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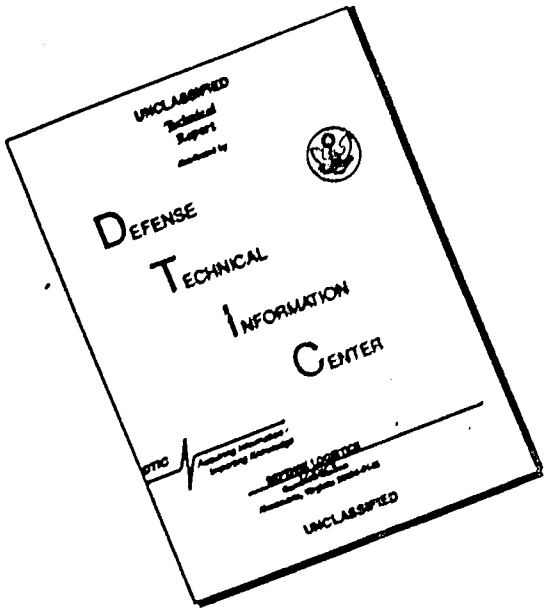

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PRELIMINARY STUDY

ELECTRONIC COUNTERMEASURES AGAINST INFRARED DEVICES (U)

PROJECT 32-56-0013

EW SYSTEMS TEST
USAEPG-3
PHASE III
ORGANIZATION AND
CONCEPT OF EMPLOYMENT

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Preliminary Study

ELECTRONIC COUNTERMEASURES AGAINST INFRARED DEVICES (U)

(Project 32-56-0013)

April 1957

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Electronic Warfare Department
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FOREWORD

This study is one of a series of studies in the U.S. Army Electronic Proving Ground Technical Program, Project 32-56-0013, (USAEPG-3 EW Systems Test) to clarify the problems of electronic warfare in the Field Army area. This study is concerned with techniques and equipments utilizing infrared.

H. McD. BROWN
Col SigC
Chief, Electronic Warfare Department

ABSTRACT

The requirements and capabilities of available infrared countermeasures for the Field Army are evaluated. Particular techniques and equipments that should be developed for the future Field Army are listed. As tactical units that have been proposed for radio-frequency VT-fuze countermeasures can also employ infrared countermeasures, no additional provisions for organization are required.

CONTENTS

Section I. Summary

Although only fragmentary qualitative and quantitative data on Soviet infrared equipment is available, the assumed direction that development in infrared techniques and equipment in the guided-missile field will take is pointed out. The difference between active and passive infrared equipment is explained. Visible illumination in night operations from requests through normal communication channels to counter enemy use of infrared detectors is recommended until at a much later date when infrared viewers will be available in quantity. The design of uniforms and equipment to prevent infrared reflectivity is recommended. The development of intercept receivers and pulsed and modulated-light countermeasures against infrared-fuzed proximity missiles is also recommended. As the tactical units that have been proposed for radio-frequency VT-fuze countermeasures can also employ infrared countermeasures, no additional provisions for organization are required.

Section II. Introduction

1. PURPOSE

It is the purpose of this report to present an assessment of the infrared countermeasures requirements and capabilities of the Field Army and to suggest organizational structures to best utilize these capabilities within the framework of present Field Army structure and within the structure of a Pentana-type Army. In the latter case, the probable development of enemy infrared equipment and the requirements to counter this equipment will be considered.

2. BACKGROUND

The fields covered by the term "infrared" are diverse. Its primary connotation is that applying to "seeing in the dark", and this has been its principal application in modern warfare. The use of infrared as an aid to night fighting can be expected to increase in importance as improved equipment becomes available and as the scale of night operations increases. It is to be expected that accentuation of night operations will be required to reduce vulnerability to enemy mass destruction weapons and to keep pressure on the enemy for the most effective exploitation of friendly atomic weapons. As these night operations must be as secure from detection as possible, infrared, rather than visible light, is advantageous.

Certain other technical functions that are now performed by radio-frequency devices can be shifted to utilize the infrared portion of the spectrum. As infrared techniques and equipment become further developed, it is reasonable to expect their application to increase in those fields where the use of shorter wavelengths provide advantages or where limitations occur in the use of radio frequencies (i.e., crowding of the radio spectrum or availability of well developed radio-frequency countermeasures). These applications include proximity fuzes, radar, and missile guidance and homing.

The development of infrared countermeasures equipment and techniques does not appear commensurate with the probable need for them.

3. ENEMY CAPABILITIES

No information appertaining to types of characteristics of current Soviet infrared equipment, the quantity of such equipment, if any, or its tactical employment is available.

Fragmentary data obtained shortly after World War II by prisoner

interrogation, knowledge of German World War II infrared equipment known to be in Soviet hands, and estimates of Soviet technical capabilities have led military infrared authorities in this country to believe that Soviet infrared equipment is no more advanced than that in use by the United States; however, it may be available in larger quantity, particularly in the near infrared region, which includes active equipment for night driving and related purposes.

Section III. Infrared Equipment, Technical Considerations

4. ACTIVE EQUIPMENT

Active infrared, often termed "near-infrared", equipment utilizes detector and wavelength conversion units associated with infrared illuminating sources. The infrared radiation reflected from the target is detected and converted to a visible image or indication. Representative of this class of equipment are the Sniperscope and the Leaflet II night-driving equipment. The following general statements can be made of this equipment but active infrared, which is not itself a countermeasure, is of advantage in a countermeasure program only as a means of locating the enemy equipment to be countered.

1. Near-infrared detectors can detect the active source at a considerably greater distance than the user of the active source can see.

2. Direction of fire against the illuminating source is a direct and effective countermeasure.

3. Evasive action may be taken to escape detection.

4. Camouflage is effective. It is required that the infrared reflectivity of the surface to be protected be as nearly as possible identical to that of the background.

5. Active infrared equipment is in an advanced state of development.

5. PASSIVE EQUIPMENT

Passive infrared equipment detects target radiation and does not require an illuminating source. The following considerations apply:

1. There is no known method of detecting passive infrared viewers since they do not radiate.

2. Camouflage is effective but different in principle from that used against active infrared. It is required that the temperature and emissivity of the camouflaged surface be as nearly as possible identical to that of the surrounding terrain.

3. Present United States passive infrared equipments are of doubtful or unproved utility in field service. Improved and field-useful devices can be expected to be available in the near future.

Section IV. Surveillance Countermeasures, Present Army

6. AVAILABLE EQUIPMENT

1. Metascope, type US/F

   The metascope is a passive device that accepts near infrared. It weighs 14 ounces and is enclosed in a 3-inch cubical metal case. A radium button serves as power supply.

2. Image metascope

   The image metascope gives an improved capability for viewing near infrared but requires an internal electric power source. Models that utilize either batteries or hand crank generators have also been fabricated.

7. CONCEPT

Metascopes, which are presently distributed (146 per infantry division), are to determine if and when the enemy employs active infrared. Communication via normal command channels will be used to request howitzer illuminating shell or searchlight illumination of the battle area.[3*]

No specific electronic-warfare organization is required to carry out this concept.

8. TECHNICAL CONSIDERATIONS

The use of visible illumination as a counter to enemy use of active infrared has the following advantages:

1. Near-infrared capabilities of the enemy do not force us to develop equal capabilities to avoid suffering a disadvantage. The intolerable situation wherein we are required to carry in reserve a large quantity of seldom-used infrared equipment is avoided.

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* Superior numbers refer to items in the bibliography.

2. The weight, bulk, and limited capability of near-infrared equipment as compared to visible illuminating sources gives us a margin of advantage over the enemy who uses near infrared.

3. In most cases, use of visible illumination will force the enemy to turn to visible illumination also.

9. EQUIPMENT REQUIREMENTS

1. There is a requirement for a metascope which, in addition to its surveillance function, may be used as a rifle sight so that aimed fire may be directed at enemy near-infrared sources.

2. There is a requirement for camouflage of the following types:

   a. The infrared reflectance of uniforms and equipment used at the front lines should be such that they will blend with the terrain.

   b. Power equipment (vehicles, generators) used within range of enemy viewers should be designed so as not to radiate with appreciable intensity in the near-infrared region.

   c. It is recommended that design of new equipment be done with these factors as partial criteria. Extensive modification of present equipment is not warranted.

Section V. Surveillance Countermeasures, Partana Army

10. CONCEPT

1. The design of Army equipment will be such as to make difficult its detection by passive-infrared viewers with particular emphasis on prevention of detection by airborne infrared surveillance.

2. Improved metascope-size viewers with intermediate infrared capability will be used to determine if and when the enemy is utilising active infrared. Communication via normal command channels will be used to request howitzer illuminating shells or searchlight illumination of the battle area.

3. No specific electronic-warfare organization is required to carry out this concept.

11. TECHNICAL CONSIDERATIONS

1. The absence of a means of detection of enemy use of passive-infrared surveillance imposes the logical requirement that all night movements be protected from infrared surveillance. The magnitude of this protection requirement appears to preclude a continuous camouflage effort in the field. The importance of early action at the design and production level to provide "built-in" camouflage by such means as concealing hot spots of vehicles is, therefore, clear.

2. Abandonment of the concept of visible battlefield illumination as countermeasure to enemy use of active infrared appears to await the development of lightweight, inexpensive passive viewers suitable for distribution to all personnel. It is not considered likely that such equipment will be available in the 1960-70 period.

12. EQUIPMENT REQUIREMENTS

1. It is required that concealment of hot spots from passive-infrared detection be given serious consideration in the development of all new vehicles and weapons.

2. Improved lightweight, passive infrared viewers with far-infrared capabilities are required in advance of enemy development in this field.

Section VI. Proximity Fuzes

13. TECHNICAL CONSIDERATIONS

1. The use of infrared instead of radio wavelengths to detect proximity to targets is technically feasible and presents a reasonable enemy counter to radio fuze jamming.

2. It is most probable that the infrared fuzes which will be encountered will be either the "rise time" or "modulated source" types. These types are both active (i.e. radiating) fuzes and may operate either in the visible or the infrared spectrum.

3. The "rise time" fuze is detonated when its return signal increases in amplitude rapidly as it approaches its target. A pulse of infrared energy such as may be obtained from a shuttered searchlight will predetonate such a fuze.

4. The "modulated source" fuze detonates only on receipt of a signal varying at the fuze modulation frequency. A probable upper limit for this frequency considering the present state of the art is 10,000 cps. A swept, modulated-frequency, broad-band jammer is indicated as countermeasure equipment.

14. CONCEPT

Tactical units proposed for radio frequency VT-fuze countermeasures will be given infrared-countermeasures capabilities and responsibilities also.

No additional electronic-warfare organization is required to carry out this concept.

15. EQUIPMENT REQUIREMENTS

1. There is a requirement for a light source radiating in both the visible and near infrared portions of the spectrum which will provide: single pulse output and frequency swept pulse output.

2. There is a requirement for an intercept receiver capable of determining the pulse repetition rate of modulated source fuzes.

Section VII. Conclusions

16. From this study, the following conclusions are made:

1. Infrared surveillance countermeasures do not require specific electronic-warfare organizations for their implementation.

2. Infrared-proximity-fuze countermeasures can be implemented in conjunction with radio-frequency-fuze countermeasures and by the same electronic-warfare organization.

3. There is and will be need for continual improvement of miniature light-weight infrared viewers that are adaptable for use as infrared weapons sights.

4. Primary emphasis in the infrared-surveillance-countermeasures field is required at the design and manufacturing level. Army field equipment should embody infrared concealment as a design criterion.

BIBLIOGRAPHY

1. Army Field Forces Board 5, Infrared Development Program, (Secret) Army Field Forces Board 5, Fort Bragg, N.C. November 1954.

2. Brown University, The Military Role of Infrared Detection, Project Metcalf, Final Report in two volumes, (Secret) Brown University, Providence, Rhode Island. October 1952.

3. Headquarters CONARC, Fort Monroe, Va., Combat Operations Research Group, Combat Developments Section, Requirements for Infrared Equipment for use by the Army in the Field During the Period 1960-70, Special Study, (Secret) Combat Operations Research Group, Combat Developments Section, Headquarters CONARC, Fort Monroe, Va. September 1955.

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