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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 910

WARHEADS FOR GUIDED MISSILES

34th Partial Report

SUPERSONIC FLIGHT TESTS OF
NAVAL ORDNANCE LABORATORY MODEL 114

Final Report

Task Assignment NPG-Re3f-607-1-52

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Supersonic Flight Tests of Naval Ordnance Laboratory Model 114

PART A

SYNOPSIS

1. The Naval Ordnance Laboratory is engaged in developing a guided missile warhead which will expel a number of individually fuzed explosive pellets as the warhead approaches its target. In addition to static tests, certain data, such as flight stability and pellet dispersion, must be obtained during the development stages from test vehicles traveling at supersonic speeds. It was decided that the most satisfactory method of obtaining this data would be from a 5 inch diameter model fired from the Naval Proving Ground's 1050 ft. rocket launcher.

a. The object of this test was to determine the flight stability and dispersion of sub-missiles ejected from a 5 inch model warhead traveling at a velocity approaching 2000 f.s..

b. It is concluded that:

(1) Sub-missiles can be satisfactorily ejected from a 5 inch diameter model warhead traveling at 1800 f.s., with an ejection velocity of approximately 130 f.s. provided by an internal charge of 30 grams of FFF-G black powder.

(2) The sub-missiles provided for this test, BUORD SK-315181, assumed a stable flight-trajectory approximately 8 ft. from the line of fire, after their ejection from the Trial Warhead #114.

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PART B

INTRODUCTION

1. AUTHORITY:

This test was conducted in accordance with reference (a).

2. REFERENCES:

a. NOL ltr NP/NOL/X11(94) WG:LEH Ser 0649 of 17 April 1951
b. NOL ltr NP/NOL/X11(68) WG:LEH Ser 0422 of 16 March 1951

3. BACKGROUND:

The Naval Ordnance Laboratory is engaged in developing a guided missile warhead which will expel a number of individually fuzed explosive pellets as the warhead approaches its target. In addition to static tests, certain data, such as flight stability and pellet dispersion, must be obtained during the development stages from test vehicles traveling at supersonic speeds. It was decided that the most satisfactory method of obtaining this data would be from a 5 inch diameter model fired from the Naval Proving Ground's 1050 ft. rocket launcher.

4. OBJECT OF TEST:

The object of this test was to determine the flight stability and dispersion of sub-missiles ejected from a 5 inch model warhead traveling at a velocity approaching 2000 f.s..

5. PERIOD OF TEST:

a.	Date Project Letter	17 April 1951
b.	Date Necessary Material Received	23 April 1951
c.	Date Commenced Test	30 April 1951
d.	Test Completed	3 May 1951

6. REPRESENTATIVE PRESENT:

Mr. L. E. Hightower — Naval Ordnance Laboratory

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. Figures 1 through 4 illustrate the method of construction of the model warhead #114, the design of the sub-missiles, attachment and method of ejection. An empty 5 inch rocket head Mk 6 was machined to permit partial insertion of the sub-missiles in its sides, 180° apart. A special primer tube fitted in the base plug was equipped with a Mk 113 detonator (ND-24) and then filled with 30 grams of FFF-G black powder as an expulsion charge. Leads from the detonator were run through holes drilled in the side of the rocket head to electrical contact "ears" secured to the rocket nose plug. The sub-missiles, weighing 1.4 pounds each, were kept in place by notched metal bands attached to the rocket head by a single screw at each end.

8. DESCRIPTION OF TEST EQUIPMENT:

Launcher:	NPG 1050 ft.
Propulsion:	Two 5"0 rocket motors Mk 2 Mod 3.
Cameras:	Bowen Acceleration (on side) 35mm Fastax (rear - line of fire).
Velocity Measurement:	Potter Chronograph and Oscillograph.
Ignition of Primer in Ejection System:	Knife blades connected to primer cutting through copper screens, charged with 300 Volts D. C. by means of Power Pack - 65 M.F. condenser across screens.

9. PROCEDURE:

a. The 5 inch rocket head with its sub-missiles, Figure 3, was threaded into a 5"0 motor Mk 2 and placed in the 1050 ft. rocket launcher. A second 5"0 motor Mk 2 was placed behind it to boost the velocity. The forward motor was ignited 200 ft. down the launcher while being propelled by the booster motor at a velocity of approximately 600 f.s..

b. A second set of copper screens was placed at the muzzle end of the launcher and a 300 volt D. C. power source connected to them. When the brass ears on the nose of the rocket cut through the screens the voltage was applied to the Mk 113 detonator which ignited the black powder ejection charge.

c. Both rounds were photographed from the side, as they left the launcher, with a Bowen acceleration camera operated at 90 frames per second, Figures 5 and 6. A 35mm Fastax camera placed directly below the muzzle of the launcher covered the rocket as it left the launcher and continued down range, thereby recording the spread of the sub-missiles, Figure 7.

10. RESULTS AND DISCUSSION:

a. Following is a brief summarization of the results obtained with the two Model 114 warheads tested:

Date	Velocity of Round at Ejection f.s.	Results
4-30-51	1800	Sub-missiles ejected approximately 5 ft. beyond ignition point - traveled in same plane as warhead - each sub-missile approximately 8 ft. from warhead when 150 ft. off launcher.
5-3-51	1734	Sub-missiles ejected approximately 5 ft. beyond ignition point - traveled in same plane as warhead - each sub-missile approximately 8 ft. from warhead when 150 ft. off launcher.

b. The Bowen film indicated that the sub-missiles assumed a stable trajectory when ejected and traveled in the same plane as the warhead. Yaw cards 12 ft. wide, erected 150 ft. from the muzzle, indicated that the warhead had a stable trajectory at that point and that the sub-missiles had spread out so that each was more than 6 ft. from the line of fire, since they did not penetrate the yaw cards, Figure 7.

c. The Fastax film confirmed the stable flight of the rounds and the spread indicated above. Static tests had previously indicated that the sub-missiles would be ejected with a lateral velocity of about 130 f.s.

PART

CONCLUSIONS

11. It is concluded that:

a. Sub-missiles can be satisfactorily ejected from a 5 inch diameter model warhead traveling at 1800 f.s., with an ejection velocity of approximately 130 f.s. provided by an internal charge of 30 grams of FFF-G black powder.

b. The sub-missiles provided for this test, BUORD SK-315181, assumed a stable flight trajectory approximately 8 ft. from the line of fire after their ejection from the Trial Warhead #114.

Supersonic Flight Tests of Naval Ordnance Laboratory Model 114

The tests upon which this report is based were conducted by:
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By direction

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NPG REPORT NO. 910

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Thirty-fourth Partial Report

on

Warheads for Guided Missiles

- - - - - - - - - - - - - - - - - - - -

Final Report

on

Supersonic Flight Tests of

Naval Ordnance Laboratory Model 114

Project No.: NPG-Re3f-607-1-52

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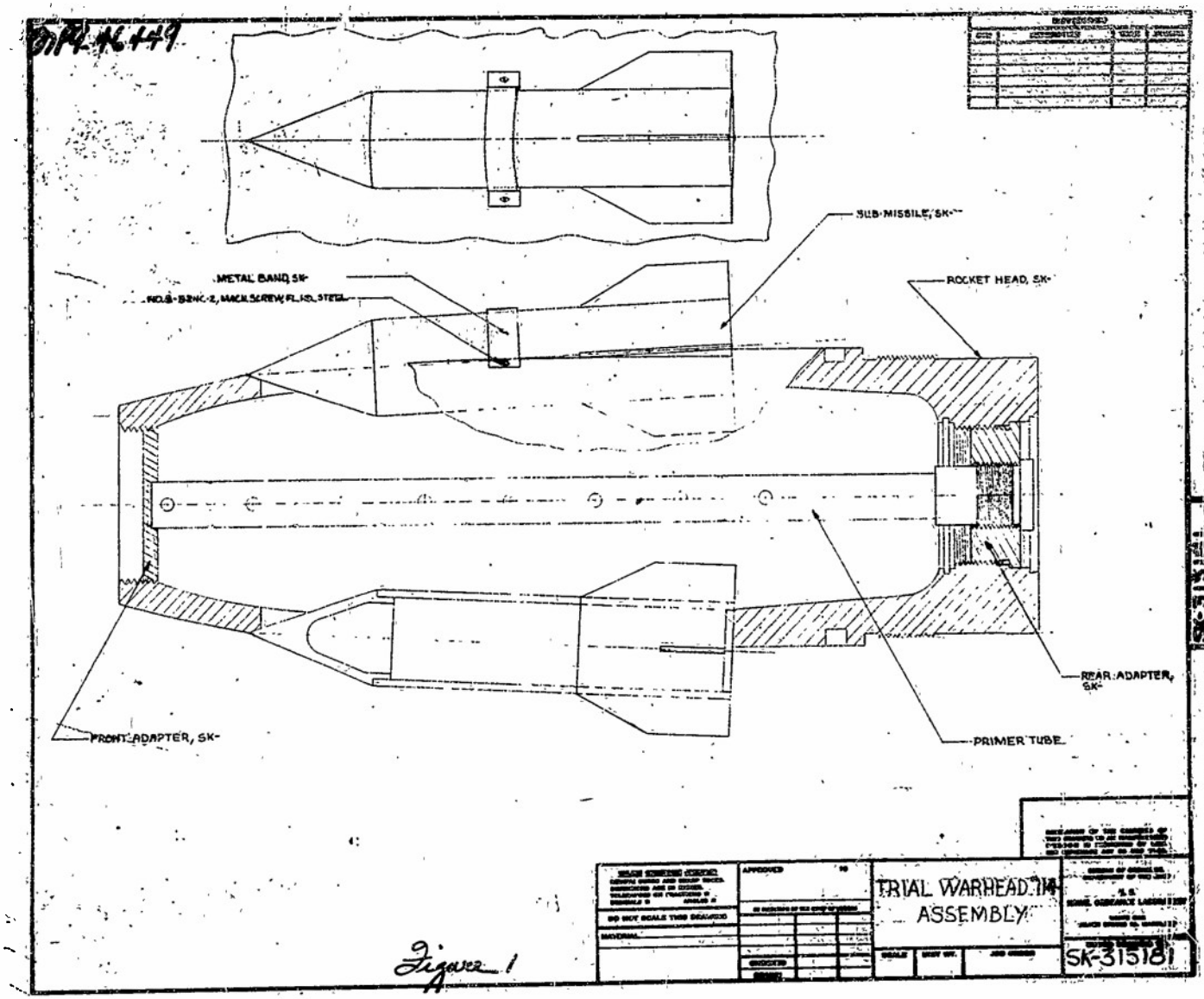

SUB-MISSILE, SK-
METAL BAND, SK-
ROCKET HEAD, SK-
REAR ADAPTER, SK-
PRIMER TUBE
FRONT ADAPTER, SK-
TRIAL WARHEAD IN ASSEMBLY
SK-315181

Figure 1

NPG-46450

SK-313540

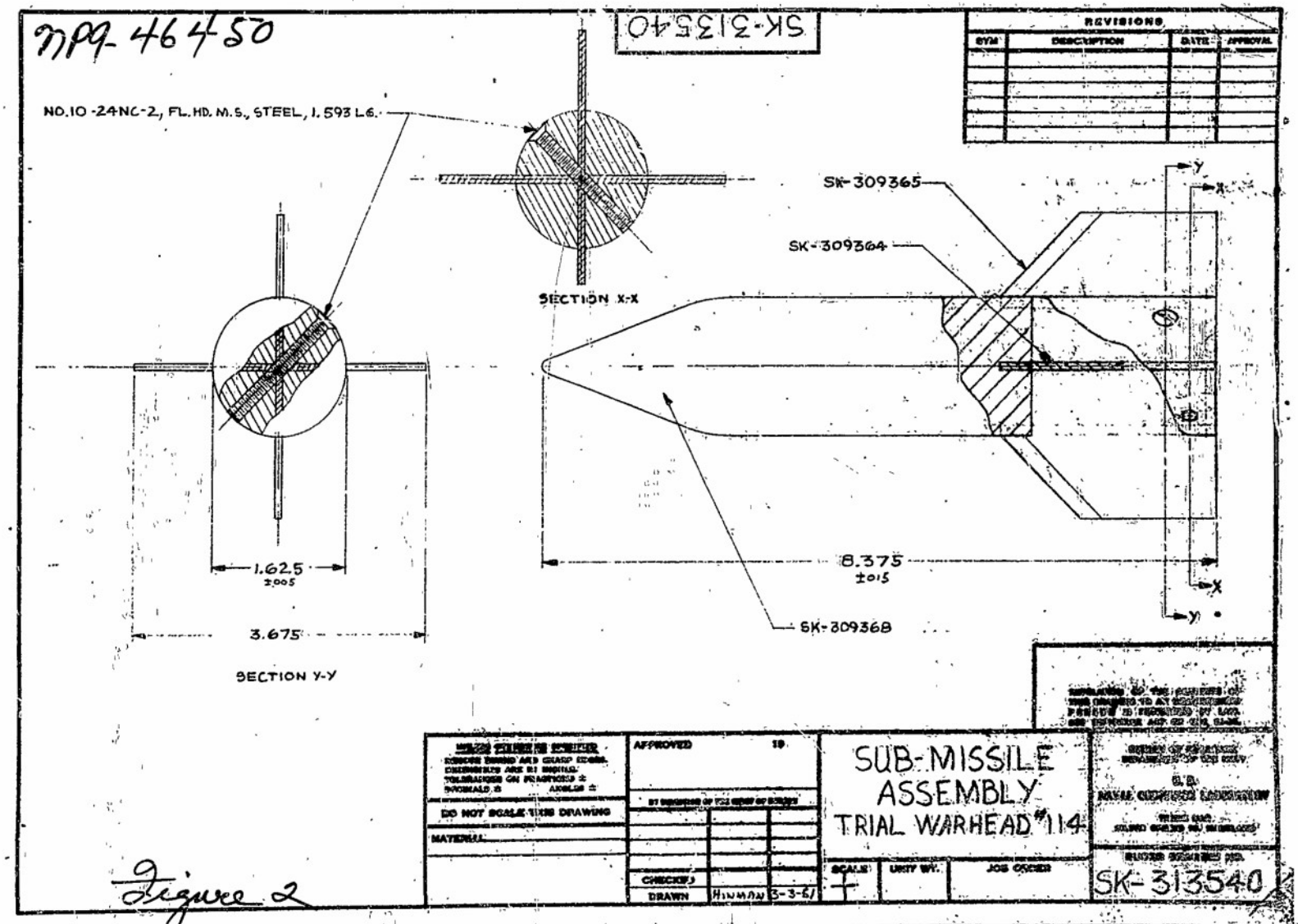
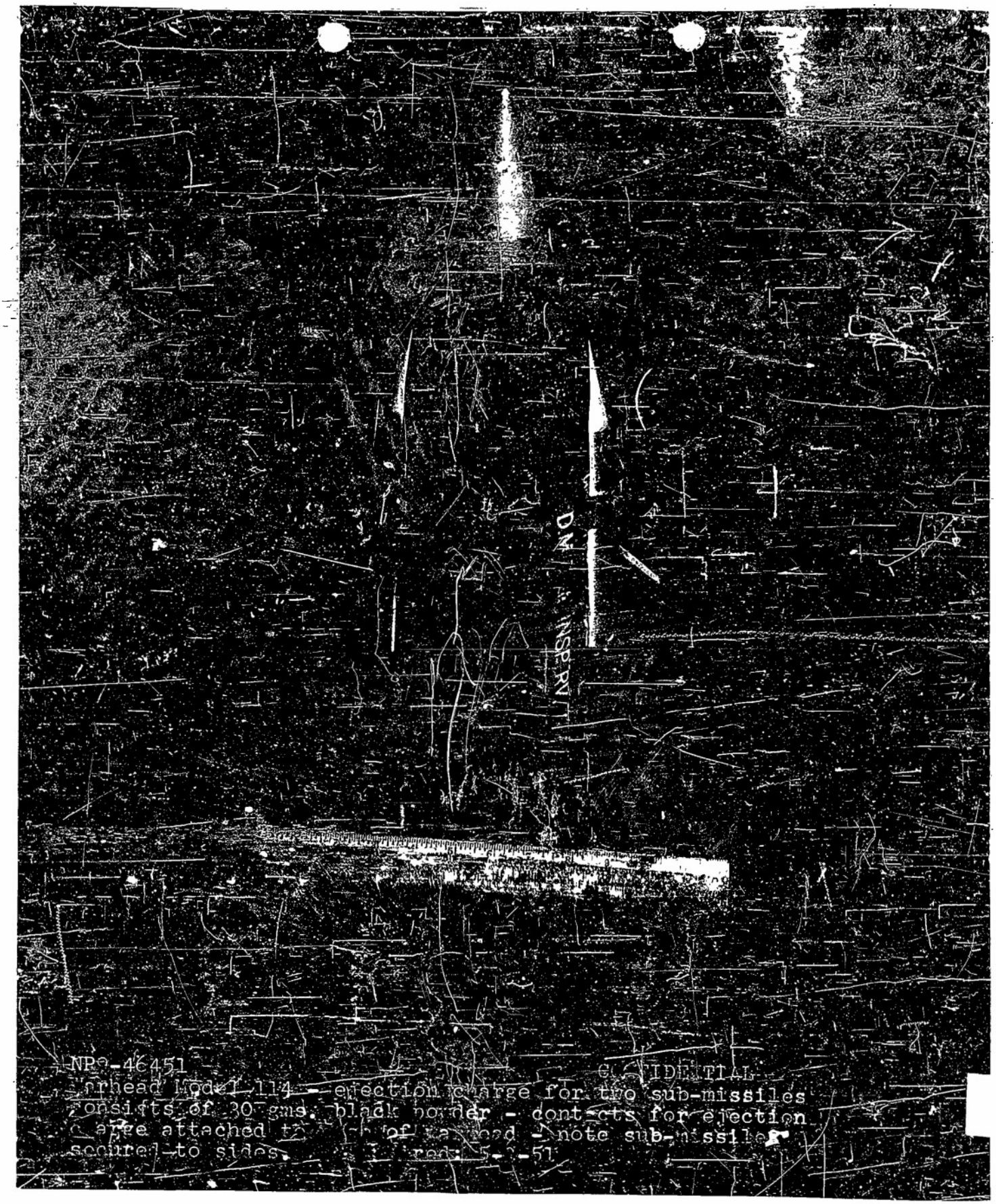
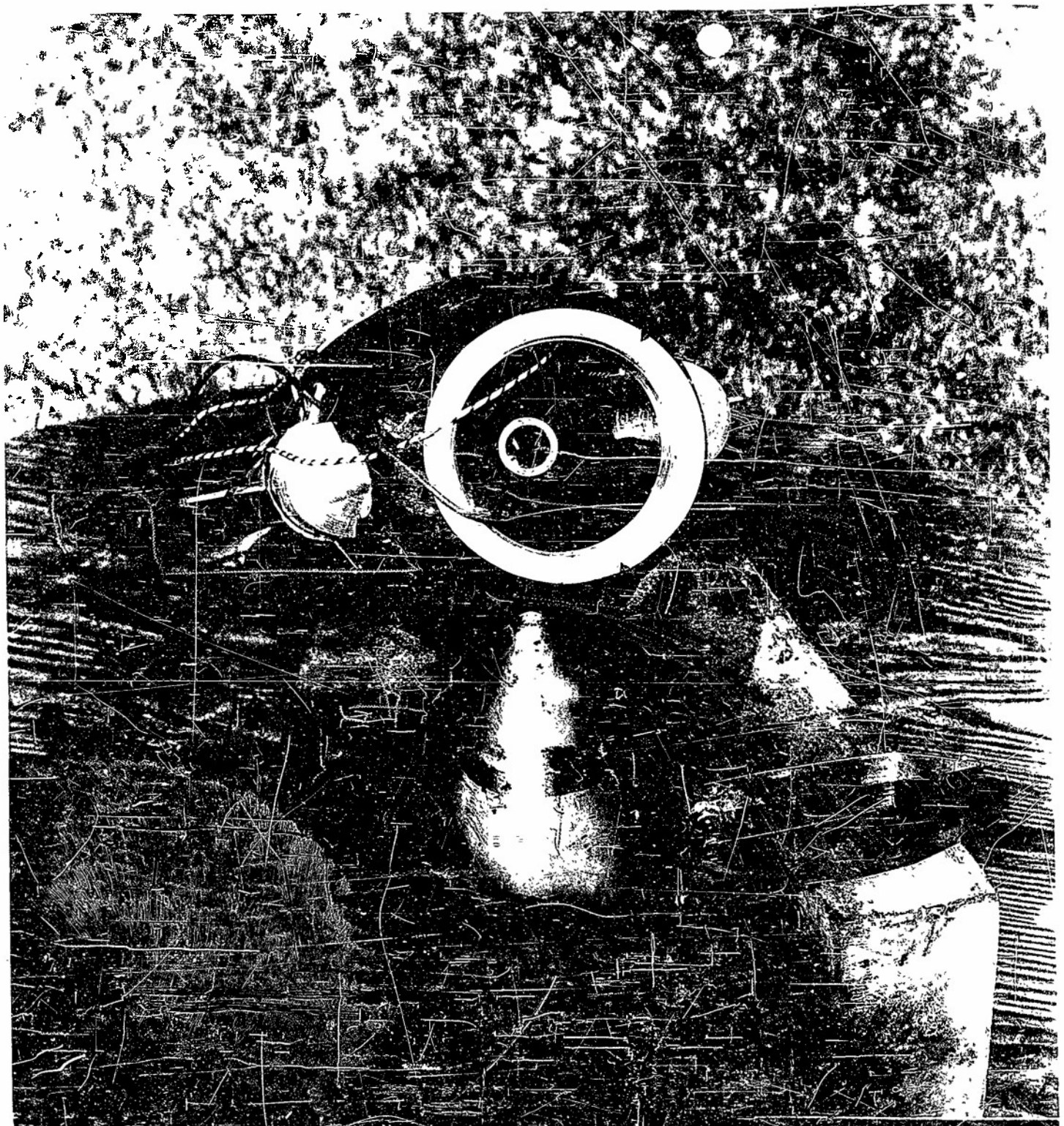


Figure 2



NPO-46451 CONFIDENTIAL
rhead Model 114 - ejection charge for two sub-missiles
onsists of 30 gms. black powder - dont cts for ejection
are attached to [illegible] of a rod - note sub-missiles
secured to sides. [illegible] red 5-[illegible]-51



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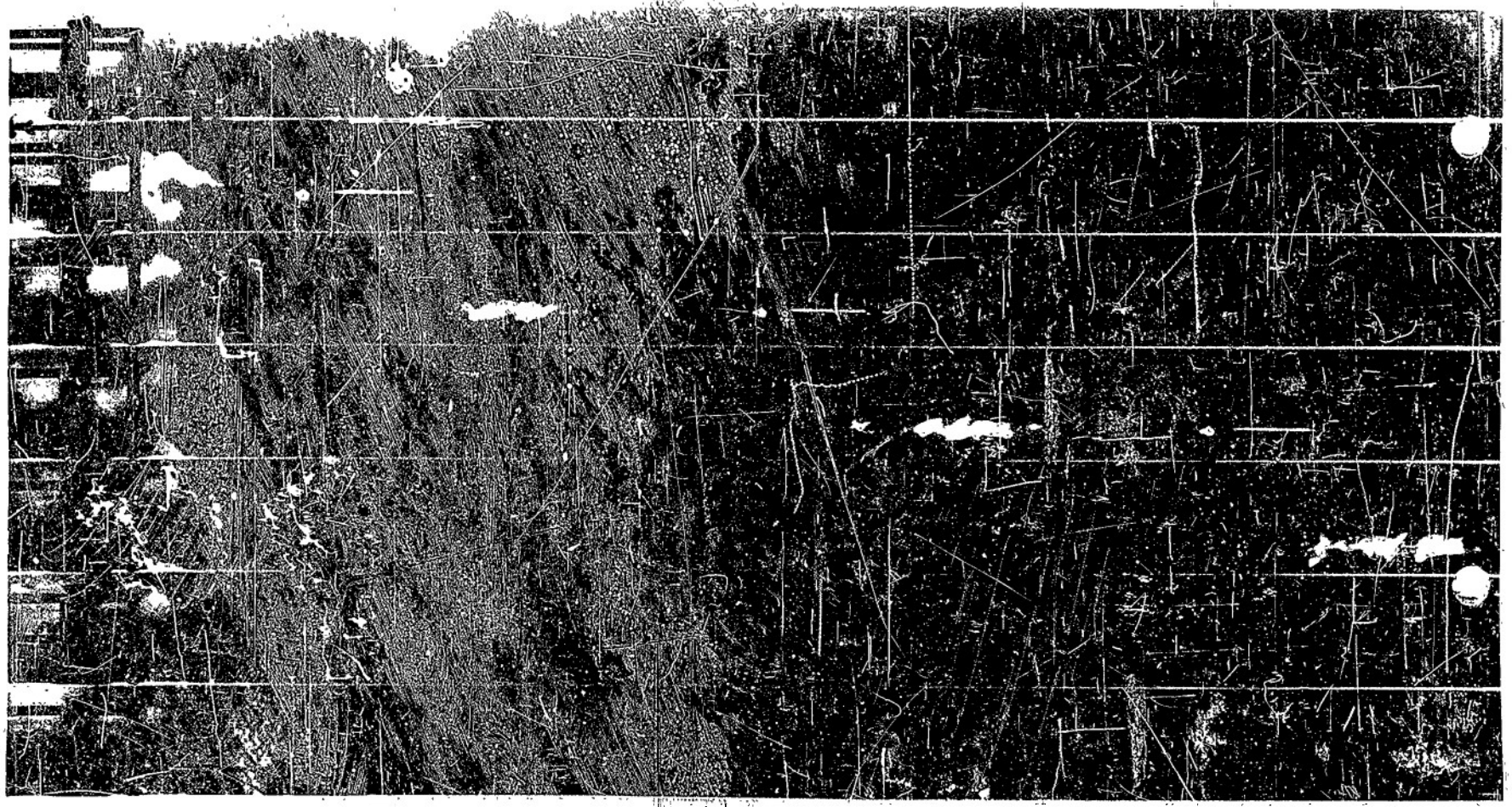
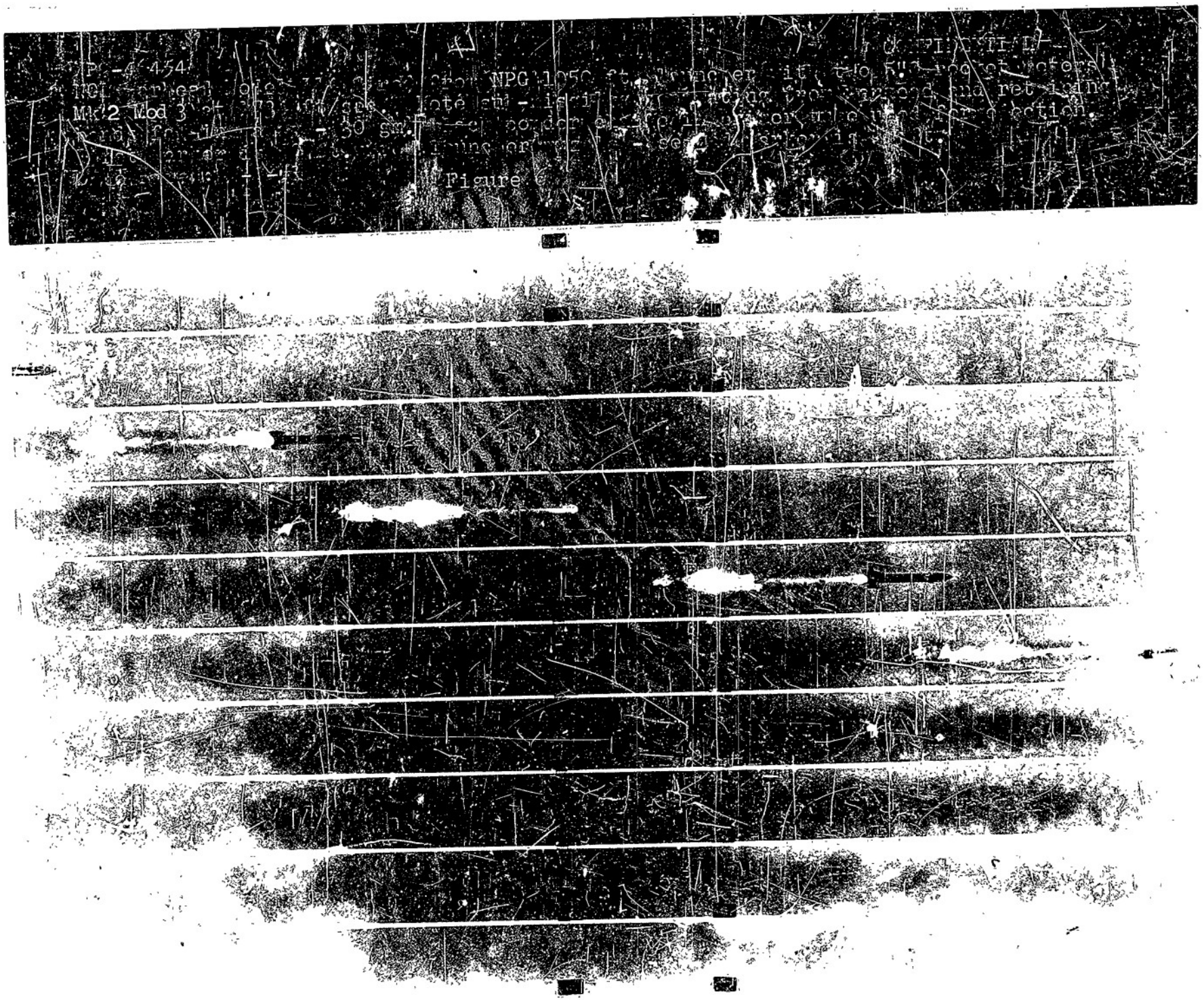
Warhead Model 114 - showing internal tube containing 30 gm black powder ejection charge and 2 sub-missiles housed in sides of warhead - contacts for ejection charge shown on nose cap in foreground. Date Fired: 5-3-51

Figure 4

ID TIAL
ft. launcher with two 5.0 rocket motors
Separation
Date Fired: 4-30-51

Figure 5




Mk 2 Mod 3
Figure

Supersonic Flight Tests of Naval Ordnance Laboratory Model 114

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