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TEST REPORT OF DROP TEST 53-4R

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Bert P. Neumon, 1217

December 1959

Approved by S. A. Moore
S. A. Moore, 1210

ABSTRACT

This report presents a description and the results of the second high-altitude ballistic retarded test of the TX-53 Drop Test Program.

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TEST REPORT OF DROP TEST 53-4R

Introduction

The TX-53 is a Class C weapon incorporating three different delivery profiles: high-altitude free fall, high-altitude retarded, and low-level laydown. Ballistic drop tests are being conducted to prove out and evaluate the electrical system, the retardation system, and the laydown shock mitigation system.

This report contains a description of the second high-altitude ballistic retarded test.

Test Objectives

The 53-4R test unit (see Figure 1) was parachute retarded and was to provide data regarding:

1. The aerodynamic stability of the vehicle, before and after parachute deployment.

2. The best location on the skin of the vehicle for baroswitch sensing ports (the third in a series of pressure surveys).

3. The retarding parachute system (for defects in construction or in deployment sequence).

4. Trajectory information for use in bombing table.

Test Description

Test Conditions

The 53-4R unit was dropped at Tonopah Test Range on August 29, 1959, from a B-52, No. 620. The release speed was 465 knots ground speed, and the release altitude was 38,000 feet above terrain.

Test Vehicle Description

Electrical System -- The operation of the automatic parachute deployment system was scheduled for 1.5 seconds after release. In order to accomplish this desired action, the following components were used in the electrical system:

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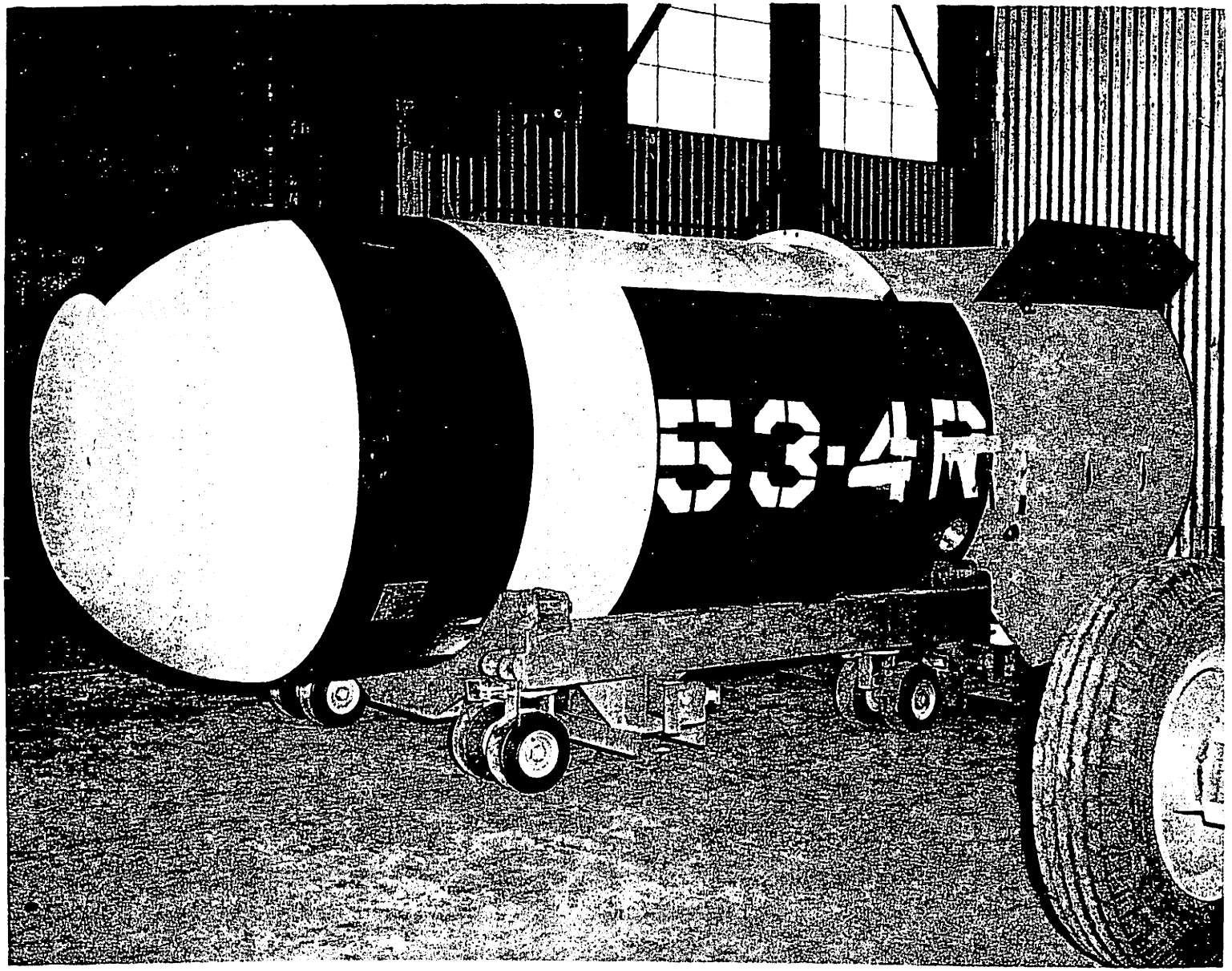

Figure 1. 53-4R Test Unit

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1 - MC-543 timer, Serial No. GP-12547-I8 (modified for 1.5-second closure)

1 - 28-volt battery (Ni-Cad)

1 - Interconnecting box with associated cabling.

Figure 2 is a drawing of the electrical system. No contact detonation switch was used in this test; therefore, no simulated X-unit or high-voltage source was included.

Mechanical System -- The test vehicle was composed essentially of three major pieces of hardware: the nose section, the main weapon case (cylinder), and the afterbody. These sections are shown in Figures 3, 4, and 5.

The nose section (Figure 3) is a combination hemisphere, having a radius of 25 inches and a 30-inch diameter "flat" at Station 0. This shape was derived from preliminary wind tunnel data, and it is defined by SK(1217)2997-8, Issue C.

The main weapon case (Figure 4) was a converted TX-46 ballistic cylinder. This modified cylinder helped to establish the over-all size, weight, and CG of the TX-53. The modified cylinders were used because they were already available and because, being surplus from the TX-46, they were more economical to use in the ballistic free fall and retarded test vehicles. This case is described by SK(1217)2979-8, Issue C.

The afterbody (Figure 5) housed the 12-foot retarding parachute and served as a mounting structure for the four wedge fins (see Figure 1). Automatic deployment hardware was installed in this afterbody. The afterbody is defined by SK9(1217)9415. The fins are described by SK9(1217)3824.

Parachute System (See Figure 6) -- A 12-foot ribbon parachute was furnished by WADC for this vehicle. The eight 6000-pound suspension lines were 40 feet long and had two octopus keepers (the keepers were 12 feet from the skirt and 8 feet from the tie loops).

The pilot chute was 4 feet in diameter, guide surface canopy type, with suspension lines 7 feet long and 3000 pounds strength. This parachute was automatically deployed.

Telemetry System -- The telemetry system was set up to record roll, pitch, yaw, parachute produced accelerations, and aerodynamic pressure along the outer skin of the cylinder and afterbody.

Pressure ports were located at Stations: 92, 100, 104, 107, 113, 125, 135, and 140. Each of the baro hoses at Stations 92, 100, and 104 was 30 inches from port to T, with a 24-inch lead. Each of the baro hoses at Stations 107 and 113 was 40 inches from port to T, with a 24-inch lead. Each of the baro hoses at stations 125 and 135 was 40 inches from port to T, with a 50-inch lead.

All baro ports were rotated 4 degrees 40 minutes counterclockwise from the horizontal center line (viewed from the rear of the cylinder).

Two ejectable Pluto cameras were located on the cylinder at Station 104. Both cameras were rotated 15 degrees CCW from the horizontal center line, 180 degrees apart, to view the parachute performance (the cameras were intended to be ejected 60 seconds after release).

Three kick rockets (7000 pounds thrust each) were inserted in the nose. These rockets were to fire 10, 25, and 40 seconds after release, and the resulting deviations in flight were to be used to check the flight stability of the weapon.

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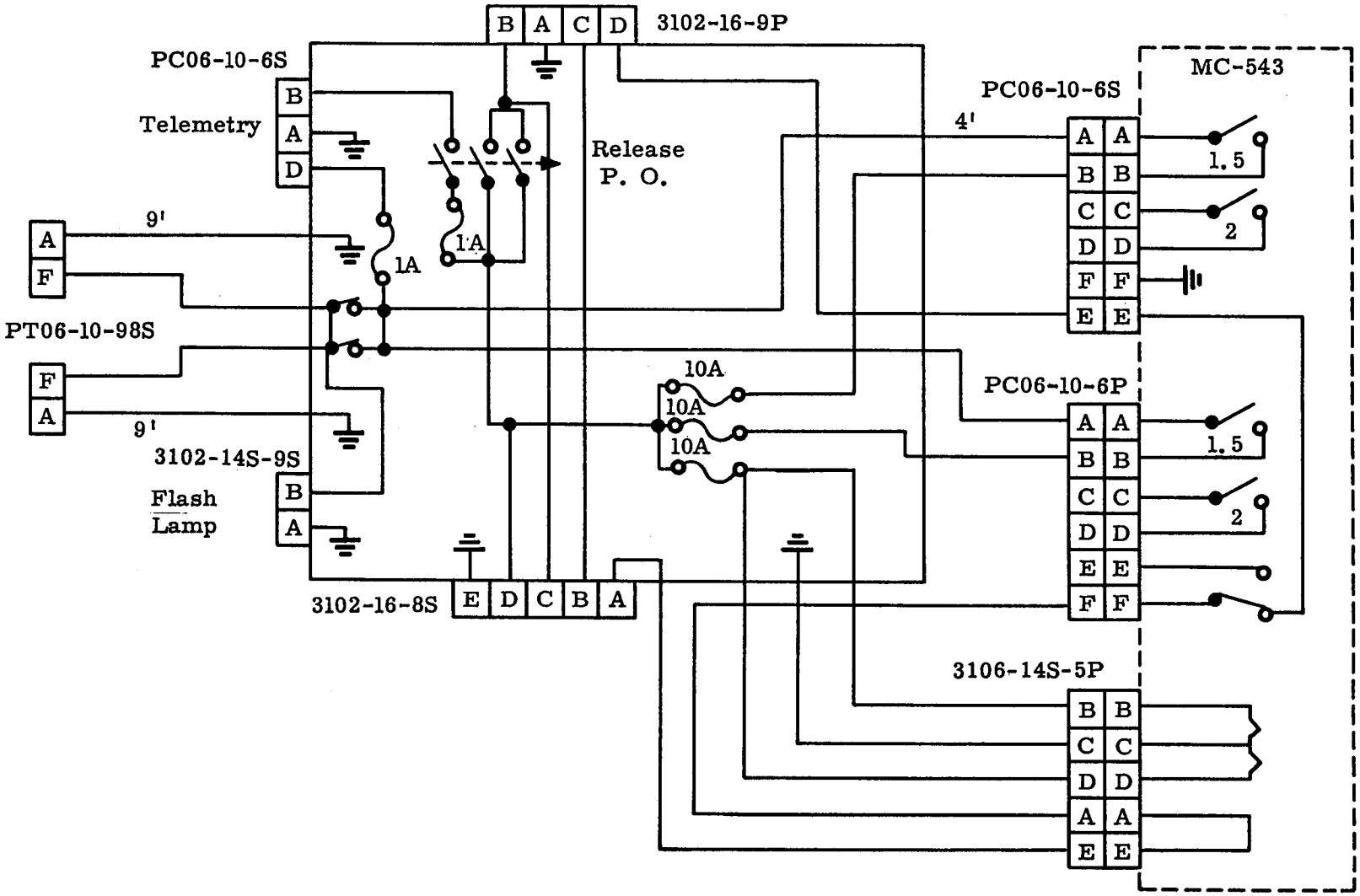

PLATE DEPLOYMENT SYSTEM BPN 1217

Figure 2. 53-4R Electrical System

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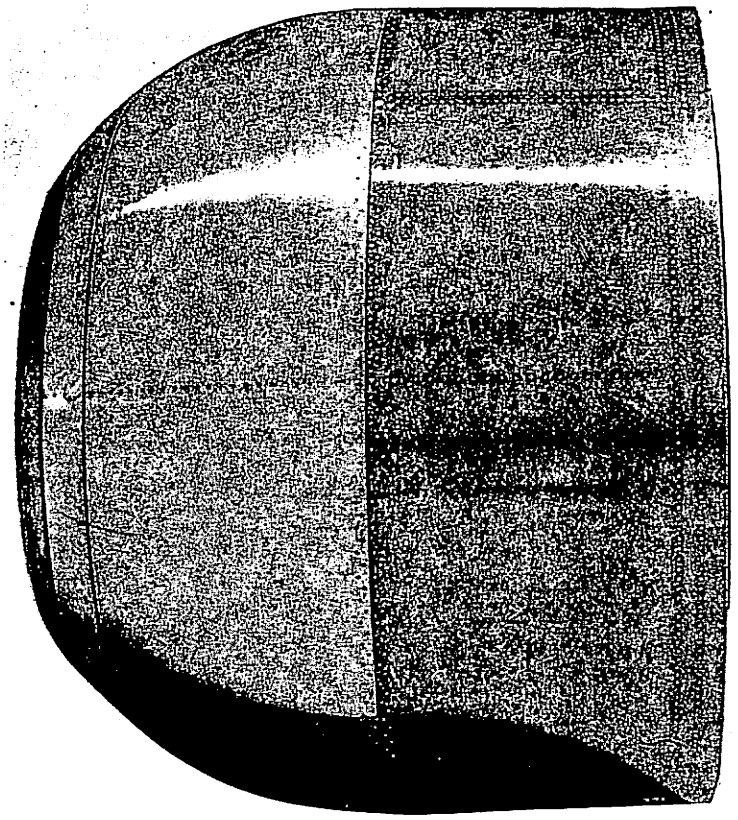

Figure 3. 53-4R Test Vehicle Nose Section

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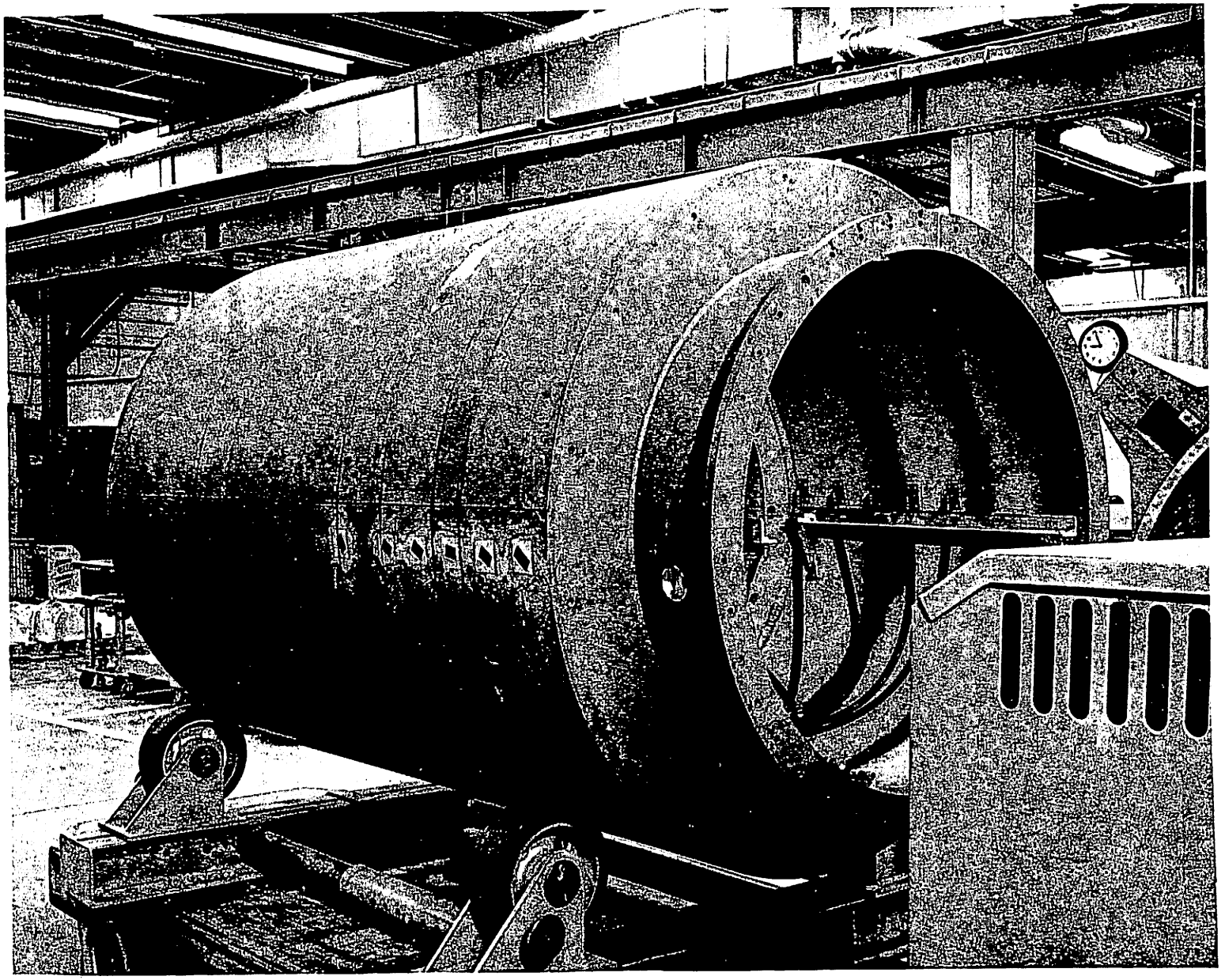

Figure 4. 53-4R Test Vehicle Main Weapon Case

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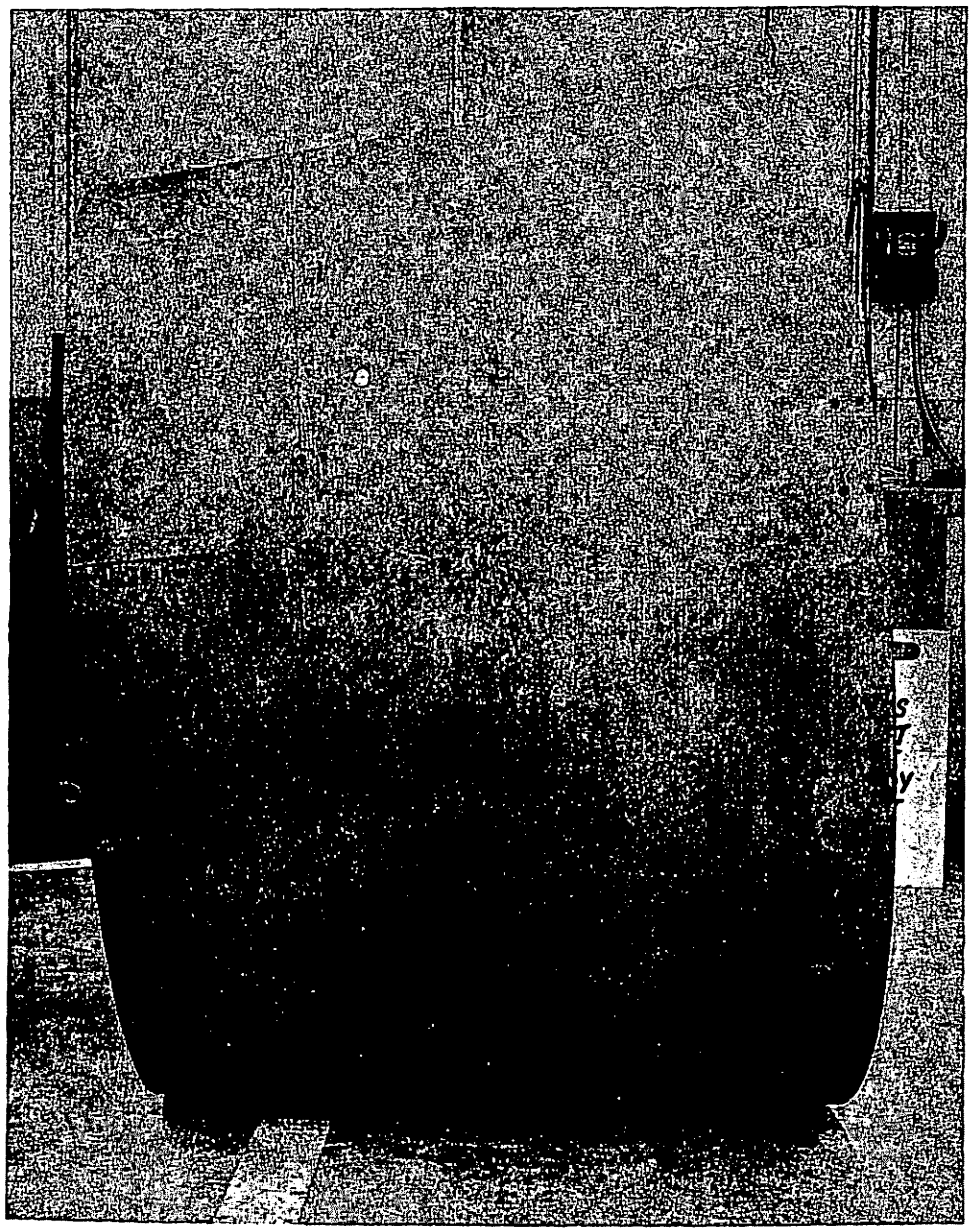

Figure 5. 53-4R Test Vehicle Afterbody

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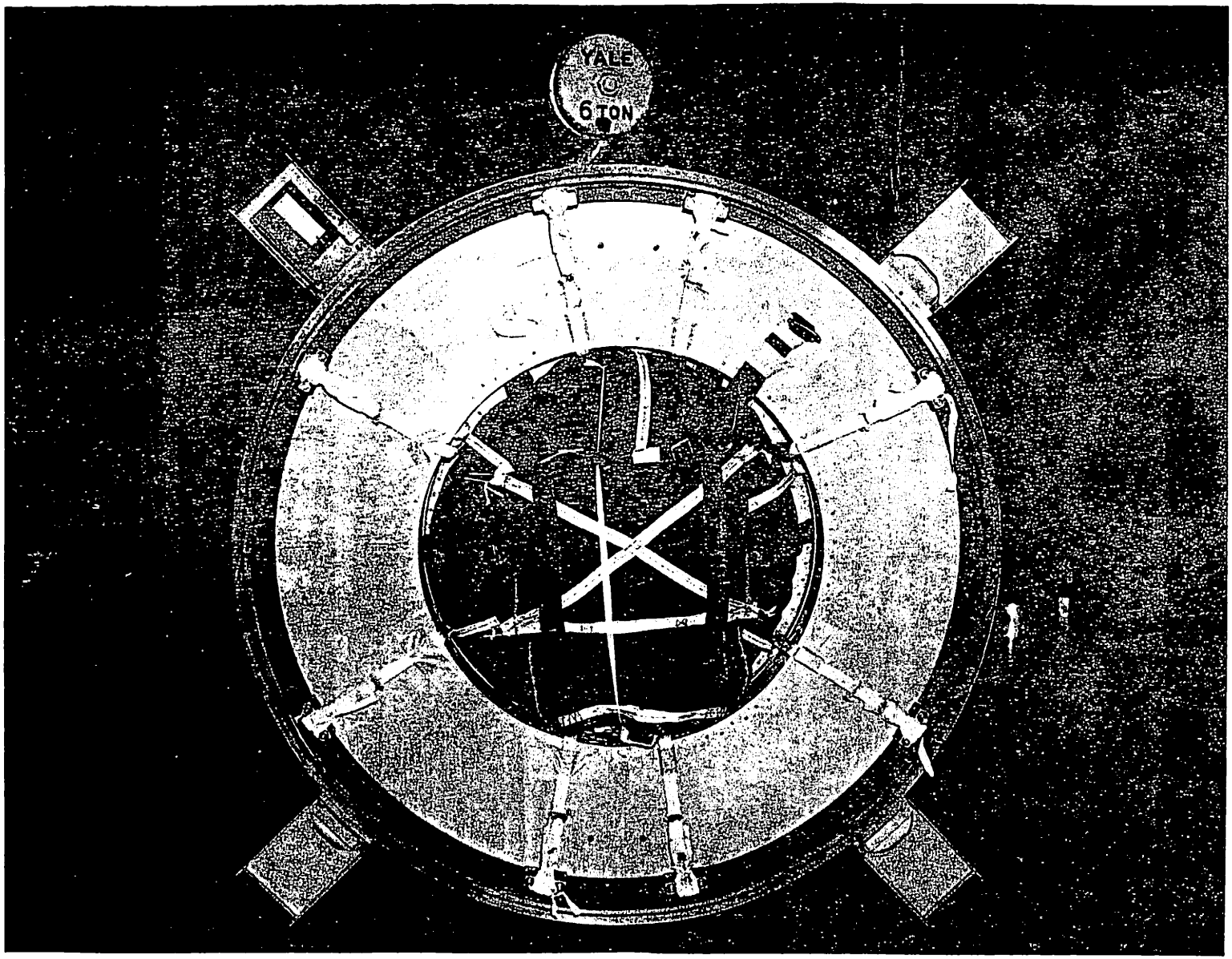

Figure 6. 53-4R Parachute Assembly

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Miscellaneous Information

The test vehicle configuration compared with the WR configuration as follows:

	Test vehicle configuration	WR configuration
Weight	8412 pounds	8350 pounds
Center of gravity	87.24 inches	76.84 inches
MI yaw	3483.0 slug/ft^2	2144 slug/ft^2
Over-all length	146.5 inches	146.4 inches

Supplementary description:

1. The spoiler band was 2 inches high at Station 95.

2. The afterbody was tapered.

3. Stationary-type fins (34-1/2 inches long, 14 inches high, and tapered to 9 inches aft) were used.

Summary of Test Results

Telemetry System Performance

The two telemetry packages utilized vacuum tubes; no transistors were used. The telemetry package produced a clean useful record throughout the drop. 53-4R performed satisfactorily.

The following information was telemetered:

A Package (226.7 mc)

Subcarrier frequency (kc)	
7.35	Pressure 10-790 mm Hg Sta. 107
10.5	Pressure 10-790 mm Hg Sta. 113
14.5	Pressure 10-790 mm Hg Sta. 125
22.0	Pressure 10-790 mm Hg Sta. 135
30.0	Acceleration vertical ± 5 g
40.0	Acceleration horizontal ± 3 g
52.5	Acceleration longitudinal 0-5 g
70.0	Vibration ± 2 g longitudinal

B Package (232.7 mc)

Subcarrier frequency (kc)	
7.35	Roll gyro $\pm 60^\circ$/sec
10.5	Pitch gyro $\pm 400^\circ$/sec
14.5	Yaw gyro $\pm 200^\circ$/sec
22.0	Pressure 10-790 mm Hg Sta. 92
30.0	Pressure 10-790 mm Hg Sta. 100
40.0	Pressure 10-790 mm Hg Sta. 104
52.5	Acceleration longitudinal 10-5 g
70.0	Vibration (radius of unit) ± 2 g

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The two Pluto cameras (200 fps) installed in the unit ejected 60 seconds after release, but only one camera was recovered.

The three kick rockets (700-pound thrust) mounted in the nose fired at the programmed times of 10, 25, and 40 seconds.

Electrical and Parachute System Performance

The telemetry indicated that the fire signal for deployment (primer cord) came at the proper time (1.5 seconds after release). However, the tail plate blew free of the unit without deploying the parachute.

Ballistic Performance

The unit began to roll in a counterclockwise direction approximately 1 second after release, and 17 seconds later the rate of roll was greater than 81 degrees per second. The roll gyro reached its maximum recording level at 13 seconds and remained in this position until impact.

The pitch and yaw planes remained fairly stable until approximately 20 seconds after release. Then the unit began to oscillate in the yaw and pitch planes at the rate of approximately 1.1 cps. The oscillatory motion in the pitch plane was out of phase with the yaw motion by 90 degrees. This means that the nose of the unit had a helical motion in a counterclockwise direction as the unit descended. This motion continued until impact.

Release and Impact Data

Release Data

Airplane type - B-52 #620

Altitude - 44848 (msl)

Attitude - level

True airspeed - 447 (kts)

Ground speed, Askania - 437.3 (kts)

Vertical velocity, Askania - -1.0 (fps)

Wind at release altitude (Rawidar)
- Velocity - 65 (kts)
- Direction - 262 (deg)

Impact Data

Time of fall
- Askania - 58.323 (sec)
- Telemetered - 58.319 (sec)

Range - 30160 (ft)
- Impact altitude (msl) - 5340 (ft)
- Impact velocity and angle (Askania)
- Velocity - 1014 (fps)
- Angle - 76°

Bombing error
- Circular error - 15,387 (ft)
- Range component - over 15,167 (ft)
- Deflection - left 2588 (ft)
- Based on true course of - 347°10'

For views after impact see Figures 7 and 8.

Pressure Data

The recorded pressure data taken from each individual pressure-sensing port appears in Figures 9 through 15.

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Figure 7. 53-4R After Impact

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Figure 8. 53-4R After Impact

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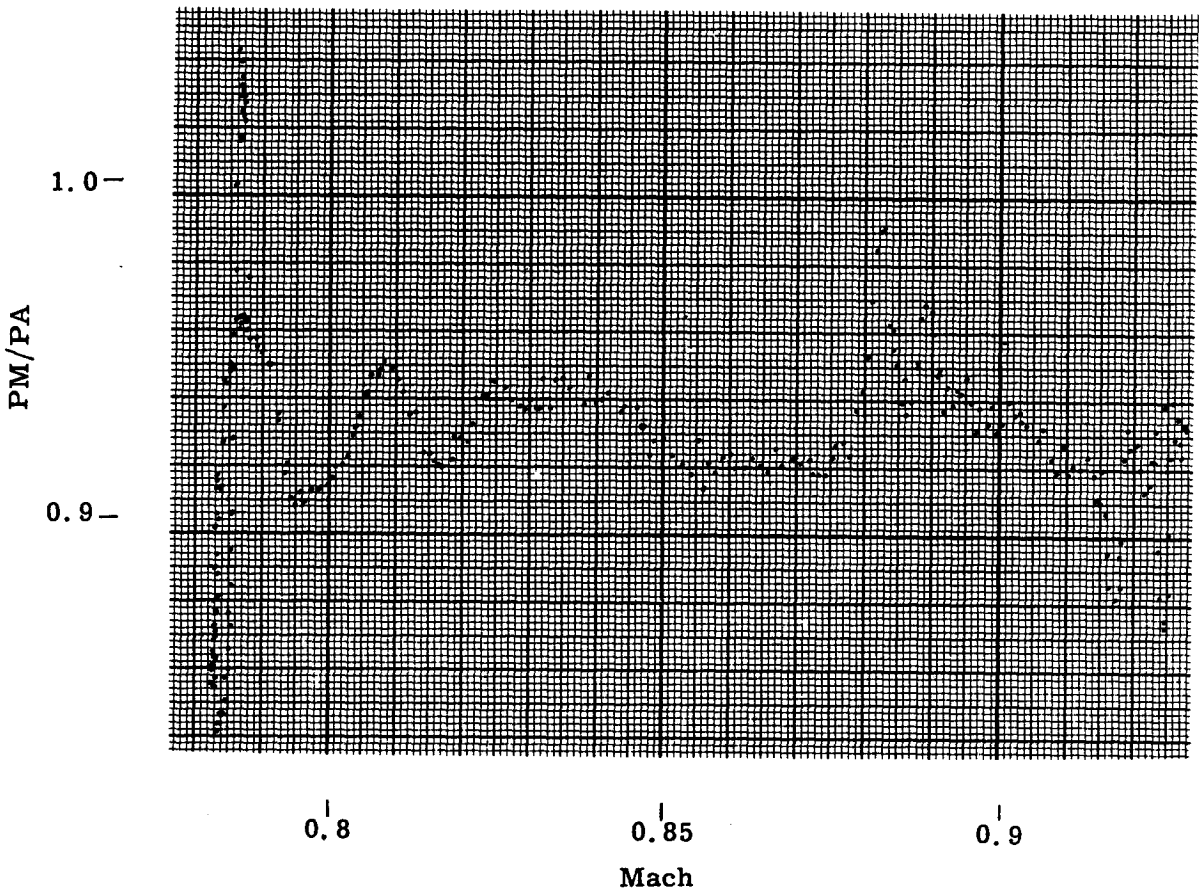

Figure 9. Station 113, PPU #2347

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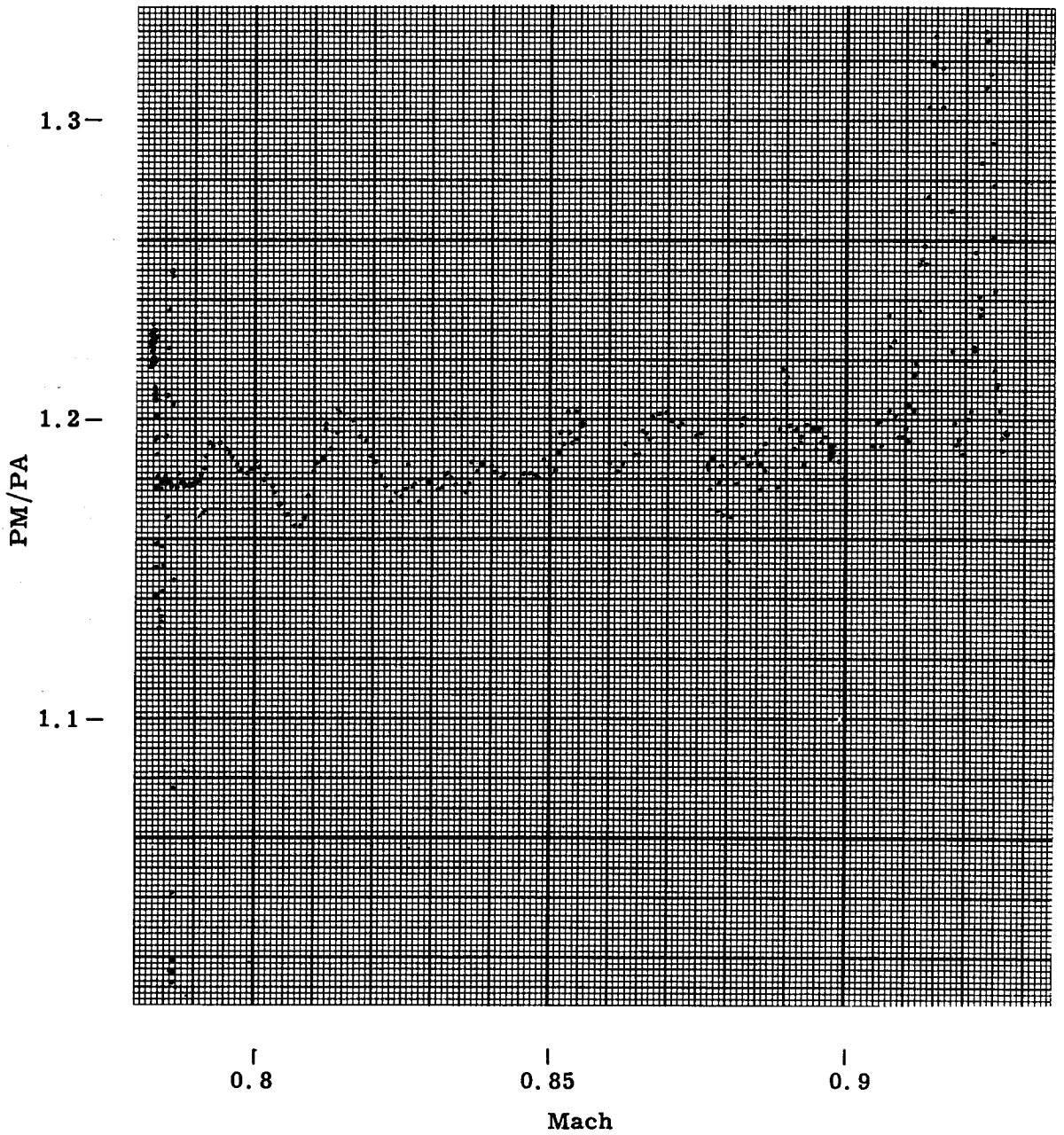

Figure 10. Station 92, PPU #2403

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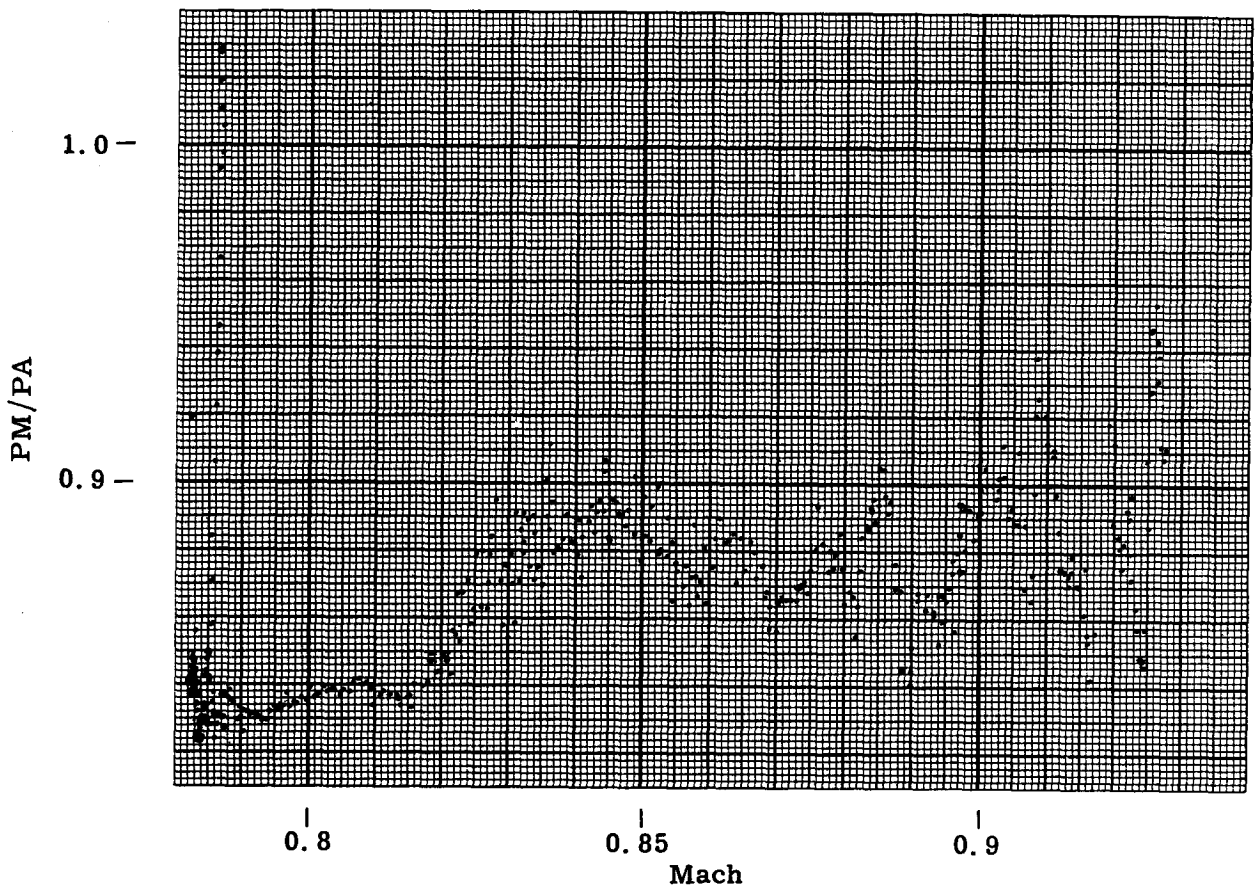

Figure 11. Station 100, PPU #2401

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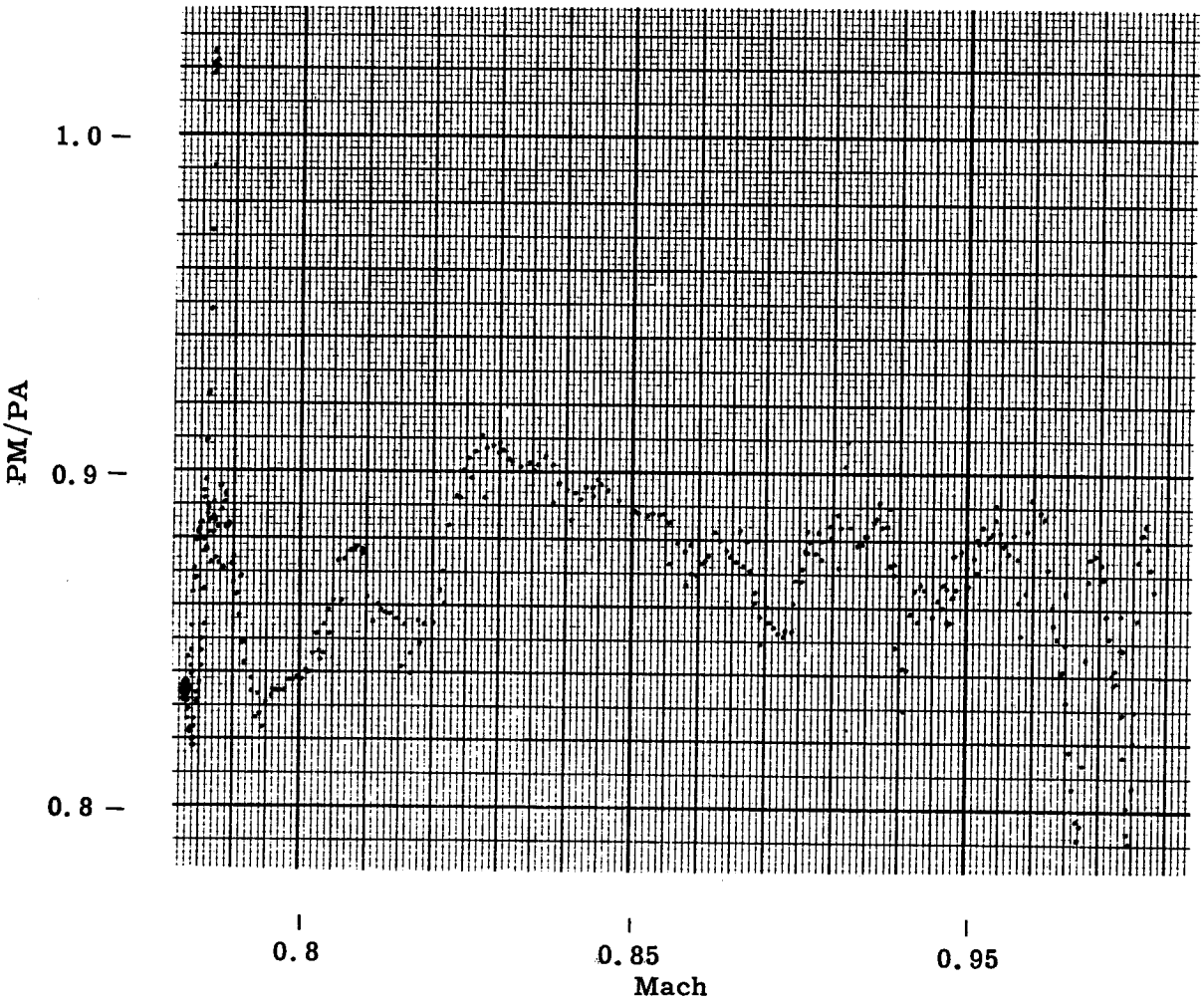

Figure 12. Station 104, #2366

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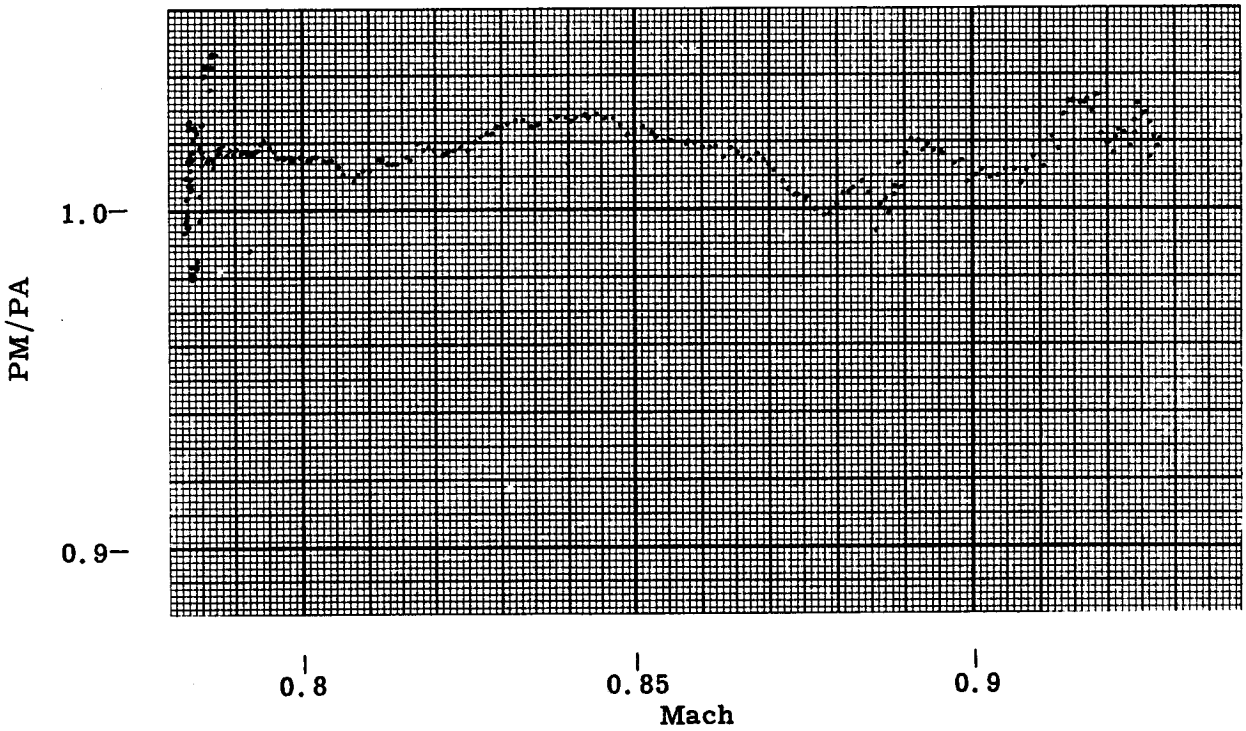

Figure 13. Station 135, PPU #2236

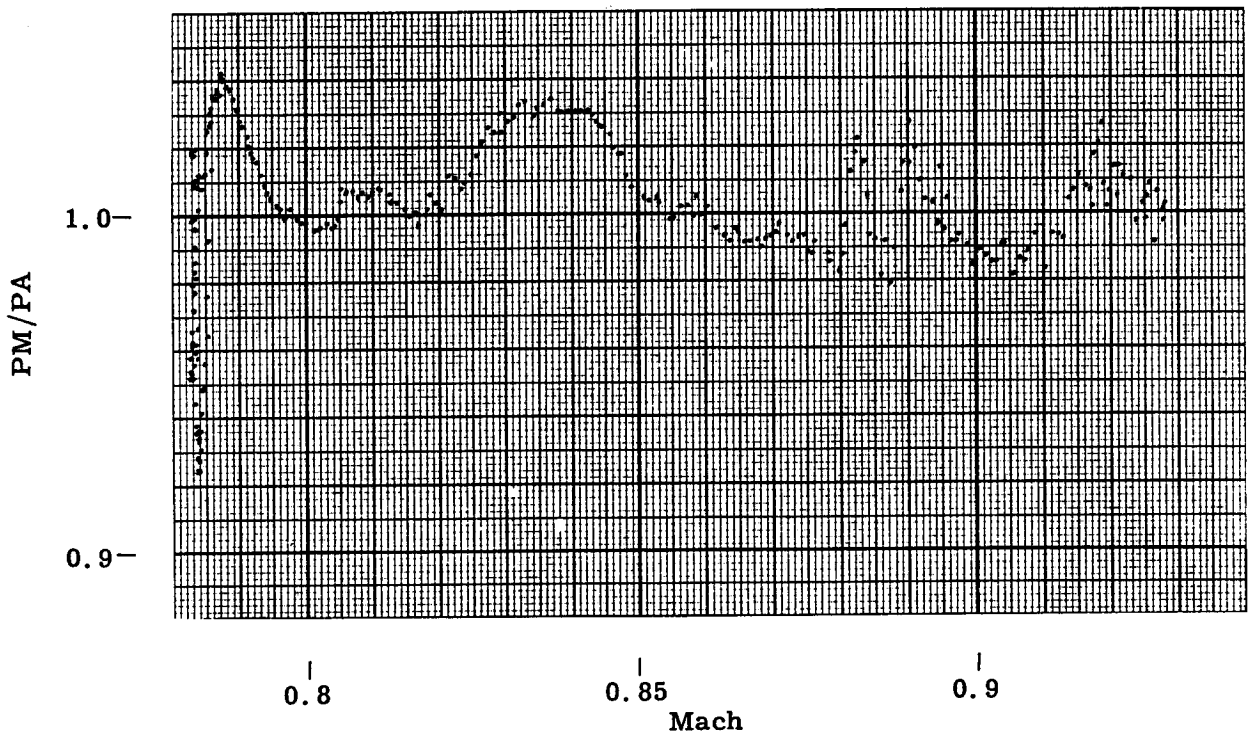

Figure 14. Station 125, PPU #2247

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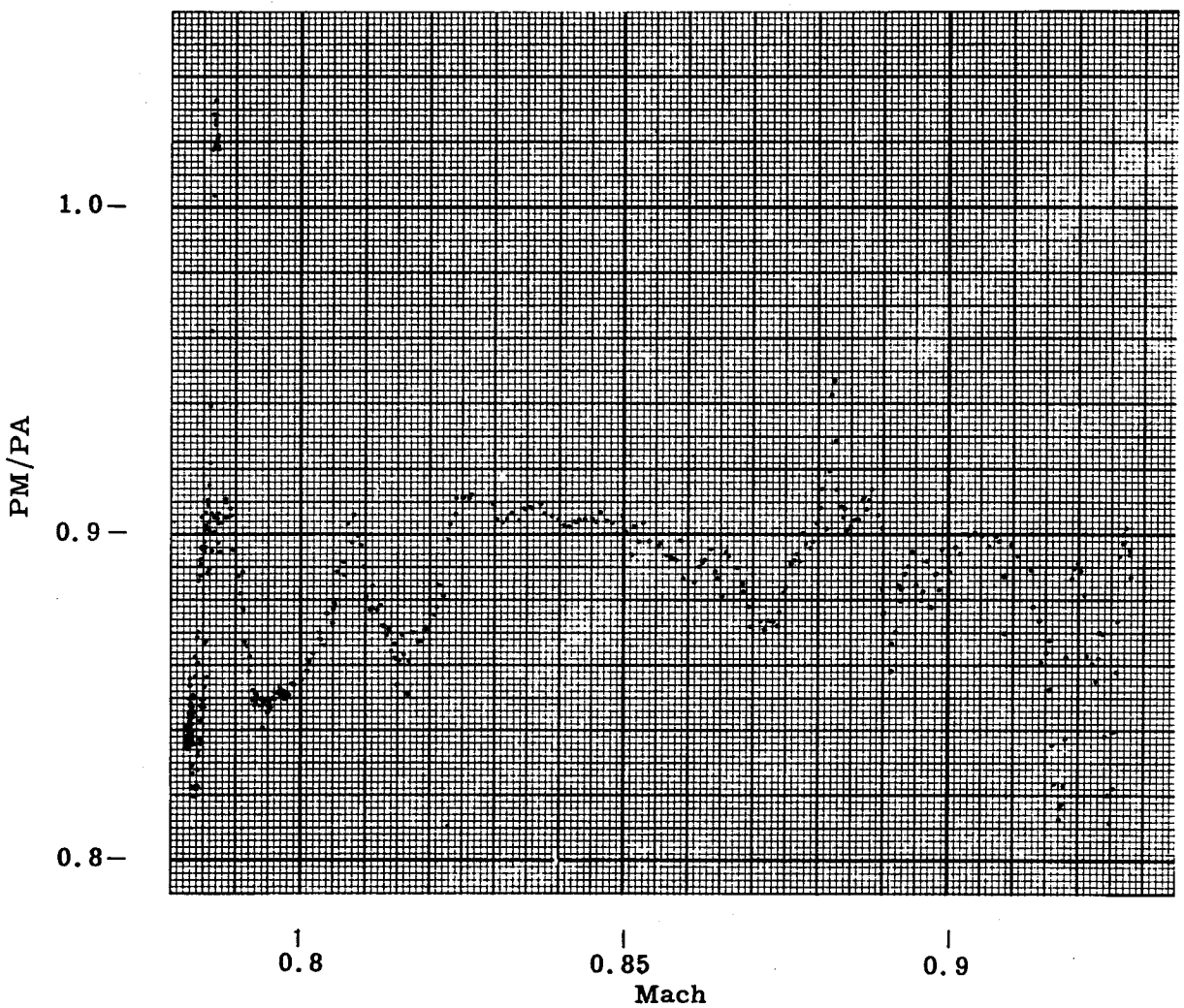

Figure 15. Station 107, PPU #2417

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