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
I.1	Introduction	9
I.2	Objectives	10
II.1	Field Layout	12
II.2	Geometrical Corrections	14
II.3	Film Calibration	16
II.4	Shock Radius Calculations	18
II.5	Time Determination	20
II.6	Analysis of Photogrammetrical Results	20
III.1	Camera Operation	23
III.2	Results of Shock Photogrammetry Analysis	23
III.3	Shock Front Trajectories	24
III.4	Peak Hydrostatic Overpressures	25
III.5	Relative Energy Estimates	27
III.6	Triple Point Trajectories	28
IV.1	Discussion and Conclusions	30
	Acknowledgements	33
	References	33

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
1a.	Predicted shocks and triple point loci— 50-ft separation.	34
1b.	Predicted shocks and triple point loci— 30-ft separation.	35
1c.	Tracing of the shock fronts—Shot 8, 3-ft camera.	36
1d.	Tracing of the shock fronts—Shot 8, 57-ft camera.	37
1e.	Tracing of the shock fronts—Shot 9, 3-ft camera.	38
1f.	Tracing of the shock fronts—Shot 9, 30-ft camera.	39
1g.	Tracing of the shock fronts—Shot 10, 3-ft camera.	40
1h.	Tracing of the shock fronts—Shot 10, 30-ft camera.	41
1i.	Tracing of the shock fronts—Shot 11, 3-ft camera.	42
1j.	Tracing of the shock fronts—Shot 11, 57-ft camera.	43
2.	Dipole West test site layout.	44
3.	Field of view of camera at 57-ft elevation—Shot 8.	45
4.	Field of view of camera at ground level—Shot 10.	46
5.	Optical transformation for object plane to record plane.	47
6.	Geometry for calculating mach stem and primary shock radii.	48
7.	Plan of tangent point trajectory for a mach stem at the ground surface.	49
8.	Primary shock radius versus time—Shot 8.	50
9.	Primary shock radius versus time—Shot 11.	51
10.	Primary shock radius versus time—Shots 8, 9, 10 and 11.	52

11. Primary shock scaled radius versus scaled time—Shots 8, 9, 10 and 11. 53

12. Upper and ground mach stem radius versus time—Shot 8. 54

13. Upper and ground mach stem radius versus time—Shot 9. 55

14. Upper and ground mach stem radius versus time—Shot 10. 56

15. Upper and ground mach stem radius versus time—Shot 11. 57

16. Ground mach stem radius versus time—Shots 8, 9, 10 and 11. 58

17. Upper mach stem radius versus time—Shots 8, 9, 10 and 11. 59

18. Mach stem radius above and below the ideal reflection plane versus time—Shot 10. 60

19. Upper mach stem scaled radius versus scaled time—Shots 8, 9, 10 and 11. 61

20. Ground mach stem scaled radius versus scaled time—Shots 8, 9, 10 and 11. 62

21. Primary shock overpressure versus distance—Shot 8. 63

22. Primary shock overpressure versus distance—Shot 11. 64

23. Primary shock overpressure versus distance—Shots 8, 9, 10 and 11. 65

24. Ground and upper mach stem overpressures versus distance—Shot 8. 66

25. Ground and upper mach stem overpressures versus distance—Shot 9. 67

26. Ground and upper mach stem overpressures versus distance—Shot 10. 68

27. Ground and upper mach stem overpressures versus distance—Shot 11. 69

28. Primary shock overpressure compared with gauge measurements— Shot 8, WF5 at 57 feet. 70

29. Primary shock overpressure compared with gauge measurements— Shot 8, WF3T at 3 feet. 71

30. Ground mach stem overpressure compared with gauge measurements— Shot 8. 72

31. Upper mach stem overpressure compared with gauge measurements— Shot 8. 73

32. Primary shock overpressure compared with gauge measurements —Shot 9. 74

33. Ground mach stem overpressures compared with gauge measurements— Shot 9. 75

34. Upper mach stem overpressures compared with gauge measurements— Shot 9. 76

35. Primary shock overpressures compared with gauge results— Shot 10. 77

36. Ground mach stem overpressures compared with gauge results — Shot 10. 78

37. Upper mach stem overpressures compared with gauge results — Shot 10, WF3T at 3 feet. 79

38. Upper mach stem overpressures compared with gauge results — Shot 10, WF5 at 30 feet. 80

39. Top charge mach stem overpressures compared with gauge results— Shot 10. 81

40. Primary shock overpressures compared with gauge results— Shot 11, WF3T at 3 feet. 82

41. Primary shock overpressures compared with gauge results— Shot 11, WF5 at 57 feet. 83

42. Ground mach stem overpressures compared with gauge results — Shot 11. 84

43. Upper mach stem overpressures compared with gauge results — Shot 11. 85

44. Primary shock overpressure versus scaled distance—Shots 8, 9, 10 and 11. 86

45. Upper and ground mach stem overpressures versus scaled distance— Shot 8. 87

46. Upper and ground mach stem overpressures versus scaled distance— Shot 9. 88

47. Upper and ground mach stem overpressures versus scaled distance—Shot 10. 89

48. Upper and ground mach stem overpressures versus scaled distance—Shot 11. 90

49. Mach stem overpressures above and below the ideal reflecting plane versus scaled distance—Shot 10. 91

50. Comparison of upper mach stem overpressures versus scaled distance—Shots 8 and 11. 92

51. Comparison of upper mach stem overpressures versus scaled distance—Shots 9 and 10. 93

52. Comparison of ground mach stem overpressures versus scaled distance—Shots 8 and 11. 94

53. Comparions of ground mach stem overpressures versus scaled distance—Shots 9 and 10. 95

54. Comparisons of ground mach stem overpressures versus scaled distance—Shots 8 and 9. 96

55. Comparisons of upper mach stem overpressures versus scaled distance—Shots 8 and 9. 97

56. Comparison of ground mach stem overpressures versus scaled distance—Shots 10 and 11. 98

57. Comparison of upper mach stem overpressures versus scaled distance—Shots 10 and 11. 99

58. Triple point paths— Shots 8 and 11. 100

59. Scaled triple point paths— Shots 8 and 11. 101

60. Triple point paths— Shots 9 and 10. 102

61. Scaled triple point paths— Shots 9 and 10. 103

62. Primary shock overpressures versus scaled distance compared with Brode's results. 104

LIST OF TABLES

TABLE	TITLE	PAGE
1.	Calculated camera positions and orientations.	105
2-8.	Photomarker and gauge survey data—Shot 8.	106
3-8-WF3T(3).	Film calibration data transformed to the object plane—Shot 8, WF3T at 3 feet.	109
3-8-WF5(57).	Film calibration data transformed to the object plane—Shot 8, WF5 at 57 feet.	110
4a.	Film speeds—WF5 (Serial 267) Shots 8, 9, 10 and 11.	111
4b.	Film speeds—WF3T (Serial 218) Shots 8, 9, 10 and 11.	112
4c.	Film speeds—WF3T (Serial 209) Shots 8, 9, 10 and 11.	113
4-8-WF3T(3).	Film timing data—Shot 8, WF3T at 3 feet.	114
4-8-WF5(57).	Film timing data—Shot 8, WF5 at 57 feet.	114
5-8.	Meteorological observations—Shot 8.	115
6-8-WF3T(3)a.	Shock trajectory analysis- primary front, bottom charge—Shot 8.	116
6-8-WF3T(3)b.	Shock trajectory analysis—ground mach stem—Shot 8.	119
6-8-WF5(57)a.	Shock trajectory analysis—primary front, bottom charge—Shot 8.	122
6-8-WF5(57)b.	Shock trajectory analysis—upper mach stem, bottom charge—Shot 8.	124
2-9.	Photo marker and gauge survey data- Shot 9.	127
3-9-WF3T(3).	Film calibration data transformed to the object plant—Shot 9, WF3T at 3 feet.	130
4-9-WF3T(3).	Film timing data—Shot 9, WF3T at 3 feet.	131

5-9.	Meteorological observations—Shot 9.	132
6-9-WF3T(3)a.	Shock trajectory analysis—primary front, bottom charge—Shot 9.	133
6-9-WF3T(3)b.	Shock trajectory analysis—ground mach stem—Shot 9.	134
6-9-WF3T(3)c.	Shock trajectory analysis—upper mach stem, bottom charge— Shot 9.	136
2-10.	Photo marker and gauge survey data—Shot 10.	138
3-10-WF5(30).	Film calibration data transformed to the object plane—Shot 10, WF5 at 30 feet.	141
4-10-WF5(30).	Film timing data— Shot 10, WF5 at 30 feet.	142
5-10.	Meteorological observations—Shot 10.	143
6-10-WF5(30)a.	Shock trajectory analysis—primary front, bottom charge—Shot 10.	144
6-10-WF5(30)b.	Shock trajectory analysis—upper mach stem, bottom charge—Shot 10.	145
6-10-WF5(30)c.	Shock trajectory analysis—lower mach stem, top charge— Shot 10.	147
3-10-WF3T(3).	Film calibration data transformed to the object plane—Shot 10, WF3T at 3 feet.	150
4-10-WF3T(3).	Film timing data—Shot 10, WF3T at 3 feet.	151
6-10-WF3T(3)a.	Shock trajectory analysis—ground mach stem, bottom charge—Shot 10.	152
6-10-WF3T(3)b.	Shock trajectory analysis—upper mach stem, bottom charge—Shot 10.	154
2-11.	Photo marker and gauge survey data—Shot 11.	156
3-11-WF5(57).	Film calibration data transformed to the object plane—Shot 11, WF5 at 57 feet.	159
4-11-WF5(57).	Film timing data—Shot 11, WF5 at 57 feet.	160
5-11.	Meteorological observations—Shot 11.	161

6-11-WF5(57)a. Shock trajectory analysis—primary front, bottom charge—Shot 11. 162

6-11-WF5(57)b. Shock trajectory analysis—upper mach stem, bottom charge—Shot 11. 164

3-11-WF3T(3). Film calibration data transformed to the object plane—Shot 11, WF3T at 3 feet. 167

4-11-WF3T(3). Film timing data—Shot 11, WF3T at 3 feet. 168

6-11-WF3T(3)a. Shock trajectory analysis— primary front, bottom charge—Shot 11. 169

6-11-WF3T(3)b. Shock trajectory analysis—ground mach stem, bottom charge—Shot 11. 172

7-8-WF5(57). Triple point path below ideal surface—Shot 8. 175

7-8-WF3T(3). Triple point path above smooth ground—Shot 8. 177

7-9-WF3T(3)a. Triple point path below ideal surface—Shot 9. 179

7-9-WF3T(3)b. Triple point path above smooth ground—Shot 9. 180

7-10-WF3T(3)a. Triple point path below ideal surface— Shot 10. 181

7-10-WF3T(3)b. Triple point path above rough ground—Shot 10. 182

7-11-WF5(57). Triple point path below ideal surface—Shot 11. 183

7-11-WF3T(3). Triple point path above rough surface—Shot 11. 185

CHAPTER I

I.1 Introduction

When a spherical charge is detonated above the ground surface the resulting spherical blast wave reflects from the ground. At a distance from the point on the ground immediately beneath the charge, approximately equal to the height of the charge above the ground, the reflected shock begins to overtake and combine with the primary shock to form a single shock known as the Mach stem. The point at which the primary shock, the reflected shock and the Mach stem meet is called the triple point. As the Mach stem shock moves outwards the height of the triple point continues to grow in a hyperbola-like trajectory.

The physical properties of the Mach stem blast wave and the trajectory of the triple point depend upon the energy yield of the charge; the height of burst of the charge above the ground, and on the nature of the ground surface. When the primary shock reflects from the ground, some energy will be absorbed by the ground and will appear as seismic disturbances, including cratering if the explosion is close enough to the ground. As the blast wave continues to move across the ground surface there will be a continued transfer of energy between the air and the ground, and also a redistribution of energy within the blast wave. Little is known about the transfer of energy to the ground from an air blast, or about the redistribution of energy within a blast wave as it passes over the ground surface. The experiments described in this report are an attempt to elucidate some of these problems.

It is postulated that if two identical charges are simultaneously detonated, at a certain distance apart, the two resulting identical spherical blast waves will interact along a plane, and since there will be no energy loss in this interaction it will be possible to observe an ideal spherical shock reflection. The properties of the Mach stems lying above and below the ideal reflecting plane may then be compared with those produced over various real ground surfaces.

I.2 Objectives

The primary purpose of the project described in this report was to obtain information on the interaction of spherical shock waves from explosive sources with real surfaces as contrasted with an ideal reflecting surface. The results are to be used to evaluate hydrodynamic airblast computer codes. The shock interactions were obtained by the simultaneous detonation of two identical spherical charges placed one above the other such that the distance between the charges was equal to twice the height of the lower charge above the ground surface. Two different charge configurations were used over two different types of ground surface. The positions of the charges relative to the ground surface, and the expected shock patterns are illustrated in Figures 1a and 1b.

The four experiments were titled Dipole West Shots 8, 9, 10 and 11. The charge configuration for Shots 8 and 11 is shown in Figure 1a, using smooth ground in Shot 8 and rough ground in Shot 11. The configuration for shots 9 and 10 is shown in Figure 1b, using smooth ground in Shot 9 and rough ground in Shot 10.

The project reported here involved for each Shot, the photography, against a suitable background, of the primary shock front

from the lower charge and the Mach stem shocks produced above the ground surface and below the ideal reflecting plane between the two charges. The objective was to measure from the photographic records, the radius versus time sequence for these three shocks, and thus calculate the shock speed in each case. The shock Mach number could then be used to determine the pressure, density and particle velocity immediately behind the shock. In addition, measurements were to be made of the triple point trajectories above the ground and below the ideal reflecting plane.

Figures 1(c) to 1(j) show tracings of the shock fronts observed from two camera positions for each shot, together with the positions of the charges, if they were in the field of view, and the various surveyed markers which were used to make the necessary geometrical corrections. Some frame numbers are also given. It must be stressed that neither the distance nor the time scales on these tracings are linear so that measurements of shock radius or time should not be made from these plots, which are presented to give a qualitative picture only.

A second project involved the photography of the space-time trajectories of an array of gas particle tracers (smoke puffs) in the regions behind the Mach stems above the ground and below the ideal reflecting plane. These observations were to provide a determination of the space and time variations of both density and particle velocity throughout the flow regions. The results of these measurements will be reported later.

CHAPTER II

II.1 Field Layout

The plan of the field layout used for the photogrammetrical measurements is shown as Figure 2. The main camera position (MCP), for the cameras photographing both the shock fronts and the particle tracers, was six hundred feet south of ground zero (GZ). Photography of the shock fronts was made possible by viewing the shocks against the specially prepared backdrop. The backdrop line began at the point on the MCP-GZ line, 400 ft from GZ on the opposite side of the charge to the MCP. The backdrop extended on a line making an angle of 80° to the MCP-GZ line, for a distance of 325 ft. Ten 30 ft by 50 ft polka-dot patterned canvas backdrops, similar to those used on previous large scale experiments at the Defence Research Establishment Suffield (DRES), were used on Shot 8. During preparation for Shot 9, the polka-dot backdrops were severely damaged in a wind storm. Replacements were made with striped backdrops and these were used in Shots 9 through 11.

In order to observe, against the backdrop, the Mach stem produced by the reflection at the ground surface of the shock from the lower charge, it was necessary to use a camera as close as possible to the ground. The camera for these observations was placed at a minimum practical height of 3 ft. In order to see the Mach stem along the ideal reflecting surface, against the backdrop, it was necessary to have the camera on or above the line of sight from the top of the backdrop through the ideal reflecting plane. An upper camera position at 57 ft was

therefore used when the ideal reflecting plane was at a height of 50 ft, and a camera position at 30 ft was used when the ideal reflecting plane was at a height of 30 ft. The original plan called for two cameras at each elevation, in case of camera failure. However, only one camera was available for use at the 3 ft level, and this functioned adequately in all experiments.

The field of view for a camera at the 57 ft level on Shot 8 is shown as Figure 3. The field of view for the camera at the 3 ft level on Shot 10 is shown as Figure 4. In order to permit the necessary geometrical corrections of the measurements made from the photographic records, accurately surveyed markers were placed in the fields of view of the cameras. Three primary markers,(E1, E2 and E3),were placed at ground level to the east of GZ at nominal distances of 36, 70 and 105 ft from GZ on the semi-circle which had the MCP-GZ line as diameter. After Shot 8 the 36 ft marker was removed because it interferred with the view of the shock pattern at a point close to that at which the triple point was expected to intersect the ground surface. Three markers, (300-1, 300-2 and 300-3), each two feet square, were located at ground level on a line parallel with the backdrop and intersecting the MCP-GZ line at a distance of 300 ft south of GZ. An additional three markers (BME 1, 2, and 3) were placed on top of the backdrop array. A large number of pressure transducers were visible in the fields of view of the cameras, and since these were accurately surveyed they could also be used as additional photo-markers.

II.2 Geometrical Corrections

Two geometrical corrections are necessary in order to transform data measured directly from photographic records into data describing the position of a shock front. The first of these corrections may be termed film calibration. It involves a transformation from an object plane to a projected image or record plane from which the measurements are made, and depends on the images of points whose positions in real space are both known and fixed throughout the experiment. The second geometrical transformation arises because the image of a shock front seen against a background does not define a true shock position, but rather defines a line through the camera which is tangential to the shock front. For this transformation a different geometrical correction is necessary for each data point on each frame of the photographic record.

All of the photogrammetrical transformations are made assuming that the optics of both the camera and the subsequent film projection system have cylindrical symmetry in which both the film plane and the projection or record plane are perpendicular to a central optical axis. Moreover, it is assumed that the optical axis of the system intersects both the film and the record planes at the frame centre. Each point measured in the record plane is related to a point in an object plane defined as perpendicular to the optic axis of the camera and at some convenient distance in front of the camera.

The relationship between the film plane, the record plane and the object plane is shown in Figure 5. An azimuthal angle θ and an elevation angle ϕ together define the optic axis. The x-y coordinate system is defined in the object plane with its origin at the centre of the field of view, the x axis in the horizontal plane and the y axis in the vertical plane. All points along the same line of sight of the camera, for example, P_1 and P_2 in Figure 5, will appear at common position P' in the record plane and at the corresponding point P in the object plane.

Transformation of the coordinates of a point measured in the record plane to coordinates in the object plane is achieved by rotating the record plane coordinates by an angle α and multiplying the coordinates by a scale factor σ. The determination of the rotation angle α and the scale factor σ requires that surveyed positions be known of at least two points which are visible in each record image. The lines joining each of these points to the camera intersect the object plane and define primary reference positions in that plane. The rotation angle α is the difference between the slope of the line connecting the two primary reference points in the object plane and the slope of the same line measured in the record plane. Similarly, the scale factor σ is the ratio of the lengths of these two lines. However, in order to transfer the primary reference points from survey coordinates to object plane coordinates a knowledge is required of the orientation angles θ and ϕ, and of the exact camera position in survey coordinates.

II.3 Film Calibration

In order to make the transformation described above, it is necessary to determine the orientation angles θ and ϕ, the exact survey coordinates of the camera, and the optical parameters α and σ. It was necessary to determine these parameters from the film record because neither the orientation data nor the exact position of each camera lens, with respect to the main camera position, was measured in the field.

The orientation angles ϕ and θ, were determined by considering the triangle defined by the frame centre and the two primary reference point images in the record plane. The specific parameters considered were the ratio of the lengths of two sides of the triangle and the angle contained between the sides. These parameters do not depend on the optical parameters α and σ , and hence are constant under transformation from the record plane to the object plane. An iteration process was used to match the similarities of the triangles in the object and record planes. The camera orientation was considered to have been determined when successive iterations differed by less than a specified small angle (0.001^{o}). So that the orientation process would not be particularly sensitive to small errors in camera position, the orientation reference points were chosen in a plane which differed minimally from the object plane, namely the plane containing the pressure gauges, running approximately eastward from ground zero.

Exact camera coordinates were obtained by using two secondary reference points which were chosen as far as possible out of the plane of the primary reference points. The east-west and elevation coordinates of the camera were optimized by finding the camera position such that the secondary reference point images, trans-

formed to the object plane, coincided with the corresponding positions calculated directly from the survey data. Simultaneously, the north-south coordinate was optimized by finding the camera position such that the distance between the secondary reference points transformed from the record plane to the object plane was the same as the corresponding distance calculated from the survey data. At each step in the position optimizing procedure the camera orientation was adjusted using the primary reference points as described above. The camera position was considered as determined when successive iteration differed by less than 0.1 ft in each of the three position coordinates.

The optimized camera position and orientation angles calculated for the seven cameras used in Shots 8 through 11 are summarized in Table 1. The survey data used for the film analysis are given in Table 2. (N.B. Similar tables for each experiment and for each camera in an experiment will have the same initial number, e.g. Table 2-8 is Table 2 of Shot 8, and Table 3-8-WF3T(3) is Table 3 of Shot 8 for the WF3T camera at 3 ft elevation.) The primary reference points (pressure gauges in all but one case) were chosen for rapid convergence of the camera orientation calculation. The secondary points were selected from the background markers BME 1, BME 2, and BME 3, chosen on the basis of consistency in calculating the position of a particular camera over all four shots.

The optimized position and orientation of each camera was then used to calculate the positions in the object plane of all surveyed points visible in the field of view, and these were compared with the positions calculated directly from the field survey. These comparisons are shown in Tables 3. The two

primary reference points generally show shifts of only several hundredths of an inch. The maximum error in position in the object plane was estimated by adding the maximum error in the orientation angles and the maximum uncertainty in the record plane measurements after these were expressed in distance units in the reference plane. The total error was found normally to be less than two inches and in most cases less than half an inch.

For all the points used in the calibration, the average difference in the position calculated from the film record and from the field survey was approximately half an inch, except when the survey markers midway between the cameras and the ground zero were used. These markers (labelled 300-1, 300-2, and 300-3), showed apparent shifts in the object plane as large as 3.2 feet and are inconsistent with any camera position or orientation. These markers were only visible in the field of view of the cameras at 3 ft elevation. This large apparent error may arise from the fact that in all cases these markers appear in the extreme edge of the field of view where optical distortions are likely to be large. In addition the survey errors may have been significantly larger for these particular markers.

II.4 Shock Radius Calculations

The camera position and orientation were calculated using reference points measured on a frame of the film taken shortly before the charges were detonated. In the subsequent analysis it was assumed that the camera position and orientation, and the position of the two primary reference points would remain fixed in real space for the duration of the event being filmed.

The calibrations and geometrical corrections for each frame required only the measurement of the position of the primary reference points in the record plane. The frame centre coordinates, the rotation angle α, and scale factor σ were assumed to vary from frame to frame and were calculated for each frame using two reference points which were not necessarily those points used as primary reference points for the film calibrations, since these were not always visible throughout the duration of the event.

By these means the apparent position of a shock front was transformed to a point in the object plane. The line joining this point to the camera is tangential to the shock front surface. In the case of the Mach stem above or below the ideal reflecting plane the shock surface was assumed to have cylindrical symmetry about the line joining the two charge centres. In the case of the Mach stem above the ground the shock surface was assumed to have cylindrical symmetry about the vertical through the centre of the lower charge. The primary shock was considered to have spherical symmetry about the charge centre. This is illustrated in Figure 6.

The object plane was defined as perpendicular to the optic axis of the camera and containing ground zero. This is illustrated in plan view in Figure 7 for the case where the elevation angle of the optic axis is zero. P is an image point in the object plane, and the line of sight CP is tangent to the shock front at T. The radius of a spherical shock front is therefore the distance from T to the charge centre, while the radius of a Mach stem is measured from T to the axis of symmetry. In the case of a spherical shock all tangent points T will lie on a sphere with the line joining the charge centre to the camera as

diameter, or in the case of a Mach stem, a cylinder, the axis of which is parallel to the Mach stem axis and passes through a point midway between that line and a line through the camera parallel to that line. Shock radii calculated in this manner, using different points on the same shock front, were averaged.

II.5 Time Determination

The time at which each frame was taken, relative to the time of detonation, was determined from a zero time mark and a sequence of one millisecond timing marks on the film. The zero timing light in the camera did not correspond to the frame in the film gate but was displaced from it by a known distance along the film that was constant for each camera. Knowing this distance, the zero frame could be determined on each film. The time values for each successive frame were calculated by integrating the reciprocal of the film speed measured in frames per second. Film speeds were interpolated from values calculated at four points spaced evenly along the film, namely at frames number -31, 36, 169, 269. The film speeds at these positions were calculated from the measured distances between the timing marks. The timing data for each film analysed are shown in Tables 4.

II.6 Analysis of Photogrammetrical Results

The measured shock radius-time (R-t) data were analysed by least squares fitting to an equation of the form

$$R = A + Bt + C \ln (1+t) + D\sqrt{\ln (1+t)} \quad .$$

The data were weighted inversely with the square of the observed radius so as to obtain a fit with a constant percentage error

throughout the range of the input data. The above ad hoc equation has been found valuable for describing a wide variety of monotonically decaying shocks. It satisfies two appropriate boundary conditions; namely, that at t = 0 the shock radius may have a positive or negative finite value, and that as $t \to \infty$ the shock velocity asymtotically approaches a constant value, which one would expect to be close to the ambient velocity of sound. The equation is differentiated with respect to time, to obtain the shock velocity at any point.

The ambient values of the temperature, pressure and vapour pressure, and the charge weight were used in each experiment to calculate the ambient speed of sound, and Sach's scaling factor defined as $S = \sqrt[3]{WP_o/P}$ where W is the charge mass in pounds, P the atmospheric pressure and P_o a standard pressure of 14.7 psi. The ambient conditions in each experiment are given in Tables 5.

The results of the photogrammetrical analyses are given in Tables 6. The columns of the output table, in order, are interpreted as follows: the frame time in milliseconds after detonation; the observed shock radius in feet; the shock radius calculated from the fitted curve; the difference between the observed and fitted shock radii; the frame time scaled by a factor c/S where c is the ambient velocity of sound; the scaled shock radius using the scaling factor S; the shock velocity in Mach units; the overpressure immediately behind the shock in atmospheres; the overpressure behind the shock in pounds/square inch; the gas particle velocity immediately behind the shock in Mach units relative to the ambient sound speed; the gas density immediately behind the shock in terms of the ambient density, and the number of the film frame from which the measurements were made. The scaled radius

and time may be considered as the shock trajectory to be expected from a one pound charge detonated at standard atmospheric pressure in a gas with a velocity of sound of one foot per millisecond. These scaled values will subsequently be used to compare shocks from different explosions, eliminating differences to be expected because of charge weight and variations in atmospheric conditions.

CHAPTER III

III.1 The Camera Operation

The shock photogrammetry cameras operated satisfactorily in all four experiments, with the following exceptions. No zero time mark was obtained on any film for Shot 9. This does not seriously affect the analysis of the results but prevents exact time correlation between the photogrammetrical results and those from other measurements, such as pressure transducers. The maximum error is only ±0.12 ms. No timing marks were obtained on the film from one of the upper shock trajectory cameras on the Shot 9, and there was therefore no purpose in analysing this film. Satisfactory results were obtained however, from the back-up camera. This upper level back-up camera malfunctioned in Shot 10 due to the low temperature, but in this case the primary camera operated satisfactorily. A complete shock analysis was therefore possible for all experiments.

III.2 Results of Shock Photogrammetry Analysis

In each experiment measurements were made of the radius versus time of the primary shock from the lower charge, of the Mach stem produced by the lower charge along the ground surface, and of the Mach stem produced by the lower charge beneath the ideal reflecting plane. In addition, on Shot 10, it was possible to measure the trajectory of the Mach stem produced by the upper charge above the ideal reflecting surface.

In Shots 9 and 10, in which the charge separation was only thirty feet, the primary shock from the lower charge could only be observed for a distance of approximately 10 feet. In addition, the measurements were made with difficulty in this region because

the backdrops were partially obscured by the towers which supported the charges. As a result no satisfactory analysis of the primary shock front trajectories was possible for these two shots, although an attempt was made, using an abbreviated form of the least squares fitted equation. Satisfactory measurement of the trajectories of the upper and lower Mach stems was possible, however.

The results of analyses of all the shock trajectories are presented as Tables 6.

III.3 Shock Front Trajectories

The results of the photogrammetrical analyses are more clearly illustrated in graphic form. Figure 8 is a plot of the primary shock radius versus time for the lower charge of Shot 8. The results shown are for two cameras, the 16 mm WF3T at an elevation of 3 ft and the 35 mm WF5 at an elevation of 57 ft. The perfect agreement between these two sets of measurements validates the geometrical corrections and film timing procedures which were used. The individual points which have been plotted are every fifth measured value and the curves are the least squares fits.

Figure 9 shows similar results for Shot 11, in which the same charge configuration was used.

Figure 10 shows the actual primary shock trajectories for all four experiments. The effect of scaling these trajectories to a one pound charge at standard atmospheric pressure and an ambient velocity of sound of a one foot per millisecond is shown in Figure 11. As would be expected, there is now very little difference in the shock trajectories, and the differences illustrated in Figure 9 are more than accounted for by the differences in atmospheric

conditions, particularly the temperature.

Figure 12 shows the trajectories of the Mach stems produced by the lower charge in Shot 8 over the ground surface and beaneath the ideal reflecting surface. The Mach stem over the ground is slightly slower than that beneath the ideal reflecting surface. Similar results are presented for Shots 9, 10 and 11 in Figures 13, 14 and 15, respectively. In each case the speed of the Mach stem over the ground is slower than that beneath the ideal reflecting surface, and this difference is most marked in Shots 10 and 11 in which the ground surface had been roughened. The trajectories of all the ground Mach stems and ideal Mach stems are given in Figures 16 and 17. Only on Shot 10 was it possible to observe the Mach stems produced above and below the ideal reflecting surface. No difference in these shock trajectories could be detected, as is illustrated in Figure 18.

Once again, in order to make a valid comparison between the results of one experiment and another, it is necessary to scale the results so as to eliminate the effects of differences in atmospheric conditions. These results are presented in Figures 19 and 20. Figure 19 shows that there is little difference between the trajectories of the ideal Mach stems with the same charge configuration, but there are significant differences for the Mach stems over the smooth and rough ground surfaces, as shown in Figure 20.

III.4 Peak Hydrostatic Overpressures

The peak hydrostatic overpressure immediately behind the shocks was calculated by applying the shock Mach number obtained from fitted radius time curves into the modified Rankine-Hugoniot

equation. Figures 21 and 22 show the variation of peak overpressure with distance for the primary shocks from the lower charges in Shots 8 and 11 respectively. In each case two curves are shown for results obtained from different cameras at different elevations. These are presented here to indicate the probable magnitude of the experimental error inherent in the photogrammetrical analysis. The overpressure-distance variation for the primary shocks in all four experiments is given in Figure 23. For Shots 9 and 10 the primary shock from the lower charges could be seen only for a distance of approximately 10 ft, so that it was possible to calculate the pressure at a single point only.

The variations of overpressure with distance from the axis of symmetry, for the Mach stems, are plotted in Figures 24 to 27. Shots 8 and 9 were carried out over hard smooth ground, and there is only a slight difference between the overpressures in the Mach stems above the ground and below the ideal reflecting surface, with that above the ground significantly lower in each case. Shots 10 and 11 were carried out over rough ground, and a more marked difference in the overpressures at all distances can be seen for both shots. In Shot 10, the Mach stem could be observed below the ideal reflecting surface with two cameras, and the results from both analyses are plotted. Also on this experiment, it was possible to observe the Mach stem from the upper charge above the ideal reflecting surface, and this result is also plotted in Figure 26.

In Figures 28 to 43 the overpressures calculated from the photogrammetrical analyses are compared with the peak pressures measured by electronic gauges and given in the preliminary report. The numbers associated with the gauge pressures plotted on these

graphs are the horizontal and vertical coordinates of the gauge's position relative to ground zero, measured in feet. The gauge positions correspond as closely as possible to the position at which the photogrammetrical measurements were made. In nearly all cases the agreement between the photogrammetrical and gauge pressures are extremely good, and this speaks well for the accuracy and reliability of both systems.

III.5 Relative Energy Estimates

The peak hydrostatic overpressures, in atmospheres, have been plotted against scaled distances in Figures 44 to 57. These are the most valuable results for making comparisons between the various shock trajectories and strengths, since the effects of differences in atmospheric conditions have been eliminated.

Figure 45 shows a comparison between the peak overpressure-distance variations of the Mach stems produced by the lower charge in Shot 8 over the ground surface and beneath the ideal reflecting surface. A comparison of the cubes of the radii at which equal overpressures were observed for each of these Mach stems is an indication of the relative energy in each blast wave. The average value, over the range of data shown in Figure 45, indicates an energy loss, due to the reflection at ground surface, of approximately 9% (±2%). A similar comparison for Shot 9 indicates an energy loss at the ground reflection of approximately 8% (±2%) although in this case the two pressure distance curves are not parallel over the range of observation. The corresponding figures for Shots 10 and 11, which were carried out over rough

ground, are 42% (±5%) and 40% (±5%) respectively.

The overpressure variation for the Mach stems produced beneath the ideal reflecting surfaces in Shots 8 and 11 are compared in Figure 50 and for Shots 9 and 10 are compared in Figure 51. As might be expected the two curves are virtually identical in each case.

III.6 Triple Point Trajectories

The triple point is the junction of the primary shock, the reflected shock and the Mach stem. The trajectory of the triple point for each Mach stem over the ground surface or beneath the ideal reflecting surface was measured for the lower charge in each experiment. These data were smoothed by a least squares fit and scaled in the manner previously described. The results are given in Tables 7.

Figure 58 shows the measured triple point data for Shots 8 and 11. The plotted points are every fifth measured point, and the curves are the least squares fits to all the data for each triple point trajectory. An interesting feature of this plot is the large amount of scatter in the observed trajectory of the triple point over the rough ground in Shot 11, compared with the trajectories under the ideal reflecting surfaces and over the smooth ground. Figure 59 shows the fitted triple point trajectories scaled to a 1 lb charge at standard atmospheric pressure. The two trajectories below the ideal reflecting surfaces are almost identical, and the effect of the smooth and rough ground surfaces on the other trajectories is clearly demonstrated.

Figures 60 and 61 attempt to show the same effects for Shots 9 and 10. Unfortunately in these experiments the triple

point could be seen only for a distance of about 10 to 12 ft and there is insufficient data to define a triple point trajectory. However, it may be valid to take a single point from each curve at the midpoint of the data, at a horizontal distance of about 47 ft from ground zero, for comparison with computer predictions.

CHAPTER IV

IV.1 Discussion and Conclusions

As a general check on the reliability of the photogrammetrical technique, the scaled radius-time and pressure-distance curves have been compared, in Figure 62, with the theoretical predications of Brode (1959). The agreement here is very good. Brode's numerical calculations were based on a TNT charge with an energy yield of one kilocalorie. Dewey (1964, 1971) has shown that the appropriate scaling factor from Brode's results to experimental measurements with TNT charges, is 10.0. On the basis of reported energy yields for TNT, factors of 9.6 or 9.8 have been calculated. Considerable past experience has shown that 10.0 is a more appropriate figure and this is confirmed again in the present work.

The conclusions reached as a result of the photogrammetrical analyses reported here, may be summarized as follows.

On the basis of shock front trajectory measurements, all of the lower charges seem to have behaved as predicted. It is unfortunate that no measurements were available to provide an estimate of the yieldsof the upper charges.

On Shots 10 and 11, the ground surface had been roughened by ploughing, and the effects of this on the strength of the Mach stem shock and the triple point trajectories, has been clearly illustrated.

In Shots 8 and 9, over smooth ground, the energy loss in the Mach stem shock front appears to be about 8 to 10%, compared with

the strength of the Mach stem at the ideal reflecting surface. In Shots 10 and 11, over rough ground, this energy loss appears to be about 40 to 42%.

It must be stressed that these energy loss calculations are based on shock front trajectories only, and it is not suggested that this amount of energy had been transferred to the ground surface. The majority of the energy not appearing at the shock front has probably moved back into the blast wave and would appear in the form of an extended pressure and kinetic energy blast wave profile. The validity of this assumption is illustrated by the pressure impulse results given in the preliminary report. The pressure impulse measured by a gauge in the Mach stem close to the ground, compared with the impulse measured by a gauge in the Mach stem below the ideal reflecting surface, for each experiment is as follows:

Shot 8, 211:181 psi-ms;

Shot 9, 278:244 psi-ms;

Shot 10, 285:244 psi-ms; and

Shot 11, 224:202 psi-ms.

In each experiment the pressure impulse close to the ground was larger than that close to the ideal reflecting surface, although in every case the peak pressure close to the ground was less than that close to the ideal reflecting surface, as follows:

Shot 8, 31:37 psi;

Shot 9, 79:93 psi;

Shot 10, 67:80 psi;

Shot 11, 30:38 psi.

In order to account for all of the energy within the blast wave it is necessary to know, independently, the pressure, density, and particle velocity histories throughout the wave. The pressure histories are available from gauge measurements, and it is hoped that it will be possible to obtain the density and particle velocity histories from the analyses of the particle trajectories.

Acknowledgements

The authors gratefully acknowledge the opportunity offered by the Defence Research Establishment Suffield and the Defence Nuclear Agency to participate in the experiments described in this report. The analyses described here were carried out under contract with the Canadian General Electric Company, and with additional financial support from research grants by the Defence Research Board (1601-26) and the National Research Council (A 2952). The advice and assistance of Mr. A. P. Lambert, C.G.E. Project Officer at DRES, and Mr. J. Keefer, of the Ballistic Research Laboratory, is also gratefully acknowledged.

References

Brode, H.L. 1959 Phys. Fluids 2, 217.

Dewey, J.M. 1964 Proc. Roy. Soc. Lond. A279, 366-385.

1971 Proc. Roy. Soc. Lond. A324, 275-299.

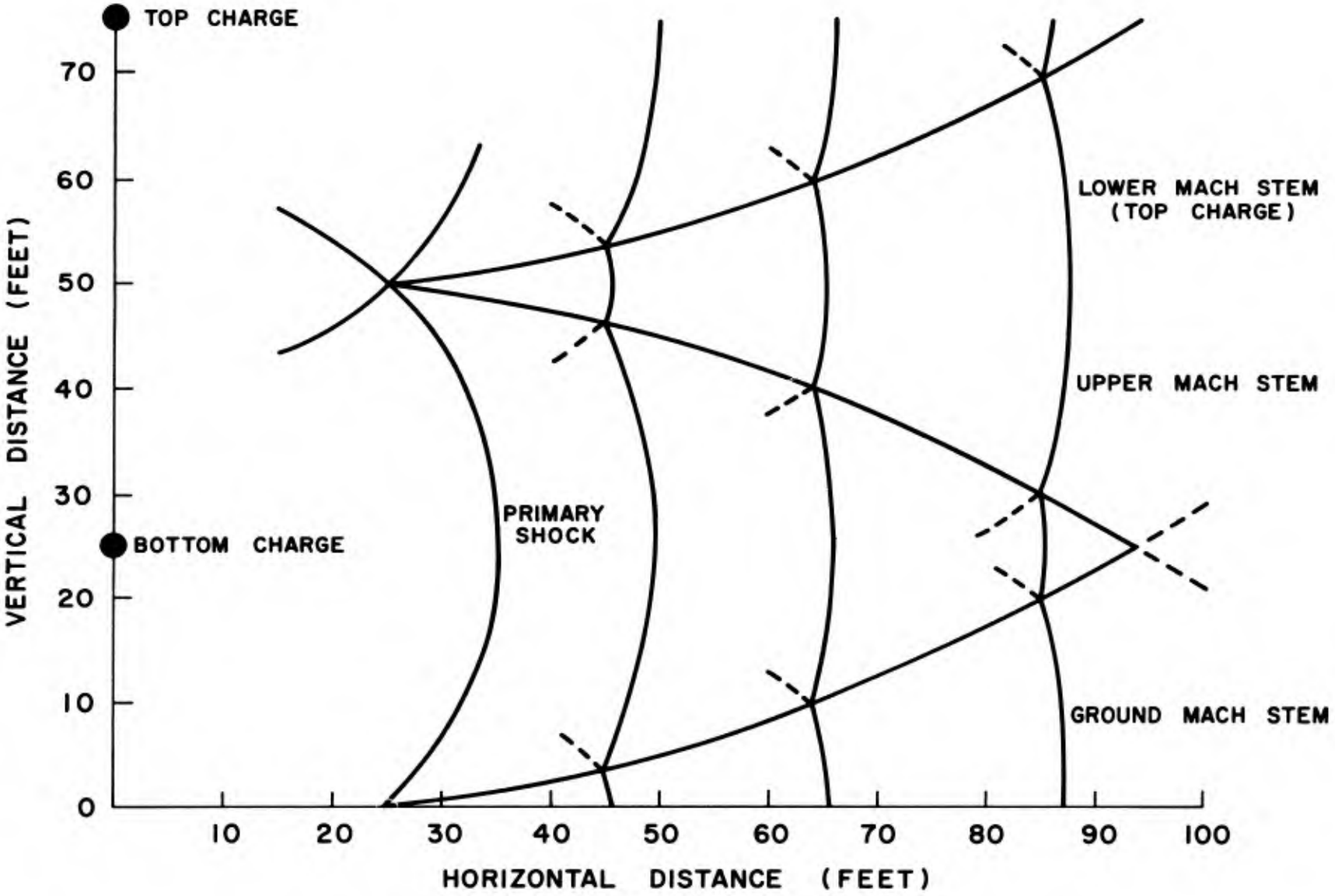


Figure 1a. Predicted shocks and triple point loci—50-ft separation.

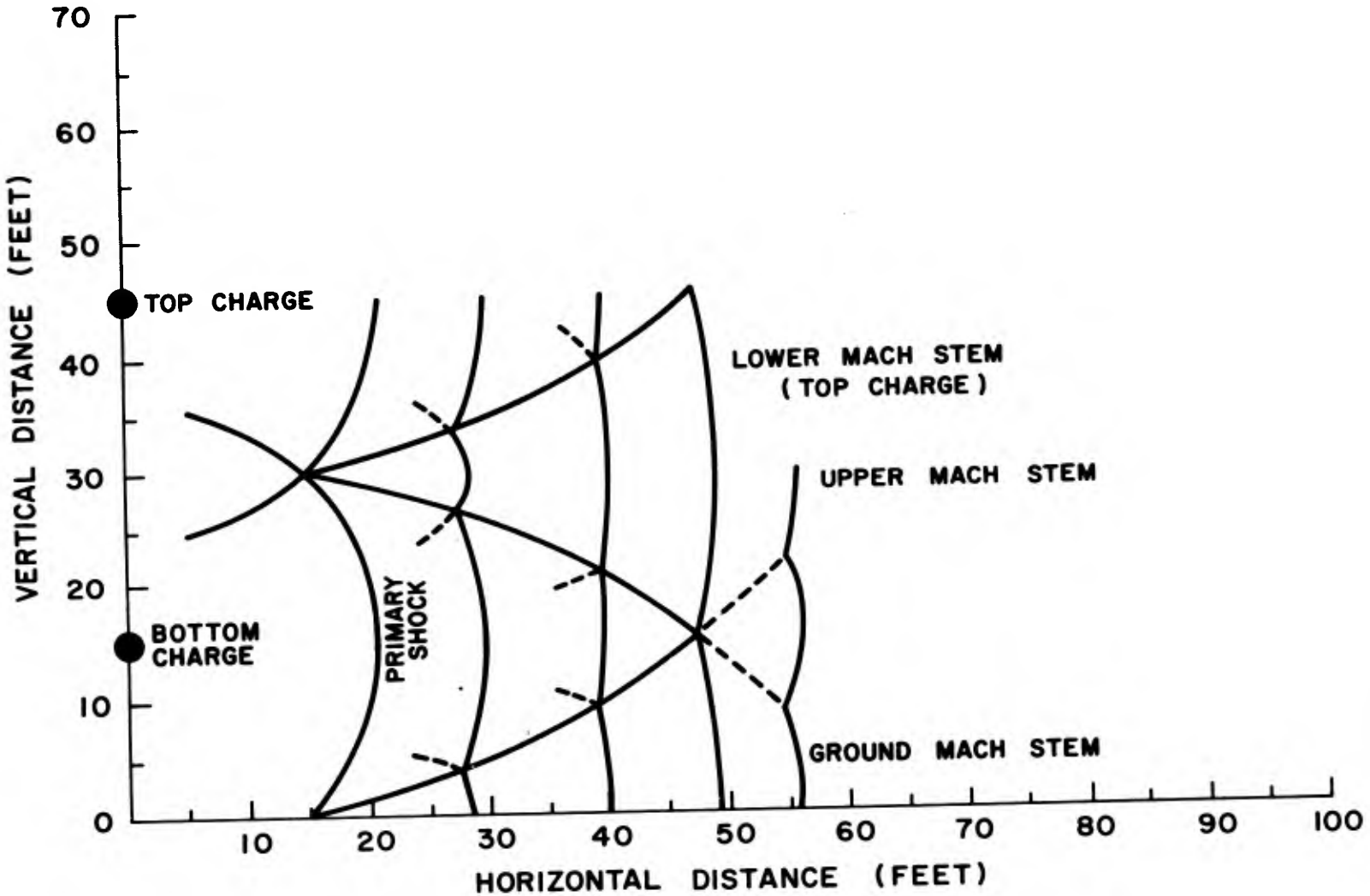


Figure 1b. Predicted shocks and triple point loci—30-ft separation.

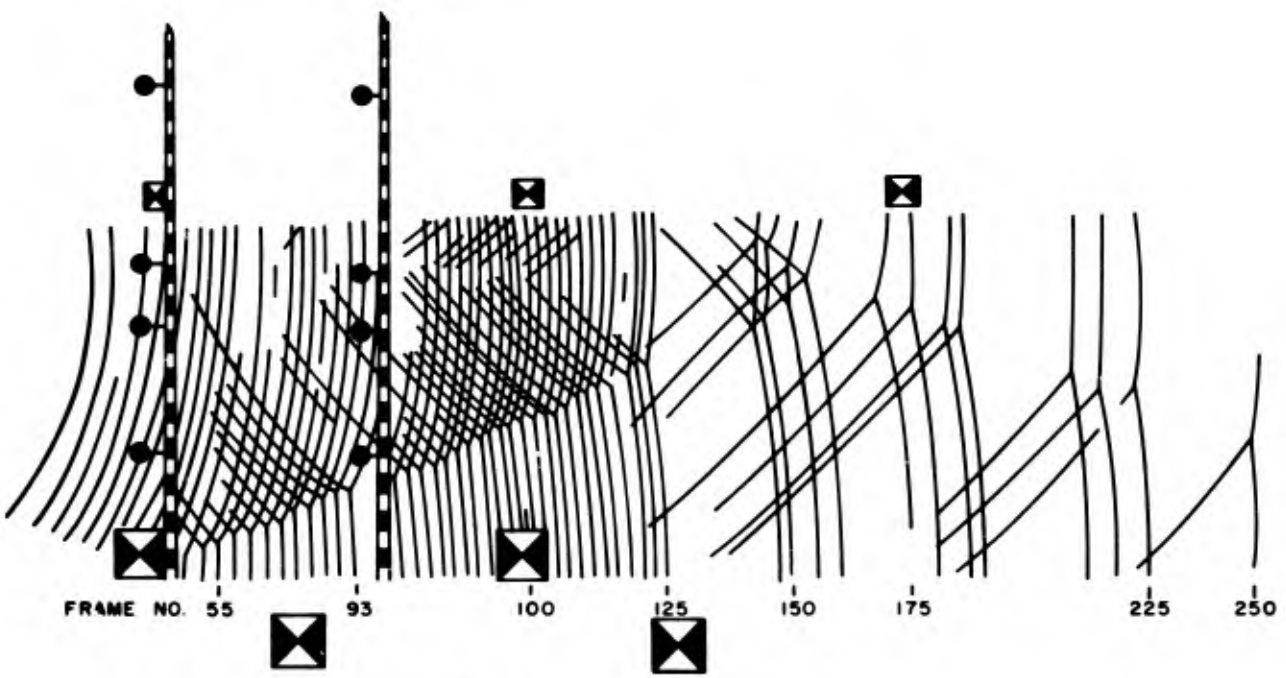


Figure 1c. Tracing of the shock fronts—Shot 8, 3-ft camera.

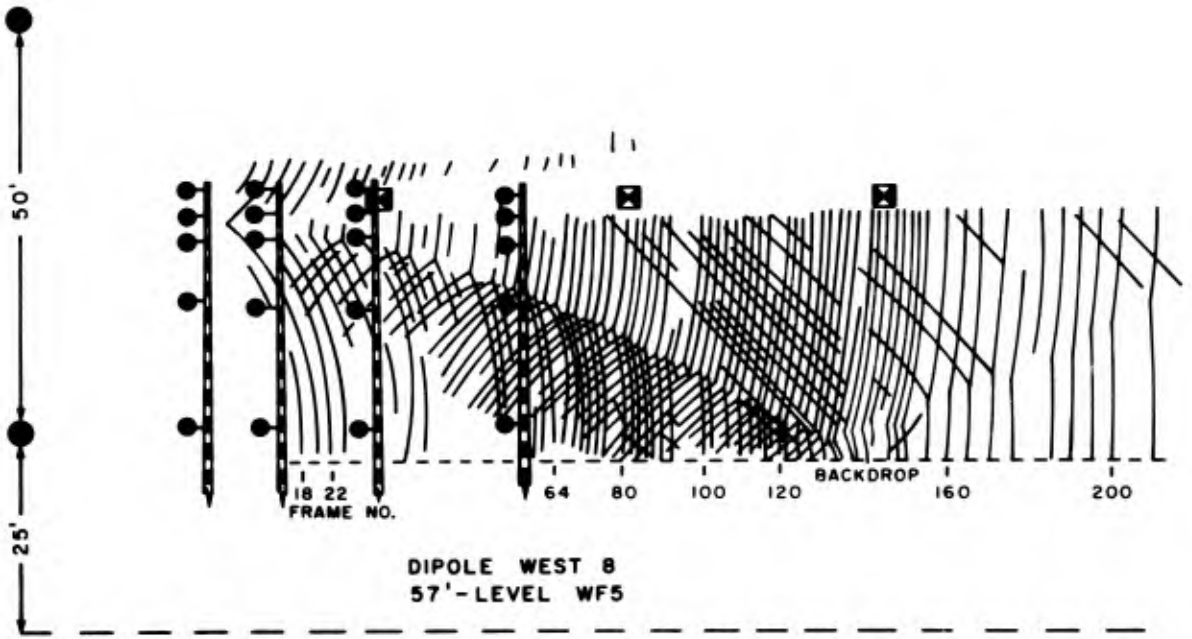


Figure 1d. Tracing of the shock fronts—Shot 8, 57-ft camera.

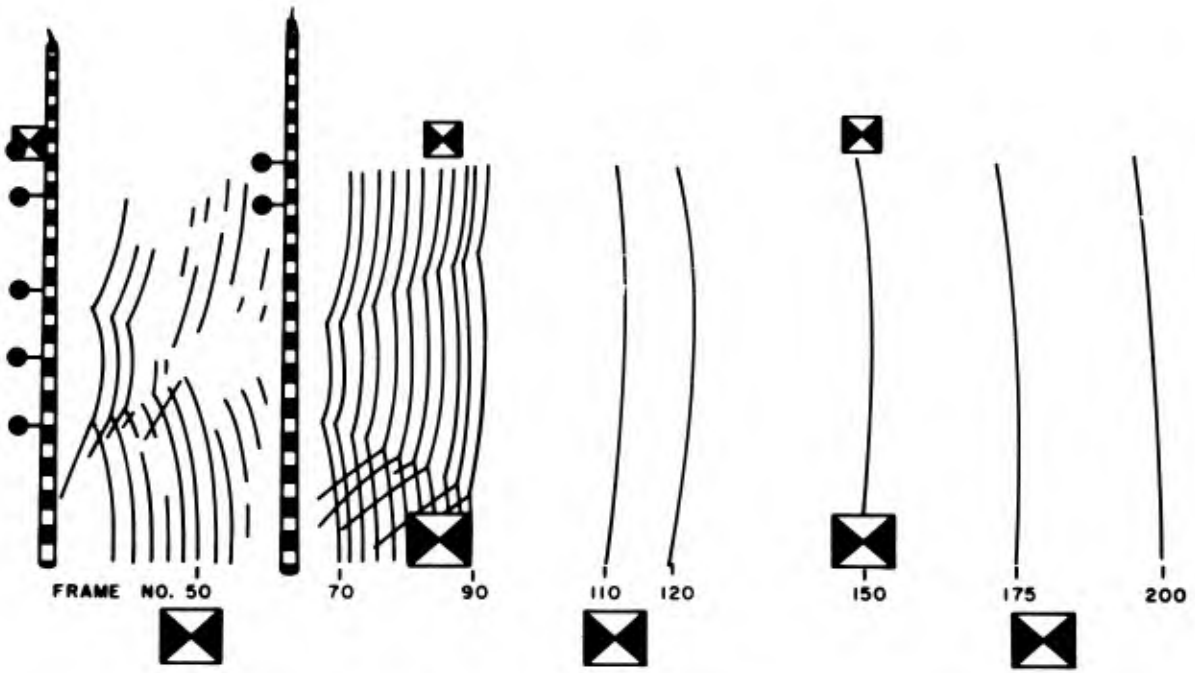


Figure 1e. Tracing of the shock fronts—Shot 9, 3-ft camera.

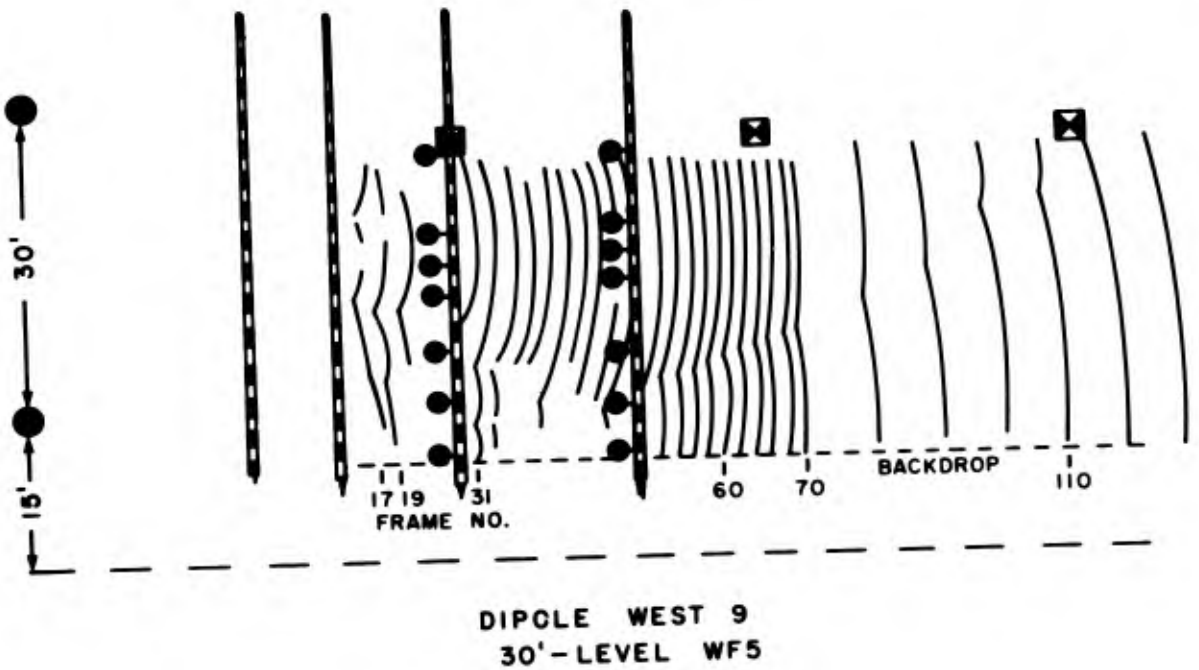


Figure 1f. Tracing of the shock fronts—Shot 9, 30-ft camera.

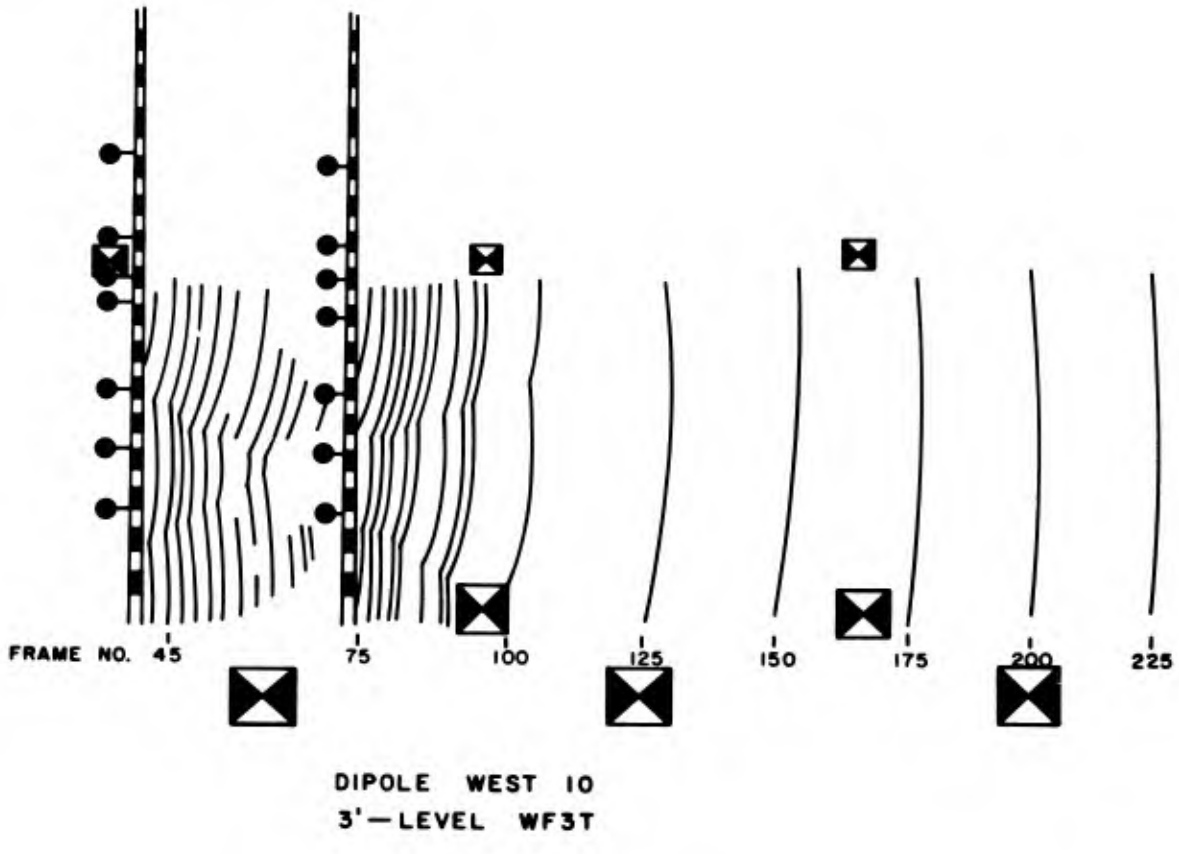


Figure 1g. Tracing of the shock fronts—Shot 10, 3-ft camera.

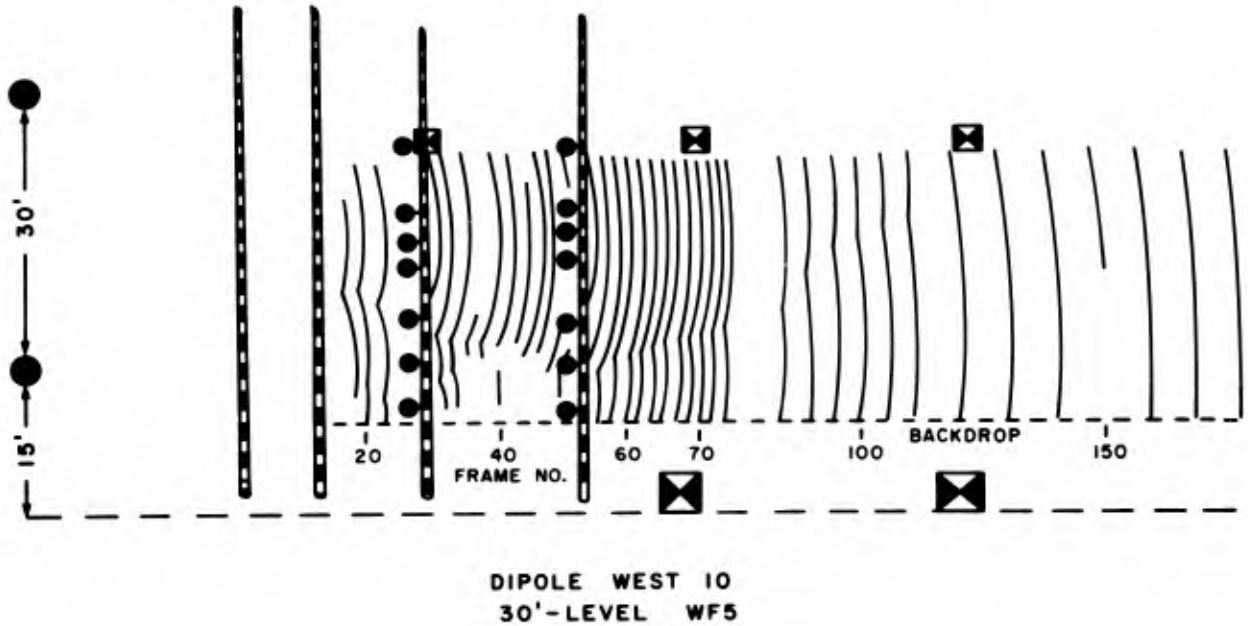


Figure 1h. Tracing of the shock fronts—Shot 10, 30-ft camera.

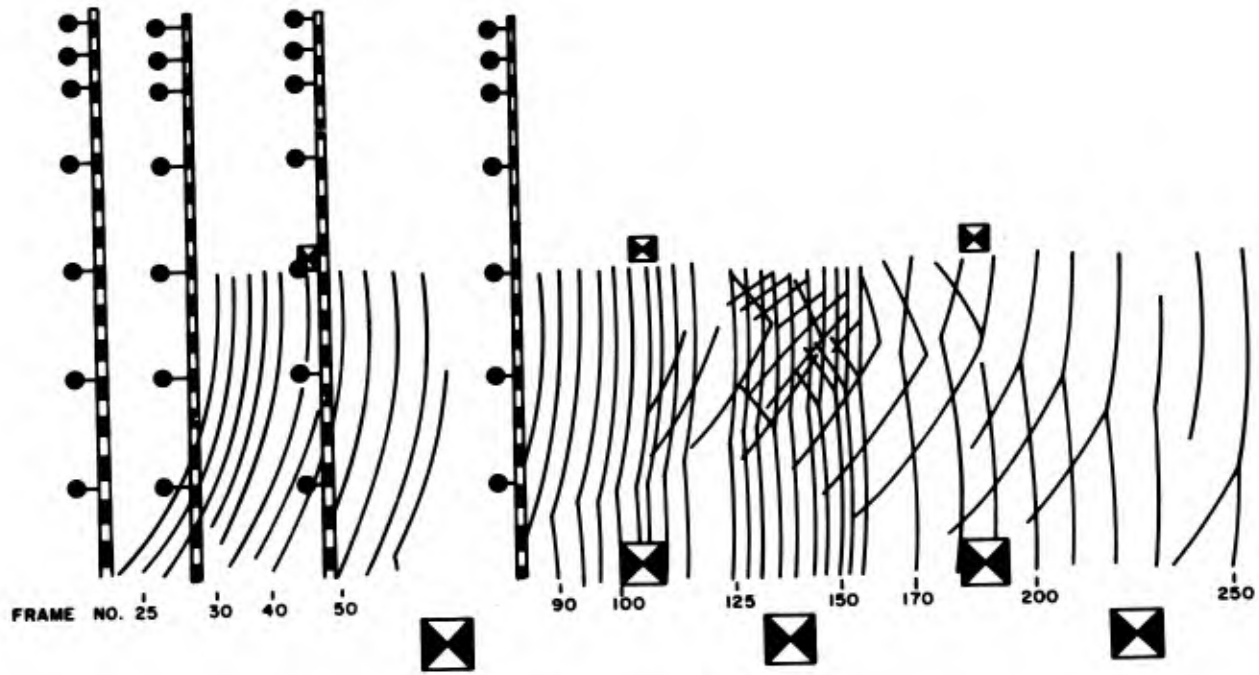


Figure 1i. Tracing of the shock fronts—Shot 11, 3-ft camera.

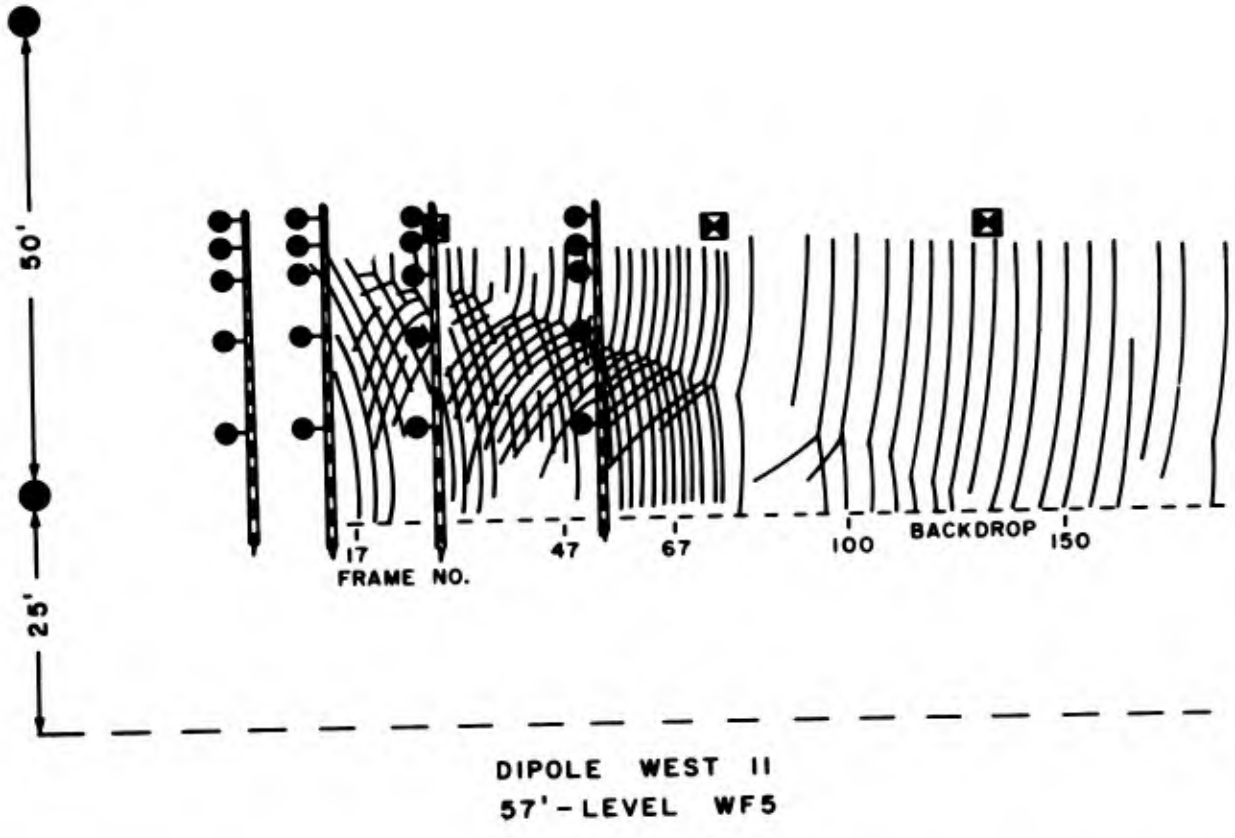


Figure 1j. Tracing of the shock fronts—Shot 11, 57-ft camera.

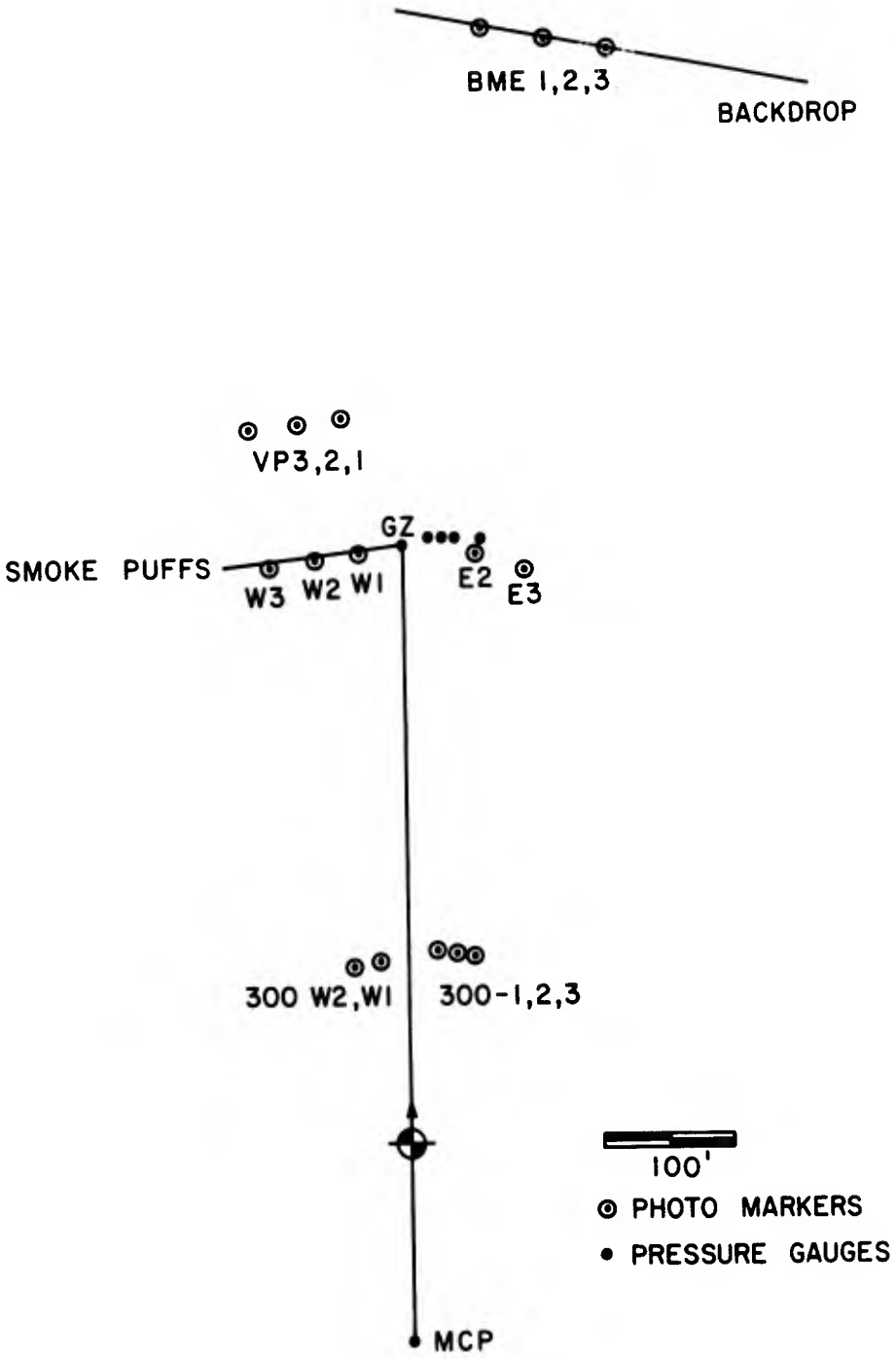


Figure 2. Dipole West test site layout.

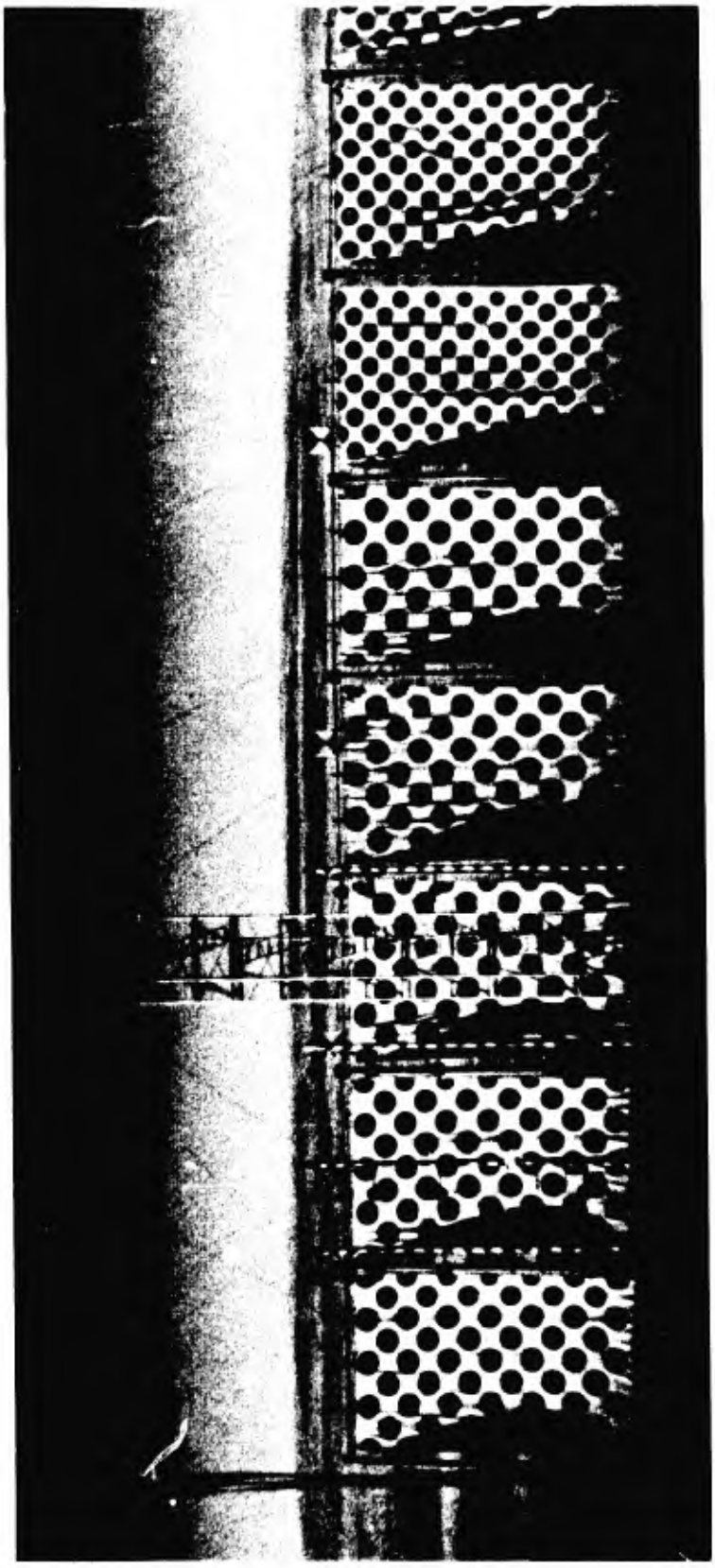


Figure 3. Field of view of camera at 57-ft elevation—Shot 8.

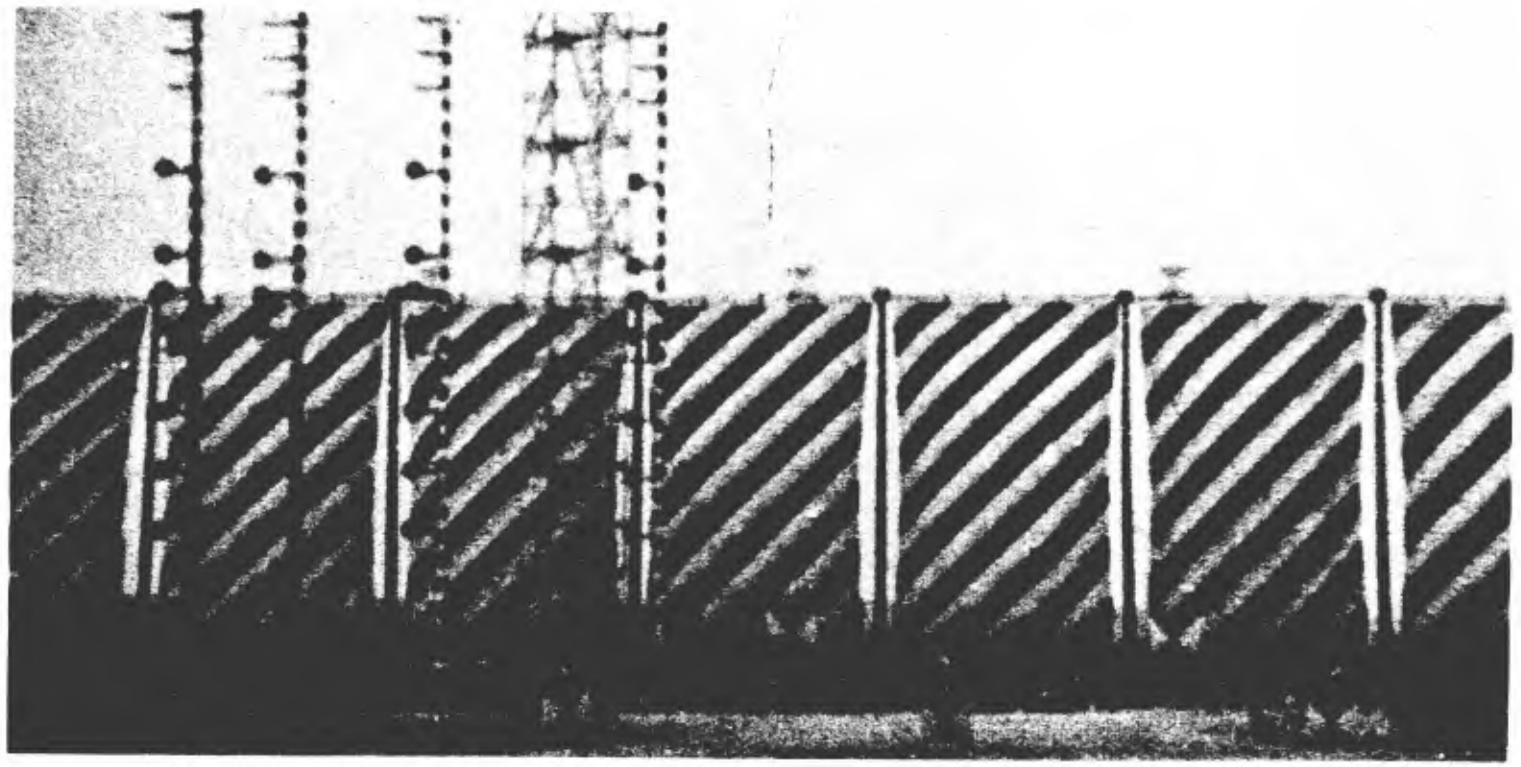


Figure 4. Field of view of camera at ground level—Shot 10.

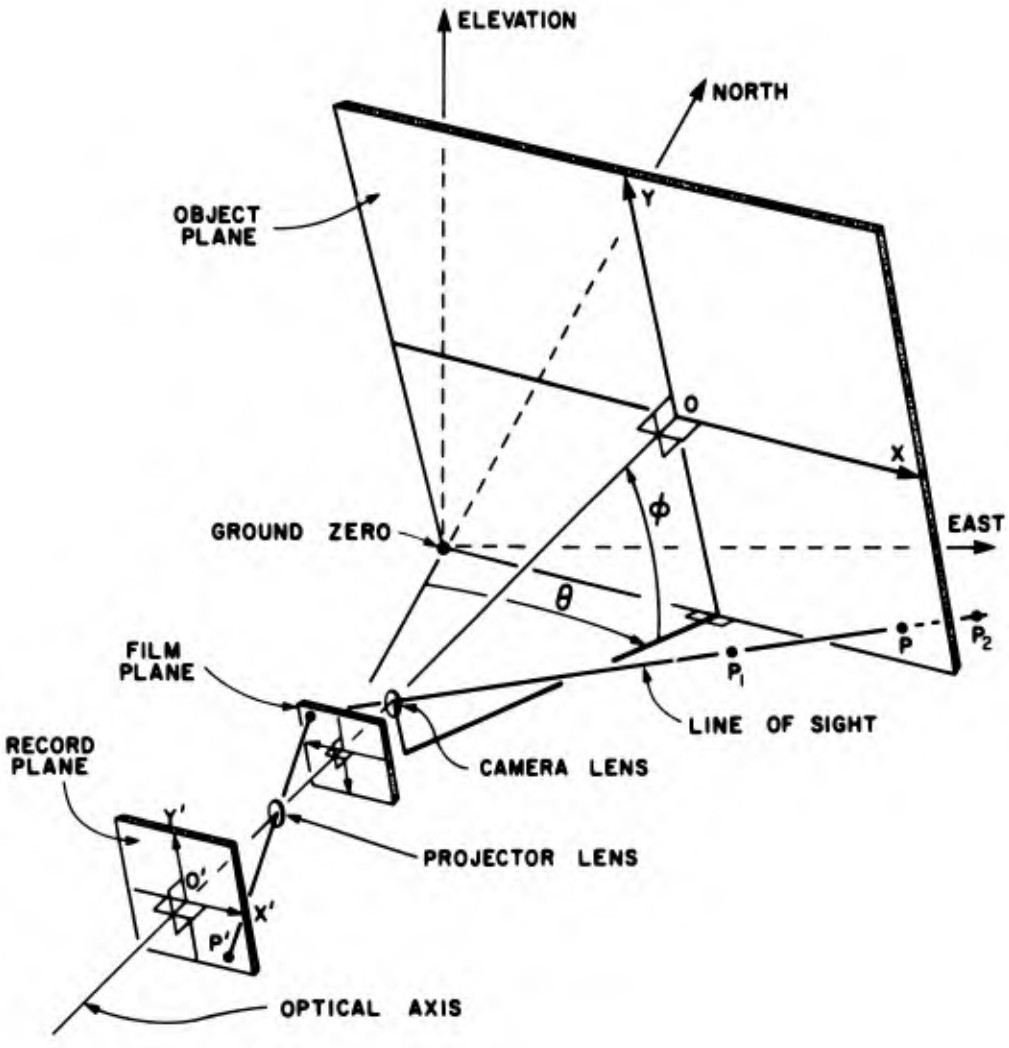


Figure 5. Optical transformation for object plane to record plane.

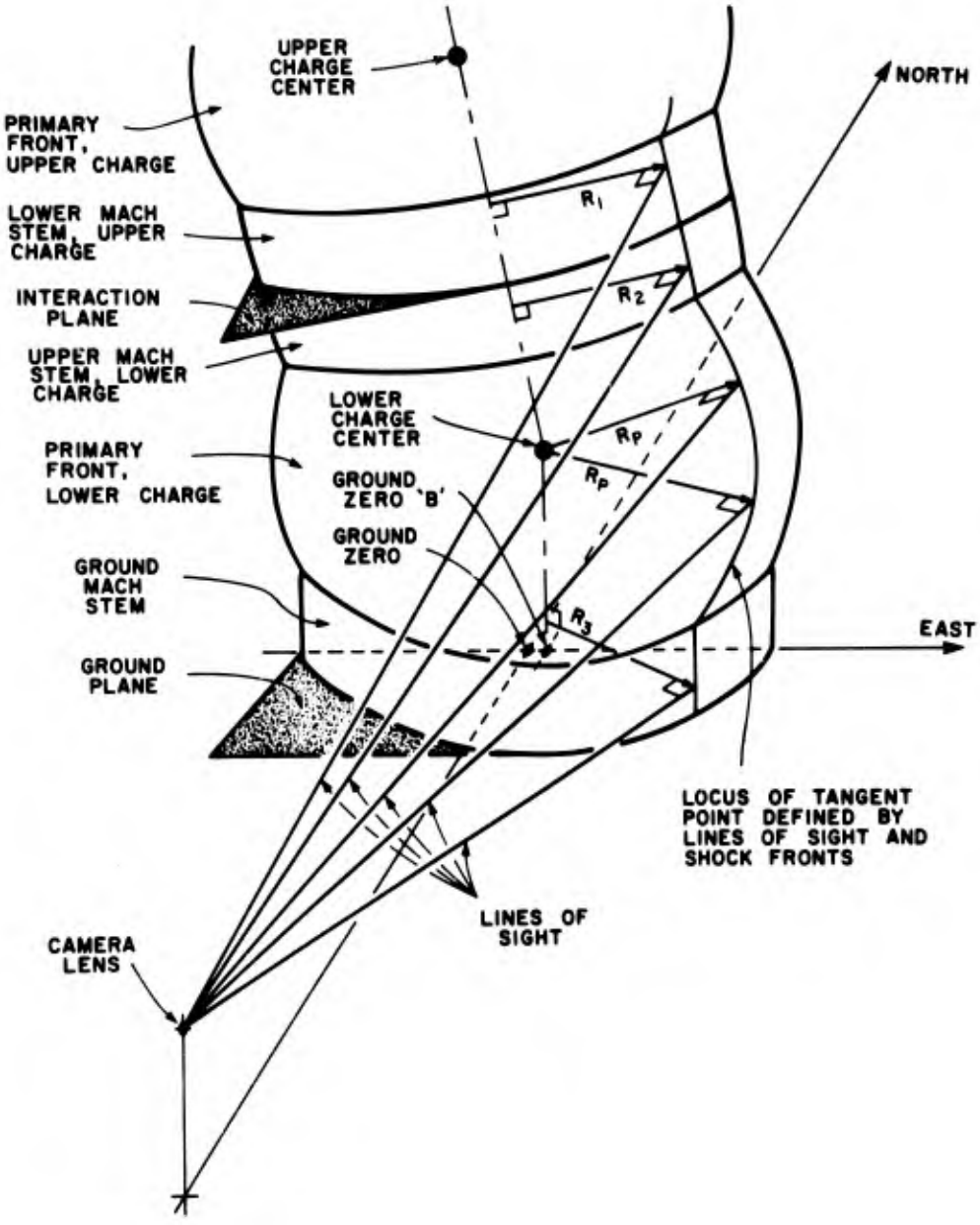


Figure 6. Geometry for calculating mach stem and primary shock radii.

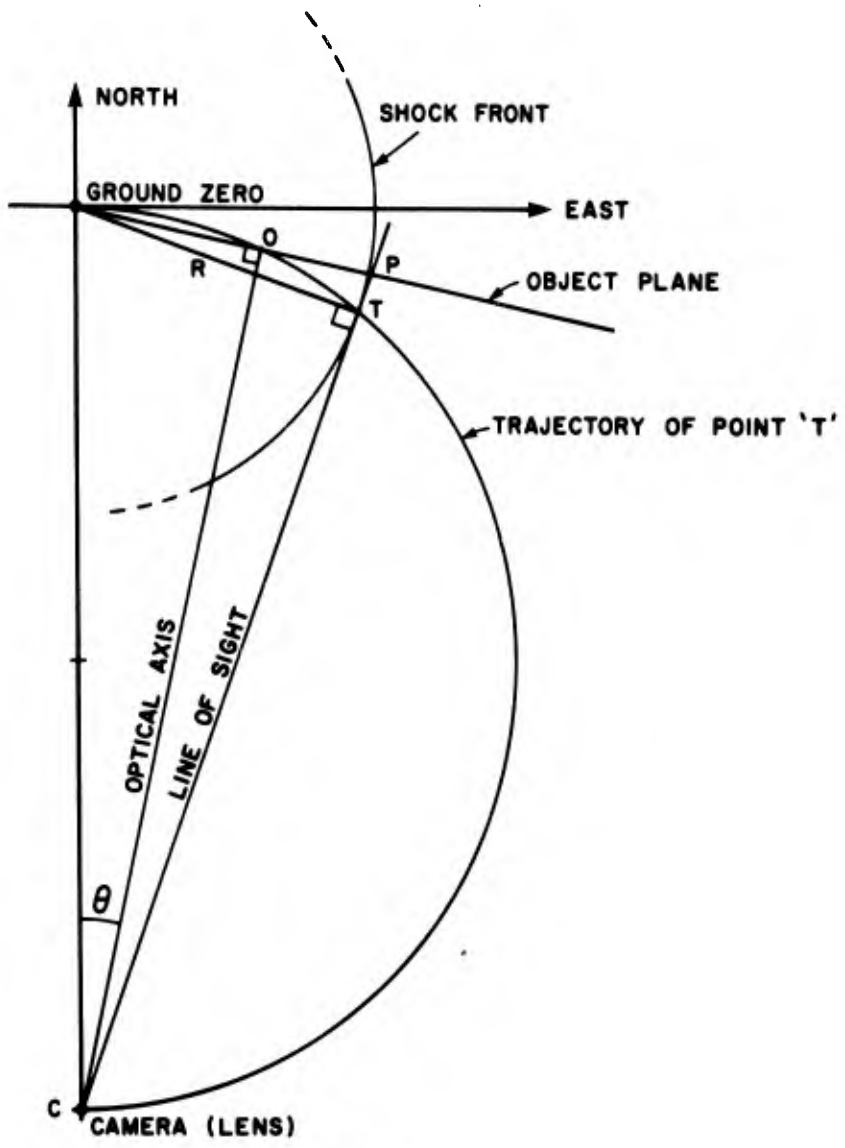


Figure 7. Plan of tangent point trajectory for a mach stem at the ground surface.

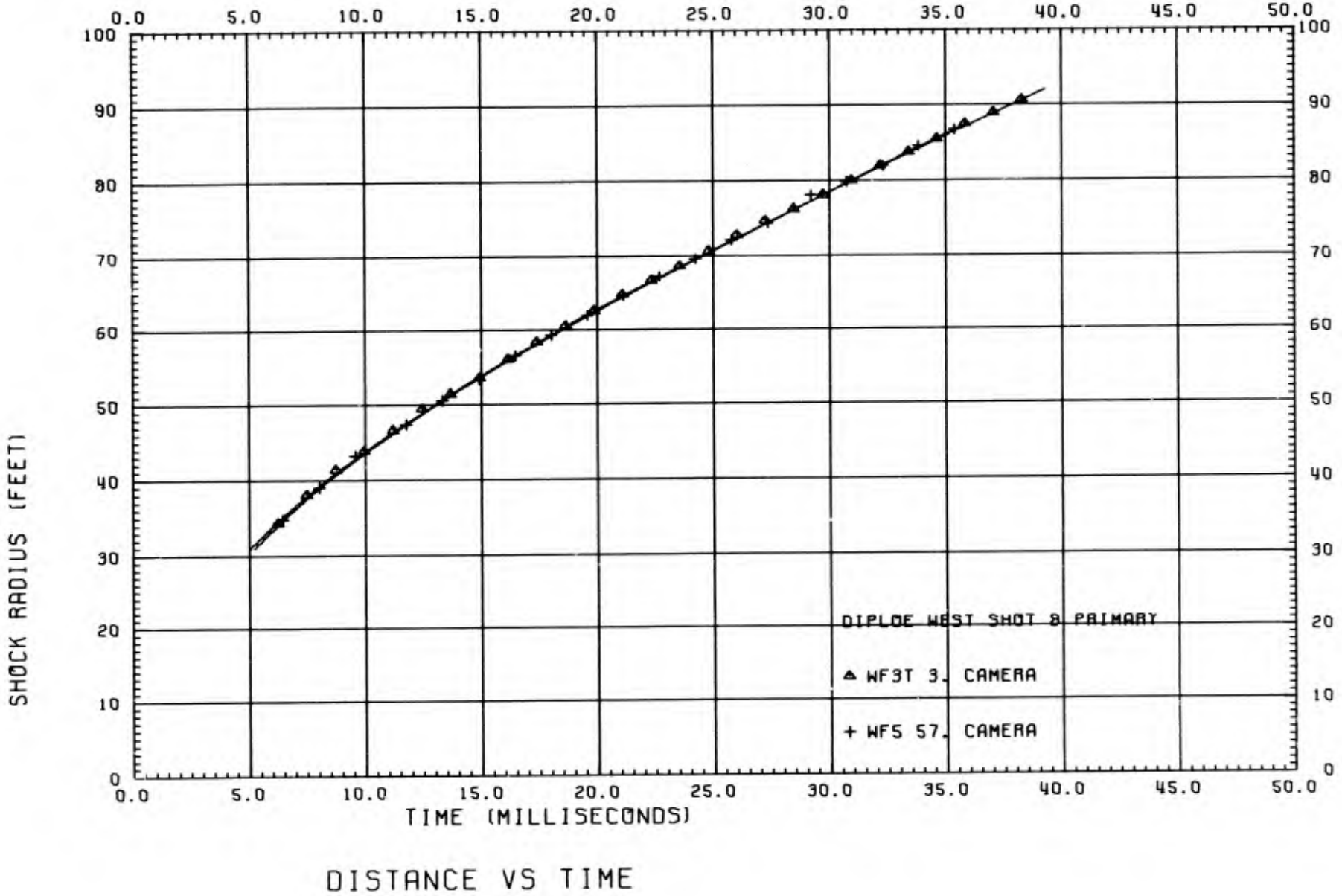


Figure 8. Primary shock radius versus time—Shot 8.

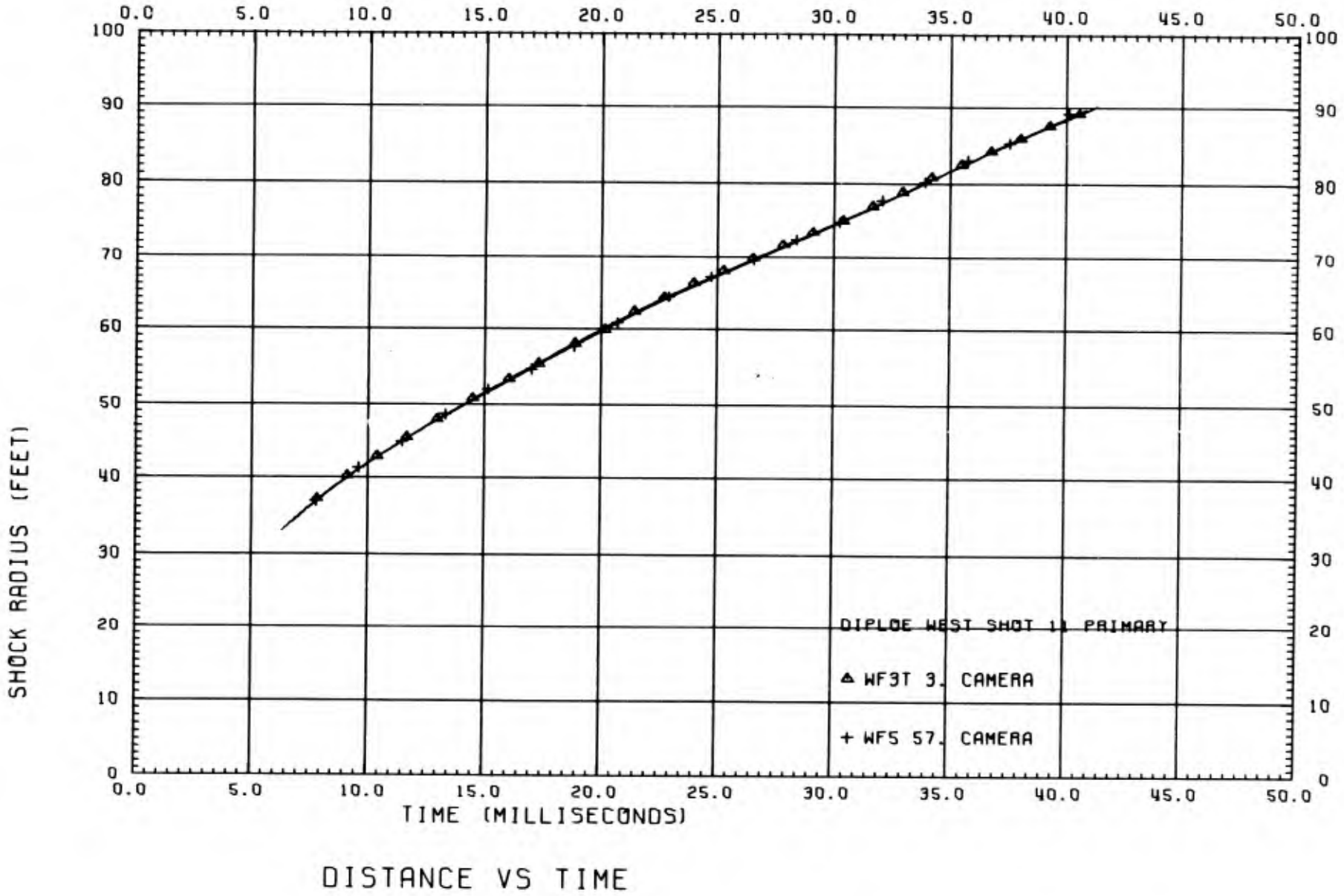


Figure 9. Primary shock radius versus time—Shot 11.

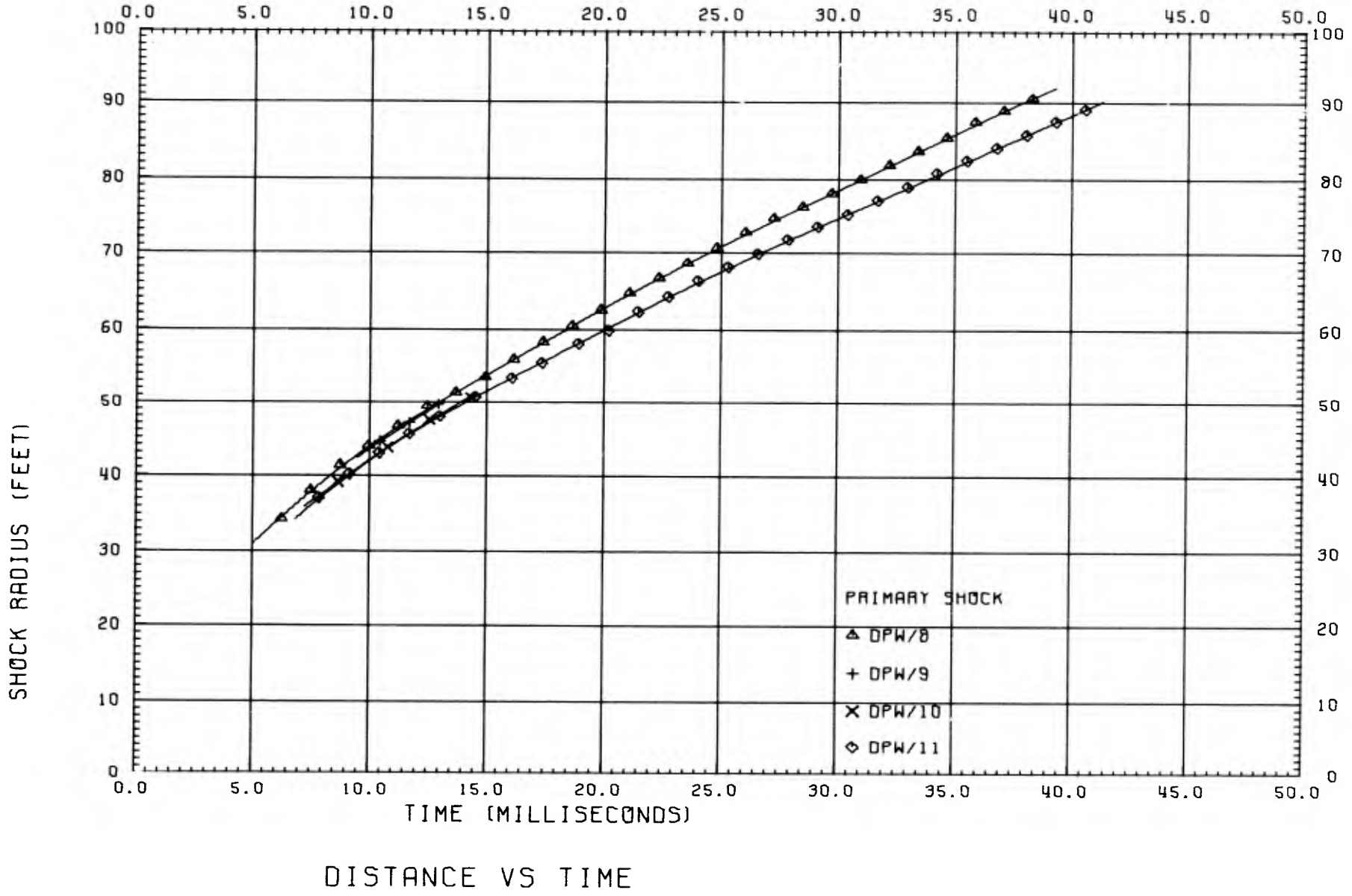


Figure 10. Primary shock radius versus time—Shots 8, 9, 10 and 11.

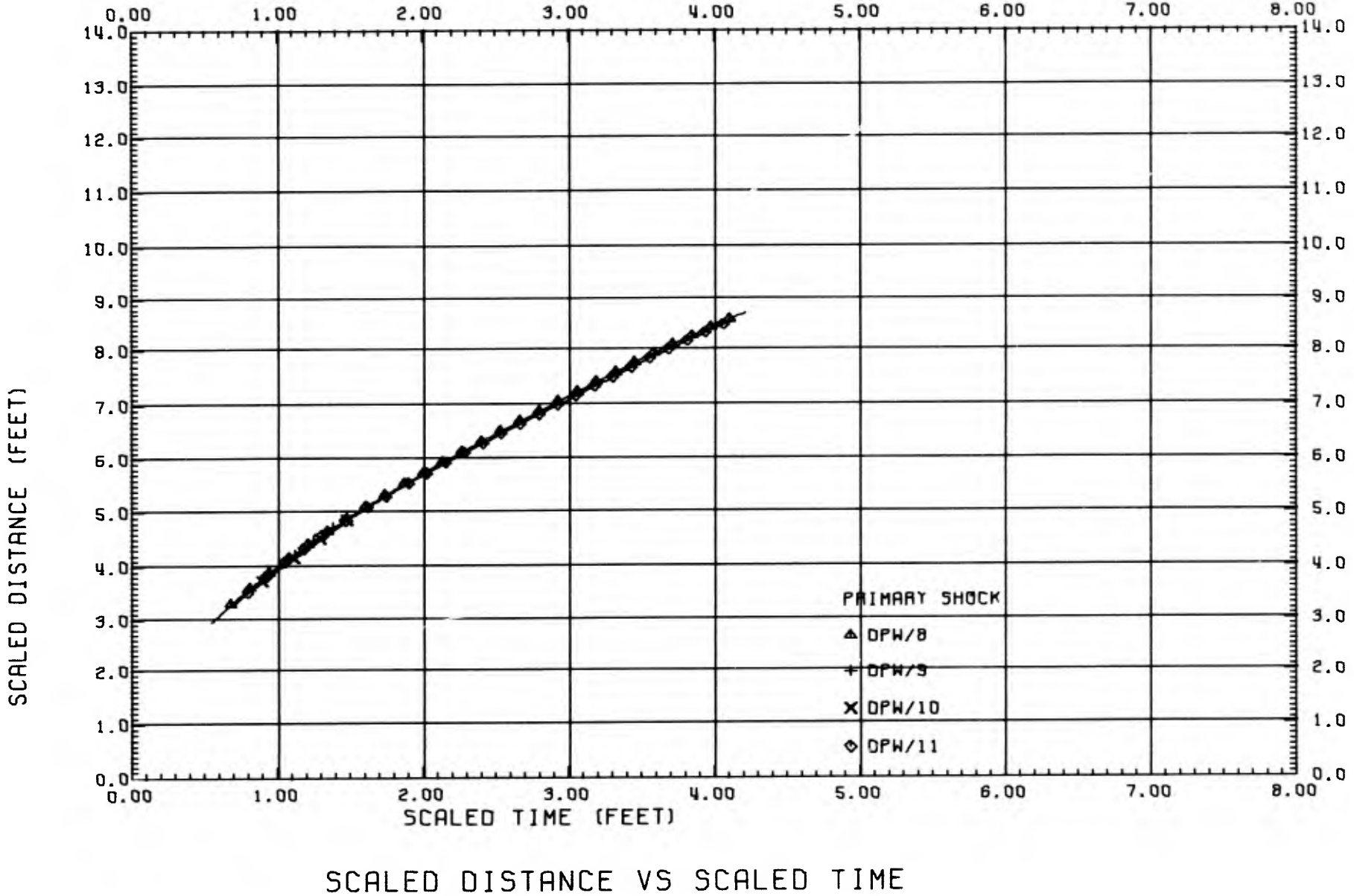


Figure 11. Primary shock scaled radius versus scaled time—Shots 8, 9, 10 and 11.

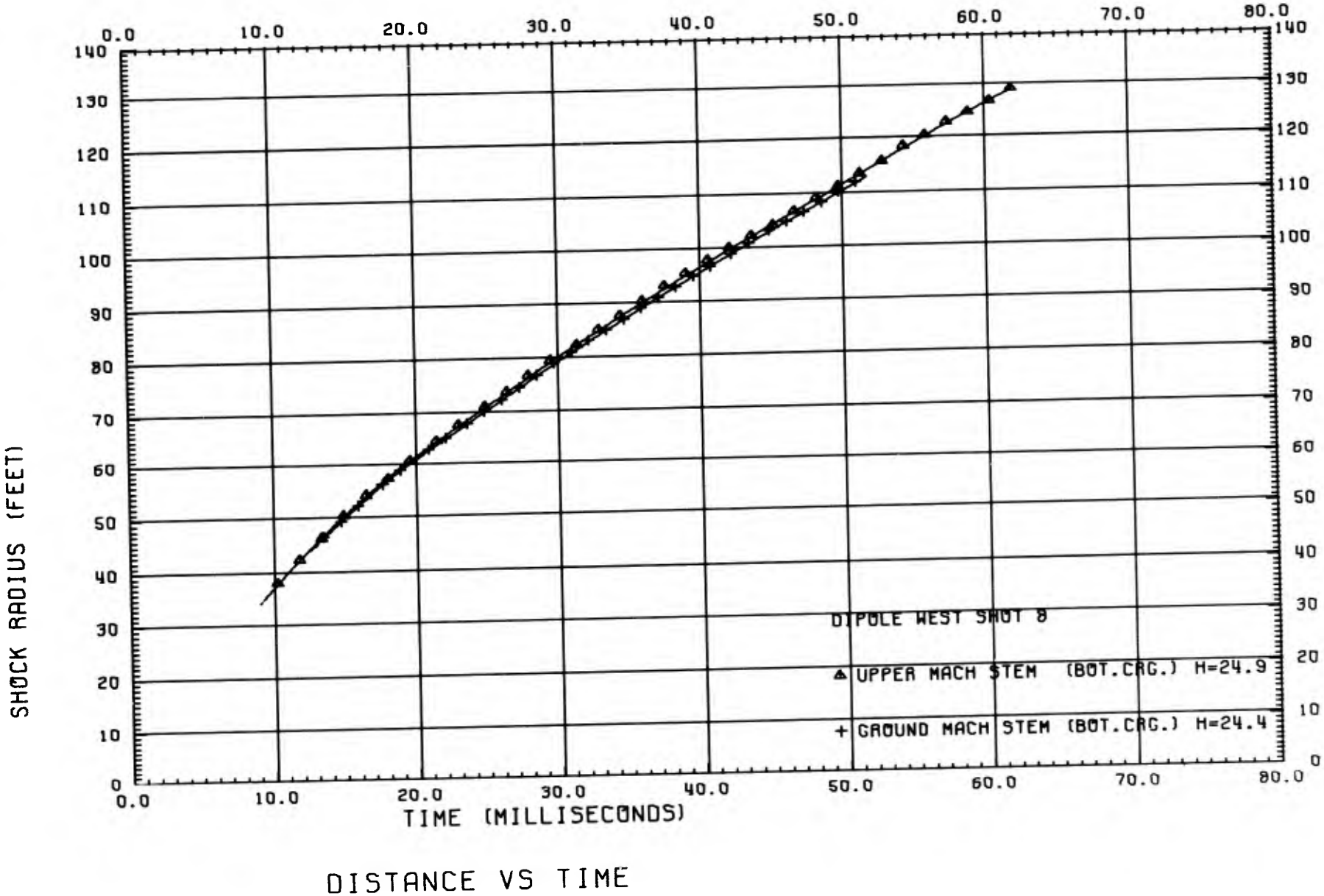


Figure 12. Upper and ground mach stem radius versus time—Shot 8.

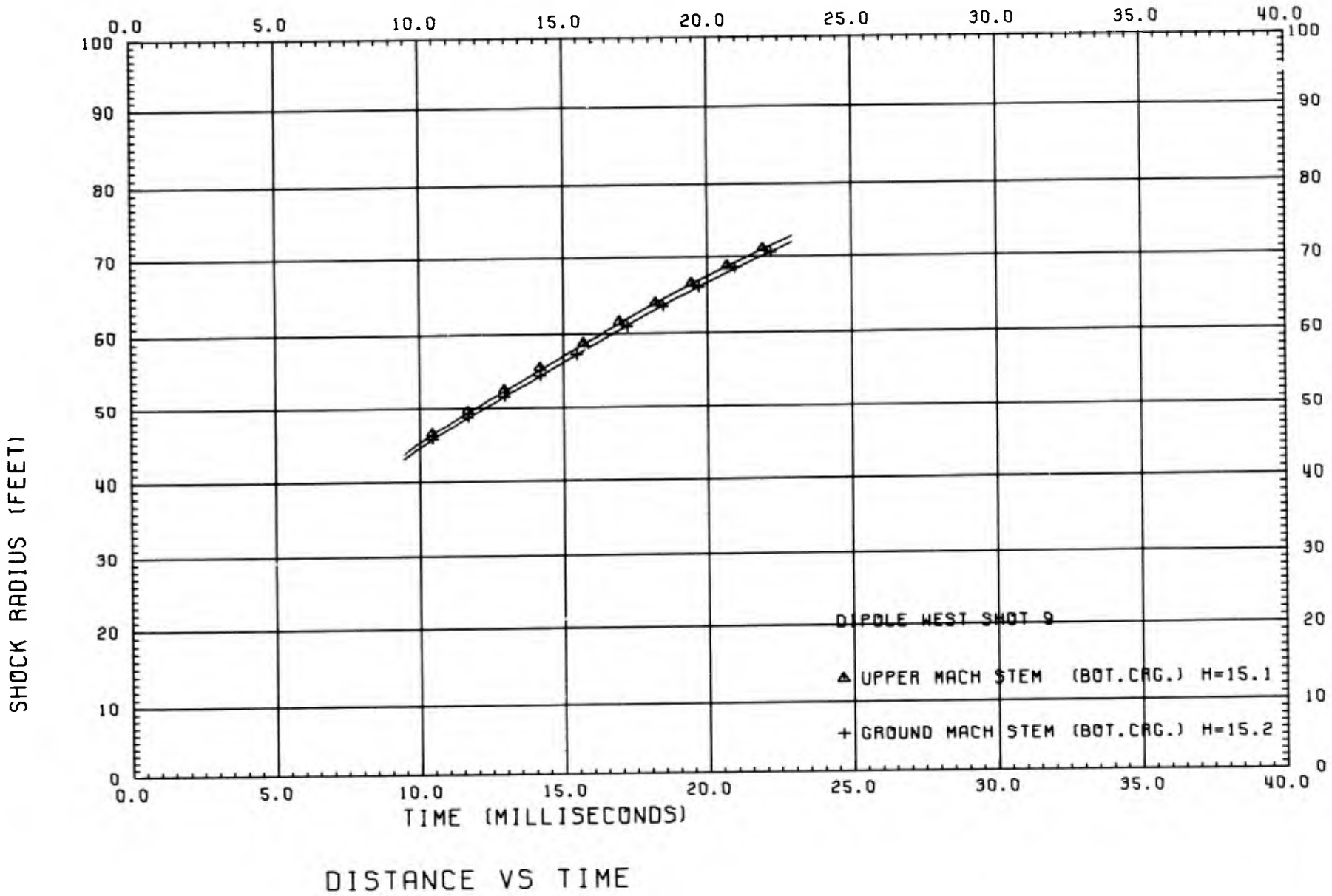


Figure 13. Upper and ground mach stem radius versus time—Shot 9.

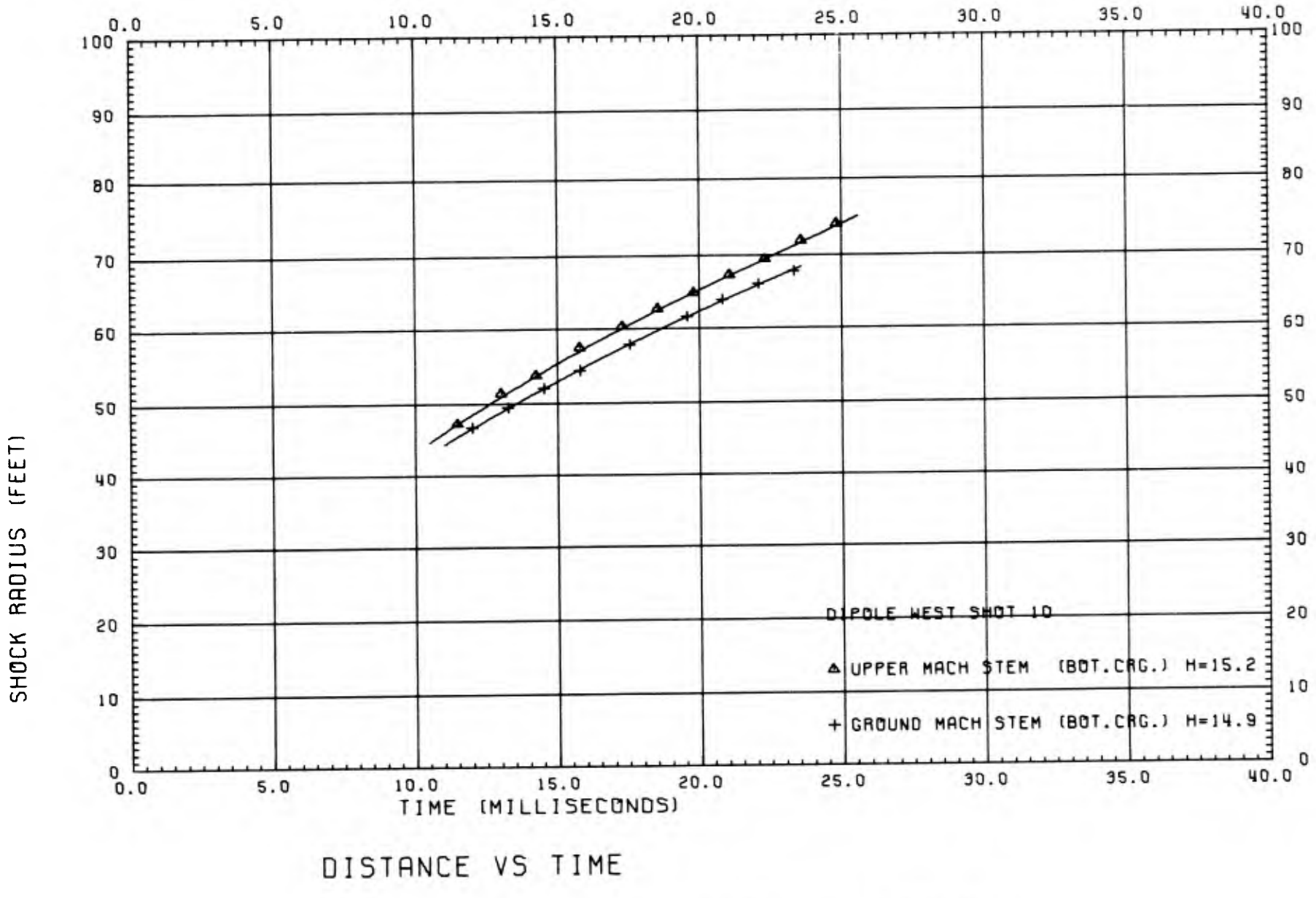


Figure 14. Upper and ground mach stem radius versus time—Shot 10.

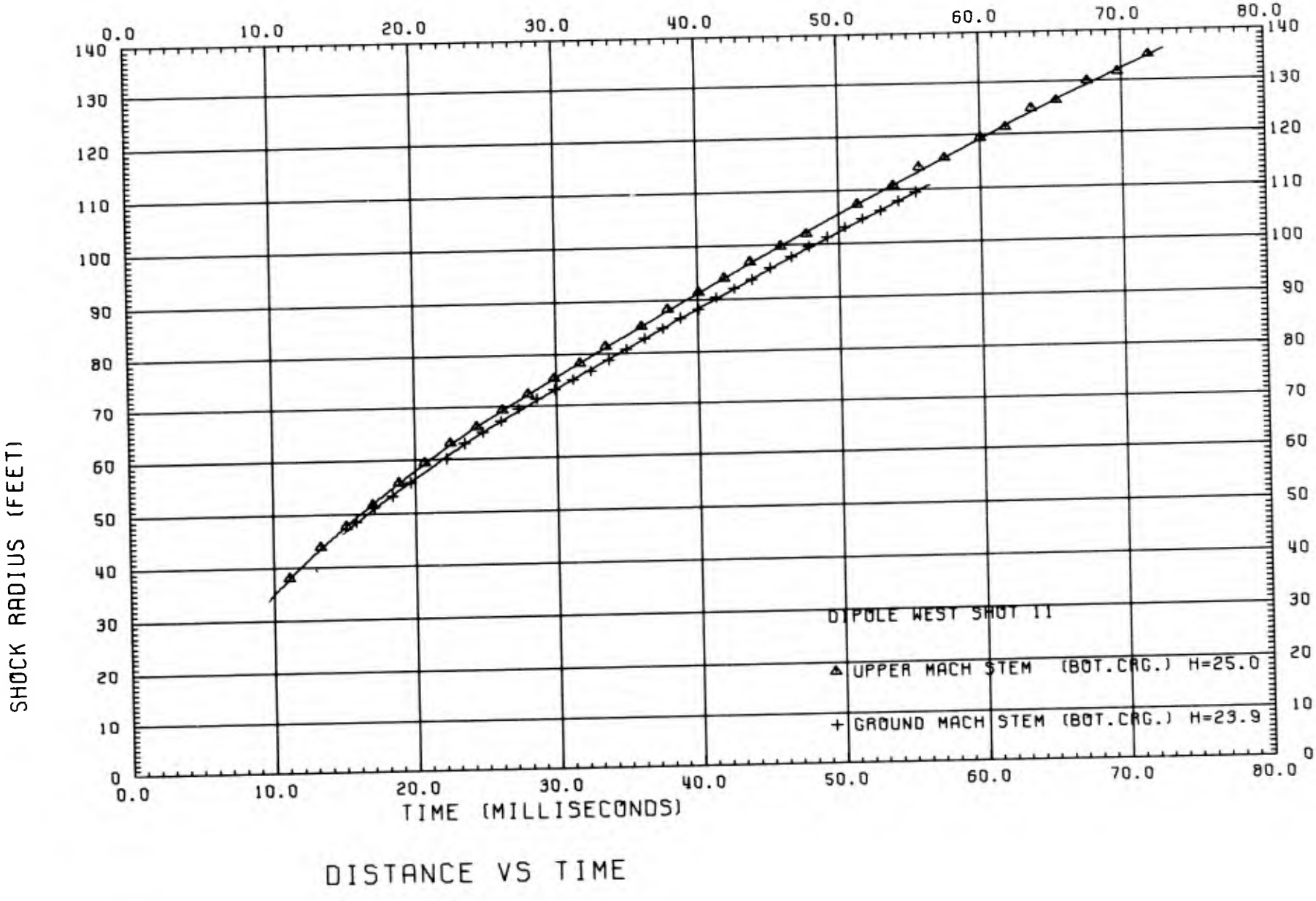


Figure 15. Upper and ground mach stem radius versus time—Shot 11.

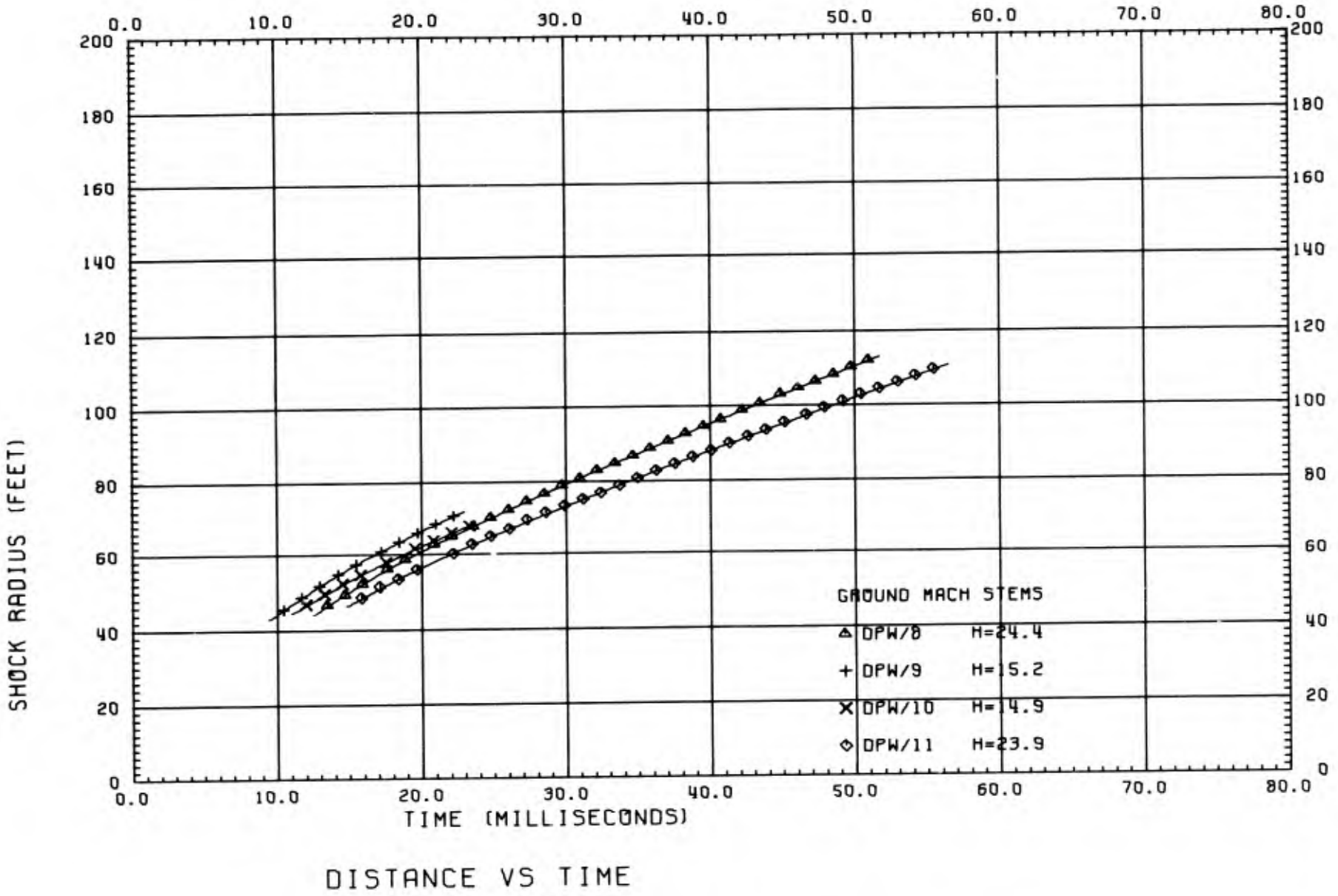


Figure 16. Ground mach stem radius versus time—Shots 8, 9, 10 and 11.

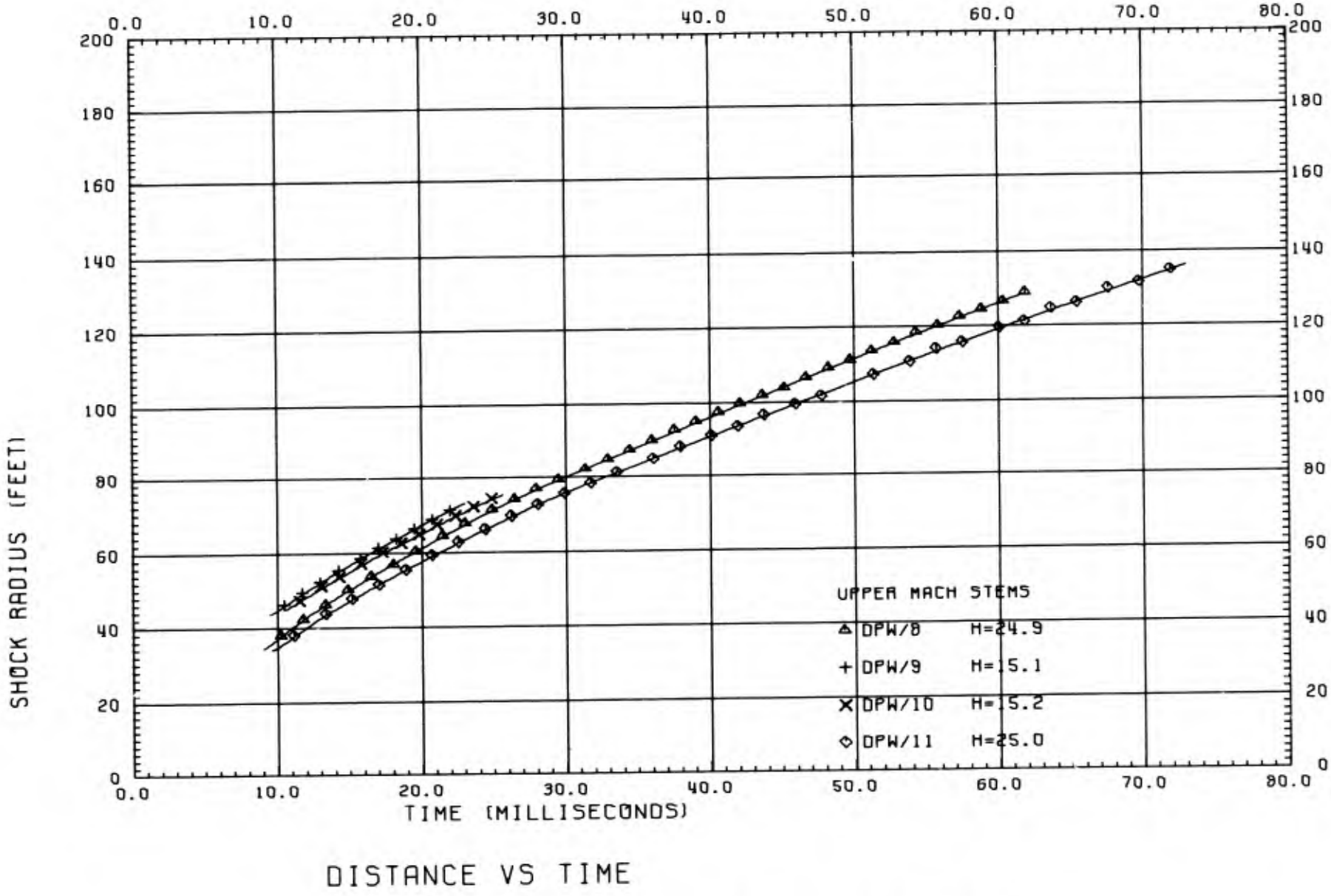


Figure 17. Upper mach stem radius versus time—Shots 8, 9, 10 and 11.

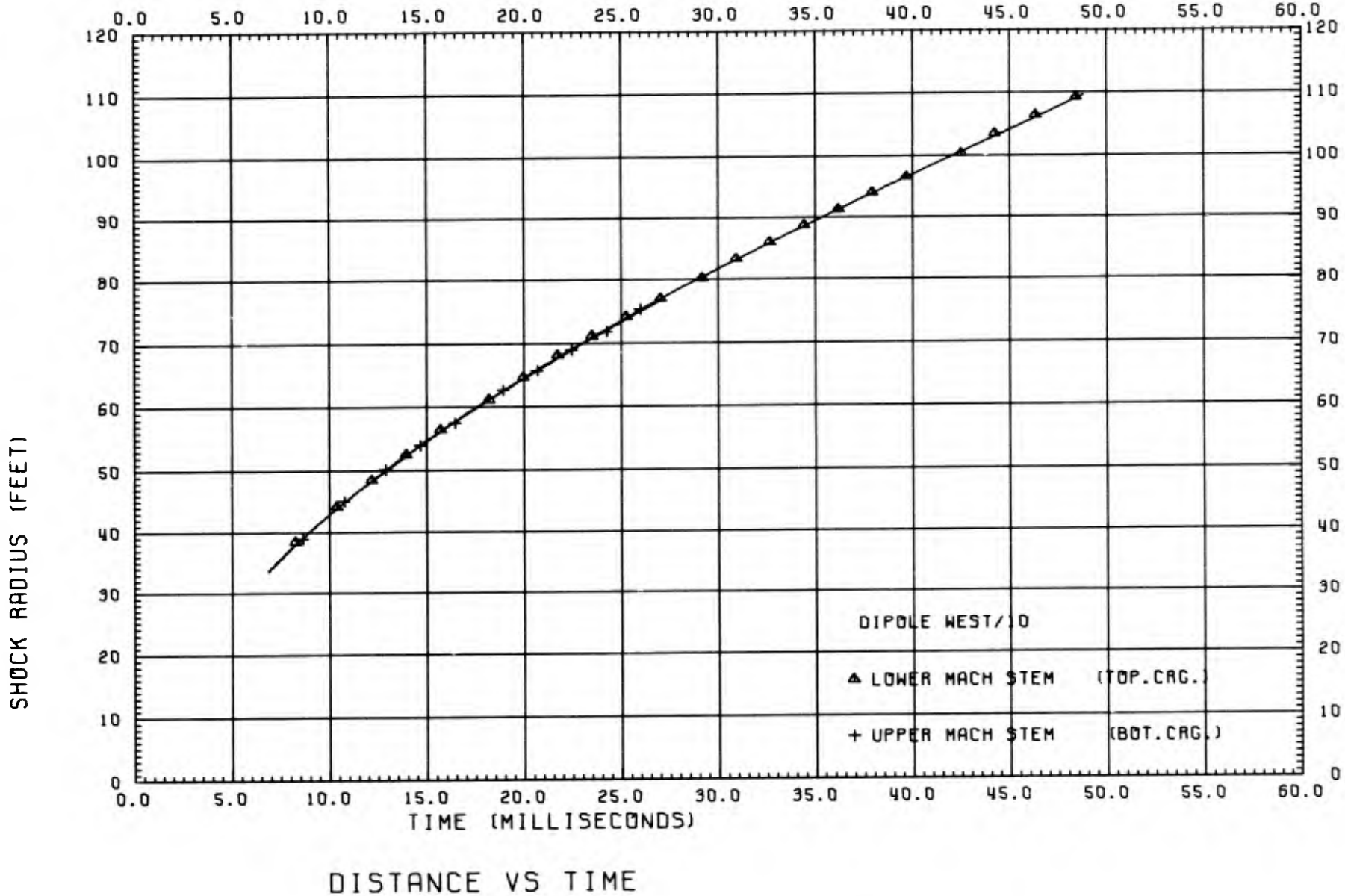


Figure 18. Mach stem radius above and below the idel reflection plane versus time—Shot 10.

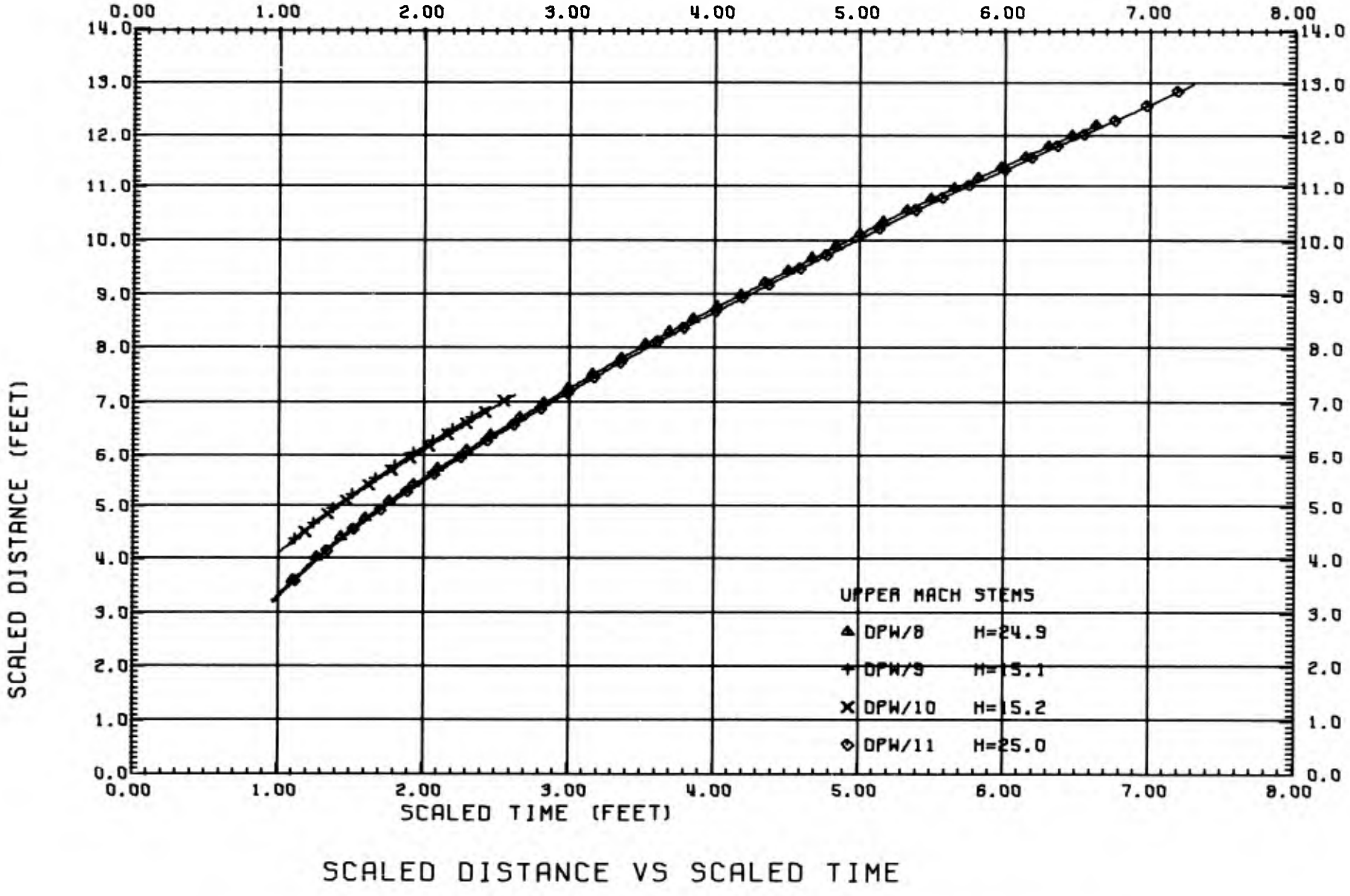
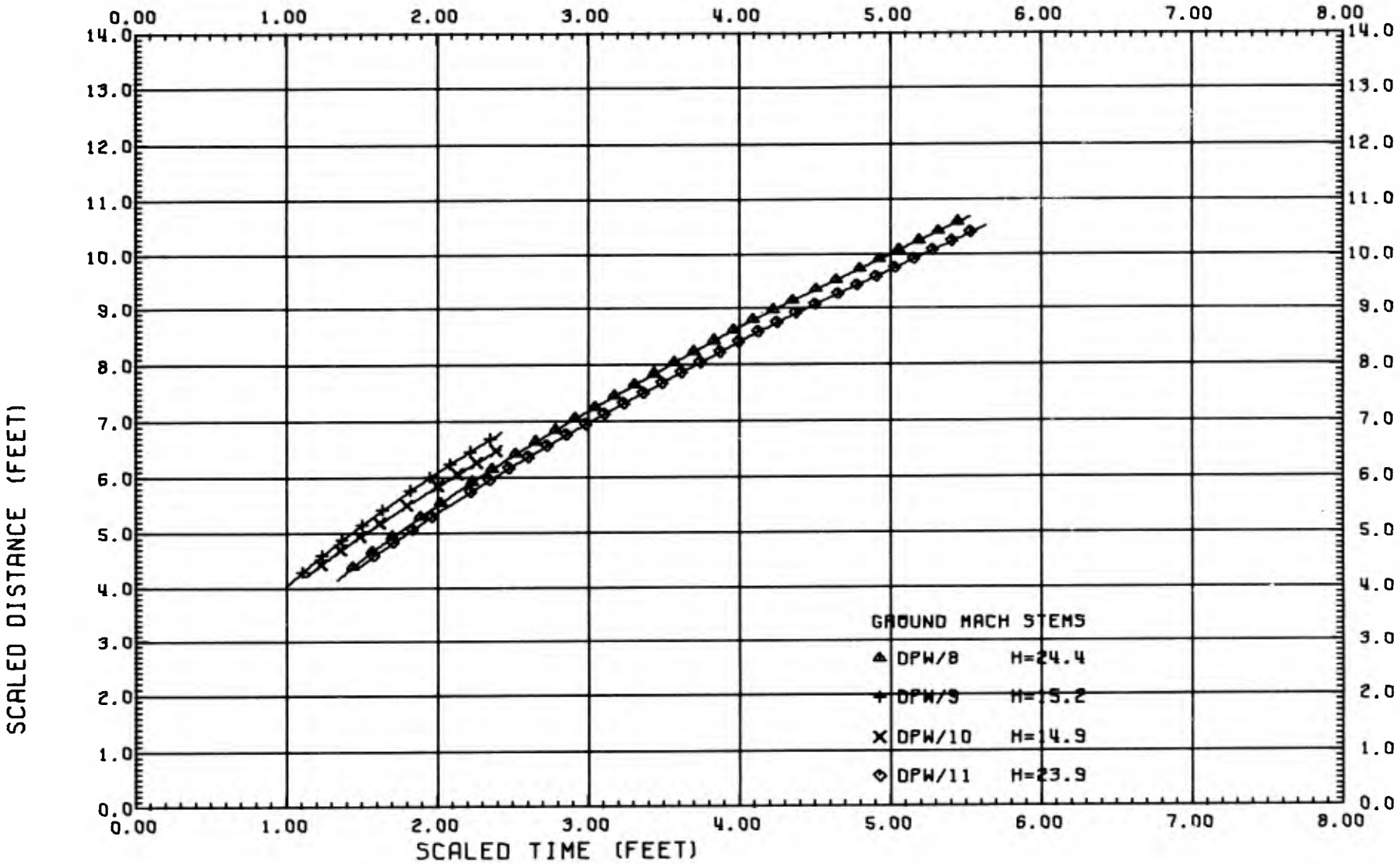


Figure 19. Upper mach stem scaled radius versus scaled time—Shots 8, 9, 10 and 11.



SCALED DISTANCE VS SCALED TIME

Figure 20. Ground mach stem scaled radius versus scaled time—Shots 8, 9, 10 and 11.

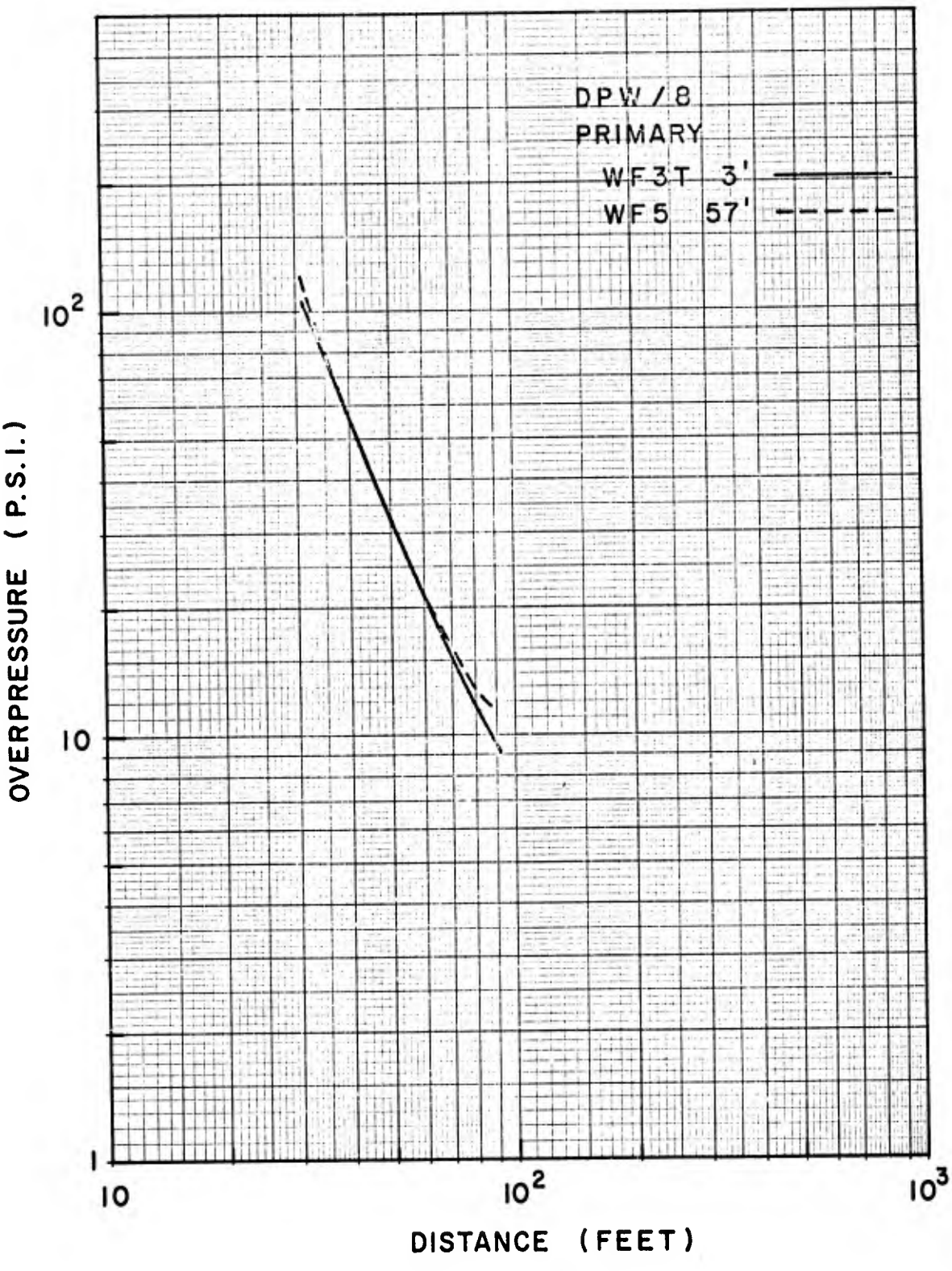


Figure 21. Primary shock overpressure versus distance—Shot 8.

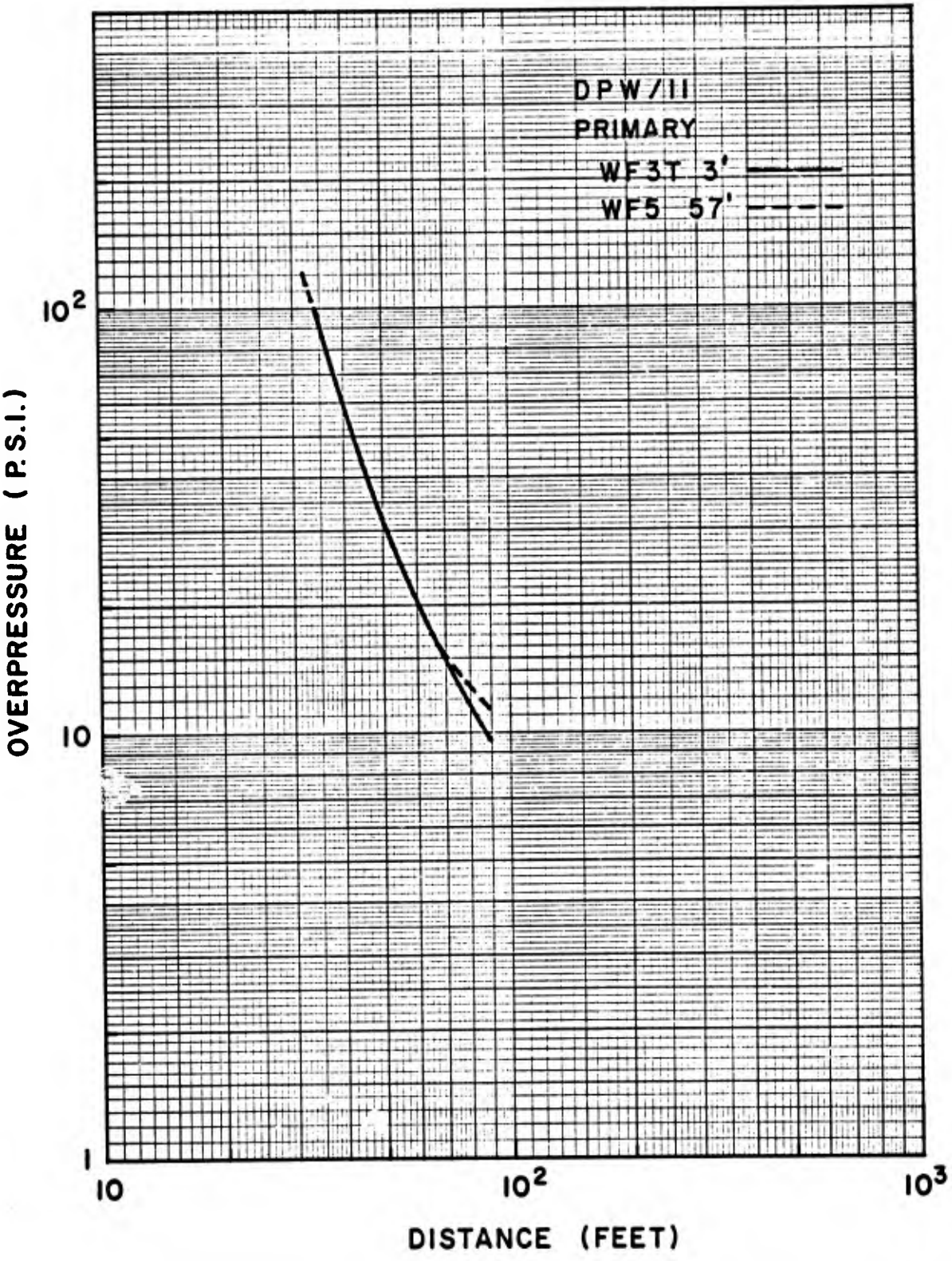


Figure 22. Primary shock overpressure versus distance—Shot 11.

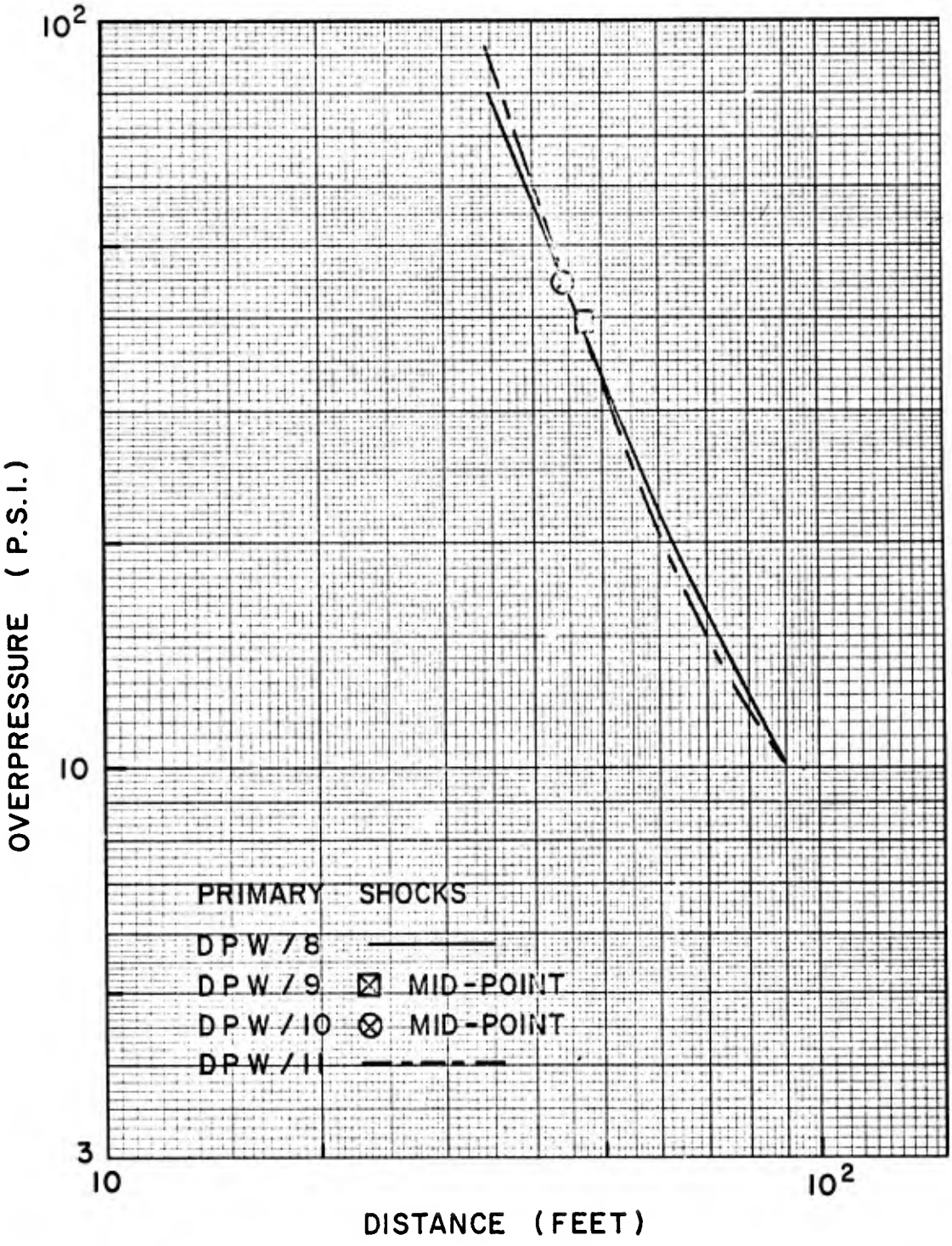


Figure 23. Primary shock overpressure versus distance—Shots 8, 9, 10 and 11.

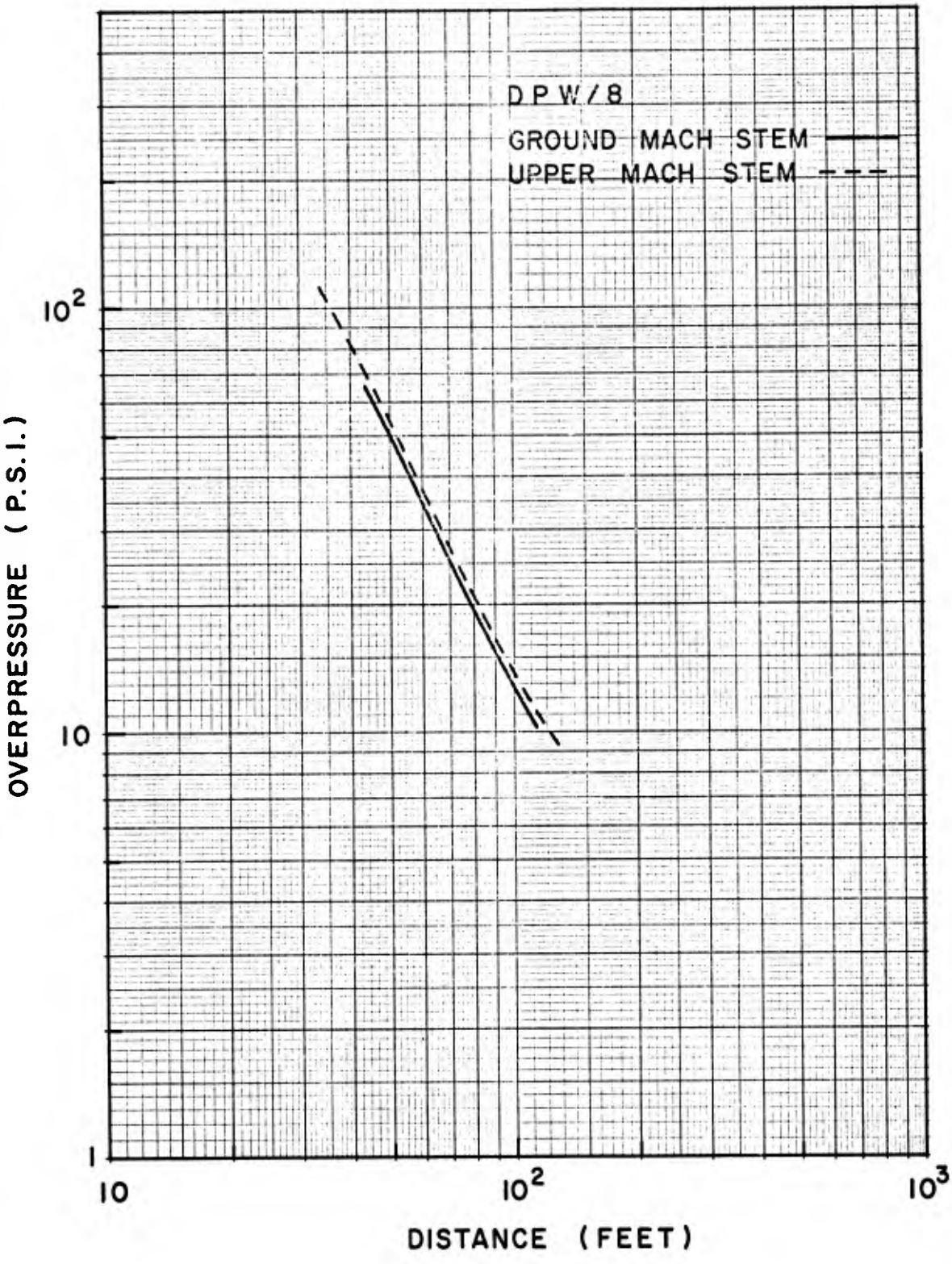


Figure 24. Ground and upper mach stem overpressures versus distance —Shot 8.

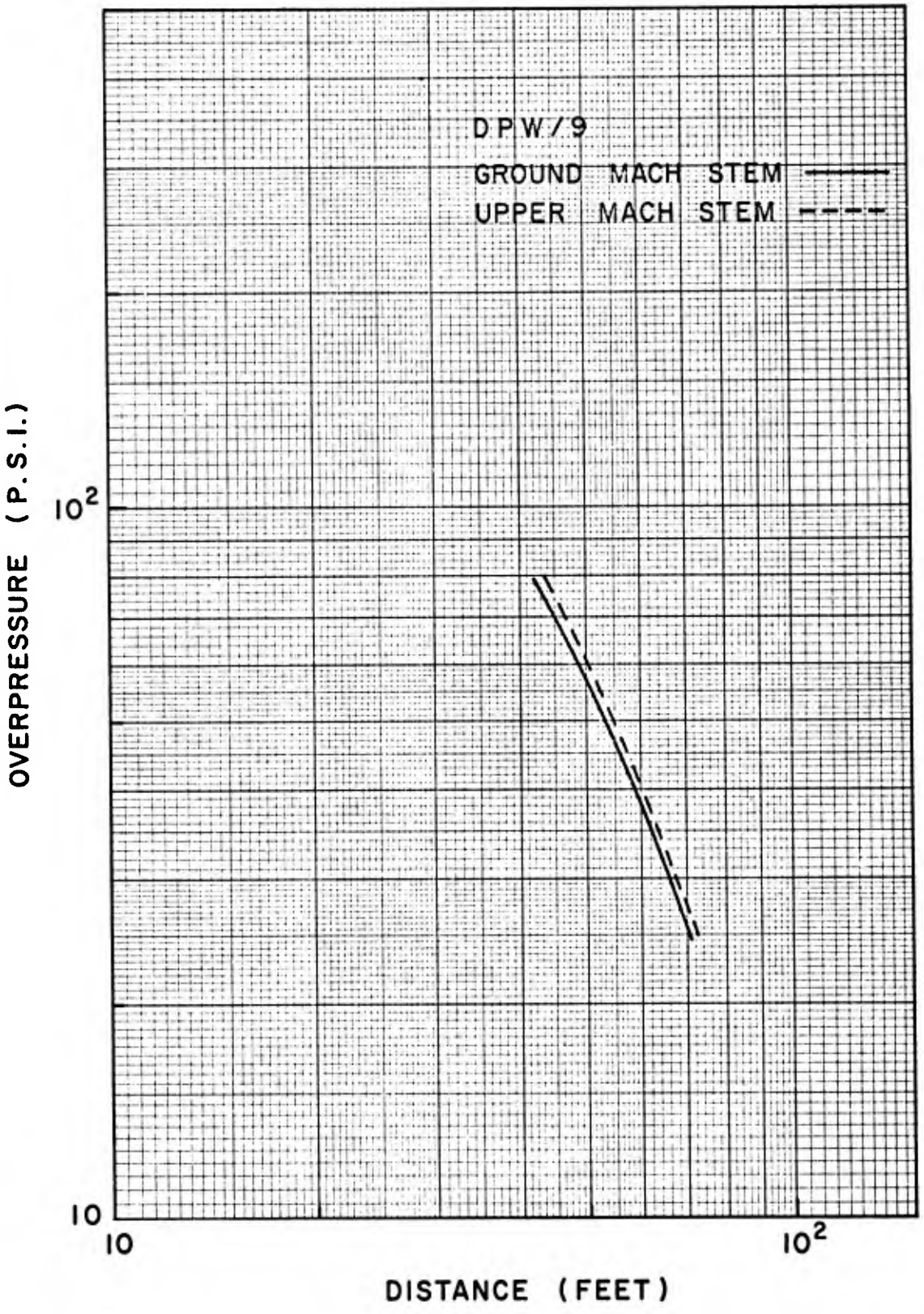


Figure 25. Ground and upper mach stem overpressures versus distance —Shot 9.

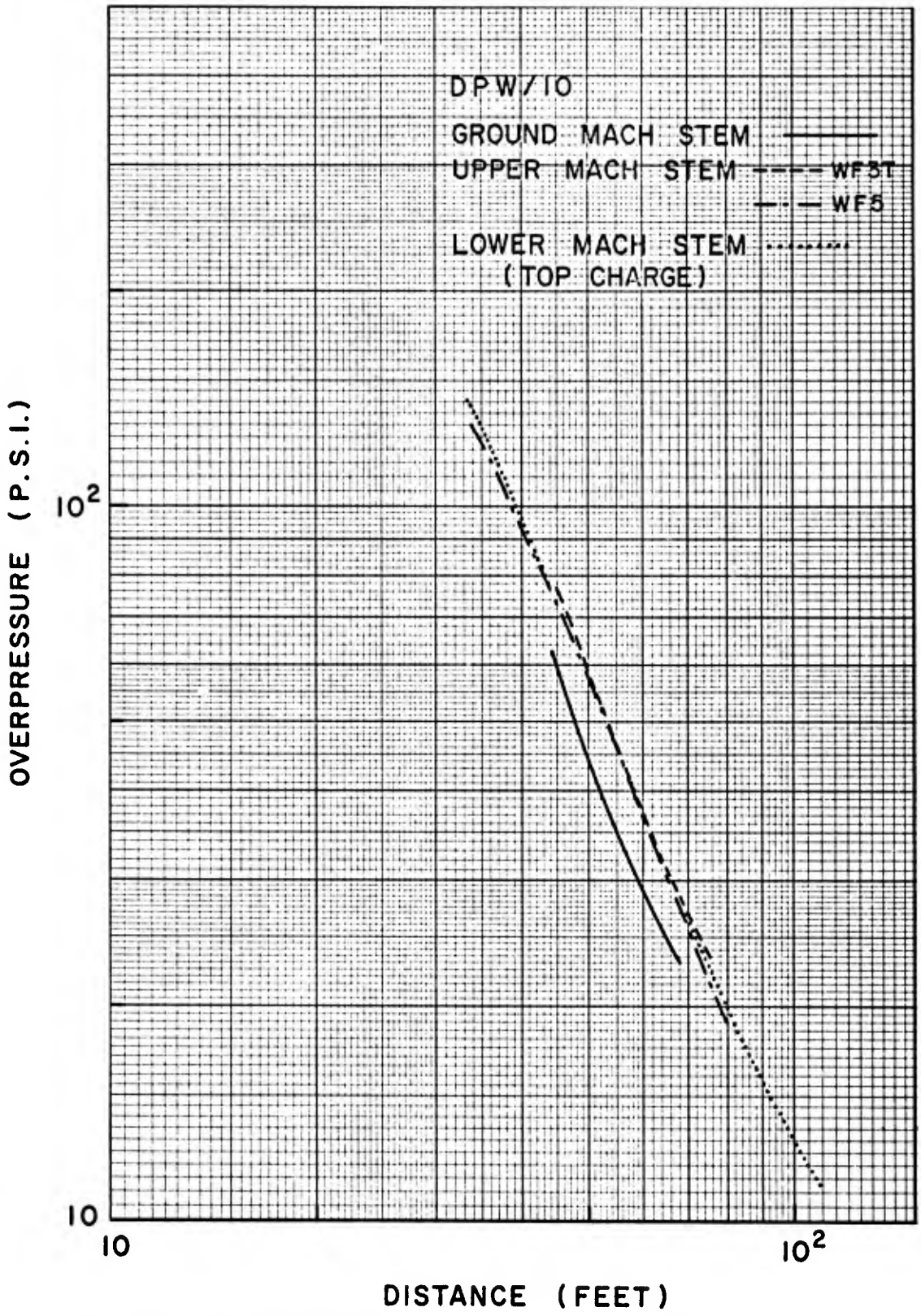


Figure 26. Ground and upper mach stem overpressures versus distance —Shot 10.

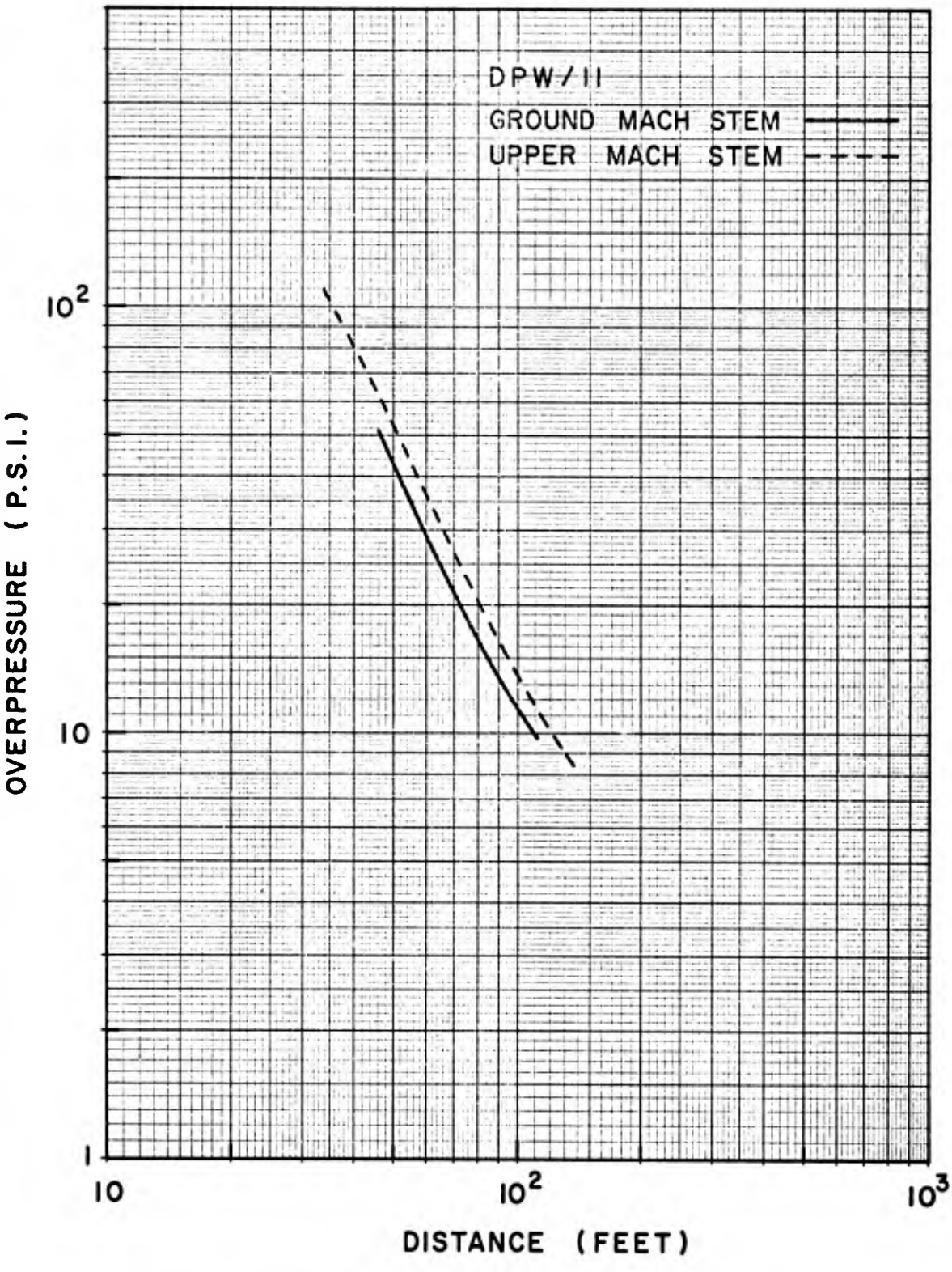


Figure 27. Ground and upper mach stem overpressures versus distance —Shot 11.

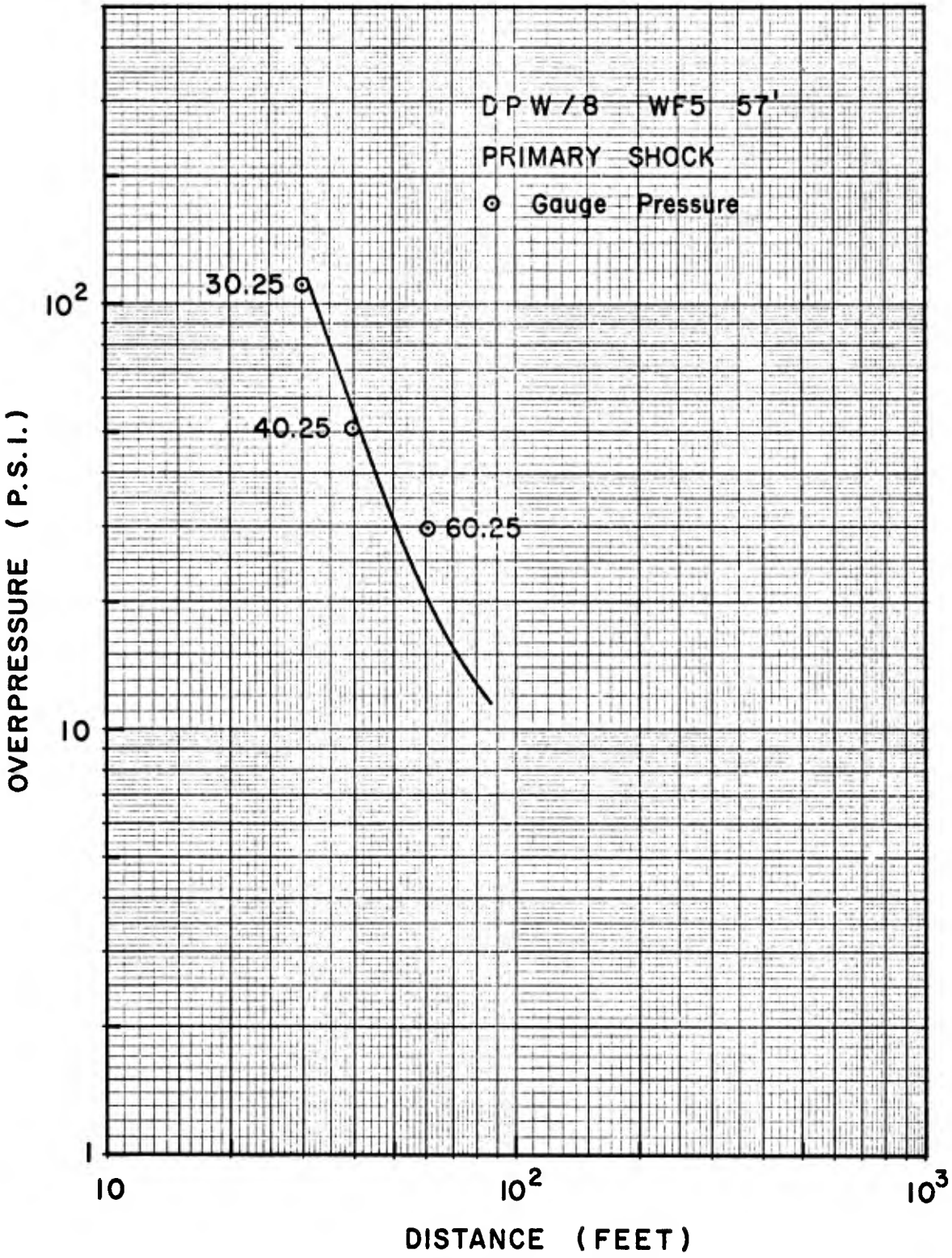


Figure 28. Primary shock overpressure compared with gauge measurements —Shot 8, WF5 at 57 feet.

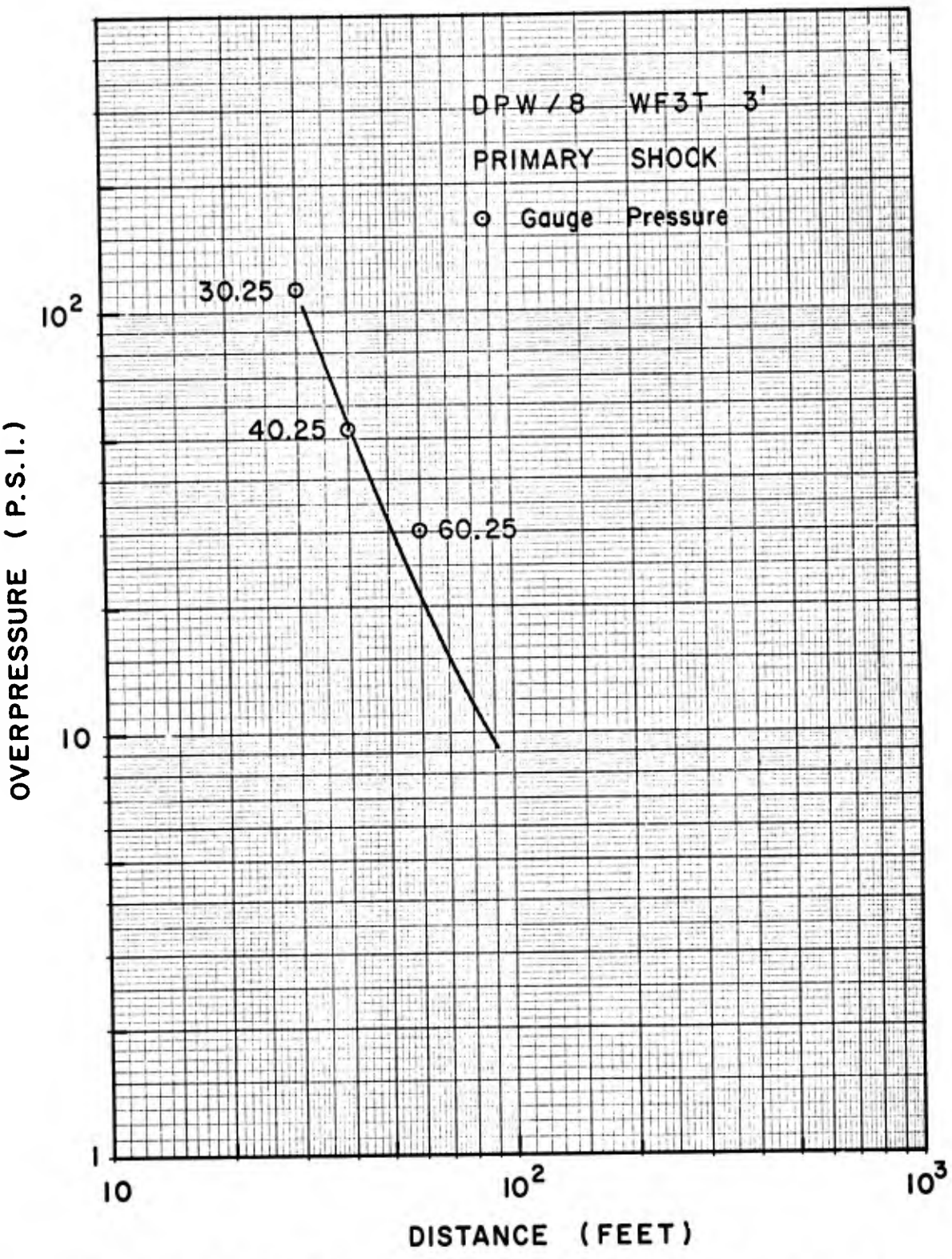


Figure 29. Primary shock overpressure compared with gauge measurements —Shot 8, WF3T at 3 feet.

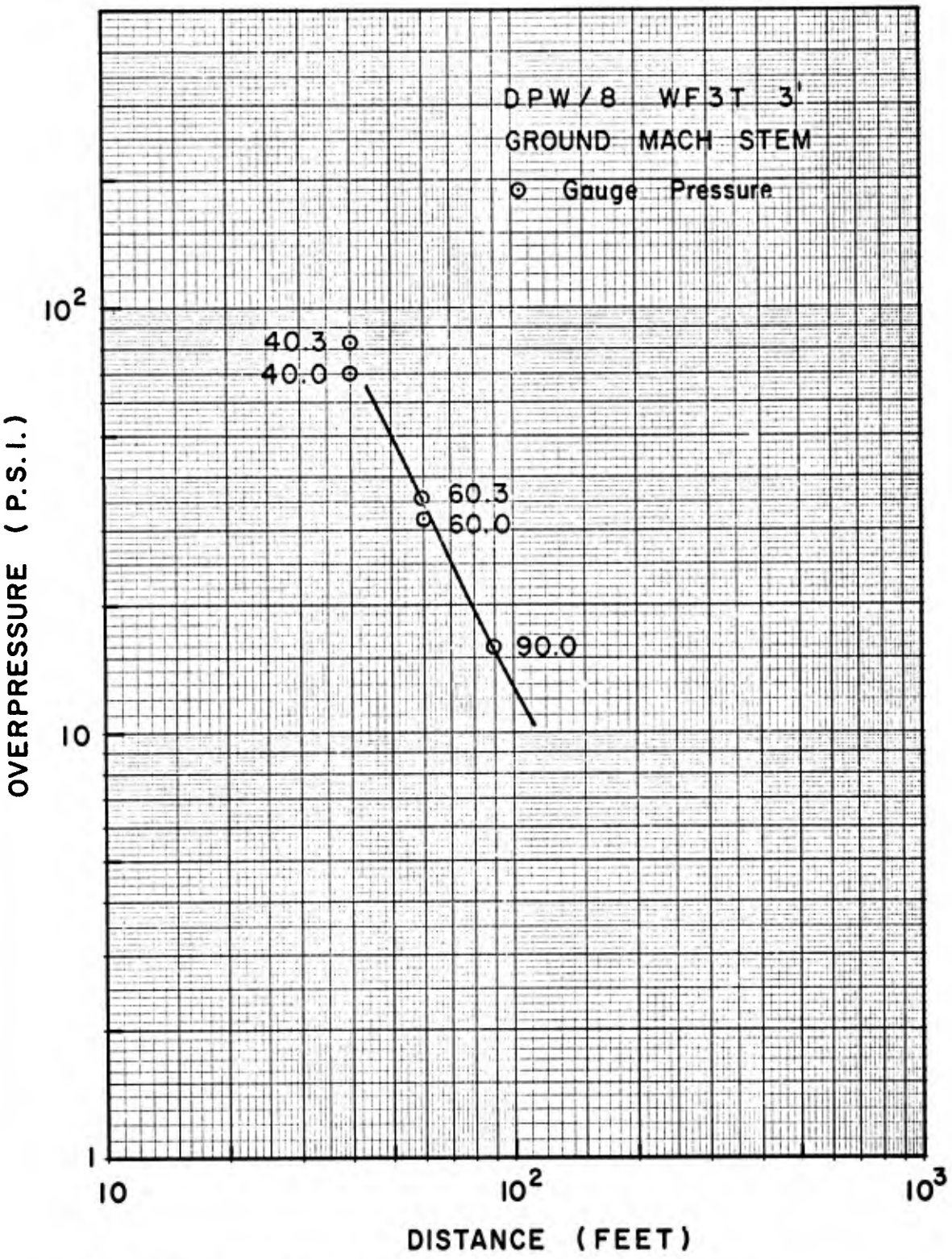


Figure 30. Ground mach stem overpressure compared with gauge measurements—Shot 8.

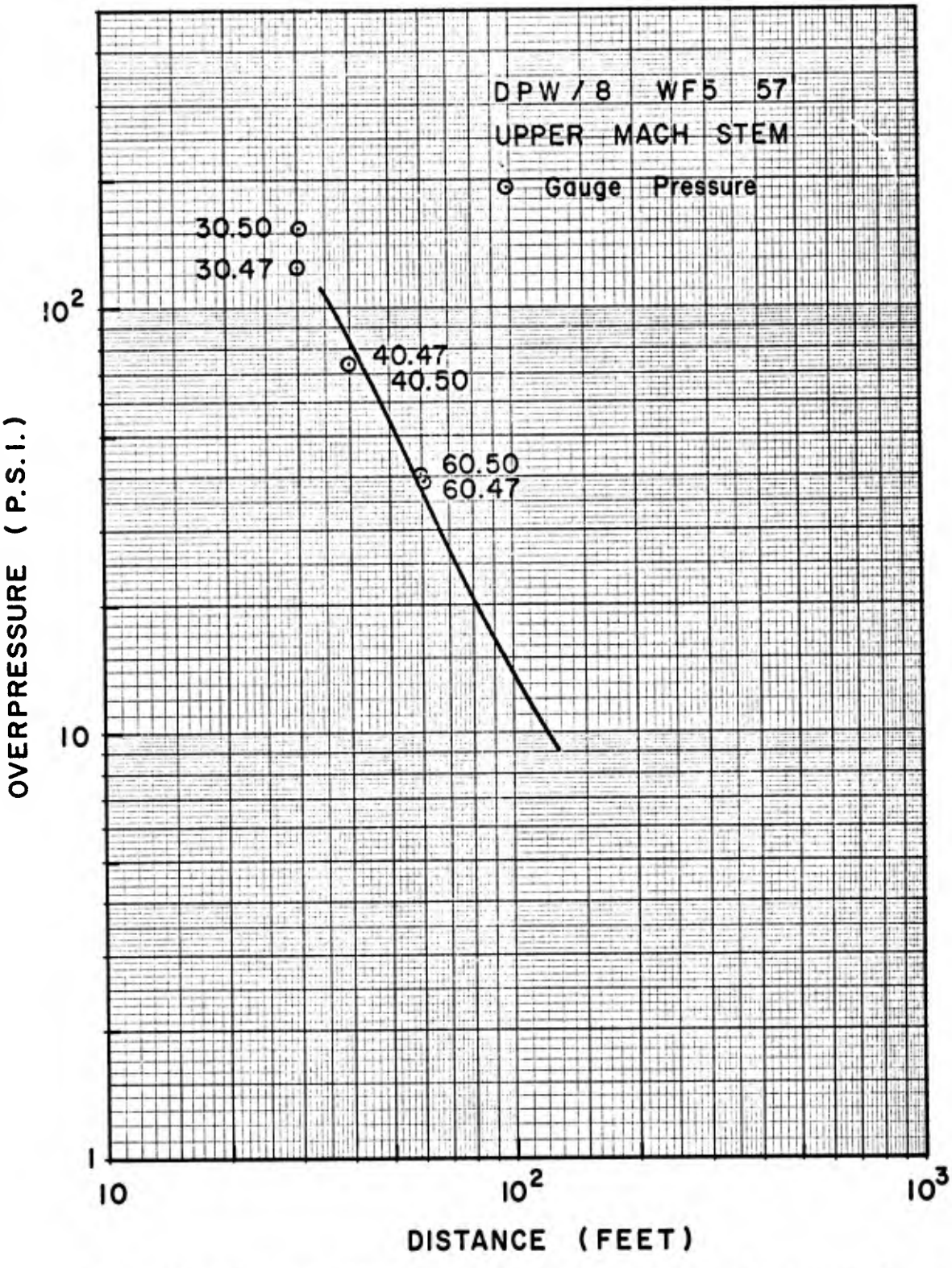


Figure 31. Upper mach stem overpressure compared with gauge measurements —Shot 8.

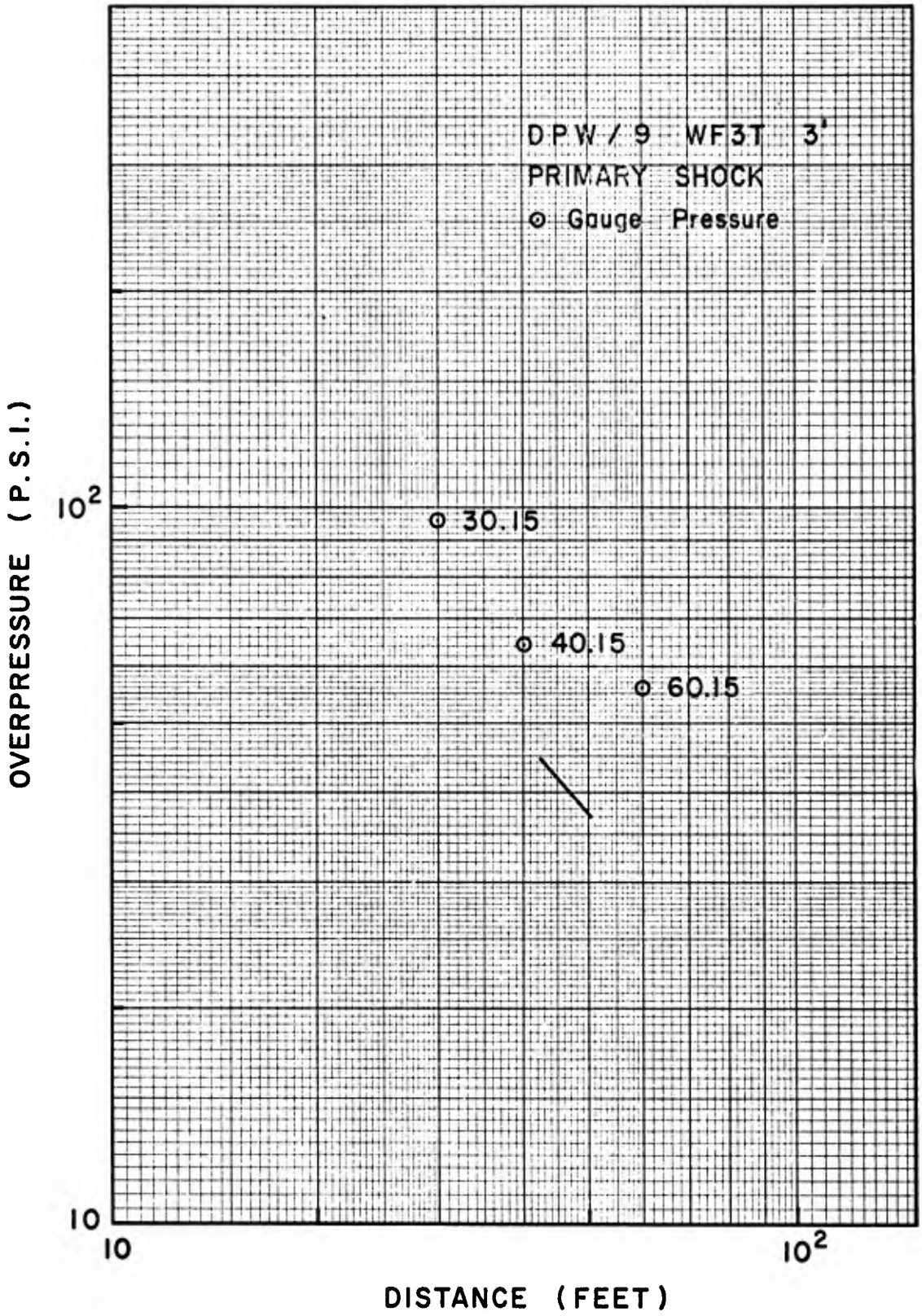


Figure 32. Primary shock overpressure compared with gauge measurements —Shot 9.

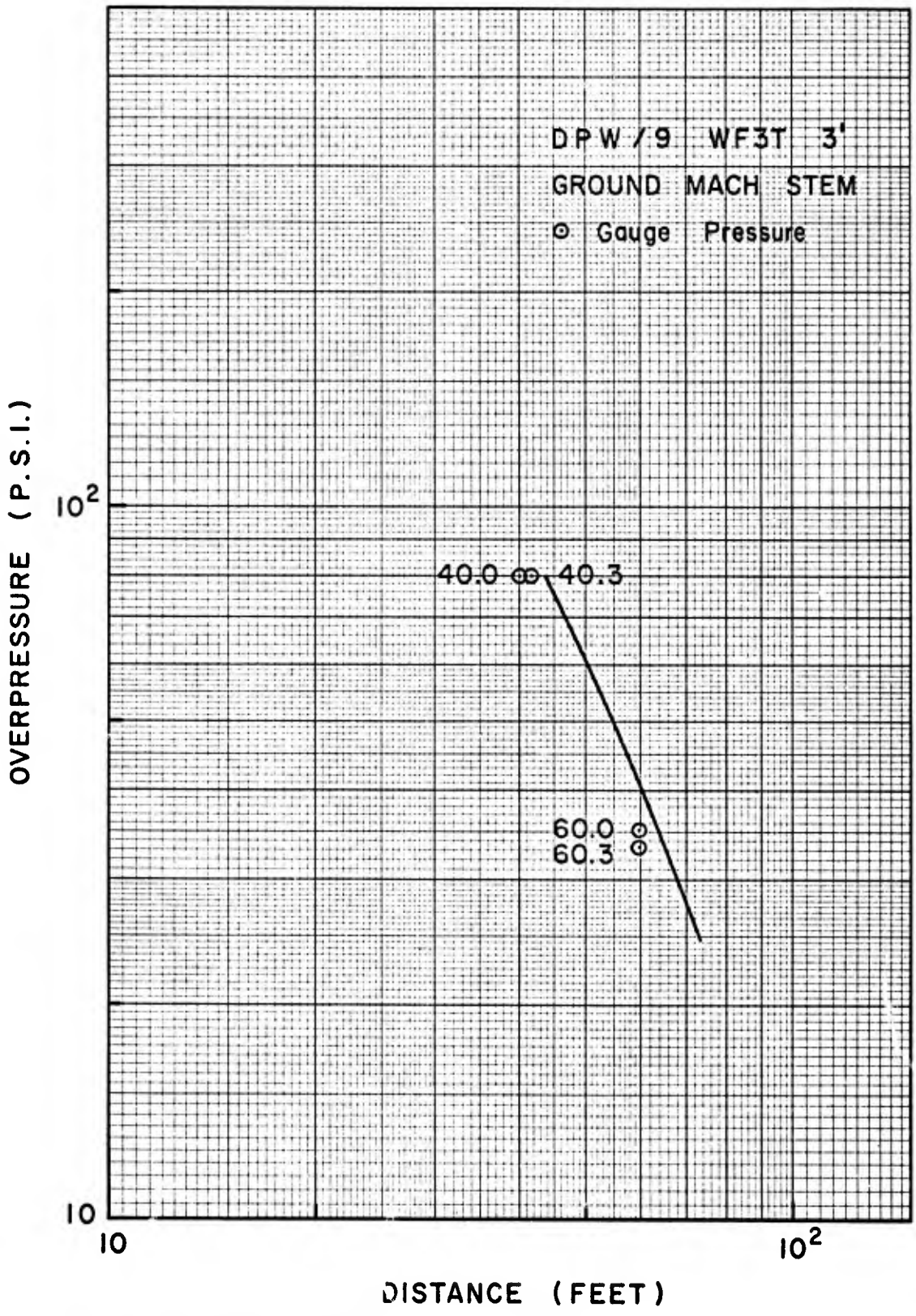


Figure 33. Ground mach stem overpressures compared with gauge measurements —Shot 9.

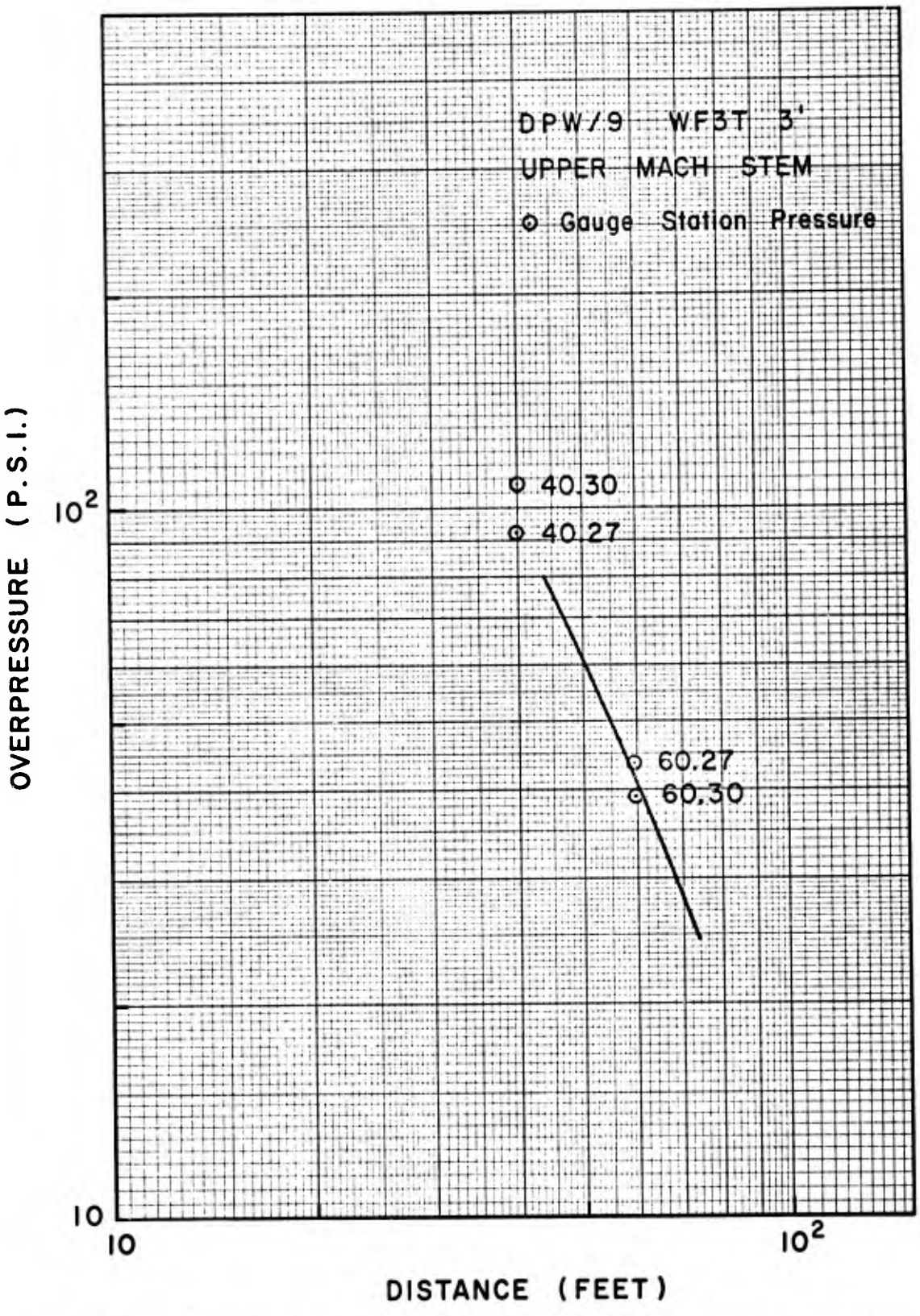


Figure 34. Upper mach stem overpressures compared with gauge measurements —Shot 9.

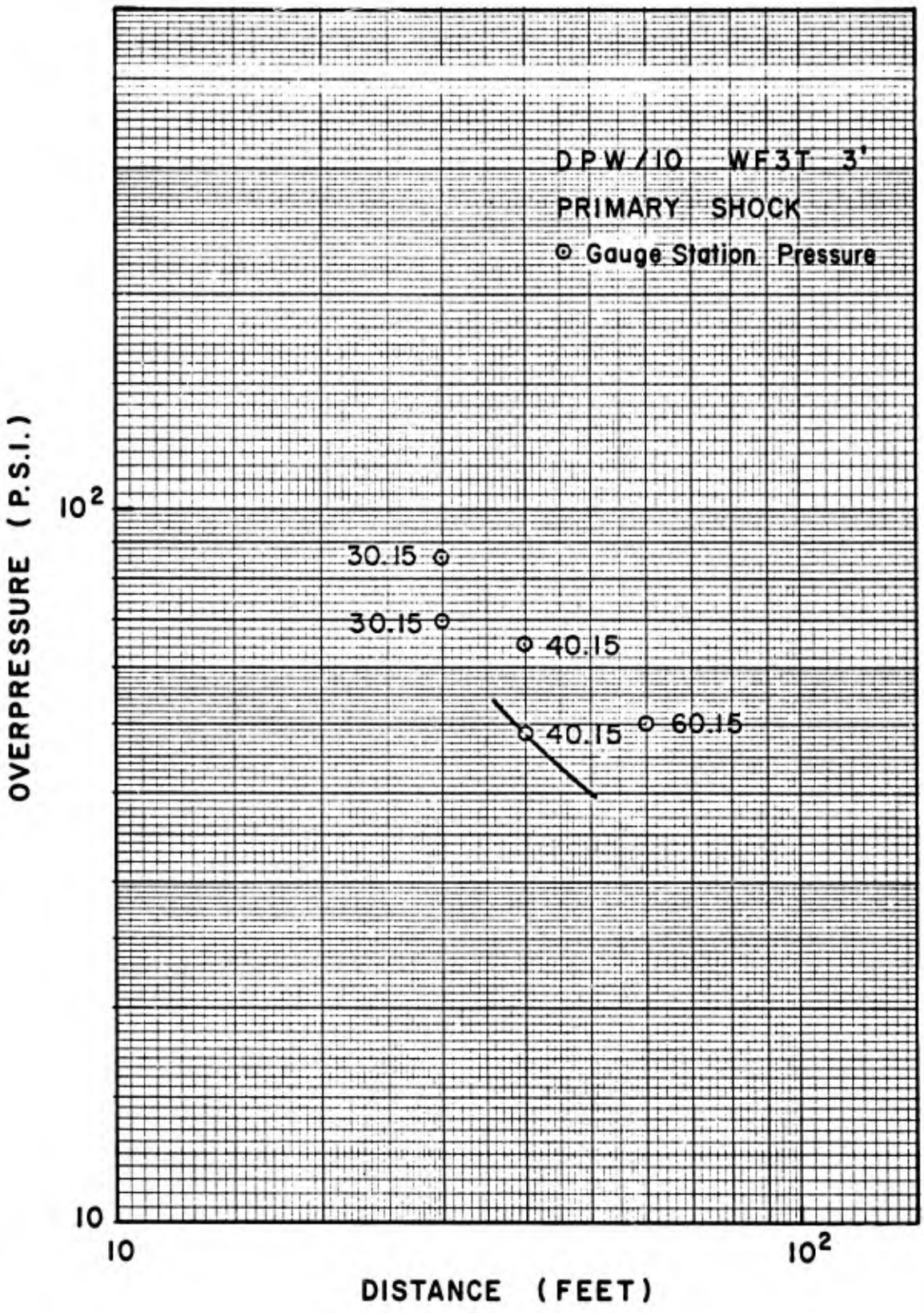


Figure 35. Primary shock overpressures compared with gauge results —Shot 10.

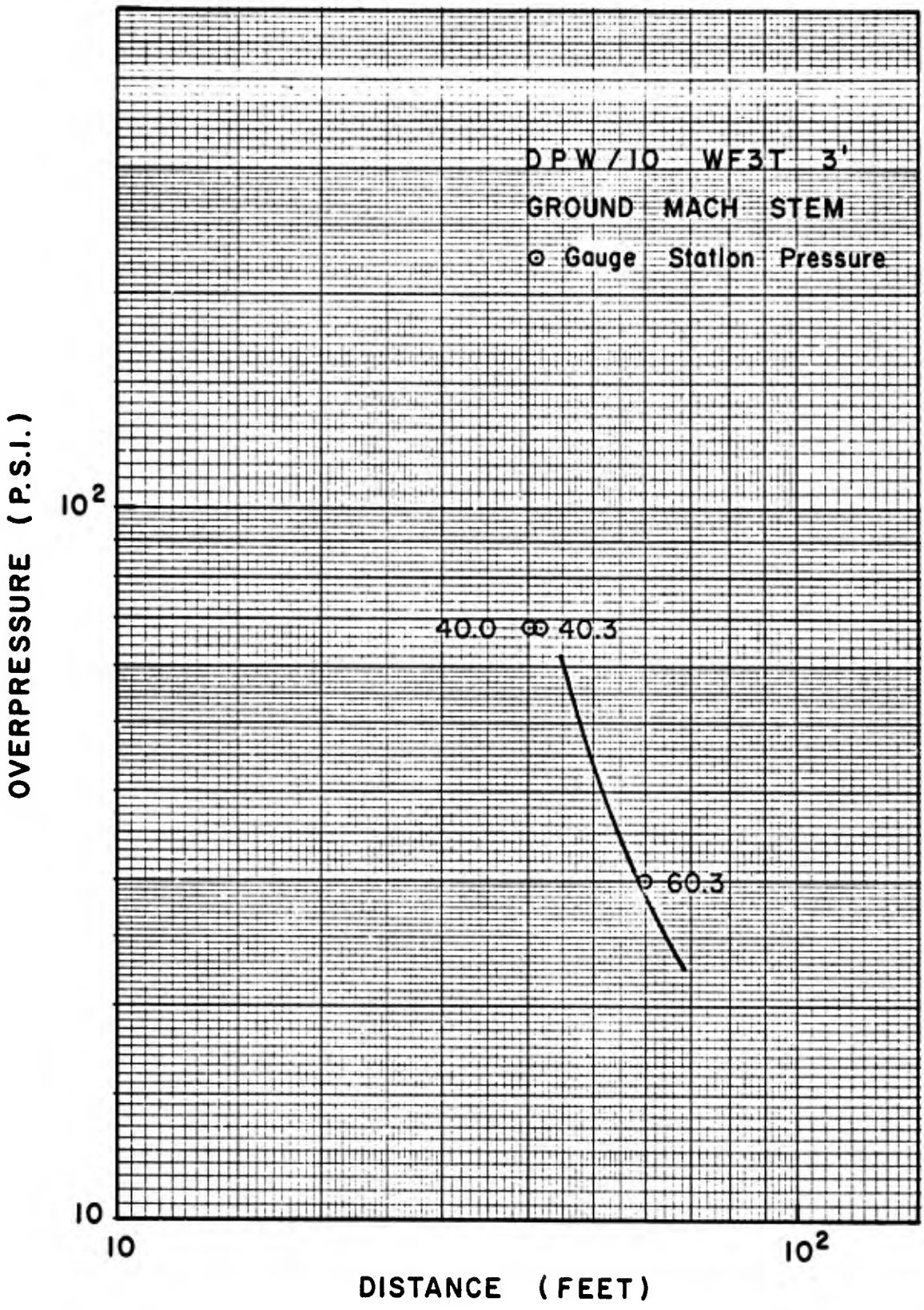


Figure 36. Ground mach stem overpressures compared with gauge results —Shot 10.

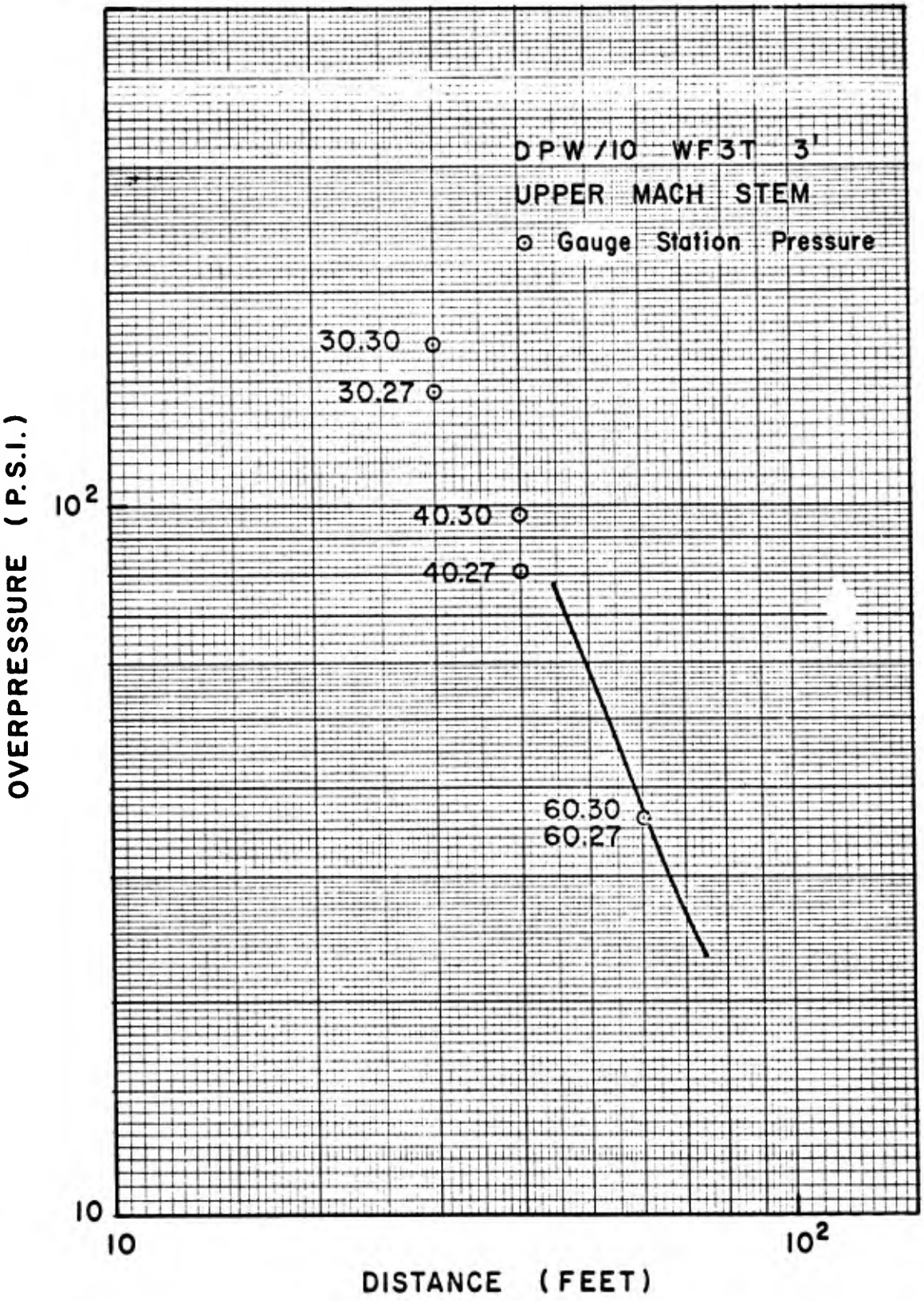


Figure 37. Upper mach stem overpressures compared with gauge results —Shot 10, WF3T at 3 feet.

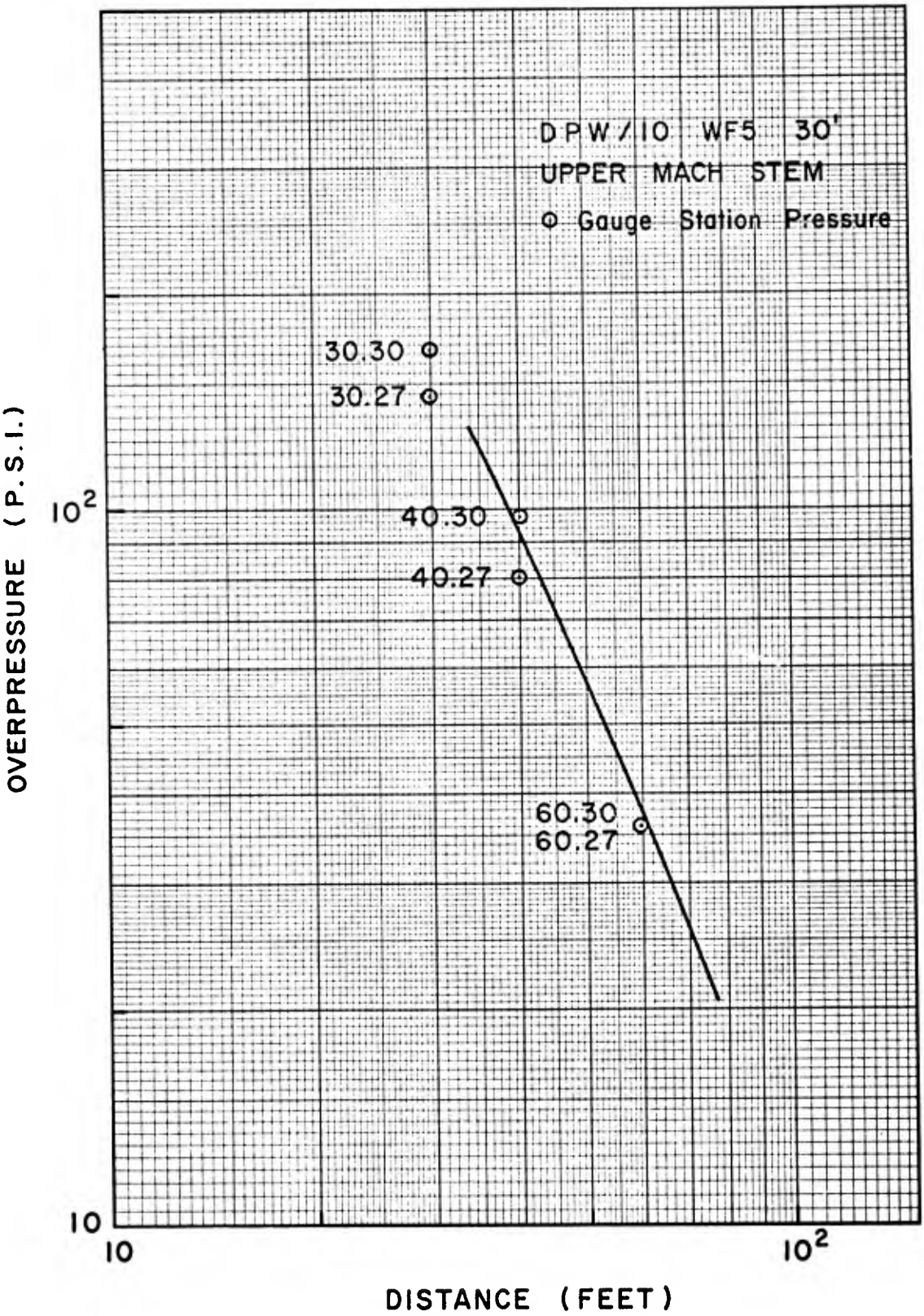


Figure 38. Upper mach stem overpressures compared with gauge results —Shot 10, WF5 at 30 feet.

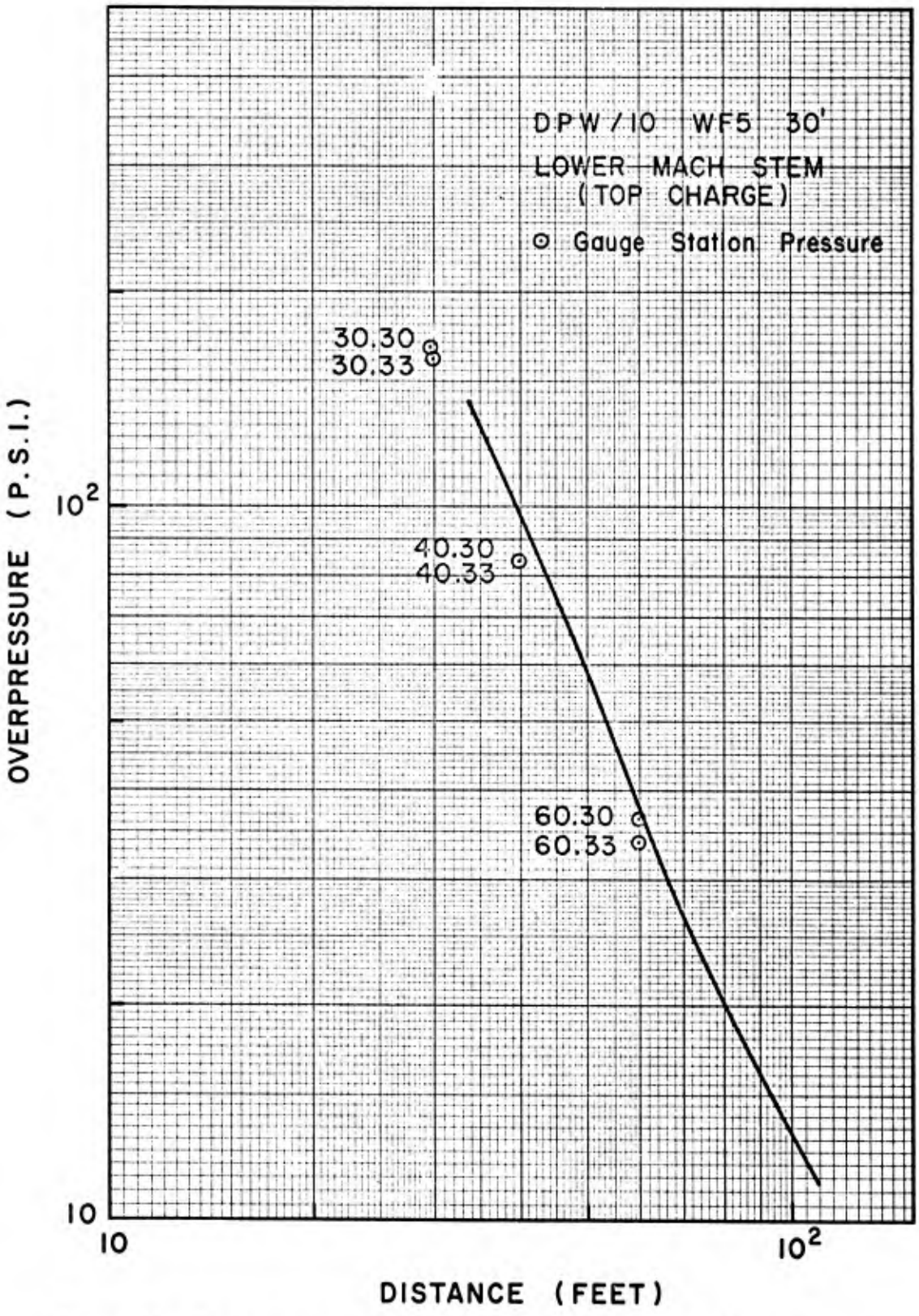


Figure 39. Top charge mach stem overpressures compared with gauge results—Shot 10.

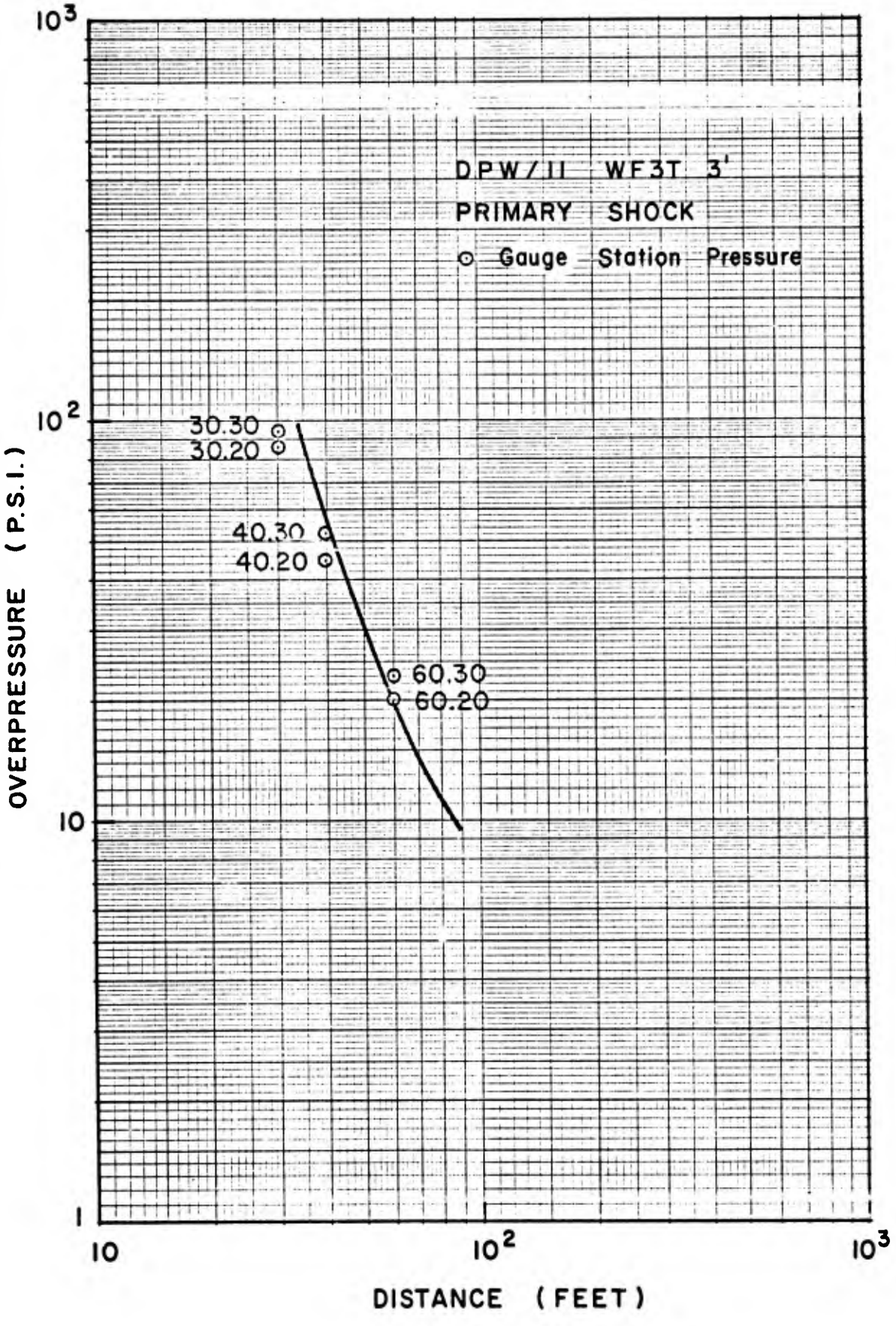


Figure 40. Primary shock overpressures compared with gauge results —Shot 11, WF3T at 3 feet.

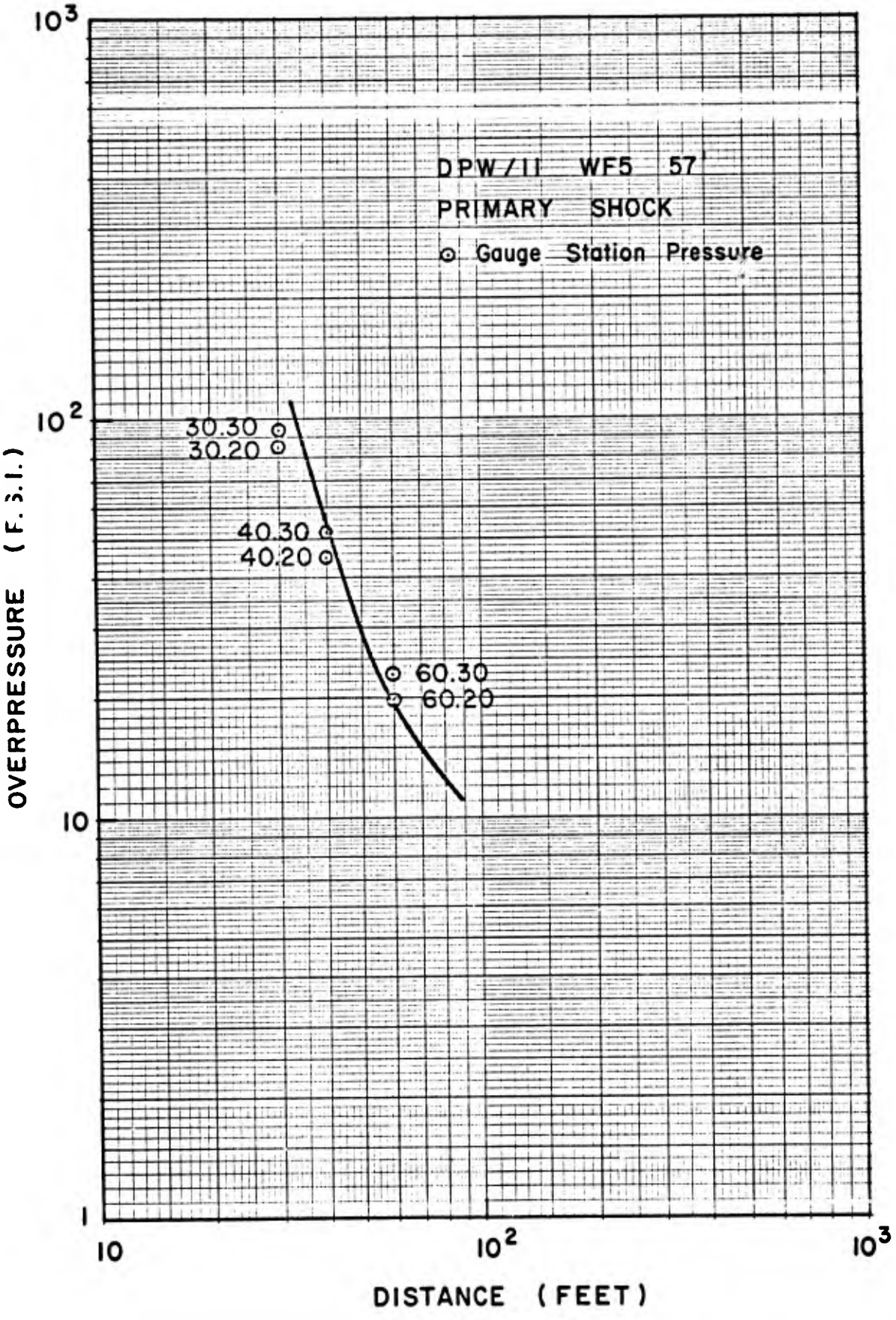


Figure 41. Primary shock overpressures compared with gauge results —Shot 11, WF5 at 57 feet.

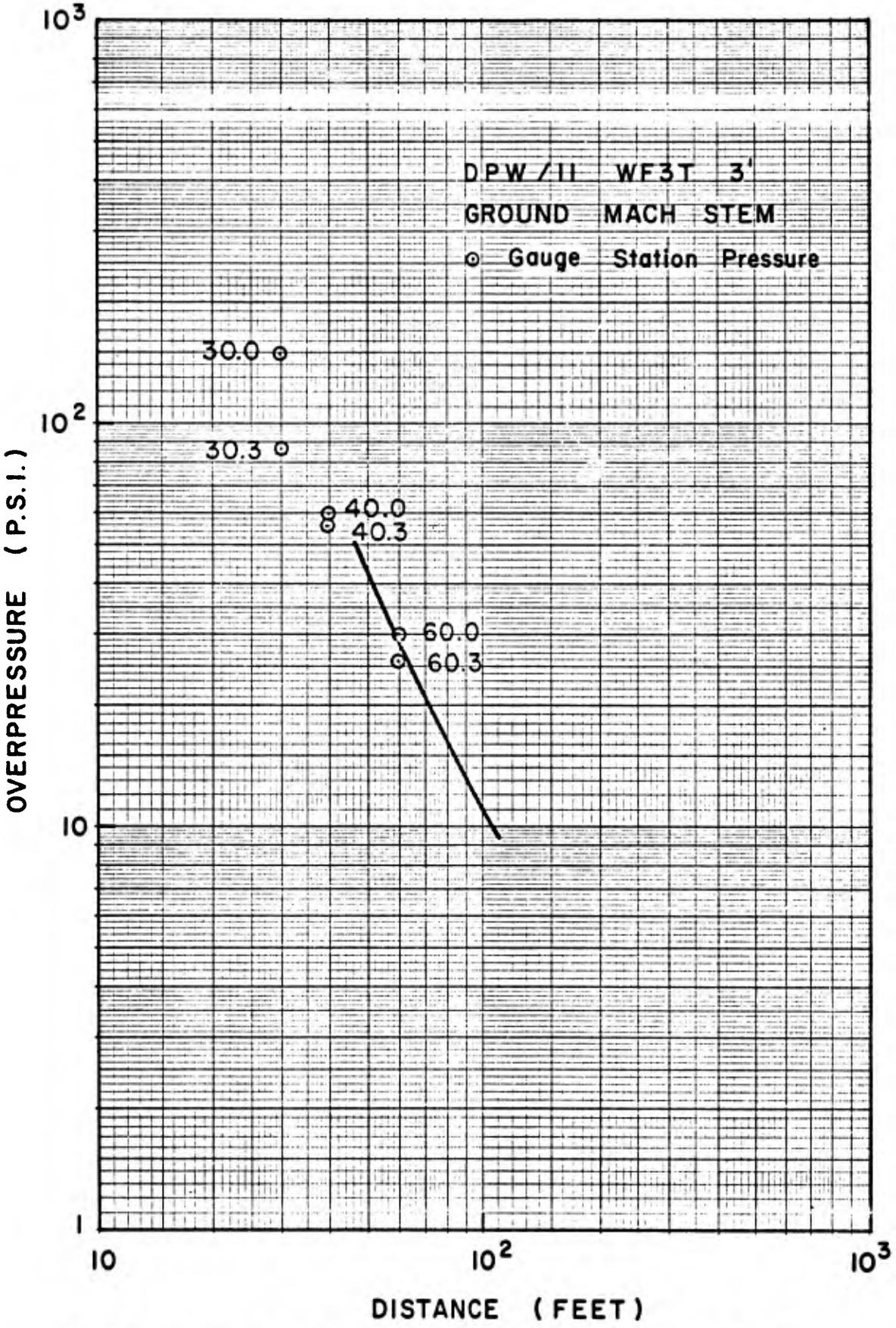


Figure 42. Ground mach stem overpressures compared with gauge results —Shot 11.

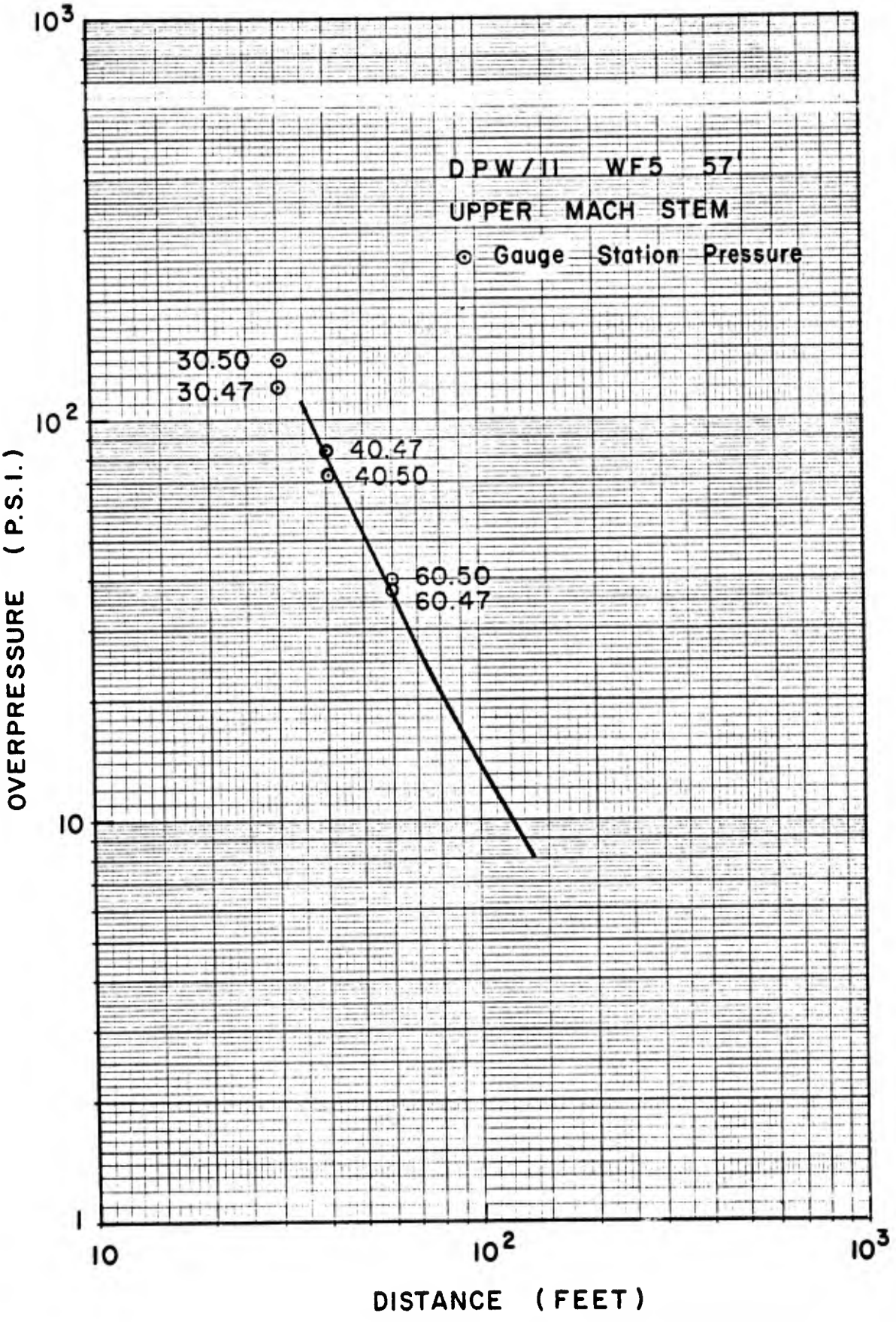


Figure 43. Upper mach stem overpressures compared with gauge results —Shot 11.

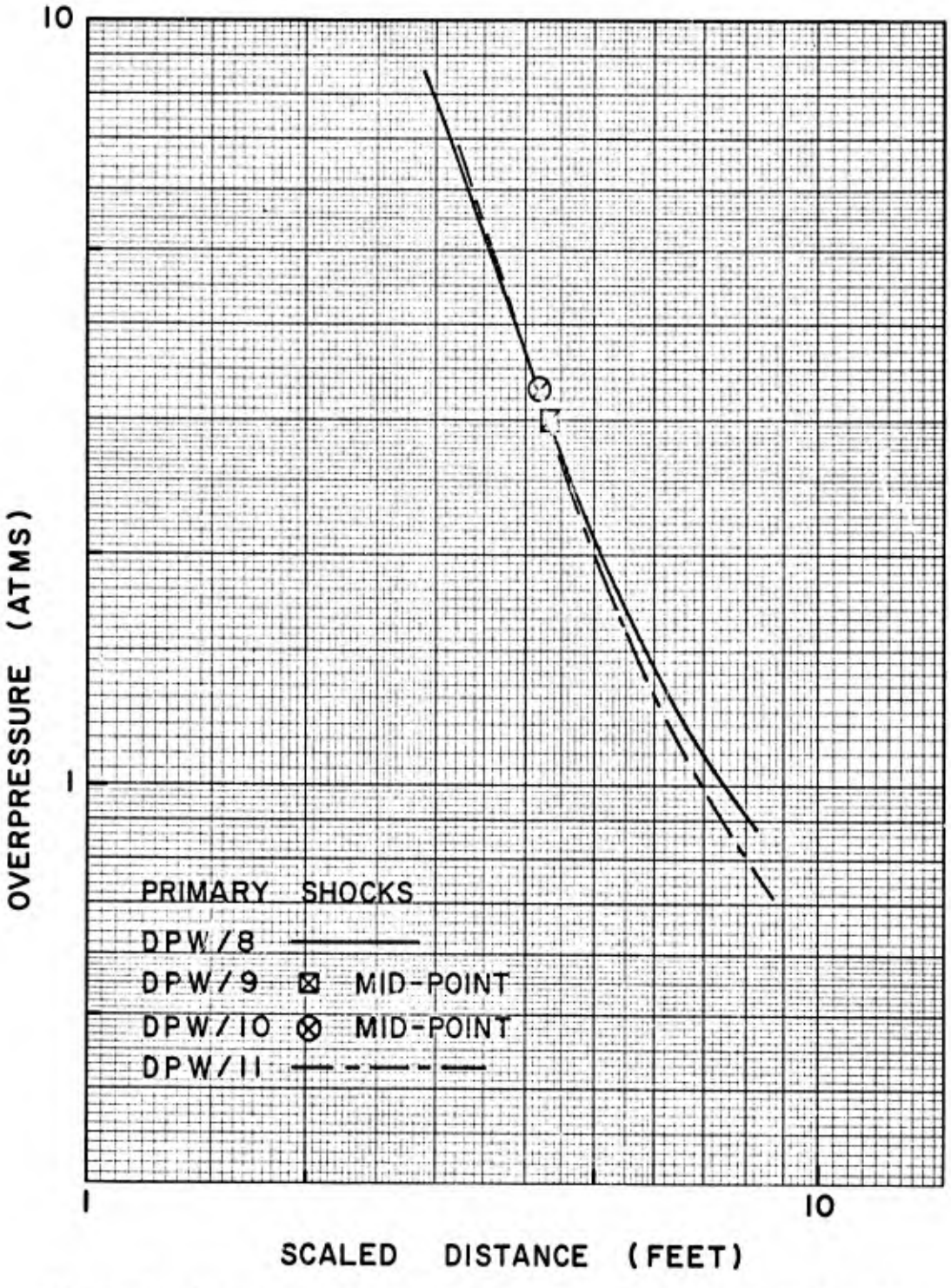


Figure 44. Primary shock overpressure versus scaled distance—Shots 8, 9, 10 and 11.

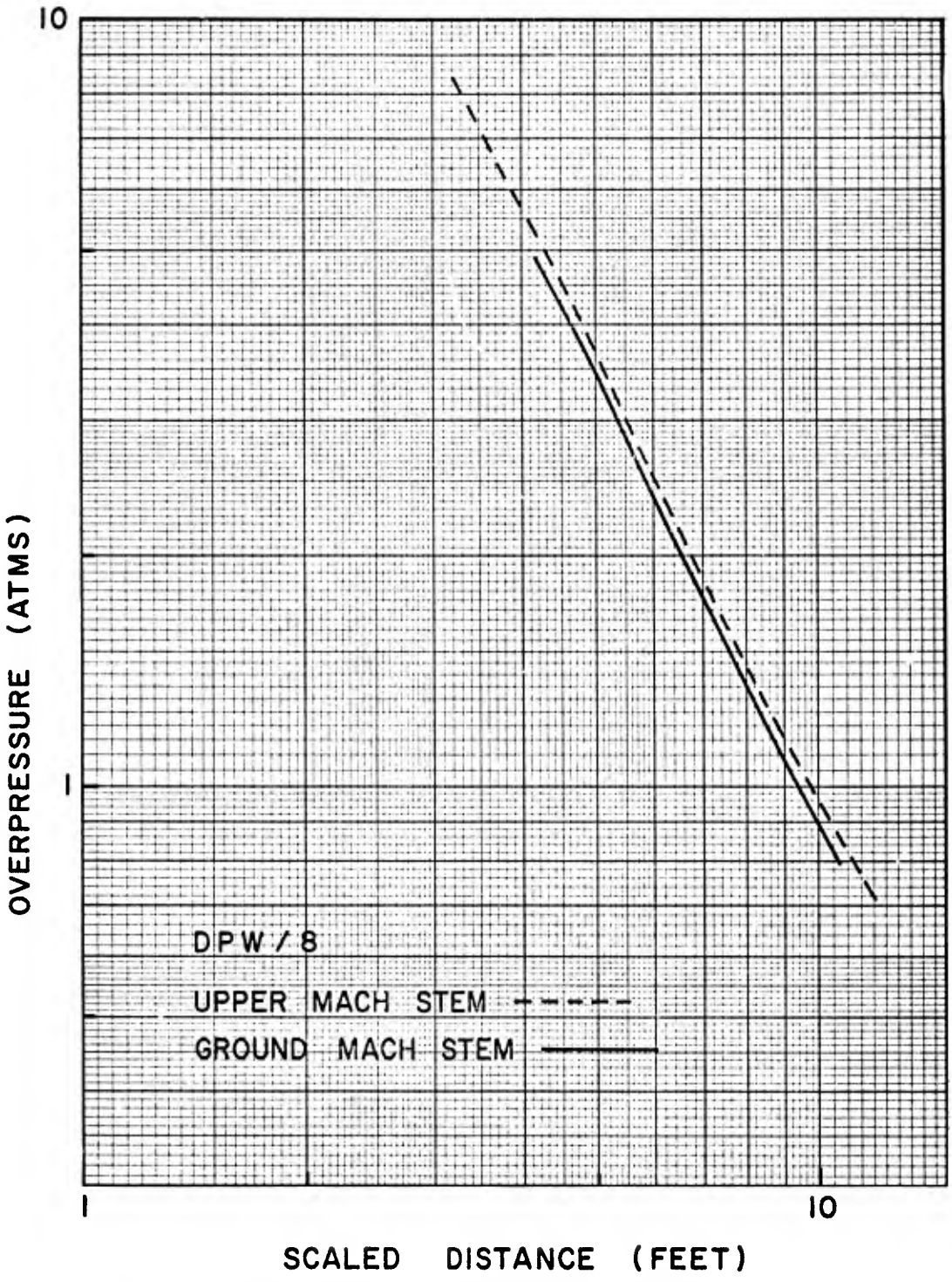


Figure 45. Upper and ground mach stem overpressures versus scaled distance— Shot 8.

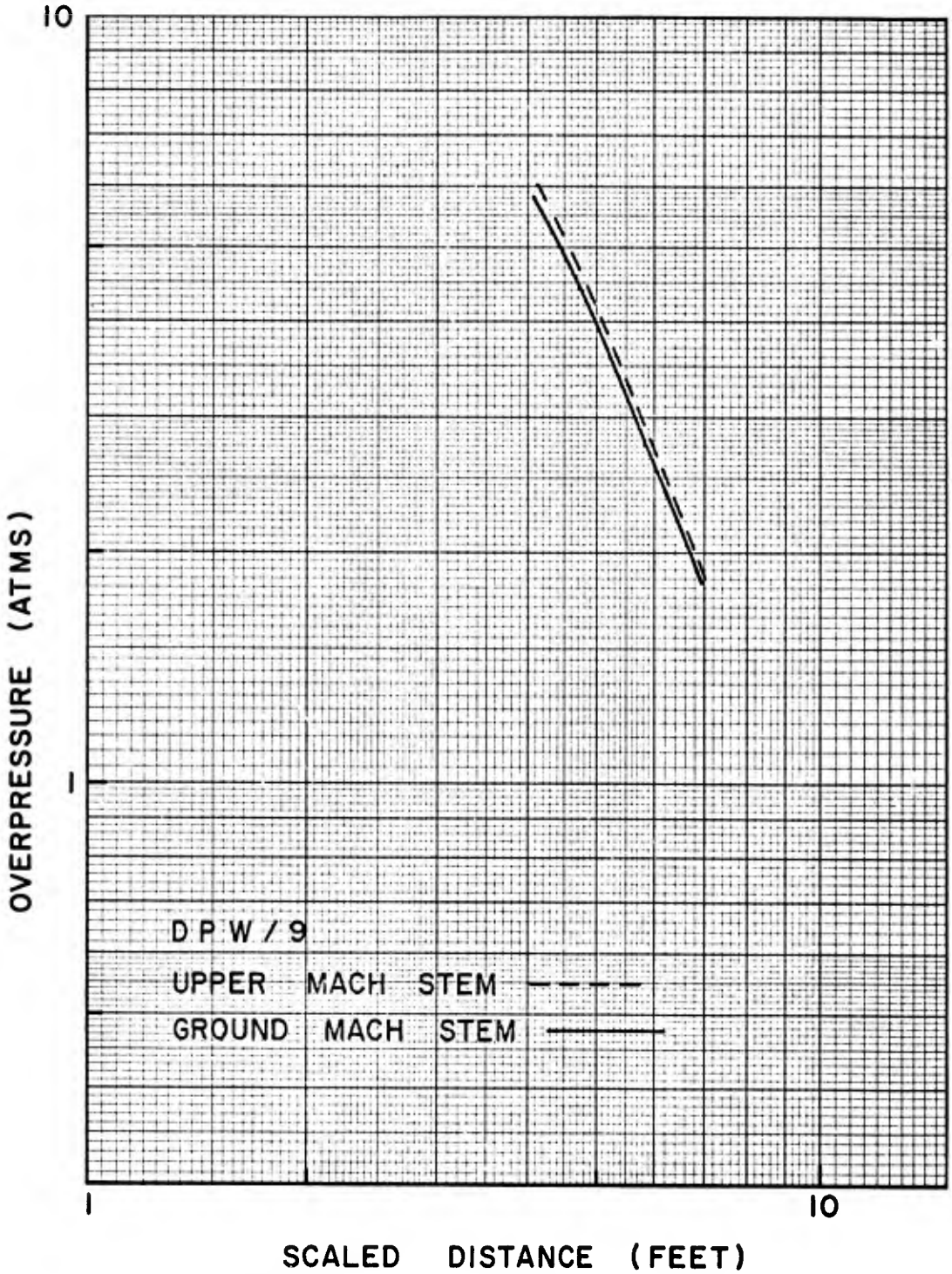


Figure 46. Upper and ground mach stem overpressures versus scaled distance—Shot 9.

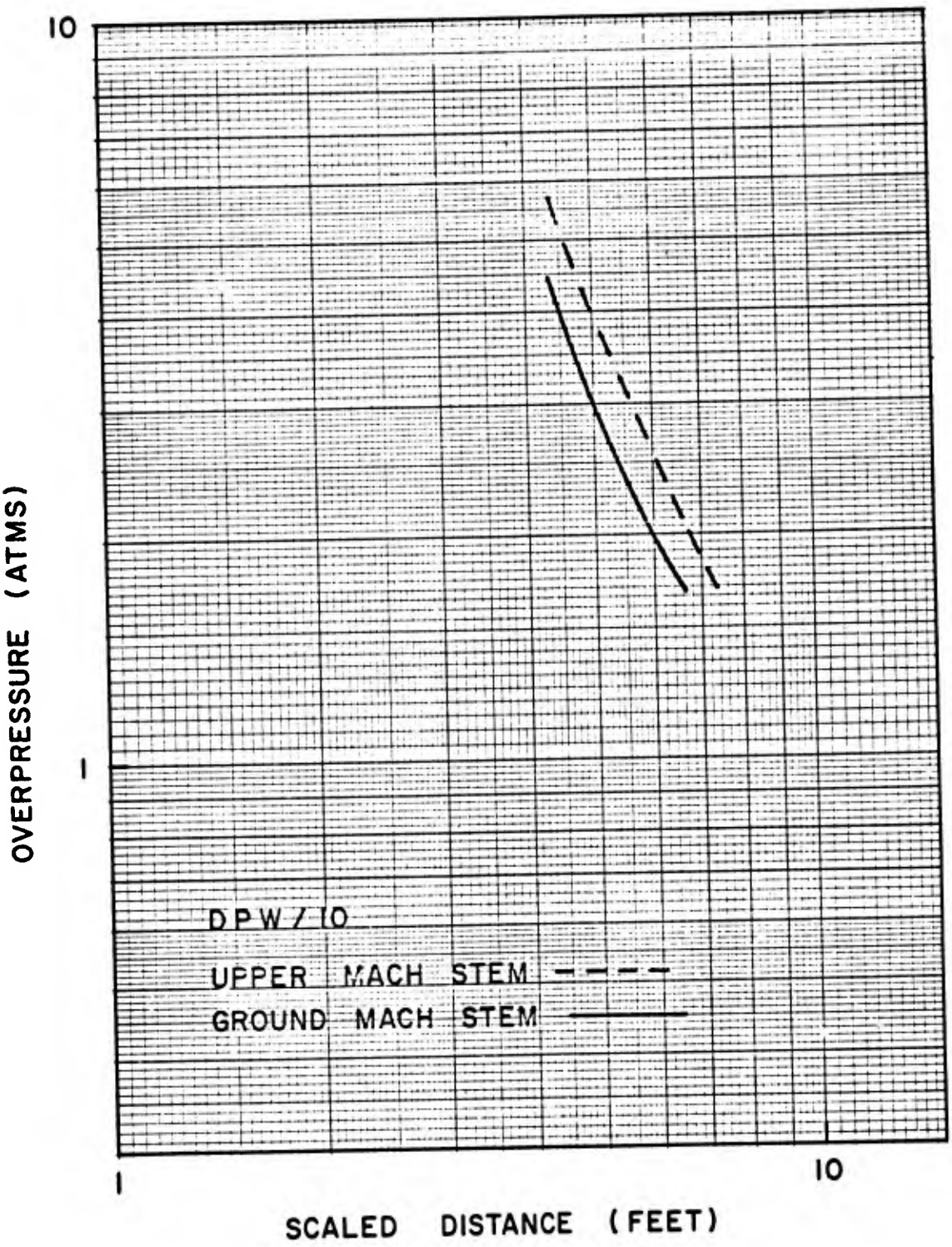


Figure 47. Upper and ground mach stem overpressures versus scaled distance—Shot 10.

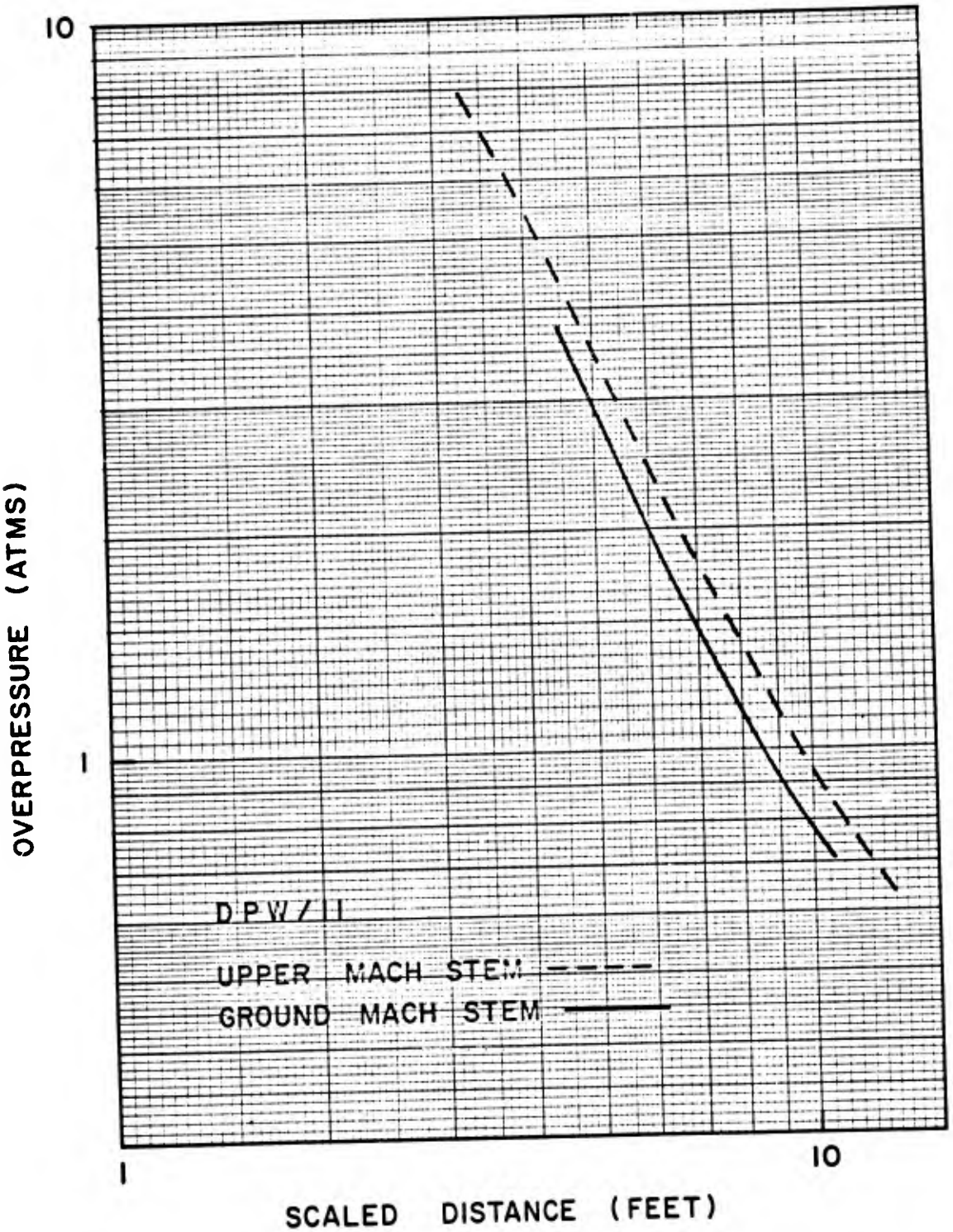


Figure 48. Upper and ground mach stem overpressures versus scaled distance—Shot 11.

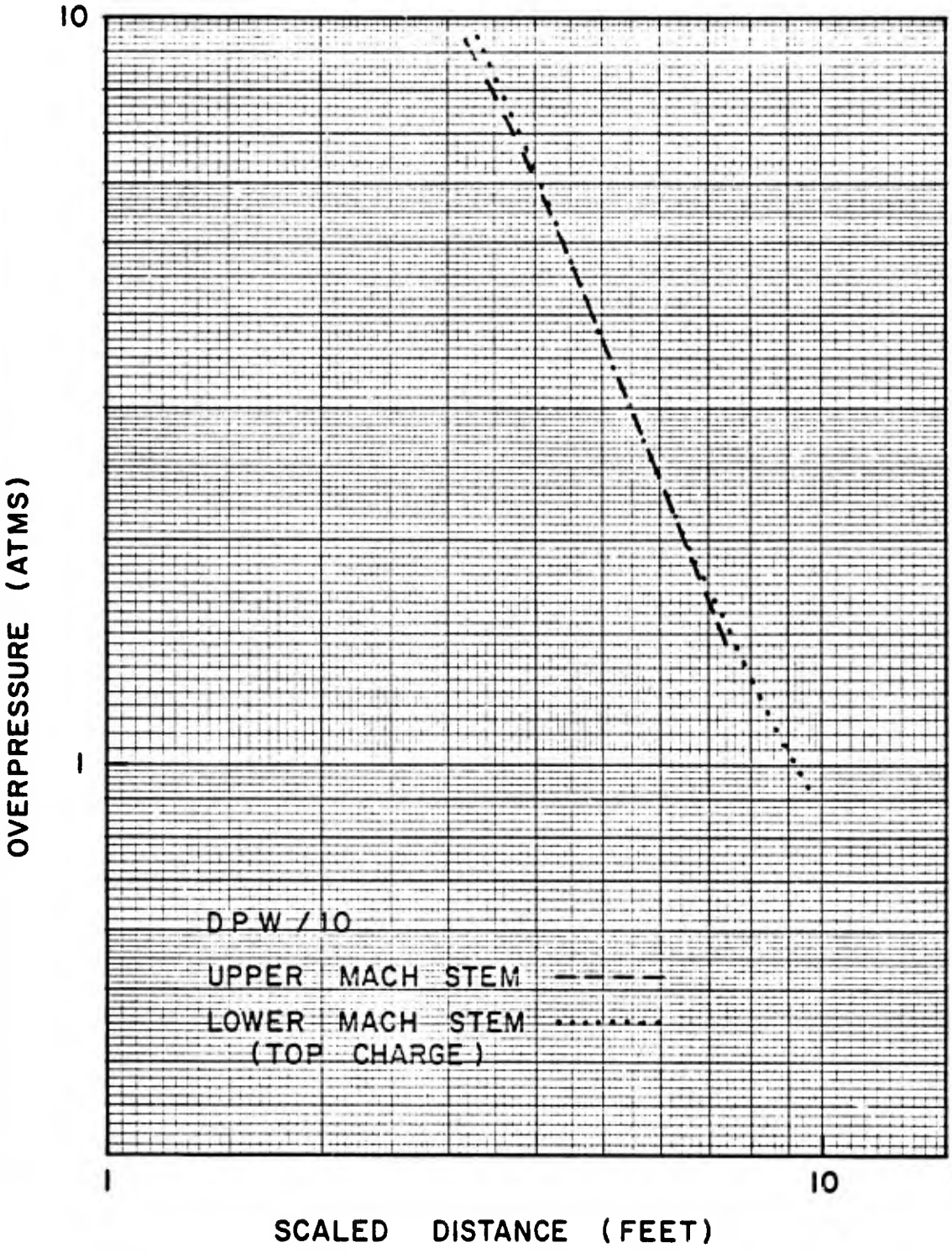


Figure 49. Mach stem overpressures above and below the ideal reflecting plane versus scaled distance—Shot 10.

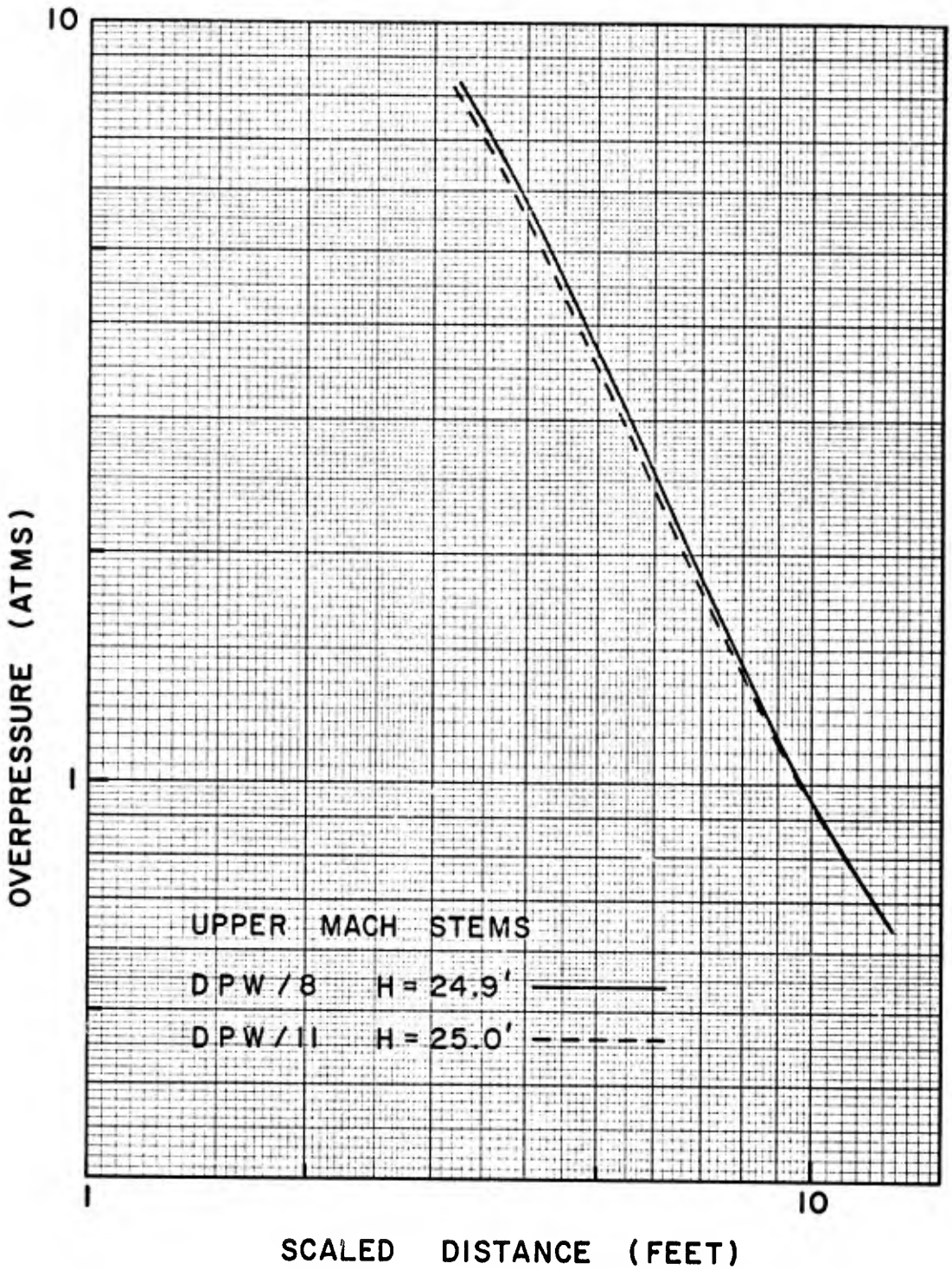


Figure 50. Comparison of upper mach stem overpressures versus scaled distance—Shots 8 and 11.

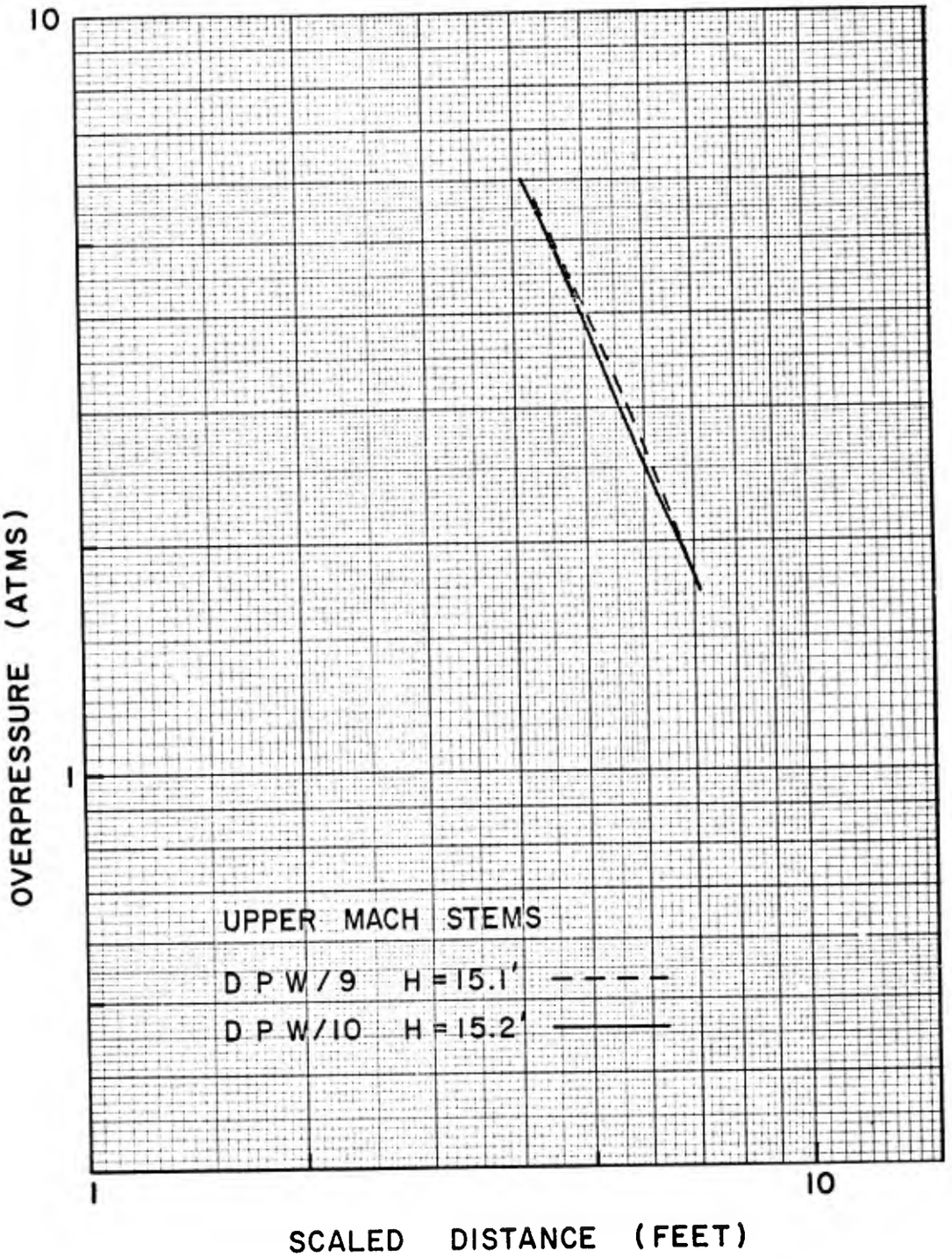


Figure 51. Comparison of upper mach stem overpressures versus scaled distance—Shots 9 and 10.

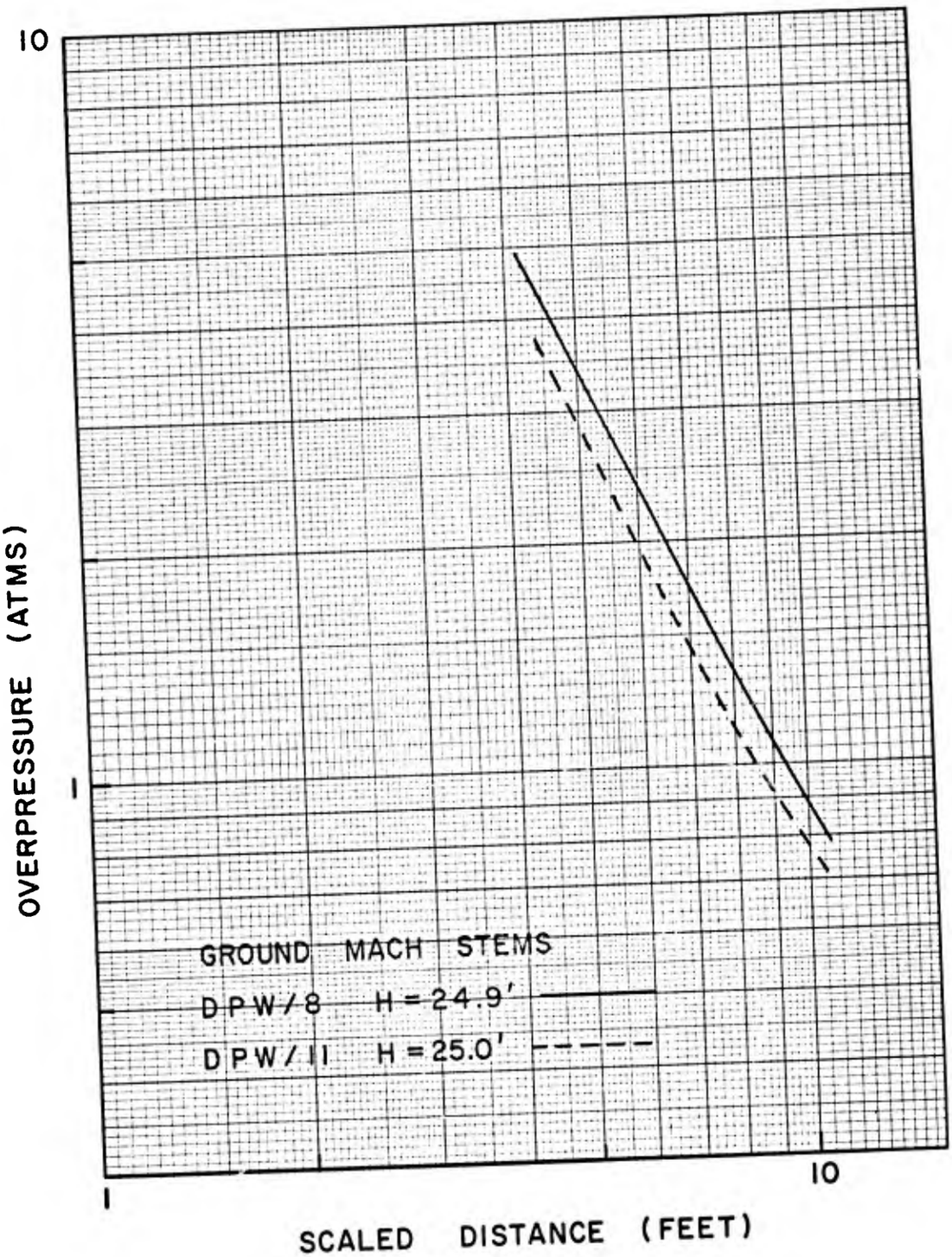


Figure 52. Comparison of ground mach stem overpressures versus scaled distance—Shots 8 and 11.

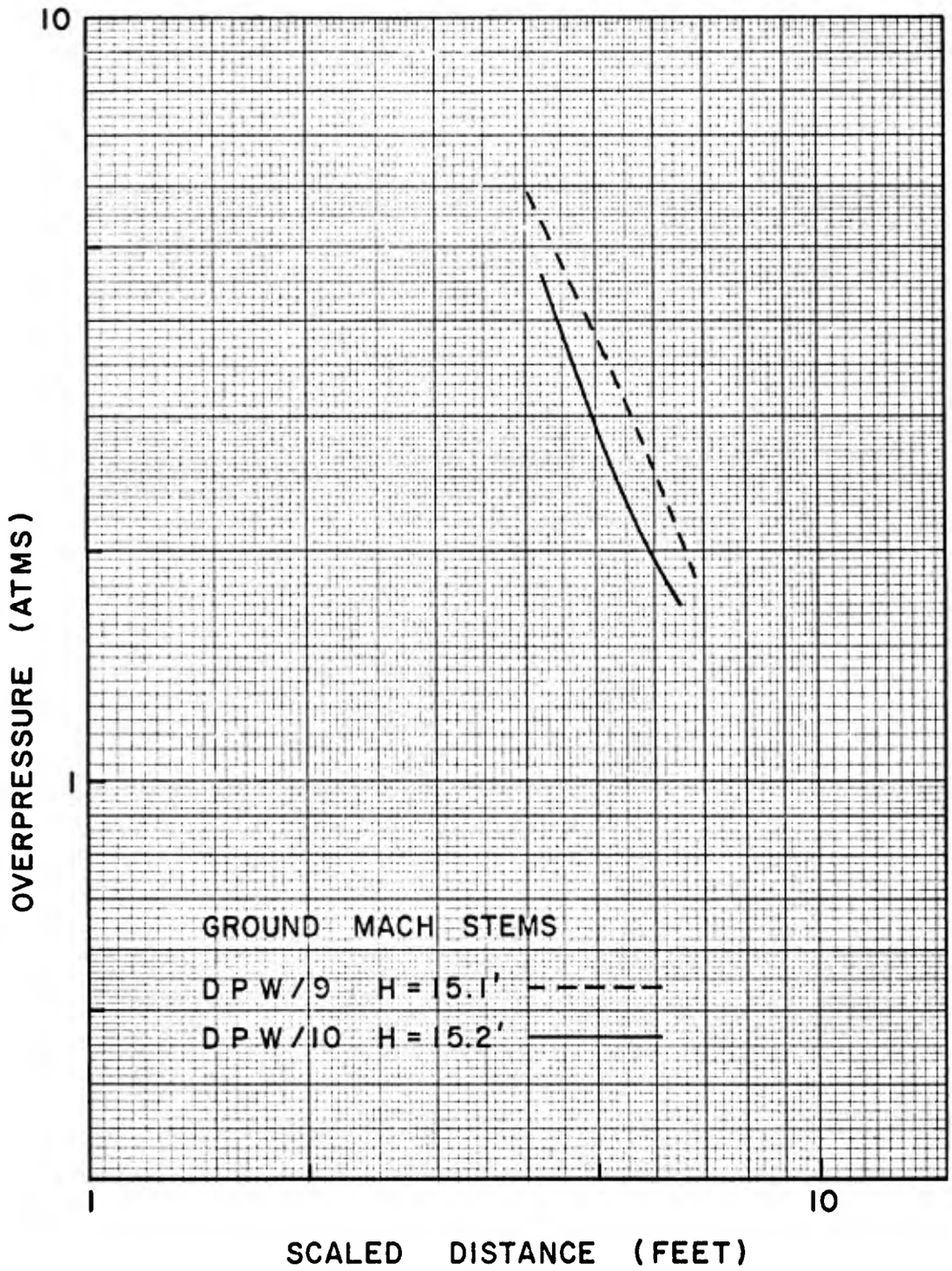


Figure 53. Comparisons of ground mach stem overpressures versus scaled distance—Shots 9 and 10.

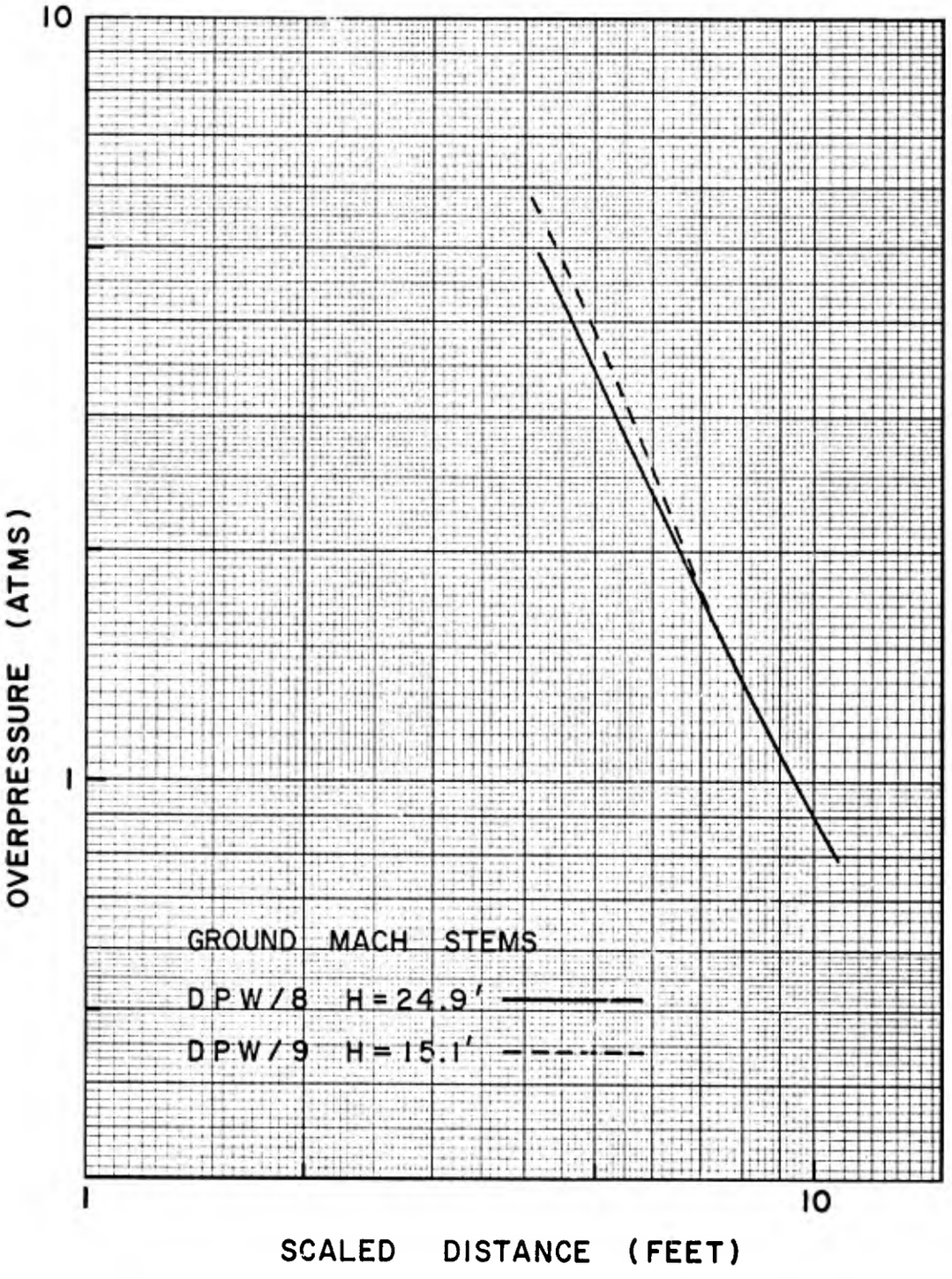


Figure 54. Comparisons of ground mach stem overpressures versus scaled distance—Shots 8 and 9.

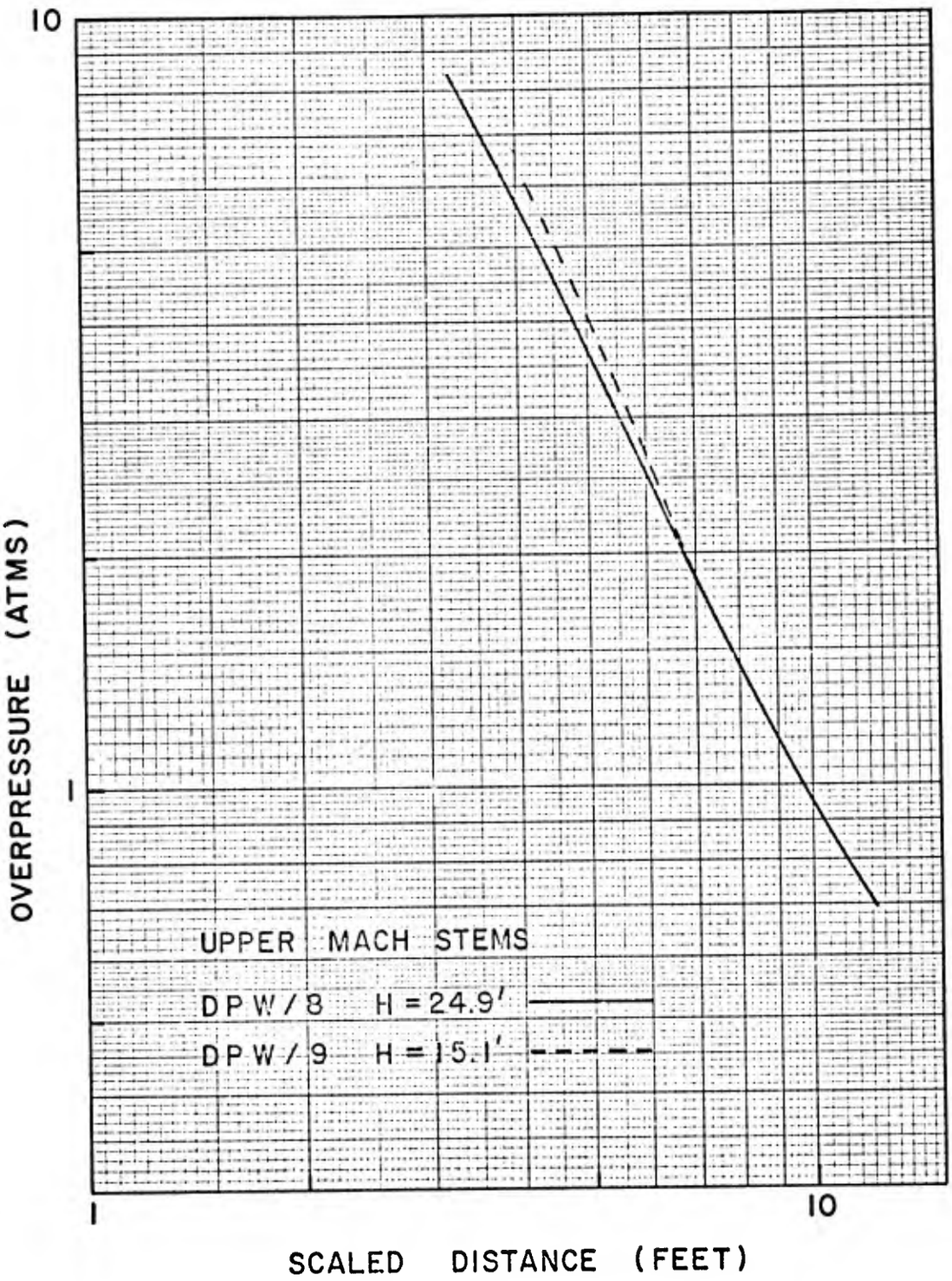


Figure 55. Comparisons of upper mach stem overpressures versus scaled distance—Shots 8 and 9.

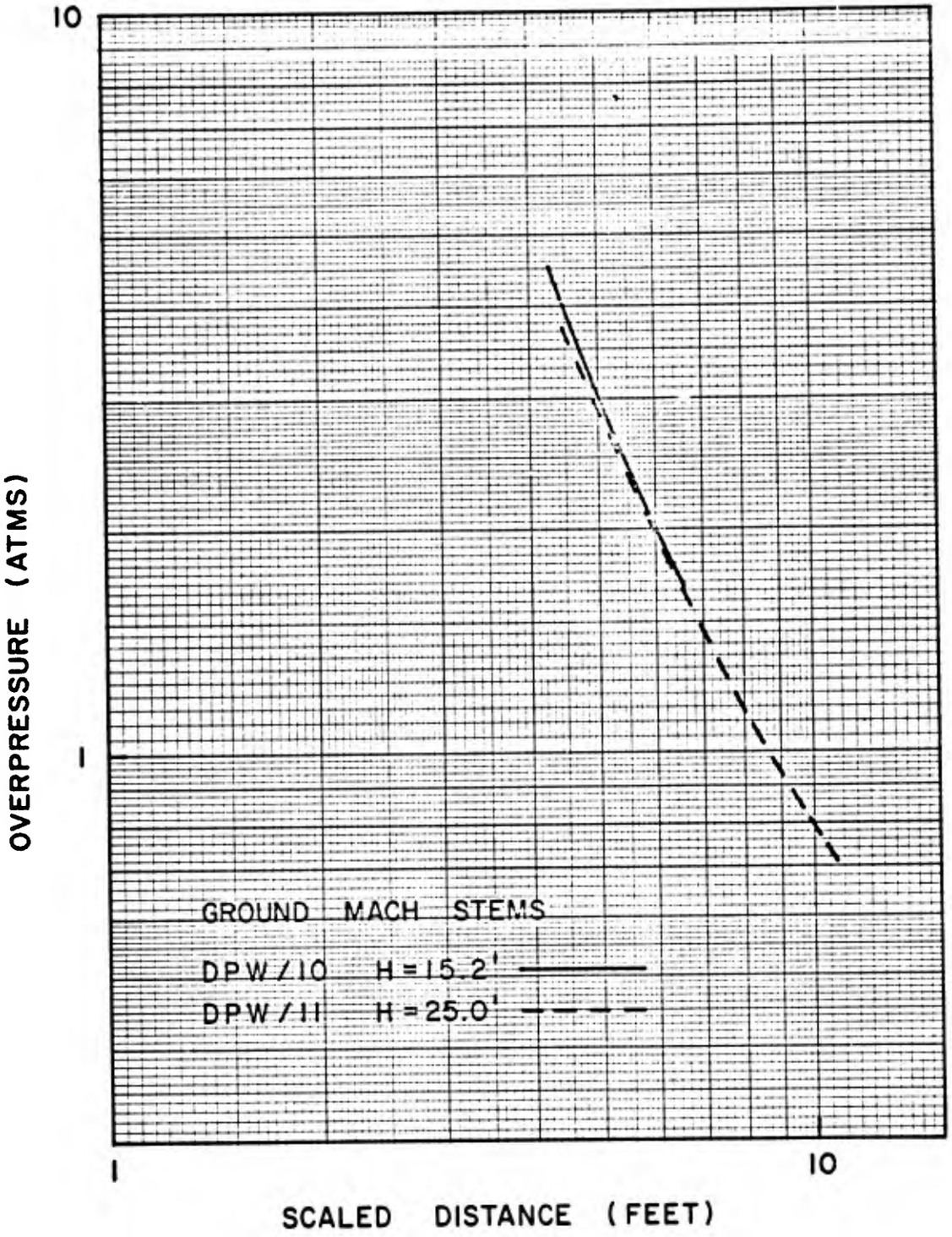


Figure 56. Comparison of ground mach stem overpressures versus scaled distance—Shots 10 and 11.

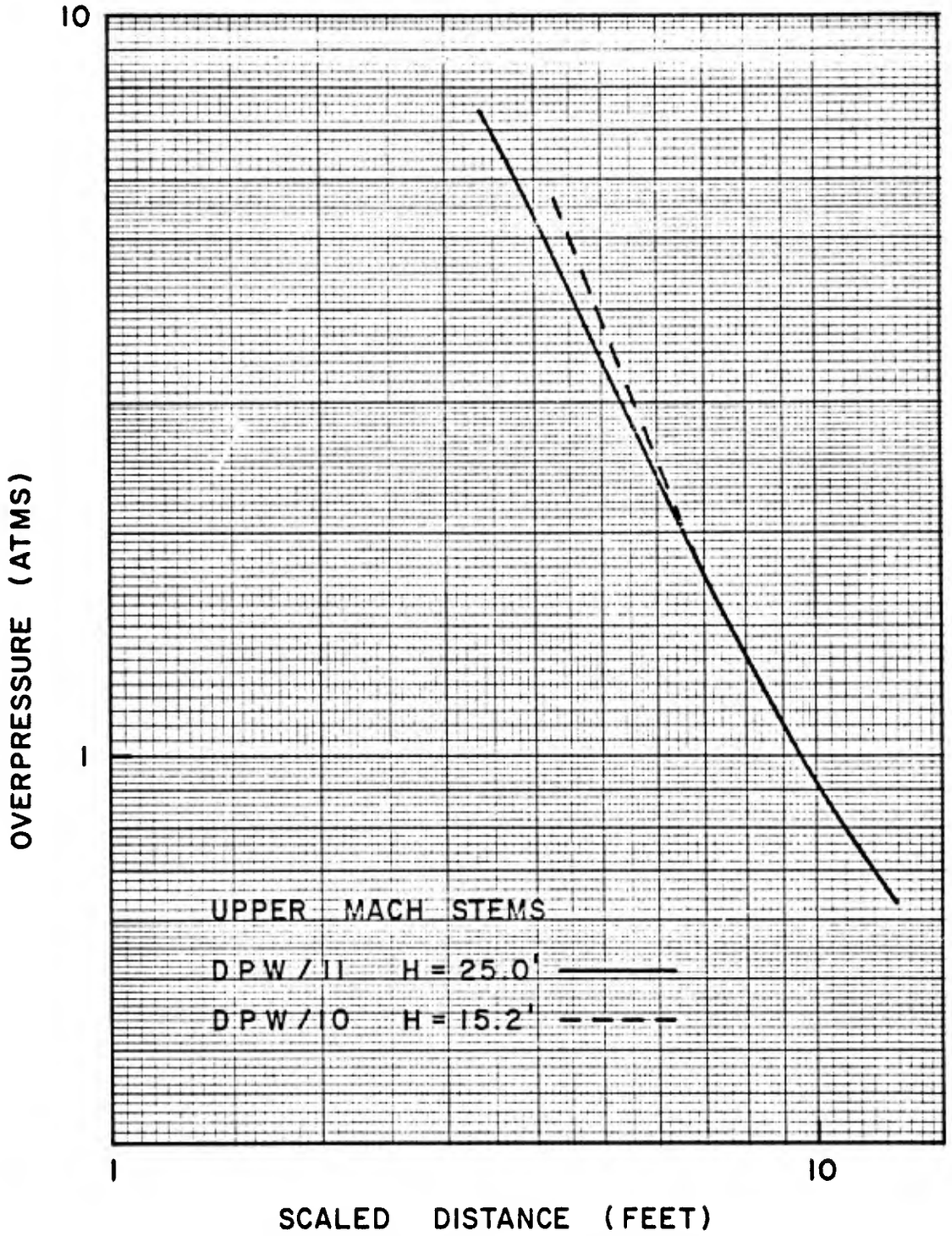


Figure 57. Comparison of upper mach stem overpressures versus scaled distance—Shots 10 and 11.

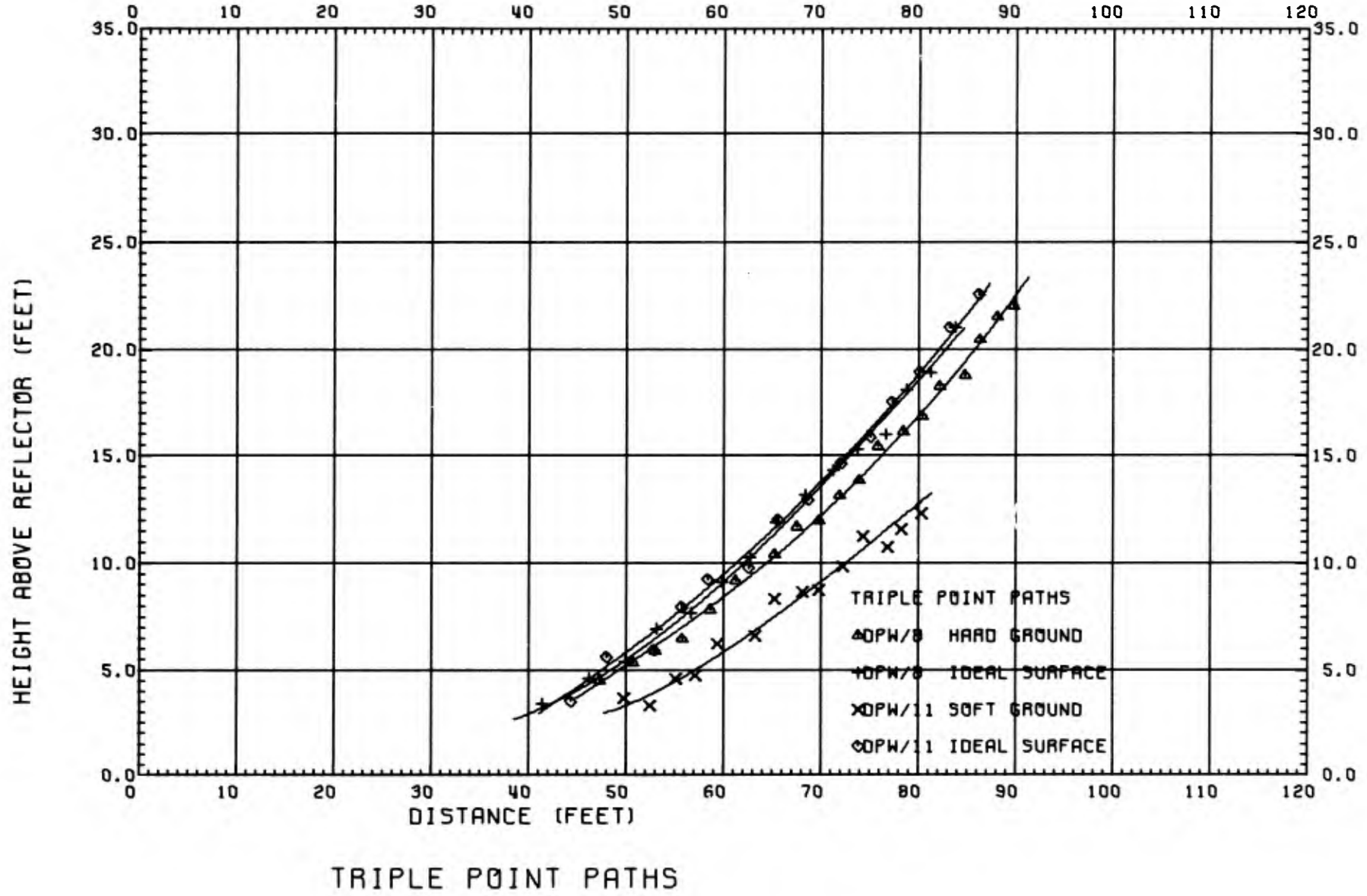
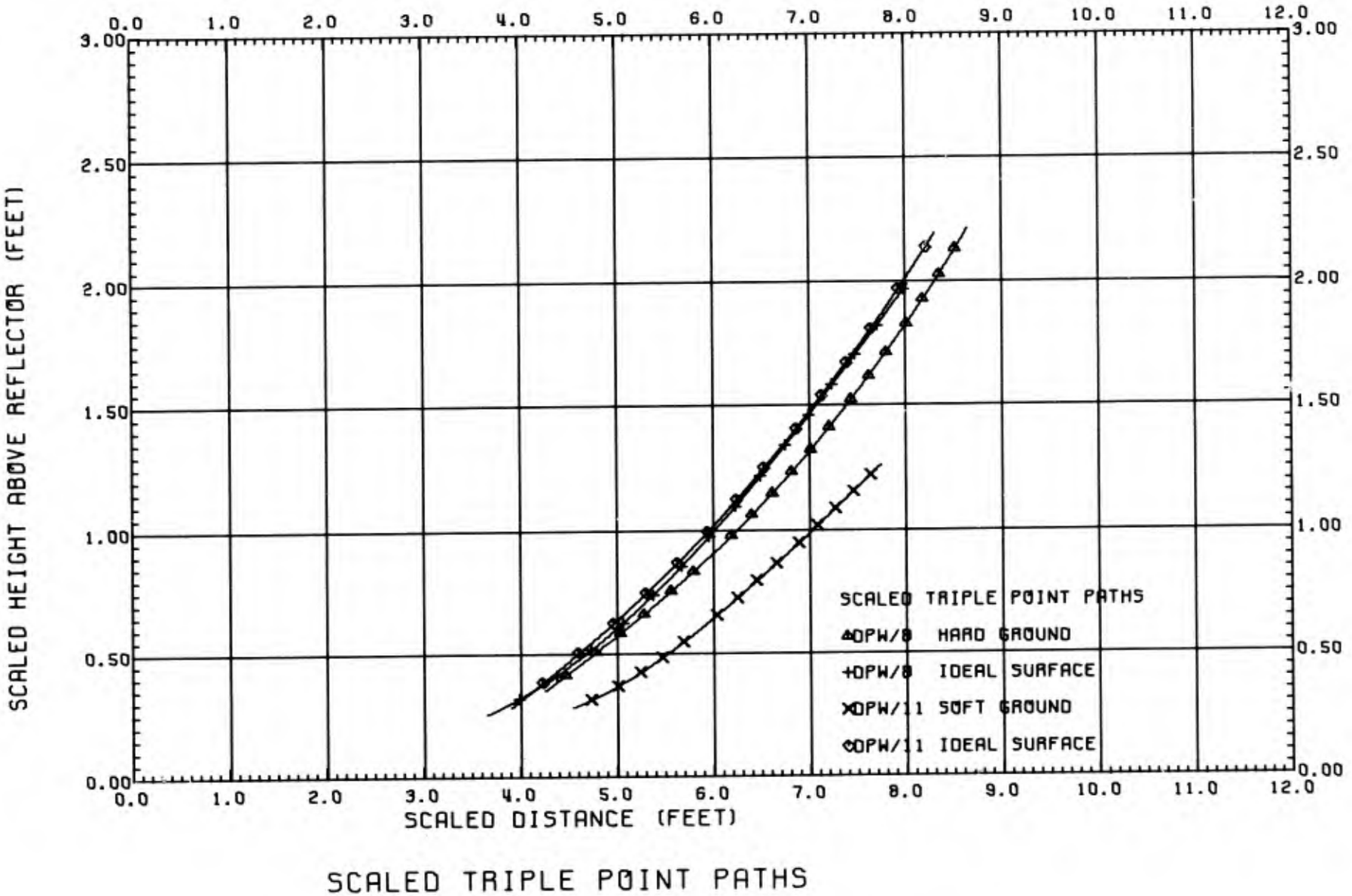


Figure 58. Triple point paths—Shots 8 and 11.



SCALED TRIPLE POINT PATHS

Figure 59. Scaled triple point paths—Shots 8 and 11.

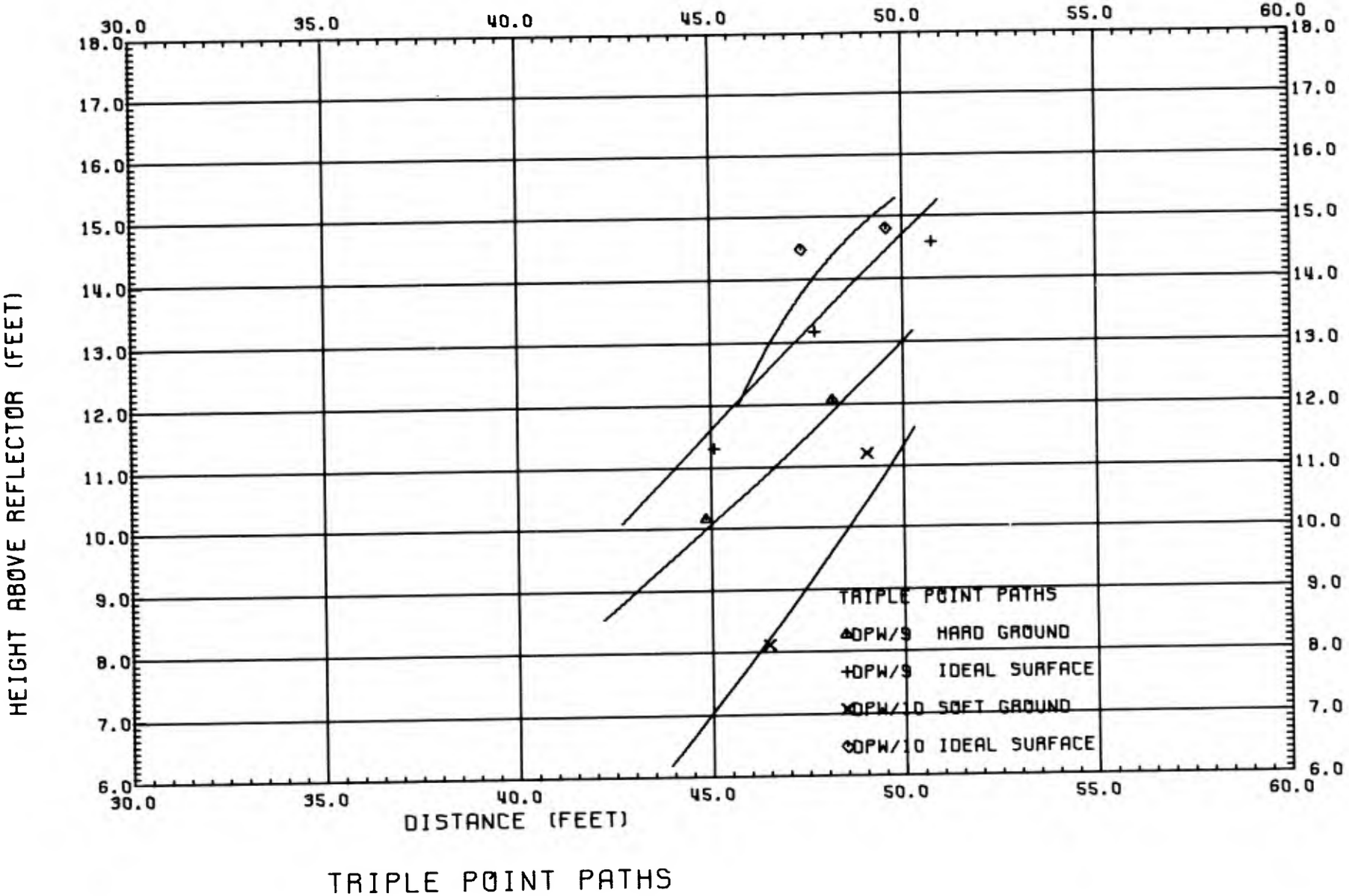
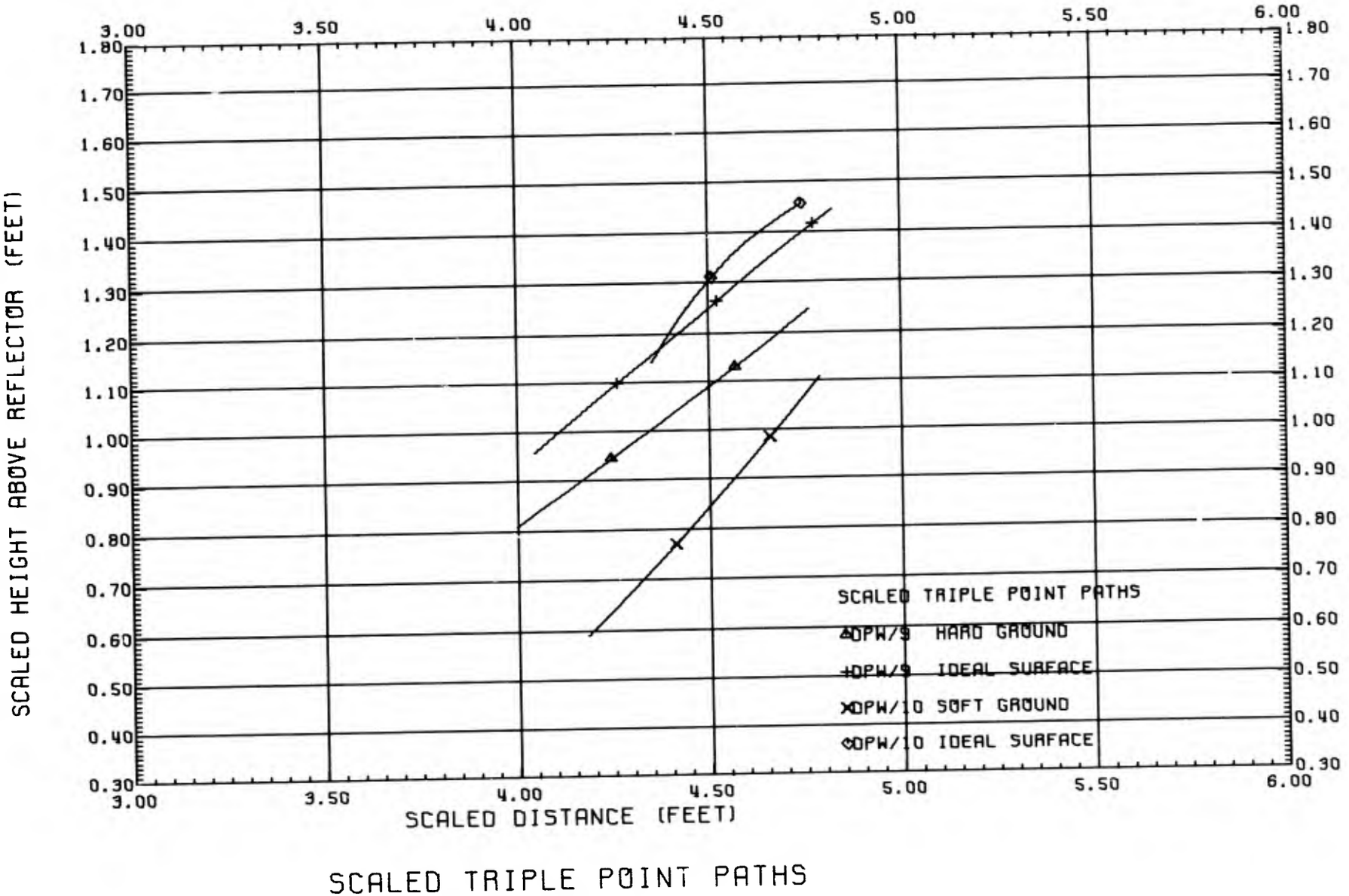


Figure 60. Triple point paths—Shots 9 and 10.



SCALED TRIPLE POINT PATHS

Figure 61. Scaled triple point paths—Shots 9 and 10.

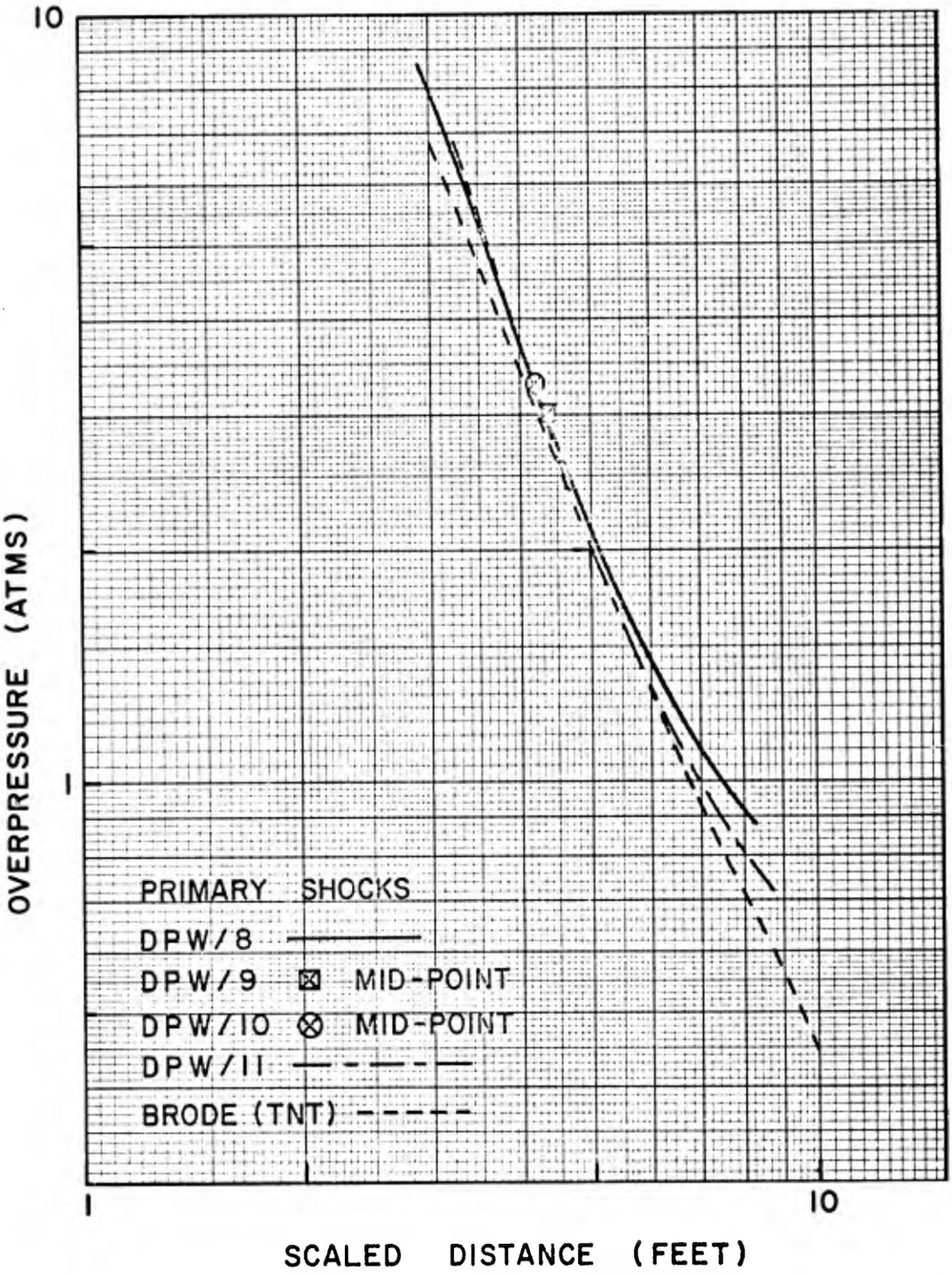


Figure 62. Primary shock overpressures versus scaled distance compared with Brode's results.

Table 1. Calculated camera positions and orientations.

Camera Name	Nominal Elevation (Ft.)	Shot No.	Camera Position* (Ft.)			Camera Orientation (Deg.)	
			East	North	Elevation	Azimuth	Elevation
WF3T	3.	8	-2.3	- 7.9	3.0	6.8	3.2
"	"	9	-2.2	- 9.5	2.5	6.7	3.3
"	"	10	-2.3	- 1.9	3.2	6.7	3.2
"	"	11	-1.8	- 1.9	3.7	6.7	3.2
WF5	30.	10	2.9	-10.0	29.8	9.5	-0.2
WF5	57.	8	1.0	- 9.9	56.8	7.0	-0.5
"	"	11	3.3	- 1.8	56.0	7.9	0.1

* Camera position is measured from main camera position, which has survey coordinates of 1998.289 feet east, 1401.290 feet north, and 2313.750 feet elevation.

Table 2-8. Photomarker and gauge survey data—Shot 8.

SURVEY DATA LIST DPW/8 C.750205

PT. NAME	BEARING	DISTANCE	COORD. E	COORD. N	COORD. H
GRD.ZERO	0. 0. 0	0.0	2000.000	2000.000	2316.320
G.ZERO.B	320.42. 5	0.360	1999.772	2000.279	2316.320
BOT.CRG.	320.42. 5	0.360	1999.772	2000.279	2340.767
TOP.CRG.	337.45. 6	1.187	1999.551	2001.099	2390.629
MCP	180. 2.47	598.713	1998.289	1401.240	2313.750
WFS 267			1999.302	1391.444	2370.614
WFST 209			1999.028	1393.456	2316.745
3-20.1	80.19.35	21.453	2021.153	2003.573	2317.371
3-20.2	80.24.54	21.468	2021.177	2003.525	2318.390
3-20.3	80.23.19	21.466	2021.167	2003.556	2319.393
3-20.4	80.24.14	21.455	2021.157	2003.563	2320.389
1-20.10	84. 7.37	19.875	2019.774	2002.002	2325.369
2-20.10	76.25.18	19.891	2019.339	2004.655	2326.371
1-20.20	84.12.46	19.889	2019.792	2001.966	2336.381
2-20.20	76.24.22	19.886	2019.333	2004.655	2336.397
1-20.25	84. 8.14	19.911	2019.808	2002.022	2341.453
2-20.25	76.23.30	19.898	2019.345	2004.659	2341.394
1-20.40	84. 4.43	19.819	2019.717	2002.003	2356.412
2-20.40	76.11.32	19.818	2019.252	2004.703	2356.344
3-20.46	80.16.54	21.400	2021.101	2003.553	2362.329
1-20.47	83.57.34	19.816	2019.709	2002.056	2363.310
2-20.47	76.13.41	19.802	2019.241	2004.679	2363.321
3-20.48	80.17. 9	21.388	2021.083	2003.601	2364.350
3-20.49	80.15.12	21.395	2021.088	2003.611	2365.329
1-20.50	83.56.22	19.792	2019.683	2002.071	2366.338
2-20.50	76. 9.30	19.798	2019.229	2004.711	2366.310
3-20.51	80.14.58	21.365	2021.065	2003.565	2367.336
3-20.52	80.16.38	21.345	2021.044	2003.570	2368.323
1-20.53	84. 6.13	19.716	2019.613	2002.014	2369.343
3-30.1	71.18.30	32.000	2030.325	2010.215	2317.499
3-30.2	71.18.57	31.890	2030.235	2010.141	2318.500
3-30.3	71.19. 7	31.800	2030.128	2010.177	2319.490
3-30.4	71.19.12	31.740	2030.073	2010.150	2320.479
1-30.10	64.25. 1	29.023	2027.171	2010.202	2326.517
2-30.10	72.36.31	30.777	2029.377	2009.177	2326.461
1-30.20	68.23. 2	30.020	2027.910	2011.056	2336.469
2-30.20	73.31.20	29.937	2028.715	2008.465	2336.442
1-30.25	68.26. 9	30.016	2027.919	2011.021	2341.498
2-30.25	73.34.54	29.909	2028.709	2008.386	2341.453
1-30.40	68.36. 6	30.017	2027.950	2010.944	2356.023
2-30.40	73.48.49	29.936	2028.767	2008.283	2356.232
3-30.46	71.19.34	31.645	2029.994	2010.088	2362.467
1-30.47	68.45. 2	30.016	2027.976	2010.876	2363.505
2-30.47	73.51.22	29.959	2028.785	2008.302	2363.433
3-30.48	71.17.45	31.712	2030.057	2010.110	2364.474
3-30.49	71.23.34	31.628	2029.990	2010.047	2365.466
1-30.50	68.46.45	30.039	2028.023	2010.818	2366.458
2-30.50	73.56.32	29.922	2028.766	2008.236	2366.457
3-30.51	71.27.12	31.617	2029.980	2010.041	2367.435
3-30.52	71.27. 0	31.617	2029.974	2010.058	2368.462
1-30.53	68.44.54	30.042	2028.024	2010.823	2369.425
2-30.53	73.53.32	29.937	2028.773	2008.266	2369.422
3-40.1	84.24.50	41.472	2041.284	2003.947	2317.529
3-40.2	84.23.23	41.462	2041.267	2004.012	2318.535
3-40.3	84.25. 5	41.461	2041.265	2004.024	2319.540
3-40.4	84.27.33	41.477	2041.289	2003.945	2320.524
1-40.10	86.13.23	39.924	2039.840	2002.500	2326.556
2-40.10	82.20.17	39.897	2039.545	2005.290	2326.506
1-40.20	86.12.55	39.836	2039.855	2002.540	2336.533

Table 2-8. (continued)

	2-40.20	82.21.38	39.886	2039.541	2005.237	2336.534
	1-40.25	86. 9.41	39.930	2039.845	2002.602	2341.543
	2-40.25	82.17.13	39.923	2039.565	2005.336	2341.517
	1-40.40	86. 7.39	39.901	2039.814	2002.927	2356.537
	2-40.40	82.15.40	39.924	2039.570	2005.307	2356.499
	3-40.46	84.14.53	41.470	2041.271	2004.061	2362.497
	1-40.47	86. 6.45	39.883	2039.796	2002.628	2363.445
	2-40.47	82. 9.15	39.864	2039.494	2005.415	2363.520
	3-40.48	84.13. 3	41.451	2041.240	2004.171	2364.490
	3-40.49	84.13. 3	41.451	2041.240	2004.171	2369.502
	1-40.50	86. 4.50	39.885	2039.797	2002.639	2369.505
	2-40.50	82.11.37	39.860	2039.499	2005.350	2369.437
	3-40.51	84.12.51	41.432	2041.230	2004.045	2367.473
	3-40.52	84.14. 0	41.411	2041.201	2004.161	2363.480
	1-40.53	86. 2.31	39.845	2039.753	2002.697	2369.433
	2-40.53	82. 9.20	39.835	2039.469	2005.387	2369.517
	3-60.1	77.19.33	61.368	2059.892	2013.378	2317.340
	3-60.2	77.18.41	61.370	2059.895	2013.373	2314.343
	3-60.3	77.19.15	61.349	2059.862	2013.426	2313.353
	3-60.4	77.18. 7	61.347	2059.851	2013.467	2309.371
	1-60.10	78.26.54	59.719	2058.537	2011.821	2329.403
	2-60.10	75.51.18	59.859	2058.055	2014.583	2326.375
	1-60.20	78.27.22	59.729	2058.532	2011.897	2335.414
	2-60.20	75.53.57	59.788	2058.022	2014.422	2330.401
	1-60.25	78.27.37	59.703	2058.515	2011.949	2341.353
	2-60.25	75.53.12	59.791	2057.994	2014.549	2341.374
	1-60.40	78.23.39	59.706	2058.506	2011.912	2356.375
	2-60.40	75.48.35	59.846	2058.044	2014.533	2356.383
	3-60.46	77.13.11	61.348	2059.834	2013.342	2362.433
	1-60.47	78.22.45	59.704	2058.504	2011.912	2367.317
	2-60.47	75.46.28	59.809	2057.993	2014.626	2363.339
	3-60.48	77.10.59	61.342	2059.849	2013.254	2364.315
	3-60.49	77.11. 3	61.303	2059.778	2013.290	2365.304
	1-60.50	78.20.47	59.663	2058.458	2011.932	2366.313
	2-60.50	75.45.13	59.810	2057.979	2014.696	2366.340
	3-60.51	77.10.12	61.305	2059.781	2013.582	2367.301
	3-60.52	77. 9.59	61.304	2059.807	2013.463	2368.330
	1-60.53	78.17.17	59.641	2058.408	2012.063	2369.352
	2-60.53	75.44. 7	59.794	2057.955	2014.716	2369.334
	II10.0N	350. 0. 9	9.960	1998.271	2009.320	2316.210
	II25.0N	350. 0.15	25.920	1995.517	2025.529	2316.320
	II50.0N	349.59.20	49.940	1991.361	2040.187	2315.410
	II82H.0N	350. 0. 5	82.490	1985.695	2061.240	2314.540
	II10.0W	0. 0. 0	10.000	2000.000	2010.000	2316.320
	II10.0S	170. 0.30	10.000	2001.722	1990.149	2316.380
	II25.0S	170. 0.41	25.080	2004.306	1975.292	2316.410
	II50.0S	170. 0.17	50.000	2008.642	1950.752	2316.410
	II82H.0S	170. 0.23	82.480	2014.232	1918.757	2315.740
	II10.0E	80. 0. 3	9.950	2009.799	2001.726	2316.320
	I20.0	108.54.14	20.100	2019.012	1993.476	2316.540
	I20.3	108.54.14	20.340	2019.239	1993.393	2319.410
	III20.3	0. 0. 0	20.150	2000.000	2020.150	2319.410
	I30.0	99.15.25	29.950	2029.554	1995.150	2316.410
	I30.3	99.15.25	30.100	2029.703	1995.125	2319.330
	III30.3	0. 0. 0	30.150	2000.000	2030.150	2319.430
	I40.0	65.43.46	39.980	2036.479	2016.360	2316.430
	I40.3	65.43.46	40.090	2036.580	2016.405	2319.340
	III40.3	0. 0. 0	40.110	2000.000	2040.110	2319.360
	I60.0	89.35.17	60.040	2060.039	2000.387	2319.380
	I60.3	89.35.17	60.280	2060.279	2000.348	2319.330
	III60.3	0. 0. 0	60.150	2000.000	2040.150	2319.280
	II90.0	80. 0. 0	90.020	2086.652	2015.632	2316.640
	II150.0	80. 0. 0	149.890	2147.613	2020.023	2315.330
	II400.0	80. 0. 0	399.940	2393.864	2060.443	2314.590

Table 2-8. (continued)

W 1	257.20.55	35.586	1965.259	1992.239	2418.150
W 2	260.21.43	70.394	1930.578	1988.344	2418.070
W 3	261.29.48	105.189	1895.935	1984.663	2317.350
E 1	94.54.38	39.607	2039.456	1996.544	2318.470
E 2	96.50.18	58.206	2057.786	1993.024	2318.240
E 3	99.32.46	99.795	2098.380	1983.252	2317.910
300-1	175.27.50	305.220	2023.476	1695.694	2313.120
300-2	172.47.59	309.388	2037.099	1692.353	2313.030
300-3	170. 9.15	314.160	2053.518	1690.432	2313.070
VP 1A	333.24.43	106.193	1952.648	2095.052	2348.923
VP 1B	333.24.40	106.422	1952.533	2095.250	2348.752
VP 2A	317.56.24	121.905	1918.429	2090.592	2348.540
VP 2B	317.48.50	122.407	1917.996	2090.979	2348.505
VP 3A	305.18.51	149.196	1878.448	2086.514	2348.176
VP 3B	305.12.35	149.142	1878.275	2086.176	2348.240
300 W1	184.39.57	314.780	1979.184	1689.902	2330.770
300 W2	187.40.48	320.020	1956.589	1682.941	2330.280
BME 1	10. 0.11	393.550	2068.546	2387.534	2367.030
BME 2	17.12. 7	396.900	2117.495	2379.110	2366.770
BME 3	24. 2. 0	405.750	2165.249	2370.575	2366.390

BEARING IN DEGREES, MINUTES, AND SECONDS, AND DISTANCE IN FEET
BEARING AND DISTANCE FROM GRD.ZERO UNLESS NOTED OTHERWISE
COORDINATES EAST AND NORTH AND ELEVATION IN FEET

TOTAL NUMBER OF SURVEYED POINTS IS 143

CALCULATED DISTANCE BETWEEN BOT.CRG. AND G.ZERO.B IS 24.447 FEET
CALCULATED DISTANCE BETWEEN BOT.CRG. AND TOP.CRG. IS 49.863 FEET

Table 3-8-WF3T(3). Film calibration data transformed to the object plane—Shot 8, WF3T at 3 feet.

PHOTOGRAMMETRICS DPW/8 ST #F3T 209.M03 C.750205

CAMERA (LENS) POSITION IS 1996.028 FEET EAST, 1393.456 FEET NORTH, AND 2316.746 FEET ELEVATION
OPTICAL AXIS IS ORIENTED TO 6.773 DEGREES EAST OF NORTH AND 3.222 DEGREES ELEVATION (±0.001)
OBJECT PLANE IS 601.802 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GRD.ZERO

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y	
1-20.10	-48.074	-24.305	0.313	-0.011	
1-20.20	-47.898	-14.338	0.175	-0.048	
1-20.25	-47.820	-9.351	0.126	-0.013	
1-20.40	-47.729	5.380	0.007	0.044	
1-20.47	-47.667	12.179	-0.026	0.046	
1-20.50	-47.693	15.185	-0.008	0.023	
1-20.53	-47.748	18.174	-0.000	0.000	REFERENCE POINT P1
1-30.10	-40.103	-24.517	-0.730	0.206	
1-30.20	-40.050	-14.552	-0.088	-0.069	
1-30.25	-39.921	-9.699	-0.194	-0.023	
1-30.40	-39.797	4.873	-0.235	-0.452	
1-30.47	-39.729	11.635	-0.241	0.055	
1-30.50	-39.772	14.580	-0.134	-0.022	
1-30.53	-39.771	17.441	-0.118	-0.004	
1-40.10	-28.042	-24.139	0.098	-0.038	
1-40.20	-27.866	-14.240	-0.048	-0.031	
1-40.25	-27.823	-9.333	-0.097	-0.060	
1-40.40	-27.719	5.324	-0.197	0.031	
1-40.47	-27.718	12.073	-0.193	0.104	
1-40.50	-27.700	15.007	-0.201	0.130	
1-40.53	-27.730	17.928	-0.206	0.129	
1-60.10	-10.509	-24.501	0.001	-0.001	REFERENCE POINT P2
1-60.20	-10.404	-14.756	-0.112	-0.045	
1-60.25	-10.427	-10.040	-0.099	0.024	
1-60.40	-10.405	4.353	-0.123	0.090	
1-60.47	-10.395	11.041	-0.137	0.126	
1-60.50	-10.494	13.894	-0.070	0.161	
1-60.53	-10.580	16.833	-0.040	0.137	
E 1	-27.960	-32.180	0.063	0.027	
E 3	32.422	-32.624	-0.124	-0.077	
300-1	-15.481	-39.275	-1.155	-1.922	
300-2	14.589	-39.578	-1.957	-1.723	
300-3	45.077	-39.563	-1.063	-1.674	
RME 1	-26.350	-3.735	-0.948	0.243	
RME 2	2.041	-3.562	0.008	0.010	
RME 3	32.038	-3.433	0.012	0.100	
AVERAGES			-0.215	-0.123	

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE
SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

SMEAR = 0.024 FEET, MAX. CALIBRATION ERROR SCALED
SHAKE = 0.011 FEET, MAX. CAMERA ORIENTATION ERROR

TOTAL = ±0.035 FEET, MEASURED IN THE OBJECT PLANE.

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS 1-60.40 AND E 3

Table 3-8-WF5(57). Film calibration data transformed to the object plane—Shot 8, WF5 at 57 feet.

PHOTOGRAMMETRICS DPW/8 ST WF5 267.M57 C.750205

CAMERA (LENS) POSITION IS 1999.302 FEET EAST, 1391.444 FEET NORTH, AND 2370.614 FEET ELEVATION
OPTICAL AXIS IS ORIENTED TO 6.978 DEGREES EAST OF NORTH AND -0.487 DEGREES ELEVATION (±0.001)
OBJECT PLANE IS 604.573 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GRD.ZERO

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y	
1-20.25	-53.555	-23.995	0.150	0.171	
1-20.40	-53.549	-8.976	0.006	0.005	
1-20.47	-53.503	-2.103	-0.060	-0.016	
1-20.50	-53.642	0.885	0.051	0.004	
1-20.53	-53.661	3.874	-0.000	0.0	REFERENCE POINT P1
1-30.25	-45.754	-23.397	-0.003	0.072	
1-30.40	-45.733	-8.780	-0.028	-0.346	
1-30.47	-45.720	-1.874	-0.022	0.060	
1-30.50	-45.680	1.021	-0.016	0.052	
1-30.53	-45.711	3.953	0.015	0.023	
1-40.25	-33.594	-23.660	0.010	0.068	
1-40.40	-33.640	-8.672	0.004	-0.105	
1-40.47	-33.611	-1.708	-0.048	-0.201	
1-40.50	-33.601	1.220	-0.060	-0.145	
1-40.53	-33.667	4.076	-0.041	-0.051	
1-60.25	-16.083	-23.242	-0.000	0.002	REFERENCE POINT P2
1-60.40	-15.993	-8.586	-0.119	-0.130	
1-60.47	-16.070	-1.727	-0.047	-0.220	
1-60.50	-16.112	1.138	-0.052	-0.174	
1-60.53	-16.195	3.998	-0.029	-0.086	
BME 1	-30.995	2.445	-0.700	0.501	
BME 2	-1.621	2.802	0.002	-0.002	
BME 3	27.896	3.046	-0.000	-0.119	
AVERAGES			-0.043	-0.028	

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE
SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

SMEAR = 0.017 FEET, MAX. CALIBRATION ERROR SCALED
SHAKE = 0.011 FEET, MAX. CAMERA ORIENTATION ERROR
TOTAL = ±0.027 FEET, MEASURED IN THE OBJECT PLANE.

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS 1-40.47 AND 1-60.40

Table 4a. Film speeds—WF5 (Serial 267) Shots 8, 9, 10 and 11.

Dipole West
Film Timing Data

Film Speeds (fps)

Camera: WF5 (Ser. 267)
Frame length: .94625 cm

Event	Frame No.				Actual Zero
	-31	69	169	269	(cm)
DPW/7 - 57'	3244.±2.	3314.	3384.	3443.	4.70
DPW/8 - 57'	3139.	3215.	3289.	3361.	4.20
DPW/9 - 30'	No timing marks				
DPW/10- 30'	2769.	2830.	2885.	2938.	3.91
DPW/11- 57'	2657.	2724.	2773.	2828.	4.60

Static Zero: 3.80 (cm)

Table 4b. Film speeds—WF3T (Serial 218) Shots 8, 9, 10 and 11.

Dipole West
Film Timing Data

Film Speeds (fps)

Camera: WF3T ELEVATED (SER. 218)
Frame Length: .7585 cm

Event	Frame No.				Actual Zero
	-31	69	169	269	(cm)
DPW/7 - 57'	3960.±2.	4013.	4071.	4124.	3.64
DPW/8 - 57'	3947.	4005.	4058.	4111.	4.16
DPW/9 - 30'	3713.	3784.	3850.	3916.	3.35**
DPW/10- 30'	NO RECORD				
DPW/11- 57'	3296.	3375.	3441.	3512.	4.42

Static Zero: 3.35 (cm)

**No zero timing mark. Frame 0 given time 0.000 msec.

Table 4c. Film speeds—WF3T (Serial 209) Shots 8, 9, 10 and 11.

Dipole West
Film Timing Data

Film Speeds (fps)

Camera: WF3T Ground Level (Ser. 209)
Frame length: .7585 cm

Event	Frame No.				Actual Zero
	-31	69	169	269	(cm)
DPW/7 - 3'	3974.±2.	4029.	4079.	4134.	4.18
DPW/8 - 3'	3987.	4042.	4098.	4150.	3.44
DPW/9 - 3'*	3939.	3997.	4045.	4095.	3.38**
DPW/10- 3'	3916.	3968.	4018.	4066.	4.40
DPW/11- 3'	3837.	3895.	3953.	4005.	4.34

Static Zero: 3.38 (cm)

* The film periodically jumped off the camera sprockets resulting in an irregular increase of the framing rate between timed points. In addition sequences of frames were thrown out of focus.

** No zero timing mark. Frame 0 given time 0.000 msec.

Table 4-8-WF3T(3). Film timing data—Shot 8, WF3T at 3 feet.

FILM TIMING DATA DPW/8 ST WF5 267.M57 C.750205

STATIC ZERO = 3.80 CM
ACTUAL ZERO = 4.20 CM

FRAME LENGTH= 0.94625 CM

FRAME NO.	5-MSEC DISTANCE	FILM SPEED
-31	14.65 CM	3139./SEC
069	15.21 CM	3215./SEC
169	15.56 CM	3289./SEC
269	15.90 CM	3361./SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA
OTHER LENGTHS ARE FROM FILM MEASURMENT

Table 4-8-WF5(57). Film timing data—Shot 8, WF5 at 57 feet.

FILM TIMING DATA DPW/8 ST WF3T 209.M03 C.750205

STATIC ZERO = 3.38 CM
ACTUAL ZERO = 3.44 CM

FRAME LENGTH= 0.75850 CM

FRAME NO.	5-MSEC DISTANCE	FILM SPEED
-31	15.12 CM	3987./SEC
069	15.33 CM	4042./SEC
169	15.54 CM	4098./SEC
269	15.74 CM	4150./SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA
OTHER LENGTHS ARE FROM FILM MEASURMENT

Table 5-8. Meteorological observations—Shot 8.

DPW/8

Date: 17 September 1973

Time: 1700 MDT

Observer: WHB

Standard Meteorological Observations:

At control bunker.
22 meter wind data at Photo tower.

Wind Data:	22 Meters	2 Meters
Direction	150°	150°
Speed	6.5 mph	2.5 mph

Temperatures (°F):

Air temperature	67.5°F
Surface temperature	82.5°F
Temperature gradient (4-½ M)	--
Relative humidity	31%

Pressure: 13.521 psi

Sky Condition:

Clouds 4/10 Ci

Sun Bright through zero

Table 6-8-WF3T(3)a. Shock trajectory analysis—primary front, bottom charge—Shot 8.

SHOCK FRONT DATA DPW/8 ST WF3T 209.M03 PRIMARY FRONT, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 67.5 F
AMBIENT PRESSURE = 13.52 PSI
RELATIVE HUMIDITY = 31.0 %
VAPOUR PRESSURE= 5.335 MM HG

AMBIENT SPEED OF SOUND = 1.1274 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5488
CHARGE HEIGHT= 24.45 FEET
SEPARATION #2= 24.93 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	F A/F NO.
5.008	31.221	30.992	-0.229	0.535	2.938	2.768	7.769	105.043	2.005	3.620	20
5.257	31.511	31.759	0.248	0.562	3.011	2.698	7.323	99.012	1.939	3.555	21
5.506	32.560	32.507	-0.053	0.588	3.082	2.633	6.920	93.571	1.878	3.496	22
5.755	33.434	33.238	-0.196	0.615	3.151	2.573	6.555	88.633	1.820	3.439	23
6.253	34.365	34.651	0.286	0.668	3.285	2.465	5.921	80.055	1.716	3.291	25
6.501	34.871	35.335	0.464	0.695	3.350	2.416	5.643	76.301	1.668	3.232	26
6.750	35.175	36.007	-0.168	0.721	3.413	2.370	5.389	72.850	1.624	3.176	27
6.999	36.693	36.665	-0.027	0.748	3.476	2.327	5.153	69.669	1.581	3.120	28
7.248	37.190	37.312	0.122	0.775	3.537	2.287	4.935	66.729	1.541	3.068	29
7.497	38.019	37.948	-0.071	0.801	3.597	2.249	4.734	64.004	1.504	3.017	30
7.745	38.421	38.574	0.153	0.828	3.657	2.213	4.547	61.473	1.468	2.968	31
7.994	39.290	39.189	-0.101	0.854	3.715	2.179	4.372	59.117	1.433	2.922	32
8.243	39.829	39.795	-0.034	0.881	3.773	2.147	4.210	56.919	1.401	2.878	33
8.491	40.657	40.393	-0.265	0.908	3.829	2.116	4.058	54.864	1.370	2.835	34
8.740	41.330	40.932	-0.348	0.934	3.885	2.087	3.915	52.940	1.340	2.794	35
8.989	41.698	41.563	-0.136	0.961	3.940	2.060	3.782	51.135	1.312	2.754	36
9.237	42.134	42.136	0.002	0.987	3.994	2.033	3.656	49.438	1.285	2.716	37
9.485	43.543	42.702	0.159	1.014	4.048	2.008	3.538	47.841	1.259	2.679	38
9.734	43.261	43.261	0.016	1.040	4.101	1.984	3.427	46.335	1.234	2.643	39
9.982	43.846	43.813	-0.033	1.067	4.153	1.962	3.322	44.915	1.210	2.609	40
10.230	44.528	44.359	-0.169	1.093	4.205	1.940	3.223	43.572	1.187	2.576	41
10.479	44.823	44.899	0.076	1.120	4.256	1.919	3.129	42.301	1.165	2.544	42
10.727	45.551	45.434	-0.117	1.146	4.307	1.899	3.039	41.096	1.143	2.514	43
10.975	46.097	45.962	-0.135	1.173	4.357	1.880	2.955	39.953	1.123	2.484	44
11.223	46.640	46.486	-0.154	1.200	4.407	1.861	2.875	38.867	1.103	2.456	45
11.472	47.205	47.004	-0.201	1.226	4.456	1.844	2.798	37.835	1.084	2.428	46
11.720	47.418	47.517	0.100	1.253	4.505	1.827	2.726	36.852	1.066	2.401	47
11.968	48.166	48.026	-0.140	1.279	4.553	1.810	2.656	35.915	1.048	2.375	48
12.216	48.312	48.530	0.218	1.306	4.601	1.795	2.590	35.022	1.031	2.350	49
12.464	49.422	49.030	-0.392	1.332	4.648	1.779	2.527	34.169	1.015	2.326	50
12.712	49.547	49.525	-0.022	1.359	4.695	1.765	2.467	33.354	0.998	2.303	51
12.960	50.038	50.017	-0.021	1.385	4.741	1.751	2.409	32.575	0.983	2.280	52
13.209	50.226	50.504	0.279	1.412	4.788	1.737	2.354	31.829	0.968	2.258	53
13.456	51.066	50.988	-0.078	1.438	4.834	1.724	2.301	31.115	0.953	2.237	54
13.704	51.414	51.469	0.054	1.465	4.879	1.711	2.251	30.430	0.939	2.216	55
13.951	52.012	51.944	-0.067	1.491	4.924	1.699	2.202	29.773	0.926	2.197	56
14.199	52.433	52.417	-0.015	1.518	4.969	1.687	2.155	29.142	0.912	2.177	57
14.447	52.801	52.887	0.086	1.544	5.014	1.676	2.111	28.536	0.900	2.159	58
14.695	53.363	53.354	-0.009	1.571	5.058	1.665	2.067	27.953	0.887	2.140	59
14.942	53.531	53.817	0.286	1.597	5.102	1.654	2.026	27.393	0.875	2.122	60
15.190	54.274	54.278	0.004	1.623	5.145	1.644	1.986	26.854	0.863	2.105	61
15.438	54.739	54.735	0.338	1.650	5.189	1.634	1.948	26.334	0.850	2.088	62

Table 6-8-WF3T(3)a. (continued)

15.585	54.876	55.190	0.314	1.676	5.232	1.524	1.911	25.333	0.540	2.372	63
15.933	55.315	55.642	0.327	1.703	5.275	1.515	1.875	25.351	0.829	2.056	64
16.180	55.933	56.091	0.108	1.729	5.317	1.606	1.849	24.395	0.819	2.241	65
16.429	56.500	56.538	0.038	1.756	5.360	1.597	1.807	24.435	0.809	2.020	66
16.675	56.766	56.982	0.217	1.782	5.402	1.588	1.775	24.001	0.799	2.011	67
16.923	57.338	57.424	0.086	1.809	5.444	1.540	1.744	23.591	0.789	1.997	68
17.170	57.760	57.863	0.103	1.835	5.485	1.571	1.714	23.176	0.779	1.954	69
17.418	58.239	58.300	0.002	1.862	5.527	1.553	1.685	22.783	0.770	1.970	70
17.665	58.783	58.735	-0.048	1.888	5.568	1.556	1.657	22.404	0.761	1.957	71
17.912	58.921	59.168	0.247	1.914	5.609	1.548	1.630	22.035	0.752	1.944	72
18.159	59.309	59.598	0.289	1.941	5.650	1.541	1.603	21.680	0.743	1.933	73
18.407	59.942	60.027	0.084	1.967	5.690	1.534	1.578	21.335	0.735	1.920	74
18.654	60.453	60.453	0.000	1.994	5.731	1.527	1.553	21.001	0.727	1.908	75
18.901	61.014	60.878	-0.137	2.020	5.771	1.520	1.529	20.676	0.719	1.898	76
19.148	61.350	61.300	-0.050	2.046	5.811	1.514	1.506	20.362	0.711	1.885	77
19.395	61.909	61.721	-0.188	2.073	5.851	1.507	1.483	20.056	0.703	1.874	78
19.642	62.009	62.140	0.071	2.099	5.891	1.501	1.461	19.760	0.696	1.864	79
19.889	62.486	62.557	0.071	2.126	5.930	1.435	1.440	19.472	0.688	1.857	80
20.136	62.912	62.972	0.061	2.152	5.970	1.489	1.419	19.192	0.681	1.844	81
20.383	63.398	63.386	-0.011	2.178	6.009	1.493	1.399	18.920	0.674	1.833	82
20.630	63.777	63.798	0.021	2.205	6.048	1.477	1.380	18.656	0.667	1.823	83
20.877	64.296	64.209	-0.087	2.231	6.087	1.472	1.361	18.399	0.660	1.814	84
21.124	64.791	64.617	-0.174	2.258	6.126	1.467	1.342	18.149	0.654	1.805	85
21.370	65.091	65.025	-0.067	2.284	6.164	1.461	1.324	17.905	0.647	1.795	86
21.617	65.667	65.431	-0.237	2.310	6.203	1.456	1.307	17.668	0.641	1.787	87
21.864	66.038	65.835	-0.203	2.337	6.241	1.451	1.290	17.437	0.635	1.779	88
22.111	66.231	66.238	0.007	2.363	6.279	1.446	1.273	17.213	0.629	1.769	89
22.357	66.641	66.639	-0.002	2.389	6.317	1.441	1.257	16.993	0.623	1.761	90
22.604	67.186	67.039	-0.147	2.416	6.355	1.437	1.241	16.780	0.617	1.753	91
22.851	67.446	67.438	-0.008	2.442	6.393	1.432	1.226	16.572	0.611	1.745	92
23.097	67.934	67.836	-0.099	2.469	6.431	1.428	1.211	16.369	0.606	1.737	93
23.344	68.284	68.232	-0.052	2.495	6.468	1.423	1.196	16.171	0.600	1.730	94
23.590	68.625	68.627	0.002	2.521	6.506	1.419	1.182	15.978	0.595	1.723	95
23.837	69.133	69.020	-0.112	2.548	6.543	1.415	1.169	15.789	0.590	1.715	96
24.083	69.440	69.413	-0.027	2.574	6.580	1.410	1.154	15.605	0.585	1.708	97
24.329	69.833	69.804	-0.029	2.600	6.617	1.406	1.141	15.425	0.579	1.701	98
24.575	70.134	70.194	0.060	2.627	6.654	1.402	1.128	15.250	0.574	1.694	99
24.822	70.636	70.583	-0.053	2.653	6.691	1.399	1.115	15.078	0.570	1.687	100
25.068	71.063	70.971	-0.092	2.679	6.728	1.395	1.103	14.911	0.565	1.681	101
25.315	71.366	71.357	-0.009	2.706	6.764	1.391	1.091	14.747	0.560	1.674	102
25.561	71.814	71.743	-0.071	2.732	6.801	1.387	1.079	14.587	0.555	1.668	103
25.807	72.243	72.128	-0.115	2.758	6.838	1.384	1.067	14.430	0.551	1.662	104
26.053	72.776	72.511	-0.265	2.784	6.874	1.380	1.056	14.277	0.546	1.655	105
26.299	73.010	72.894	-0.116	2.811	6.910	1.377	1.045	14.127	0.542	1.649	106
26.546	73.217	73.275	0.058	2.837	6.946	1.373	1.034	13.981	0.538	1.644	107
26.792	73.748	73.656	-0.092	2.863	6.982	1.370	1.023	13.837	0.534	1.638	108
27.038	74.009	74.035	0.026	2.890	7.018	1.367	1.013	13.697	0.529	1.632	109
27.284	74.595	74.414	-0.281	2.916	7.054	1.364	1.003	13.559	0.525	1.627	110
27.530	74.921	74.793	-0.030	2.942	7.090	1.361	0.993	13.425	0.521	1.621	111
27.775	75.256	75.168	-0.087	2.969	7.126	1.358	0.983	13.293	0.517	1.616	112
28.021	75.574	75.544	-0.029	2.995	7.161	1.354	0.974	13.164	0.513	1.611	113
28.267	75.924	75.919	-0.004	3.021	7.197	1.352	0.964	13.038	0.510	1.605	114
28.513	76.210	76.293	0.083	3.047	7.232	1.349	0.955	12.914	0.506	1.600	115
28.759	76.567	76.667	0.100	3.074	7.268	1.346	0.946	12.792	0.502	1.595	116
29.005	77.001	77.039	0.039	3.100	7.303	1.343	0.937	12.673	0.499	1.590	117
29.250	77.409	77.411	0.002	3.126	7.338	1.340	0.929	12.556	0.495	1.585	118
29.496	77.651	77.782	0.131	3.152	7.374	1.337	0.920	12.443	0.491	1.581	119
29.742	78.076	78.152	0.075	3.179	7.409	1.335	0.912	12.332	0.488	1.576	120
29.987	78.537	78.521	-0.016	3.205	7.444	1.332	0.904	12.224	0.485	1.572	121
30.233	78.942	78.890	0.047	3.231	7.479	1.330	0.896	12.118	0.481	1.567	122
30.478	79.185	79.257	0.072	3.257	7.513	1.327	0.888	12.015	0.478	1.563	123
30.724	79.729	79.624	-0.104	3.284	7.548	1.325	0.880	11.912	0.475	1.559	124
30.969	79.939	79.991	0.052	3.310	7.583	1.322	0.873	11.813	0.472	1.554	125
31.215	80.216	80.356	0.140	3.336	7.618	1.320	0.865	11.717	0.468	1.550	126

Table 6-8-WF3T(3)a. (continued)

31.460	80.613	80.721	0.108	3.362	7.652	1.317	0.858	11.601	0.465	1.546	127
31.706	81.187	81.085	-0.102	3.389	7.687	1.315	0.851	11.504	0.462	1.542	128
31.951	81.426	81.448	0.023	3.415	7.721	1.313	0.844	11.409	0.459	1.538	129
32.196	81.796	81.811	0.015	3.441	7.755	1.311	0.837	11.316	0.456	1.534	130
32.442	82.234	82.173	-0.061	3.467	7.790	1.308	0.830	11.224	0.453	1.530	131
32.687	82.592	82.535	-0.057	3.493	7.824	1.306	0.824	11.133	0.450	1.526	132
32.932	82.909	82.896	-0.013	3.520	7.858	1.304	0.817	11.046	0.448	1.523	133
33.177	83.308	83.256	-0.052	3.546	7.892	1.302	0.811	10.959	0.445	1.519	134
33.423	83.625	83.615	-0.010	3.572	7.927	1.300	0.804	10.874	0.442	1.515	135
33.668	84.052	83.974	-0.078	3.598	7.961	1.298	0.798	10.790	0.439	1.512	136
33.913	84.345	84.332	-0.013	3.624	7.994	1.296	0.792	10.707	0.437	1.508	137
34.158	84.704	84.690	-0.014	3.651	8.028	1.294	0.786	10.626	0.434	1.505	138
34.403	84.967	85.047	0.080	3.677	8.062	1.292	0.780	10.547	0.431	1.501	139
34.648	85.412	85.404	-0.008	3.703	8.096	1.290	0.774	10.469	0.429	1.498	140
34.893	85.712	85.760	0.048	3.729	8.130	1.288	0.769	10.391	0.426	1.495	141
35.138	86.117	86.115	-0.002	3.755	8.163	1.286	0.763	10.315	0.424	1.491	142
35.383	86.605	86.470	-0.135	3.782	8.197	1.284	0.757	10.240	0.421	1.488	143
35.627	86.844	86.824	-0.020	3.808	8.231	1.282	0.752	10.167	0.419	1.485	144
35.872	87.422	87.178	-0.244	3.834	8.264	1.281	0.747	10.095	0.416	1.482	145
36.117	87.531	87.531	0.0	3.860	8.298	1.279	0.741	10.023	0.414	1.479	146
36.362	87.950	87.884	0.024	3.886	8.331	1.277	0.735	9.953	0.412	1.476	147
36.607	88.156	88.236	0.080	3.912	8.365	1.275	0.731	9.884	0.409	1.473	148
36.851	88.546	88.587	0.041	3.939	8.398	1.274	0.726	9.817	0.407	1.470	149
37.096	88.904	88.939	0.034	3.965	8.431	1.272	0.721	9.750	0.405	1.467	150
37.341	89.224	89.289	0.065	3.991	8.464	1.270	0.716	9.684	0.403	1.464	151
37.585	89.597	89.639	0.042	4.017	8.498	1.269	0.711	9.619	0.401	1.461	152
37.830	89.976	89.989	0.013	4.043	8.531	1.267	0.707	9.555	0.398	1.459	153
38.074	90.297	90.339	0.041	4.069	8.564	1.266	0.702	9.492	0.396	1.456	154
38.319	90.606	90.687	0.080	4.095	8.597	1.264	0.698	9.430	0.394	1.453	155
38.563	91.076	91.035	-0.041	4.121	8.630	1.263	0.693	9.369	0.392	1.450	156
38.808	91.327	91.383	0.055	4.148	8.663	1.261	0.689	9.309	0.390	1.448	157
39.052	91.553	91.730	0.177	4.174	8.696	1.260	0.684	9.250	0.388	1.445	158
39.296	91.855	92.077	0.222	4.200	8.729	1.258	0.680	9.192	0.386	1.443	159

ALL VELOCITIES IN MACH UNITS.

Table 6-8-WF3T(3)b. Shock trajectory analysis—ground mach stem—Shot 8.

SHOCK FRONT DATA DPW/8 ST WF3T 209.M03 GROUND MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 67.5 F
AMBIENT PRESSURE = 13.52 PSI
RELATIVE HUMIDITY = 31.0 %
VAPOUR PRESSURE= 5.335 MM HG
AMBIENT SPEED OF SOUND = 1.1274 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5488
CHARGE HEIGHT= 24.45 FEET
SEPARATION #2= 24.93 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
12.464	44.040	43.922	-0.118	1.332	4.164	2.281	4.906	66.332	1.536	3.050	50
12.712	44.687	44.556	-0.131	1.359	4.224	2.256	4.772	64.522	1.511	3.027	51
12.960	45.265	45.184	-0.081	1.385	4.283	2.232	4.644	62.797	1.486	2.994	52
13.208	45.863	45.904	-0.059	1.412	4.342	2.208	4.523	61.151	1.463	2.963	53
13.456	46.588	46.418	-0.170	1.438	4.400	2.186	4.406	59.578	1.440	2.932	54
13.704	46.993	47.026	0.043	1.465	4.458	2.164	4.295	58.076	1.418	2.901	55
13.951	47.553	47.628	0.074	1.491	4.515	2.143	4.189	56.639	1.397	2.872	56
14.199	48.215	48.223	0.008	1.518	4.571	2.122	4.087	55.263	1.376	2.843	57
14.447	48.744	48.813	0.069	1.544	4.627	2.102	3.990	53.945	1.356	2.815	58
14.695	49.314	49.398	0.084	1.571	4.683	2.083	3.896	52.682	1.336	2.788	59
14.942	49.922	49.977	0.055	1.597	4.738	2.065	3.807	51.470	1.317	2.761	60
15.190	50.226	50.551	0.324	1.623	4.792	2.047	3.721	50.307	1.299	2.735	61
15.438	50.676	51.120	0.444	1.650	4.846	2.029	3.638	49.189	1.281	2.710	62
15.685	51.628	51.684	0.056	1.676	4.899	2.013	3.559	48.115	1.263	2.685	63
15.933	52.114	52.243	0.129	1.703	4.953	1.996	3.482	47.082	1.246	2.661	64
16.428	53.700	53.349	-0.351	1.756	5.057	1.965	3.338	45.131	1.213	2.614	66
16.675	53.903	53.895	-0.008	1.782	5.109	1.950	3.270	44.209	1.198	2.592	67
16.923	54.242	54.437	0.194	1.809	5.160	1.936	3.204	43.320	1.182	2.570	68
17.418	55.330	55.509	0.178	1.862	5.262	1.908	3.079	41.595	1.153	2.529	70
17.665	56.010	56.038	0.029	1.888	5.312	1.894	3.020	40.836	1.139	2.507	71
17.912	56.392	56.565	0.172	1.914	5.362	1.881	2.963	40.054	1.125	2.487	72
18.159	57.153	57.087	-0.065	1.941	5.412	1.869	2.908	39.319	1.112	2.468	73
18.407	57.670	57.607	-0.063	1.967	5.461	1.857	2.855	38.594	1.098	2.448	74
18.654	58.101	58.122	-0.038	1.994	5.510	1.845	2.803	37.900	1.085	2.430	75
18.901	58.631	58.635	0.003	2.020	5.558	1.833	2.753	37.226	1.073	2.411	76
19.149	60.553	60.652	0.099	2.126	5.750	1.789	2.569	34.733	1.025	2.342	80
20.139	61.136	61.149	0.013	2.152	5.797	1.779	2.526	34.156	1.014	2.326	81
20.383	61.824	61.643	-0.181	2.178	5.844	1.769	2.485	33.597	1.003	2.310	82
20.630	62.596	62.134	-0.462	2.205	5.890	1.759	2.445	33.055	0.993	2.294	83
20.877	62.753	62.622	-0.131	2.231	5.936	1.750	2.406	32.529	0.982	2.279	84
21.124	63.273	63.109	-0.165	2.258	5.982	1.741	2.368	32.017	0.972	2.264	85
21.370	63.760	63.591	-0.169	2.284	6.028	1.732	2.331	31.521	0.962	2.249	86
21.617	64.244	64.072	-0.172	2.310	6.074	1.723	2.296	31.038	0.952	2.235	87
21.864	64.582	64.549	-0.133	2.337	6.119	1.714	2.261	30.569	0.942	2.221	88
22.111	64.995	65.025	0.030	2.363	6.164	1.706	2.227	30.113	0.933	2.207	89
22.357	65.620	65.498	-0.122	2.389	6.209	1.697	2.194	29.669	0.923	2.193	90
22.604	66.204	65.969	-0.235	2.416	6.254	1.689	2.162	29.237	0.914	2.180	91
23.097	66.938	66.904	-0.035	2.469	6.342	1.674	2.101	28.404	0.897	2.154	93
23.344	67.295	67.368	0.073	2.495	6.386	1.666	2.072	28.009	0.888	2.142	94
23.590	67.810	67.830	0.020	2.521	6.430	1.659	2.043	27.621	0.880	2.130	95
23.837	68.227	68.290	0.063	2.548	6.474	1.651	2.015	27.243	0.872	2.118	96
24.083	68.702	68.748	0.046	2.574	6.517	1.644	1.988	26.874	0.863	2.106	97

Table 6-8-WF3T(3)b. (continued)

24.329	69.153	69.203	0.050	2.600	6.560	1.637	1.961	26.315	0.859	2.044	98
24.576	69.622	69.657	0.035	2.627	6.603	1.631	1.935	26.164	0.848	2.043	99
24.822	70.151	70.109	-0.042	2.653	6.646	1.624	1.910	25.823	0.840	2.072	100
25.068	70.454	70.559	0.105	2.679	6.689	1.617	1.885	25.483	0.833	2.041	101
25.315	70.830	71.007	0.168	2.706	6.731	1.611	1.861	25.154	0.825	2.050	102
25.561	71.340	71.454	0.114	2.732	6.774	1.605	1.839	24.845	0.818	2.040	103
25.807	71.833	71.808	0.075	2.758	6.816	1.599	1.815	24.535	0.811	2.039	104
26.053	72.331	72.341	0.010	2.784	6.858	1.593	1.792	24.233	0.804	2.013	105
26.299	72.903	72.782	-0.121	2.811	6.900	1.587	1.770	23.937	0.797	2.000	106
26.546	73.323	73.221	-0.101	2.837	6.941	1.581	1.749	23.647	0.790	2.030	107
26.792	73.769	73.659	-0.110	2.863	6.983	1.575	1.729	23.365	0.784	1.990	108
27.038	74.041	74.095	0.055	2.890	7.024	1.570	1.709	23.089	0.777	1.991	109
27.284	74.600	74.530	-0.070	2.916	7.065	1.564	1.689	22.819	0.771	1.971	110
27.530	74.854	74.963	0.109	2.942	7.106	1.559	1.668	22.554	0.764	1.962	111
27.775	75.533	75.394	-0.139	2.969	7.147	1.554	1.649	22.296	0.758	1.953	112
28.021	75.825	75.824	0.130	2.995	7.188	1.548	1.630	22.043	0.752	1.945	113
28.267	76.312	76.253	-0.059	3.021	7.229	1.543	1.612	21.796	0.746	1.935	114
28.513	76.717	76.680	-0.037	3.047	7.269	1.538	1.594	21.554	0.740	1.927	115
28.759	77.089	77.105	0.016	3.074	7.309	1.533	1.577	21.317	0.734	1.919	116
29.005	77.737	77.530	-0.208	3.100	7.350	1.529	1.559	21.086	0.729	1.911	117
29.250	77.971	77.952	-0.019	3.126	7.390	1.524	1.543	20.859	0.723	1.903	118
29.496	78.430	78.374	-0.056	3.152	7.430	1.519	1.526	20.635	0.718	1.895	119
29.742	78.996	78.794	-0.202	3.179	7.469	1.515	1.510	20.419	0.712	1.887	120
29.987	79.326	79.213	-0.113	3.205	7.509	1.510	1.493	20.204	0.707	1.880	121
30.233	79.637	79.630	-0.007	3.231	7.549	1.506	1.479	19.995	0.702	1.873	122
30.478	79.951	80.047	0.096	3.257	7.588	1.502	1.464	19.790	0.696	1.866	123
30.724	80.401	80.462	0.060	3.284	7.628	1.497	1.449	19.589	0.691	1.859	124
30.969	80.803	80.875	0.072	3.310	7.667	1.493	1.434	19.392	0.686	1.852	125
31.215	81.168	81.288	0.120	3.336	7.706	1.489	1.420	19.199	0.681	1.845	126
31.460	81.790	81.700	-0.090	3.362	7.745	1.485	1.405	19.009	0.676	1.838	127
31.706	82.165	82.110	-0.055	3.389	7.784	1.481	1.392	18.823	0.671	1.832	128
31.951	82.405	82.519	0.034	3.415	7.823	1.477	1.379	18.641	0.667	1.825	129
32.195	83.013	82.927	-0.086	3.441	7.861	1.473	1.365	18.462	0.662	1.819	130
32.442	83.248	83.334	0.086	3.467	7.900	1.469	1.352	18.286	0.657	1.813	131
32.687	83.790	83.740	-0.050	3.493	7.938	1.466	1.340	18.114	0.653	1.807	132
32.932	84.130	84.144	0.014	3.520	7.977	1.462	1.327	17.945	0.648	1.797	133
33.177	84.523	84.548	0.025	3.546	8.015	1.458	1.315	17.779	0.644	1.791	134
33.423	84.914	84.951	0.037	3.572	8.053	1.455	1.303	17.616	0.640	1.785	135
33.668	85.202	85.352	0.150	3.598	8.091	1.451	1.291	17.456	0.635	1.779	136
33.913	85.565	85.753	0.188	3.624	8.129	1.448	1.279	17.298	0.631	1.773	137
34.159	86.137	86.152	0.015	3.651	8.167	1.445	1.268	17.144	0.627	1.767	138
34.403	86.543	86.551	0.008	3.677	8.205	1.441	1.257	16.992	0.623	1.761	139
34.648	86.901	86.949	0.047	3.703	8.243	1.438	1.246	16.843	0.619	1.755	140
34.893	87.377	87.345	-0.031	3.729	8.280	1.435	1.235	16.696	0.615	1.750	141
35.138	87.765	87.741	-0.024	3.755	8.318	1.432	1.224	16.552	0.611	1.744	142
35.383	88.066	88.136	0.069	3.782	8.355	1.428	1.214	16.411	0.607	1.739	143
35.627	88.525	88.530	0.005	3.808	8.392	1.425	1.203	16.271	0.603	1.734	144
35.872	88.849	88.923	0.074	3.834	8.430	1.422	1.193	16.135	0.599	1.728	145
36.117	89.233	89.315	0.082	3.860	8.467	1.419	1.183	15.999	0.595	1.723	146
36.362	89.628	89.706	0.078	3.886	8.504	1.416	1.174	15.868	0.592	1.718	147
36.607	90.022	90.096	0.074	3.912	8.541	1.413	1.164	15.738	0.588	1.713	148
36.851	90.378	90.486	0.108	3.939	8.578	1.411	1.155	15.610	0.585	1.708	149
37.096	90.780	90.875	0.095	3.965	8.615	1.408	1.145	15.484	0.581	1.703	150
37.341	91.120	91.263	0.143	3.991	8.651	1.405	1.136	15.360	0.578	1.698	151
37.585	91.693	91.649	-0.043	4.017	8.688	1.402	1.127	15.238	0.574	1.693	152
37.830	91.974	92.036	0.062	4.043	8.725	1.399	1.118	15.118	0.571	1.688	153
38.074	92.390	92.421	0.031	4.069	8.761	1.397	1.109	15.000	0.567	1.684	154
38.319	92.790	92.806	0.026	4.095	8.798	1.394	1.101	14.884	0.564	1.679	155
38.563	93.121	93.190	0.069	4.121	8.834	1.392	1.092	14.769	0.561	1.675	156
38.808	93.543	93.573	0.030	4.148	8.870	1.389	1.084	14.657	0.558	1.671	157
39.052	93.931	93.955	0.024	4.174	8.907	1.386	1.076	14.546	0.554	1.666	158
39.296	94.295	94.337	0.052	4.200	8.943	1.384	1.068	14.437	0.551	1.662	159
39.541	94.744	94.718	-0.026	4.226	8.979	1.381	1.060	14.329	0.548	1.657	160
39.785	95.026	95.098	0.072	4.252	9.015	1.379	1.052	14.223	0.545	1.653	161

Table 6-8-WF3T(3)b. (continued)

40.029	95.391	95.477	0.086	4.278	9.051	1.377	1.044	14.119	0.542	1.549	162
40.274	95.846	95.856	0.010	4.304	9.087	1.374	1.037	14.016	0.539	1.545	163
40.518	96.068	96.234	0.166	4.330	9.123	1.372	1.029	13.915	0.536	1.541	164
40.762	96.474	96.611	0.137	4.356	9.158	1.370	1.022	13.815	0.533	1.537	165
41.250	97.686	97.364	-0.322	4.409	9.230	1.365	1.007	13.620	0.527	1.529	167
41.494	97.824	97.739	-0.084	4.435	9.265	1.363	1.000	13.525	0.524	1.525	168
41.739	97.963	98.114	0.151	4.461	9.301	1.361	0.993	13.431	0.521	1.521	169
41.982	98.459	98.488	0.029	4.487	9.336	1.359	0.985	13.338	0.519	1.518	170
42.226	98.871	98.861	-0.010	4.513	9.372	1.356	0.980	13.246	0.516	1.514	171
42.470	99.174	99.234	0.060	4.539	9.407	1.354	0.973	13.155	0.513	1.510	172
42.714	99.547	99.606	0.059	4.565	9.442	1.352	0.967	13.067	0.511	1.507	173
42.958	99.940	99.978	0.038	4.591	9.478	1.350	0.960	12.980	0.508	1.503	174
43.202	100.340	100.349	0.008	4.617	9.513	1.348	0.954	12.893	0.505	1.500	175
43.446	100.673	100.719	0.046	4.643	9.548	1.346	0.947	12.808	0.503	1.497	176
43.689	100.974	101.089	0.115	4.669	9.583	1.344	0.941	12.724	0.500	1.493	177
44.177	102.033	101.826	-0.206	4.721	9.653	1.340	0.929	12.559	0.495	1.486	179
44.421	102.380	102.194	-0.086	4.747	9.688	1.338	0.923	12.479	0.493	1.483	180
44.664	102.638	102.561	-0.077	4.774	9.723	1.335	0.917	12.399	0.490	1.479	181
44.908	103.120	102.928	-0.192	4.800	9.757	1.333	0.911	12.321	0.488	1.476	182
45.151	103.332	103.295	-0.037	4.826	9.792	1.331	0.905	12.243	0.485	1.473	183
45.395	103.933	103.660	-0.173	4.852	9.827	1.329	0.900	12.167	0.483	1.470	184
45.639	104.115	104.025	-0.090	4.878	9.861	1.327	0.894	12.091	0.481	1.466	185
45.882	104.240	104.390	0.150	4.904	9.896	1.325	0.889	12.017	0.478	1.463	186
46.125	104.740	104.756	0.016	4.930	9.930	1.323	0.883	11.943	0.476	1.460	187
46.369	105.105	105.118	0.012	4.956	9.965	1.321	0.878	11.871	0.474	1.457	188
46.612	105.414	105.481	0.066	4.982	9.999	1.320	0.873	11.799	0.472	1.454	189
46.856	105.873	105.843	-0.030	5.008	10.034	1.318	0.867	11.728	0.469	1.451	190
47.099	106.206	106.205	-0.000	5.034	10.068	1.317	0.862	11.658	0.467	1.448	191
47.342	106.499	106.567	0.068	5.060	10.102	1.315	0.857	11.590	0.465	1.445	192
47.586	106.983	106.928	-0.056	5.086	10.136	1.314	0.852	11.521	0.463	1.443	193
47.829	107.276	107.288	0.012	5.112	10.171	1.312	0.847	11.454	0.461	1.440	194
48.072	107.717	107.648	-0.069	5.138	10.205	1.311	0.842	11.388	0.459	1.437	195
48.315	108.108	108.009	-0.100	5.164	10.239	1.309	0.837	11.322	0.456	1.434	196
48.558	108.304	108.367	0.063	5.190	10.273	1.308	0.833	11.257	0.454	1.432	197
48.801	108.736	108.725	-0.010	5.216	10.307	1.306	0.829	11.193	0.452	1.429	198
49.045	109.096	109.084	-0.013	5.242	10.341	1.305	0.823	11.130	0.450	1.426	199
49.288	109.403	109.441	0.038	5.268	10.375	1.303	0.819	11.068	0.448	1.424	200
49.531	109.709	109.708	-0.001	5.294	10.409	1.302	0.814	11.006	0.446	1.421	201
49.774	110.206	110.155	-0.051	5.320	10.442	1.300	0.810	10.945	0.444	1.419	202
50.017	110.431	110.511	0.081	5.346	10.476	1.299	0.805	10.885	0.442	1.416	203
50.259	110.850	110.857	0.008	5.372	10.510	1.297	0.801	10.825	0.440	1.413	204
50.502	111.127	111.223	0.096	5.397	10.544	1.297	0.796	10.767	0.439	1.411	205
50.745	111.621	111.578	-0.043	5.423	10.577	1.296	0.792	10.708	0.437	1.409	206
50.988	111.957	111.932	-0.024	5.449	10.611	1.294	0.788	10.651	0.435	1.406	207
51.231	112.346	112.286	-0.059	5.475	10.644	1.293	0.784	10.594	0.433	1.403	208
51.474	112.944	112.640	-0.304	5.501	10.678	1.292	0.779	10.538	0.431	1.401	209
51.716	113.023	112.993	-0.029	5.527	10.711	1.290	0.775	10.483	0.429	1.399	210

ALL VELOCITIES IN MACH UNITS.

Table 6-8-WF5(57)a. Shock trajectory analysis—primary front, bottom charge—Shot 8.

SHOCK FRONT DATA DPW/8 ST WF5 267.M57 PRIMARY FRONT, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 67.5 F
AMBIENT PRESSURE = 13.52 PSI
RELATIVE HUMIDITY = 31.0 %
VAPOUR PRESSURE= 5.335 MM HG
AMBIENT SPEED OF SOUND = 1.1274 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5488
CHARGE HEIGHT= 24.45 FEET
SEPARATION +Z= 24.93 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
5.183	30.925	30.939	0.014	0.554	2.933	2.890	8.577	115.975	2.120	3.753	16
5.497	31.754	31.946	0.192	0.588	3.028	2.786	7.889	106.564	2.023	3.649	17
5.812	33.051	32.913	-0.133	0.621	3.121	2.692	7.289	98.557	1.934	3.551	18
6.127	33.963	33.858	-0.105	0.655	3.210	2.607	6.764	91.450	1.853	3.457	19
6.442	34.833	34.769	-0.063	0.688	3.296	2.530	6.300	85.191	1.779	3.368	20
6.756	35.674	35.654	0.080	0.722	3.380	2.459	5.889	79.519	1.710	3.284	21
7.071	36.490	36.514	0.025	0.756	3.461	2.394	5.522	74.660	1.647	3.205	22
7.385	37.338	37.352	0.016	0.789	3.541	2.335	5.193	70.217	1.589	3.130	23
7.700	38.184	38.170	-0.014	0.823	3.618	2.280	4.893	66.210	1.534	3.059	24
8.014	39.009	38.969	-0.039	0.857	3.694	2.229	4.630	62.607	1.484	2.991	25
8.328	39.621	39.750	0.129	0.890	3.768	2.182	4.389	59.332	1.437	2.927	26
8.642	40.429	40.515	0.086	0.924	3.841	2.138	4.168	56.353	1.392	2.866	27
8.957	41.220	41.265	0.045	0.957	3.912	2.098	3.967	53.633	1.351	2.809	28
9.271	42.179	42.001	-0.178	0.991	3.982	2.060	3.782	51.143	1.312	2.754	29
9.584	43.212	42.723	-0.488	1.024	4.050	2.024	3.613	48.856	1.275	2.702	30
9.898	43.289	43.434	0.145	1.058	4.117	1.991	3.458	46.752	1.241	2.653	31
10.212	44.156	44.132	-0.024	1.091	4.184	1.960	3.314	44.810	1.208	2.607	32
11.153	46.541	46.169	-0.374	1.192	4.376	1.877	2.944	39.802	1.120	2.480	35
11.467	46.763	46.825	0.062	1.225	4.439	1.853	2.837	38.363	1.094	2.442	36
11.780	47.385	47.476	0.090	1.259	4.501	1.829	2.738	37.021	1.069	2.406	37
12.093	48.155	48.118	-0.037	1.292	4.561	1.809	2.645	35.757	1.045	2.371	38
12.407	48.555	48.753	0.198	1.326	4.622	1.787	2.559	34.594	1.023	2.338	39
12.720	49.509	49.380	-0.129	1.359	4.681	1.767	2.477	33.495	1.001	2.307	40
13.033	49.867	50.001	0.134	1.393	4.740	1.749	2.401	32.463	0.981	2.277	41
13.346	50.542	50.615	0.073	1.426	4.798	1.731	2.329	31.494	0.961	2.248	42
13.659	51.066	51.223	0.156	1.460	4.856	1.714	2.262	30.581	0.942	2.221	43
13.972	51.826	51.824	-0.001	1.493	4.913	1.698	2.198	29.721	0.925	2.195	44
14.285	52.328	52.421	0.093	1.527	4.969	1.683	2.138	28.909	0.907	2.170	45
14.597	53.028	53.012	-0.016	1.560	5.025	1.669	2.081	28.143	0.891	2.145	46
14.910	53.302	53.597	0.295	1.594	5.081	1.655	2.028	27.417	0.875	2.123	47
15.223	54.092	54.178	0.086	1.627	5.136	1.642	1.977	26.731	0.860	2.101	48
15.535	54.685	54.754	0.069	1.660	5.191	1.629	1.929	26.080	0.846	2.080	49
15.848	55.358	55.326	-0.032	1.694	5.245	1.617	1.883	25.452	0.832	2.060	50
16.160	55.831	55.893	0.063	1.727	5.299	1.605	1.840	24.875	0.819	2.041	51
16.472	56.499	56.457	-0.042	1.760	5.352	1.594	1.799	24.317	0.806	2.022	52
16.784	56.911	57.016	0.104	1.794	5.405	1.584	1.759	23.787	0.794	2.004	53
17.097	57.642	57.571	-0.070	1.827	5.458	1.574	1.722	23.281	0.782	1.987	54
17.409	58.071	58.123	0.052	1.861	5.510	1.564	1.686	22.799	0.770	1.971	55
17.721	58.687	58.672	-0.015	1.894	5.562	1.554	1.652	22.340	0.759	1.955	56
18.033	59.214	59.217	0.002	1.927	5.614	1.545	1.620	21.901	0.749	1.940	57
18.344	59.735	59.759	0.023	1.961	5.665	1.537	1.589	21.481	0.738	1.925	58
18.656	60.249	60.297	-0.352	1.994	5.716	1.529	1.559	21.080	0.729	1.911	59

Table 6-8-WF5(57)a. (continued)

19.969	60.770	60.833	0.063	2.027	5.767	1.521	1.531	20.697	0.719	1.897	60
19.280	61.160	61.366	0.206	2.061	5.817	1.513	1.504	20.329	0.710	1.894	61
19.591	61.926	61.896	-0.030	2.094	5.868	1.506	1.478	19.973	0.701	1.871	62
19.303	62.202	62.423	0.221	2.127	5.918	1.498	1.453	19.640	0.693	1.859	63
20.214	62.893	62.948	0.055	2.160	5.967	1.492	1.429	19.316	0.684	1.849	64
20.525	63.288	63.471	0.182	2.194	6.017	1.485	1.406	19.006	0.676	1.836	65
20.837	63.831	63.991	0.159	2.227	6.066	1.479	1.384	18.707	0.668	1.825	66
21.148	64.617	64.509	-0.108	2.260	6.115	1.472	1.362	18.421	0.661	1.815	67
21.459	65.074	65.024	-0.050	2.293	6.164	1.466	1.342	18.145	0.654	1.804	68
21.770	65.602	65.537	-0.065	2.327	6.213	1.461	1.322	17.880	0.647	1.795	69
22.081	66.140	66.048	-0.092	2.360	6.261	1.455	1.304	17.624	0.640	1.785	70
22.392	66.750	66.557	-0.193	2.393	6.309	1.450	1.285	17.379	0.633	1.776	71
22.703	67.267	67.064	-0.203	2.426	6.358	1.445	1.268	17.141	0.627	1.767	72
23.014	67.593	67.569	-0.023	2.460	6.405	1.440	1.251	16.913	0.621	1.759	73
23.324	68.099	68.073	-0.026	2.493	6.453	1.435	1.235	16.693	0.615	1.750	74
23.635	68.489	68.574	0.086	2.526	6.501	1.430	1.219	16.480	0.609	1.742	75
23.945	69.158	69.074	-0.083	2.559	6.548	1.425	1.204	16.275	0.603	1.734	76
24.256	69.607	69.572	-0.035	2.592	6.595	1.421	1.189	16.077	0.598	1.726	77
24.566	70.356	70.069	-0.287	2.626	6.642	1.417	1.175	15.886	0.592	1.719	78
24.877	70.650	70.564	-0.086	2.659	6.689	1.413	1.161	15.701	0.587	1.711	79
25.187	71.197	71.057	-0.139	2.692	6.736	1.409	1.148	15.522	0.582	1.705	80
25.497	71.346	71.549	0.203	2.725	6.783	1.405	1.135	15.349	0.577	1.698	81
25.807	72.135	72.040	-0.096	2.758	6.829	1.401	1.123	15.182	0.573	1.691	82
26.117	72.539	72.529	-0.010	2.791	6.876	1.397	1.111	15.020	0.568	1.685	83
26.427	72.916	73.016	0.101	2.824	6.922	1.394	1.099	14.863	0.563	1.679	84
26.737	73.444	73.503	0.059	2.858	6.968	1.390	1.088	14.711	0.559	1.673	85
27.047	74.139	73.988	-0.152	2.891	7.014	1.387	1.077	14.564	0.555	1.667	86
27.357	74.403	74.471	0.063	2.924	7.060	1.384	1.067	14.422	0.551	1.661	87
27.666	75.235	74.954	-0.281	2.957	7.105	1.380	1.056	14.283	0.547	1.656	88
27.976	75.360	75.435	0.075	2.990	7.151	1.377	1.047	14.149	0.543	1.650	89
28.286	75.935	75.915	-0.020	3.023	7.197	1.374	1.037	14.019	0.539	1.645	90
28.596	76.132	76.394	0.262	3.056	7.242	1.371	1.028	13.893	0.535	1.640	91
28.906	78.076	77.349	-0.727	3.122	7.332	1.366	1.010	13.652	0.528	1.630	93
29.215	78.309	77.825	-0.485	3.155	7.378	1.363	1.001	13.535	0.525	1.625	94
29.532	77.918	78.299	0.382	3.188	7.423	1.361	0.993	13.424	0.521	1.621	95
30.141	78.830	78.773	-0.077	3.221	7.467	1.358	0.985	13.315	0.518	1.617	96
30.450	78.923	79.246	0.323	3.254	7.512	1.356	0.977	13.209	0.515	1.612	97
30.759	79.796	79.718	-0.079	3.287	7.557	1.353	0.969	13.105	0.512	1.608	98
31.068	80.134	80.188	0.005	3.320	7.602	1.351	0.962	13.005	0.509	1.604	99
31.377	80.731	80.658	-0.072	3.353	7.646	1.348	0.955	12.909	0.506	1.600	100
31.686	80.926	81.127	0.201	3.386	7.691	1.346	0.948	12.813	0.503	1.596	101
31.994	81.455	81.595	0.140	3.419	7.735	1.344	0.941	12.720	0.500	1.592	102
32.303	81.840	82.063	0.222	3.452	7.779	1.342	0.934	12.630	0.497	1.589	103
32.612	82.931	82.529	-0.402	3.485	7.824	1.340	0.928	12.543	0.495	1.585	104
32.920	82.802	82.995	0.193	3.518	7.868	1.338	0.921	12.457	0.492	1.582	105
33.229	83.590	83.459	-0.130	3.551	7.912	1.336	0.915	12.374	0.489	1.578	106
33.537	83.489	83.923	0.435	3.584	7.956	1.334	0.909	12.293	0.487	1.575	107
33.845	84.526	84.387	-0.140	3.617	8.000	1.332	0.903	12.214	0.484	1.572	108
34.153	84.744	84.849	0.105	3.650	8.043	1.330	0.898	12.138	0.482	1.569	109
34.461	85.401	85.311	-0.090	3.683	8.087	1.328	0.892	12.063	0.480	1.565	110
34.770	85.597	85.772	0.175	3.716	8.131	1.327	0.887	11.989	0.477	1.562	111
35.077	86.199	86.232	0.034	3.749	8.175	1.325	0.882	11.918	0.475	1.559	112
35.385	86.706	86.692	-0.014	3.782	8.218	1.323	0.876	11.849	0.473	1.556	113
35.693	87.201	87.151	-0.050	3.815	8.262	1.322	0.871	11.781	0.471	1.554	114
36.001	87.463	87.609	0.146	3.848	8.305	1.320	0.866	11.714	0.469	1.551	115

ALL VELOCITIES IN MACH UNITS.

Table 6-8-WF5(57)b. Shock trajectory analysis—upper mach stem, bottom charge—Shot 8.

SHOCK FRONT DATA DPW/8 ST WF5 267.M57 UPPER MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 67.5 F
AMBIENT PRESSURE = 13.52 PSI
RELATIVE HUMIDITY = 31.0 %
VAPOUR PRESSURE= 5.335 MM HG
AMBIENT SPEED OF SOUND = 1.1274 FT/MSEC
CHARGE WEIGHT= 1030.0 LBS.
SACHS SCALING FACTOR = 10.5488
CHARGE HEIGHT= 24.45 FEET
SEPARATION #2= 24.93 FEET

FIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
8.957	34.141	34.094	-0.047	0.957	3.232	2.854	8.339	112.738	2.087	3.718	28
9.271	35.103	35.094	-0.009	0.991	3.327	2.792	7.931	107.229	2.039	3.656	29
9.584	36.176	36.072	-0.105	1.024	3.420	2.734	7.555	102.160	1.994	3.595	30
9.898	37.091	37.029	-0.062	1.058	3.510	2.680	7.210	97.486	1.952	3.537	31
10.212	37.955	37.958	0.014	1.091	3.599	2.628	6.890	93.164	1.913	3.480	32
10.526	38.943	38.883	-0.095	1.125	3.687	2.579	6.594	89.157	1.876	3.425	33
10.839	39.562	39.793	0.231	1.158	3.772	2.533	6.319	85.440	1.842	3.372	34
11.153	40.560	40.680	0.120	1.192	3.856	2.489	6.063	81.990	1.810	3.321	35
11.467	41.380	41.553	0.173	1.225	3.939	2.448	5.825	78.754	1.780	3.271	36
11.780	42.323	42.411	0.088	1.259	4.020	2.409	5.602	75.741	1.751	3.223	37
12.093	43.403	43.255	-0.148	1.292	4.100	2.371	5.393	72.921	1.725	3.176	38
12.407	44.190	44.086	-0.104	1.326	4.179	2.336	5.198	70.277	1.700	3.131	39
12.720	44.823	44.905	0.082	1.359	4.257	2.302	5.014	67.799	1.676	3.087	40
13.033	45.726	45.712	-0.014	1.393	4.333	2.269	4.842	65.468	1.654	3.044	41
13.346	46.712	46.507	0.195	1.426	4.409	2.239	4.680	63.273	1.633	3.003	42
13.659	47.316	47.292	-0.024	1.460	4.483	2.209	4.527	61.205	1.614	2.964	43
13.972	49.129	48.066	-0.063	1.493	4.557	2.181	4.382	59.252	1.595	2.925	44
14.285	48.720	48.830	0.110	1.527	4.629	2.154	4.246	57.406	1.578	2.888	45
14.597	49.629	49.585	-0.044	1.560	4.701	2.128	4.117	55.659	1.562	2.852	46
14.910	50.342	50.331	-0.011	1.594	4.771	2.103	3.994	54.005	1.547	2.817	47
15.223	51.070	51.068	-0.003	1.627	4.841	2.079	3.878	52.436	1.532	2.783	48
15.535	51.811	51.797	-0.015	1.660	4.910	2.057	3.768	50.946	1.519	2.750	49
15.848	52.495	52.517	0.022	1.694	4.978	2.035	3.663	49.530	1.506	2.718	50
16.160	53.081	53.230	0.149	1.727	5.046	2.014	3.564	48.183	1.494	2.687	51
16.472	53.986	53.935	-0.051	1.760	5.113	1.993	3.469	46.900	1.483	2.657	52
16.784	55.004	54.633	-0.370	1.794	5.179	1.974	3.378	45.677	1.473	2.628	53
17.097	55.389	55.325	-0.064	1.827	5.245	1.955	3.292	44.511	1.463	2.599	54
17.409	56.011	56.009	-0.002	1.861	5.310	1.937	3.210	43.398	1.454	2.572	55
17.721	56.751	56.688	-0.064	1.894	5.374	1.919	3.131	42.334	1.445	2.545	56
18.033	57.062	57.360	0.298	1.927	5.438	1.902	3.056	41.316	1.437	2.519	57
18.344	57.952	58.026	0.074	1.961	5.501	1.886	2.984	40.342	1.430	2.494	58
18.656	58.903	58.685	-0.218	1.994	5.563	1.870	2.915	39.410	1.423	2.470	59
18.968	59.347	59.340	-0.007	2.027	5.625	1.855	2.849	38.516	1.417	2.446	60
19.280	60.217	59.990	-0.227	2.061	5.687	1.841	2.785	37.658	1.411	2.423	61
19.591	60.572	60.633	0.061	2.094	5.748	1.826	2.724	36.833	1.406	2.401	62
19.903	61.497	61.272	-0.224	2.127	5.808	1.813	2.666	36.045	1.401	2.379	63
20.525	62.525	62.536	0.011	2.194	5.928	1.786	2.555	34.555	1.392	2.337	65
20.837	63.103	63.160	0.057	2.227	5.987	1.774	2.504	33.852	1.388	2.317	66
21.148	63.772	63.780	0.009	2.260	6.046	1.762	2.454	33.175	0.935	2.298	67
21.459	64.438	64.396	-0.041	2.293	6.105	1.750	2.405	32.524	0.982	2.279	68
21.770	64.939	65.008	0.069	2.327	6.163	1.738	2.359	31.896	0.969	2.260	69
22.081	65.556	65.615	0.060	2.360	6.220	1.727	2.314	31.290	0.957	2.242	70

Table 6-8-WF5(57)b. (continued)

22.392	66.202	66.219	0.017	2.393	6.277	1.717	2.271	30.705	0.945	2.225	71
22.703	66.827	66.819	-0.008	2.426	6.334	1.706	2.229	30.141	0.933	2.204	72
23.014	67.510	67.415	-0.095	2.460	6.391	1.696	2.189	29.596	0.922	2.191	73
23.325	68.476	68.596	0.120	2.526	6.503	1.677	2.112	28.560	0.900	2.159	75
23.645	69.255	69.181	-0.074	2.559	6.558	1.667	2.076	28.064	0.889	2.144	76
23.965	69.955	69.763	-0.375	2.592	6.613	1.658	2.041	27.592	0.879	2.129	77
24.285	70.139	69.763	-0.375	2.592	6.613	1.658	2.041	27.592	0.879	2.129	77
24.285	70.383	70.342	-0.041	2.626	6.668	1.649	2.007	27.131	0.869	2.114	78
24.577	71.015	70.917	-0.097	2.659	6.723	1.641	1.974	26.694	0.859	2.100	79
25.187	71.490	71.490	0.021	2.692	6.777	1.632	1.942	26.282	0.850	2.088	80
25.497	71.854	72.059	0.205	2.725	6.831	1.624	1.911	25.892	0.840	2.072	81
25.807	72.634	72.625	-0.008	2.759	6.885	1.616	1.881	25.526	0.831	2.059	82
26.117	73.058	73.189	0.131	2.792	6.939	1.609	1.851	25.032	0.822	2.046	83
26.427	73.774	73.750	-0.024	2.824	6.991	1.601	1.823	24.549	0.813	2.033	84
26.737	74.247	74.308	0.061	2.858	7.044	1.593	1.796	24.078	0.805	2.021	85
27.047	74.855	74.863	0.007	2.891	7.097	1.586	1.769	23.617	0.797	2.009	86
27.357	75.278	75.416	0.138	2.924	7.149	1.579	1.743	23.167	0.788	1.997	87
27.666	75.826	75.965	-0.060	2.957	7.201	1.572	1.718	22.727	0.780	1.985	88
27.976	76.595	76.514	-0.182	2.990	7.253	1.566	1.693	22.296	0.773	1.974	89
28.286	77.107	77.059	-0.048	3.023	7.305	1.559	1.670	22.874	0.765	1.963	90
28.596	77.650	77.602	-0.048	3.056	7.356	1.553	1.646	22.461	0.757	1.952	91
28.906	78.271	78.142	-0.129	3.089	7.408	1.547	1.624	21.957	0.750	1.942	92
29.214	78.889	78.681	-0.208	3.122	7.459	1.541	1.602	21.661	0.743	1.931	93
29.523	79.315	79.217	-0.098	3.155	7.510	1.535	1.581	21.373	0.736	1.921	94
29.832	79.936	79.751	0.185	3.188	7.560	1.529	1.560	21.092	0.729	1.911	95
30.141	80.177	80.282	0.106	3.221	7.611	1.523	1.540	20.819	0.722	1.902	96
30.450	80.702	80.812	0.110	3.254	7.661	1.518	1.520	20.552	0.716	1.892	97
31.063	81.809	81.865	0.057	3.320	7.761	1.507	1.482	20.039	0.703	1.874	99
31.377	82.147	82.389	0.202	3.353	7.810	1.502	1.464	19.793	0.696	1.865	100
31.695	82.656	82.911	0.255	3.386	7.860	1.497	1.446	19.552	0.690	1.856	101
31.994	83.323	83.431	0.108	3.419	7.909	1.492	1.429	19.317	0.684	1.848	102
32.303	83.780	83.949	0.169	3.452	7.958	1.487	1.412	19.088	0.678	1.839	103
32.612	84.575	84.465	-0.110	3.485	8.007	1.482	1.395	18.864	0.673	1.831	104
32.920	84.944	84.980	0.032	3.518	8.056	1.477	1.379	18.646	0.667	1.823	105
33.229	85.279	85.493	0.213	3.551	8.104	1.473	1.363	18.432	0.661	1.815	106
33.537	85.847	86.004	0.157	3.584	8.153	1.468	1.348	18.224	0.656	1.807	107
33.845	86.393	86.513	0.120	3.617	8.201	1.464	1.333	18.021	0.650	1.800	108
34.153	86.913	87.021	0.109	3.650	8.249	1.459	1.318	17.822	0.645	1.792	109
34.461	87.538	87.527	-0.011	3.683	8.297	1.455	1.304	17.627	0.640	1.785	110
34.770	88.057	88.032	-0.035	3.716	8.345	1.451	1.290	17.437	0.635	1.778	111
35.077	88.448	88.535	0.087	3.749	8.393	1.447	1.276	17.251	0.630	1.771	112
35.385	88.864	89.037	0.173	3.782	8.440	1.443	1.263	17.070	0.625	1.764	113
35.693	89.670	89.537	-0.133	3.815	8.488	1.439	1.249	16.892	0.620	1.757	114
36.001	90.139	90.035	-0.103	3.848	8.535	1.435	1.236	16.718	0.615	1.751	115
36.309	90.453	90.533	0.069	3.881	8.582	1.431	1.224	16.548	0.611	1.744	116
36.616	91.159	91.028	-0.130	3.913	8.629	1.428	1.212	16.381	0.606	1.738	117
36.924	91.651	91.524	-0.138	3.946	8.676	1.424	1.200	16.218	0.602	1.731	118
37.231	92.009	92.016	0.014	3.979	8.723	1.421	1.189	16.058	0.597	1.725	119
37.539	92.922	92.508	-0.414	4.012	8.769	1.417	1.176	15.902	0.593	1.719	120
37.846	93.086	92.998	-0.088	4.045	8.816	1.414	1.165	15.749	0.589	1.713	121
38.153	93.551	93.497	-0.063	4.078	8.862	1.410	1.154	15.599	0.584	1.708	122
38.461	94.122	93.975	-0.147	4.111	8.909	1.407	1.143	15.452	0.580	1.702	123
38.768	94.302	94.462	0.160	4.143	8.955	1.404	1.132	15.308	0.576	1.696	124
39.075	95.204	94.947	-0.257	4.176	9.001	1.401	1.122	15.166	0.572	1.691	125
39.382	95.341	95.431	0.090	4.209	9.047	1.397	1.112	15.029	0.568	1.685	126
39.689	96.027	95.914	-0.113	4.242	9.092	1.394	1.101	14.892	0.564	1.680	127
39.995	96.269	96.396	0.128	4.275	9.138	1.391	1.092	14.759	0.560	1.675	128
40.302	97.096	96.877	-0.219	4.307	9.184	1.388	1.082	14.629	0.557	1.669	129
40.609	97.622	97.357	-0.265	4.340	9.229	1.385	1.072	14.500	0.553	1.664	130
40.916	97.594	97.835	0.241	4.373	9.275	1.383	1.063	14.375	0.549	1.659	131
41.222	98.358	98.312	-0.045	4.406	9.320	1.380	1.054	14.252	0.546	1.654	132
41.529	98.931	98.789	-0.143	4.438	9.365	1.377	1.045	14.131	0.542	1.650	133
41.835	99.480	99.264	-0.216	4.471	9.410	1.374	1.036	14.012	0.539	1.645	134
42.142	99.925	99.738	-0.187	4.504	9.455	1.371	1.028	13.895	0.535	1.640	135
42.448	100.353	100.211	-0.142	4.537	9.500	1.369	1.019	13.781	0.532	1.636	136

Table 6-8-WF5(57)b. (continued)

42.754	100.390	100.683	0.294	4.569	9.545	1.366	1.011	13.669	0.529	1.631	137
43.061	101.069	101.155	0.086	4.602	9.589	1.364	1.003	13.558	0.525	1.627	138
43.367	101.414	101.625	0.211	4.635	9.634	1.361	0.995	13.449	0.522	1.622	139
43.673	102.137	102.094	-0.043	4.668	9.678	1.359	0.987	13.343	0.519	1.618	140
43.979	102.572	102.562	-0.010	4.700	9.723	1.356	0.979	13.238	0.516	1.614	141
44.285	102.825	103.029	0.204	4.733	9.767	1.354	0.972	13.135	0.513	1.609	142
44.590	103.541	103.496	-0.045	4.766	9.811	1.351	0.964	13.034	0.510	1.605	143
44.896	103.437	103.961	0.524	4.798	9.855	1.349	0.957	12.935	0.507	1.601	144
45.202	104.027	104.426	0.399	4.831	9.899	1.347	0.949	12.838	0.504	1.597	145
45.507	105.068	104.889	-0.179	4.864	9.943	1.345	0.942	12.742	0.501	1.593	146
45.813	105.564	105.352	-0.212	4.896	9.987	1.342	0.935	12.647	0.498	1.589	147
46.118	105.910	105.814	-0.096	4.929	10.031	1.340	0.929	12.554	0.495	1.585	148
46.424	106.251	106.275	0.014	4.962	10.075	1.338	0.922	12.463	0.492	1.582	149
46.729	106.636	106.735	0.049	4.994	10.118	1.336	0.915	12.373	0.489	1.578	150
47.035	107.172	107.195	0.023	5.027	10.162	1.334	0.909	12.285	0.487	1.574	151
47.340	107.340	107.653	0.313	5.059	10.205	1.332	0.902	12.198	0.484	1.571	152
47.645	108.078	109.111	0.033	5.092	10.249	1.330	0.896	12.113	0.481	1.567	153
47.950	108.096	108.569	0.472	5.125	10.292	1.328	0.890	12.029	0.479	1.564	154
48.256	109.128	109.024	-0.103	5.157	10.335	1.326	0.884	11.946	0.476	1.560	155
48.560	109.255	109.480	0.215	5.190	10.378	1.324	0.878	11.865	0.474	1.557	156
48.865	110.053	109.934	-0.119	5.222	10.421	1.322	0.872	11.785	0.471	1.554	157
49.170	110.498	110.388	-0.109	5.255	10.465	1.320	0.866	11.706	0.469	1.550	158
49.474	110.908	110.841	-0.067	5.288	10.507	1.318	0.860	11.628	0.466	1.547	159
49.779	111.156	111.294	0.128	5.320	10.550	1.316	0.854	11.552	0.464	1.544	160
50.084	111.837	111.745	-0.091	5.353	10.593	1.314	0.849	11.476	0.461	1.541	161
50.388	112.305	112.196	-0.109	5.385	10.636	1.313	0.843	11.402	0.459	1.538	162
50.693	112.798	112.647	-0.152	5.418	10.679	1.311	0.838	11.329	0.457	1.535	163
50.997	113.034	113.096	0.062	5.450	10.721	1.309	0.833	11.257	0.454	1.532	164
51.301	113.507	113.545	0.038	5.483	10.764	1.307	0.827	11.186	0.452	1.529	165
51.605	114.313	113.993	-0.319	5.515	10.806	1.306	0.822	11.117	0.450	1.526	166
51.910	114.237	114.441	0.203	5.548	10.849	1.304	0.817	11.048	0.448	1.523	167
52.214	114.948	114.888	-0.060	5.580	10.891	1.302	0.812	10.980	0.445	1.520	168
52.518	115.045	115.334	0.289	5.613	10.933	1.301	0.807	10.913	0.443	1.517	169
52.822	115.668	115.779	0.111	5.645	10.976	1.299	0.802	10.847	0.441	1.514	170
53.126	116.454	116.224	-0.230	5.678	11.018	1.298	0.798	10.783	0.439	1.511	171
53.430	116.550	116.668	0.119	5.710	11.060	1.296	0.793	10.719	0.437	1.509	172
53.733	117.445	117.112	-0.333	5.743	11.102	1.294	0.788	10.656	0.435	1.506	173
54.037	117.519	117.555	0.036	5.775	11.144	1.293	0.784	10.593	0.433	1.503	174
54.341	118.354	117.997	-0.357	5.808	11.186	1.291	0.779	10.532	0.431	1.501	175
54.644	118.722	118.439	-0.283	5.840	11.228	1.290	0.775	10.472	0.429	1.498	176
54.948	119.002	118.980	-0.122	5.873	11.270	1.288	0.770	10.412	0.427	1.495	177
55.251	119.014	119.321	0.307	5.905	11.311	1.287	0.766	10.354	0.425	1.493	178
55.555	119.768	119.761	-0.007	5.937	11.353	1.286	0.761	10.296	0.423	1.491	179
55.858	120.192	120.200	0.008	5.970	11.395	1.284	0.757	10.238	0.421	1.488	180
56.161	120.658	120.639	-0.020	6.002	11.436	1.283	0.753	10.182	0.419	1.486	181
56.465	121.072	121.077	0.005	6.035	11.478	1.281	0.749	10.126	0.418	1.483	182
56.768	121.423	121.515	0.092	6.067	11.519	1.280	0.745	10.072	0.416	1.481	183
57.071	121.728	121.952	0.224	6.099	11.561	1.279	0.741	10.018	0.414	1.479	184
57.374	122.561	122.383	-0.172	6.132	11.602	1.277	0.737	9.964	0.412	1.476	185
57.677	122.823	122.824	0.002	6.164	11.643	1.276	0.733	9.911	0.410	1.474	186
57.979	123.396	123.260	-0.136	6.197	11.685	1.275	0.729	9.859	0.409	1.472	187
58.282	123.546	123.693	0.149	6.229	11.726	1.274	0.725	9.808	0.407	1.470	188
58.585	124.577	124.129	-0.448	6.261	11.767	1.272	0.722	9.757	0.405	1.467	189
58.889	124.424	124.563	0.139	6.294	11.808	1.271	0.718	9.707	0.404	1.465	190
59.190	125.093	124.996	-0.086	6.326	11.849	1.270	0.714	9.658	0.402	1.463	191
59.493	125.350	125.429	0.079	6.358	11.890	1.269	0.711	9.609	0.400	1.461	192
59.795	125.931	125.862	-0.069	6.391	11.931	1.267	0.707	9.561	0.399	1.459	193
60.098	126.263	126.293	0.030	6.423	11.972	1.266	0.704	9.514	0.397	1.457	194
60.400	126.551	126.725	0.174	6.455	12.013	1.265	0.700	9.467	0.395	1.455	195
60.702	126.912	127.156	0.244	6.488	12.054	1.264	0.697	9.421	0.394	1.453	196
61.004	127.637	127.586	-0.051	6.520	12.095	1.263	0.693	9.375	0.392	1.451	197
61.306	127.757	128.016	0.259	6.552	12.136	1.262	0.690	9.330	0.391	1.449	198
61.607	128.845	128.445	-0.400	6.584	12.176	1.260	0.687	9.285	0.389	1.447	199
61.910	128.930	128.874	-0.045	6.617	12.217	1.259	0.683	9.241	0.388	1.445	200

Table 2-9. Photo marker and gauge survey data—Shot 9.

SURVEY DATA LIST — DPW/9 — C.750205

PT. NAME	BEARING	DISTANCE	COORD. E	COORD. N	COORD. H
GRD.ZERO	0. 0. 0	0.0	2000.000	2000.000	2316.320
G.ZERO.B	167.36.16	1.063	2000.227	1998.961	2316.320
BOT.CRG.	167.36.16	1.063	2000.227	1998.961	2331.526
TOP.CRG.	165.33.40	1.032	2000.255	1999.000	2351.748
MCP	180. 2.47	598.713	1998.289	1401.290	2313.750
WEST 209			1996.144	1391.805	2316.229
3-20.1	80.19.35	21.453	2021.153	2003.573	2317.371
3-20.2	80.24.54	21.468	2021.177	2003.525	2318.390
3-20.3	80.23.19	21.466	2021.167	2003.566	2319.393
3-20.4	80.24.14	21.455	2021.157	2003.563	2320.389
1-20.10	84. 7.37	19.875	2019.774	2002.002	2326.369
2-20.10	76.25.18	19.891	2019.339	2004.655	2326.371
1-20.15	83.52.20	19.864	2019.752	2002.103	2331.376
2-20.15	76. 7.46	19.997	2019.423	2004.755	2331.364
1-20.20	84.12.46	19.889	2019.792	2001.996	2336.381
2-20.20	76.24.22	19.886	2019.333	2004.655	2336.397
1-20.27	83.53.34	19.841	2019.731	2002.082	2343.354
2-20.27	76.14.11	19.948	2019.377	2004.737	2343.381
1-20.30	83.45. 6	19.906	2019.689	2002.150	2346.363
2-20.30	75.59.18	19.983	2019.392	2004.823	2346.363
1-20.33	83.43.18	19.790	2019.673	2002.149	2349.316
2-20.33	75.59.43	19.969	2019.384	2004.796	2349.332
1-20.40	84. 4.43	19.819	2019.717	2002.003	2356.412
2-20.40	76.11.32	19.818	2019.252	2004.703	2356.344
3-20.46	80.16.54	21.400	2021.101	2003.563	2362.329
3-20.48	80.17. 9	21.388	2021.093	2003.601	2364.350
3-20.49	80.15.12	21.395	2021.088	2003.611	2365.323
3-20.51	80.14.58	21.365	2021.065	2003.585	2367.336
3-20.52	80.16.38	21.345	2021.044	2003.570	2368.323
3-30.1	71.18.30	32.000	2030.325	2010.215	2317.490
3-30.2	71.18.57	31.890	2030.235	2010.141	2318.500
3-30.3	71.19. 7	31.800	2030.128	2010.177	2319.490
3-30.4	71.19.12	31.740	2030.073	2010.150	2320.470
1-30.10	69.25. 1	29.023	2027.171	2010.202	2326.517
2-30.10	72.34.31	30.777	2029.377	2009.177	2326.461
1-30.15	68.48.13	29.890	2027.974	2010.791	2331.406
2-30.15	73.53.53	30.034	2028.875	2008.263	2331.469
1-30.20	68.23. 2	30.020	2027.910	2011.056	2336.462
2-30.20	73.31.20	29.937	2028.715	2008.466	2336.442
1-30.27	68.52.31	29.873	2027.880	2010.729	2343.442
2-30.27	73.59.42	30.072	2029.921	2008.239	2343.455
1-30.30	68.54.25	29.879	2027.889	2010.722	2346.473
2-30.30	73.58.51	30.066	2028.917	2008.233	2346.424
1-30.33	68.52.56	29.935	2027.951	2010.717	2349.432
2-30.33	74. 0. 4	30.071	2028.907	2008.283	2349.426
1-30.40	69.36. 6	30.017	2027.950	2010.944	2356.023
2-30.40	73.48.49	29.936	2028.767	2008.283	2356.232
3-30.46	71.19.34	31.645	2029.994	2010.089	2362.467
3-30.48	71.17.45	31.712	2030.057	2010.110	2364.474
3-30.49	71.23.34	31.628	2029.990	2010.047	2365.466
3-30.51	71.27.12	31.617	2029.980	2010.041	2367.435
3-30.52	71.27. 0	31.617	2029.974	2010.054	2369.462
3-40.1	84.24.50	41.472	2041.284	2003.947	2317.522
3-40.2	84.23.23	41.462	2041.267	2004.012	2318.535
3-40.3	84.25. 5	41.461	2041.265	2004.024	2319.540
3-40.4	84.27.33	41.477	2041.289	2003.945	2320.524
1-40.10	86.13.23	39.924	2039.840	2002.590	2326.556
2-40.10	82.20.17	39.897	2039.545	2005.290	2326.505
1-40.15	86. 3.24	39.872	2039.780	2002.700	2331.547

Table 2-9. (continued)

	2-40.15	82.12.42	39.971	2039.612	2005.344	2331.491
	1-40.20	86.12.55	39.936	2039.855	2002.540	2336.592
	2-40.20	82.21.38	39.886	2039.541	2005.237	2336.584
	1-40.27	86. 2.23	39.901	2039.808	2002.710	2343.502
	2-40.27	82.12.10	39.983	2039.615	2005.407	2343.477
	1-40.30	85.58.53	39.889	2039.797	2002.703	2346.575
	2-40.30	82.10.21	40.005	2039.637	2005.412	2346.550
	1-40.33	86. 6.44	39.953	2039.866	2002.632	2349.466
	2-40.33	82. 9.53	39.983	2039.622	2005.359	2349.437
	1-40.40	86. 7.39	39.901	2039.814	2002.627	2356.537
	2-40.40	82.15.40	39.924	2039.570	2005.307	2356.499
	3-40.46	84.14.53	41.470	2041.271	2004.061	2362.497
	3-40.48	84.13. 3	41.451	2041.240	2004.171	2364.499
	3-40.49	84.13. 3	41.451	2041.240	2004.171	2365.502
	3-40.51	84.12.51	41.432	2041.230	2004.085	2367.478
	3-40.52	84.14. 0	41.411	2041.201	2004.161	2368.480
	3-60.1	77.19.33	61.368	2059.892	2013.378	2317.380
	3-60.2	77.18.41	61.370	2059.895	2013.373	2318.343
	3-60.3	77.19.15	61.349	2059.862	2013.426	2319.359
	3-60.4	77.18. 7	61.347	2059.851	2013.467	2320.371
	1-60.10	78.26.54	59.719	2058.537	2011.821	2326.403
	2-60.10	75.51.18	59.859	2058.055	2014.583	2326.376
	1-60.15	78.30.30	59.726	2058.544	2011.822	2331.318
	2-60.15	75.56.30	59.759	2057.988	2014.440	2331.292
	1-60.20	78.27.22	59.729	2058.532	2011.897	2336.418
	2-60.20	75.53.57	59.788	2058.022	2014.422	2336.401
	1-60.27	78.28.46	59.729	2058.549	2011.812	2343.223
	2-60.27	75.54.46	59.784	2058.015	2014.435	2343.337
	1-60.30	78.28.57	59.759	2058.585	2011.786	2346.351
	2-60.30	75.55.19	59.788	2058.004	2014.495	2346.358
	1-60.33	78.27.26	59.747	2058.552	2011.989	2349.315
	2-60.33	75.54. 9	59.812	2058.016	2014.546	2349.330
	1-60.40	78.23.39	59.706	2058.506	2011.912	2356.336
	2-60.40	75.48.35	59.848	2058.044	2014.583	2356.363
	3-60.46	77.13.11	61.348	2059.834	2013.542	2362.335
	3-60.48	77.10.59	61.342	2059.849	2013.454	2364.315
	3-60.49	77.11. 3	61.303	2059.778	2013.590	2365.304
	3-60.51	77.10.12	61.305	2059.781	2013.582	2367.301
	3-60.52	77. 9.59	61.304	2059.807	2013.463	2368.330
	I110.0N	350. 0. 9	9.980	1998.271	2009.829	2316.210
	I125.0N	350. 0.15	25.920	1995.517	2025.529	2316.020
	I150.0N	349.59.20	49.940	1991.361	2049.187	2315.410
	II92H.0N	350. 0. 5	82.490	1985.695	2081.240	2314.540
	II10.0W	0. 0. 0	10.000	2000.000	2010.000	2316.320
	II10.0S	170. 0.30	10.000	2001.722	1990.149	2316.380
	II25.0S	170. 0.41	25.080	2004.306	1975.292	2316.410
	II50.0S	170. 0.17	50.000	2008.642	1950.752	2316.410
	II92H.0S	170. 0.23	82.480	2014.232	1918.757	2315.940
	III10.0E	80. 0. 3	9.950	2009.799	2001.726	2316.320
	I20.0E	108.54.14	20.100	2019.012	1993.476	2316.540
	I20.3E	108.54.14	20.340	2019.239	1993.398	2319.410
	III20.3E	0. 0. 0	20.150	2000.000	2020.150	2319.410
	I30.0E	99.15.25	29.950	2029.554	1995.150	2316.410
	I30.3E	99.15.25	30.100	2029.703	1995.125	2319.330
	III30.3E	0. 0. 0	30.150	2000.000	2030.150	2319.430
	I40.0E	65.43.46	39.980	2036.479	2016.360	2316.430
	I40.3E	65.43.46	40.090	2036.580	2016.405	2319.340
	III40.3E	0. 0. 0	40.110	2000.000	2040.110	2319.260
	I60.0E	89.35.17	60.040	2060.039	2000.387	2316.390
	I60.3E	89.35.17	60.280	2060.279	2000.389	2319.290
	III60.3E	0. 0. 0	60.150	2000.000	2060.150	2319.260
	II90.0E	90. 0. 0	90.020	2088.652	2015.632	2316.040
	III50.0E	80. 0. 0	149.890	2147.513	2026.029	2315.330
	II400.0E	80. 0. 0	399.940	2393.864	2069.449	2314.380

Table 2-9. (continued)

W 1	257.20.55	35.586	1965.259	1992.289	2318.150
W 2	260.21.43	70.394	1930.578	1988.344	2318.070
W 3	261.29.48	105.189	1895.935	1984.663	2317.350
E 2	96.50.18	58.206	2057.786	1993.024	2318.240
E 3	99.32.46	99.795	2098.380	1983.252	2317.910
300-1	175.27.50	305.220	2023.476	1695.684	2313.120
300-2	172.47.59	309.388	2037.988	1692.953	2313.030
300-3	170. 9.15	314.160	2053.518	1690.432	2313.070
VP 1A	333.24.43	106.193	1952.648	2095.052	2348.823
VP 1B	333.24.40	106.422	1952.533	2095.250	2383.752
VP 2A	317.56.24	121.905	1918.429	2090.592	2348.640
VP 2B	317.48.50	122.407	1917.996	2090.878	2383.605
VP 3A	305.18.51	149.196	1879.448	2086.514	2348.376
VP 3B	305.12.35	149.142	1878.275	2086.176	2383.340
300 W1	183.38.57	314.780	1979.184	1685.909	2330.730
300 W2	187.40.48	320.020	1956.569	1682.941	2330.280
BME 1	10. 0.11	393.550	2069.546	2387.534	2367.000
BME 2	17.12. 7	396.900	2117.495	2379.110	2366.770
BME 3	24. 2. 0	405.750	2165.249	2370.575	2366.990

BEARING IN DEGREES, MINUTES, AND SECONDS, AND DISTANCE IN FEET
BEARING AND DISTANCE FROM GRD.ZERO UNLESS NOTED OTHERWISE
COORDINATES EAST AND NORTH AND ELEVATION IN FEET

TOTAL NUMBER OF SURVEYED POINTS IS 142

CALCULATED DISTANCE BETWEEN BOT.CRG. AND G.ZERO.B IS 15.206 FEET
CALCULATED DISTANCE BETWEEN BOT.CRG. AND TOP.CRG. IS 30.222 FEET

Table 3-9-WF3T(3). Film calibration data transformed to the object plane—Shot 9, WF3T at 3 feet.

PHOTOGRAMMETRICS DPW/9 ST WF3T 209.M03 C.750205

CAMERA (LENS) POSITION IS 1996.144 FEET EAST, 1391.805 FEET NORTH, AND 2316.298 FEET ELEVATION
OPTICAL AXIS IS ORIENTED TO 6.738 DEGREES EAST OF NORTH AND 3.311 DEGREES ELEVATION (±0.001)
OBJECT PLANE IS 603.439 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GRD.ZERO

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y	
1-20.10	-47.980	-25.104	0.281	0.204	
1-20.15	-47.734	-19.970	0.018	0.036	
1-20.20	-47.840	-15.153	0.179	0.184	
1-20.27	-47.624	-8.055	-0.080	-0.015	
1-20.30	-47.578	-5.158	-0.160	0.062	
1-20.33	-47.771	-2.283	0.030	0.106	
1-20.40	-47.659	4.839	-0.000	0.000	REFERENCE POINT P1
1-30.10	-40.120	-25.048	-0.649	0.147	
1-30.15	-40.018	-20.173	-0.087	0.037	
1-30.20	-39.923	-15.225	-0.150	0.014	
1-30.27	-39.813	-8.440	-0.256	0.044	
1-30.30	-39.723	-5.715	-0.328	0.270	
1-30.33	-39.709	-2.702	-0.271	0.138	
1-30.40	-39.691	4.100	-0.276	-0.269	
1-40.10	-27.894	-24.763	0.002	0.000	REFERENCE POINT P2
1-40.15	-27.832	-19.864	-0.112	0.027	
1-40.20	-27.725	-14.873	-0.127	0.017	
1-40.27	-27.793	-8.035	-0.105	-0.019	
1-40.30	-27.691	-5.255	-0.211	0.227	
1-40.33	-27.648	-2.175	-0.175	-0.007	
1-40.40	-27.734	4.645	-0.119	0.124	
1-60.10	-10.172	-25.301	-0.270	0.205	
1-60.15	-10.156	-20.379	-0.277	0.048	
1-60.20	-10.136	-15.346	-0.314	-0.047	
1-60.27	-9.848	-8.620	-0.573	-0.182	
1-60.30	-10.150	-5.832	-0.232	0.050	
1-60.33	-10.250	-3.072	-0.171	0.149	
1-60.40	-10.366	3.692	-0.095	0.159	
E 3	32.668	-33.191	-0.313	-0.087	
300-1	-15.339	-39.885	-1.499	-1.334	
300-2	14.750	-40.131	-2.398	-1.289	
300-3	43.325	-40.040	-1.673	-1.314	
BME 1	-26.397	-4.198	-0.759	-0.019	
BME 2	2.798	-4.179	0.034	-0.096	
BME 3	32.221	-4.029	0.043	-0.025	
AVERAGES			-0.317	-0.070	

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE
SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

SMEAR = 0.024 FEET, MAX. CALIBRATION ERROR SCALED
SHAKE = 0.011 FEET, MAX. CAMERA ORIENTATION ERROR

TOTAL = ±0.035 FEET, MEASURED IN THE OBJECT PLANE.

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS 1-40.27 AND E 3

Table 4-9-WF3T(3). Film timing data—Shot 9, WF3T at 3 feet.

FILM TIMING DATA DPW/9 ST WF3T 209.M03 C.750205

STATIC ZERO = 3.38 CM
ACTUAL ZERO = 4.48 CM

FRAME LENGTH= 0.75850 CM

FRAME NO.	5-MSEC DISTANCE	FILM SPEED
-31	14.94 CM	3939./SEC
069	15.16 CM	3997./SEC
169	15.34 CM	4045./SEC
269	15.53 CM	4095./SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA
OTHER LENGTHS ARE FROM FILM MEASURMENT

Table 5-9. Meteorological observations—Shot 9.

DPW/9

Date: 22 October 1973

Time: 1156 MDT

Observer: WHB

Standard Meteorological Observations:

At control bunker.
22 meter wind data at Photo tower.

Wind Data:	22 Meters	2 Meters
Direction	245°	245°
Speed	4.5 mph	3.8 mph

Temperatures (°F):

Air temperature	57.5°F
Surface temperature	59.8°F
Temperature gradient (4-½ M)	-1.0°F
Relative humidity	55%

Pressure: 13.491 psi

Sky Condition:

Clouds 1/10 Ac 6/10 Ci

Sun Moderate through zero

Table 6-9-WF3T(3)a. Shock trajectory analysis— primary front, bottom charge—Shot 9.

SHOCK FRONT DATA DPW/9 ST WF3T 209.M03 PRIMARY FRONT, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 57.5 F
AMBIENT PRESSURE = 13.49 PSI
RELATIVE HUMIDITY = 55.0 %
VAPOUR PRESSURE= 6.677 MM HG
AMBIENT SPEED OF SOUND = 1.1170 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5566
CHARGE HEIGHT= 15.21 FEET
SEPARATION #2= 15.11 FEET

RFIT=A+B*T+C*LOG(1+T)

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
9.434	42.290	42.289	-0.001	0.998	4.006	1.962	3.323	44.832	1.210	2.610	36
9.685	42.783	42.839	0.055	1.025	4.058	1.952	3.277	44.203	1.199	2.594	37
9.935	43.460	43.384	-0.076	1.051	4.110	1.942	3.231	43.594	1.189	2.579	38
10.184	43.899	43.927	0.028	1.078	4.161	1.932	3.188	43.003	1.179	2.564	39
10.433	44.432	44.468	-0.015	1.105	4.212	1.922	3.145	42.430	1.169	2.550	40
10.680	45.021	45.006	-0.015	1.131	4.263	1.913	3.104	41.875	1.159	2.536	41
10.941	45.589	45.541	-0.048	1.158	4.314	1.904	3.064	41.335	1.149	2.522	42
11.192	46.041	46.074	0.033	1.184	4.364	1.896	3.025	40.812	1.140	2.509	43
11.443	46.577	46.604	0.027	1.211	4.415	1.887	2.987	40.303	1.131	2.496	44
11.694	47.075	47.132	0.057	1.237	4.465	1.879	2.951	39.808	1.122	2.483	45
11.945	47.612	47.657	0.045	1.264	4.514	1.871	2.915	39.328	1.113	2.470	46
12.196	48.200	48.180	-0.020	1.290	4.564	1.863	2.881	38.860	1.105	2.458	47
12.446	48.800	48.701	-0.099	1.317	4.613	1.855	2.847	38.406	1.096	2.446	48
12.697	49.222	49.220	-0.003	1.344	4.662	1.847	2.814	37.963	1.088	2.434	49
12.948	49.735	49.736	0.001	1.370	4.711	1.840	2.782	37.532	1.080	2.422	50
13.199	50.220	50.250	0.030	1.397	4.760	1.833	2.751	37.113	1.072	2.411	51

ALL VELOCITIES IN MACH UNITS.

Table 6-9-WF3T(3)b. Shock trajectory analysis– ground mach stem—Shot 9.

SHOCK FRONT DATA DPW/9 ST WF3T 209.M03 GROUND MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 57.5 F
AMBIENT PRESSURE = 17.49 PSI
RELATIVE HUMIDITY = 55.0 %
VAPOUR PRESSURE= 8.677 MM HG
AMBIENT SPEED OF SOUND = 1.1170 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5566
CHARGE HEIGHT= 15.21 FEET
SEPARATION R2= 15.11 FEET

R=IT-A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
9.434	42.875	42.813	-0.062	0.998	4.056	2.452	5.845	78.456	1.703	3.275	36
9.685	43.434	43.497	0.063	1.025	4.120	2.421	5.673	76.535	1.674	3.238	37
9.939	44.234	44.172	-0.062	1.051	4.184	2.392	5.509	74.323	1.645	3.202	38
10.184	44.815	44.839	-0.076	1.078	4.247	2.364	5.353	72.210	1.617	3.167	39
10.439	45.534	45.498	-0.036	1.105	4.310	2.337	5.203	70.194	1.591	3.132	40
10.690	46.087	46.150	0.093	1.131	4.372	2.310	5.060	68.266	1.565	3.098	41
10.941	46.707	46.794	0.087	1.158	4.433	2.285	4.923	66.421	1.539	3.065	42
11.192	47.382	47.431	0.049	1.184	4.493	2.260	4.793	64.655	1.515	3.032	43
11.443	48.116	48.062	-0.054	1.211	4.553	2.236	4.667	62.967	1.491	3.000	44
11.694	48.685	48.685	0.001	1.237	4.612	2.213	4.547	61.338	1.468	2.969	45
11.945	49.234	49.302	0.068	1.264	4.670	2.190	4.431	59.779	1.445	2.938	46
12.196	49.843	49.913	-0.030	1.290	4.728	2.169	4.320	58.282	1.423	2.908	47
12.446	50.239	50.518	0.218	1.317	4.785	2.147	4.213	56.843	1.402	2.879	48
12.697	51.136	51.116	0.010	1.344	4.842	2.127	4.111	55.458	1.381	2.850	49
12.948	51.652	51.709	0.057	1.370	4.898	2.107	4.012	54.125	1.360	2.822	50
13.199	52.337	52.297	-0.040	1.397	4.954	2.087	3.917	52.841	1.340	2.794	51
13.449	52.876	52.879	0.002	1.423	5.009	2.069	3.825	51.604	1.321	2.767	52
13.700	53.689	53.455	-0.234	1.450	5.064	2.050	3.737	50.411	1.302	2.740	53
13.951	54.262	54.027	-0.235	1.476	5.118	2.032	3.651	49.260	1.283	2.714	54
14.201	54.595	54.593	-0.002	1.503	5.171	2.015	3.569	48.149	1.265	2.688	55
14.452	55.173	55.155	-0.019	1.529	5.225	1.998	3.489	47.075	1.248	2.663	56
14.703	55.699	55.712	0.012	1.556	5.277	1.981	3.413	46.038	1.230	2.639	57
14.953	56.347	56.264	-0.084	1.582	5.330	1.965	3.338	45.033	1.213	2.615	58
15.204	56.777	56.811	0.034	1.609	5.382	1.949	3.266	44.065	1.197	2.591	59
15.454	57.357	57.354	-0.002	1.635	5.433	1.934	3.197	43.126	1.181	2.568	60
15.704	58.130	57.893	-0.297	1.662	5.484	1.919	3.129	42.216	1.165	2.545	61
15.955	59.457	58.428	-0.029	1.688	5.535	1.904	3.064	41.335	1.149	2.522	62
16.206	59.692	60.007	0.315	1.768	5.684	1.862	2.880	38.852	1.105	2.457	65
16.956	60.426	60.526	0.100	1.794	5.733	1.849	2.822	39.073	1.090	2.437	66
17.206	60.892	61.041	0.149	1.821	5.782	1.836	2.766	37.317	1.076	2.416	67
17.456	61.522	61.553	0.031	1.847	5.831	1.823	2.712	36.583	1.062	2.396	68
17.707	62.071	62.060	-0.011	1.874	5.879	1.811	2.659	35.869	1.049	2.376	69
17.957	62.684	62.564	-0.120	1.900	5.927	1.799	2.607	35.176	1.036	2.357	70
18.207	62.973	63.065	0.092	1.927	5.974	1.787	2.558	34.503	1.022	2.338	71
18.457	63.450	63.563	0.112	1.953	6.021	1.775	2.509	33.849	1.010	2.319	72
18.707	63.981	64.057	0.076	1.979	6.068	1.764	2.462	33.210	0.997	2.301	73
18.957	64.571	64.548	-0.023	2.006	6.114	1.752	2.416	32.590	0.985	2.283	74
19.207	65.070	65.035	-0.035	2.032	6.161	1.741	2.371	31.987	0.973	2.265	75
19.457	65.379	65.520	0.141	2.059	6.207	1.731	2.327	31.399	0.961	2.248	76
19.707	65.935	66.002	0.067	2.085	6.252	1.720	2.285	30.827	0.949	2.231	77
19.957	66.344	66.480	0.136	2.112	6.297	1.710	2.244	30.269	0.937	2.214	78
20.206	66.959	66.956	-0.003	2.138	6.343	1.700	2.203	29.725	0.926	2.197	79

Table 6-9-WF3T(3)b. (continued)

20.456	67.542	67.429	-0.113	2.165	6.387	1.690	2.164	29.136	0.915	2.141	80
20.706	68.144	67.899	-0.245	2.191	6.432	1.680	2.126	28.479	0.904	2.165	81
20.956	68.525	68.366	-0.159	2.217	6.476	1.670	2.088	28.175	0.903	2.149	82
21.206	68.827	68.831	0.004	2.244	6.520	1.661	2.052	27.844	0.892	2.133	83
21.455	69.318	69.293	-0.025	2.270	6.564	1.652	2.016	27.204	0.878	2.110	84
21.705	69.962	69.752	-0.210	2.297	6.607	1.643	1.982	26.736	0.892	2.103	85
21.955	70.282	70.209	-0.073	2.323	6.651	1.634	1.948	26.278	0.852	2.088	86
22.204	70.618	70.664	0.046	2.349	6.694	1.625	1.915	25.839	0.842	2.074	87
22.454	71.036	71.115	0.079	2.376	6.737	1.617	1.882	25.396	0.832	2.060	88
22.703	71.417	71.565	0.148	2.402	6.779	1.608	1.851	24.957	0.822	2.045	89
22.953	71.919	72.012	0.093	2.429	6.821	1.600	1.820	24.551	0.813	2.032	90

ALL VELOCITIES IN MACH UNITS.

Table 6-9-WF3T(3)c. Shock trajectory analysis—upper mach stem, bottom charge—Shot 9.

SHOCK FRONT DATA DPW/9 ST WF3T 209.M03 UPPER MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 57.5 F
AMBIENT PRESSURE = 13.49 PSI
RELATIVE HUMIDITY = 55.0 %
VAPOUR PRESSURE= 6.677 MM HG
AMBIENT SPEED OF SOUND = 1.1170 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5560
CHARGE HEIGHT= 15.21 FEET
SEPARATION #2= 15.11 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
9.434	43.473	43.516	0.043	0.998	4.122	2.480	6.011	81.093	1.731	3.310	36
9.685	44.138	44.208	0.070	1.025	4.188	2.449	5.828	79.626	1.700	3.272	37
9.936	44.964	44.891	-0.073	1.051	4.252	2.419	5.654	76.279	1.670	3.234	38
10.183	45.574	45.565	-0.009	1.078	4.316	2.388	5.488	74.044	1.641	3.197	39
10.439	46.295	46.231	-0.064	1.105	4.379	2.360	5.331	71.915	1.613	3.162	40
10.690	46.897	46.889	-0.008	1.131	4.442	2.332	5.180	69.883	1.586	3.126	41
10.941	47.813	47.539	-0.274	1.158	4.503	2.306	5.036	67.942	1.560	3.092	42
11.192	47.816	48.182	0.366	1.184	4.564	2.280	4.899	66.087	1.535	3.059	43
11.443	48.822	48.818	-0.005	1.211	4.624	2.255	4.767	64.312	1.510	3.026	44
11.694	49.568	49.446	-0.138	1.237	4.684	2.231	4.641	62.613	1.486	2.993	45
11.945	49.769	50.068	0.099	1.264	4.743	2.208	4.520	60.984	1.462	2.962	46
12.196	50.687	50.684	-0.003	1.290	4.801	2.185	4.405	59.422	1.440	2.931	47
12.446	51.418	51.293	-0.125	1.317	4.859	2.163	4.293	57.923	1.418	2.901	48
12.697	51.965	51.896	-0.068	1.344	4.916	2.142	4.187	56.483	1.396	2.871	49
12.948	52.571	52.493	-0.078	1.370	4.973	2.122	4.084	55.099	1.375	2.842	50
13.199	52.758	53.085	0.326	1.397	5.029	2.101	3.985	53.767	1.355	2.814	51
13.449	53.852	53.671	-0.181	1.423	5.084	2.082	3.890	52.486	1.335	2.786	52
13.700	54.121	54.251	0.130	1.450	5.139	2.063	3.799	51.252	1.315	2.759	53
13.951	54.669	54.826	0.157	1.476	5.194	2.045	3.711	50.062	1.296	2.732	54
14.201	55.398	55.396	-0.202	1.503	5.247	2.027	3.626	48.916	1.278	2.706	55
14.452	55.936	55.961	0.024	1.529	5.301	2.009	3.544	47.810	1.260	2.681	56
14.703	56.913	57.076	0.158	1.582	5.407	1.976	3.388	45.710	1.225	2.631	58
15.204	57.319	57.626	0.307	1.609	5.459	1.960	3.314	44.714	1.208	2.607	59
15.454	58.422	58.173	-0.249	1.635	5.511	1.944	3.243	43.750	1.192	2.583	60
15.704	58.744	58.714	-0.030	1.662	5.562	1.929	3.174	42.818	1.175	2.560	61
15.955	59.321	59.252	-0.069	1.688	5.613	1.914	3.107	41.916	1.160	2.537	62
16.205	59.898	59.785	-0.113	1.715	5.663	1.899	3.042	41.043	1.144	2.515	63
16.455	60.336	60.314	-0.022	1.741	5.713	1.885	2.980	40.197	1.129	2.493	64
16.706	60.828	60.839	0.011	1.768	5.763	1.871	2.919	39.377	1.114	2.471	65
16.956	61.467	61.360	-0.107	1.794	5.812	1.858	2.860	38.583	1.100	2.450	66
17.206	61.824	61.878	0.053	1.821	5.861	1.845	2.803	37.812	1.085	2.430	67
17.456	62.424	62.391	-0.033	1.847	5.910	1.832	2.747	37.064	1.071	2.409	68
17.707	62.867	62.901	0.034	1.874	5.958	1.819	2.694	36.339	1.058	2.389	69
17.957	63.418	63.408	-0.011	1.900	6.006	1.807	2.641	35.634	1.044	2.370	70
18.207	63.869	63.911	0.041	1.927	6.054	1.795	2.591	34.950	1.031	2.351	71
18.457	64.330	64.410	0.080	1.953	6.101	1.783	2.541	34.285	1.018	2.332	72
18.707	64.885	64.907	0.022	1.979	6.148	1.771	2.493	33.638	1.006	2.313	73
18.957	65.396	65.400	-0.196	2.006	6.195	1.760	2.447	33.010	0.993	2.295	74
19.207	65.928	65.890	-0.039	2.032	6.242	1.749	2.402	32.398	0.981	2.277	75
19.457	66.377	66.376	-0.001	2.059	6.288	1.738	2.357	31.803	0.969	2.260	76
19.707	66.871	66.860	-0.011	2.085	6.333	1.727	2.314	31.224	0.957	2.242	77
19.957	67.253	67.341	0.088	2.112	6.379	1.717	2.273	30.660	0.946	2.226	78

Table 6-9-WF3T(3)c. (continued)

20.206	67.893	67.818	-0.074	2.138	6.424	1.707	2.232	30.111	0.934	2.209	79
20.456	68.276	68.293	0.018	2.165	6.469	1.697	2.192	29.576	0.923	2.193	80
20.706	68.720	68.765	0.046	2.191	6.514	1.687	2.154	29.055	0.912	2.176	81
20.955	69.169	69.235	0.065	2.217	6.558	1.677	2.116	28.547	0.901	2.161	82
21.206	69.657	69.701	0.044	2.244	6.603	1.669	2.079	28.052	0.890	2.145	83
21.455	70.178	70.165	-0.013	2.270	6.647	1.659	2.044	27.563	0.880	2.130	84
21.705	70.658	70.627	-0.031	2.297	6.690	1.650	2.009	27.097	0.870	2.115	85
21.955	71.063	71.085	0.022	2.323	6.734	1.641	1.974	26.637	0.860	2.100	86
22.204	71.442	71.542	0.100	2.349	6.777	1.632	1.941	26.188	0.850	2.086	87
22.454	72.010	71.995	-0.015	2.376	6.820	1.624	1.909	25.749	0.840	2.071	88
22.703	72.400	72.447	0.047	2.402	6.863	1.615	1.877	25.321	0.830	2.057	89
22.953	73.037	72.896	-0.141	2.429	6.905	1.607	1.846	24.903	0.821	2.043	90

ALL VELOCITIES IN MACH UNITS.

Table 2-10. Photo marker and gauge survey data—Shot 10.

SURVEY DATA LIST — DDW/10 — C.750205

PT. NAME	BEARING	DISTANCE	COORD. E	COORD. N	COORD. H
GND.ZERO	0. 0. 0	0.0	2000.000	2000.000	2316.320
G.ZERO.B	230.55. 5	1.229	1999.046	1999.225	2316.320
TOT.CRG.	230.55. 5	1.229	1999.046	1999.225	2331.240
TOP.CRG.	249.41.17	1.190	1998.884	1999.588	2361.634
MCP	180. 2.47	598.713	1998.289	1401.290	2313.750
MP5 267			2001.207	1391.327	2342.473
MP3T 209			1996.000	1399.400	2317.000
3-20.1	80.19.35	21.453	2021.153	2003.573	2317.371
3-20.2	80.24.54	21.468	2021.177	2003.525	2318.340
3-20.3	80.23.19	21.466	2021.167	2003.506	2319.303
3-20.4	80.24.14	21.455	2021.157	2003.503	2320.348
1-20.10	84. 7.37	19.875	2019.774	2002.052	2326.307
2-20.10	70.25.18	19.891	2019.339	2004.653	2320.371
1-20.15	83.52.20	19.864	2019.752	2002.103	2331.375
2-20.15	76. 7.46	19.997	2019.423	2004.755	2331.364
1-20.20	84.12.46	19.889	2019.792	2001.966	2336.381
2-20.20	76.24.22	19.886	2019.333	2004.555	2336.337
1-20.27	83.53.34	19.841	2019.731	2002.092	2343.354
2-20.27	76.14.11	19.948	2019.377	2004.737	2343.331
1-20.30	83.45. 6	19.806	2019.689	2002.150	2346.364
2-20.30	75.59.18	19.983	2019.392	2004.823	2346.368
1-20.33	83.43.18	19.790	2019.673	2002.149	2349.319
2-20.33	75.59.43	19.969	2019.394	2004.790	2349.332
1-20.40	84. 4.43	19.819	2019.717	2002.008	2356.412
2-20.40	76.11.32	19.818	2019.252	2004.703	2356.344
3-20.46	80.16.54	21.400	2021.101	2003.563	2362.329
3-20.48	80.17. 9	21.388	2021.083	2003.501	2364.330
3-20.49	80.15.12	21.395	2021.088	2003.511	2365.328
3-20.51	80.14.58	21.365	2021.065	2003.565	2367.334
3-20.52	80.16.38	21.345	2021.044	2003.570	2368.323
3-30.1	71.18.30	32.000	2030.325	2010.215	2317.430
3-20.2	71.18.57	31.890	2030.235	2010.141	2318.500
3-30.3	71.19. 7	31.800	2030.128	2010.177	2319.490
3-30.4	71.19.12	31.740	2030.073	2010.150	2320.470
1-30.10	69.25. 1	29.023	2027.171	2010.203	2326.317
2-30.10	72.34.31	30.777	2029.377	2009.177	2326.361
1-30.15	69.48.13	29.890	2027.874	2010.791	2331.406
2-30.15	73.53.53	30.034	2028.875	2008.253	2331.403
1-30.20	69.23. 2	30.020	2027.910	2011.056	2336.462
2-30.20	73.31.20	29.937	2028.715	2008.466	2336.442
1-30.27	69.52.31	29.873	2027.890	2010.729	2343.442
2-30.27	73.59.42	30.072	2028.921	2008.238	2343.455
1-30.30	69.54.25	29.879	2027.885	2010.722	2346.473
2-30.30	73.58.51	30.066	2028.917	2008.233	2346.424
1-30.33	69.52.56	29.935	2027.951	2010.717	2349.432
2-30.33	74. 0. 4	30.071	2028.907	2008.283	2349.426
1-30.40	69.36. 6	30.017	2027.950	2010.944	2356.023
2-30.40	73.48.49	29.936	2028.767	2008.283	2356.232
3-30.46	71.19.34	31.645	2029.994	2010.088	2362.467
3-30.48	71.17.45	31.712	2030.057	2010.110	2364.474
3-30.49	71.23.34	31.628	2029.990	2010.047	2365.466
3-30.51	71.27.12	31.617	2029.980	2010.041	2367.435
3-30.52	71.27. 0	31.617	2029.974	2010.053	2368.462
3-40.1	84.24.50	41.472	2041.284	2003.947	2317.522
3-40.2	84.23.23	41.462	2041.267	2004.012	2318.535
3-40.3	84.25. 5	41.461	2041.265	2004.024	2319.540
3-40.4	84.27.33	41.477	2041.289	2003.945	2320.524
1-40.10	86.13.23	39.924	2039.840	2002.590	2326.556
2-40.10	82.20.17	39.897	2039.545	2005.240	2326.505

Table 2-10. (continued)

1-40.15	86. 3.24	39.872	2039.780	2002.700	2331.547
2-40.15	82.12.42	39.971	2039.612	2005.344	2331.491
1-40.20	86.12.55	39.936	2039.855	2002.540	2336.592
2-40.20	82.21.38	39.886	2039.541	2005.237	2336.584
1-40.27	86. 2.23	39.901	2039.808	2002.716	2343.502
2-40.27	82.12.10	39.983	2039.615	2005.407	2343.477
1-40.30	85.58.53	39.889	2039.797	2002.703	2346.575
2-40.30	82.10.21	40.005	2039.637	2005.412	2346.550
1-40.33	86. 6.44	39.953	2039.866	2002.632	2349.466
2-40.33	82. 9.53	39.983	2039.622	2005.359	2349.437
1-40.40	86. 7.39	39.901	2039.814	2002.527	2356.537
2-40.40	82.15.40	39.924	2039.570	2005.307	2356.499
3-40.46	84.14.53	41.470	2041.271	2004.061	2362.497
3-40.48	84.13. 3	41.451	2041.240	2004.171	2364.499
3-40.49	84.13. 3	41.451	2041.240	2004.171	2365.502
3-40.51	84.12.51	41.432	2041.230	2004.085	2367.473
3-40.52	84.14. 0	41.411	2041.201	2004.161	2368.480
3-60.1	77.19.33	61.368	2059.892	2013.378	2317.380
3-60.2	77.19.41	61.370	2059.899	2013.355	2318.343
3-60.3	77.19.15	61.349	2059.862	2013.426	2319.359
3-60.4	77.18. 7	61.347	2059.851	2013.467	2320.371
1-60.10	78.26.54	59.719	2058.537	2011.921	2326.403
2-60.10	75.51.18	59.859	2058.055	2014.583	2326.375
1-60.15	78.30.30	59.726	2058.544	2011.822	2331.318
2-60.15	75.56.30	59.759	2057.988	2014.440	2331.293
1-60.20	78.27.22	59.729	2058.532	2011.897	2336.419
2-60.20	75.53.57	59.788	2058.022	2014.422	2336.401
1-60.27	78.28.46	59.729	2058.549	2011.812	2343.229
2-60.27	75.54.46	59.784	2058.015	2014.435	2343.337
1-60.30	78.28.57	59.759	2058.585	2011.786	2346.351
2-60.30	75.55.19	59.788	2058.004	2014.495	2346.383
1-60.33	78.27.26	59.747	2058.552	2011.889	2349.315
2-60.33	75.54. 9	59.812	2058.016	2014.545	2349.330
1-60.40	78.23.39	59.706	2058.506	2011.912	2356.336
2-60.40	75.48.35	59.848	2058.044	2014.583	2356.363
3-60.46	77.13.11	61.348	2059.834	2013.542	2362.335
3-60.48	77.10.59	61.342	2059.848	2013.454	2364.315
3-60.49	77.11. 3	61.303	2059.778	2013.593	2365.334
3-60.51	77.10.12	61.305	2059.781	2013.582	2367.301
3-60.52	77. 9.59	61.304	2059.807	2013.463	2368.330
II10.0N	350. 0. 9	9.980	1998.271	2009.329	2316.210
II25.0N	350. 0.15	25.920	1995.517	2025.529	2316.020
II50.0N	349.59.20	49.940	1991.361	2049.187	2315.410
II82H.0N	350. 0. 5	82.490	1985.695	2081.240	2314.540
II10.0W	0. 0. 0	10.000	2000.000	2010.000	2316.320
II10.0S	170. 0.30	10.000	2001.722	1990.149	2316.380
II25.0S	170. 0.41	25.080	2004.306	1975.292	2316.410
II50.0S	170. 0.17	50.000	2008.642	1950.752	2316.410
II82H.0S	170. 0.23	82.480	2014.232	1918.757	2315.940
II10.0E	80. 0. 3	9.950	2009.799	2001.726	2316.320
I20.0E	108.54.14	20.100	2019.012	1993.476	2316.540
I20.3E	108.54.14	20.340	2019.239	1993.398	2319.410
III20.3E	0. 0. 0	20.150	2000.000	2020.150	2319.410
I30.0E	99.15.25	29.950	2029.554	1995.150	2316.410
I30.3E	99.15.25	30.100	2029.703	1995.125	2319.330
III30.3E	0. 0. 0	30.150	2000.000	2030.150	2319.430
I40.0E	65.43.46	39.980	2036.474	2016.360	2316.430
I40.3E	65.43.46	40.090	2036.580	2016.405	2319.340
III40.3E	0. 0. 0	40.110	2000.000	2040.110	2319.260
I60.0E	89.35.17	60.040	2060.039	2000.387	2316.390
I60.3E	89.35.17	60.280	2060.279	2000.389	2319.290
III60.3E	0. 0. 0	60.150	2000.000	2060.150	2319.260
II90.0E	80. 0. 0	90.020	2088.652	2015.632	2316.040
II150.0E	80. 0. 0	149.990	2147.613	2025.028	2315.330

Table 2-10. (continued)

II400.0E	80. 0. 0	399.940	2393.864	2069.449	2314.330
W 1	257.20.55	35.586	1965.259	1992.299	2318.150
W 2	260.21.43	70.394	1930.578	1988.344	2318.070
W 3	261.29.48	105.189	1895.935	1984.663	2317.350
E 2	95.50.18	58.206	2057.786	1993.024	2318.240
E 3	99.32.46	99.795	2098.380	1983.252	2317.910
300-1	175.27.50	305.220	2023.476	1695.684	2313.120
300-2	172.47.59	309.388	2037.988	1692.953	2313.030
300-3	170. 9.15	314.160	2053.518	1690.432	2313.570
VP 1A	333.24.43	106.193	1952.648	2095.052	2348.423
VP 1B	333.24.40	106.422	1952.537	2095.250	2383.753
VP 2A	317.56.24	121.905	1918.429	2090.592	2348.340
VP 2B	317.48.50	122.407	1917.996	2090.878	2383.605
VP 3A	305.18.51	149.196	1878.448	2086.514	2348.375
VP 3B	305.12.35	149.142	1878.275	2086.176	2383.340
300 W1	183.38.57	314.780	1979.184	1685.900	2330.730
300 W2	187.40.48	320.020	1956.569	1682.941	2330.230
345 1	10. 0.11	393.550	2069.546	2387.534	2367.000
345 2	17.12. 7	396.900	2117.495	2379.110	2366.770
345 3	24. 2. 0	405.750	2165.249	2370.575	2366.390

BEARING IN DEGREES, MINUTES, AND SECONDS, AND DISTANCE IN FEET
BEARING AND DISTANCE FROM GED.ZERO UNLESS NOTED OTHERWISE
COORDINATES EAST AND NORTH AND ELEVATION IN FEET

TOTAL NUMBER OF SURVEYED POINTS IS 143

CALCULATED DISTANCE BETWEEN BOT.CRG. AND G.ZERO.B IS 14.920 FEET
CALCULATED DISTANCE BETWEEN BOT.CRG. AND TOP.CRG. IS 30.445 FEET

Table 3-10-WF5(30). Film calibration data transformed to the object plane— Shot 10, WF5 at 30 feet.

PHOTOGRAMMETRICS DPW/10 ST WF5 267.M3C C.750305

CAMERA (LENS) POSITION IS 2001.207 FEET EAST, 1391.327 FEET NORTH, AND 2342.479 FEET ELEVATION
OPTICAL AXIS IS ORIENTED TO 9.458 DEGREES EAST OF NORTH AND -0.234 DEGREES ELEVATION (±0.001)
OBJECT PLANE IS 600.301 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GRD.ZERO

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y	
1-20.10	-81.341	-13.431	0.026	-0.092	
1-20.15	-81.343	-8.556	-0.011	-0.003	
1-20.20	-81.186	-3.420	-0.135	-0.178	
1-20.27	-81.171	3.237	-0.217	0.079	
1-20.30	-81.140	6.278	-0.292	0.021	
1-20.33	-81.110	9.266	-0.334	-0.039	
1-20.40	-81.301	16.187	-0.078	0.078	
1-30.10	-73.579	-13.143	-0.699	0.005	
1-30.15	-73.426	-8.427	-0.199	0.075	
1-30.20	-73.377	-3.552	-0.233	0.134	
1-30.27	-73.464	3.316	-0.165	0.072	
1-30.30	-73.435	6.199	-0.184	0.145	
1-30.33	-73.246	9.238	-0.307	-0.006	
1-30.40	-73.333	16.159	-0.217	-0.501	
1-40.10	-61.522	-13.161	0.122	-0.076	
1-40.15	-61.366	-8.183	-0.110	-0.137	
1-40.20	-61.422	-3.359	0.023	0.307	
1-40.27	-61.404	3.561	-0.055	-0.104	
1-40.30	-61.427	6.496	-0.042	-0.012	
1-40.33	-61.396	9.484	0.003	-0.152	
1-40.40	-61.432	16.300	0.0	0.000	REFERENCE POINT P1
1-60.10	-43.854	-13.079	0.002	0.001	REFERENCE POINT P2
1-60.15	-43.807	-8.414	-0.047	0.092	
1-60.20	-43.652	-3.488	-0.225	0.093	
1-60.27	-43.793	3.276	-0.082	-0.104	
1-60.30	-43.711	6.107	-0.106	0.082	
1-60.33	-43.682	9.042	-0.175	0.009	
1-60.40	-43.695	15.904	-0.230	0.029	
SME 1	-58.748	17.268	-0.002	-0.005	
SME 2	-29.234	17.230	0.471	-0.102	
SME 3	0.543	17.294	-0.004	-0.025	
AVERAGES			-0.112	-0.020	

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE
SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

SMEAR = 0.157 FEET, MAX. CALIBRATION ERROR SCALED
SHAKE = 0.010 FEET, MAX. CAMERA ORIENTATION ERROR

TOTAL = ±0.168 FEET, MEASURED IN THE OBJECT PLANE.

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS 1-60.40 AND E 3

Table 4-10-WF5(30). Film timing data— Shot 10, WF5 at 30 feet.

FILM TIMING DATA DPW/10 ST WF5 267.M30 C.750205

STATIC ZERO = 3.80 CM
ACTUAL ZERO = 3.91 CM

FRAME LENGTH= 0.94625 CM

FRAME NO.	5-MSEC DISTANCE	FILM SPEED
-31	13.10 CM	2769./SEC
069	13.39 CM	2830./SEC
169	13.65 CM	2885./SEC
269	13.90 CM	2938./SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA
OTHER LENGTHS ARE FROM FILM MEASURMENT

Table 5-10. Meteorological observations—Shot 10.

DPW/10

Date: 2 November 1973

Time: 1400 MST

Observer: WHB

Standard Meteorological Observations:

At control bunker.
22 meter wind data at Photo tower.

Wind Data:	22 Meters	2 Meters
Direction	30°	30°
Speed	7.5 mph	7.2 mph

Temperatures (°F):

Air temperature	21.3°
Surface temperature	--
Temperature gradient (4-½ M)	-1.0°F
Relative humidity	81%

Pressure: 13.689 psi

Sky Condition:

Clouds 7/10 Sc

Sun Slightly visible through zero

Table 6-10-WF5(30)a. Shock trajectory analysis— primary front, bottom charge— Shot 10.

SHOCK FRONT DATA DPW/10 ST WF5 267.M30 PRIMARY FRONT, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 21.3 F
AMBIENT PRESSURE = 13.69 PSI
RELATIVE HUMIDITY = 81.0 %
VAPOUR PRESSURE= 2.373 MM HG
AMBIENT SPEED OF SOUND) = 1.0761 FT/MSEC
CHARGE WEIGHT= 1090.0 LBS.
SACHS SCALING FACTOR = 10.5055
CHARGE HEIGHT= 14.92 FEET
SEPARATION #2= 15.22 FEET

FIT=A+B*T+C*LOG(1+T)

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
7.197	35.903	35.909	0.006	0.737	3.418	2.095	3.954	54.125	1.348	2.805	20
7.254	36.211	36.210	-0.201	0.774	3.494	2.078	3.872	53.001	1.331	2.791	21
7.910	37.372	37.505	0.133	0.810	3.570	2.062	3.794	51.930	1.314	2.757	22
8.267	38.379	38.294	-0.085	0.847	3.645	2.046	3.719	50.911	1.298	2.735	23
8.624	39.173	39.077	-0.097	0.883	3.720	2.032	3.648	49.938	1.283	2.713	24
9.337	40.550	40.625	0.075	0.956	3.867	2.003	3.515	48.122	1.253	2.672	26
9.693	41.010	41.390	0.381	0.993	3.940	1.990	3.453	47.273	1.240	2.652	27
10.050	41.990	42.151	0.161	1.029	4.012	1.977	3.394	46.460	1.226	2.633	28
10.405	42.531	42.907	0.376	1.066	4.084	1.965	3.337	45.681	1.213	2.614	29
10.762	43.674	43.658	-0.016	1.102	4.156	1.953	3.282	44.933	1.201	2.596	30
11.113	44.570	44.404	-0.266	1.139	4.227	1.941	3.230	44.216	1.189	2.579	31
11.475	45.273	45.146	-0.133	1.175	4.297	1.930	3.180	43.527	1.177	2.562	32
11.831	45.404	45.883	-0.521	1.212	4.368	1.919	3.131	42.864	1.165	2.545	33
12.188	46.574	46.616	0.042	1.248	4.437	1.909	3.085	42.227	1.154	2.529	34
12.543	47.535	47.345	-0.190	1.285	4.507	1.899	3.040	41.614	1.144	2.514	35
12.898	48.137	48.070	-0.067	1.321	4.576	1.889	2.997	41.022	1.133	2.499	36
13.254	48.982	48.792	-0.190	1.358	4.644	1.880	2.955	40.453	1.123	2.484	37
13.609	49.341	49.509	0.168	1.394	4.713	1.870	2.915	39.903	1.113	2.470	38
13.965	50.149	50.223	0.074	1.430	4.781	1.862	2.876	39.373	1.104	2.455	39
14.320	50.628	50.934	0.306	1.467	4.848	1.853	2.839	38.861	1.094	2.443	40

ALL VELOCITIES IN MACH UNITS.

Table 6-10-WF5(30)b. Shock trajectory analysis— upper mach stem, bottom charge— Shot 10.

SHOCK FRONT DATA DPW/10 ST WFS 267.M30 UPPER MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 21.3 F
AMBIENT PRESSURE = 13.69 PSI
RELATIVE HUMIDITY = 81.0 %
VAPOUR PRESSURE= 2.373 MM HG
AMBIENT SPEED OF SOUND = 1.0761 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.6055
CHARGE HEIGHT= 14.92 FEET
SEPARATION #2= 15.22 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
6.840	33.797	33.699	-0.098	0.701	3.208	3.034	9.574	131.054	2.254	3.448	19
7.564	36.212	35.965	-0.248	0.774	3.423	2.857	8.425	115.330	2.099	3.731	21
7.910	36.799	37.051	0.252	0.810	3.527	2.793	7.936	108.634	2.029	3.857	22
8.267	37.764	38.110	0.346	0.847	3.628	2.725	7.493	102.575	1.955	3.985	23
8.624	38.859	39.144	0.285	0.883	3.726	2.661	7.091	97.073	1.884	3.519	24
8.980	40.638	40.153	-0.485	0.920	3.822	2.601	6.725	92.055	1.817	3.450	25
9.693	42.143	42.105	-0.037	0.993	4.008	2.493	6.082	83.250	1.743	3.325	27
10.050	42.932	43.052	0.120	1.029	4.098	2.443	5.798	79.372	1.695	3.265	28
10.406	44.038	43.980	-0.108	1.066	4.186	2.397	5.537	75.792	1.650	3.208	29
10.762	45.147	44.891	-0.256	1.102	4.273	2.353	5.295	72.479	1.607	3.153	30
11.118	45.488	45.785	0.297	1.139	4.358	2.312	5.070	69.406	1.566	3.100	31
11.475	46.235	46.663	0.398	1.175	4.442	2.273	4.862	66.549	1.528	3.049	32
11.831	47.852	47.527	-0.325	1.212	4.524	2.236	4.667	63.886	1.491	3.000	33
12.188	48.408	48.377	-0.031	1.248	4.605	2.201	4.485	61.401	1.456	2.953	34
12.903	50.153	50.037	-0.126	1.321	4.763	2.135	4.156	56.897	1.390	2.863	36
13.259	51.167	50.849	-0.318	1.358	4.840	2.106	4.007	54.852	1.359	2.820	37
13.609	51.683	51.649	-0.034	1.394	4.916	2.077	3.867	52.930	1.330	2.779	38
13.965	52.158	52.438	0.281	1.430	4.992	2.050	3.734	51.113	1.301	2.739	39
14.320	53.307	53.217	-0.089	1.467	5.066	2.023	3.610	49.412	1.274	2.701	40
14.675	54.005	53.986	-0.018	1.503	5.139	1.998	3.492	47.799	1.248	2.664	41
15.031	54.938	54.746	-0.193	1.540	5.211	1.974	3.380	46.275	1.223	2.628	42
15.386	55.732	55.496	-0.236	1.576	5.283	1.951	3.275	44.831	1.199	2.594	43
15.742	56.351	56.238	-0.114	1.612	5.353	1.929	3.175	43.463	1.176	2.560	44
16.097	57.091	56.971	-0.110	1.649	5.423	1.908	3.080	42.164	1.153	2.528	45
16.452	57.495	57.696	0.200	1.685	5.492	1.888	2.990	40.930	1.132	2.497	46
16.807	57.959	58.413	0.444	1.722	5.560	1.868	2.904	39.757	1.111	2.466	47
17.516	59.370	59.825	0.455	1.794	5.695	1.831	2.745	37.574	1.071	2.408	49
18.226	61.174	61.210	0.035	1.867	5.826	1.797	2.600	35.588	1.034	2.354	51
18.580	61.904	61.892	-0.012	1.903	5.891	1.781	2.532	34.661	1.016	2.328	52
18.935	62.739	62.568	-0.171	1.940	5.956	1.765	2.467	33.774	0.999	2.303	53
19.289	63.240	63.238	-0.001	1.976	6.020	1.750	2.405	32.925	0.982	2.279	54
19.643	64.011	63.903	-0.108	2.012	6.083	1.735	2.346	32.111	0.966	2.255	55
19.998	64.410	64.562	0.152	2.048	6.146	1.721	2.289	31.332	0.950	2.232	56
20.352	65.339	65.215	-0.124	2.085	6.208	1.707	2.234	30.583	0.935	2.210	57
20.706	65.849	65.863	0.014	2.121	6.269	1.694	2.182	29.865	0.920	2.188	58
21.060	66.630	66.506	-0.124	2.157	6.331	1.681	2.131	29.175	0.905	2.167	59
21.414	67.175	67.144	-0.031	2.194	6.391	1.669	2.083	28.511	0.891	2.147	60
21.768	67.832	67.773	-0.054	2.230	6.452	1.657	2.036	27.873	0.878	2.127	61
22.122	68.468	68.406	-0.062	2.266	6.511	1.645	1.991	27.253	0.865	2.107	62
22.476	68.990	69.030	0.041	2.302	6.571	1.634	1.948	26.656	0.852	2.089	63
22.829	69.382	69.650	0.268	2.339	6.630	1.623	1.906	26.075	0.839	2.070	64
23.183	70.326	70.266	-0.060	2.375	6.688	1.612	1.866	25.545	0.827	2.052	65

Table 6-10-WF5(30)b. (continued)

23.536	70.871	70.877	0.006	2.411	6.747	1.602	1.827	25.914	0.815	2.035	66
23.890	71.536	71.485	-0.052	2.447	6.805	1.592	1.790	24.501	0.803	2.018	67
24.243	71.902	72.088	0.186	2.483	6.862	1.582	1.754	24.006	0.792	2.002	68
24.597	72.685	72.688	0.003	2.520	6.919	1.573	1.719	23.527	0.781	1.986	69
24.950	73.096	73.284	0.188	2.556	6.976	1.563	1.685	23.064	0.770	1.970	70
25.303	73.839	73.877	0.038	2.592	7.032	1.554	1.652	22.617	0.759	1.955	71
25.656	74.472	74.466	-0.006	2.628	7.088	1.546	1.621	22.183	0.749	1.940	72
26.009	75.256	75.051	-0.205	2.664	7.144	1.537	1.590	21.764	0.739	1.925	73
26.362	75.739	75.633	-0.105	2.700	7.199	1.529	1.560	21.358	0.729	1.911	74
26.715	76.345	76.212	-0.134	2.737	7.255	1.521	1.531	20.964	0.719	1.898	75
27.068	76.760	76.788	0.029	2.773	7.309	1.513	1.504	20.582	0.710	1.884	76

ALL VELOCITIES IN MACH UNITS.

Table 6-10-WF5(30)c. Shock trajectory analysis— lower mach stem, top charge— Shot 10.

SHOCK FRONT DATA DPW/10 ST WF5 267.M30 LOWER MACH STEM, TOP CHARGE C.750205

AMBIENT TEMPERATURE = 21.3 F
AMBIENT PRESSURE = 13.69 PSI
RELATIVE HUMIDITY = 81.0 %
VAPOUR PRESSURE= 2.373 MM HG
AMBIENT SPEED OF SOUND = 1.0761 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5055
CHARGE HEIGHT= 14.92 FEET
SEPARATION #2= 15.22 FEET

PFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FLAME NO.
6.840	33.461	33.541	0.080	0.701	3.193	3.141	10.344	141.594	2.352	3.982	19
7.197	34.885	34.728	-0.157	0.737	3.306	3.041	9.622	131.711	2.250	3.974	20
7.554	36.290	35.879	-0.411	0.774	3.415	2.949	8.981	122.933	2.175	3.910	21
7.910	36.775	36.995	0.219	0.810	3.521	2.865	8.409	115.112	2.097	3.729	22
8.267	38.488	38.079	-0.409	0.847	3.625	2.787	7.896	108.094	2.024	3.660	23
8.624	38.868	39.135	0.268	0.883	3.725	2.715	7.435	101.775	1.956	3.575	24
8.980	39.773	40.164	0.391	0.920	3.823	2.649	7.017	96.062	1.893	3.503	25
9.337	40.978	41.168	0.191	0.956	3.919	2.587	6.639	90.877	1.833	3.434	26
9.693	41.724	42.149	0.426	0.993	4.012	2.529	6.294	86.155	1.778	3.367	27
10.406	44.166	44.048	-0.118	1.066	4.193	2.424	5.690	77.899	1.677	3.242	29
10.762	44.911	44.968	0.057	1.102	4.280	2.377	5.425	74.257	1.630	3.183	30
11.118	45.041	45.870	-0.170	1.139	4.366	2.332	5.180	70.910	1.586	3.127	31
11.475	46.803	46.756	-0.047	1.175	4.451	2.291	4.954	67.819	1.545	3.072	32
11.831	47.712	47.626	-0.086	1.212	4.533	2.251	4.745	64.956	1.506	3.020	33
12.186	48.536	48.481	-0.055	1.248	4.615	2.214	4.551	62.300	1.469	2.970	34
12.542	49.174	49.322	0.147	1.285	4.695	2.179	4.371	59.830	1.433	2.922	35
12.898	50.026	50.149	0.124	1.321	4.774	2.145	4.203	57.529	1.399	2.876	36
13.254	51.126	50.965	-0.162	1.358	4.851	2.114	4.046	55.383	1.367	2.831	37
13.609	51.883	51.768	-0.116	1.394	4.928	2.084	3.899	53.373	1.337	2.788	38
13.965	52.546	52.559	0.013	1.430	5.003	2.055	3.762	51.491	1.307	2.748	39
14.320	53.600	53.340	-0.260	1.467	5.077	2.028	3.633	49.726	1.279	2.709	40
14.676	54.059	54.111	0.044	1.503	5.151	2.002	3.511	48.067	1.253	2.670	41
15.031	54.836	54.872	0.036	1.540	5.223	1.978	3.397	46.507	1.227	2.634	42
15.386	55.532	55.624	0.092	1.576	5.295	1.955	3.290	45.039	1.202	2.599	43
15.742	56.405	56.366	-0.039	1.612	5.366	1.932	3.189	43.647	1.179	2.565	44
16.097	57.151	57.101	-0.050	1.649	5.435	1.911	3.093	42.335	1.156	2.532	45
16.452	57.913	57.827	-0.086	1.685	5.504	1.890	3.003	41.095	1.134	2.501	46
16.807	58.536	58.545	0.008	1.722	5.573	1.871	2.916	39.920	1.114	2.470	47
17.161	59.146	59.256	0.110	1.758	5.640	1.852	2.835	38.806	1.093	2.441	48
17.516	61.155	61.346	0.191	1.867	5.839	1.800	2.614	35.787	1.037	2.360	51
18.226	61.981	62.030	0.049	1.903	5.905	1.784	2.548	34.877	1.020	2.334	52
18.580	62.748	62.703	-0.040	1.940	5.969	1.769	2.485	34.010	1.003	2.310	53
18.935	63.492	63.380	-0.112	1.976	6.033	1.754	2.425	33.183	0.987	2.286	54
19.289	64.208	64.046	-0.162	2.012	6.096	1.740	2.368	32.393	0.971	2.263	55
19.643	64.731	64.707	-0.024	2.048	6.159	1.727	2.311	31.634	0.956	2.241	56
19.998	65.513	65.362	-0.151	2.085	6.222	1.713	2.259	30.917	0.942	2.220	57
20.352	66.330	66.013	0.123	2.121	6.284	1.701	2.208	30.226	0.927	2.199	58
20.706	66.834	66.659	-0.175	2.157	6.345	1.689	2.160	29.565	0.914	2.179	59
21.060	67.320	67.300	-0.021	2.194	6.406	1.677	2.114	28.931	0.900	2.160	60
21.414	68.131	67.936	-0.195	2.230	6.467	1.665	2.069	28.323	0.887	2.141	61
21.768	68.652	68.568	-0.084	2.266	6.527	1.654	2.026	27.740	0.875	2.123	62
22.122	69.373	69.196	-0.178	2.302	6.587	1.644	1.986	27.180	0.863	2.105	63

Table 6-10-WF5(30)c. (continued)

22.329	69.767	69.820	0.053	2.339	6.646	1.634	1.945	26.542	0.851	2.648	64
23.183	70.541	70.439	-0.102	2.375	6.705	1.624	1.908	26.124	0.840	2.071	65
23.536	71.151	71.055	-0.096	2.411	6.764	1.614	1.872	25.525	0.829	2.055	66
23.890	71.749	71.667	-0.082	2.447	6.822	1.605	1.837	25.146	0.818	2.039	67
24.243	72.393	72.276	-0.117	2.483	6.880	1.596	1.803	24.685	0.807	2.024	68
24.597	73.052	72.891	-0.182	2.520	6.937	1.587	1.771	24.239	0.797	2.009	69
24.950	73.576	73.482	-0.094	2.556	6.995	1.578	1.739	23.810	0.787	1.995	70
25.303	74.103	74.081	-0.022	2.592	7.052	1.570	1.709	23.396	0.778	1.981	71
25.656	74.603	74.676	0.073	2.628	7.108	1.562	1.680	22.996	0.769	1.968	72
26.009	75.441	75.268	-0.173	2.664	7.165	1.554	1.652	22.610	0.759	1.955	73
26.362	75.710	75.857	0.146	2.700	7.221	1.547	1.625	22.237	0.750	1.942	74
26.715	76.439	76.443	0.015	2.737	7.276	1.539	1.598	21.877	0.742	1.929	75
27.068	76.920	77.026	0.106	2.773	7.332	1.532	1.573	21.528	0.733	1.917	76
27.421	77.573	77.606	0.033	2.809	7.387	1.525	1.548	21.191	0.725	1.905	77
27.773	78.130	78.184	0.053	2.845	7.442	1.519	1.524	20.864	0.717	1.894	78
28.126	78.595	78.759	-0.107	2.881	7.497	1.512	1.501	20.549	0.709	1.883	79
28.481	79.508	79.901	0.393	2.953	7.606	1.500	1.457	19.944	0.694	1.861	81
28.184	80.169	80.469	0.300	2.989	7.660	1.494	1.435	19.657	0.687	1.851	82
29.536	80.960	81.034	0.074	3.025	7.713	1.488	1.415	19.377	0.680	1.841	83
29.888	81.441	81.597	0.156	3.062	7.767	1.482	1.396	19.107	0.673	1.831	84
30.240	82.176	82.158	-0.018	3.098	7.820	1.476	1.377	18.844	0.666	1.822	85
30.592	82.637	82.716	0.079	3.134	7.874	1.471	1.358	18.588	0.659	1.812	86
30.945	83.303	83.272	-0.031	3.170	7.927	1.466	1.340	18.340	0.653	1.803	87
31.297	83.837	83.827	-0.010	3.206	7.979	1.461	1.322	18.099	0.647	1.794	88
31.648	84.458	84.378	-0.080	3.242	8.032	1.456	1.305	17.865	0.640	1.785	89
32.000	84.851	84.929	0.078	3.278	8.084	1.451	1.288	17.638	0.634	1.777	90
32.352	85.453	85.477	0.024	3.314	8.136	1.446	1.272	17.416	0.629	1.769	91
32.704	86.024	86.024	0.001	3.350	8.188	1.441	1.257	17.201	0.623	1.761	92
33.056	86.704	86.568	-0.135	3.386	8.240	1.437	1.241	16.991	0.617	1.753	93
33.407	87.313	87.111	0.098	3.422	8.292	1.432	1.226	16.787	0.612	1.745	94
33.759	87.637	87.652	0.015	3.458	8.343	1.428	1.212	16.589	0.606	1.738	95
34.110	88.037	88.191	0.154	3.494	8.395	1.424	1.198	16.395	0.601	1.731	96
34.461	88.736	88.728	-0.008	3.530	8.446	1.419	1.184	16.207	0.596	1.723	97
34.813	89.073	89.264	0.191	3.566	8.497	1.415	1.171	16.023	0.591	1.716	98
35.164	89.831	89.798	-0.033	3.602	8.548	1.411	1.157	15.844	0.586	1.709	99
35.515	90.258	90.331	0.073	3.638	8.598	1.408	1.145	15.669	0.581	1.703	100
35.865	90.823	90.862	-0.061	3.674	8.649	1.404	1.132	15.499	0.576	1.696	101
36.217	91.308	91.392	0.084	3.710	8.699	1.400	1.120	15.333	0.572	1.690	102
36.568	91.923	91.920	-0.004	3.746	8.750	1.396	1.108	15.171	0.567	1.683	103
36.919	92.425	92.446	0.021	3.782	8.800	1.393	1.097	15.012	0.562	1.677	104
37.270	92.954	92.971	0.018	3.818	8.850	1.389	1.085	14.853	0.558	1.671	105
37.621	93.339	93.495	0.156	3.854	8.900	1.386	1.074	14.707	0.554	1.665	106
37.971	93.954	94.019	0.064	3.890	8.949	1.383	1.064	14.560	0.550	1.660	107
38.322	94.250	94.539	0.288	3.925	8.999	1.379	1.053	14.416	0.545	1.654	108
38.672	95.148	95.058	-0.089	3.961	9.048	1.376	1.043	14.275	0.541	1.648	109
39.023	95.402	95.577	0.175	3.997	9.098	1.373	1.033	14.138	0.537	1.643	110
39.373	96.342	96.094	-0.248	4.033	9.147	1.370	1.023	14.004	0.533	1.638	111
39.724	96.504	96.610	0.106	4.069	9.196	1.367	1.013	13.872	0.530	1.632	112
40.074	97.249	97.125	-0.125	4.105	9.245	1.364	1.004	13.744	0.526	1.627	113
40.424	97.471	97.638	0.167	4.141	9.294	1.361	0.995	13.618	0.522	1.622	114
40.774	97.962	98.151	0.189	4.177	9.343	1.358	0.986	13.496	0.518	1.617	115
41.124	98.261	98.662	0.401	4.213	9.391	1.356	0.977	13.375	0.515	1.612	116
42.524	100.322	100.695	0.374	4.356	9.585	1.345	0.944	12.919	0.501	1.594	120
42.874	101.196	101.201	0.005	4.392	9.633	1.342	0.936	12.811	0.498	1.590	121
43.223	101.469	101.706	0.237	4.428	9.681	1.340	0.928	12.705	0.495	1.585	122
43.573	102.332	102.209	-0.123	4.463	9.729	1.339	0.921	12.601	0.492	1.581	123
43.923	102.635	102.712	0.027	4.499	9.777	1.335	0.913	12.500	0.489	1.577	124
44.272	103.537	103.214	-0.324	4.535	9.825	1.333	0.906	12.400	0.486	1.573	125
44.621	103.622	103.714	0.092	4.571	9.872	1.331	0.899	12.302	0.483	1.569	126
45.320	104.653	104.713	0.050	4.642	9.967	1.326	0.885	12.113	0.477	1.561	128
45.669	105.493	105.211	-0.282	4.678	10.015	1.324	0.878	12.021	0.474	1.557	129
46.018	105.788	105.708	-0.080	4.714	10.062	1.322	0.872	11.930	0.471	1.554	130
46.367	106.445	106.204	-0.241	4.750	10.109	1.320	0.865	11.842	0.468	1.550	131
46.716	106.924	106.699	-0.225	4.785	10.157	1.318	0.859	11.755	0.466	1.546	132

Table 6-10-WF5(30)c. (continued)

47.065	107.513	107.194	-0.319	4.821	10.204	1.316	0.853	11.669	0.453	1.343	133
47.414	107.813	107.687	-0.126	4.857	10.251	1.314	0.846	11.596	0.460	1.537	134
48.112	108.830	108.672	-0.158	4.928	10.344	1.310	0.834	11.423	0.455	1.533	136
48.460	109.242	109.163	-0.079	4.964	10.391	1.308	0.829	11.344	0.453	1.529	137
48.809	109.726	109.653	-0.073	5.000	10.438	1.306	0.823	11.266	0.450	1.526	139

ALL VELOCITIES IN MACH UNITS.

Table 3-10-WF3T(3). Film calibration data transformed to the object plane—
Shot 10, WF3T at 3 feet.

PHOTOGRAMMETRICS DPW/10 ST WF3T 209.M03 C.750205

CAMERA (LENS) POSITION IS 1996.000 FEET EAST, 1399.400 FEET NORTH, AND 2317.000 FEET ELEVATION
OPTICAL AXIS IS ORIENTED TO 6.714 DEGREES EAST OF NORTH AND 3.227 DEGREES ELEVATION (±0.001)
OBJECT PLANE IS 595.964 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GRD.ZERO

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y	
1-20.10	-46.650	-24.411	0.226	0.114	
1-20.15	-46.630	-19.290	0.188	-0.041	
1-20.20	-46.542	-14.315	0.155	-0.052	
1-20.27	-46.477	-7.310	0.046	-0.158	
1-20.30	-46.418	-4.452	-0.047	-0.042	
1-20.33	-46.361	-1.496	-0.108	-0.079	
1-20.40	-46.387	5.441	-0.000	0.000	REFERENCE POINT P1
1-30.10	-38.121	-23.993	-1.381	-0.296	
1-30.15	-38.580	-19.275	-0.259	-0.250	
1-30.20	-38.360	-14.507	-0.448	-0.094	
1-30.27	-38.617	-7.738	-0.188	-0.051	
1-30.30	-38.614	-4.856	-0.173	0.019	
1-30.33	-38.526	-1.907	-0.191	-0.051	
1-30.40	-38.617	4.871	-0.087	-0.434	
1-40.10	-26.790	-24.081	0.178	-0.076	
1-40.15	-26.670	-19.130	-0.004	-0.102	
1-40.20	-26.673	-14.205	0.090	-0.046	
1-40.27	-26.434	-7.369	-0.195	-0.081	
1-40.30	-26.731	-4.491	0.097	0.067	
1-40.33	-26.626	-1.400	0.072	-0.177	
1-40.40	-26.595	5.354	0.009	0.019	
1-60.10	-9.190	-24.481	0.001	0.001	REFERENCE POINT P2
1-60.15	-9.270	-19.734	0.089	0.018	
1-60.20	-9.171	-14.606	-0.027	-0.174	
1-60.27	-9.075	-8.157	-0.094	-0.033	
1-60.30	-9.218	-4.849	0.087	-0.323	
1-60.33	-9.156	-2.248	-0.014	-0.065	
1-60.40	-9.260	4.523	0.049	-0.064	
E 3	33.530	-32.326	0.121	-0.360	
300-1	-14.470	-38.632	-0.260	-2.777	
300-2	15.637	-39.209	-0.802	-2.408	
300-3	46.036	-39.190	0.503	-2.365	
BME 1	-25.728	-3.458	-0.417	-0.033	
BME 2	3.632	-3.512	0.058	-0.037	
BME 3	32.921	-3.280	0.061	-0.048	
AVERAGES			-0.076	-0.299	

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE
SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

SMEAR = 0.024 FEET, MAX. CALIBRATION ERROR SCALED
SHAKE = 0.010 FEET, MAX. CAMERA ORIENTATION ERROR

TOTAL = ±0.035 FEET, MEASURED IN THE OBJECT PLANE.

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS 1-40.27 AND E 3

Table 4-10-WF3T(3). Film timing data— Shot 10, WF3T at 3 feet.

FILM TIMING DATA DRW/10 ST WF3T 209.M03 C.750205

STATIC ZERO = 3.38 CM
ACTUAL ZERO = 4.40 CM

FRAME LENGTH= 0.75850 CM

FRAME NO.	5-MSEC DISTANCE	FILM SPEED
-31	14.85 CM	3916./SEC
069	15.05 CM	3968./SEC
169	15.24 CM	4018./SEC
269	15.42 CM	4066./SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA
OTHER LENGTHS ARE FROM FILM MEASURMENT

Table 6-10-WF3T(3)a. Shock trajectory analysis— ground mach stem, bottom charge—Shot 10.

SHOCK FRONT DATA DPW/10 ST WF3T 209.M03 GROUND MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 21.3 F
AMBIENT PRESSURE = 13.59 PSI
RELATIVE HUMIDITY = 81.0 %
VAPOUR PRESSURE= 2.373 MM HG
AMBIENT SPEED OF SOUND = 1.0761 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5055
CHARGE HEIGHT= 14.92 FEET
SEPARATION #2= 15.22 FEET

R=IT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
10.992	44.407	44.373	-0.034	1.126	4.224	2.222	4.593	62.875	1.477	2.981	42
11.245	44.863	44.973	0.110	1.152	4.281	2.183	4.422	60.531	1.443	2.936	43
11.493	45.547	45.564	0.017	1.178	4.337	2.157	4.262	58.341	1.411	2.892	44
11.751	46.106	46.147	0.041	1.204	4.393	2.127	4.112	56.292	1.381	2.850	45
12.003	46.778	46.721	-0.056	1.230	4.447	2.099	3.972	54.374	1.352	2.810	46
12.255	47.282	47.288	0.027	1.255	4.501	2.072	3.841	52.575	1.324	2.771	47
12.509	47.877	47.848	-0.029	1.281	4.555	2.046	3.717	50.886	1.298	2.734	48
12.761	48.436	48.401	-0.025	1.307	4.607	2.022	3.601	49.299	1.272	2.699	49
13.014	49.160	48.948	-0.212	1.333	4.659	1.998	3.492	47.805	1.248	2.664	50
13.267	49.492	49.488	-0.004	1.359	4.711	1.976	3.390	46.393	1.225	2.631	51
13.519	50.058	50.022	-0.036	1.385	4.762	1.955	3.293	45.072	1.203	2.600	52
13.772	50.640	50.550	-0.089	1.411	4.812	1.935	3.201	43.821	1.182	2.569	53
14.024	50.943	51.074	0.131	1.437	4.862	1.916	3.115	42.639	1.161	2.540	54
14.277	51.644	51.591	-0.052	1.462	4.911	1.897	3.033	41.522	1.142	2.512	55
14.529	52.111	52.104	-0.007	1.488	4.960	1.880	2.956	40.465	1.123	2.485	56
14.781	52.468	52.613	0.145	1.514	5.008	1.863	2.883	39.464	1.105	2.459	57
15.034	53.218	53.116	-0.101	1.540	5.056	1.847	2.814	38.515	1.088	2.434	58
15.286	53.632	53.616	-0.016	1.566	5.104	1.832	2.748	37.615	1.072	2.410	59
15.538	54.146	54.111	-0.035	1.592	5.151	1.817	2.686	36.761	1.056	2.386	60
15.791	54.440	54.603	0.163	1.618	5.198	1.803	2.625	35.950	1.040	2.364	61
16.043	54.737	55.090	0.354	1.643	5.244	1.790	2.570	35.179	1.026	2.343	62
16.547	55.993	56.054	0.061	1.695	5.336	1.764	2.465	33.748	0.998	2.302	64
16.799	56.743	56.532	-0.212	1.721	5.381	1.753	2.417	33.084	0.985	2.283	65
17.303	57.674	57.476	-0.198	1.772	5.471	1.730	2.327	31.848	0.960	2.247	67
17.555	57.801	57.944	0.143	1.798	5.516	1.720	2.285	31.273	0.949	2.230	68
17.807	58.459	58.409	-0.050	1.824	5.560	1.710	2.244	30.724	0.938	2.214	69
18.059	59.095	58.871	-0.223	1.850	5.604	1.700	2.205	30.200	0.927	2.198	70
18.311	58.930	59.331	0.401	1.876	5.648	1.691	2.170	29.699	0.916	2.183	71
19.319	61.185	61.146	-0.039	1.979	5.820	1.658	2.039	27.906	0.879	2.123	75
19.570	61.602	61.594	-0.009	2.005	5.863	1.650	2.009	27.505	0.870	2.115	76
19.822	61.986	62.040	0.053	2.030	5.905	1.643	1.981	27.121	0.862	2.103	77
20.074	62.595	62.483	-0.112	2.056	5.948	1.636	1.954	26.754	0.854	2.091	78
20.325	62.925	62.926	0.001	2.082	5.990	1.629	1.929	26.401	0.846	2.080	79
20.577	63.446	63.366	-0.081	2.108	6.032	1.622	1.904	26.063	0.838	2.059	80
20.829	63.538	63.804	-0.083	2.134	6.073	1.616	1.880	25.739	0.831	2.049	81
21.080	64.324	64.241	-0.083	2.159	6.115	1.610	1.858	25.428	0.824	2.049	82
21.332	64.689	64.676	-0.013	2.185	6.156	1.604	1.836	25.130	0.817	2.039	83
21.583	65.111	65.109	-0.002	2.211	6.198	1.599	1.815	24.844	0.811	2.029	84
21.835	65.467	65.541	0.074	2.237	6.239	1.593	1.795	24.569	0.805	2.020	85
22.086	66.046	65.971	-0.074	2.262	6.280	1.588	1.776	24.305	0.799	2.012	86
22.339	66.471	66.400	-0.070	2.288	6.321	1.583	1.757	24.051	0.793	2.003	87
22.590	66.855	66.828	-0.027	2.314	6.361	1.578	1.739	23.807	0.787	1.995	88

Table 6-10-WF3T(3)a. (continued)

22.940	67.213	67.254	0.041	2.340	6.402	1.574	1.722	23.573	0.732	1.[illegible]	[illegible]
23.092	67.735	67.679	-0.056	2.365	6.442	1.569	1.706	23.348	0.776	1.[illegible]	[illegible]
23.343	67.816	68.103	0.287	2.391	6.483	1.565	1.690	23.131	0.771	1.[illegible]	[illegible]
23.594	68.560	68.525	-0.035	2.417	6.523	1.561	1.675	22.923	0.767	1.[illegible]	[illegible]

ALL VELOCITIES IN MACH UNITS.

Table 6-10-WF3T(3)b. Shock trajectory analysis— upper mach stem, bottom charge—Shot 10.

SHOCK FRONT DATA DPW/10 ST WF3T 209.M03 UPPER MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = 21.3 F
AMBIENT PRESSURE = 13.69 PSI
RELATIVE HUMIDITY = 81.0 %
VAPOUR PRESSURE= 2.373 MM HG
AMBIENT SPEED OF SOUND = 1.0761 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5055
CHARGE HEIGHT= 14.92 FEET
SEPARATION #2= 15.22 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
10.486	44.806	44.790	-0.016	1.074	4.264	2.431	5.729	78.421	1.683	3.250	40
10.739	45.536	45.447	-0.119	1.100	4.326	2.396	5.530	75.706	1.649	3.207	41
10.992	46.054	46.095	0.041	1.126	4.388	2.362	5.344	73.150	1.616	3.165	42
11.245	46.759	46.733	-0.025	1.152	4.448	2.330	5.168	70.742	1.584	3.124	43
11.498	47.286	47.363	0.077	1.178	4.508	2.299	5.002	68.471	1.554	3.084	44
11.751	47.986	47.984	-0.002	1.204	4.568	2.270	4.845	66.324	1.525	3.045	45
12.003	48.344	48.598	0.254	1.230	4.626	2.242	4.697	64.295	1.497	3.008	46
12.256	49.342	49.204	-0.138	1.255	4.684	2.215	4.556	62.373	1.469	2.971	47
12.761	50.656	50.394	-0.262	1.307	4.797	2.164	4.297	58.823	1.418	2.902	49
13.014	51.386	50.979	-0.407	1.333	4.853	2.140	4.177	57.193	1.394	2.869	50
13.267	51.129	51.558	0.429	1.359	4.908	2.117	4.063	55.622	1.371	2.836	51
13.519	52.252	52.130	-0.122	1.385	4.962	2.095	3.955	54.137	1.348	2.805	52
13.772	53.530	52.697	0.117	1.411	5.016	2.074	3.852	52.723	1.327	2.775	53
14.024	53.869	53.258	0.388	1.437	5.069	2.054	3.753	51.375	1.305	2.745	54
14.277	53.751	53.813	0.062	1.462	5.122	2.034	3.659	50.089	1.285	2.716	55
14.529	54.022	54.363	0.341	1.488	5.175	2.015	3.569	48.861	1.265	2.689	56
14.781	54.592	54.907	0.315	1.514	5.227	1.997	3.484	47.688	1.246	2.662	57
15.286	56.001	55.982	-0.019	1.566	5.329	1.962	3.323	45.492	1.210	2.610	59
15.538	56.825	56.512	-0.313	1.592	5.379	1.945	3.249	44.464	1.193	2.585	60
15.791	57.417	57.039	-0.378	1.618	5.429	1.929	3.176	43.479	1.176	2.561	61
16.043	57.692	57.560	-0.132	1.643	5.479	1.914	3.107	42.534	1.160	2.537	62
16.547	58.895	58.591	-0.305	1.695	5.577	1.885	2.977	40.758	1.128	2.492	64
16.799	59.161	59.100	-0.061	1.721	5.626	1.871	2.916	39.922	1.114	2.471	65
17.051	59.410	59.606	0.196	1.747	5.674	1.857	2.858	39.118	1.099	2.449	66
17.303	60.253	60.108	-0.146	1.772	5.722	1.844	2.801	38.345	1.085	2.429	67
17.555	60.965	60.606	-0.359	1.798	5.769	1.832	2.747	37.601	1.071	2.409	68
17.807	61.044	61.101	0.057	1.824	5.816	1.819	2.695	36.885	1.058	2.390	69
18.059	61.616	61.593	-0.023	1.850	5.863	1.807	2.644	36.195	1.045	2.371	70
18.311	62.197	62.081	-0.116	1.876	5.909	1.796	2.596	35.529	1.032	2.352	71
18.563	62.628	62.566	-0.062	1.902	5.956	1.785	2.549	34.888	1.020	2.335	72
18.815	62.895	63.048	0.153	1.927	6.001	1.774	2.503	34.269	1.008	2.317	73
19.067	63.566	63.528	-0.038	1.953	6.047	1.763	2.460	33.672	0.997	2.300	74
19.319	64.092	64.004	-0.078	1.979	6.092	1.753	2.418	33.095	0.985	2.284	75
19.570	64.363	64.477	0.115	2.005	6.138	1.743	2.377	32.537	0.974	2.267	76
19.822	64.821	64.948	0.127	2.030	6.182	1.733	2.338	31.999	0.963	2.252	77
20.074	65.347	65.416	0.069	2.056	6.227	1.724	2.300	31.479	0.953	2.236	78
20.325	65.866	65.882	0.016	2.082	6.271	1.715	2.263	30.974	0.943	2.221	79
20.577	66.336	66.345	0.008	2.108	6.315	1.705	2.227	30.486	0.933	2.207	80
20.829	66.786	66.806	0.020	2.134	6.359	1.697	2.193	30.014	0.923	2.193	81
21.080	67.292	67.264	-0.028	2.159	6.403	1.688	2.159	29.556	0.913	2.179	82
21.332	67.626	67.720	0.094	2.185	6.446	1.680	2.127	29.113	0.904	2.165	83
21.583	67.964	68.173	0.210	2.211	6.489	1.672	2.095	28.684	0.895	2.152	84

Table 6-10-WF3T(3)b. (continued)

21.835	69.566	68.625	0.059	2.237	6.532	1.664	2.065	29.267	0.833	2.145	[illegible]
22.086	68.983	69.074	0.091	2.262	6.575	1.657	2.035	27.963	0.874	2.124	[illegible]
22.339	69.454	69.521	0.067	2.288	6.618	1.649	2.007	27.471	0.859	2.114	[illegible]
22.589	69.957	69.966	0.010	2.314	6.660	1.642	1.979	27.091	0.861	2.109	[illegible]
22.840	70.428	70.410	-0.018	2.340	6.702	1.635	1.952	26.721	0.853	2.080	89
23.092	70.891	70.851	-0.039	2.365	6.744	1.628	1.926	26.363	0.845	2.079	90
23.343	71.063	71.290	0.228	2.391	6.786	1.621	1.900	26.014	0.837	2.068	91
23.594	71.876	71.728	-0.148	2.417	6.828	1.615	1.876	25.675	0.830	2.057	92
23.845	72.107	72.163	0.056	2.443	6.869	1.608	1.852	25.346	0.822	2.045	93
24.097	72.494	72.597	0.103	2.468	6.910	1.602	1.829	25.026	0.815	2.035	94
24.348	72.915	73.029	0.114	2.494	6.952	1.596	1.805	24.714	0.808	2.025	95
24.599	73.560	73.460	-0.101	2.520	6.993	1.590	1.783	24.411	0.801	2.015	96
24.850	74.054	73.889	-0.166	2.545	7.033	1.584	1.762	24.116	0.794	2.005	97
25.101	74.231	74.315	0.075	2.571	7.074	1.579	1.741	23.829	0.788	1.996	98
25.352	74.910	74.742	-0.169	2.597	7.115	1.573	1.720	23.550	0.781	1.986	99
25.603	75.301	75.185	-0.135	2.623	7.155	1.568	1.700	23.277	0.775	1.977	100

ALL VELOCITIES IN MACH UNITS.

Table 2-11. Photo marker and gauge survey data—Shot 11.

SURVEY DATA LIST DPW/11 C.750205

PT. NAME	BEARING	DISTANCE	COORD. E	COORD. N	COORD. H
GRD.ZERO	0. 0. 0	0.0	2000.000	2000.000	2316.320
G.ZERO.B	234.28.52	0.680	1999.446	1999.606	2316.320
BOT.CRG.	234.28.52	0.680	1999.446	1999.606	2340.295
TOP.CRG.	237.35.50	0.768	1999.351	1999.590	2350.419
MCP	180. 2.47	598.713	1999.289	1401.290	2313.750
WFS 267			2001.558	1399.479	2369.843
WF3T 209			1996.520	1399.390	2317.500
3-20.1	80.19.35	21.453	2021.153	2003.573	2317.371
3-20.2	80.24.54	21.468	2021.177	2003.625	2318.390
3-20.3	80.23.19	21.466	2021.167	2003.565	2319.393
3-20.4	80.24.14	21.455	2021.157	2003.563	2320.381
1-20.10	84. 7.37	19.875	2019.774	2002.002	2326.369
2-20.10	76.25.18	19.891	2019.339	2004.055	2326.371
1-20.20	84.12.46	19.889	2019.792	2001.966	2336.381
2-20.20	76.24.22	19.886	2019.333	2004.655	2336.397
1-20.30	84. 8.44	19.854	2019.754	2001.937	2346.396
2-20.30	76.17.57	19.852	2019.299	2004.654	2346.370
1-20.40	84. 4.43	19.819	2019.717	2002.008	2356.412
2-20.40	76.11.32	19.818	2019.253	2004.703	2356.344
3-20.46	80.16.54	21.400	2021.101	2003.553	2362.323
3-20.48	80.17. 9	19.816	2019.533	2003.336	2363.310
3-20.49	80.15.12	21.395	2021.088	2003.611	2365.328
1-20.50	83.56.22	19.792	2019.683	2002.071	2366.338
2-20.50	76. 9.30	19.798	2019.229	2004.711	2366.310
3-20.51	80.14.58	21.365	2021.065	2003.565	2367.336
3-20.52	80.16.38	21.345	2021.044	2003.570	2368.323
1-20.53	84. 6.13	19.716	2019.613	2002.014	2369.343
2-20.53	76. 8.46	19.796	2019.229	2004.701	2369.328
3-30.1	71.18.30	32.000	2030.325	2010.215	2317.490
3-30.2	71.18.57	31.890	2030.235	2010.141	2318.500
3-30.3	71.19. 7	31.800	2030.128	2010.177	2319.490
3-30.4	71.19.12	31.740	2030.073	2010.150	2320.470
1-30.10	69.25. 1	29.023	2027.171	2010.202	2326.517
2-30.10	72.34.31	30.777	2029.377	2009.177	2326.451
1-30.20	68.23. 2	30.020	2027.910	2011.056	2336.462
2-30.20	73.31.20	29.937	2028.715	2008.466	2336.442
1-30.30	68.29.34	30.019	2027.945	2010.964	2346.242
2-30.30	73.40. 4	29.936	2028.729	2008.413	2346. 337
1-30.40	68.36. 6	30.017	2027.950	2010.944	2356.023
2-30.40	73.48.49	29.936	2028.767	2008.283	2356.232
3-30.46	71.19.34	31.645	2029.994	2010.088	2362.467
3-30.48	71.17.45	31.712	2030.057	2010.110	2364.474
3-30.49	71.23.34	31.628	2029.990	2010.047	2365.466
1-30.50	68.46.45	30.039	2028.023	2010.318	2366.458
2-30.50	73.56.32	29.922	2028.766	2009.236	2366.457
3-30.51	71.27.12	31.617	2029.980	2010.041	2367.435
3-30.52	71.27. 0	31.617	2029.974	2010.059	2368.462
1-30.53	68.44.54	30.042	2028.024	2010.833	2369.426
2-30.53	73.53.32	29.937	2028.773	2009.266	2369.422
3-40.1	84.24.50	41.472	2041.284	2007.947	2317.522
3-40.2	84.23.23	41.462	2041.267	2004.012	2318.535
3-40.3	84.25. 5	41.461	2041.265	2004.024	2319.540
3-40.4	84.27.33	41.477	2041.289	2003.945	2320.524
1-40.10	86.13.23	39.924	2039.840	2002.590	2326.550
2-40.10	82.20.17	39.897	2039.545	2005.290	2326.505
1-40.20	86.12.55	39.936	2039.855	2002.540	2336.532
2-40.20	82.21.38	39.886	2039.541	2005.237	2336.584
1-40.30	86.10.17	39.918	2039.831	2002.636	2346.564
2-40.30	82.18.39	39.907	2039.557	2005.272	2346.545

Table 2-11. (continued)

	1-40.40	86. 7.39	39.901	2039.814	2002.627	2356.537
	2-40.40	82.15.40	39.924	2039.570	2005.307	2356.499
	3-40.46	84.14.53	41.470	2041.271	2004.061	2362.497
	3-40.48	84.13. 3	41.451	2041.240	2004.171	2364.499
	3-40.49	84.13. 3	41.451	2041.240	2004.171	2365.502
	1-40.50	86. 4.50	39.885	2039.797	2002.639	2366.505
	2-40.50	82.11.37	39.860	2039.499	2005.350	2366.497
	3-40.51	84.12.51	41.432	2041.230	2004.085	2367.475
	3-40.52	84.14. 0	41.411	2041.201	2004.161	2368.489
	1-40.53	86. 2.31	39.845	2039.753	2002.637	2369.489
	2-40.53	82. 9.28	39.835	2039.469	2005.337	2369.513
	3-60.1	77.19.33	61.368	2059.892	2013.379	2317.330
	3-60.2	77.18.41	61.370	2059.895	2013.373	2318.343
	3-60.3	77.19.15	61.349	2059.862	2013.426	2319.359
	3-60.4	77.18. 7	61.347	2059.851	2013.467	2320.371
	1-60.10	78.26.54	59.719	2058.537	2011.821	2326.403
	2-60.10	75.51.18	59.859	2059.055	2014.583	2326.376
	1-60.20	78.27.22	59.729	2058.532	2011.897	2336.418
	2-60.20	75.53.57	59.788	2058.022	2014.422	2336.401
	1-60.30	78.25.20	59.717	2058.512	2011.934	2346.388
	2-60.30	75.51.16	59.818	2058.014	2014.578	2346.382
	1-60.40	78.23.39	59.706	2058.506	2011.912	2356.335
	2-60.40	75.48.35	59.848	2058.044	2014.583	2356.363
	3-60.46	77.13.11	61.348	2058.834	2013.542	2362.335
	3-60.48	77.10.59	61.342	2059.848	2013.454	2364.315
	3-60.49	77.11. 3	61.303	2059.778	2013.590	2365.304
	1-60.50	78.20.47	59.663	2058.458	2011.932	2366.313
	2-60.50	75.45.13	59.810	2057.979	2014.585	2366.340
	3-60.51	77.10.12	61.305	2059.781	2013.532	2367.301
	3-60.52	77. 9.59	61.304	2059.807	2013.403	2368.330
	1-60.53	78.17.17	59.641	2058.408	2012.063	2369.352
	2-60.53	75.44. 7	59.794	2057.955	2014.716	2369.338
	II10.0N	350. 0. 9	9.980	1998.271	2009.829	2316.210
	II25.0N	350. 0.15	25.920	1995.517	2025.529	2316.020
	II50.0N	349.59.20	49.940	1991.361	2049.187	2315.410
	II82H.0N	350. 0. 5	82.490	1985.695	2081.240	2314.540
	III10.0W	0. 0. 0	10.000	2000.000	2010.000	2316.320
	II10.0S	170. 0.30	10.000	2001.722	1990.149	2316.380
	II25.0S	170. 0.41	25.080	2004.306	1975.292	2316.410
	II50.0S	170. 0.17	50.000	2008.642	1950.752	2316.410
	II82H.0S	170. 0.23	82.480	2014.232	1918.757	2315.340
	III10.0E	80. 0. 3	9.950	2009.799	2001.726	2316.320
	I20.0E	109.54.14	20.100	2019.012	1993.476	2316.540
	I20.3E	109.54.14	20.340	2019.239	1993.398	2319.410
	III20.3E	0. 0. 0	20.150	2000.000	2020.150	2319.410
	I30.0E	99.15.25	29.950	2029.554	1995.150	2316.410
	I30.3E	99.15.25	30.100	2029.703	1995.125	2319.330
	III30.3E	0. 0. 0	30.150	2000.000	2030.150	2319.430
	I40.0E	65.43.46	39.980	2035.479	2016.360	2316.430
	I40.3E	65.43.46	40.090	2036.580	2016.405	2319.340
	III40.3E	0. 0. 0	40.110	2000.000	2040.110	2319.260
	I60.0E	99.35.17	60.040	2060.039	2000.387	2316.390
	I60.3E	99.35.17	60.280	2060.279	2000.389	2319.290
	III60.3E	0. 0. 0	60.150	2000.000	2060.150	2319.260
	II90.0E	80. 0. 0	90.020	2088.652	2015.632	2316.040
	II150.0E	80. 0. 0	149.890	2147.613	2026.028	2315.330
	II400.0E	80. 0. 0	399.940	2393.864	2069.449	2314.380
	W 1	257.20.55	35.586	1965.259	1992.289	2318.150
	W 2	260.21.43	70.394	1930.578	1988.344	2319.070
	W 3	261.29.48	105.189	1895.935	1984.663	2317.350
	E 2	99.50.18	58.206	2057.786	1993.024	2318.240
	E 3	99.32.46	99.795	2098.380	1983.252	2317.910
	300-1	175.27.50	305.220	2023.476	1695.684	2313.120
	300-2	173.47.59	309.388	2037.698	1692.953	2313.030

Table 2-11. (continued)

300-3	170. 9.15	314.160	2053.518	1690.432	2313.070
VP 1A	333.24.43	106.193	1952.648	2095.052	2348.323
VP 1B	333.24.40	106.422	1952.533	2095.250	2383.752
VP 2A	317.56.24	121.905	1918.429	2090.592	2348.640
VP 2B	317.48.50	122.407	1917.996	2090.878	2383.505
VP 3A	305.18.51	149.196	1878.448	2086.514	2348.376
VP 3B	305.12.35	149.142	1878.275	2086.176	2383.340
300 W1	183.38.57	314.780	1979.184	1685.902	2330.730
300 W2	187.40.48	320.020	1956.569	1682.941	2330.240
RME 1	10. 0.11	393.550	2068.546	2387.534	2307.000
RME 2	17.12. 7	390.900	2117.495	2379.110	2366.770
RME 3	24. 2. 0	405.750	2165.249	2370.575	2365.990

BEARING IN DEGREES, MINUTES, AND SECONDS, AND DISTANCE IN FEET
BEARING AND DISTANCE FROM GRD.ZERO UNLESS NOTED OTHERWISE
COORDINATES EAST AND NORTH AND ELEVATION IN FEET

TOTAL NUMBER OF SURVEYED POINTS IS 135

CALCULATED DISTANCE BETWEEN BOT.CRG. AND G.ZERO.R IS 23.975 FEET
CALCULATED DISTANCE BETWEEN BOT.CRG. AND TOP.CRG. IS 50.124 FEET

Table 3-11-WF5(57). Film calibration data transformed to the object plane—
Shot 11, WF5 at 57 feet.

PHOTOGRAMMETRICS DPW/11 ST WF5 267.M57 C.750205

CAMERA (LENS) POSITION IS 2001.558 FEET EAST, 1399.479 FEET NORTH, AND 2359.843 FEET ELEVATION
OPTICAL AXIS IS ORIENTED TO 7.885 DEGREES EAST OF NORTH AND 0.111 DEGREES ELEVATION (±0.001)
OBJECT PLANE IS 594.524 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GRD.ZERO

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y	
BOT.CRS.	-94.611	-30.998	0.239	0.275	
TOP.CRS.	-84.521	19.434	-0.000	0.000	REFERENCE POINT P1
1-20.30	-64.101	-24.397	0.031	-0.019	
1-20.50	-64.144	-4.696	-0.046	0.065	
1-20.53	-64.163	-1.701	-0.097	0.051	
1-30.30	-56.533	-24.113	0.225	-0.070	
1-30.40	-56.266	-14.292	-0.063	-0.347	
1-30.50	-56.262	-4.469	-0.005	0.011	
1-30.53	-56.177	-1.633	-0.089	0.072	
1-40.30	-44.399	-24.249	0.204	0.130	
1-40.40	-44.340	-14.215	0.107	-0.065	
1-40.50	-44.227	-4.130	-0.033	-0.317	
1-40.53	-44.251	-1.503	-0.059	-0.000	
1-60.30	-26.691	-23.868	-0.001	-0.000	REFERENCE POINT P2
1-60.40	-26.687	-14.097	-0.022	-0.126	
1-60.50	-26.790	-4.482	0.027	-0.087	
1-60.53	-26.863	-1.644	0.040	0.015	
BAE 1	-41.641	-2.003	-0.003	0.138	
BAE 2	-12.115	-2.859	0.326	-0.147	
BAE 3	17.465	-2.559	-0.001	-0.313	
AVERAGES			0.039	-0.037	

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE
SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

SMEAR = 0.158 FEET, MAX. CALIBRATION ERROR SCALED
SHAKE = 0.010 FEET, MAX. CAMERA ORIENTATION ERROR

TOTAL = ±0.158 FEET, MEASURED IN THE OBJECT PLANE.

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS 1-40.53 AND 1-60.40

Table 4-11-WF5(57). Film timing data—Shot 11, WF5 at 57 feet.

C.750305

FILM TIMING DATA DRW/11 ST WF5 267.M57

STATIC ZERO = 3.80 CM
ACTUAL ZERO = 4.60 CM

FRAME LENGTH= 0.94625 CM

FRAME NO.	5-MSEC DISTANCE	FILM SPEED
-31	12.57 CM	2657./SEC
069	12.89 CM	2724./SEC
169	13.12 CM	2773./SEC
269	13.38 CM	2828./SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA
OTHER LENGTHS ARE FROM FILM MEASURMENT

Table 5-11. Meteorological observations— Shot 11.

DPW/11

Date: 8 November 1973

Time: 1535 MST

Observer: JUG

Standard Meteorological Observations:

At control bunker.
22 Meter wind data at Photo tower.

Wind Data:	22 Meters	2 Meters
Direction	Calm	Calm
Speed		

Temperatures (^{O}F):

Air temperature	-2.4^{O}F
Surface temperature	--
Temperature gradient (4-½ M)	+0.3^{O}F
Relative humidity	60%

Pressure: 13.683 psi

Sky Condition:

Clouds 4/10 Ac 3/10 Ci

Sun Fairly bright through zero.

Table 6-11-WF5(57)a. Shock trajectory analysis—primary front, bottom charge—Shot 11.

SHOCK FRONT DATA DE#/11 ST WF5 267.M57 PRIMARY FRONT, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = -2.4 F
AMBIENT PRESSURE = 13.68 PSI
RELATIVE HUMIDITY = 60.0 %
VAPOUR PRESSURE= 0.000 MM HG
AMBIENT SPEED OF SOUND = 1.0488 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5070
CHARGE HEIGHT= 23.98 FEET
SEPARATION #2= 25.06 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
6.269	32.778	32.902	0.104	0.626	3.131	2.730	7.527	102.088	1.970	3.591	14
6.640	33.842	33.945	0.103	0.663	3.231	2.625	6.874	94.055	1.870	3.477	
7.012	35.028	34.948	-0.080	0.700	3.326	2.531	6.310	86.434	1.780	3.379	15
7.383	35.918	35.917	-0.001	0.737	3.418	2.447	5.819	79.615	1.699	3.290	19
7.754	36.830	36.854	0.024	0.774	3.508	2.370	5.389	73.731	1.626	3.175	20
8.125	37.791	37.762	-0.029	0.811	3.594	2.301	5.010	68.547	1.559	3.086	21
8.496	38.919	38.645	-0.274	0.848	3.678	2.238	4.674	63.957	1.499	3.002	22
8.866	39.605	39.503	-0.103	0.885	3.760	2.180	4.376	59.873	1.444	2.923	23
9.237	40.734	40.340	-0.003	0.922	3.839	2.127	4.109	56.222	1.393	2.849	24
9.607	41.335	41.157	-0.178	0.959	3.917	2.078	3.870	52.949	1.350	2.780	25
9.978	41.937	41.955	0.018	0.996	3.993	2.033	3.654	49.995	1.284	2.715	26
10.348	42.834	42.737	-0.097	1.033	4.067	1.991	3.459	47.329	1.241	2.654	27
10.719	43.517	43.503	-0.014	1.070	4.140	1.953	3.282	44.906	1.201	2.596	28
11.089	43.903	44.254	0.351	1.107	4.212	1.917	3.121	42.703	1.163	2.542	29
11.459	44.892	44.992	0.100	1.144	4.282	1.884	2.974	40.694	1.128	2.491	30
11.829	45.546	45.717	0.171	1.181	4.351	1.853	2.840	38.855	1.095	2.443	31
12.199	46.485	46.430	-0.055	1.218	4.419	1.824	2.716	37.168	1.064	2.398	32
12.569	47.109	47.133	0.024	1.255	4.486	1.798	2.603	35.617	1.034	2.355	33
12.939	47.839	47.825	-0.014	1.292	4.552	1.773	2.499	34.187	1.007	2.315	34
13.308	48.657	48.508	-0.149	1.328	4.617	1.749	2.402	32.857	0.981	2.277	35
13.678	49.324	49.182	-0.142	1.365	4.681	1.727	2.313	31.645	0.957	2.242	36
14.043	49.850	49.847	-0.003	1.402	4.744	1.705	2.230	30.512	0.934	2.208	37
14.417	50.405	50.504	0.099	1.439	4.807	1.687	2.153	29.460	0.912	2.176	38
14.786	51.101	51.154	0.053	1.476	4.869	1.669	2.082	28.481	0.891	2.145	39
15.156	52.049	51.797	-0.252	1.513	4.930	1.651	2.015	27.569	0.872	2.118	40
15.525	52.347	52.433	0.047	1.550	4.990	1.635	1.953	26.718	0.853	2.091	41
15.894	53.028	53.064	0.036	1.587	5.050	1.620	1.894	25.922	0.835	2.065	42
16.263	53.720	53.688	-0.033	1.623	5.110	1.605	1.840	25.177	0.819	2.041	43
16.632	54.234	54.306	0.072	1.660	5.169	1.592	1.789	24.479	0.803	2.018	44
17.001	54.715	54.919	0.204	1.697	5.227	1.579	1.741	23.823	0.788	1.995	45
17.370	55.465	55.528	0.063	1.734	5.285	1.567	1.696	23.209	0.773	1.975	46
17.738	55.815	56.131	0.316	1.771	5.342	1.555	1.654	22.628	0.760	1.956	47
18.107	56.646	56.730	0.085	1.808	5.399	1.544	1.614	22.083	0.747	1.937	48
18.476	57.122	57.325	0.203	1.844	5.456	1.533	1.576	21.569	0.734	1.919	49
18.844	57.712	57.916	0.204	1.881	5.512	1.523	1.541	21.084	0.723	1.902	50
19.212	58.774	58.502	-0.271	1.918	5.568	1.514	1.507	20.626	0.711	1.885	51
19.581	58.991	59.086	0.094	1.955	5.623	1.505	1.476	20.192	0.700	1.871	52
19.949	59.526	59.665	0.039	1.991	5.679	1.496	1.446	19.782	0.690	1.856	53
20.317	60.156	60.241	0.085	2.028	5.733	1.488	1.417	19.394	0.680	1.842	54
20.685	60.728	60.814	0.087	2.065	5.788	1.481	1.391	19.026	0.671	1.829	55
21.053	61.527	61.384	-0.142	2.102	5.842	1.473	1.365	18.677	0.662	1.815	56
21.421	61.812	61.952	0.139	2.138	5.896	1.466	1.341	18.345	0.653	1.804	57

Table 6-11-WF5(57)a. (continued)

21.789	62.562	62.516	-0.046	2.175	5.950	1.459	1.318	18.031	0.645	1.792	53
22.525	63.631	63.637	-0.044	2.248	6.057	1.447	1.275	17.447	0.630	1.770	60
22.892	64.265	64.193	-0.072	2.285	6.110	1.441	1.255	17.176	0.622	1.760	61
23.260	64.955	64.748	-0.207	2.322	6.162	1.435	1.236	16.917	0.615	1.751	62
23.627	65.475	65.300	-0.175	2.359	6.215	1.430	1.219	16.671	0.609	1.741	63
23.995	65.992	65.850	-0.142	2.395	6.267	1.425	1.201	16.437	0.602	1.732	64
24.362	66.383	66.398	0.014	2.432	6.319	1.420	1.185	16.213	0.596	1.724	65
24.729	67.190	66.944	-0.247	2.469	6.371	1.415	1.169	15.999	0.590	1.716	66
25.096	67.490	67.488	-0.002	2.505	6.423	1.411	1.154	15.795	0.585	1.708	67
25.464	68.147	68.030	-0.117	2.542	6.475	1.406	1.140	15.600	0.579	1.700	68
25.831	68.565	68.571	0.005	2.578	6.526	1.402	1.127	15.414	0.574	1.693	69
26.198	69.242	69.109	-0.233	2.615	6.577	1.398	1.113	15.235	0.569	1.686	70
26.564	69.568	69.647	0.079	2.652	6.629	1.394	1.101	15.065	0.564	1.680	71
26.931	70.623	70.182	-0.441	2.688	6.680	1.391	1.089	14.901	0.559	1.673	72
27.298	70.564	70.716	0.152	2.725	6.730	1.387	1.078	14.745	0.555	1.667	73
27.663	71.123	71.249	0.127	2.762	6.781	1.384	1.067	14.595	0.551	1.661	74
28.031	71.340	71.781	0.441	2.798	6.832	1.380	1.056	14.451	0.547	1.656	75
28.398	72.538	72.311	-0.227	2.835	6.882	1.377	1.046	14.313	0.543	1.650	76
28.764	72.770	72.839	0.069	2.871	6.932	1.374	1.036	14.181	0.539	1.645	77
29.131	73.635	73.367	-0.289	2.908	6.983	1.371	1.027	14.054	0.535	1.640	78
29.497	73.951	73.893	-0.058	2.944	7.033	1.369	1.018	13.933	0.532	1.635	79
29.863	74.357	74.419	0.051	2.981	7.083	1.366	1.010	13.816	0.528	1.630	80
30.229	74.805	74.943	0.047	3.018	7.133	1.363	1.002	13.704	0.525	1.626	81
30.595	75.304	75.466	-0.338	3.054	7.182	1.361	0.994	13.595	0.522	1.622	82
30.962	75.800	75.988	0.187	3.091	7.232	1.358	0.986	13.492	0.519	1.617	83
31.328	76.559	76.509	-0.151	3.127	7.282	1.356	0.979	13.393	0.516	1.613	84
31.694	77.016	77.029	0.012	3.164	7.331	1.354	0.972	13.297	0.513	1.610	85
32.059	77.910	77.549	-0.262	3.200	7.381	1.352	0.965	13.205	0.510	1.606	86
32.425	77.725	78.066	0.341	3.237	7.430	1.350	0.959	13.116	0.507	1.602	87
32.791	78.790	78.583	-0.207	3.273	7.479	1.348	0.952	13.031	0.505	1.599	88
33.157	78.845	79.100	0.255	3.310	7.528	1.346	0.946	12.949	0.502	1.596	89
33.522	79.602	79.613	0.013	3.346	7.577	1.344	0.941	12.870	0.500	1.593	90
33.888	80.151	80.130	-0.021	3.383	7.626	1.342	0.935	12.794	0.498	1.589	91
34.253	80.899	80.644	-0.255	3.419	7.675	1.341	0.930	12.721	0.495	1.586	92
34.618	80.969	81.158	0.189	3.456	7.724	1.339	0.925	12.650	0.493	1.583	93
34.984	81.674	81.670	-0.024	3.492	7.773	1.337	0.920	12.582	0.491	1.581	94
35.349	82.061	82.182	0.121	3.529	7.822	1.336	0.915	12.517	0.489	1.578	95
35.714	82.952	82.694	-0.259	3.565	7.870	1.334	0.910	12.454	0.487	1.575	96
36.079	82.892	83.204	0.313	3.602	7.919	1.333	0.906	12.393	0.485	1.573	97
36.444	83.432	83.714	0.282	3.638	7.967	1.331	0.902	12.335	0.484	1.570	98
36.809	84.026	84.224	0.198	3.674	8.016	1.330	0.897	12.279	0.482	1.568	99
37.174	84.797	84.733	-0.054	3.711	8.064	1.329	0.893	12.224	0.480	1.566	100
37.539	85.179	85.241	0.062	3.747	8.113	1.328	0.890	12.171	0.479	1.564	101
37.904	85.948	85.749	-0.200	3.784	8.161	1.326	0.886	12.121	0.477	1.562	102
38.269	85.943	86.256	0.313	3.820	8.209	1.325	0.882	12.072	0.476	1.560	103
38.633	86.648	86.762	0.114	3.856	8.258	1.324	0.879	12.025	0.474	1.558	104
39.727	87.917	88.279	0.362	3.966	8.402	1.321	0.869	11.893	0.470	1.552	107
40.091	88.181	88.784	-0.397	4.002	8.450	1.320	0.866	11.852	0.469	1.551	108
40.455	89.505	89.283	-0.218	4.038	8.498	1.319	0.863	11.813	0.468	1.549	109
40.820	89.848	89.792	-0.056	4.075	8.546	1.318	0.861	11.775	0.466	1.547	110

ALL VELOCITIES IN MACH UNITS.

Table 6-11-WF5(57)b. Shock trajectory analysis— upper mach stem, bottom charge— Shot 11.

SHOCK FRONT DATA DPW/11 ST WF5 267.M57 UPPER MACH STEM, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = -2.4 F
AMBIENT PRESSURE = 13.68 PSI
RELATIVE HUMIDITY = 60.0 %
VAPOUR PRESSURE= 0.600 MM HG
AMBIENT SPEED OF SOUND = 1.0488 FT/MSEC
CHARGE WEIGHT= 1040.0 LBS.
SACHS SCALING FACTOR = 10.5070
CHARGE HEIGHT= 23.92 FEET
SEPARATION #2= 25.06 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
9.607	33.577	33.750	0.173	0.959	3.212	2.811	8.054	110.203	2.046	3.675	25
9.973	34.933	34.830	-0.163	0.996	3.315	2.745	7.627	104.355	1.984	3.607	26
10.348	35.925	35.884	-0.041	1.033	3.415	2.634	7.235	99.016	1.926	3.542	27
10.719	37.078	36.915	-0.162	1.070	3.513	2.626	6.879	94.127	1.871	3.478	28
11.089	38.029	37.924	-0.105	1.107	3.609	2.572	6.551	89.638	1.819	3.417	29
11.459	38.696	38.913	0.247	1.144	3.704	2.521	6.249	85.504	1.770	3.358	30
11.829	40.328	39.882	-0.446	1.181	3.796	2.473	5.970	81.693	1.724	3.302	31
12.199	40.775	40.833	0.058	1.218	3.886	2.428	5.712	78.157	1.680	3.247	32
12.569	41.189	41.767	0.577	1.255	3.975	2.386	5.473	74.882	1.639	3.194	33
13.703	43.812	43.586	-0.226	1.328	4.148	2.307	5.043	69.004	1.561	3.094	35
13.673	44.545	44.473	-0.072	1.365	4.233	2.271	4.850	66.359	1.525	3.046	36
14.043	45.371	45.347	-0.025	1.402	4.316	2.237	4.669	63.887	1.491	3.001	37
14.417	46.187	46.207	0.020	1.439	4.398	2.204	4.500	61.573	1.458	2.957	38
14.746	46.803	47.055	0.252	1.476	4.478	2.173	4.341	59.402	1.427	2.914	39
15.159	47.812	47.891	0.079	1.513	4.558	2.143	4.192	57.363	1.397	2.873	40
15.525	48.615	48.715	0.100	1.550	4.636	2.115	4.052	55.445	1.369	2.833	41
15.894	49.480	49.529	0.048	1.587	4.714	2.088	3.920	53.638	1.341	2.795	42
16.263	50.276	50.332	0.056	1.623	4.790	2.062	3.796	51.934	1.315	2.758	43
16.632	50.874	51.125	0.251	1.660	4.866	2.038	3.678	50.324	1.289	2.722	44
17.001	51.634	51.909	0.275	1.697	4.940	2.014	3.567	48.802	1.265	2.688	45
17.370	53.261	52.684	-0.577	1.734	5.014	1.992	3.461	47.360	1.241	2.654	46
17.739	53.511	53.450	-0.061	1.771	5.087	1.970	3.361	45.994	1.219	2.622	47
18.107	54.286	54.207	-0.079	1.808	5.159	1.949	3.267	44.697	1.197	2.591	48
18.476	55.439	54.957	-0.482	1.844	5.231	1.930	3.177	43.465	1.176	2.561	49
18.844	55.745	55.699	-0.046	1.881	5.301	1.910	3.091	42.294	1.156	2.532	50
19.212	56.533	56.434	-0.100	1.918	5.371	1.892	3.010	41.179	1.136	2.503	51
19.581	56.924	57.161	0.237	1.955	5.440	1.874	2.932	40.117	1.117	2.475	52
19.949	57.520	57.882	0.361	1.991	5.509	1.857	2.858	39.103	1.099	2.450	53
20.317	58.641	58.596	-0.045	2.028	5.577	1.841	2.787	38.137	1.081	2.424	54
20.686	59.439	59.303	-0.136	2.065	5.644	1.825	2.720	37.213	1.064	2.399	55
21.053	59.467	60.005	0.538	2.102	5.711	1.810	2.655	36.330	1.048	2.375	56
21.421	60.646	60.700	0.054	2.138	5.777	1.795	2.593	35.486	1.032	2.352	57
21.789	61.417	61.390	-0.027	2.175	5.843	1.781	2.534	34.675	1.016	2.329	58
22.157	61.799	62.075	0.275	2.212	5.908	1.767	2.478	33.900	1.001	2.307	59
22.525	62.905	62.754	-0.152	2.248	5.973	1.754	2.423	33.157	0.987	2.286	60
22.892	63.531	63.428	-0.103	2.285	6.037	1.741	2.371	32.443	0.973	2.265	61
23.260	63.968	64.097	0.128	2.322	6.100	1.729	2.321	31.758	0.959	2.245	62
23.627	64.939	64.761	-0.179	2.359	6.164	1.717	2.273	31.100	0.946	2.226	63
23.995	65.435	65.420	-0.015	2.395	6.226	1.705	2.227	30.467	0.933	2.207	64
24.362	65.005	66.075	0.070	2.432	6.289	1.694	2.182	29.858	0.920	2.188	65
24.729	67.151	66.725	-0.436	2.469	6.351	1.683	2.139	29.272	0.908	2.170	66
25.096	67.632	67.372	-0.260	2.505	6.412	1.673	2.099	28.707	0.896	2.153	67

Table 6-11-WF5(57)b. (continued)

25.484	68.119	68.014	-0.105	2.542	6.473	1.653	2.058	29.163	0.334	2.136	68
25.831	68.764	68.652	-0.112	2.578	6.534	1.653	2.020	27.639	0.873	2.120	69
26.193	69.268	69.286	0.018	2.615	6.594	1.643	1.983	27.133	0.862	2.104	70
26.564	69.630	69.917	0.287	2.652	6.654	1.634	1.947	25.644	0.851	2.088	71
26.931	70.691	70.544	-0.137	2.688	6.714	1.625	1.913	24.172	0.841	2.073	72
27.293	71.374	71.167	-0.207	2.725	6.773	1.616	1.879	25.717	0.831	2.059	73
27.665	71.643	71.787	0.143	2.762	6.832	1.607	1.847	25.276	0.821	2.044	74
28.071	72.398	72.403	0.005	2.798	6.891	1.599	1.816	24.450	0.811	2.030	75
28.394	73.700	73.019	-0.284	2.835	6.949	1.591	1.785	24.443	0.802	2.016	76
28.764	73.746	73.626	-0.120	2.871	7.007	1.583	1.757	24.232	0.793	2.003	77
29.141	74.435	74.233	-0.202	2.908	7.065	1.575	1.729	23.992	0.784	1.990	78
29.497	75.160	74.837	-0.323	2.944	7.123	1.568	1.701	23.979	0.775	1.978	79
29.867	75.415	75.438	0.022	2.981	7.180	1.561	1.675	22.715	0.767	1.965	80
30.259	75.159	75.036	-0.134	3.018	7.237	1.554	1.649	22.583	0.758	1.953	81
30.596	76.434	76.631	0.197	3.054	7.293	1.547	1.624	22.229	0.750	1.942	82
30.962	77.006	77.223	0.217	3.091	7.350	1.540	1.600	21.491	0.742	1.930	83
31.328	77.736	77.413	0.017	3.127	7.406	1.533	1.575	21.570	0.734	1.919	84
31.694	78.227	78.401	0.174	3.164	7.462	1.527	1.554	21.358	0.727	1.908	85
32.059	78.790	78.985	0.195	3.200	7.517	1.521	1.531	20.955	0.719	1.898	86
32.425	79.606	79.568	-0.038	3.237	7.573	1.515	1.510	20.550	0.712	1.887	87
32.791	80.179	80.147	-0.032	3.273	7.628	1.509	1.489	20.374	0.705	1.877	88
33.157	81.067	80.725	-0.343	3.310	7.683	1.503	1.469	20.020	0.698	1.867	89
33.522	81.407	81.300	-0.107	3.346	7.735	1.497	1.449	19.325	0.691	1.857	90
33.888	82.059	81.873	-0.186	3.383	7.792	1.492	1.430	19.552	0.685	1.848	91
34.613	82.930	84.012	0.093	3.456	7.901	1.481	1.393	19.059	0.672	1.830	93
34.984	83.930	83.579	-0.311	3.492	7.955	1.476	1.375	18.814	0.665	1.821	94
35.714	84.224	84.705	0.482	3.565	8.062	1.466	1.341	18.346	0.653	1.804	96
36.079	85.051	85.266	0.215	3.602	8.115	1.461	1.324	18.122	0.647	1.796	97
36.444	85.266	85.825	0.559	3.638	8.168	1.457	1.308	17.903	0.642	1.787	98
36.809	86.505	86.381	-0.123	3.674	8.221	1.452	1.293	17.690	0.636	1.780	99
37.174	87.470	86.936	-0.533	3.711	8.274	1.447	1.278	17.481	0.631	1.772	100
37.539	87.167	87.489	0.322	3.747	8.327	1.443	1.263	17.278	0.625	1.764	101
37.904	88.253	88.041	-0.212	3.784	8.379	1.439	1.248	17.079	0.620	1.757	102
38.269	88.835	88.590	-0.244	3.820	8.432	1.435	1.234	16.885	0.615	1.749	103
38.633	89.183	89.138	-0.045	3.856	8.484	1.430	1.220	16.697	0.609	1.742	104
38.998	89.115	89.684	0.570	3.893	8.536	1.426	1.207	16.512	0.604	1.735	105
39.363	90.108	90.772	-0.336	3.966	8.639	1.419	1.181	16.155	0.595	1.722	107
39.727	91.108	90.772	-0.336	3.966	8.639	1.419	1.181	16.155	0.595	1.722	107
40.091	91.298	91.313	0.015	4.002	8.691	1.415	1.168	15.984	0.590	1.715	108
40.455	91.819	91.853	0.034	4.038	8.742	1.411	1.156	15.815	0.585	1.709	109
40.820	92.150	92.391	0.241	4.075	8.793	1.407	1.144	15.651	0.581	1.702	110
41.184	93.305	92.928	-0.377	4.111	8.844	1.404	1.132	15.490	0.575	1.696	111
41.543	93.770	93.474	0.093	4.147	8.895	1.400	1.121	15.333	0.572	1.690	112
41.912	93.915	93.998	0.083	4.184	8.946	1.397	1.109	15.179	0.567	1.684	113
42.276	94.333	94.530	0.197	4.220	8.997	1.393	1.098	15.028	0.563	1.678	114
42.640	95.594	95.061	-0.533	4.256	9.047	1.390	1.088	14.881	0.559	1.672	115
43.004	95.520	95.591	0.062	4.293	9.098	1.387	1.077	14.737	0.555	1.667	116
43.368	96.029	96.120	0.090	4.329	9.148	1.384	1.067	14.596	0.551	1.661	117
43.731	96.933	96.647	-0.186	4.365	9.198	1.381	1.057	14.458	0.547	1.656	118
44.095	97.407	97.173	-0.234	4.402	9.248	1.377	1.047	14.322	0.543	1.650	119
44.822	98.070	98.221	0.151	4.474	9.348	1.371	1.028	14.060	0.535	1.640	121
45.186	98.237	98.744	0.507	4.511	9.398	1.369	1.018	13.932	0.532	1.635	122
45.549	99.578	99.265	-0.313	4.547	9.447	1.366	1.009	13.808	0.528	1.630	123
45.913	99.624	99.785	0.160	4.583	9.497	1.363	1.000	13.685	0.524	1.625	124
46.276	99.933	100.304	0.371	4.619	9.546	1.360	0.991	13.565	0.521	1.620	125
46.639	100.516	100.821	0.305	4.656	9.596	1.357	0.983	13.448	0.517	1.616	126
47.002	100.802	101.338	0.536	4.692	9.645	1.355	0.974	13.332	0.514	1.611	127
47.365	101.739	101.853	0.114	4.728	9.694	1.352	0.965	13.219	0.510	1.606	128
47.729	101.900	102.368	0.467	4.764	9.743	1.350	0.958	13.108	0.507	1.602	129
48.092	102.393	102.881	0.488	4.801	9.792	1.347	0.950	13.000	0.504	1.598	130
48.455	103.424	103.393	-0.031	4.837	9.840	1.345	0.942	12.893	0.501	1.593	131
48.818	103.875	103.904	0.029	4.873	9.888	1.342	0.934	12.788	0.497	1.589	132
49.180	104.375	104.415	0.040	4.909	9.936	1.340	0.927	12.685	0.494	1.585	133
49.543	104.415	104.926	0.511	4.945	9.984	1.338	0.919	12.584	0.491	1.581	134
49.906	105.114	105.436	0.322	4.981	10.032	1.335	0.912	12.484	0.488	1.577	135
50.268	105.911	105.945	0.034	5.017	10.079	1.333	0.905	12.386	0.485	1.573	136
50.631	106.240	106.455	0.215	5.053	10.127	1.331	0.898	12.290	0.482	1.569	137
50.993	107.114	106.965	-0.149	5.090	10.175	1.329	0.891	12.196	0.479	1.565	138
51.356	107.249	107.475	0.226	5.126	10.223	1.327	0.885	12.103	0.477	1.561	139
51.718	104.815	107.983	-0.856	5.163	10.271	1.324	0.878	12.015	0.474	1.557	140

Table 6-11-WF5(57)b. (continued)

52.905	109.251	109.465	0.214	5.271	10.418	1.318	0.859	11.753	0.466	1.547	[illegible]
53.167	110.072	109.965	-0.107	5.307	10.466	1.316	0.853	11.664	0.463	1.543	144
53.529	111.024	110.464	-0.560	5.343	10.513	1.314	0.847	11.585	0.460	1.540	145
53.891	110.740	110.963	0.222	5.380	10.561	1.312	0.841	11.503	0.458	1.536	146
54.253	111.132	111.460	0.328	5.416	10.608	1.310	0.835	11.423	0.455	1.533	147
54.615	111.871	111.957	0.086	5.452	10.655	1.309	0.829	11.344	0.453	1.530	148
54.977	112.604	112.453	-0.151	5.488	10.703	1.306	0.823	11.266	0.450	1.526	149
55.339	113.054	112.948	-0.106	5.524	10.750	1.304	0.818	11.189	0.448	1.523	150
55.700	114.038	113.443	-0.595	5.560	10.797	1.302	0.812	11.114	0.445	1.520	151
56.062	114.081	113.936	-0.144	5.596	10.844	1.301	0.807	11.040	0.443	1.517	152
56.424	114.096	114.429	0.343	5.632	10.891	1.299	0.802	10.967	0.441	1.514	153
56.785	114.635	114.922	0.316	5.668	10.938	1.297	0.796	10.895	0.439	1.511	154
57.147	115.493	115.413	-0.240	5.705	10.984	1.295	0.791	10.825	0.436	1.508	155
57.509	115.737	115.904	0.166	5.741	11.031	1.294	0.786	10.755	0.434	1.505	156
57.869	116.710	116.394	-0.316	5.777	11.078	1.292	0.781	10.687	0.432	1.502	157
58.231	117.394	116.843	-0.491	5.813	11.124	1.290	0.776	10.620	0.430	1.499	158
58.592	117.159	117.372	0.212	5.849	11.171	1.289	0.771	10.553	0.427	1.496	159
58.953	117.561	117.859	0.198	5.885	11.217	1.287	0.767	10.488	0.425	1.494	160
59.035	119.445	119.319	-0.126	5.993	11.356	1.283	0.753	10.308	0.419	1.485	163
60.297	119.581	119.804	0.223	6.029	11.402	1.281	0.748	10.237	0.417	1.483	164
60.753	120.283	120.289	0.007	6.065	11.448	1.280	0.744	10.176	0.415	1.480	165
61.113	120.690	120.773	0.083	6.101	11.494	1.278	0.739	10.117	0.413	1.478	166
61.480	121.536	121.256	-0.280	6.137	11.540	1.277	0.735	10.058	0.411	1.475	167
61.840	121.238	121.733	0.505	6.173	11.586	1.275	0.731	10.000	0.409	1.473	168
62.201	121.920	122.221	0.302	6.209	11.632	1.274	0.727	9.943	0.407	1.470	169
62.561	122.912	122.703	-0.210	6.245	11.678	1.273	0.723	9.887	0.406	1.468	170
62.922	123.017	123.183	0.166	6.281	11.724	1.271	0.719	9.831	0.404	1.465	171
63.282	123.194	123.664	0.470	6.317	11.770	1.270	0.715	9.777	0.402	1.463	172
63.642	124.676	124.143	-0.533	6.353	11.815	1.269	0.711	9.723	0.400	1.461	173
64.003	124.751	124.623	-0.129	6.389	11.861	1.267	0.707	9.670	0.398	1.459	174
64.363	124.992	125.101	0.109	6.425	11.906	1.266	0.703	9.617	0.397	1.456	175
64.723	125.212	125.579	0.367	6.461	11.952	1.265	0.699	9.565	0.395	1.454	176
65.083	125.102	126.055	-0.046	6.497	11.997	1.263	0.695	9.513	0.393	1.452	177
65.443	126.172	126.533	0.361	6.533	12.043	1.262	0.692	9.464	0.392	1.450	178
65.803	127.154	127.010	-0.145	6.569	12.088	1.261	0.688	9.415	0.390	1.448	179
66.163	127.159	127.485	0.327	6.605	12.133	1.260	0.685	9.366	0.388	1.445	180
66.523	129.116	127.961	-0.155	6.641	12.179	1.259	0.681	9.318	0.387	1.443	181
66.883	128.295	128.435	0.140	6.676	12.224	1.257	0.678	9.270	0.385	1.441	182
67.302	129.029	129.333	-0.546	6.748	12.314	1.255	0.671	9.177	0.382	1.437	184
67.662	129.079	129.359	-0.122	6.784	12.359	1.254	0.667	9.131	0.380	1.435	185
68.021	130.774	130.801	0.027	6.856	12.449	1.252	0.661	9.041	0.377	1.431	187
68.740	131.735	131.272	-0.464	6.892	12.494	1.251	0.658	8.998	0.376	1.429	188
69.100	131.472	131.743	0.272	6.928	12.539	1.249	0.654	8.954	0.374	1.428	189
69.459	131.713	132.214	0.501	6.964	12.583	1.248	0.651	8.911	0.373	1.426	190
69.759	131.713	132.214	0.501	6.964	12.583	1.247	0.648	8.869	0.371	1.424	191
70.118	133.066	132.684	-0.382	6.999	12.628	1.245	0.642	8.785	0.368	1.420	193
70.437	133.755	133.623	-0.132	7.071	12.717	1.244	0.639	8.745	0.367	1.419	194
71.196	133.936	134.092	0.095	7.107	12.762	1.243	0.635	8.705	0.366	1.417	195
71.555	134.324	134.560	-0.264	7.143	12.807	1.242	0.633	8.666	0.364	1.415	196
71.914	135.001	135.028	0.027	7.179	12.851	1.241	0.630	8.629	0.363	1.413	197
72.272	135.490	135.495	-0.395	7.214	12.896	1.240	0.628	8.588	0.362	1.411	198
72.631	136.003	135.962	-0.041	7.250	12.940	1.239	0.625	8.549	0.360	1.410	199
72.990	136.279	136.428	0.050	7.286	12.984						

ALL VELOCITIES IN MACH UNITS.

Table 3-11-WF3T(3). Film calibration data transformed to the object plane—Shot 11, WF3T at 3 feet.

PHOTOGRAMMETRICS DPW/11 ST WF3T 209.M03 C.750205

CAMERA (LENS) POSITION IS 1996.520 FEET EAST, 1399.390 FEET NORTH, AND 2317.500 FEET ELEVATION
OPTICAL AXIS IS ORIENTED TO 6.702 DEGREES EAST OF NORTH AND 3.217 DEGREES ELEVATION (±0.001)
OBJECT PLANE IS 595.904 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GRD.ZERO

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y	
1-20.10	-47.087	-24.640	0.272	-0.041	
1-20.20	-47.010	-14.575	0.232	-0.176	
1-20.30	-46.845	-4.668	0.060	-0.169	
1-20.50	-46.805	14.872	0.047	-0.029	
1-20.53	-46.807	17.807	-0.000	0.000	REFERENCE POINT P1
1-30.10	-38.895	-24.422	-0.990	-0.244	
1-30.20	-39.229	-14.810	0.038	-0.167	
1-30.30	-39.024	-5.136	-0.104	-0.313	
1-30.40	-39.004	4.591	-0.083	-0.529	
1-30.50	-38.984	14.239	-0.078	-0.042	
1-30.53	-38.953	17.041	-0.092	0.034	
1-40.10	-26.975	-23.656	-0.025	-0.582	
1-40.20	-26.604	-14.272	-0.368	-0.361	
1-40.30	-26.956	-4.636	-0.028	-0.178	
1-40.40	-26.911	5.061	-0.064	-0.068	
1-40.50	-26.329	14.777	-0.131	-0.002	
1-40.53	-26.848	17.645	-0.148	0.050	
1-60.10	-9.568	-24.849	-0.000	-0.003	REFERENCE POINT P2
1-60.20	-9.630	-14.952	0.052	-0.200	
1-60.30	-9.477	-5.542	-0.117	0.009	
1-60.40	-9.479	4.007	-0.111	0.081	
1-60.50	-9.647	13.597	0.020	0.102	
1-60.53	-9.635	16.496	-0.048	0.117	
E 3	33.214	-32.946	0.038	-0.132	
300-1	-14.752	-39.081	-0.893	-3.222	
300-2	15.338	-39.743	-1.421	-2.773	
300-3	45.718	-39.647	-0.097	-2.908	
RME 1	-25.052	-3.642	-0.381	-0.039	
RME 2	3.499	-3.748	-0.000	0.009	
RME 3	32.788	-3.556	0.003	0.038	
AVERAGES			-0.147	-0.391	

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE
SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

SMEAR = 0.025 FEET, MAX. CALIBRATION ERROR SCALED
SHAKE = 0.010 FEET, MAX. CAMERA ORIENTATION ERROR
TOTAL = ±0.035 FEET, MEASURED IN THE OBJECT PLANE.

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS 1-60.40 AND E 3

Table 4-11-WF3T(3). Film timing data—Shot 11, WF3T at 3 feet.

FILM TIMING DATA DPW/11 ST WF3T 209.M03 C.750205

STATIC ZERO = 3.38 CM
ACTUAL ZERO = 4.34 CM

FRAME LENGTH= 0.75850 CM

FRAME NO.	5-MSEC DISTANCE	FILM SPEED
-31	14.55 CM	3837./SEC
069	14.77 CM	3895./SEC
169	14.99 CM	3953./SEC
269	15.19 CM	4005./SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA
OTHER LENGTHS ARE FROM FILM MEASURMENT

Table 6-11-WF3T(3)a. Shock trajectory analysis— primary front, bottom charge—Shot 11.

SHOCK FRONT DATA OPW/11 ST WF3T 209.M03 PRIMARY FRONT, BOTTOM CHARGE C.750205

AMBIENT TEMPERATURE = -2.4 F
AMBIENT PRESSURE = 13.68 PSI
RELATIVE HUMIDITY = 60.0 %
VAPOUR PRESSURE= 0.600 MM HG
AMBIENT SPEED OF SOUND = 1.0488 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5070
CHARGE HEIGHT= 23.08 FEET
SEPARATION #2= 25.06 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	FRAME NO.
6.902	34.105	34.241	0.136	0.679	3.259	2.615	6.813	93.219	1.861	3.466	25
7.081	34.916	34.942	0.026	0.705	3.326	2.553	6.438	88.095	1.801	3.396	26
7.319	35.476	35.626	0.149	0.731	3.391	2.495	6.097	83.424	1.745	3.328	27
7.577	36.270	36.294	0.024	0.756	3.454	2.441	5.785	79.153	1.693	3.262	28
7.836	37.094	36.949	-0.146	0.782	3.517	2.390	5.499	75.237	1.643	3.200	29
8.094	37.760	37.590	-0.170	0.808	3.578	2.343	5.235	71.636	1.596	3.140	30
8.352	37.953	38.213	0.260	0.834	3.637	2.298	4.993	68.318	1.552	3.082	31
8.611	38.843	38.835	-0.008	0.860	3.696	2.255	4.769	65.253	1.510	3.026	32
8.869	39.763	39.440	-0.323	0.885	3.754	2.215	4.562	62.419	1.470	2.973	33
9.127	40.135	40.035	-0.150	0.911	3.810	2.178	4.369	59.794	1.433	2.922	34
9.385	41.096	40.620	-0.477	0.937	3.866	2.143	4.190	57.337	1.397	2.872	35
9.643	40.949	41.195	0.246	0.963	3.921	2.109	4.024	55.058	1.363	2.825	36
9.901	41.640	41.762	0.121	0.988	3.975	2.073	3.869	52.932	1.330	2.780	37
10.159	42.711	42.320	-0.392	1.014	4.028	2.047	3.723	50.946	1.299	2.736	38
10.417	42.916	42.870	-0.046	1.040	4.080	2.019	3.587	49.087	1.269	2.694	39
10.675	43.205	43.412	0.207	1.066	4.132	1.991	3.460	47.344	1.241	2.654	40
10.933	43.884	43.947	0.063	1.091	4.183	1.966	3.341	45.709	1.214	2.615	41
11.190	44.246	44.475	0.229	1.117	4.233	1.941	3.228	44.170	1.188	2.578	42
11.448	44.996	44.997	0.001	1.143	4.283	1.917	3.122	42.722	1.163	2.542	43
11.706	45.469	45.512	0.043	1.169	4.332	1.895	3.023	41.357	1.139	2.508	44
11.964	46.038	46.021	-0.016	1.194	4.380	1.874	2.928	40.069	1.117	2.475	45
12.221	46.502	46.525	0.023	1.220	4.428	1.853	2.839	38.852	1.095	2.443	46
12.479	46.876	47.023	0.147	1.246	4.475	1.834	2.755	37.701	1.073	2.412	47
12.737	47.627	47.516	-0.112	1.271	4.522	1.815	2.676	36.611	1.053	2.383	48
12.994	47.994	48.003	0.009	1.297	4.569	1.797	2.600	35.578	1.034	2.354	49
13.252	48.471	48.486	0.016	1.323	4.615	1.780	2.529	34.598	1.015	2.327	50
13.787	49.358	49.439	0.080	1.374	4.705	1.747	2.396	32.782	0.979	2.275	52
14.024	49.760	49.908	0.148	1.400	4.750	1.732	2.334	31.940	0.963	2.250	53
14.291	50.249	50.374	0.125	1.426	4.794	1.718	2.276	31.138	0.946	2.227	54
14.539	50.842	50.836	-0.006	1.451	4.838	1.704	2.220	30.374	0.931	2.204	55
14.796	51.422	51.294	-0.129	1.477	4.882	1.690	2.167	29.645	0.916	2.182	56
15.053	51.737	51.748	0.011	1.503	4.925	1.677	2.116	28.949	0.901	2.161	57
15.567	52.753	52.646	-0.107	1.554	5.011	1.653	2.021	27.649	0.873	2.120	59
15.805	53.389	53.090	0.201	1.580	5.053	1.641	1.976	27.041	0.860	2.101	60
16.042	53.443	53.531	0.088	1.605	5.095	1.630	1.934	26.459	0.847	2.082	61
16.339	54.093	53.969	-0.123	1.631	5.137	1.619	1.893	25.902	0.835	2.064	62
16.596	54.780	54.404	-0.376	1.657	5.178	1.609	1.854	25.367	0.823	2.047	63
16.853	54.902	54.837	0.035	1.682	5.219	1.599	1.817	24.855	0.811	2.030	64
17.110	55.173	55.266	0.093	1.708	5.260	1.589	1.781	24.363	0.800	2.014	65
17.366	55.496	55.693	0.198	1.734	5.301	1.580	1.746	23.891	0.789	1.998	66
17.623	55.996	56.118	0.122	1.759	5.341	1.571	1.713	23.437	0.779	1.983	67
17.880	56.113	56.540	-0.074	1.785	5.381	1.562	1.681	23.001	0.769	1.969	68

Table 6-11-WF3T(3)a. (continued)

18.137	56.729	56.959	0.230	1.810	5.421	1.554	1.650	22.381	0.759	1.956	69
18.304	57.440	57.377	-0.034	1.836	5.461	1.546	1.621	22.177	0.749	1.940	70
18.937	58.073	58.205	0.132	1.887	5.540	1.530	1.565	21.414	0.731	1.914	72
19.154	59.065	58.615	-0.449	1.913	5.579	1.523	1.539	21.053	0.722	1.901	73
19.420	59.310	59.024	-0.285	1.939	5.618	1.516	1.513	20.705	0.713	1.889	74
19.677	59.054	59.431	0.367	1.964	5.656	1.509	1.489	20.369	0.705	1.877	75
19.933	59.517	59.836	0.319	1.990	5.695	1.502	1.465	20.045	0.697	1.865	76
20.190	59.871	60.239	0.368	2.015	5.733	1.495	1.442	19.732	0.689	1.854	77
20.445	60.433	60.640	0.207	2.041	5.771	1.489	1.420	19.430	0.681	1.843	78
20.702	61.060	61.040	-0.020	2.067	5.809	1.483	1.399	19.138	0.674	1.833	79
20.957	61.436	61.439	0.002	2.092	5.847	1.477	1.378	18.856	0.667	1.822	80
21.215	61.811	61.834	0.023	2.118	5.885	1.471	1.358	18.583	0.659	1.812	81
21.471	62.223	62.229	0.005	2.143	5.923	1.465	1.339	18.319	0.653	1.803	82
21.727	62.636	62.622	0.016	2.169	5.960	1.460	1.320	18.063	0.646	1.793	83
21.984	62.954	63.013	0.059	2.194	5.997	1.455	1.302	17.816	0.639	1.784	84
22.240	63.527	63.403	-0.124	2.220	6.034	1.450	1.285	17.577	0.633	1.775	85
22.496	63.931	63.792	-0.109	2.246	6.071	1.445	1.268	17.344	0.627	1.767	86
22.752	64.185	64.179	-0.006	2.271	6.108	1.440	1.251	17.119	0.621	1.758	87
23.009	64.657	64.565	-0.101	2.297	6.145	1.435	1.235	16.900	0.615	1.750	88
23.264	64.983	64.950	-0.033	2.322	6.182	1.430	1.220	16.689	0.609	1.742	89
23.520	65.359	65.333	-0.026	2.348	6.218	1.426	1.205	16.485	0.604	1.734	90
23.776	65.746	65.715	-0.030	2.373	6.254	1.421	1.190	16.288	0.598	1.727	91
24.032	65.222	66.096	-0.126	2.399	6.291	1.417	1.176	16.097	0.593	1.719	92
24.288	66.537	66.476	-0.061	2.424	6.327	1.413	1.163	15.916	0.588	1.712	93
24.543	66.964	66.855	-0.009	2.450	6.363	1.409	1.149	15.734	0.583	1.705	94
24.799	67.410	67.232	-0.178	2.476	6.399	1.405	1.136	15.567	0.578	1.698	95
25.055	67.729	67.608	-0.121	2.501	6.435	1.401	1.124	15.375	0.573	1.692	96
25.311	68.041	67.984	-0.098	2.527	6.470	1.397	1.112	15.209	0.569	1.685	97
25.566	68.585	68.358	-0.207	2.552	6.506	1.394	1.100	15.046	0.564	1.679	98
25.822	68.900	68.731	-0.069	2.578	6.541	1.390	1.088	14.888	0.559	1.673	99
26.077	69.105	69.103	-0.002	2.603	6.577	1.387	1.077	14.735	0.555	1.667	100
26.333	69.548	69.474	-0.074	2.629	6.612	1.383	1.066	14.585	0.550	1.661	101
26.588	69.833	69.844	0.011	2.654	6.647	1.380	1.055	14.440	0.546	1.655	102
26.844	70.216	70.214	-0.002	2.680	6.683	1.377	1.045	14.298	0.542	1.650	103
27.099	70.595	70.582	-0.012	2.705	6.718	1.374	1.035	14.161	0.538	1.644	104
27.355	71.046	70.950	-0.096	2.731	6.753	1.371	1.025	14.027	0.534	1.639	105
27.610	71.234	71.316	0.032	2.756	6.788	1.368	1.016	13.896	0.530	1.634	106
27.865	71.795	71.682	-0.102	2.782	6.822	1.365	1.006	13.769	0.527	1.628	107
28.120	72.035	72.047	0.012	2.807	6.857	1.362	0.997	13.645	0.523	1.624	108
28.376	72.374	72.411	0.038	2.833	6.892	1.359	0.988	13.524	0.519	1.619	109
28.631	72.749	72.775	0.033	2.858	6.926	1.356	0.980	13.406	0.516	1.614	110
28.886	73.109	73.137	0.028	2.884	6.961	1.354	0.971	13.291	0.513	1.609	111
29.141	73.571	73.499	-0.032	2.909	6.995	1.351	0.963	13.179	0.509	1.605	112
29.396	73.956	73.860	0.006	2.934	7.030	1.349	0.955	13.070	0.506	1.600	113
29.651	74.220	74.221	0.001	2.960	7.064	1.346	0.947	12.963	0.503	1.596	114
29.906	74.687	74.581	-0.106	2.985	7.098	1.344	0.940	12.859	0.500	1.592	115
30.161	74.928	74.940	0.012	3.011	7.132	1.341	0.932	12.758	0.497	1.588	116
30.416	75.151	75.298	0.147	3.036	7.166	1.339	0.925	12.658	0.494	1.584	117
30.671	75.634	75.656	0.021	3.062	7.200	1.337	0.918	12.562	0.491	1.580	118
30.926	76.002	76.013	0.011	3.087	7.234	1.335	0.911	12.467	0.488	1.576	119
31.181	76.404	76.369	-0.096	3.113	7.268	1.332	0.904	12.375	0.485	1.572	120
31.435	76.701	76.725	0.024	3.138	7.302	1.330	0.898	12.285	0.482	1.568	121
31.690	77.083	77.080	-0.003	3.163	7.336	1.328	0.891	12.197	0.479	1.565	122
31.945	77.346	77.434	0.088	3.189	7.370	1.326	0.885	12.111	0.477	1.561	123
32.199	77.555	77.788	0.223	3.214	7.403	1.324	0.879	12.027	0.474	1.558	124
32.454	78.142	78.142	-0.040	3.240	7.437	1.322	0.873	11.944	0.472	1.554	125
32.709	78.323	78.494	0.171	3.265	7.471	1.320	0.867	11.864	0.469	1.551	126
32.963	78.911	78.847	-0.066	3.291	7.504	1.318	0.861	11.785	0.467	1.548	127
33.218	79.200	79.198	-0.001	3.316	7.538	1.317	0.856	11.709	0.464	1.545	128
33.472	79.509	79.549	0.041	3.341	7.571	1.315	0.850	11.634	0.462	1.542	129
33.727	79.874	79.900	0.026	3.367	7.604	1.313	0.845	11.560	0.460	1.539	130
33.981	80.295	80.250	-0.045	3.392	7.638	1.311	0.840	11.488	0.457	1.536	131
34.235	80.756	80.600	-0.156	3.417	7.671	1.310	0.835	11.418	0.455	1.533	132
34.490	80.975	80.949	-0.026	3.443	7.704	1.308	0.829	11.349	0.453	1.530	133

Table 6-11-WF3T(3)a. (continued)

34.744	81.462	81.298	-0.165	3.468	7.737	1.306	0.825	11.282	0.451	1.527	134
34.998	81.644	81.646	0.002	3.494	7.771	1.305	0.820	11.215	0.449	1.524	135
35.252	81.972	81.993	0.021	3.519	7.804	1.303	0.815	11.151	0.447	1.521	136
35.507	82.385	82.341	-0.044	3.544	7.837	1.302	0.810	11.088	0.445	1.519	137
35.761	82.635	82.688	0.052	3.570	7.870	1.300	0.806	11.026	0.443	1.516	138
36.015	83.018	83.034	0.016	3.595	7.903	1.299	0.801	10.966	0.441	1.514	139
36.269	83.429	83.380	-0.049	3.620	7.936	1.297	0.797	10.906	0.439	1.511	140
36.523	83.736	83.725	-0.011	3.645	7.968	1.296	0.793	10.848	0.437	1.509	141
36.777	84.099	84.070	-0.028	3.671	8.001	1.295	0.789	10.791	0.435	1.506	142
37.031	84.416	84.415	-0.001	3.697	8.034	1.293	0.785	10.735	0.433	1.504	143
37.285	84.765	84.759	-0.006	3.722	8.067	1.292	0.781	10.681	0.432	1.503	144
37.539	85.081	85.103	0.022	3.747	8.100	1.291	0.777	10.627	0.430	1.499	145
37.793	85.511	85.446	-0.064	3.773	8.132	1.289	0.773	10.575	0.429	1.497	146
38.046	85.790	85.789	-0.001	3.798	8.165	1.288	0.769	10.523	0.427	1.495	147
38.300	86.227	86.132	-0.095	3.823	8.198	1.287	0.765	10.473	0.425	1.493	148
38.554	86.510	86.474	-0.036	3.849	8.230	1.286	0.762	10.423	0.423	1.491	149
38.807	86.902	86.816	0.015	3.874	8.263	1.285	0.758	10.375	0.422	1.489	150
39.061	87.118	87.158	0.040	3.899	8.295	1.283	0.755	10.327	0.420	1.487	151
39.315	87.498	87.499	0.001	3.925	8.328	1.282	0.751	10.281	0.419	1.485	152
39.569	87.772	87.840	0.068	3.950	8.360	1.281	0.748	10.235	0.417	1.483	153
39.822	88.134	88.181	0.046	3.975	8.393	1.280	0.745	10.190	0.416	1.481	154
40.075	88.492	88.521	0.029	4.000	8.425	1.279	0.742	10.145	0.414	1.479	155
40.329	88.822	88.861	0.039	4.026	8.457	1.278	0.738	10.103	0.413	1.477	156
40.582	89.099	89.200	0.101	4.051	8.490	1.277	0.735	10.061	0.411	1.475	157
40.836	89.445	89.539	0.094	4.076	8.522	1.276	0.732	10.019	0.410	1.474	158
41.089	89.801	89.878	0.077	4.102	8.554	1.275	0.729	9.978	0.409	1.472	159
41.342	90.167	90.217	0.050	4.127	8.586	1.274	0.726	9.938	0.407	1.470	160

ALL VELOCITIES IN MACH UNITS.

Table 6-11-WF3T(3)b. Shock trajectory analysis— ground mach stem, bottom charge— Shot 11.

SHOCK FRONT DATA DPG/11 ST WF3T 209.M03 GROUND MACH STEM, BOTTOM CHARGE 0.750000

AMBIENT TEMPERATURE = -2.4 F
AMBIENT PRESSURE = 13.68 PSI
RELATIVE HUMIDITY = 60.0 %
VAPOUR PRESSURE= 0.000 MM HG
AMBIENT SPEED OF SOUND = 1.0438 FT/MSEC
CHARGE WEIGHT= 1040.0 LBS.
SACHS SCALING FACTOR = 10.5070
CHARGE HEIGHT= 23.98 FEET
SEPARATION #2= 25.00 FEET

FIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS DAS-FT	RADIUS FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	SHOCK VELOCITY	PRESSURE ATMS	PRESSURE PSI	PARTICLE VELOCITY	DENSITY RATIO	[illegible] NO.
14.796	46.233	46.183	-0.050	1.477	4.395	2.056	3.764	51.509	1.309	2.749	56
15.062	46.702	46.735	0.033	1.503	4.448	2.036	3.671	50.231	1.288	2.720	57
15.313	47.418	47.282	-0.136	1.528	4.500	2.017	3.582	49.003	1.268	2.693	58
15.567	47.772	47.824	0.052	1.554	4.552	1.999	3.496	47.831	1.249	2.666	59
15.825	48.483	48.361	-0.129	1.580	4.603	1.982	3.414	46.717	1.231	2.639	60
16.082	48.780	48.493	0.104	1.605	4.653	1.965	3.336	45.641	1.213	2.614	61
16.339	49.323	49.420	0.097	1.631	4.704	1.948	3.260	44.602	1.196	2.589	62
16.599	50.087	49.943	-0.144	1.657	4.753	1.932	3.188	43.618	1.179	2.565	63
16.863	50.640	50.461	-0.178	1.682	4.803	1.916	3.118	42.655	1.163	2.541	64
17.110	51.333	50.976	-0.357	1.708	4.852	1.901	3.051	41.750	1.148	2.518	65
17.365	51.764	51.486	0.222	1.734	4.900	1.887	2.987	40.873	1.134	2.495	66
17.623	51.988	51.992	0.095	1.759	4.948	1.873	2.925	40.022	1.116	2.474	67
17.880	52.290	52.495	0.235	1.785	4.996	1.859	2.865	39.206	1.101	2.452	68
18.137	52.870	52.994	0.124	1.810	5.044	1.846	2.808	38.420	1.087	2.431	69
18.394	53.331	53.489	0.158	1.836	5.091	1.833	2.752	37.662	1.073	2.411	70
18.653	53.944	53.981	0.037	1.862	5.138	1.820	2.699	36.930	1.059	2.391	71
18.907	54.567	54.469	-0.087	1.887	5.184	1.808	2.647	36.225	1.046	2.372	72
19.164	54.735	54.954	0.229	1.913	5.230	1.796	2.598	35.543	1.033	2.353	73
19.420	55.307	55.436	0.059	1.939	5.276	1.785	2.550	34.885	1.020	2.335	74
19.677	55.750	55.915	0.155	1.964	5.322	1.774	2.503	34.249	1.008	2.317	75
19.933	56.435	56.390	-0.245	1.990	5.367	1.763	2.458	33.635	0.996	2.300	76
20.190	57.430	56.863	-0.567	2.015	5.412	1.752	2.415	33.040	0.984	2.282	77
20.449	57.063	57.333	0.270	2.041	5.457	1.742	2.373	32.465	0.973	2.266	78
20.454	57.832	58.284	0.442	2.092	5.545	1.722	2.293	31.369	0.951	2.234	80
22.240	60.100	60.547	0.447	2.220	5.783	1.677	2.113	28.911	0.900	2.159	85
22.499	60.736	60.996	0.270	2.246	5.825	1.668	2.080	28.452	0.891	2.145	86
22.753	61.419	61.443	0.024	2.271	5.868	1.660	2.048	28.027	0.881	2.131	87
23.008	61.790	61.888	0.098	2.297	5.890	1.652	2.017	27.604	0.872	2.119	88
23.264	62.347	62.330	-0.016	2.322	5.932	1.644	1.987	27.194	0.863	2.105	89
23.523	62.944	62.771	-0.073	2.348	5.974	1.637	1.956	26.783	0.855	2.093	90
23.779	63.336	63.209	-0.127	2.373	6.016	1.629	1.930	26.407	0.846	2.081	91
24.032	63.788	63.645	-0.143	2.399	6.057	1.622	1.902	26.033	0.838	2.068	92
24.288	64.180	64.073	-0.101	2.424	6.099	1.615	1.876	25.663	0.830	2.057	93
24.543	64.529	64.512	-0.017	2.450	6.140	1.608	1.849	25.305	0.822	2.045	94
24.799	64.991	64.942	-0.049	2.476	6.181	1.601	1.824	24.957	0.814	2.034	95
25.055	65.320	65.371	0.051	2.501	6.222	1.594	1.799	24.619	0.806	2.022	96
25.311	65.896	65.797	-0.099	2.527	6.262	1.588	1.775	24.290	0.799	2.012	97
25.569	66.302	66.223	-0.080	2.552	6.303	1.582	1.752	23.969	0.791	2.001	98
25.822	66.644	66.645	0.001	2.578	6.343	1.575	1.729	23.656	0.784	1.990	99
26.077	67.099	67.067	0.011	2.603	6.383	1.569	1.707	23.351	0.777	1.980	100
26.333	67.628	67.487	-0.033	2.629	6.423	1.563	1.685	23.054	0.770	1.970	101
26.588	68.109	67.905	-0.195	2.654	6.463	1.557	1.664	22.764	0.763	1.960	102

Table 6-11-WF3T(3)b. (continued)

26.844	68.611	68.321	-0.289	2.680	6.502	1.552	1.643	22.481	0.756	1.951	103
27.093	68.939	68.736	-0.203	2.705	6.542	1.546	1.623	22.209	0.750	1.941	104
27.355	69.492	69.150	-0.342	2.731	6.581	1.541	1.603	21.937	0.743	1.932	105
27.610	69.756	69.562	-0.194	2.756	6.620	1.536	1.584	21.674	0.737	1.923	106
27.865	70.169	69.972	-0.197	2.782	6.660	1.530	1.565	21.413	0.731	1.914	107
28.120	70.695	70.381	-0.314	2.807	6.698	1.525	1.547	21.167	0.725	1.906	108
28.376	70.995	70.789	-0.207	2.833	6.737	1.520	1.529	20.923	0.719	1.898	109
28.621	71.496	71.195	-0.301	2.858	6.776	1.515	1.512	20.694	0.714	1.890	110
28.885	71.903	71.600	-0.303	2.884	6.814	1.510	1.495	20.461	0.708	1.882	111
29.141	72.209	72.003	-0.206	2.909	6.853	1.505	1.478	20.232	0.703	1.874	112
29.395	72.539	72.405	-0.123	2.934	6.891	1.501	1.462	20.009	0.698	1.866	113
29.651	72.930	72.806	-0.074	2.960	6.929	1.496	1.446	19.782	0.693	1.859	114
29.905	73.276	73.206	-0.070	2.985	6.967	1.492	1.430	19.563	0.688	1.852	115
30.161	73.590	73.604	0.014	3.011	7.005	1.488	1.415	19.360	0.679	1.841	116
30.416	73.925	74.001	0.076	3.036	7.043	1.483	1.400	19.165	0.674	1.833	117
30.671	74.576	74.397	-0.179	3.062	7.081	1.479	1.385	18.955	0.669	1.826	118
30.926	74.833	74.792	-0.040	3.087	7.118	1.475	1.371	18.761	0.664	1.819	119
31.181	75.095	75.186	0.090	3.113	7.156	1.471	1.357	18.570	0.659	1.812	120
31.435	75.710	75.578	-0.132	3.138	7.193	1.467	1.344	18.383	0.654	1.805	121
31.690	75.957	75.969	0.013	3.163	7.230	1.463	1.330	18.199	0.649	1.798	122
31.945	76.310	76.360	0.050	3.189	7.267	1.459	1.317	18.020	0.645	1.792	123
32.199	76.626	76.749	0.123	3.214	7.305	1.455	1.304	17.844	0.640	1.785	124
32.454	76.753	77.137	0.385	3.240	7.341	1.452	1.292	17.672	0.636	1.779	125
32.709	77.113	77.524	0.412	3.265	7.378	1.448	1.279	17.503	0.631	1.773	126
32.963	77.653	77.910	0.259	3.291	7.415	1.444	1.267	17.333	0.627	1.766	127
33.218	78.031	78.295	0.264	3.316	7.452	1.441	1.255	17.176	0.622	1.760	128
33.472	78.475	78.679	0.204	3.341	7.488	1.437	1.244	17.017	0.618	1.754	129
33.727	78.781	79.063	0.281	3.367	7.525	1.434	1.232	16.861	0.614	1.748	130
33.981	79.234	79.445	0.161	3.392	7.561	1.431	1.221	16.709	0.610	1.743	131
34.235	79.639	79.826	0.127	3.417	7.597	1.427	1.210	16.559	0.606	1.737	132
34.490	80.182	80.206	0.025	3.443	7.634	1.424	1.199	16.412	0.602	1.732	133
34.744	80.491	80.586	0.095	3.468	7.670	1.421	1.189	16.265	0.598	1.726	134
34.999	80.948	80.964	0.116	3.494	7.706	1.418	1.179	16.125	0.594	1.721	135
35.253	81.181	81.342	0.160	3.519	7.742	1.415	1.168	15.983	0.590	1.715	136
35.507	81.760	81.718	-0.042	3.544	7.778	1.412	1.159	15.851	0.586	1.710	137
35.761	82.005	82.094	0.089	3.570	7.813	1.409	1.149	15.718	0.582	1.705	138
36.015	82.273	82.469	0.196	3.595	7.849	1.406	1.139	15.589	0.579	1.700	139
36.269	82.732	82.844	0.051	3.620	7.885	1.403	1.130	15.458	0.575	1.695	140
36.523	83.082	83.217	0.135	3.646	7.920	1.400	1.120	15.331	0.572	1.690	141
36.777	83.550	83.590	0.040	3.671	7.956	1.397	1.111	15.207	0.568	1.685	142
37.031	83.933	83.961	0.028	3.697	7.991	1.393	1.102	15.085	0.565	1.680	143
37.285	84.338	84.333	-0.005	3.722	8.026	1.392	1.094	14.965	0.561	1.676	144
37.539	84.649	84.703	0.054	3.747	8.062	1.389	1.085	14.847	0.558	1.671	145
37.792	85.046	85.072	0.027	3.773	8.097	1.387	1.077	14.731	0.555	1.667	146
38.046	85.399	85.441	0.042	3.798	8.132	1.384	1.068	14.618	0.551	1.662	147
38.300	85.782	85.809	0.027	3.823	8.167	1.382	1.060	14.509	0.548	1.658	148
38.554	86.185	86.178	-0.019	3.849	8.202	1.379	1.052	14.396	0.545	1.653	149
38.807	86.681	86.543	-0.038	3.874	8.237	1.377	1.044	14.288	0.542	1.648	150
39.061	86.954	86.909	-0.055	3.899	8.272	1.374	1.037	14.182	0.539	1.645	151
39.315	87.204	87.274	0.070	3.925	8.306	1.372	1.029	14.077	0.536	1.641	152
39.569	87.582	87.639	0.056	3.950	8.341	1.370	1.021	13.975	0.533	1.637	153
39.822	87.914	88.003	0.089	3.975	8.376	1.367	1.014	13.874	0.530	1.633	154
40.076	88.177	88.366	0.189	4.000	8.410	1.365	1.007	13.775	0.527	1.629	155
40.329	88.692	88.728	0.036	4.026	8.445	1.363	1.000	13.677	0.524	1.625	156
40.583	89.004	89.090	0.086	4.051	8.479	1.360	0.993	13.581	0.521	1.621	157
40.836	89.347	89.452	0.064	4.076	8.513	1.358	0.986	13.486	0.518	1.617	158
41.090	89.849	89.812	-0.084	4.102	8.548	1.356	0.979	13.393	0.515	1.613	159
41.342	90.249	90.172	-0.077	4.127	8.582	1.354	0.972	13.302	0.513	1.610	160
41.596	90.638	90.532	-0.107	4.152	8.616	1.352	0.965	13.212	0.510	1.606	161
41.849	91.010	90.890	-0.119	4.177	8.650	1.350	0.959	13.123	0.508	1.603	162
42.103	91.105	91.249	0.144	4.203	8.685	1.348	0.953	13.035	0.505	1.599	163
42.356	91.633	91.606	-0.033	4.228	8.719	1.346	0.946	12.950	0.502	1.596	164
42.609	91.953	91.963	0.001	4.253	8.753	1.344	0.940	12.865	0.500	1.593	165
42.861	92.367	92.320	-0.047	4.279	8.788	1.342	0.934	12.782	0.497	1.589	166

Table 6-11-WF3T(3)b. (continued)

42.114	92.734	92.676	-0.058	4.304	8.820	1.340	0.923	12.700	0.495	1.535	167
42.368	93.038	93.031	-0.007	4.329	8.854	1.338	0.922	12.519	0.492	1.533	168
42.620	93.310	93.386	0.076	4.354	8.888	1.336	0.916	12.539	0.490	1.529	169
42.873	93.591	93.740	0.149	4.380	8.922	1.334	0.911	12.461	0.488	1.525	170
43.126	94.126	94.094	-0.032	4.405	8.955	1.333	0.905	12.383	0.485	1.522	171
43.379	94.519	94.447	-0.071	4.430	8.989	1.331	0.900	12.307	0.483	1.518	172
43.632	94.881	94.800	-0.161	4.455	9.023	1.329	0.894	12.232	0.481	1.515	173
43.885	95.201	95.152	-0.049	4.481	9.056	1.327	0.889	12.159	0.478	1.513	174
44.138	95.594	95.504	-0.120	4.506	9.090	1.325	0.883	12.085	0.476	1.510	175
44.390	95.915	95.955	0.040	4.531	9.123	1.324	0.878	12.014	0.474	1.507	176
44.643	96.237	96.206	-0.031	4.556	9.156	1.322	0.873	11.943	0.472	1.504	177
44.896	96.579	96.905	0.326	4.582	9.223	1.319	0.868	11.805	0.467	1.499	179
45.148	96.939	97.085	0.146	4.607	9.256	1.317	0.858	11.737	0.465	1.496	180
45.401	97.109	97.255	0.009	4.632	9.289	1.316	0.853	11.670	0.463	1.493	181
45.654	97.595	97.603	0.078	4.657	9.322	1.314	0.848	11.605	0.461	1.490	182
45.906	97.874	97.952	0.153	4.682	9.356	1.313	0.843	11.540	0.459	1.488	183
46.159	98.146	98.299	-0.059	4.708	9.389	1.311	0.838	11.475	0.457	1.485	184
46.411	98.706	98.647	-0.063	4.733	9.422	1.310	0.834	11.412	0.455	1.482	185
46.664	99.056	98.994	-0.222	4.758	9.455	1.308	0.830	11.350	0.453	1.480	186
46.916	99.552	99.340	-0.218	4.783	9.488	1.307	0.825	11.289	0.451	1.477	187
47.168	99.904	99.686	-0.255	4.808	9.520	1.305	0.821	11.228	0.449	1.475	188
47.421	100.287	100.032	-0.052	4.834	9.553	1.304	0.816	11.168	0.447	1.472	189
47.673	100.429	100.377	-0.202	4.859	9.586	1.302	0.812	11.109	0.445	1.470	190
47.925	100.923	100.722	-0.160	4.884	9.619	1.301	0.808	11.051	0.444	1.467	191
48.177	101.226	101.066	-0.308	4.909	9.652	1.300	0.804	10.994	0.442	1.465	192
48.430	101.718	101.410	-0.180	4.934	9.684	1.298	0.799	10.937	0.440	1.462	193
48.682	101.934	101.753	-0.301	4.959	9.717	1.297	0.795	10.881	0.438	1.460	194
48.934	102.397	102.096	-0.211	4.985	9.750	1.295	0.791	10.825	0.436	1.458	195
49.186	102.550	102.439	-0.101	5.010	9.782	1.294	0.787	10.771	0.435	1.455	196
49.438	102.972	102.791	-0.077	5.035	9.782	1.293	0.783	10.718	0.433	1.453	197
49.690	103.200	103.123	-0.057	5.060	9.815	1.292	0.779	10.665	0.431	1.451	198
49.942	103.521	103.465	-0.044	5.085	9.847	1.290	0.775	10.612	0.429	1.449	199
50.194	103.752	103.806	-0.016	5.110	9.880	1.289	0.772	10.561	0.428	1.447	200
50.446	104.162	104.147	-0.005	5.135	9.912	1.288	0.768	10.509	0.426	1.444	201
50.698	104.492	104.487	0.043	5.161	9.944	1.287	0.764	10.459	0.424	1.442	202
50.949	104.733	104.827	0.047	5.186	9.977	1.285	0.761	10.409	0.423	1.440	203
51.201	105.119	105.167	-0.173	5.211	10.009	1.284	0.757	10.360	0.421	1.438	204
51.453	105.678	105.506	0.056	5.236	10.041	1.283	0.754	10.312	0.420	1.436	205
51.705	105.788	105.845	0.076	5.261	10.074	1.282	0.750	10.264	0.418	1.434	206
51.957	106.107	106.183	-0.038	5.286	10.106	1.280	0.747	10.216	0.416	1.432	207
52.209	106.610	106.521	0.022	5.311	10.138	1.281	0.743	10.169	0.415	1.430	208
52.460	107.837	106.859	-0.091	5.337	10.170	1.279	0.740	10.123	0.413	1.428	209
52.711	107.238	107.197	0.013	5.362	10.202	1.278	0.737	10.078	0.412	1.426	210
52.963	107.520	107.534	0.097	5.387	10.234	1.277	0.733	10.032	0.410	1.424	211
53.214	107.774	107.871	0.193	5.412	10.267	1.276	0.730	9.988	0.409	1.422	212
53.465	108.015	108.207	0.173	5.437	10.299	1.275	0.727	9.944	0.408	1.420	213
53.717	108.371	108.543	0.251	5.462	10.331	1.274	0.724	9.900	0.406	1.418	214
53.968	108.628	108.879	0.166	5.487	10.362	1.273	0.720	9.857	0.405	1.417	215
54.220	109.049	109.214	0.089	5.512	10.394	1.272	0.717	9.815	0.403	1.415	216
54.471	109.450	109.550	0.074	5.537	10.426	1.271	0.714	9.773	0.402	1.413	217
54.723	109.811	109.884	0.126	5.562	10.458	1.270	0.711	9.731	0.400	1.411	218
54.974	110.093	110.219	0.024	5.588	10.490	1.269	0.708	9.690	0.399	1.410	219
55.225	110.529	110.553	-0.041	5.613	10.522	1.268	0.705	9.650	0.398	1.408	220
55.477	110.928	110.887		5.638	10.554	1.267					

ALL VELOCITIES IN MACH UNITS.

Table 7-8-WF5(57). Triple point path below ideal surface— Shot 8.

SHOCK FRONT DATA DRW/8 ST WF5 267.M57 TRIPLE POINT PATH, IDEAL SURFACE C.750005

AMBIENT TEMPERATURE = 67.5 F
AMBIENT PRESSURE = 13.52 PSI
RELATIVE HUMIDITY = 31.0 %
VAPOUR PRESSURE= 5.335 MM HG
AMBIENT SPEED OF SOUND = 1.1274 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5488
CHARGE HEIGHT= 24.45 FEET
SEPARATION #2= 24.93 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
10.526	33.732	38.527	-0.205	2.740	2.660	-0.080	1.125	3.652	0.252	33
10.840	39.375	39.435	0.060	2.851	2.825	-0.026	1.158	3.738	0.268	34
11.153	40.618	40.325	-0.292	3.020	2.997	-0.023	1.192	3.823	0.284	35
11.467	40.926	41.198	0.272	3.142	3.176	0.034	1.225	3.905	0.301	36
11.780	41.333	42.053	0.671	3.402	3.361	-0.041	1.259	3.987	0.319	37
12.093	43.059	42.893	-0.165	3.533	3.551	0.018	1.292	4.066	0.337	38
12.407	43.784	43.713	-0.066	3.317	3.746	0.429	1.326	4.144	0.355	39
12.720	44.740	44.529	-0.211	3.818	3.946	0.128	1.359	4.221	0.374	40
13.033	45.323	45.326	0.003	3.980	4.151	0.171	1.393	4.297	0.393	41
13.346	46.190	46.110	-0.081	4.601	4.359	-0.241	1.426	4.371	0.413	42
13.659	46.722	46.881	0.159	5.511	4.572	-0.939	1.460	4.444	0.433	43
13.972	47.411	47.641	0.230	5.148	4.787	-0.361	1.493	4.515	0.454	44
14.285	48.552	48.390	-0.162	4.773	5.007	0.234	1.527	4.587	0.475	45
14.597	49.251	49.128	-0.122	5.182	5.229	0.047	1.560	4.657	0.496	46
14.910	49.915	49.855	-0.058	5.396	5.454	0.063	1.594	4.725	0.517	47
15.223	50.631	50.575	-0.056	5.615	5.681	0.066	1.627	4.794	0.539	48
15.535	51.353	51.283	-0.070	6.302	5.911	-0.391	1.660	4.862	0.560	49
15.848	52.287	51.983	-0.304	5.475	6.143	0.668	1.694	4.928	0.582	50
16.160	52.592	52.674	0.083	6.600	6.377	-0.223	1.727	4.993	0.605	51
16.472	53.162	53.357	0.196	6.929	6.614	-0.315	1.760	5.058	0.627	52
16.784	53.900	54.033	0.133	7.161	6.852	-0.310	1.794	5.122	0.650	53
17.097	55.071	54.699	-0.372	7.606	7.091	-0.515	1.827	5.185	0.672	54
17.409	55.300	55.359	0.059	7.396	7.332	-0.064	1.861	5.248	0.695	55
17.721	56.067	56.012	-0.055	7.299	7.575	0.276	1.894	5.310	0.718	56
18.033	56.679	56.658	-0.021	7.683	7.819	0.136	1.927	5.371	0.741	57
18.344	57.335	57.298	-0.037	7.556	8.064	0.508	1.961	5.432	0.764	58
18.656	57.822	57.931	0.109	8.152	8.310	0.158	1.994	5.492	0.788	59
18.968	58.459	58.558	0.100	8.652	8.557	-0.095	2.027	5.551	0.811	60
19.280	59.070	59.180	0.110	8.878	8.805	-0.073	2.061	5.610	0.835	61
19.591	59.893	59.795	-0.098	9.102	9.055	-0.047	2.094	5.668	0.858	62
19.903	60.437	60.405	-0.032	9.474	9.304	-0.170	2.127	5.726	0.882	63
20.214	60.831	61.010	0.179	9.975	9.555	-0.420	2.160	5.784	0.906	64
20.525	61.654	61.610	-0.044	9.855	9.806	-0.050	2.194	5.840	0.930	65
20.837	62.293	62.205	-0.088	10.103	10.058	-0.045	2.227	5.897	0.953	66
21.148	62.731	62.795	0.063	10.261	10.311	0.050	2.260	5.953	0.977	67
21.459	63.334	63.380	0.046	10.922	10.564	-0.358	2.293	6.008	1.001	68
21.770	64.024	63.961	-0.063	11.033	10.817	-0.216	2.327	6.063	1.025	69
22.081	64.479	64.537	0.058	11.512	11.071	-0.441	2.360	6.118	1.050	70
22.392	65.203	65.110	-0.093	11.283	11.325	0.042	2.393	6.172	1.074	71
22.703	65.373	65.677	0.305	11.871	11.580	-0.291	2.426	6.226	1.098	72
23.014	66.264	66.242	-0.022	11.961	11.834	-0.127	2.460	6.280	1.122	73
23.324	66.795	66.802	0.007	11.213	12.089	0.876	2.493	6.333	1.146	74

Table 7-8-WF5(57). (continued)

23.675	67.340	67.358	0.018	12.143	12.345	0.202	2.526	5.385	1.170	73
23.945	67.853	67.911	0.058	12.454	12.600	0.145	2.559	5.434	1.194	75
24.256	68.335	68.401	0.066	13.145	12.858	-0.288	2.592	5.490	1.218	77
24.569	68.933	69.007	0.073	12.942	13.111	0.169	2.926	6.542	1.343	78
24.877	69.444	69.549	0.106	13.376	13.367	-0.009	2.659	6.593	1.367	79
25.187	70.136	70.069	-0.067	13.488	13.623	0.135	2.692	6.644	1.391	80
25.497	70.757	70.625	-0.132	14.030	13.879	-0.151	2.725	6.695	1.415	81
25.807	71.238	71.159	-0.126	14.298	14.135	-0.163	2.758	6.745	1.439	82
26.117	71.706	71.688	-0.018	14.212	14.391	0.179	2.791	6.796	1.463	84
26.427	72.031	72.216	0.185	14.741	14.647	-0.094	2.824	6.846	1.487	86
26.737	72.926	72.740	-0.186	14.894	14.903	0.009	2.858	6.899	1.511	88
27.047	73.248	73.269	0.021	15.364	15.159	-0.205	2.891	6.949	1.535	89
27.357	73.714	73.781	0.067	15.279	15.414	0.135	2.924	6.998	1.559	91
27.668	74.434	74.297	-0.137	15.830	15.670	-0.160	2.957	7.043	1.583	92
27.976	74.975	74.911	-0.064	15.560	15.925	0.366	2.990	7.092	1.607	94
28.286	75.242	75.322	0.033	15.944	16.181	0.237	3.023	7.140	1.631	96
28.596	75.852	75.831	-0.021	15.984	16.436	0.452	3.056	7.189	1.655	97
28.904	76.651	76.339	-0.324	15.974	16.691	0.717	3.089	7.237	1.679	98
29.214	77.814	76.942	0.028	16.632	16.946	0.314	3.122	7.286	1.703	99
29.523	77.342	77.344	-0.038	17.409	17.201	-0.208	3.155	7.335	1.727	101
29.832	77.955	77.847	-0.111	17.291	17.459	0.164	3.188	7.383	1.751	102
30.141	78.426	78.341	-0.085	17.723	17.710	-0.013	3.221	7.432	1.775	103
30.450	78.791	78.835	0.045	18.108	17.964	-0.144	3.254	7.478	1.799	105
30.759	79.544	79.330	-0.085	18.137	18.218	-0.169	3.287	7.530	1.823	106
31.069	79.929	79.821	0.296	18.581	18.472	-0.109	3.320	7.579	1.847	108
31.377	80.552	80.311	-0.241	18.550	18.726	0.176	3.353	7.613	1.775	100
31.686	80.700	80.793	0.098	19.460	19.079	-0.381	3.386	7.654	1.799	101
31.994	81.285	81.234	-0.001	18.923	19.232	0.309	3.419	7.703	1.823	102
32.303	82.149	81.744	-0.381	19.562	19.486	-0.077	3.452	7.751	1.847	103
32.612	82.366	82.250	-0.116	19.219	19.737	0.519	3.485	7.797	1.871	104
32.920	83.052	82.730	-0.322	19.915	19.990	0.074	3.518	7.843	1.895	106
33.229	83.413	83.235	0.272	21.564	20.493	-1.070	3.551	7.933	1.919	107
33.965	84.323	84.161	0.338	21.054	20.745	-0.310	3.617	7.973	1.967	109
34.153	84.818	84.634	-0.184	21.461	20.996	-0.465	3.650	8.023	1.990	109

Table 7-8-WF3T(3). Triple point path above smooth ground—Shot 8.

SHOCK FRONT DATA DPW/8 ST WF3T 209.M03 TRIPLE POINT PATH, SMOOTH SURFACE C.750205

AMBIENT TEMPERATURE = 67.5 F
AMBIENT PRESSURE = 13.52 PSI
RELATIVE HUMIDITY = 31.0 %
VAPOUR PRESSURE= 5.335 MM HG
AMBIENT SPEED OF SOUND = 1.1274 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5488
CHARGE HEIGHT= 24.45 FEET
SEPARATION #2= 24.93 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
12.712	44.647	44.890	0.243	3.371	3.683	0.312	1.359	4.255	0.349	51
12.960	45.727	45.460	-0.267	3.848	3.857	0.009	1.385	4.309	0.366	52
13.209	46.026	46.026	0.001	3.668	4.029	0.361	1.412	4.363	0.382	53
13.456	46.653	46.589	-0.064	4.387	4.200	-0.187	1.438	4.417	0.398	54
13.704	47.327	47.149	-0.178	4.491	4.369	-0.122	1.465	4.470	0.414	55
13.951	47.629	47.705	0.076	5.399	4.537	-0.862	1.491	4.522	0.430	56
14.199	47.908	48.259	0.351	5.612	4.704	-0.908	1.518	4.575	0.446	57
14.695	49.574	49.355	-0.219	5.275	5.036	-0.239	1.571	4.679	0.477	59
14.942	49.772	49.899	0.126	5.202	5.201	-0.001	1.597	4.730	0.493	60
15.190	50.702	50.439	-0.264	5.334	5.365	0.032	1.623	4.781	0.509	61
15.438	50.953	50.976	0.023	5.421	5.529	0.108	1.650	4.832	0.524	62
15.685	51.954	51.510	-0.444	6.023	5.693	-0.330	1.676	4.883	0.540	63
15.933	52.798	52.041	-0.757	6.440	5.856	-0.584	1.703	4.933	0.555	64
16.180	51.976	52.568	0.593	5.843	6.019	0.176	1.729	4.983	0.571	65
16.428	53.017	53.093	0.076	5.875	6.182	0.307	1.756	5.033	0.586	66
16.675	53.588	53.615	0.027	6.569	6.344	-0.225	1.782	5.083	0.601	67
16.923	53.629	54.133	0.504	6.359	6.507	0.148	1.809	5.132	0.617	68
17.170	54.699	54.649	-0.050	6.623	6.670	0.046	1.835	5.181	0.632	69
17.418	55.312	55.162	-0.171	6.418	6.832	0.415	1.862	5.229	0.648	70
17.665	55.782	55.671	-0.111	6.456	6.995	0.540	1.888	5.277	0.663	71
17.912	56.007	56.178	0.171	6.609	7.159	0.549	1.914	5.325	0.679	72
18.159	56.265	56.682	0.417	7.262	7.322	0.060	1.941	5.373	0.694	73
18.407	57.083	57.183	0.100	7.279	7.485	0.207	1.967	5.421	0.710	74
18.901	58.128	59.177	0.049	7.589	7.814	0.225	2.020	5.515	0.741	76
19.148	58.653	58.670	0.016	7.805	7.978	0.173	2.046	5.562	0.756	77
19.396	59.087	59.160	0.073	8.725	8.143	-0.581	2.073	5.608	0.772	78
19.643	59.790	59.647	-0.143	8.592	8.309	-0.283	2.099	5.654	0.788	79
19.889	60.071	60.132	0.061	7.993	8.475	0.482	2.126	5.700	0.803	80
20.135	60.742	60.613	-0.129	8.478	8.641	0.163	2.152	5.746	0.819	81
20.383	61.269	61.093	-0.176	9.150	8.808	-0.342	2.178	5.791	0.835	82
20.877	62.286	62.044	-0.242	8.907	9.144	0.237	2.231	5.882	0.867	84
21.617	63.724	63.451	-0.273	9.865	9.652	-0.214	2.310	6.015	0.915	87
21.864	63.896	63.915	0.019	9.300	9.822	-0.478	2.337	6.059	0.931	88
22.357	64.755	64.836	0.081	10.010	10.165	0.155	2.389	6.146	0.964	90
22.604	65.302	65.293	-0.006	10.706	10.338	-0.368	2.416	6.190	0.980	91
22.851	65.923	65.748	-0.175	10.681	10.511	-0.170	2.442	6.233	0.996	92
23.097	66.152	66.200	0.038	10.155	10.685	0.529	2.469	6.276	1.013	93
23.344	66.725	66.650	-0.074	10.841	10.859	0.018	2.495	6.318	1.029	94
23.590	67.102	67.093	-0.004	10.993	11.035	0.041	2.521	6.361	1.046	95
23.837	67.561	67.543	-0.018	11.653	11.211	-0.442	2.548	6.403	1.063	96
24.083	68.040	67.987	-0.054	11.377	11.387	0.010	2.574	6.445	1.079	97
24.330	68.263	68.429	0.165	11.495	11.565	0.070	2.600	6.487	1.096	98

Table 7-8-WF3T(3). (continued)

24.576	68.926	68.866	-0.059	11.482	11.743	0.261	2.627	6.528	1.113	99
24.822	69.391	69.303	-0.088	12.166	11.922	-0.244	2.653	6.570	1.130	100
25.068	69.808	69.738	-0.070	11.937	12.101	0.164	2.679	6.611	1.147	101
25.315	70.307	70.170	-0.137	12.174	12.282	0.108	2.706	6.652	1.164	102
25.561	70.739	70.600	-0.137	12.895	12.463	-0.432	2.732	6.693	1.181	103
25.807	71.090	71.028	-0.062	12.852	12.645	-0.207	2.758	6.733	1.199	104
26.053	71.435	71.455	0.019	13.186	12.828	-0.358	2.784	6.774	1.216	105
26.299	71.907	71.879	-0.028	13.109	13.011	-0.098	2.811	6.814	1.233	106
26.545	72.331	72.301	-0.030	13.180	13.195	0.015	2.837	6.854	1.251	107
26.792	72.723	72.721	-0.001	13.171	13.380	0.209	2.863	6.894	1.268	108
27.038	73.093	73.139	0.047	13.331	13.566	0.235	2.890	6.933	1.286	109
27.284	73.502	73.556	0.053	13.661	13.753	0.092	2.916	6.973	1.304	110
27.530	73.920	73.970	0.050	13.796	13.940	0.144	2.942	7.012	1.321	111
27.775	74.440	74.382	-0.058	14.406	14.128	-0.278	2.969	7.051	1.339	112
28.021	74.793	74.793	-0.001	14.121	14.317	0.196	2.995	7.090	1.357	113
28.267	75.146	75.202	0.056	14.541	14.507	-0.034	3.021	7.129	1.375	114
28.513	75.735	75.608	-0.127	14.617	14.697	0.080	3.047	7.167	1.393	115
28.759	75.846	76.013	0.173	15.399	14.888	-0.510	3.074	7.206	1.411	116
29.005	76.427	76.417	-0.011	15.566	15.080	-0.486	3.100	7.244	1.430	117
29.250	76.460	76.818	0.358	15.990	15.273	-0.717	3.126	7.282	1.448	118
29.742	77.586	77.616	0.030	15.787	15.661	-0.125	3.179	7.358	1.485	120
29.987	77.877	78.012	0.135	15.988	15.856	-0.132	3.205	7.395	1.503	121
30.233	78.448	78.406	-0.042	16.095	16.052	-0.044	3.231	7.433	1.522	122
30.479	78.682	78.799	0.117	16.447	16.249	-0.199	3.257	7.470	1.540	123
30.724	79.103	79.130	0.027	16.212	16.446	0.233	3.284	7.507	1.559	124
30.969	79.520	79.579	0.059	16.914	16.644	-0.270	3.310	7.544	1.578	125
31.215	79.892	79.967	0.085	17.082	16.842	-0.239	3.336	7.581	1.597	126
31.460	80.398	80.353	-0.035	16.826	17.042	0.216	3.362	7.617	1.616	127
31.706	80.739	80.737	-0.002	17.168	17.242	0.074	3.389	7.654	1.635	128
31.951	80.979	81.120	0.141	18.308	17.444	-0.864	3.415	7.690	1.654	129
32.196	81.528	81.502	-0.026	17.576	17.645	0.069	3.441	7.726	1.673	130
32.442	81.781	81.881	0.100	17.510	17.849	0.338	3.467	7.762	1.692	131
32.687	82.202	82.259	0.057	18.247	19.051	-0.195	3.493	7.799	1.711	132
32.933	82.662	82.676	-0.025	17.734	19.255	0.521	3.520	7.834	1.731	133
33.423	83.328	83.385	0.057	19.542	18.666	-0.876	3.572	7.905	1.769	135
33.668	83.693	83.757	0.064	19.319	18.872	-0.447	3.598	7.940	1.789	136
33.913	84.128	84.127	-0.001	19.554	19.079	-0.475	3.624	7.975	1.809	137
34.158	84.776	84.496	-0.280	18.774	19.287	0.513	3.651	8.010	1.828	138
34.403	84.876	84.864	-0.012	19.606	19.495	-0.111	3.677	8.045	1.848	139
34.649	85.139	85.230	0.091	19.542	19.704	0.163	3.703	8.080	1.868	140
34.893	85.579	85.595	0.015	19.690	19.914	0.224	3.729	8.114	1.888	141
35.139	85.987	85.959	-0.028	19.677	20.125	0.448	3.755	8.149	1.908	142
35.383	86.308	86.320	0.012	20.452	20.336	-0.116	3.782	8.183	1.928	143
35.627	87.109	86.681	-0.428	20.478	20.548	0.070	3.808	8.217	1.948	144
35.872	87.105	87.040	-0.065	21.010	20.761	-0.249	3.834	8.251	1.968	145
36.117	87.362	87.398	0.035	20.807	20.974	0.167	3.860	8.285	1.988	146
36.362	87.691	87.754	0.073	21.406	21.198	-0.217	3.886	8.319	2.009	147
36.607	88.112	88.109	-0.003	21.532	21.403	-0.128	3.912	8.353	2.029	148
36.851	88.411	88.463	0.052	21.731	21.619	-0.113	3.939	8.386	2.049	149
37.096	88.846	88.816	-0.030	21.586	21.935	0.349	3.965	8.419	2.070	150
37.341	89.432	89.167	0.235	22.385	22.052	-0.334	3.991	8.453	2.090	151
37.585	89.589	89.517	-0.073	22.045	22.269	0.224	4.017	8.486	2.111	152
37.830	89.791	89.865	0.074	22.023	22.497	0.474	4.043	8.519	2.132	153
38.074	90.316	90.213	-0.103	[illegible]035	22.706	0.772	4.069	8.552	2.152	154
38.319	90.633	90.559	-0.074	22.886	23.026	0.140	4.095	8.585	2.173	155
38.563	91.041	90.904	-0.138	22.846	23.146	0.300	4.121	8.617	2.194	156
38.809	91.213	91.247	0.034	22.866	23.367	0.501	4.148	8.650	2.215	157

Table 7-9-WF3T(3)a. Triple point path below ideal surface—Shot 9.

SHOCK FRONT DATA DP#/9 ST WF3T 209.M03 TRIPLE POINT PATH, IDEAL SURFACE C.750205

AMBIENT TEMPERATURE = 57.5 F
AMBIENT PRESSURE = 13.49 PSI
RELATIVE HUMIDITY = 55.0 %
VAPOUR PRESSURE = 8.877 MM HG
AMBIENT SPEED OF SOUND = 1.1170 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5566
CHARGE HEIGHT= 15.21 FEET
SEPARATION #2= 15.11 FEET

RFIT=A+B*T+C*LOG(1+T)

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
9.685	42.539	42.675	0.137	10.598	10.095	-0.502	1.025	4.043	0.956	37
9.935	43.285	43.254	-0.031	10.150	10.480	0.330	1.051	4.097	0.993	38
10.188	43.734	43.828	0.044	10.776	10.858	0.083	1.078	4.152	1.030	39
10.439	44.466	44.398	-0.068	11.245	11.230	-0.015	1.105	4.206	1.064	40
10.690	45.084	44.963	-0.122	11.723	11.596	0.273	1.131	4.259	1.098	41
10.941	45.658	45.524	-0.134	12.031	11.956	-0.075	1.158	4.312	1.133	42
11.192	46.125	46.081	-0.044	11.809	12.310	0.411	1.184	4.366	1.164	43
11.443	46.597	46.634	0.046	12.929	12.659	-0.270	1.211	4.417	1.198	44
11.694	47.317	47.182	-0.135	12.936	13.002	0.066	1.237	4.469	1.232	45
11.945	47.715	47.727	0.012	13.184	13.339	0.155	1.264	4.521	1.264	46
12.196	48.170	48.268	0.099	13.885	13.672	-0.213	1.290	4.572	1.295	47
12.446	48.627	48.806	0.179	14.696	13.999	-0.697	1.317	4.623	1.326	48
12.697	49.095	49.340	0.245	14.742	14.321	-0.421	1.344	4.674	1.357	49
12.948	49.584	49.870	0.286	14.931	14.638	-0.292	1.370	4.724	1.387	50
13.199	50.756	50.397	-0.359	14.592	14.951	0.359	1.397	4.774	1.416	51
13.449	51.094	50.921	-0.174	14.742	15.259	0.517	1.423	4.824	1.445	52

Table 7-9-WF3T(3)b. Triple point path above smooth ground—Shot 9.

SHOCK FRONT DATA DBW/9 ST WF3T 209.M03 TRIPLE POINT PATH, SMOOTH SURFACE C.750205

AMBIENT TEMPERATURE = 57.5 F
AMBIENT PRESSURE = 13.49 PSI
RELATIVE HUMIDITY = 55.0 %
VAPOUR PRESSURE= 6.677 MM HG
AMBIENT SPEED OF SOUND = 1.1170 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5566
CHARGE HEIGHT= 15.21 FEET
SEPARATION #2= 15.11 FEET

RFIT=A+B*T+C*LOG(1+T)

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
9.685	42.193	42.185	0.003	8.672	8.552	-0.120	1.025	3.996	0.810	37
9.936	42.775	42.862	0.087	8.716	8.914	0.198	1.051	4.060	0.844	38
10.188	43.555	43.522	-0.033	9.311	9.270	-0.041	1.078	4.123	0.878	39
10.439	44.275	44.164	-0.111	9.322	9.621	0.299	1.105	4.184	0.911	40
10.690	44.863	44.791	-0.072	10.156	9.967	-0.189	1.131	4.243	0.944	41
10.941	45.426	45.402	-0.024	10.423	10.308	-0.115	1.158	4.301	0.976	42
11.192	45.838	45.997	0.159	10.912	10.644	-0.268	1.184	4.357	1.008	43
11.443	46.541	46.577	0.036	11.523	10.976	-0.548	1.211	4.412	1.040	44
11.945	47.729	47.693	-0.036	11.008	11.625	0.617	1.264	4.518	1.101	46
12.196	48.172	48.230	0.058	12.070	11.943	-0.127	1.290	4.569	1.131	47
12.446	48.752	48.753	0.001	12.001	12.257	0.255	1.317	4.618	1.161	48
12.697	49.352	49.263	-0.089	12.367	12.566	0.199	1.344	4.667	1.190	49
12.948	49.799	49.760	-0.039	12.669	12.872	0.203	1.370	4.714	1.219	50
13.199	50.186	50.244	0.058	13.793	13.173	-0.620	1.397	4.759	1.248	51

Table 7-10-WF3T(3)a. Triple point path below ideal surface—Shot 10.

SHOCK FRONT DATA DPW/10 ST WF3T 209.M03 TRIPLE POINT PATH, IDEAL SURFACE C.750205

AMBIENT TEMPERATURE = 21.3 F
AMBIENT PRESSURE = 13.69 PSI
RELATIVE HUMIDITY = 81.0 %
VAPOUR PRESSURE= 2.373 MM HG
AMBIENT SPEED OF SOUND = 1.0761 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5055
CHARGE HEIGHT= 14.92 FEET
SEPARATION +2= 15.22 FEET

RFIT=A+B*T+C*LOG(1+T)

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
11.498	45.821	45.700	-0.121	12.099	11.995	-0.104	1.178	4.360	1.142	44
11.751	46.009	46.085	0.076	12.581	12.485	-0.096	1.204	4.387	1.188	45
12.003	46.324	46.489	0.165	12.775	12.943	0.168	1.230	4.425	1.223	46
12.255	47.021	46.913	-0.108	12.846	13.369	0.523	1.255	4.455	1.273	47
12.509	47.390	47.355	-0.035	14.480	13.764	-0.716	1.281	4.508	1.310	48
12.761	47.662	47.816	0.154	13.936	14.130	0.194	1.307	4.561	1.345	49
13.014	48.265	48.294	0.029	14.212	14.465	0.253	1.333	4.597	1.377	50
13.267	48.950	48.790	-0.160	15.166	14.773	-0.393	1.359	4.644	1.409	51
13.519	49.570	49.303	-0.267	15.601	15.052	-0.549	1.385	4.693	1.433	52
13.772	49.576	49.833	0.257	14.811	15.303	0.492	1.411	4.744	1.457	53

Table 7-10-WF3T(3)b. Triple point path above rough ground—Shot 10.

SHOCK FRONT DATA DPW/10 ST WF3T 209.M03 TRIPLE POINT PATH, ROUGH SURFACE C.750205

AMBIENT TEMPERATURE = 21.3 F
AMBIENT PRESSURE = 13.69 PSI
RELATIVE HUMIDITY = 81.0 %
VAPOUR PRESSURE= 2.373 MM HG
AMBIENT SPEED OF SOUND = 1.0761 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5055
CHARGE HEIGHT= 14.92 FEET
SEPARATION #2= 15.22 FEET

RFIT=A+B*T+C*LOG(1+T)

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
10.992	43.832	43.901	0.069	6.106	6.201	0.095	1.126	4.179	0.590	42
11.245	44.592	44.536	-0.056	7.437	6.681	-0.756	1.152	4.239	0.636	43
11.498	45.042	45.151	0.108	6.953	7.156	0.203	1.178	4.298	0.681	44
11.751	45.857	45.745	-0.111	7.263	7.625	0.362	1.204	4.354	0.726	45
12.003	46.488	46.322	-0.166	8.110	8.089	-0.021	1.230	4.409	0.770	46
12.256	46.973	46.879	-0.094	7.682	8.548	0.867	1.255	4.462	0.814	47
12.509	47.319	47.418	0.098	9.121	9.002	-0.119	1.281	4.514	0.857	48
12.761	47.692	47.939	0.257	10.469	9.452	-1.017	1.307	4.563	0.900	49
13.014	48.398	48.442	0.044	10.034	9.896	-0.138	1.333	4.611	0.942	50
13.267	49.053	48.928	-0.125	11.220	10.336	-0.884	1.359	4.657	0.984	51
13.519	49.466	49.398	-0.069	11.080	10.772	-0.308	1.385	4.702	1.025	52
13.772	49.730	49.851	0.121	10.936	11.203	0.267	1.411	4.745	1.066	53
14.024	50.371	50.288	-0.083	11.015	11.630	0.615	1.437	4.787	1.107	54

Table 7-11-WF5(57). Triple point path below ideal surface—Shot 11.

SHOCK FRONT DATA DPW/11 ST WF5 267.M57 TRIPLE POINT PATH, IDEAL SURFACE C.750205

AMBIENT TEMPERATURE = -2.4 F
AMBIENT PRESSURE = 13.68 PSI
RELATIVE HUMIDITY = 60.0 %
VAPOUR PRESSURE= 0.600 MM HG
AMBIENT SPEED OF SOUND = 1.0488 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5070
CHARGE HEIGHT= 23.98 FEET
SEPARATION +2= 25.06 FEET

RFIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
12.199	40.792	41.035	0.243	2.967	2.959	-0.007	1.218	3.905	0.282	32
12.569	42.303	41.889	-0.414	3.055	3.224	0.170	1.255	3.987	0.307	33
12.939	42.629	42.733	0.104	3.688	3.487	-0.200	1.292	4.067	0.332	34
13.308	43.720	43.566	-0.154	4.329	3.749	-0.580	1.328	4.146	0.357	35
13.678	44.345	44.389	0.045	3.512	4.009	0.497	1.365	4.225	0.382	36
14.049	45.205	45.203	-0.002	4.347	4.268	-0.079	1.402	4.302	0.406	37
14.417	45.983	46.007	0.025	4.427	4.526	0.100	1.439	4.379	0.431	38
14.786	46.871	46.803	-0.068	4.867	4.784	-0.083	1.476	4.454	0.455	39
15.156	47.336	47.589	0.253	5.250	5.041	-0.210	1.513	4.529	0.480	40
15.525	48.009	48.367	0.358	5.614	5.297	-0.317	1.550	4.603	0.504	41
15.894	48.900	49.136	0.236	5.726	5.553	-0.173	1.587	4.677	0.529	42
16.263	50.022	49.897	-0.125	5.941	5.809	-0.131	1.623	4.749	0.553	43
16.632	50.767	50.650	-0.117	6.227	6.065	-0.163	1.660	4.821	0.577	44
17.001	51.541	51.396	-0.145	6.187	6.321	0.133	1.697	4.892	0.602	45
17.370	52.880	52.134	-0.747	5.914	6.577	0.662	1.734	4.962	0.626	46
17.738	52.808	52.864	0.056	6.613	6.832	0.220	1.771	5.031	0.650	47
18.107	53.655	53.587	-0.068	7.532	7.089	-0.443	1.808	5.100	0.675	48
18.475	54.216	54.304	0.088	7.309	7.345	0.036	1.844	5.168	0.699	49
18.844	55.025	55.013	-0.012	7.396	7.602	0.205	1.881	5.235	0.724	50
19.212	55.712	55.716	0.004	7.935	7.859	-0.076	1.918	5.303	0.748	51
19.581	56.508	56.412	-0.096	7.873	8.117	0.244	1.955	5.369	0.772	52
19.949	56.878	57.102	0.224	8.157	8.375	0.217	1.991	5.435	0.797	53
20.317	57.722	57.786	0.064	8.908	8.633	-0.275	2.028	5.500	0.822	54
20.685	58.289	58.468	0.174	9.214	8.892	-0.321	2.065	5.564	0.846	55
21.053	58.425	59.135	0.710	9.228	9.152	-0.075	2.102	5.628	0.871	56
21.421	59.856	59.801	-0.055	9.551	9.412	-0.139	2.139	5.691	0.896	57
21.789	60.251	60.461	0.210	9.388	9.673	0.285	2.175	5.754	0.921	58
22.157	61.177	61.116	-0.062	9.607	9.935	0.328	2.212	5.817	0.946	59
22.525	61.934	61.765	-0.119	10.507	10.197	-0.310	2.249	5.878	0.970	60
22.892	62.574	62.402	-0.165	9.781	10.460	0.679	2.285	5.940	0.996	61
23.260	62.955	63.047	0.093	11.274	10.723	-0.551	2.322	6.001	1.021	62
23.627	63.642	63.681	0.040	10.962	10.988	0.026	2.359	6.061	1.046	63
23.995	64.408	64.310	-0.099	11.400	11.253	-0.148	2.395	6.121	1.071	64
24.362	64.935	64.934	-0.002	11.827	11.518	-0.309	2.432	6.180	1.096	65
24.729	65.628	65.553	-0.076	11.983	11.785	-0.199	2.469	6.239	1.122	66
25.095	66.236	66.167	-0.069	12.166	12.052	-0.114	2.505	6.297	1.147	67
25.464	67.177	66.777	-0.400	12.682	12.320	-0.362	2.542	6.355	1.173	68
25.831	67.510	67.392	-0.129	12.892	12.589	-0.304	2.578	6.413	1.198	69
26.198	68.192	67.933	-0.179	13.028	12.858	-0.170	2.615	6.470	1.224	70
26.564	68.637	68.579	-0.107	12.922	13.128	0.207	2.652	6.527	1.249	71
27.298	69.733	69.760	0.027	13.460	13.671	0.211	2.725	6.639	1.301	73
27.665	70.560	70.344	-0.216	13.976	13.944	-0.032	2.762	6.696	1.327	74

Table 7-11-WF5(57). (continued)

28.031	71.047	70.924	-0.123	14.104	14.217	0.113	2.798	6.750	1.353	75
28.398	71.574	71.500	-0.073	14.880	14.491	-0.389	2.935	6.805	1.379	76
28.764	72.082	72.072	-0.009	14.627	14.766	0.139	2.871	6.859	1.405	77
29.131	72.268	72.641	0.373	14.696	15.042	0.346	2.909	6.914	1.432	78
29.497	73.684	73.206	-0.478	15.435	15.318	-0.117	2.944	6.967	1.458	79
29.863	73.920	73.767	-0.153	15.213	15.595	0.382	2.981	7.021	1.484	80
30.229	74.466	74.325	-0.141	15.584	15.873	0.289	3.018	7.074	1.511	81
30.596	75.047	74.879	-0.168	15.833	16.152	0.319	3.054	7.127	1.537	82
30.962	75.363	75.429	0.067	16.280	16.431	0.152	3.091	7.174	1.564	83
31.328	75.775	76.077	0.202	16.817	16.711	-0.106	3.127	7.231	1.590	84
31.694	76.444	76.521	0.077	16.904	16.992	0.088	3.164	7.283	1.617	85
32.059	76.937	77.061	0.124	17.041	17.274	0.233	3.200	7.334	1.644	86
32.425	77.348	77.599	0.251	17.508	17.555	0.048	3.237	7.385	1.671	87
32.791	77.961	78.133	0.172	17.729	17.839	0.111	3.273	7.435	1.698	88
33.157	78.300	78.664	0.363	18.756	18.123	-0.632	3.310	7.487	1.725	89
33.522	79.036	79.192	0.156	19.148	18.408	-0.740	3.346	7.537	1.752	90
33.888	79.800	79.717	0.917	19.590	18.693	-0.897	3.383	7.587	1.779	91
34.253	80.132	80.239	0.107	18.930	19.079	0.149	3.419	7.637	1.806	92
34.618	80.899	80.758	-0.141	19.408	19.266	-0.142	3.456	7.686	1.834	93
35.349	81.810	81.788	-0.022	20.083	19.842	-0.241	3.529	7.784	1.888	95
35.714	82.252	82.289	0.037	20.011	20.131	0.119	3.565	7.833	1.916	96
36.079	82.954	82.807	-0.147	19.780	20.420	0.640	3.602	7.881	1.943	97
36.444	83.230	83.312	0.092	21.022	20.711	-0.311	3.638	7.929	1.971	98
36.809	83.978	83.814	-0.164	20.403	21.001	0.599	3.674	7.977	1.998	99
37.539	85.109	84.812	-0.297	21.432	21.585	0.247	3.747	8.073	2.054	101
37.904	85.475	85.307	-0.169	21.649	21.878	0.229	3.784	8.119	2.082	102
38.269	86.158	85.799	-0.359	22.299	22.172	-0.127	3.820	8.166	2.110	103
38.633	86.176	86.289	0.113	22.582	22.466	-0.115	3.856	8.212	2.138	104
38.998	86.832	86.776	-0.056	22.073	22.761	0.689	3.893	8.259	2.166	105
39.362	87.257	87.261	0.005	23.433	23.057	-0.376	3.929	8.305	2.194	106

Table 7-11-WF3T(3). Triple point path above rough surface—Shot 11.

SHOCK FRONT DATA DPW/11 ST WF3T-209.M03 TRIPLE POINT PATH, ROUGH SURFACE C.750205

AMBIENT TEMPERATURE = -2.4 F
AMBIENT PRESSURE = 13.68 PSI
RELATIVE HUMIDITY = 60.0 %
VAPOUR PRESSURE= 0.600 MM HG
AMBIENT SPEED OF SOUND = 1.0488 FT/MSEC
CHARGE WEIGHT= 1080.0 LBS.
SACHS SCALING FACTOR = 10.5070
CHARGE HEIGHT= 23.98 FEET
SEPARATION +2= 25.06 FEET

FIT=A+B*T+C*LOG(1+T)+D*SQRT(LOG(1+T))

TIME MSEC	RADIUS OBS-FT	RADIUS FIT-FT	DIFFERENCE FT	HEIGHT OBS-FT	HEIGHT FIT-FT	DIFFERENCE FT	TIME SCAL-FT	RADIUS SCAL-FT	HEIGHT SCAL-FT	FRAME NO.
15.310	47.384	47.708	0.324	2.392	2.951	0.559	1.528	4.541	0.281	58
15.567	48.650	48.204	-0.446	4.072	3.024	-1.048	1.554	4.588	0.298	59
15.825	48.331	48.700	0.349	3.042	3.101	0.059	1.580	4.635	0.295	60
16.082	49.312	49.195	-0.118	4.097	3.184	-0.914	1.605	4.682	0.303	61
16.339	49.776	49.689	-0.087	3.657	3.271	-0.387	1.631	4.729	0.311	62
16.596	50.229	50.182	-0.047	3.460	3.362	-0.098	1.657	4.776	0.320	63
16.853	50.634	50.674	0.040	4.058	3.457	-0.601	1.682	4.823	0.329	64
17.366	51.896	51.655	-0.241	3.320	3.658	0.338	1.734	4.916	0.348	66
17.623	51.911	52.143	0.232	3.457	3.764	0.307	1.759	4.953	0.358	67
17.880	52.470	52.630	0.161	3.287	3.872	0.586	1.785	5.009	0.369	68
18.137	53.365	53.116	-0.250	3.778	3.984	0.207	1.810	5.055	0.379	69
18.394	53.636	53.601	-0.035	4.594	4.099	-0.495	1.836	5.101	0.390	70
18.650	54.483	54.084	-0.399	4.911	4.216	-0.695	1.862	5.147	0.401	71
18.907	54.736	54.565	0.180	4.308	4.335	0.028	1.887	5.193	0.413	72
19.164	55.149	55.045	-0.104	4.580	4.457	-0.122	1.913	5.239	0.424	73
19.420	55.471	55.524	0.053	3.899	4.581	0.683	1.939	5.294	0.436	74
19.677	55.920	56.000	0.080	4.335	4.707	0.373	1.964	5.330	0.448	75
19.933	56.696	56.475	-0.220	4.983	4.835	-0.148	1.990	5.375	0.460	76
20.190	56.625	56.949	0.324	5.558	4.965	-0.593	2.015	5.420	0.473	77
20.446	57.136	57.421	0.284	4.715	5.096	0.381	2.041	5.465	0.485	78
20.702	57.579	57.891	0.313	5.170	5.229	0.059	2.067	5.510	0.498	79
20.959	58.495	58.359	-0.136	5.994	5.364	-0.631	2.092	5.554	0.510	80
21.215	59.315	58.825	-0.490	5.797	5.499	-0.298	2.118	5.599	0.523	81
21.471	59.481	59.290	-0.191	5.944	5.636	-0.308	2.143	5.643	0.536	82
21.727	59.380	59.753	0.373	6.220	5.774	-0.446	2.169	5.687	0.550	83
21.984	60.353	60.214	-0.139	6.501	5.913	-0.588	2.194	5.731	0.563	84
22.752	61.354	61.586	0.232	5.624	6.336	0.712	2.271	5.851	0.603	87
23.264	62.210	62.492	0.281	6.274	6.622	0.347	2.322	5.948	0.630	89
23.520	62.998	62.942	-0.057	7.062	6.765	-0.296	2.348	5.990	0.644	90
23.776	63.250	63.390	0.140	6.588	6.910	0.322	2.373	6.033	0.658	91
24.032	64.124	63.836	-0.288	6.975	7.055	0.080	2.399	6.076	0.671	92
24.288	64.333	64.280	-0.053	7.513	7.200	-0.313	2.424	6.118	0.685	93
24.543	64.919	64.723	-0.196	7.634	7.346	-0.288	2.450	6.160	0.699	94
24.799	65.170	65.163	-0.006	7.991	7.492	-0.499	2.476	6.202	0.713	95
25.055	65.292	65.602	0.310	8.307	7.638	-0.669	2.501	6.244	0.727	96
25.311	66.193	66.039	-0.154	7.650	7.785	0.135	2.527	6.285	0.741	97
25.566	66.812	66.474	-0.338	7.169	7.932	0.763	2.552	6.327	0.755	98
25.822	66.838	66.907	0.069	8.239	8.079	-0.160	2.578	6.368	0.769	99
26.077	66.989	67.338	0.350	8.546	8.226	-0.320	2.603	6.409	0.783	100
26.333	68.132	67.768	-0.364	8.621	8.373	-0.248	2.629	6.450	0.797	101
26.588	68.206	68.195	-0.011	9.019	8.520	-0.499	2.654	6.490	0.811	102
26.844	68.405	68.621	0.215	8.950	8.668	-0.283	2.680	6.531	0.825	103

Table 7-11-WF3T(3). (continued)

27.099	69.398	69.044	-0.343	8.977	8.815	-0.162	2.705	6.571	0.839	104
27.355	69.369	69.465	0.097	8.711	8.962	0.251	2.731	6.611	0.853	105
27.610	69.813	69.887	0.073	8.709	9.109	0.400	2.756	6.651	0.867	106
27.865	70.231	70.305	0.074	8.252	9.256	1.004	2.782	6.691	0.881	107
28.120	70.331	70.721	0.391	9.213	9.403	0.190	2.807	6.731	0.895	108
28.375	70.944	71.135	0.192	8.917	9.550	0.633	2.833	6.770	0.909	109
28.631	71.498	71.549	0.051	10.303	9.696	-0.607	2.858	6.810	0.923	110
28.886	72.276	72.369	0.093	9.820	9.988	0.169	2.909	6.888	0.951	112
29.141	73.000	72.776	-0.223	10.148	10.134	-0.014	2.934	6.926	0.964	113
29.396	73.194	73.182	-0.012	11.007	10.279	-0.728	2.960	6.965	0.978	114
29.651	73.610	73.586	-0.024	10.863	10.425	-0.438	2.985	7.003	0.992	115
29.905	73.905	73.988	0.083	11.002	10.570	-0.432	3.011	7.042	1.006	116
30.161	74.338	74.388	0.050	11.240	10.714	-0.526	3.036	7.080	1.020	117
30.415	74.687	74.787	0.100	11.240	10.858	-0.382	3.062	7.119	1.033	118
30.671	75.214	75.184	-0.031	11.045	11.002	-0.043	3.087	7.156	1.047	119
30.926	75.505	75.579	0.074	11.549	11.145	-0.402	3.113	7.193	1.061	120
31.181	76.409	75.972	-0.436	11.470	11.288	-0.182	3.138	7.231	1.074	121
31.435	76.877	76.364	-0.513	10.727	11.431	0.703	3.163	7.268	1.088	122
31.690	77.150	76.754	-0.396	11.651	11.573	-0.078	3.189	7.305	1.101	123
31.945	77.163	77.142	-0.021	11.763	11.715	-0.049	3.214	7.342	1.115	124
32.199	77.705	77.529	-0.177	11.601	11.856	0.255	3.240	7.379	1.128	125
32.454	78.000	77.913	-0.087	11.418	11.997	0.579	3.265	7.415	1.142	126
32.709	78.250	78.287	0.037	11.538	12.137	0.599	3.291	7.452	1.155	127
32.963	78.943	78.678	-0.265	11.746	12.277	0.531	3.316	7.488	1.168	128
33.218	78.891	79.059	0.177	12.472	12.416	-0.056	3.341	7.524	1.182	129
33.472	78.571	79.437	0.865	12.483	12.555	0.072	3.367	7.560	1.195	130
33.727	79.555	79.813	0.258	12.300	12.693	0.393	3.392	7.596	1.208	131
33.981	80.361	80.188	-0.173	12.267	12.831	0.564	3.417	7.632	1.221	132
34.235	80.662	80.562	-0.100	13.598	12.968	-0.630	3.443	7.667	1.234	133
34.490	80.966	80.933	-0.033	13.619	13.105	-0.514	3.468	7.703	1.247	134
34.744	81.175	81.304	0.129	14.442	13.241	-1.202	3.494	7.738	1.260	135

DISTRIBUTION LIST

DEPARTMENT OF DEFENSE

Director
Defense Advanced Research Projects Agency
ATTN: Strategic Tech. Office

Defense Communication Engineer Center
ATTN: Code R-1035, John Worthington

Director
Defense Communications
ATTN: NMCSSC, Code 510

Defense Documentation Center
12 cy ATTN: TC

Director
Defense Intelligence Agency
ATTN: DT-1C, Nuc. Eng. Br.
ATTN: DT-2, Wpns. & Sys. Div.
ATTN: DI-7D

Director
Defense Nuclear Agency
ATTN: DDST
ATTN: STSI, Archives
ATTN: STSP
2 cy ATTN: STTL, Tech. Lib.
3 cy ATTN: SPAS

Director of Defense Research & Engineering
ATTN: AD/DS
ATTN: AD/OS
ATTN: DD/S&SS

Commander
Field Command
Defense Nuclear Agency
ATTN: FCPR
ATTN: FCTMD

Director
Joint Strategic Target Planning Staff, JCS
ATTN: JPTP
ATTN: JLTW-2

Chief
Livermore Division, Field Command, DNA
Lawrence Livermore Laboratory
ATTN: FCPRL

OJCS/J-5
ATTN: J-5, Plans & Policy, R & D Div.

Weapons Systems Evaluation Group
ATTN: Doc. Con.

DEPARTMENT OF THE ARMY

Assistant Chief of Staff for Ops. & Plans
ATTN: Dir. of Chem. & Nuc. Ops.

Commander
Ballistic Defense System Command
ATTN: BDMSC-TEN, Noah J. Hurst

DEPARTMENT OF THE ARMY (Continued)

Manager
Ballistic Missile Defense Program Office
ATTN: DACS-BMT, Clifford E. McLain
ATTN: John Shea
ATTN: DACS-BMS, Julian Davidson
ATTN: DACS-BMZ

Chief of Research, Development & Acquisition
ATTN: NCB Division

Commander
Harry Diamond Laboratories
ATTN: AMXDO-RBH, James H. Gwaltney
ATTN: AMXDO-NP
ATTN: AMXDO-RC, Robert B. Oswald, Jr.

Commander
Picatinny Arsenal
ATTN: SARPA-FR-E, Louis Avrami
ATTN: SMUPA-MD, Henry Opat
ATTN: SARPA-ND-C-T, Donald Miller

Commander
TRASANA
ATTN: R. E. DeKinder, Jr.

Director
U.S. Army Ballistic Research Laboratories
ATTN: AMXBR-TB, J. T. Frasier
ATTN: Val Kucher
ATTN: AMXRD-BVL, William J. Schuman, Jr.
ATTN: Robert E. Eichelberger

Commander
U.S. Army Mat. & Mechanics Research Center
ATTN: AMXMR-HH, John F. Dignam

Commander
U.S. Army Materiel Command
ATTN: AMCRD-WN-RE, John F. Corrigan

Commander
U.S. Army Missile Command
ATTN: AMCPM-PE-EA, Wallace O. Wagner
ATTN: AMS-RKP, W. B. Thomas
ATTN: AMSMI-RRR, Bud Gibson
ATTN: AMSMI-XS, Chief Scientist

Commander
U.S. Army Nuclear Agency
ATTN: ATCA-NAW

DEPARTMENT OF THE NAVY

Chief of Naval Material
ATTN: MAT 0323, Irving Jaffe

Chief of Naval Operations
ATTN: OP-985
ATTN: OP-985D
ATTN: OP-62

Chief of Naval Research
ATTN: Code 464, Thomas P. Quinn

DEPARTMENT OF THE NAVY (Continued)

Director
Naval Research Laboratory
ATTN: Gerald Cooperstein
ATTN: Code 2027, Tech. Lib.
ATTN: Code 5180, Mario A. Persechino

Commander
Naval Sea Systems Command
ATTN: 0333A, Marlin A. Kinna

Commander
Naval Surface Weapons Center
ATTN: Code 2302, Leo F. Gower
ATTN: Code WA-501, Navy Nuc. Prgms. Off.
ATTN: Code 323, W. Carson Lyons

Director
Strategic Systems Project Office
ATTN: NSP-272, CDR Leslie Stoessl

DEPARTMENT OF THE AIR FORCE

AF Cambridge Research Laboratories, AFSC
ATTN: LCS, R. E. Wilton

AF Materials Laboratory, AFSC
ATTN: T. Nicholas
ATTN: MBC, Donald L. Schmidt
ATTN: MAS

AF Rocket Propulsion Laboratory, AFSC
ATTN: RTSN, G. A. Beale

Commander
AF Special Weapons Center, AFSC
ATTN: HO, Dr. Minge

AF Weapons Laboratory, AFSC
ATTN: DYS, Lt E. J. Burns
ATTN: DYV
ATTN: SUL

Commander
Foreign Technology Division, AFSC
ATTN: TDFBD, J. D. Pumphrey
ATTN: TDPTN

HQ USAF/RD
ATTN: RDQ
ATTN: RDQPN
ATTN: RDPM
ATTN: RDQSM
ATTN: RD

SAMSO/DY
ATTN: DYS

SAMSO/MN
ATTN: MNNR

SAMSO/RS
ATTN: RSS
ATTN: RSSE

Commander in Chief
Strategic Air Command
ATTN: DOXT
ATTN: XPFS

ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

Division of Military Application
ATTN: Doc. Con. for CDR Richard E. Peterson
ATTN: Doc. Con. for Res. & Dev. Br.
ATTN: Doc. Con. for
Lieutenant Colonel Donald L. McNutt

University of California
Lawrence Livermore Laboratory
ATTN: W. Isbell, L-504
ATTN: C. Joseph Taylor
ATTN: Joseph E. Keller, Jr.
ATTN: J. Coruthers, L-18
ATTN: R. N. Keeler, L-504
ATTN: R. Wagner, L-31

Los Alamos Scientific Laboratory
ATTN: Doc. Con. for R. S. Thurston
ATTN: Doc. Con. for J. W. Taylor
ATTN: Doc. Con. for John McQueen

Sandia Laboratories
Livermore Laboratory
ATTN: Doc. Con. for C. S. Hoyle
ATTN: Raymond Ng
ATTN: Doc. Con. for T. Gold
ATTN: Doc. Con. for 8131, H. F. Norris, Jr.

Sandia Laboratories
ATTN: Doc. Con. for D. McCloskey
ATTN: Doc. Con. for R. R. Boade
ATTN: Doc. Con. for Albert Chabai
ATTN: Doc. Con. for B. M. Butcher

DEPARTMENT OF DEFENSE CONTRACTORS

Aeronautical Research Assoc. of Princeton, Inc.
ATTN: Coleman Donaldson

Aeronutronic Ford Corporation
Aerospace & Communications Ops.
ATTN: P. Spangler

Aerospace Corporation
ATTN: R. Allen
ATTN: Richard Crolius, A-2, Rm. 1027
ATTN: W. Barry

Avco Research & Systems Group
ATTN: John E. Stevens, E-500
ATTN: John Gilmore, E-502

Battelle Memorial Institute
ATTN: Merwyn R. Vanderlind
ATTN: W. Pfeifer

The Boeing Company
ATTN: Brian Lempriere

Brown Engineering Company, Inc.
ATTN: Ronald Patrick

Effects Technology, Inc.
ATTN: Robert Wengler

General Electric Company
TEMPO-Center for Advanced Studies
ATTN: DASIAC

DEPARTMENT OF DEFENSE CONTRACTORS (Continued)

General Electric Company
Space Division
ATTN: Phillip Cline
ATTN: Carl Anderson
ATTN: G. Harrison

General Research Corporation
ATTN: Robert E. Rosenthal

Institute for Defense Analyses
ATTN: Joel Bengston
ATTN: IDA, Librarian, Ruth S. Smith

Ion Physics Corporation
ATTN: Robert D. Evans

Kaman Avidyne
Division of Kaman Sciences Corporation
ATTN: Norman P. Hobbs

Kaman Sciences Corporation
ATTN: Jerry L. Harper
ATTN: John R. Hoffman
ATTN: Albert P. Bridges
ATTN: Frank H. Shelton
ATTN: Donald C. Sachs
ATTN: Thomas Meagher

Lockheed Missiles & Space Co. Inc.
ATTN: Lawrence F. Hearne, Dept. 81-14
ATTN: R. Roberson

Lockheed Missiles & Space Co.
ATTN: A. P. Hardt
ATTN: Lloyd F. Chase
ATTN: Raymond R. Capiaux
ATTN: F. G. Borgardt

Martin Marietta Aerospace
Orlando Division
ATTN: Laird Kinnaird

McDonnell Douglas Corporation
ATTN: J. F. Garibotti
ATTN: J. Kirby
ATTN: R. J. Reck
ATTN: L. Cohen

National Academy of Sciences
ATTN: National Materials Advisory Board for
Donald G. Groves

Northrop Corporation
ATTN: Don Hicks

Physics International Company
ATTN: Doc. Con. for James Shea

Prototype Development Associates, Inc.
ATTN: John Slaughter

R & D Associates
ATTN: F. A. Field
ATTN: Harold L. Brode
ATTN: Albert L. Latter
ATTN: Jerry Carpenter

DEPARTMENT OF DEFENSE CONTRACTORS (Continued)

Science Applications, Inc.
ATTN: William M. Layson

Science Applications, Inc.
ATTN: G. Ray
ATTN: R. Fisher

Science Applications, Inc.
ATTN: J. Courtney

Southern Research Institute
ATTN: C. D. Pears

Stanford Research Institute
ATTN: George R. Abrahamson
ATTN: Herbert E. Lindberg
ATTN: Donald Curran

Stanford Research Institute
ATTN: Harold Carey

Systems, Science & Software, Inc.
ATTN: G. A. Gurtman
ATTN: Russell E. Duff

Tetra Tech, Inc.
ATTN: Sidney Green

TRW Systems Group
San Bernardino Operations
ATTN: Earl W. Allen
ATTN: L. Berger

University of Victoria
ATTN: J. M. Dewey
ATTN: D. F. Classen
ATTN: D. J. McMillin