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USAEPPG SIG 930-117

OPERATIONAL EVALUATION
OF THE AN/AAD-2
DRONE INFRARED DETECTOR.(U)

17 TASK 24-58-0262

- 9 + 10 NA
- 11 Sep 59,
- 12 30p
- 13 NA
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Fort Huachuca, Arizona

USAEPG-SIG 930-117, Plan of Test, Task 24-58-0262, "Operational Evaluation of the AN/AAD-2 Drone Infrared Detector (U)" has been prepared by the Combat Surveillance and Avionics Department and is published for the information of all concerned. Distribution of this publication has been approved under the provisions of paragraph 7h, AR 310-1, by the Adjutant General acting for the Secretary of the Army, 21 November 1958. Suggestions or comments relative to this report are invited and should be addressed to the Commanding General, U. S. Army Electronic Proving Ground, Fort Huachuca, Arizona, ATTN: SIGPG-OTW.

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PLAN OF TEST

OPERATIONAL EVALUATION OF THE AN/AAD-2
DRONE INFRARED DETECTOR (U)

Task 24-58-0262

AUTHORITY

(U) The authority for this test is documented under approved USAEPG Task 24-58-0262, "Drone Infrared Detector (U)," of the USAEPG Technical Program.

OBJECTIVE

Test Plans 2
(U) ~~The objective is~~ to determine the day and night surveillance capabilities of the AN/AAD-2 Drone Infrared Detector when installed and operated in the SD-1 and SD-2 surveillance drones and Army L-20 aircraft.

September 1959
U. S. Army Electronic Proving Ground
Combat Surveillance and Avionics Department
Fort Huachuca, Arizona

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U. S. ARMY ELECTRONIC PROVING GROUND
Fort Huachuca, Arizona

PLAN OF TEST - TASK 24-58-0262

OPERATIONAL EVALUATION OF THE AN/AAD-2 DRONE

INFRARED DETECTOR (U)

I. (C) BACKGROUND

1. When it became apparent that the construction of a drone infrared reconnaissance device was within the state-of-the-art, Combat Surveillance and Avionics Department, U. S. Army Electronic Proving Ground, Fort Huachuca, Arizona, prepared technical requirement TR-BASD-2-56 defining the design specifications for such a device. A contract was awarded to Servo Corporation of America for the construction of this equipment.

The AN/UAS-1 Drone Infrared Detector was then developed, laboratory and field tested, and the results evaluated. From these results it was determined that an airborne drone detector required increased ruggedness and reliability, higher resolution, inflight recording, direct liquid nitrogen cooling, and an increased field of view.

On 15 January 1958, USAEPG set forth TR-CSD-23-58 to meet the above requirements for a drone infrared detector that would be operational in the SD-1, SD-2, and SD-3 surveillance drones and also in a manned Army L-20 aircraft. (The SD-3 Drone was later deleted from USAEPG's program.)

A contract (DA-36-039-SC-80074) was awarded Haller, Raymond, and Brown, Inc., of State College, Pennsylvania, for the fabrication of three such airborne infrared drone detectors. One detector (AN/AAD-2) has been received for test and evaluation. These units are based on the principle of a line scanning device that collects the infrared

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radiation from an object on the earth and images this radiation on an infrared detector. The output of this detector is amplified and presented for viewing and film recording. The trade name "Reconofax" has been given to all such equipments developed by Haller, Raymond, and Brown, Inc.

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II. (C) DESCRIPTION OF MATERIEL

2. The drone detection equipment for the SD-1 and SD-2 Drones and Army L-20 aircraft is an air-to-ground device using passive infrared detection principles. The airborne equipment, which weighs 44 pounds, consists of a combined optical scanner, glow tube recording unit and a radio link for transmitting the scanner video data to a ground station. (See figure 1.)

The scanner-recording unit combines two separate functions: scanning the terrain beneath the aircraft and recording the output of the glow tube on 70mm recording film.

A lead selenide detector cell, sensitive in the 1-7 micron range, is equipped with an optical filter to filter out radiation below one micron. The lead selenide detector cell is cooled by direct liquid nitrogen (-196°C).

To permit day operation and for use in the 1 - 3.5 micron region of the spectrum, an uncooled lead sulfide detector is furnished.

Roll stabilization of the recording film transport is achieved by the use of a Kearfott Vertical Gyro.

The ground-based presentation and recording unit of the AN/UAS-1 Infrared Detecting Set will be used with the AN/AAD-2 Drone Detector. This ground-based unit was fabricated by the Servo Corporation of America in accordance with contract DA-36-039-SC-67869. Necessary modifications to the ground station will be made by Haller, Raymond, and Brown, Inc., in accordance with the present contract DA-36-039-SC-80074.

The ground-based station converts the received signals into a video presentation that can be recorded on 35mm film, magnetic tape, and/or viewed directly on a cathode-ray presentation screen. This unit uses a standard non-directional ground plane antenna and

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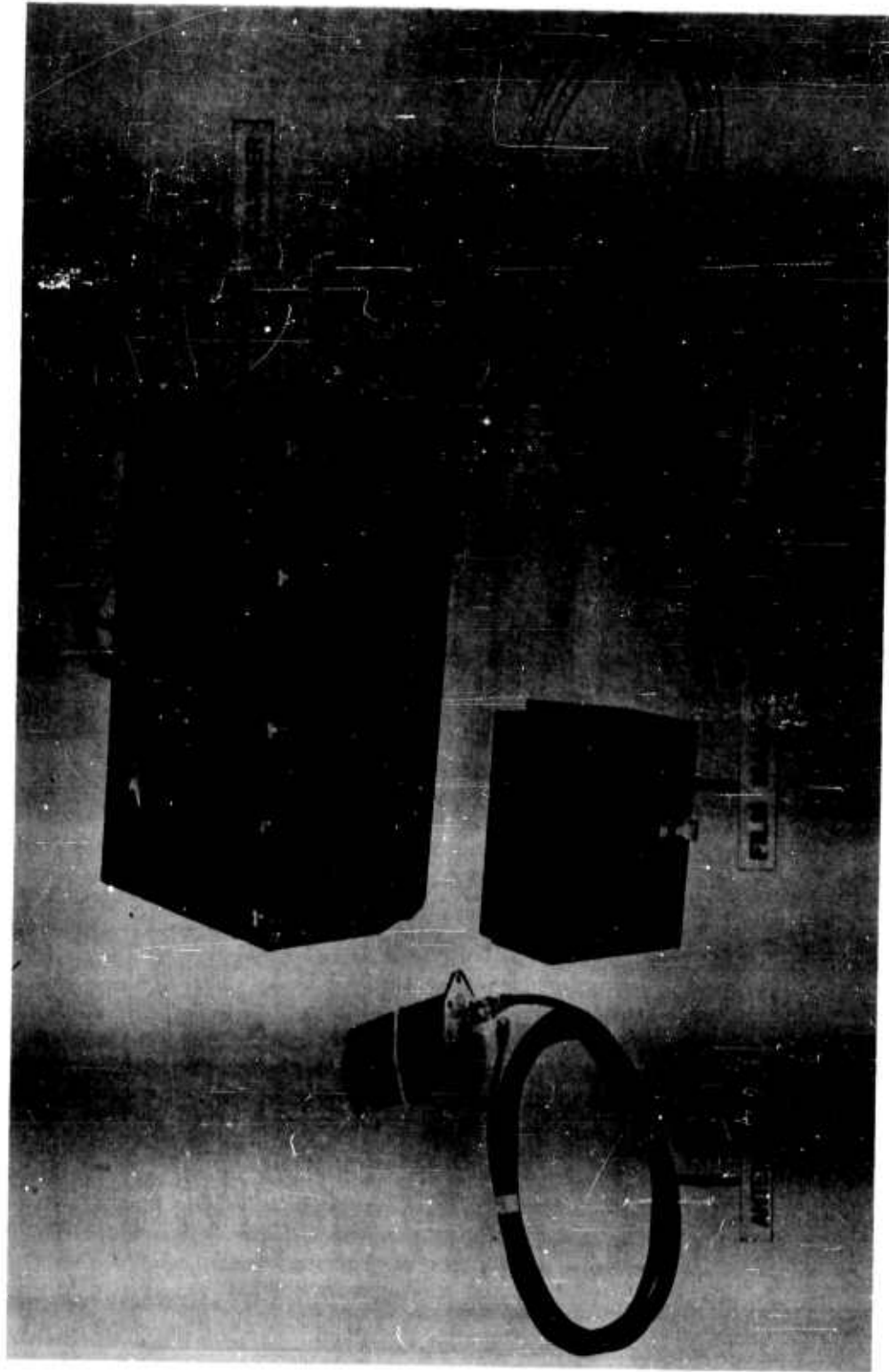


Figure 1. Airborne equipment.

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commercial FM telemetering receiver. The ground-based unit consists of the following four major components (figure 2):

- a. Receiving Unit. This FM receiving unit completes the radio link between the airborne and ground equipments.
- b. Signal Processing Unit. The signal processing unit converts telemetered composite signals, received by the receiving unit, to a form suitable for use on the visual display and film recording units.
- c. Visual Presentation Unit. This unit provides complete presentation of signals, on a long persistence cathode-ray tube, originating from ground targets.
- d. Film Recording Unit. The Oscillo-Record Camera records the data on 35mm film. Figure 3 represents an artist's conception of the equipment in a tactical situation.

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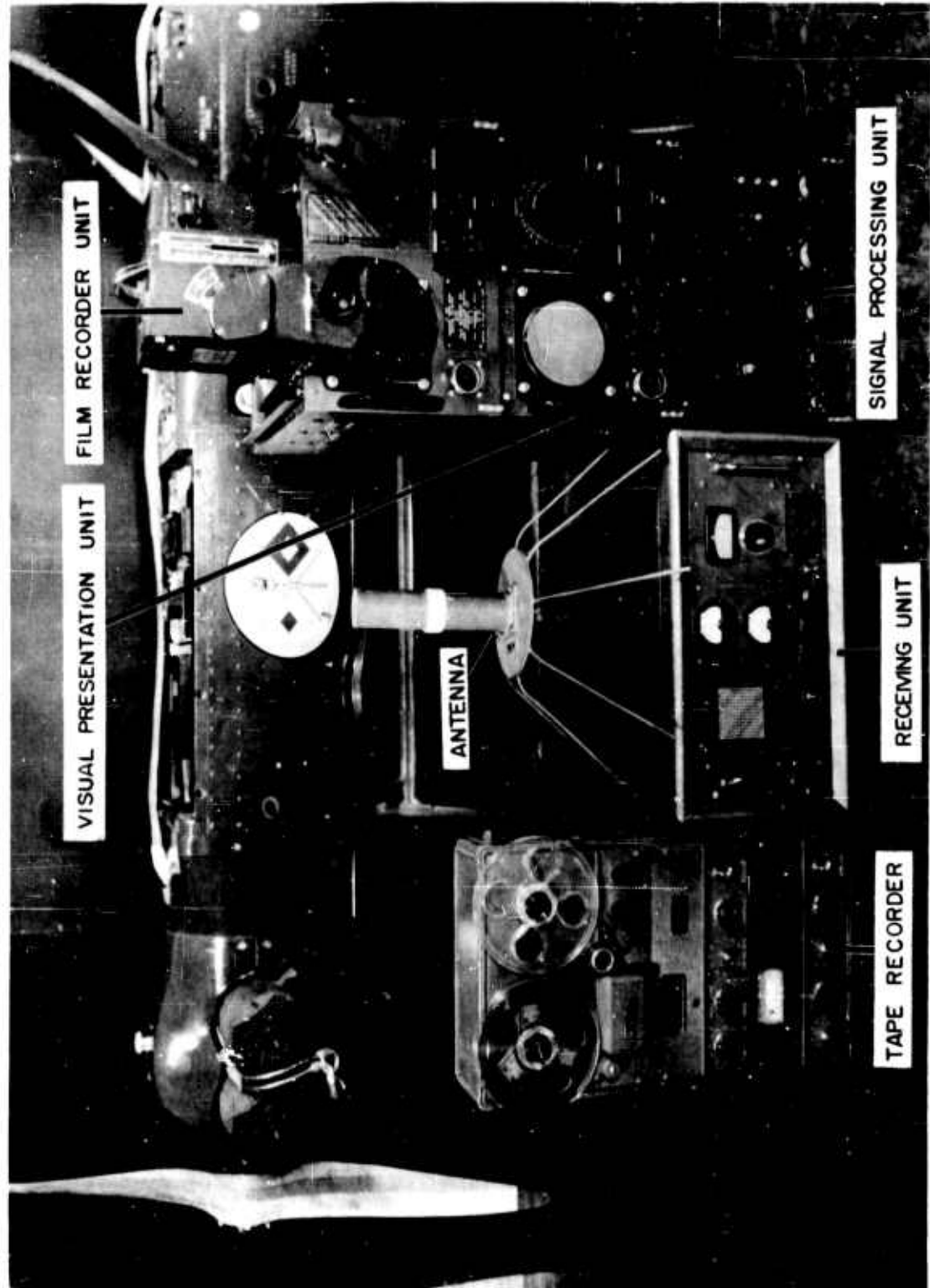


Figure 2. Ground equipment.

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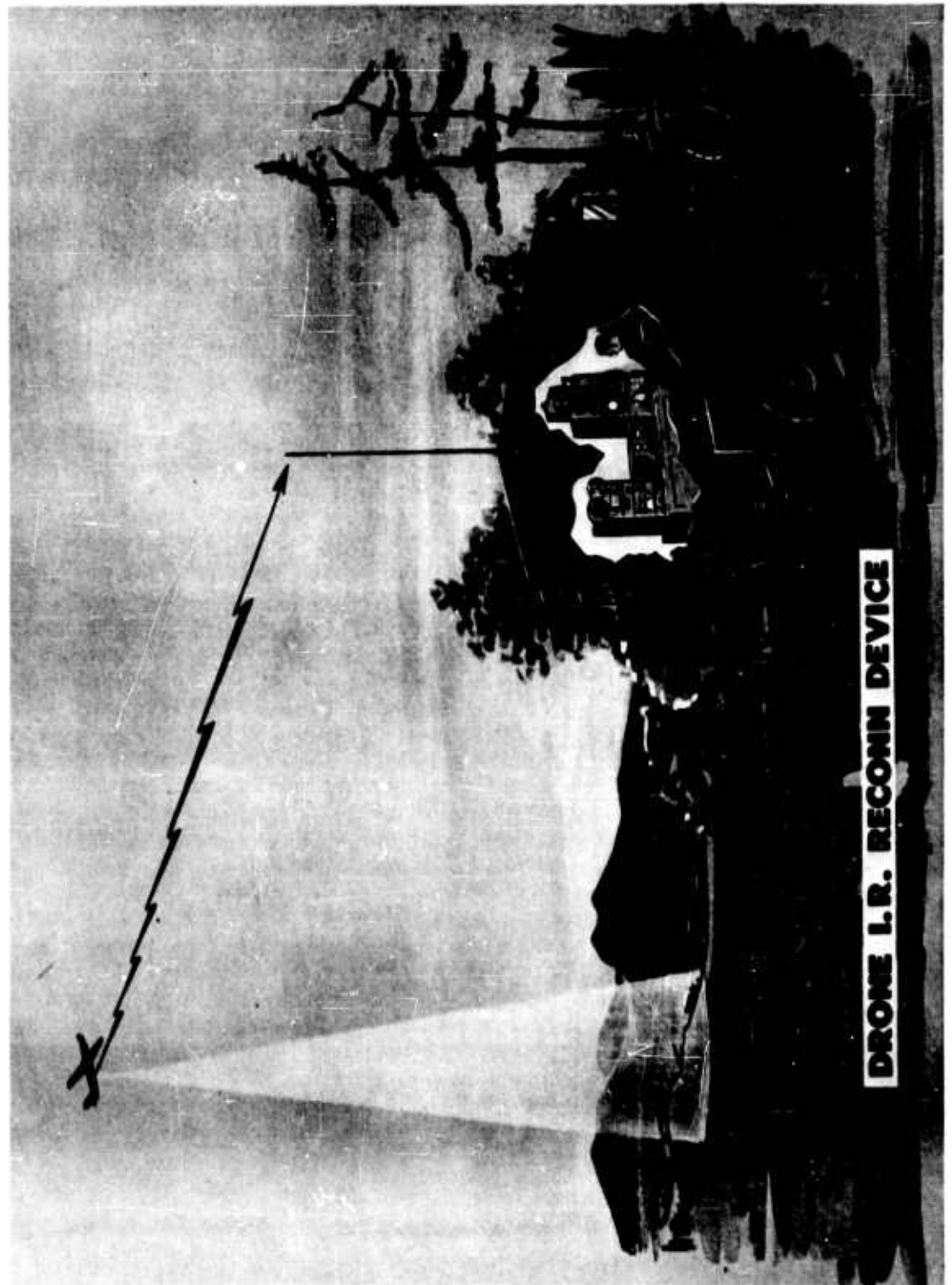


Figure 3. Artist's conception of the equipment in a tactical situation.

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III. (U) SPECIFIC TESTS

3. Details of test are covered in ANNEX A.
4. TEST NR 1 - TARGET DETECTION CAPABILITIES. To determine what types of selected military and civilian targets can be detected at altitudes ranging from 500 to 3,000 feet.
5. TEST NR 2 - TELEMETERING RANGE. To determine the maximum useful range of the telemetering link.
6. TEST NR 3 - REMOTE CONTROL. To determine the effectiveness of remote operation of the scanning unit from the pilots compartment of an Army L-20 aircraft. This test will also determine the effectiveness of remote operation of the scanning unit from a ground-based radar control station when the unit is installed in the SD-1 and SD-2 Drones.
7. TEST NR 4 - RESOLUTION. To determine the maximum angular resolution of the equipment utilizing both the 3 and 6 mil detector cells.
8. TEST NR 5 - LINE VOLTAGE VARIATION. To determine the effects upon the scanning unit due to variations in the voltage.
9. TEST NR 6 - REPRODUCIBILITY OF TAPE RECORDED DATA. To determine to what degree mapping data is reproducible after being recorded on magnetic tape.

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IV. (U) GENERAL

10. RESPONSIBILITY.

a. Optics Division, Combat Surveillance and Avionics Department, is the responsible organization for conducting the test.

b. Mr. Richard W. Fulton is the Project Officer.

11. REPORTS.

a. Partial reports will be submitted as deemed necessary.

b. A final report will be submitted upon completion of tests.


ROY F. BLACKMON
Colonel SigC
Acting Chief

ANNEX A - DETAILS
OF TEST

ANNEX B - DATA SHEET
AN/AAD-2 DRONE
INFRARED DETECTOR

ANNEX C - DATA SHEET
AN/AAD-2 GROUND
STATION

ANNEX D - DATA SHEET
AN/AAD-2 AIRBORNE
EQUIPMENT

ANNEX E - MAINTENANCE DATA SHEET
AN/AAD-2 DRONE
INFRARED DETECTOR

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ANNEX A - DETAILS OF TEST

1. (U) GENERAL.

a. Requirements Available within Department

(1) Equipment Requirements

- (a) Three drone infrared scanners
- (b) Ground-based unit (AN/UAS-1)
- (c) ARC-12 Type Radio Set
- (d) Ten kerosene flare pots
- (e) Two trucks, 3/4 ton, 4 x 4 (targets)
- (f) Two trucks, 2-1/2 ton, 6 x 6 (targets)
- (g) Two trucks, 1/4 ton, 4 x 4 (targets)
- (h) Liquid nitrogen
- (i) Power Unit, PE-95
- (j) Drones (SD-1 and SD-2)

(2) Personnel Requirements

- (a) One airborne operator
- (b) Two ground station operators
- (c) Photo laboratory technician
- (d) Six truck drivers
- (e) Drone operator crew
- (f) PE-95 operator

b. Support Requirements (outside CS and AD)

(1) Equipment Requirements

Army aircraft, L-20

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(2) Personnel Requirements

Army aviator

2. (C) TEST NR 1 - TARGET DETECTION CAPABILITIES.

a. Purpose. To determine what types of selected military and civilian targets can be detected at altitudes ranging from 500 to 3,000 feet above terrain.

b. Method. When placed in an Army L-20 aircraft, the scanning unit will be flown over selected local targets at altitudes of 500, 1,000, 1,500, 2,000, 2,500, and 3,000 feet above terrain. Tests will be performed both day and night under prevailing permissible flight conditions at Fort Huachuca, and different types of available detector cells will be used.

After the manned aircraft tests, the scanner will first be mounted in an SD-1 Drone and tested at the Proving Ground. Then it will be placed in an SD-2 Drone and tested at the test range in Yuma, Arizona. The Drones will be flown at the previous mentioned altitudes over various available military type targets.

c. Data to be Recorded. As specified on Data Sheet, annex B.

3. (C) TEST NR 2 - TELEMETERING RANGE.

a. Purpose. To determine the maximum useful range of the telemetering link.

b. Method. The ground station placement will provide a clear line-of-sight for at least 50 miles to a point 1,000 feet above terrain. Flights will be made in an Army L-20 aircraft, SD-1 and SD-2 Surveillance Drones. The aircraft will fly at a 1,000 foot altitude until a useful telemetered signal is no longer obtained at the ground station. (A useful signal is defined as that giving a recognizable presentation at the ground station of a designated target.) This test will be performed four times; drone testing will not be attempted until all tests with manned aircraft have been performed.

c. Data to be Recorded. Position of ground tracking station and position of aircraft when useful transmission ceases. Film will be adequately marked.

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4. (C) TEST NR 3 - REMOTE CONTROL.

a. Purpose. To determine the effectiveness of remote operation of the scanning unit from the pilot's compartment of an Army L-20 aircraft. This test will also determine the effectiveness of remote operation of the scanning unit from a ground-based radar control station when the unit is installed in the SD-1 and SD-2 Drones.

b. Method. The equipment will be remotely operated from the front seat of an Army L-20 aircraft. After all phases of testing have been completed in the manned L-20 aircraft remote operation of the scanner from the ground-based unit will be performed.

c. Data to be Recorded. Readings from the remote-control indicator box and any other pertinent information.

5. (C) TEST NR 4 - RESOLUTION.

a. Purpose. To determine the angular resolution of the equipment utilizing both the 3 and 6 mil detector cells.

b. Method. The equipment will be flown both day and night in an Army L-20 aircraft over preselected targets of known dimensions and spacing at a series of altitudes in 500 foot increments. (See figure 4.)

c. Data to be Recorded. All information specified on the ground station and airborne Data Sheets. (Annexes C and D.)

6. (C) TEST NR 5 - LINE VOLTAGE VARIATION.

a. Purpose. To determine the effects upon the scanning unit due to variations in the line voltage.

b. Method. In the laboratory the drone scanner will be connected to a variable voltage power supply and the voltage varied from 22 to 30 volts in increments of one volt.

c. Data to be Recorded. Effects upon scanner operation.

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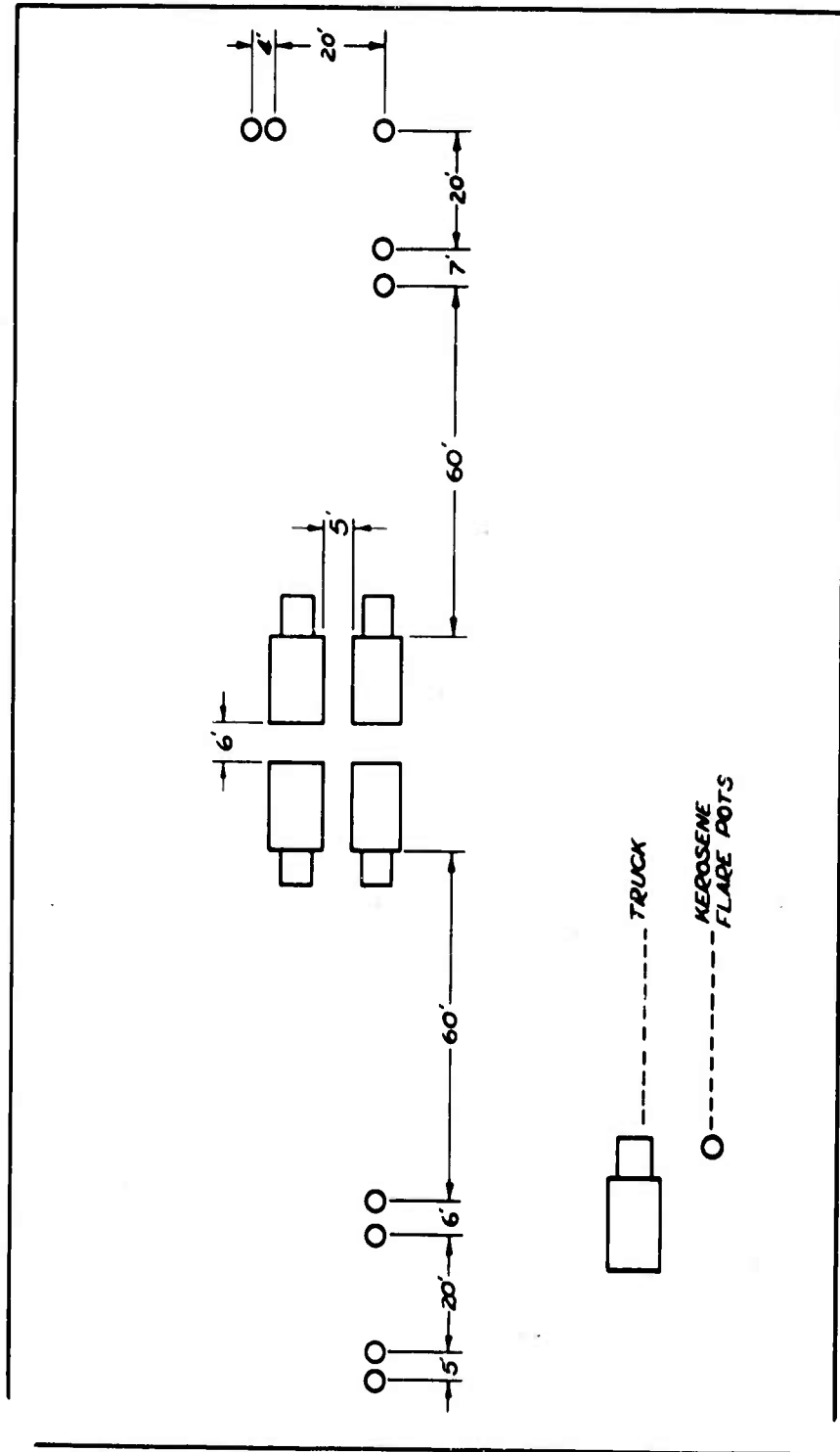


Figure 4. Resolution layout.

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7. (C) TEST NR 6 - REPRODUCIBILITY OF TAPE RECORDED DATA.

a. Purpose. To determine to what degree mapping data is reproducible after being recorded on magnetic tape.

b. Method. The tape recorder will be used in Army L-20 aircraft and SD-1 and SD-2 Drones on at least 10 flights to gather infrared information.

c. Data to be Recorded. Adequacy of data for reproduction.

8. (C) During Tests 1 through 6 data will be recorded to determine the following:

a. Time needed to train personnel to operate equipment.

b. Equipment preparation time and difficulties encountered.

c. Settings, alignment, and procedures of operation to obtain optimum performance.

d. Comparison of ground record 35mm and air record 70mm recording film.

e. Effects of vehicle handling and aircraft vibration.

f. Maintenance requirements with respect to breakdown frequency, difficulty of repair, spare parts requirements, and test equipment requirements. (See Data Sheet, Annex E)

g. Factors affecting reliability and ease of operation.

h. If the "Operational and Maintenance Handbook" is adequate for clarity and completeness of written matter, photographs, and schematics.

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ANNEX B - DATA SHEET

AN/AAD-2 DRONE INFRARED DETECTOR

FLIGHT _____ DETECTOR CELL _____

DATE _____ OPERATORS: Air _____

TIME: Ground _____
Flight _____

Equipment Operated _____

AREA _____ AUTOMATIC GAIN CONTROL
(AGC) LEVEL _____

PILOT _____

FILM FOOTAGE: FILM TYPE:
(Air) Start _____ Air _____

Finish _____ Ground _____

(Ground) Start _____

Finish _____

WEATHER:

Air Temperature _____

Ground Temperature _____

Visibility _____

Relative Humidity _____

Precipitation _____

AN/AAD-2 GROUND STATION

[illegible]

AN/AAD-2 AIRBORNE EQUIPMENT

[illegible]

ANNEX E

MAINTENANCE DATA SHEET

AN/AAD-2 DRONE INFRARED DETECTOR

INDICATION OF MALFUNCTION:

ANALYSIS OF MALFUNCTION AND CAUSE:

SIGNED _____

DATE _____

CORRECTION OR REPAIR:

REMARKS:

SIGNED _____

DATE _____

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