AD-756 939

Narcotic-Explosive Detector Dogs

Southwest Research Institute

prepared for

Army Land Warfare Laboratory

JANUARY 1973

TECHNICAL REPORT NO. LWL-CR-20B72

NARCOTIC-EXPLOSIVE DETECTOR DOGS

Final Report
Contract No. DAAD05-71-C-0285

By
Southwest Research Institute
San Antonio, Texas

January 1973

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U. S. ARMY LAND WARFARE LABORATORY
Aberdeen Proving Ground, Maryland 21005

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Southwest Research Institute San Antonio, Texas	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE

NARCOTIC-EXPLOSIVE DETECTOR DOGS

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final Report - Contract No. DAADO5-71-C-0285

5. AUTHOR(S) (First name, middle initial, last name)
Approved: C. William Hall

6. REPORT DATE January 1973	7a. TOTAL NO. OF PAGES XI 17	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. DAADO5-71-C-0285 b. PROJECT NO. c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) Project 13-3095, Amendment 2 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	

10. DISTRIBUTION STATEMENT

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY US ARMY LAND WARFARE LABORATORY ABERDEEN PROVING GROUND, MD 21005

13. ABSTRACT

A study was conducted to determine the feasibility of training dogs to search for and detect the odors of nitroglycerin dynamite, TNT, C-3, C-4, a mixture of 96% ammonium nitrate fertilizer and 4% JP4 fuel oil, smokeless powder as contained in exploded cartridges, and heroin (pure and cut 50%).

Three dogs, one male German Shepherd, one female Labrador Retriever, and one male Standard Poodle completed the training program. Two dogs, the German Shepherd and Labrador Retriever were trained to search rooms, warehouses, airplanes, etc.; the Standard Poodle was trained to search for contraband on or carried by a person.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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FOREWORD

The work described in this report was performed under Contract DAAD05-71-C-0285, Amendment P00004. This work was performed at Southwest Research Institute, San Antonio, Texas. At the completion of the contractual period the three dogs were delivered to MERDC, Ft. Belvoir, Virginia.

TABLE OF CONTENTS

I. INTRODUCTION

It has become increasingly evident that specially trained dogs can be effectively utilized in a variety of tasks involving olfactory detection. Dogs have been successfully utilized in Southeast Asia for tasks involving the detection of concealed mines, trip wires, booby-traps, and tunnels. More recently it has been demonstrated that dogs can be effectively utilized in detecting concealed bombs and explosives. It would appear that the use of dogs to detect narcotics would be a very useful extention of canine olfactory sensory capabilities. A study, which is described here, was undertaken to determine the feasibility of training dogs to detect explosives such as dynamite, C-4, smokeless powder, etc. and heroin, (pure and cut 50%).

II. CONCLUSIONS

1. It is possible to train dogs to detect small amounts of the following explosives and narcotics: nitroglycerin dynamite, TNT, C-3, C-4 a mixture of 96% ammonium nitrate fertilizer and 4% fuel oil, smokeless powder, combusted products of smokeless powder, and heroin (pure and cut 50%).

2. It is feasible to employ dogs trained to discriminate the odor of explosives and narcotics to search under conditions which simulate conditions of operational use.

3. Dogs trained to room search can be worked on or off leash.

4. Dogs can be trained to search for contraband both on and carried by a person.

III. MATERIALS

A. Dogs: A total of 3 male and 2 female German Shepherds, 1 female Labrador Retriever, and 2 male and 2 female Standard Poodles were accepted as tentative candidates for this program.

Although the concept of incorporating additional capabilities to trained patrol dogs would appear to have certain merits; the dogs selected for this project were naive dogs with no known formal training. In addition, the training of the detector dogs was programmed so as to insure that upon completion of the training period these dogs would not only be multihandler but also could be worked by persons with only minimal instruction in dog handling. Within these parameters, it was necessary to select dogs with nonagressive temperaments and to discourage any aggressive behavior during the training period.

B. Facilities

Dogs were kenneled in modern outdoor kennels. Explosives were stored in large bunkers on the Institute grounds. Special measures were taken to insure maximum security of all narcotic materials. A wide variety of environmental settings were made available for training purposes. These included both vacant and occupied buildings on the Institute grounds, both private and public airport facilities, and private residences.

C. Explosives

Commercial nitroglycerin dynamite (Red Cross Extra 40%), a variety of brands of commercial smokeless powder, commercial TNT, C-3, C-4, recently fired pistols, and a mixture of 96% ammonium nitrate fertilizer and 4% fuel oil (JP-4) were used in the training program. Methyl salicylate is a very volatile liquid which was used as the initial training odor in this program.

D. Narcotics

One hundred grams of uncut heroin hydrochloride was furnished by the Justice Department. This sample was analyzed to be at least 95% pure by chromotography and spectrographic methods.

It was assumed that the quantities of heroin which were to be used for training purposes had some odor configurations which would be peculiar to the particular sample. In addition, heroin will deteriorate a certain amount even if it is fairly well sealed. The amount of decomposition is a function of age and how well it has been sealed.

The following is the procedure which was used in cleaning bulk heroin or cocaine of extraneous odors, moisture, or other contaminates not consistently associated with these narcotic agents.

1. All bulk heroin was removed from its original container and placed in a gas washing bottle. Nitrogen (dry medical grade) gas was run through the washing bottle by means of a teflon tube. This purge removed most moisture, acetic odor, and other extraneous odor from the heroin.

Once the stock quantity of heroin had been cleaned, individual samples which would be used during training were prepared. Special precautions were taken in preparing and storing these samples.

Prior to making the S+ samples (positive controls) identical S- samples (negative controls) were made. These S- samples were identical to the S+ samples except for the absence of the drug. The desired quantity of the drug was removed from the stock bottle with a sterile spatula and put into plastic freezer bags. The plastic bag was then heat sealed to insure that a minimum of humidity or other contaminates would become associated with the heroin.

The following is a description of how the S+ samples were stored when not in use: S+ samples were stored in a large desiccator jar. A generous quantity of drierite was placed in the bottom of the desiccator jar and covered with a porcelain plate. Drierite changes color after it absorbs moisture and was replaced when this occurred. The desiccator in which the samples were stored was vacuumed and then purged with dry nitrogen gas after the samples were placed inside. All samples were stored in this manner.

IV. METHODS

A. Preliminary Training

The purpose of this phase of training was to build rapport with the dog and to condition the dog to the secondary reinforcers "good dog" and "no". In this initial stage the dog also learned to come to the handler on command. The dog learned that "good dog" signaled that it was going to receive food and that "no" signaled that it would be isolated.*

B. Initial Olfactory Training

In order to condition the training odor (methyl salicylate) as a secondary reinforcer, the dog was given food and praise in the presence of the S+ odor and not rewarded if the odor was absent. The S+ odor was put inside a Buchner funnel and the dog taught to sniff the funnel. The dog was rewarded when it sniffed the S+ funnel and received no reward if the S+ odor was not present in the funnel. The number of funnels to be sampled by the dog was gradually increased from one S+ funnel and one S- funnel to one S+ funnel and five S- funnels. Once the dog began to "alert" in the presence of the S+ funnel the sit response was incorporated. This training continued until the dog reliably sat in the presence of the S+ funnel and did not respond to the S- funnel.

C. Transfer to New Odors

The procedure for transferring the dog to an additional odor was carried out as follows: first, each dog was given training to establish the training odor (methyl salicylate) as a secondary reinforcer, by pairing the training odor with food. Second, the dogs were trained to sit to the training odor in a simple discrimination situation. The initial phase of discrimination training consisted of a three-choice discrimination task in which the dog was conditioned to sit in the presence of the S+ odor and to ignore the S- stimuli.

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*LWL Technical Report No. LWL-CR-01B70, Training Dogs for Explosion Detection, October, 1971.
LWL Technical Report No. LWL-CR-60DJ71, Training Dogs for Narcotic Detection, July, 1972.

The procedure for taining the dog to respond to additional odors was relatively simple and proved to be fast and effective. The same three-choice discrimination task previously used with the initial training odor was used to train the dogs to new odors. The technique for transferring to each of the new S+ odors was as follows:

1. The session was begun with a few trials using the training odor.

2. Once the dog was working well on the training odor, the funnel with the training odor was removed and a funnel with the new odor was put in its place.

3. On the first trial with the new S+, the dog was brought in and would begin to sniff each of the funnels, just as it had previously done. At the precise instant the dog sniffed the new S+ funnel, the handler immediately said "Good dog" and rewarded the dog with food. With the exception of heroin, the dogs learned to respond to each of the new odors in only a few trials. There was more difficulty in transferring the dogs to heroin, as this substance is considerably less odorous than the explosive odors. Although the transfer to heroin took longer, all three dogs eventually became efficient in heroin discrimination.

The following is the chronological sequence that was followed in adding the new odors: (1) nitroglycerin dynamite, (2) C-3, (3) C-4, (4) ammonium nitrate fertilizer and 4% JP4 fuel oil, (5) smokeless powder, (6) combustion products of smokeless powder, (7) TNT, (8) heroin, and (9) heroin cut 50%.

The use of certain controls is essential during all training exercises. It has been pointed out that all heroin and cocaine samples were maintained in plastic freezer bags; consequently, several empty plastic bags were always planted in the area to be searched. This assured that the dogs were responding to heroin/cocaine and not to the plastic bag or to human odor. If these precautions are not taken, the dog will quickly learn to respond to the more prevalent odors (human odor and plastic bags) which are necessarily associated with the S+ sample.

Periodically throughout the training period, the dogs were subjected to controlled laboratory tests. These tests were for the purpose of testing the dogs on newly prepared heroin or cocaine samples.

D. Discrimination Training with Aspirin, Glacial Acetic Acid, and the Diluents Mannitol, Lactose and Quinine

Once a reliable response to heroin had been established, further discrimination work with various S- substances was carried out. The dogs were initially tasked to discriminate heroin in a three choice discrimination in which the second and third choice was either glacial acetic acid in mixtures of 1/10, 1/100, 1/1000, or 1/10,000 with water, or common aspirin. All three dogs readily made this discrimination.

Heroin was cut 50% with each of the three diluents, mannitol, lactose, and quinine. The dog was then tasked to positively respond to the heroin mixtures and to ignore S- samples consisting of 100% of each diluent. All three dogs made this discrimination.

Once the dog reliably made these discriminations in the laboratory setting, they were tasked to the same problems in more realistic operational settings (room search and personnel search).

E. Search Pattern

The two room search dogs were trained to search both on and off leash. In general, the following was found to be the most efficient way in which to work the room search dogs. The dog should be run off leash. Initially upon entering the area to be searched, the dog should be allowed to move around the area and search at it's own pace. It was found that in many instances this very cursory search pattern was sufficient to result in a very high detection rate. In addition, if the dog failed to detect a target it would intensify its search behavior until removed to search another area or given direction to search by the handler.

Direction of the dog by the handler was made on a judgmental basis by the handler. Direction was given if the dog quit actively searching or if the handler noted that the dog had obviously not searched

a particular area or object. The dog was also directed to any area the handler felt should be more thoroughly searched. This search procedure was found to be most effective in maximizing the dog's capabilities.

During training sessions the personnel search dog was worked on leash. Although worked on leash, the dog was generally allowed to move around and search at its own pace. This dog was also given direction by the handler on a judgmental basis.

It is interesting to note that although these dogs searched primarily at their own pace, all three were very responsive to directions given by the handler. When directed, these dogs would quickly orient to the area or object to which they had been directed and intensify their search behavior.

F. Handler Training

For two weeks during the last month of the training period, handlers, one from MERDC, Ft. Belvoir, Va. and one from SwRI were given training in working the two room search dogs. This instruction was given at SwRI. During the last two weeks at SwRI, these two dogs were evaluated by MERDC on heroin detection.

The one personnel search dog was evaluated by MERDC at SwRI. This evaluation included practical exercises in the detection of heroin (pure and cut 50%) and hand guns.

G. Isolation and Maintenance of the Basic Odor of Heroin

Heroin is extremely sensitive to moisture; and when exposed to the atmosphere for only a short period of time will very quickly absorb moisture from the air. This process of hydrolysis precipitates a definite and discernable change in the odor profile of heroin. Special precautions were taken in order to insure that the dogs were being trained to the fundamental odor of heroin and not be a chemical radical produced when moisture decomposes heroin. These precautions included both "cleaning up" bulk samples and training aids and maintaining these samples in a moisture free and uncontaminated state. The following is the method used to achieve these goals.

All quantities of heroin which were to be used in training were processed in order to remove any contaminating material which might be associated with that particular bulk sample. After the bulk samples were processed, they were stored in dessicator jars which were vacuumed and purged with dry nitrogen. This insured that the stock samples were maintained in a relatively inert atmosphere.

Similar steps were taken to insure that the samples which were used in daily training exercises were also maintained in a moisture free and uncontaminated state. Individual samples were put in plastic freezer bags. These bags were heat sealed. When not in use these individual samples were also put into dessicator jars, vacuumed, and purged with dry nitrogen. These training samples were frequently changed in order to insure that no extraneous substance was systematically associated with the heroin sample.

V. RESULTS

Three trained dogs (one German Shepherd, one Golden Labrador Retriever, and one Standard Poodle) were delivered to MERDC at the conclusion of the training effort. All three dogs were capable of discriminating each of the explosive/narcotic materials specified in the contract. The two room search dogs were capable of searching rooms, vehicles, cargo, etc.; the personnel search dog was capable of searching for contraband on or carried by persons in areas of which there were large groups of people.

VI. DISCUSSION

The present study has demonstrated that it is feasible to use trained dogs to detect various explosives and heroin (pure and cut 50%). In addition, dogs can be trained to search buildings, cargo, airplanes, etc. and detect a high percentage of contraband if it is hidden in the designated area. It is also feasible to train dogs to search for contraband on or carried by persons. Personnel search dogs are capable of working in and around large groups of people with minimal loss of efficiency.

To have maximum operational effectiveness, a trained dog must be worked by a handler who has received instruction in the operational use of the detector dog. In order to perform his functions adequately, the handler must have an understanding of the basic principles of operant conditioning and a working knowledge of how to apply these principles in the everyday deployment of the detector dog. The handler should also have an understanding of odors and be sufficiently alert to detect problems centering around either the misuse of odorous materials or improper handling of the detector dog.

The handler must be knowledgeable enough to detect problems before they have become chronic. He should be cognizant of the possible consequences of poor training practices. Training manuals detailing the procedures for training and for handling both explosive and narcotic detector dogs are available.

Several factors which may influence the overall efficiency of the detector dog were continually monitored during the training period. The following is a brief review of some of these factors:

1. Marking: There is always the possibility that the dog will "mark" the S+ stimuli (positive control). That is, when the same S+ stimuli are reused, the dog may leave a sign by licking or salivating on the material which it can detect on subsequent trials. Therefore, it is necessary to replace the old S+ materials with new samples frequently.

2. Following: When several dogs are trained to search for the same set of samples, some dogs may learn to follow others. Also, there is always the chance that the odor of food is also present in the vicinity of the hidden S+ after one dog has been rewarded there. Even if the dog is not depending entirely on either of these two extraneous cues, it may use either or both to orient to the general vicinity of where the S+ is hidden. Appropriate steps were taken to insure that this potential problem did not develop.

3. Human odor: The sensitivity of the dog to most odors makes it possible to train it to detect almost any type of odor. Dogs are especially sensitive to the odor of humans. Training problems can develop because of this keen sensitivity. There is always the possibility that the dog is detecting the odor of the persons who prepared or planted the S+ instead of the actual S+ odor. This is especially troublesome if the S+ odor is weak. Having different people prepare and hide the S+ materials eliminates this problem.

4. Handler Cues: Any behavior on the part of the handler, whether intentional or not, may affect the dog's behavior. Handler cues may well become a problem if the handler knows where the S+ is hidden in the area being searched. In other words, if the handler knows the conditions under which the dog is working, he may unintentionally cue him. Generally, it can be assumed that if the handler does not know anything about the placement of the S+ and S- stimuli, he will not cue the dog, and the dog will not learn to watch the handler for cues.