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# USER'S GUIDE: LAND MINE AND BOOBY TRAP DETECTOR DOGS (U)

## FINAL TECHNICAL REPORT VOLUME III

by

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9 Final Technical Report.

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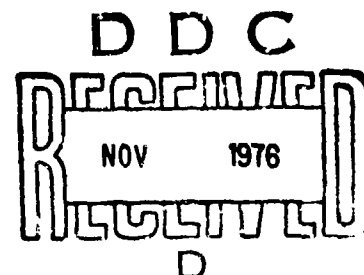
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## FOREWORD

This manual is intended as a field guide and procedures manual for use by appropriately trained canine specialists during service utilization of land mine and explosive booby trap detector canines. As such, its primary purpose is to provide a synopsis of the salient techniques and considerations relevant to the deployment of such animals. Most of the topics treated herein are discussed in greater detail in Volume II of this series, "Training and Deployment of Land Mine and Booby Trap Detector Canines (1)," and the reader is urged to refer to the latter volume for further information as required.

The present document is not a dog training manual; complete details concerning the training of initially inexperienced canines for land mine and booby trap trip wire detection applications may be found in Volume II(1). Dog selection criteria are discussed in Volume I, "Selection of Dogs for Land Mine and Booby Trap Detection Training (2)."

This field guide assumes the availability of a fully-trained land mine and explosive booby trap detector dog. It is also assumed that the canine specialist (dog handler) has completed an approved course of training in the utilization and maintenance of such animals.

The techniques and procedures herein summarized were developed for the United States Army Mobility Equipment Research and Development



Command, Ft. Belvoir, VA, over a period of approximately three years by Southwest Research Institute, San Antonio, TX, under Contract No. DAAK02-73-C-0150. Large quantities of data concerning the performance of land mine/booby trap detector dogs were collected and assessed during the course of the same program. A portion of the latter have been reported elsewhere (3).

## CHAPTER I

## INTRODUCTION

Throughout the history of warfare, including the recent hostilities in Southeast Asia, specially trained dogs have accompanied man into combat or have been used in direct or indirect support of combat operations. Initially, entire formations of attack dogs, sometimes fitted with formidable spiked collars and body armor, were sent into battle against enemy forces. With the development of gunpowder and the associated modifications in military tactics, the value of dogs in direct combat roles diminished significantly. Nevertheless, his usefulness in other military applications increased. During World War I large numbers of canines were trained as sentries, scouts, messengers, ammunition carriers, and casualty dogs. It has been estimated that Germany employed over 30,000 dogs for such purposes, and approximately 20,000 animals served in similar capacities with the French Army (4).

Dogs were employed on an even larger scale during World War II. Over 250,000 canines served with the armies of the Allied and Axis powers, and many were awarded high honors for their wartime performance.

The first large-scale use of dogs for land mine detection purposes was by the Russians during World War II. One account suggests that as many as 100,000 mines were detected by these animals on roads, in towns and villages, and at bridgeheads. According to the same report,

one especially talented dog located almost 2,000 mines in one three week period (5).

Although certain electronic instruments have proven reasonably effective in the detection of metallic land mines, the performance of detectors of this type is not fully satisfactory in the case of nonmetallic mines and related explosive booby trap and "dirty-trick" devices. Therefore the continuing military need for an effective method of detection of these kinds of battlefield threats has been met increasingly by the use of specially trained dogs.

Dogs trained to detect explosive substances have demonstrated tremendous value as land mine/booby trap detectors. Their sense of smell has been shown to be extremely sensitive to the odor of explosive materials contained in land mines, it is highly selective, and the animals have a detection range (off leash) which reduces physical danger to the handler. Furthermore, most breeds of dogs are intelligent, motivated to perform, respond reliably to verbal and non-verbal commands, and can be trained to execute complex tasks.

For certain types of devices (for example, non-metallic mines, trip wires) and in certain circumstances (for example, trails over rough ground, railroads, inside buildings), canines which have been specially trained for explosive detection appear to provide the best all-around detection method currently available.

## CHAPTER II

### OPERATING GUIDELINES

#### MAINTENANCE OF DOG AND EQUIPMENT

A dog is not a machine which can be requisitioned from inventory, pressed into service, and then returned to storage until needed at some future time. It is an animate, living being that must be fed, watered, and kept healthy at all times. As the dog's handler, it is your responsibility to insure that these needs are met during periods of service deployment. You must also not lose sight of the fact that your land mine/booby trap detector dog is a highly trained organism whose detection skills must be continually maintained during idle periods. This responsibility rests solely in your hands.

Physical Care. Proper physical care of your dog requires provision of adequate rations, clean water, routine grooming, as well as daily examination for evidence of illness or injury. Your training as a canine specialist will enable you to recognize and treat minor wounds and illnesses. More complex medical problems or failures to respond to standard treatments should be referred to an authorized veterinarian.

The amount of food required to maintain superior health and working stamina will vary considerably depending upon physical demands. For example, a dog in active service will need greater quantities of food than will idle animals. Harsh conditions such as extreme cold

will similarly increase your dog's food requirements. Remember also that extra water must be made available during deployment in warm climates.

Physical Conditioning. Dogs, like humans, require frequent exercise to remain in top physical condition — an absolute necessity in military dogs whose work may demand strenuous exertion for long periods. The rigors of daily deployment will normally serve to maintain your dog's physical conditioning, but additional exercise will be needed during periods of light duty. This need can be met most efficiently by the use of a standard canine confidence course (see Volume II of this series for details). However, such a facility may not always be available in the field, and you must use your imagination to improvise a make-shift exercise area in such cases. Running, climbing obstacles, and jumping over fallen logs, etc. all provide suitable substitutes for a formal confidence course. Be sure to inspect all obstacles first, however, to insure that your dog is not accidentally injured on sharp edges or similar hazards.

Performance Maintenance. Lack of adequate practice leads to a decline in the performance of all complex learned skills. Therefore, it is extremely important that well-trained land mine/booby trap detector dogs be given frequent refresher sessions to maintain peak performance especially during periods of light service duty. In such cases you should plan to conduct at least two 2-hour detection practice sessions per week.

Best results will be obtained if the following guidelines are observed:

- 1) Practice sessions should be undertaken in settings which resemble as closely as possible the circumstances in which the dog will be called to serve.
- 2) A random assortment of live (defuzed) and inert mines, booby trap trip wires, and distractor items should be used for practice sessions to insure that the dog's discrimination skills are maintained.
- 3) Frequent use of the same practice area should be avoided so that the dog does not learn to follow his own trail.
- 4) Practice sessions must be conducted by the dog's regular handler.
- 5) Practice exercises should be conducted according to the procedures discussed in Chapter VI of Volume II of this series of manuals (1).

Maintenance of Dog Equipment. Leashes, collars, harnesses, and other pieces of basic working dog equipment must be properly cared for so that they will remain useful for long periods of time and to prevent unexpected failures during service deployment. If not cared for these items will soon rot or corrode so that they cannot withstand the strain of normal useage. Metal equipment should be frequently inspected for corrosion. Lightly corroded areas should be removed with steel wool or sandpaper and the affected item wiped with an oily cloth. Heavily corroded items must be replaced. Leather items should be kept clean by wiping with a damp cloth followed by applications of neat's-foot oil to prevent them

from becoming dry and brittle. All equipment should be stored in a dry, protected location when not in use.

Transportation and Field Kenneling. Certain procedures must be followed to insure the health and safety of the dog when being transported from one location to another. A sturdy wooden or metal crate is normally used to house the dog during either ground or air transportation. Metal transporting crates such as the U. S. Air Force transporting kennel shown in Figure 1 are generally preferred over those made of wood since they are stronger and more easily sanitized. Regardless of construction, the transporting crate must be large enough to permit the dog to shift position and turn around inside. Large numbers of dogs may be transported simultaneously in individual crates securely attached to a special trailer such as the one shown in Figure 2.

Be sure to load transporting crates on the vehicle in a manner which will insure adequate ventilation; do not place the dog in a location where there is a danger of exhaust fume accumulation.

Never confine your dog to a transporting crate for long periods. Frequent exercise and water breaks must be scheduled during lengthy trips.

Finally, transporting crates may be used as temporary field kennels until more proper facilities can be made available. However, careful selection of a suitable location is extremely important in such

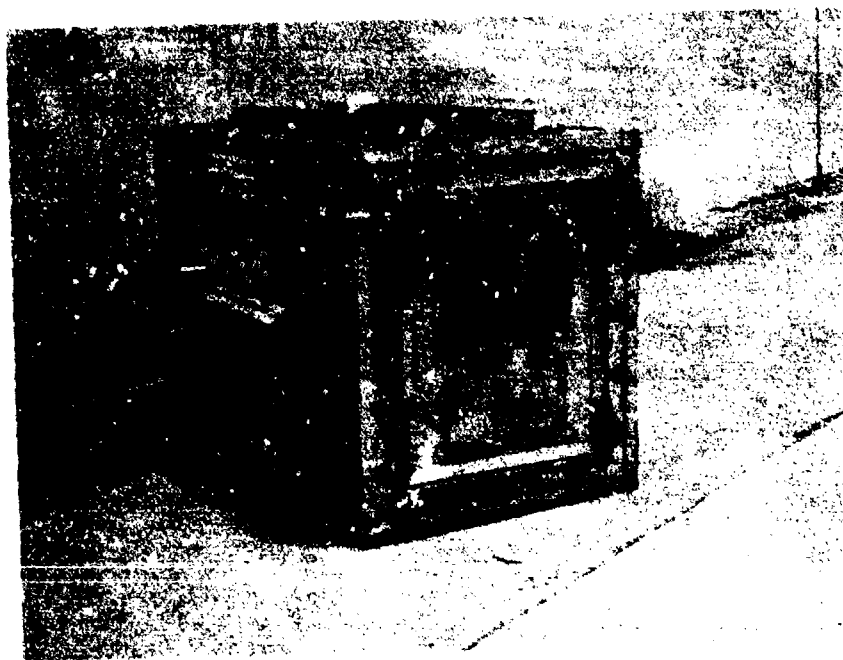


Fig. 1. Metal dog transporting crate.





Fig. 2. Specially-fabricated trailer for individual transporting of large numbers of dogs.

cases. The area must be dry and the crate raised a few inches off the ground on wooden blocks or similar supports. Provision of shade and wind protection is also necessary. Any ventilation holes on the top of the crate should be temporarily covered with waterproof tape to keep out rain or snow. An area for exercise must also be provided.

### DOG HANDLING PRINCIPLES

The method by which dogs learn and become competent in the performance of complex detection tasks is by repeated rewards ("reinforcement") for correct responding. Immediate and consistent reinforcement of the correct response is the key to success in any dog training program. This principle cannot be overstressed. No amount of reinforcement will result in the learning of a desired response unless the dog knows what is demanded of him to begin with. Worse, repeated reinforcement of incorrect behaviors may lead to the learning of erroneous responses or to a decline in the performance of skills which have been learned earlier. Therefore, the latter practice must be avoided at all costs.

Although the entire philosophy of dog training is based on the notion of positive reinforcement of correct behavior, the need for correction will arise from time to time. If a dog makes an error or commits an act of misconduct, it must be corrected in order to learn right from

wrong. Withholding of food and praise, a sternly spoken "NO," or a sharp jerk on the leash is normally adequate punishment. Correction must be administered immediately since the dog cannot associate a reprimand with an error committed in the past. Never correct a dog unless it already knows the correct response in a given situation. To do so is totally unfair and may confuse the dog concerning what is being demanded of him. Harsh punishment is neither desirable nor necessary during the training and deployment of detector dogs. Physical reprimands are used only for acts of defiance, biting, or deliberate disobedience.

When deploying your dog on operational missions, always employ the same set of verbal commands that was used during training. Dogs do not comprehend complex language. Rather, they learn to associate the sound of spoken commands with the appropriate behavior. Thus, to suddenly introduce a new set of commands will only cause confusion.

Remember, finally, that expressions of anger have no place in a proper handler/dog relationship. Nothing will be gained by verbal abuse or similar emotional outbursts. If such foolish behavior on the part of the handler has any effect at all it is probably negative and may act to destroy the dog's confidence and trust. Patience and firmness will lead to best performance.

## HANDLER/DOG RELATIONSHIP

As a land mine/booby trap detector dog handler you must rid yourself of the notion that you are dealing with a household pet. A land mine/booby trap detector dog is a working dog and must be treated as such. Practically all professional dog trainers agree that the roles of household pet and working dog can seldom be combined effectively. Therefore, the detector animal, whether still in training or an accomplished performer, must not be allowed to share the handler's quarters at any time. If the dog receives a large amount of fussing, extra food, and attention outside the working situation, then his performance in the working context is likely to decline. In other words, best performance will result if praise and attention are given mainly in reward for good working performance. This note of caution must not be mistakenly interpreted to mean that the handler should ignore his dog on nonworking days. Quite the opposite is true, but the nature of the working relationship must not be compromised.

Dogs possess a remarkable ability to sense and react to the attitude and emotions of their handler. A handler who approaches his duties with an air of boredom and disinterest is likely to produce the same kind of reaction from his dog. On the other hand, a handler who is enthusiastic and optimistic may well find that his personal attitude contributes favorably to his dog's motivation and performance.

## WORKING MOTIVATION

It is necessary for the dog to be somewhat hungry at the beginning of each work session due to the fact that food reward plays a large role in reinforcing the animal's detection performance. This requirement is achieved by means of careful regulation of the animal's daily food intake. The routine daily ration should not be provided immediately prior to an operational mission; as a general rule, food-related motivational conflicts can be minimized by feeding during late afternoon or early evening hours. Furthermore, the amount of food received as rewards during each work session must be counted as part of the total daily ration and subtracted from the regular evening meal.

Restriction of food intake cannot, of course, be carried to the point of improper nourishment. In general, maintaining a proper feeding schedule will require:

- 1) Accurate weighing or measurement of total daily food intake.
- 2) Frequent weighing of the dog. Continued loss of weight may simply mean that the dog is not receiving enough food; an increase in rations should correct this condition. If not, have the dog examined for intestinal parasites or illness by a qualified veterinarian.
- 3) Observation of the animal's physical condition.
- 4) Behavioral observation (for example, poor motivation in the working situation may be caused by overly generous rations).

Remember also that dogs subjected to strenuous duty need more than normal amounts of food. Finally, animals maintained on an "on-call" status will require careful scheduling of rations to assure maximum motivation during periods of operational deployment.

### FATIGUE AND ILLNESS

Fatigue may at times interfere with normal searching performance — especially under conditions of extreme heat or cold. The animal may continue to search under these circumstances, but its detection efficiency will be significantly reduced. The most practical remedy for fatigue is to avoid its initial development by not forcing the dog to work for extended periods without rest. Periodic access to water is also extremely important.

A dog should not be worked if it appears ill. There may be times, however, when the animal is sick but does not display obvious symptoms. Poor search behavior, low motivation, and lack of normal enthusiasm are frequently observed in such cases. If illness is suspected, the animal should be referred for veterinary examination.

### HYPERACTIVE BEHAVIOR

A tendency toward excessive excitement and hyperactivity (for example, jumping up and down, circling about in excitement, etc.) is sometimes seen in highly motivated dogs following a successful detection.

Such activities are EXTREMELY UNDESIRABLE due to the possibility of accidental detonation of certain types of booby traps and land mines — especially antipersonnel devices requiring very slight detonator pressures. Thus, a properly-trained dog is one which sits immediately upon detection of a live mine and remains almost motionless until led in a controlled fashion to a safe area by its handler.

### IMPORTANT

CORRECTION OF HYPERACTIVITY MAY PROVE EXTREMELY DIFFICULT IF IT IS NOT STOPPED AT THE VERY BEGINNING. THEREFORE, PROMPT CORRECTIVE ACTION SHOULD BE UNDERTAKEN AS SOON AS SYMPTOMS OF THIS TYPE OF BEHAVIOR ARE NOTICED. PROCEDURALLY, THIS OBJECTIVE CAN NORMALLY BE ACCOMPLISHED BY COMMANDING THE DOG TO "SIT" AND "STAY" IMMEDIATELY FOLLOWING THE INITIAL SIT RESPONSE. YOU, AS HANDLER, MUST THEN ADVANCE CAUTIOUSLY TO THE DOG'S SIDE AND LEAD IT 3 TO 4 METERS BACK FROM THE DETECTION SITE AT A SLOW, CONTROLLED PACE. PUNISHMENT OF HYPERACTIVE BEHAVIOR FOLLOWING DETECTION RESPONSES IS NOT A GOOD PRACTICE SINCE THE EFFECTS OF THE REPRIMAND MAY CARRY OVER TO THE SIT RESPONSE ITSELF AND INTERFERE WITH FUTURE PERFORMANCE.

### CARELESS REINFORCEMENT

As indicated previously, learning of complex tasks such as land mine and booby trap detection is based on the principle of repeated positive reinforcement (reward) of the desired response. Fastest

learning and highest reliability of performance require a consistent pattern of (1) reward of correct responses, and (2) nonreward of erroneous responses. For this reason, you must not develop a habit of carelessly reinforcing your dog except when it has made a correct response. You may feel that occasional "free" rewards will act to maintain rapport and attention, but any advantage thereby gained will almost certainly be counteracted by undesirable side-effects. For example, careless reinforcement may lead to confusion on the part of your dog concerning the specific task he has been trained to perform. It may also cause the dog to learn a variety of behaviors which are not relevant to land mine/booby trap detection. Some of these kinds of behaviors may even interfere with proper detection performance. In other words, a working dog must never be permitted to learn that it can earn approval and rewards or evade carrying out a command by begging for food or engaging in other diversionary behaviors.

#### REQUESTS FOR RESPONSE VERIFICATION

Many handlers fall into the habit of repeatedly asking their dog to "Show me" or requesting "Where is it?" in an attempt to pinpoint a target location more precisely or to verify a response when the dog seems hesitant or uncertain. Most dogs quickly learn the meaning of these phrases, and the practice is acceptable if not overdone. However,



requiring that the animal always verify detections may result in confusion regarding what is being demanded of him. Finally, some dogs become impatient or agitated by frequent requests for response verification. This is a very dangerous state-of-affairs since, in its excitement, the dog may accidentally detonate a mine or booby trap. The point should be clear: NEVER ask for a response verification if it causes him to become excited or hyperactive. This should be determined during training or practice sessions and NOT during service deployment.

#### DISTANCE OF TRAVERSE

Unless the weather conditions are extremely hot or cold, a well-trained land mine/booby trap detector dog in good physical condition can be expected to cover a distance of about 2 km per working day searching a path 3-4 m wide. (Depending on circumstances, it may be possible to cover greater distances if longer than normal rest breaks are taken). Thereafter a gradual decline in efficiency may occur as a result of fatigue. Do not attempt to force your dog to work when fatigue has begun to impair his normal efficiency, and remember that he will tire more quickly in hot or cold weather or when the terrain to be searched is unusually rugged.

Infrequent opportunities to respond may also lead to a loss of efficiency, probably because of a lack of sufficient reinforcements and

an associated decline in incentive to work. Similar effects are sometimes observed in narcotic and contraband detector canines. The usual corrective action in such cases involves occasional presentation of a substitute positive target which the dog is allowed to "detect." Unfuzed M14 land mines serve as highly effective "substitute" positive targets. The procedure involved is straightforward: 1) select a safe area, 2) conceal the M14 in this region, and 3) encourage the dog to search until the device is located. The reinforcement which follows these "detections" seems to boost the dog's failing motivation, thereby restoring performance to normal levels. Procedures for using substitute positive targets are also discussed in Volume II of this series (1).

#### ADAPTATION TO FIELD CONDITIONS

From time to time it will be necessary to transport your dog considerable distances from his base duty station for deployment in remote areas. In such cases it will be desirable to wait 24 to 48 hours before putting the dog into service to allow him to recover from the stresses of travel. Maximal working efficiency will be obtained if this practice is observed. A travel recovery period also permits the dog to adapt to local terrain and weather conditions. Dogs with extensive travel experience generally require less time to recover from travel stress and to adapt to local conditions than novice animals.

Overall detection performance in new areas will also be improved if the dog is permitted to engage in several practice sessions on local terrain prior to actual service deployment. Live (defuzed) mines or

appropriate substitute positive targets may be used for practice exercises.

It is recognized that logistic constraints may not always allow time for recovery and practice purposes. Circumstances permitting, however, these procedures are strongly recommended.

### TEAM CONCEPT

For practically all tasks to which highly trained canines may be assigned, the importance of the handler/dog team concept cannot be overemphasized. This concept is of particular importance in land mine and booby trap detection applications where neither dog nor man can operate effectively alone. Dog and handler must work together in a smooth and efficient manner, a goal which cannot be achieved without mutual confidence and understanding and continuous practice.

While the dog's sense of smell appears to provide the primary mechanism of detection, you must know your dog and be able to "read" his subtle reactions, alerting signs, and other unique behavior patterns.

You must never assume that a given dog will function effectively with any handler (or vice versa) immediately after being assigned to work as a team. Even in the case of a well-trained animal and an experienced handler, a period of practice and adaptation is necessary to form a smooth and efficient working partnership. Some handler/dog pairings

may never learn to work together effectively.

Finally, you must not get into the habit of relying entirely on the nose, eyes, and ears of your dog. While his senses of smell and hearing are much more sensitive than yours, your own wits and senses are also important tools which contribute to the overall detection task. For example, an alert handler can sometimes spot land mines and trip wires himself — especially if they are poorly camouflaged. Also, you, as handler, can learn to recognize locations where land mines and booby traps are likely to be placed. Being alert to these suspicious areas will improve your "team's" detection performance and will help to reduce the risk to you and your dog.

### CHAPTER III

#### FUNCTION AND EMPLACEMENT OF LAND MINES

Since the canine land mine/booby trap detector concept is based on a cooperative man/dog partnership, it is necessary that the handler be well acquainted with land mines and booby traps as well as the techniques of land mine warfare. Some common U. S. land mines (less fuzes) are shown in Figure 3.

Of particular significance is a thorough knowledge of typical emplacement strategies and patterns of deployment. An extensive treatment of the strategy of land mine warfare is beyond the scope of the present manual, and you should refer to appropriate U. S. Army field



Fig. 3. Examples of live (unfuzed) U.S. land mines. L to R: M15 antitank (metallic), M14 antipersonnel (nonmetallic), M16A1 antipersonnel (metallic, bounding type), M19 antitank (nonmetallic).

manuals for detailed discussions of these matters (e.g., 6). However, some of the more common locations selected for land mine and booby trap emplacement are listed below:

- 1) In and around established trails and natural pathways.
- 2) In potholes, road patches, or soft spots in hard-surfaced roadways.
- 3) Under the edges of road pavement at its boundary with the roadway shoulder.
- 4) On roadway shoulders in locations where mines can be easily installed and camouflaged.
- 5) In or near bypass routes around blown bridges, cratered roadways, or other obstructed pathways.
- 6) Around the edges of craters and ends of damaged bridges or culverts (CAUTION: antipersonnel mines are sometimes placed in craters or natural depressions which might offer cover from artillery fire or air attack).
- 7) Along barbed-wire entanglements, wire fences, and other obstacles such as abandoned vehicles.
- 8) Along fallen tree trunks and limbs lying across roads and trails.
- 9) In vehicle turn-outs, parking lots, and in front of entrances to buildings, narrow defiles, and airfield runways.

- 10) In the vicinity of attractive souvenirs such as discarded pistols, field glasses, liquor bottles, etc. (When booby-trapped, these items are sometimes called "dirty trick" devices).
- 11) In likely bivouac or assembly areas and in or near buildings suitable for use as headquarters or observation posts.
- 12) In likely helicopter landing zones, especially those areas to be used for combat assaults and new enemy assembly areas.

Some of the above mine emplacement locations are illustrated in Figures 4 - 8.

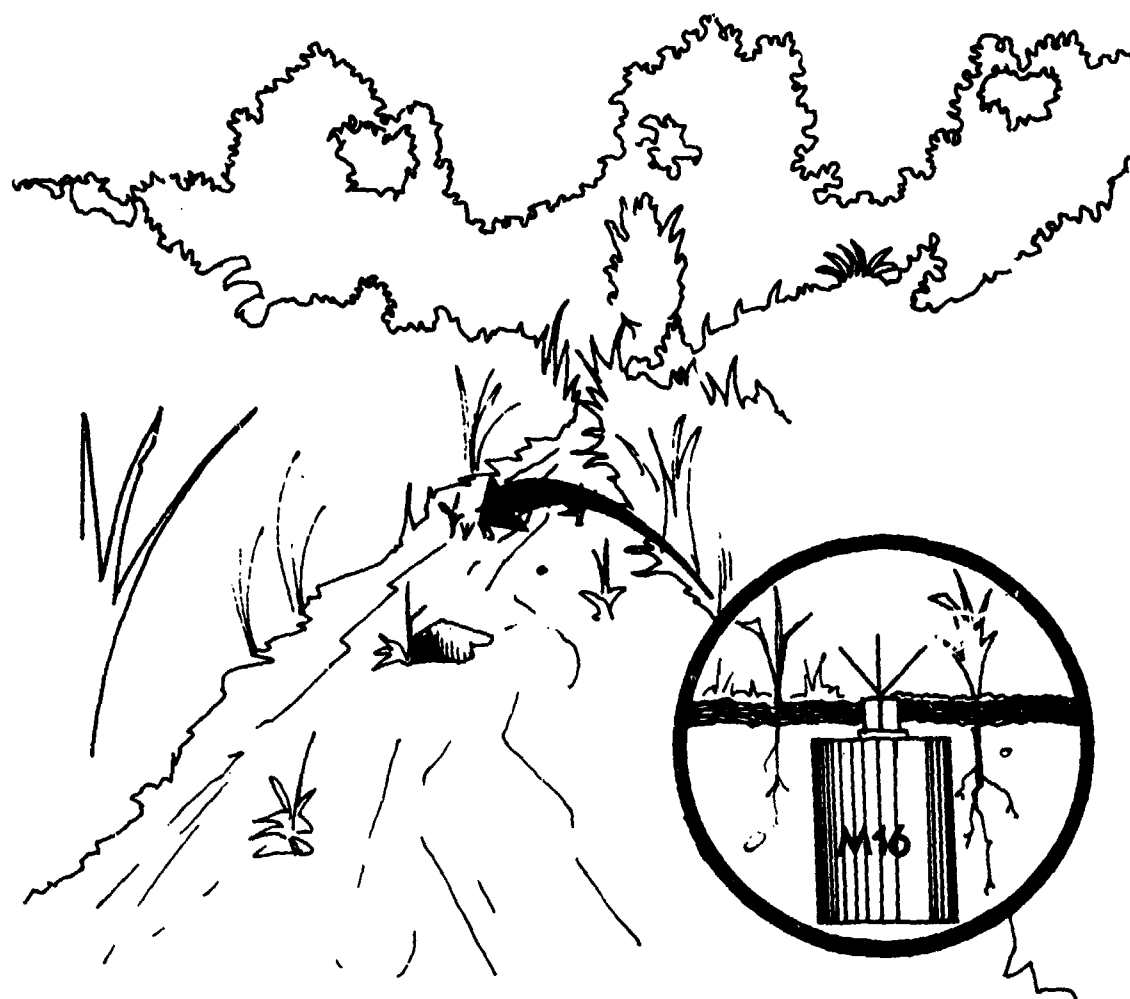


Fig. 4. Antipersonnel mine installed along a footpath.



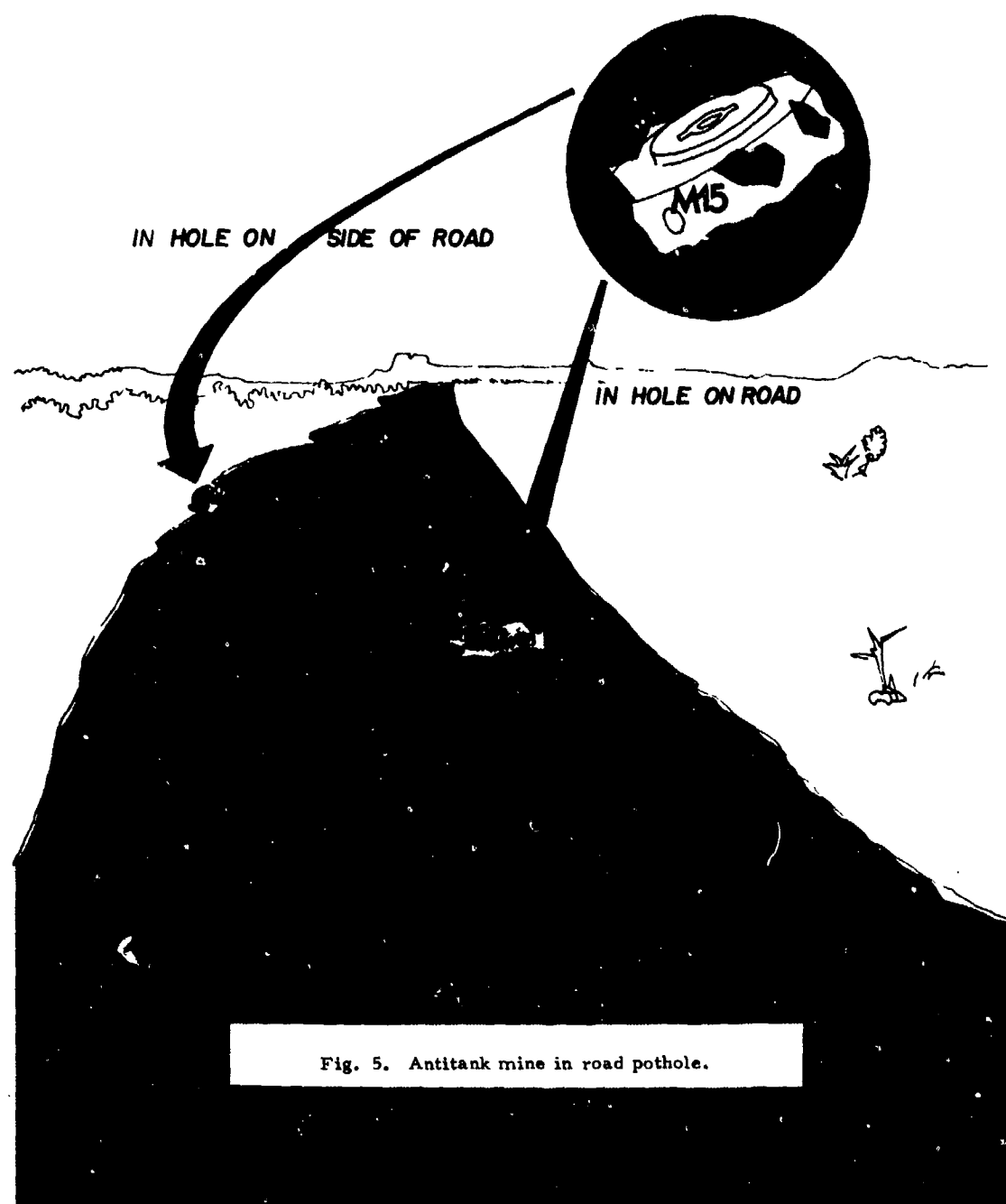


Fig. 5. Antitank mine in road pothole.

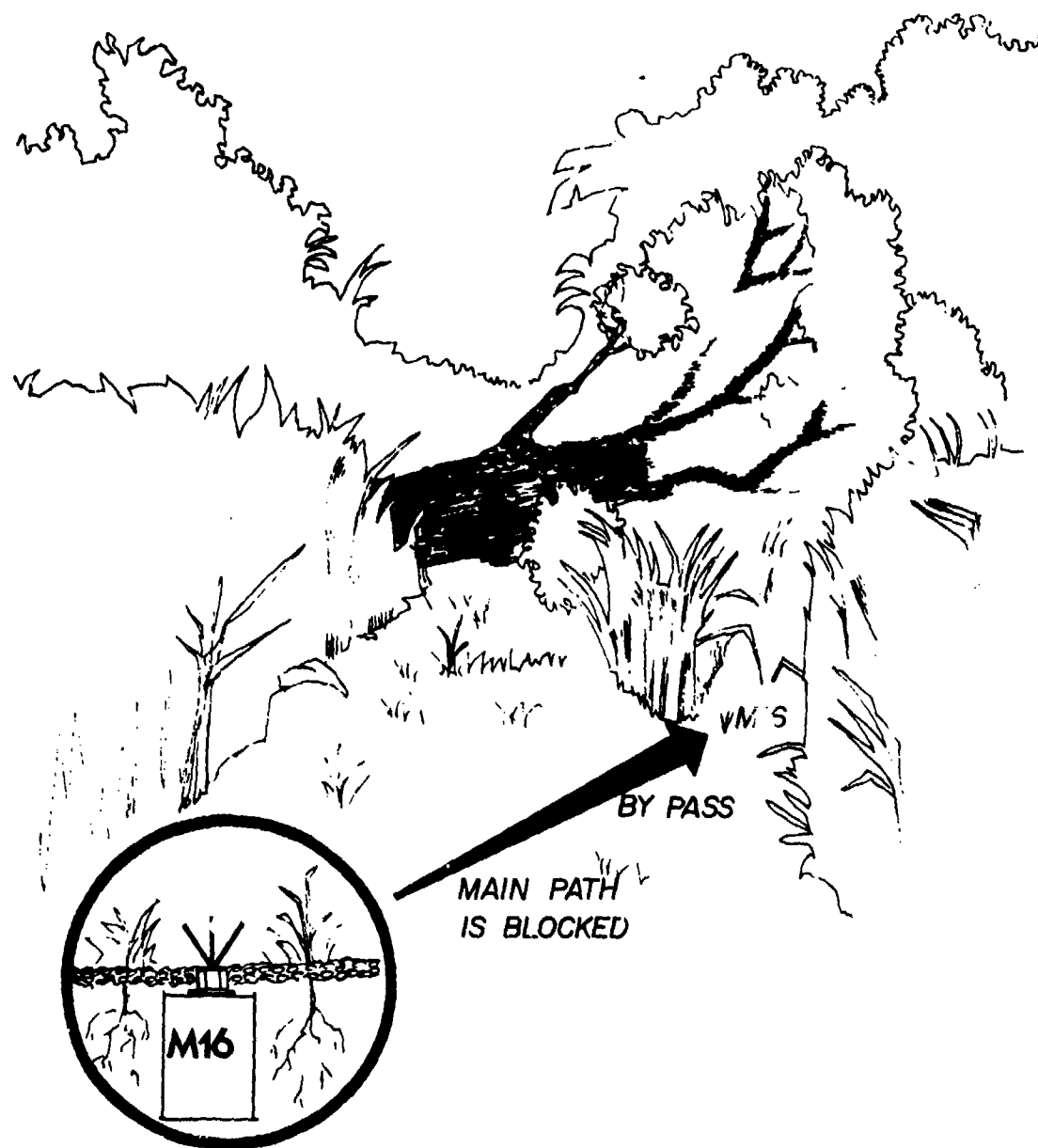


Fig. 6. Antipersonnel mine in bypass route around an obstructed pathway.

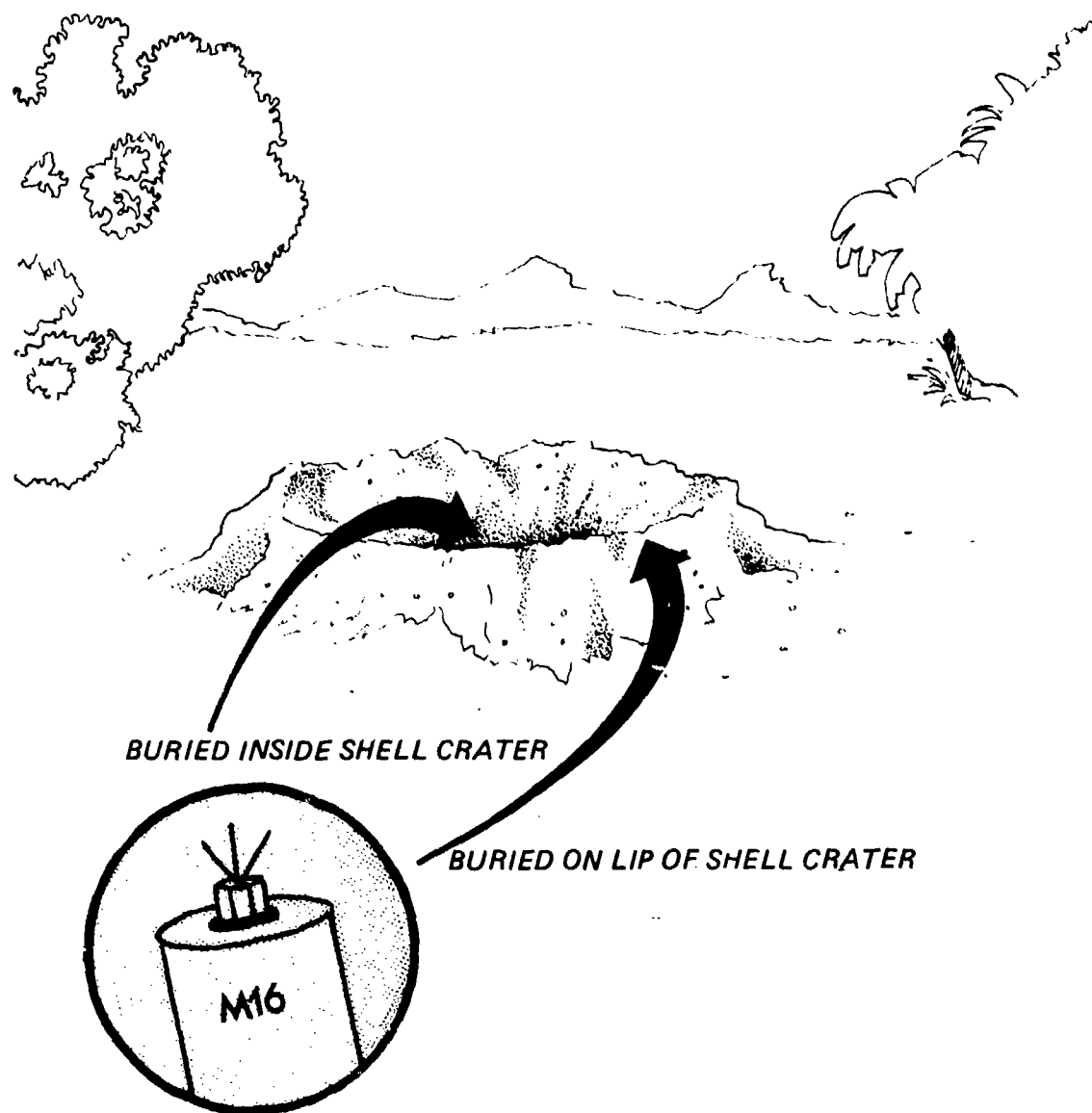


Fig. 7. Antipersonnel mine installed in a shell crater which could be used as a natural foxhole.

STRING ATTACHED TO PISTOL AND TO THE MI6



PLACEMENT OF TRIP WIRE

LOCATION OF HIDDEN MI6

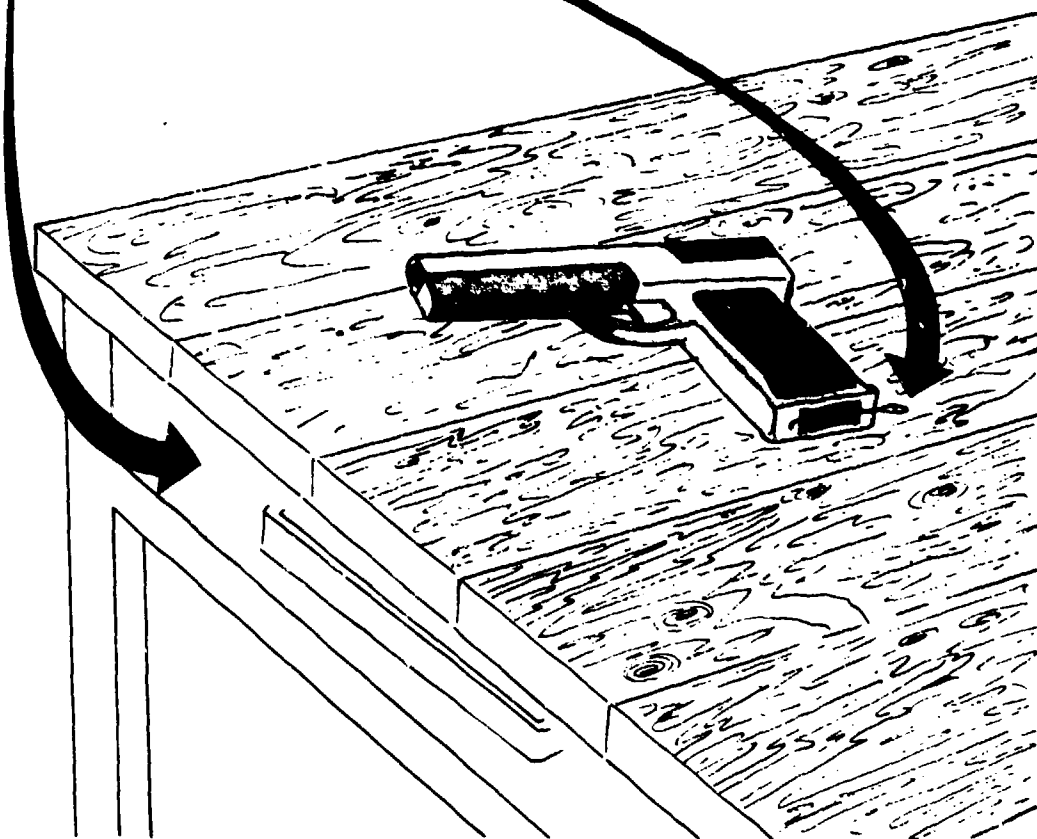


Fig. 8. Dirty trick device.

## CHAPTER IV

### SEARCH PROCEDURES

#### DETECTION RADIUS

Even exceptionally well-trained dogs rarely pinpoint the precise location of concealed land mines — partly because of their deliberate training to avoid disturbing or sitting directly on top of these devices. Furthermore, wind or terrain features may cause the odor of a mine to drift away from the source. In such cases your dog may alert several feet downwind from the actual mine location. As a rule, surface-deployed mines and booby traps will be pinpointed with greater precision than buried mines.

Scientific studies have shown that approximately 80% of all canine mine detection responses occur within 2 meters of the actual mine location. About 90% of all such responses occur within 3 meters of the mines (3). Therefore, a "region of maximal hazard" may be defined as a circular area 3 meters in radius centered at the point indicated by the dog's response. However, you must never forget that there is a small, but nevertheless real, chance that a mine may lie outside the 6 meter diameter circle. In other words, your dog may occasionally detect a mine from further away than 3 meters. Strong winds or unusual terrain features are often involved in such remote detections. These relationships are shown in Figure 9. Finally, do not lose sight of the fact that booby trap trip wires can sometimes be detected at ranges greater than 5 meters.

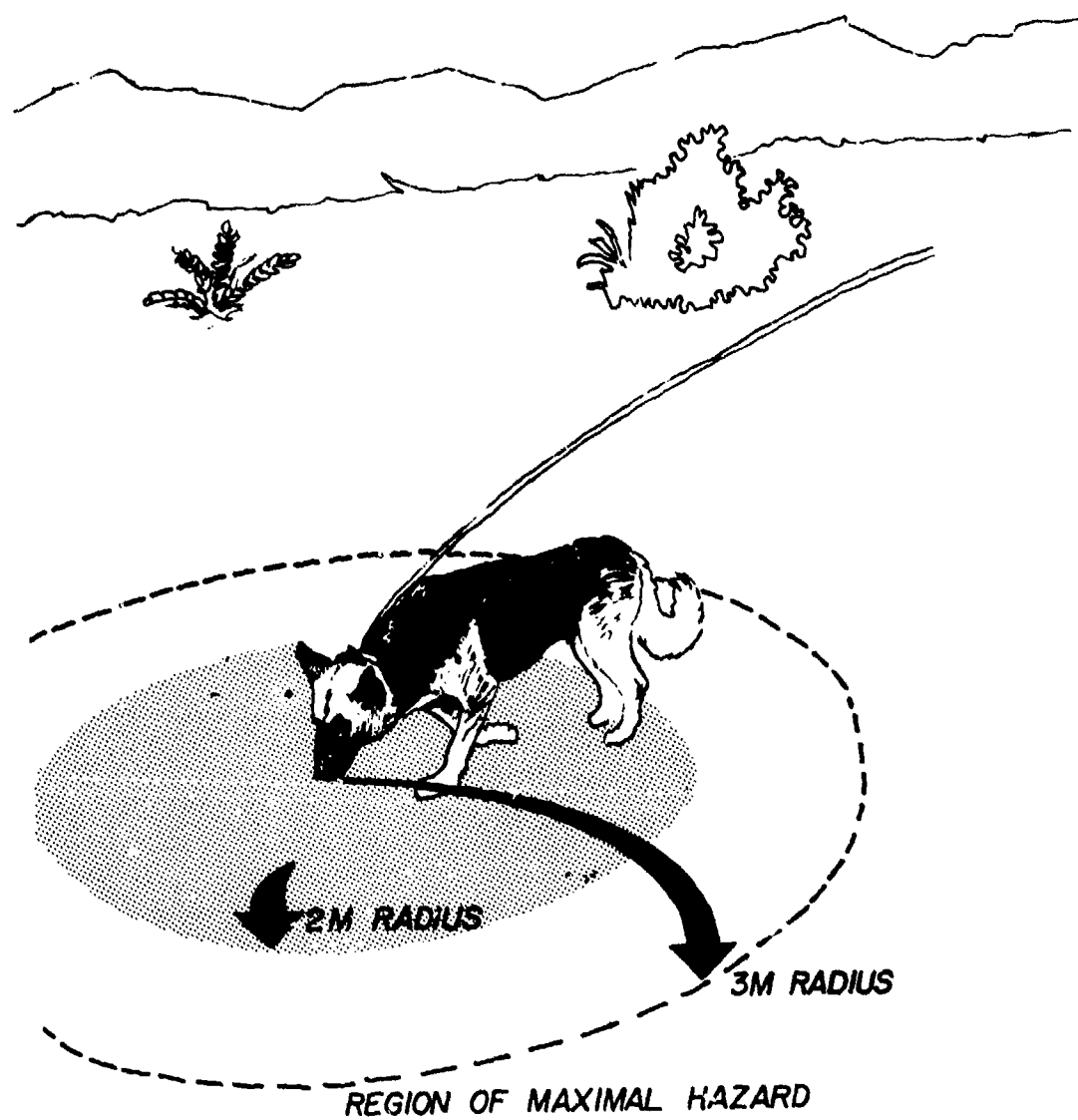


Fig. 9. Distribution of actual mine locations with respect to locus of response. Note region of maximal hazard.

## TRAIL CLEARING OPERATIONS

The basic procedure for trail clearing involves a sweeping S-pattern in which the dog casts back and forth in tight loops as he proceeds ahead of the handler. This pattern is illustrated in Figure 10. The dog should be worked into the wind whenever possible. You, the handler, must set the pace of search, always maintaining control so that the dog thoroughly covers the pathway or area to be searched and does not range ahead too quickly. For obvious reasons, you must remain behind the dog at all times never advancing ahead into unscreened territory for any reason.

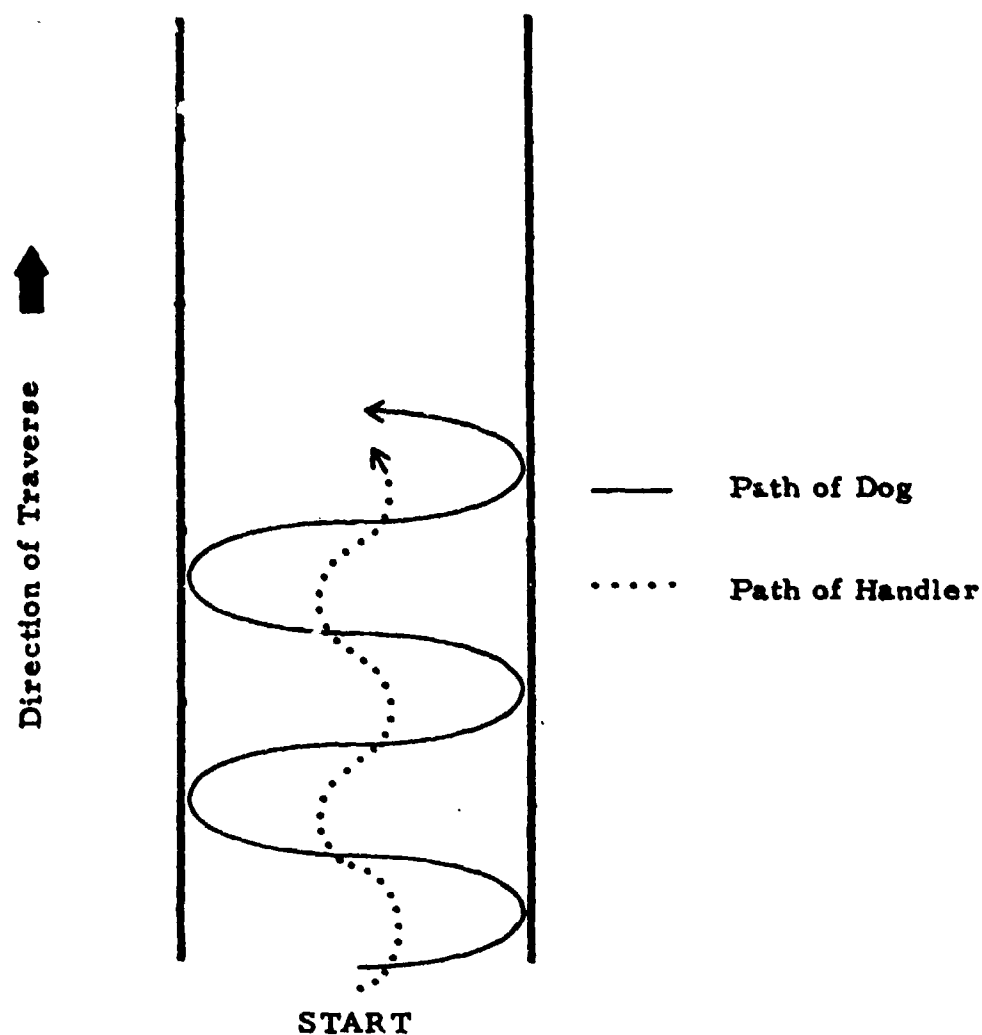


Fig. 10. Proper search pattern during trail traverse.

Similarly, you must take care not to step on spots which have not been carefully searched.

Although some dogs work effectively off leash, better control can be maintained if the dog is deployed on leash. This procedure permits more thorough screening, helps limit the region of search to areas or pathways of interest, and prevents the dog from ranging ahead too quickly. Whenever possible, however, the dog should be worked with a relatively long leash so that a reasonable distance is maintained between animal and handler. Notice that if a leash 4 m in length is employed and the dog continuously ranges ahead at this distance, you will tend to be positioned outside the region of maximal hazard (see Figure 11). Maintenance of this relationship will significantly reduce the chances of your accidentally detonating a mine or booby trap unless (a) a live device is passed by the dog, or (b) the animal has been allowed to develop a habit of backtracking. (The latter practice should have been discouraged in training).

You must enforce complete discipline at all times during search operations, and you must never allow your dog to jump over obstacles such as fallen logs, bushes, large rocks, etc. lest he alight on a mine or booby trap concealed on the opposite side.

You must constantly observe your dog for subtle behavioral changes or partial alerts. If the animal hesitates or appears uncertain, the area should be marked with warning flags and carefully circumvented.



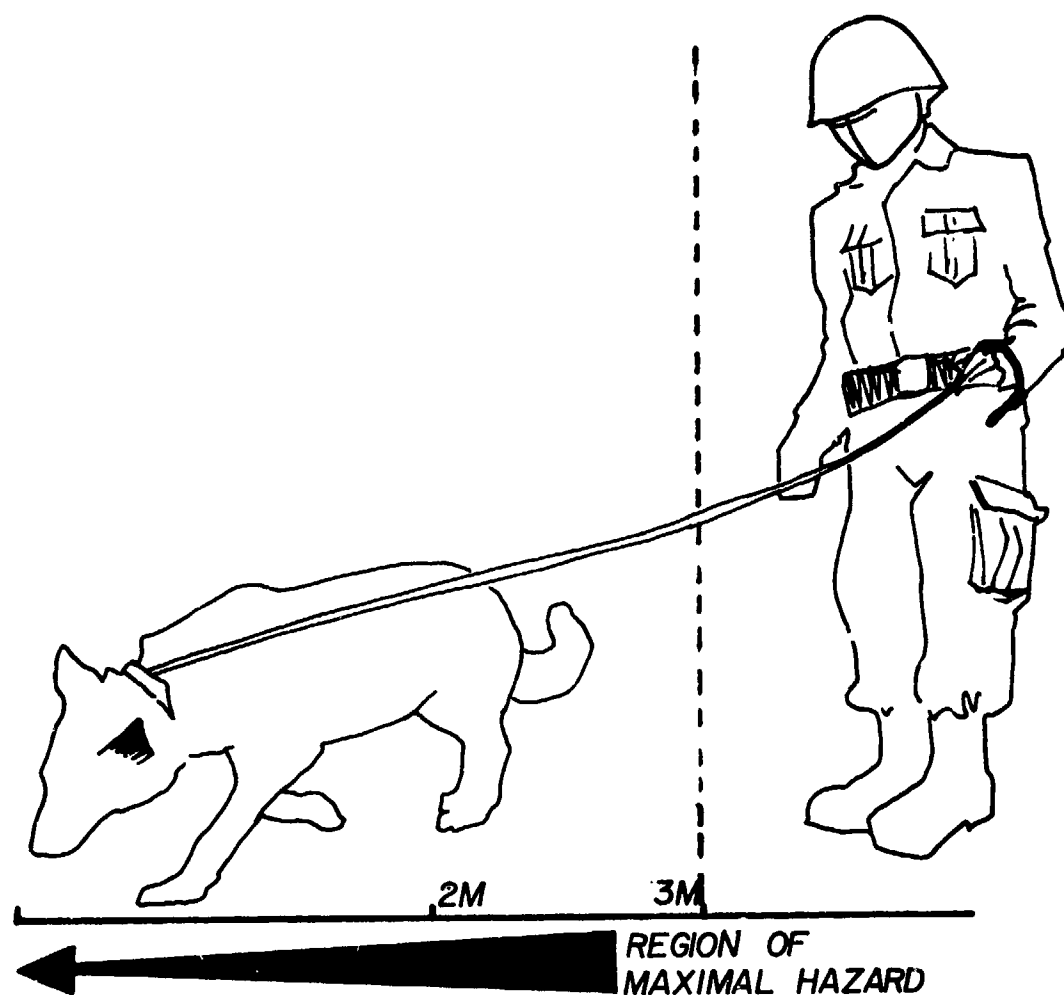


Fig. 11. Relative positions of dog and handler with respect to region of maximal hazard during normal traverse. Note that a leash 4 meters or so in length places the handler outside the region of maximal hazard.

Continued searching of suspicious areas represents an extremely hazardous practice and should be avoided whenever possible.

### MARKING RESPONSES

All responses which occur during actual service deployment must be marked with a highly visible flag or similar indicator. These markers serve to warn other troops of the possible presence of a land mine or explosive booby trap and also indicate the approximate location for subsequent removal or neutralization operations. Strips of brightly-colored surveyor's tape attached to the tops of long metal spikes make good warning flags as shown in Figures 12 and 13. A large number of these markers can be carried without difficulty.

#### IMPORTANT

AFTER INSTALLING THE MARKER FLAG, HANDLER AND DOG MUST MOVE QUICKLY BUT CAUTIOUSLY OUT OF THE RADIUS OF MAXIMAL HAZARD AND PROCEED WITH THE SEARCH. NEVER PROBE OR DISTURB SUSPECTED MINE LOCATION SITES UNLESS YOU HAVE HAD SPECIALIZED TRAINING IN THE FUNCTION AND EMPLACEMENT OF LAND MINES AND BOOBY TRAPS; EOD SUPPORT SHOULD BE REQUESTED. FURTHERMORE, YOU SHOULD ALWAYS ASSUME THAT ALL MINES REGARDLESS OF TYPE ARE BOOBY TRAPPED OR EQUIPPED WITH ANTIHANDLING/ANTILIFT DEVICES WHICH WILL CAUSE THE MINE TO DETONATE IF DISTURBED. REMEMBER THAT REPEATED SEARCHING OF SUSPICIOUS LOCATIONS REPRESENTS AN EXTREMELY DANGEROUS PRACTICE.

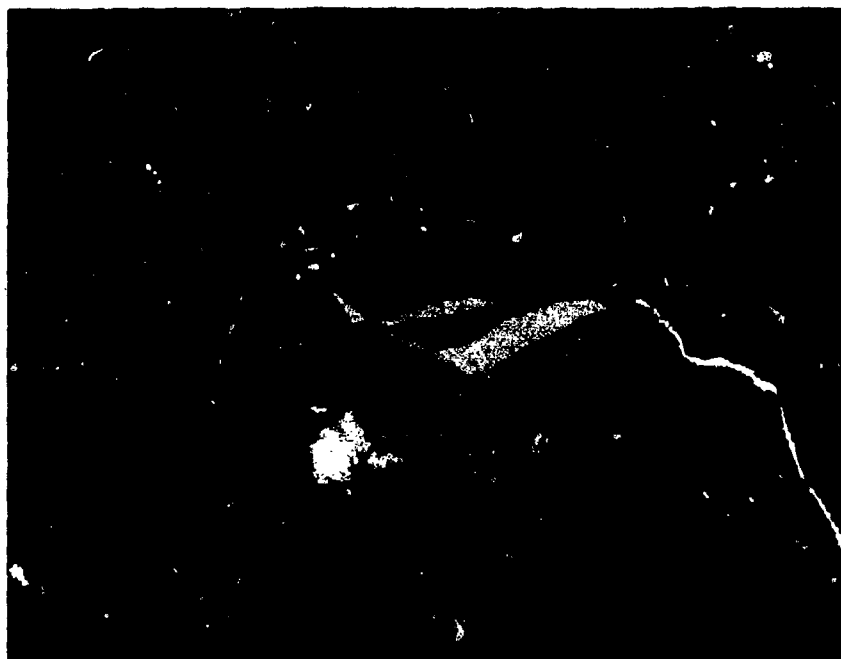


Fig. 12. Warning marker flag.

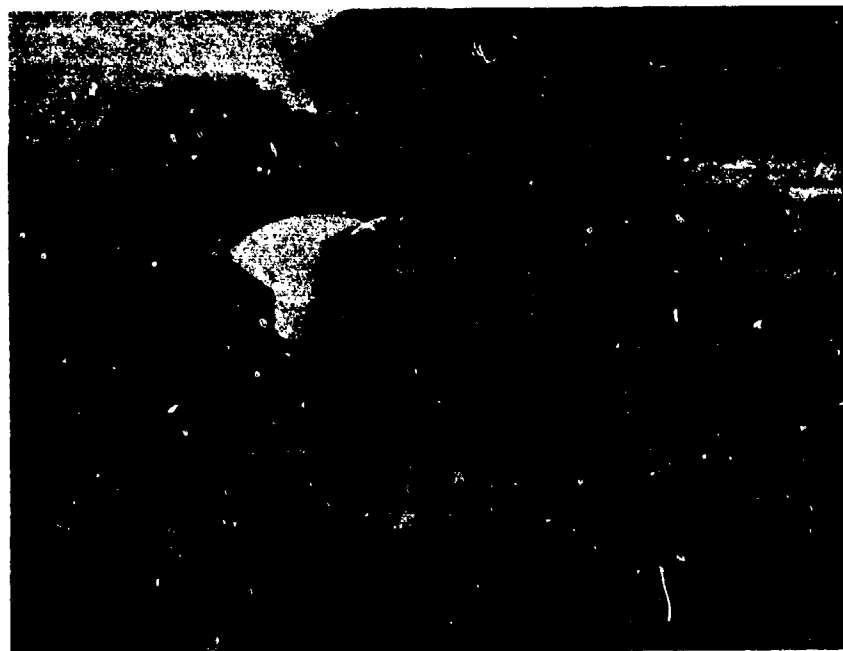


Fig. 13. Insertion of warning flag.

## ROADWAY SEARCHES

The procedures for searching both unimproved and paved roadways are essentially the same as those employed for trail clearing operations. Narrow roads (i. e., 4 m or less in width) can generally be covered in one pass as illustrated in Figure 14.

Roadways wider than 4 m will require two or more parallel sweeps. For example, the left lane may be searched first followed by a clearing of the right lane (or vice versa). Both passes must be made in the same direction -- into the wind whenever possible. Accordingly, upon completing the search of one lane, you should return to the starting point (taking care to remain in the portion of the road just cleared) and begin a parallel screening of the other lane. Always search the downwind lane first if crosswinds are experienced.

If it is necessary to clear long stretches of relatively wide roadways, the overall search operation may be broken into a number of paired sections or segments. That is, search the left lane (or right lane depending on prevailing wind conditions) for a distance of about 100 m, then return to the starting point (staying in the lane already cleared) and screen the right lane for the same distance. This sequence is then repeated (starting at the end of the 100 m interval just cleared) until the total distance is covered. See Figure 15 for a diagram of this procedure. Note that two dog/handler teams working parallel lanes will reduce total



Fig. 14. Searching for mines in an unimproved roadway.

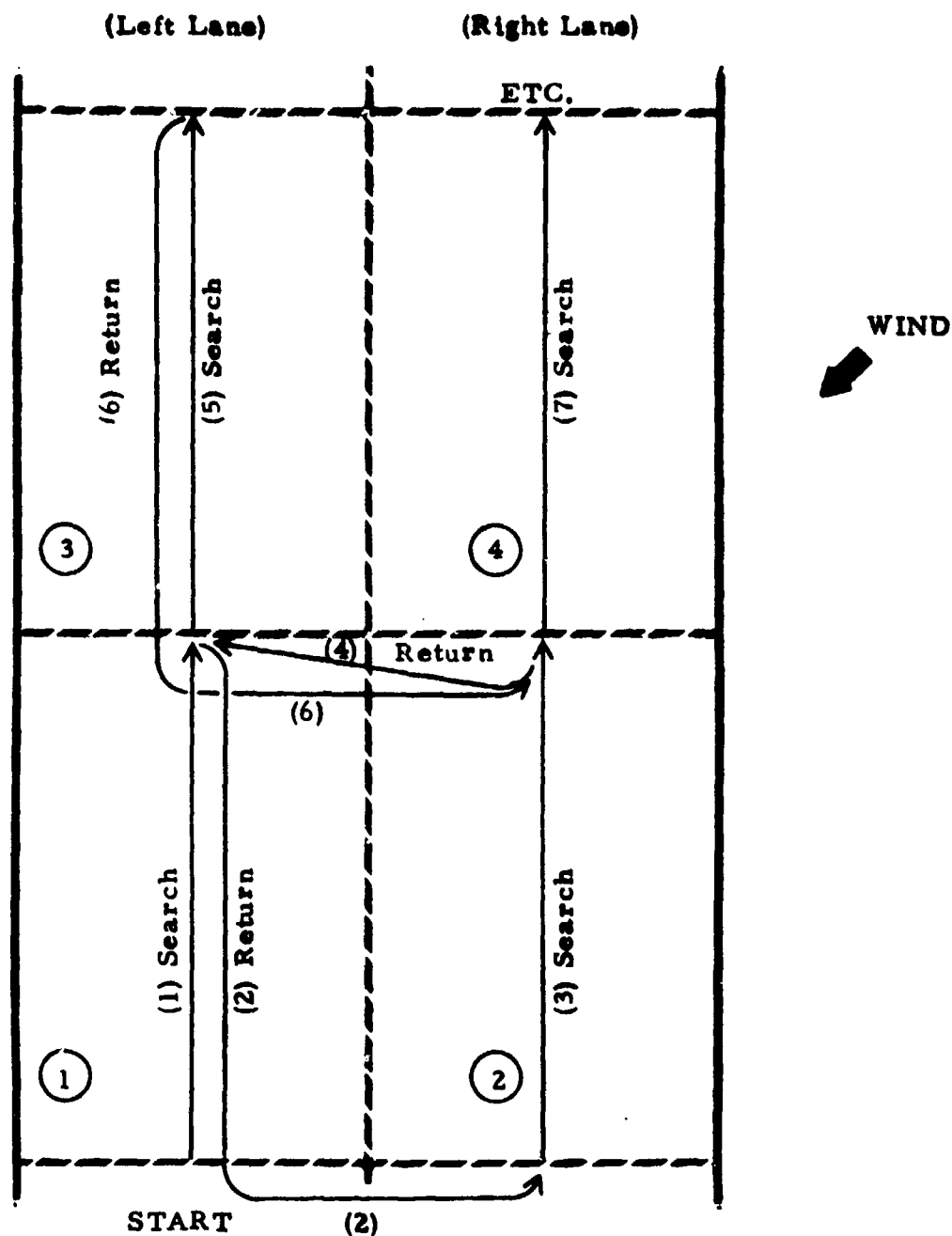


Fig. 35. Technique for wide roadway clearing. Dashed lines divide road into sections. Circled numbers show order in which sections are searched. Numbers in parentheses indicate sequence of operations.

clearing time by one-half. However, multiple teams should be staggered by approximately 50 meters to minimize interference as well as for protection should one team inadvertently detonate a mine.

In most instances, paved roadways can be cleared more rapidly than their unimproved counterparts since, in the former case, a knowledgeable handler can visually identify probable mine location sites (e.g., along the boundary of the road surface and shoulder; in potholes, craters, or similar breaks in the surfacing materials; etc.). Such clues may not be apparent on unpaved roads. Shoulder areas must also be carefully screened.

### RAILROAD SEARCHES

Railroads should be cleared using a procedure similar to that used for wide roadways — multiple parallel passes in the same direction. The downwind shoulder should be searched first, followed by the area bounded by the rails and crossties, and completed with a third pass over the upwind shoulder. Alternatively, three handler/dog teams working together can accomplish all three sweeps in one pass as shown in Figure 16. As always, you should avoid working your dog downwind.

The most common locations for installing mines in railroad beds are in the vicinity of culverts, bridges, sharp turns, tunnels, and steep grades (6). These areas should be searched with special care. Figure 17 shows a team of dogs and handlers searching a railroad bridge.





Fig. 16. Railroad clearing. Note that one team clears the left shoulder, another the right shoulder, and a third searches the center area bounded by the rails and crossties.

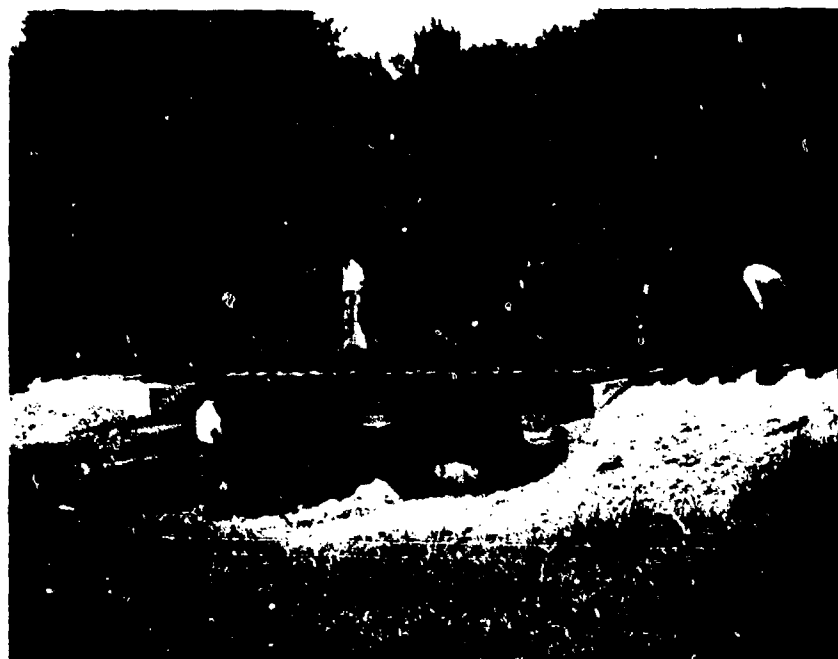


Fig. 17. Clearing a railroad bridge.

Note that properly-trained dogs are uniquely suited to railroad mine clearing operations since they do not false alert on the rails or other metal fixtures as is the case with conventional metal-sensing mine detectors.

### MINEFIELD BREACHING

If the objective of the mine detection operation is to clear a corridor through a known or suspected minefield, procedures similar to those used for trail searches are employed. This can be accomplished in one pass if only a narrow pathway is required (e.g., 4 m or less). Wider passages can be developed in multiple parallel passes or by simultaneous deployment of two or more dog/handler teams. The handler should strive to maintain a straight course across the field deviating only to bypass obstacles or unusually suspicious locations. A field breaching operation is illustrated in Figure 18; a response to a well-camouflaged live mine is shown in Figure 19.

It is necessary that the lane of safe passage across the field be clearly marked in a highly visible manner. Mine tape, string, or some similar marking system which provides a continuous guideline may be deployed for this purpose by the handler during the course of traverse. Mine tape or string should be securely fastened at frequent intervals (e.g., tied to bushes, weighted down with rocks, fastened with



Fig. 18. Field breaching operation.



Fig. 19. Detection of a live mine. Note the excellent camouflage.

metal pins, etc.) to prevent it from being shifted out of position by wind or other elements. As always, warning marker flags must be installed at the location of each response.

### FIELD CLEARING

Total clearing of open fields is normally undertaken in areas not under enemy observation or fire and often follows a simple breaching operation. Large fields must be cleared by systematic screening of successive "sectors" each approximately 4 m in width and of variable length depending on the size of the field. Downwind sectors are always searched first.

Sectioning of the field must be accomplished before clearing operations are begun. This procedure requires that you improvise and install a set of reference markers to set off successive sectors and to guide your movements during the actual search. You must also evaluate the local terrain, established wind direction, identify unusually suspicious areas, and determine the best order in which to screen successive sectors before beginning the search. It will be helpful to draw a rough sketch of the area to guide the clearing operation and to provide a method of recording which sectors have been screened and which have not. A sample sectioning sketch is shown in Figure 20. A slight overlapping during the search of adjacent sectors is recommended to insure that no areas are skipped.

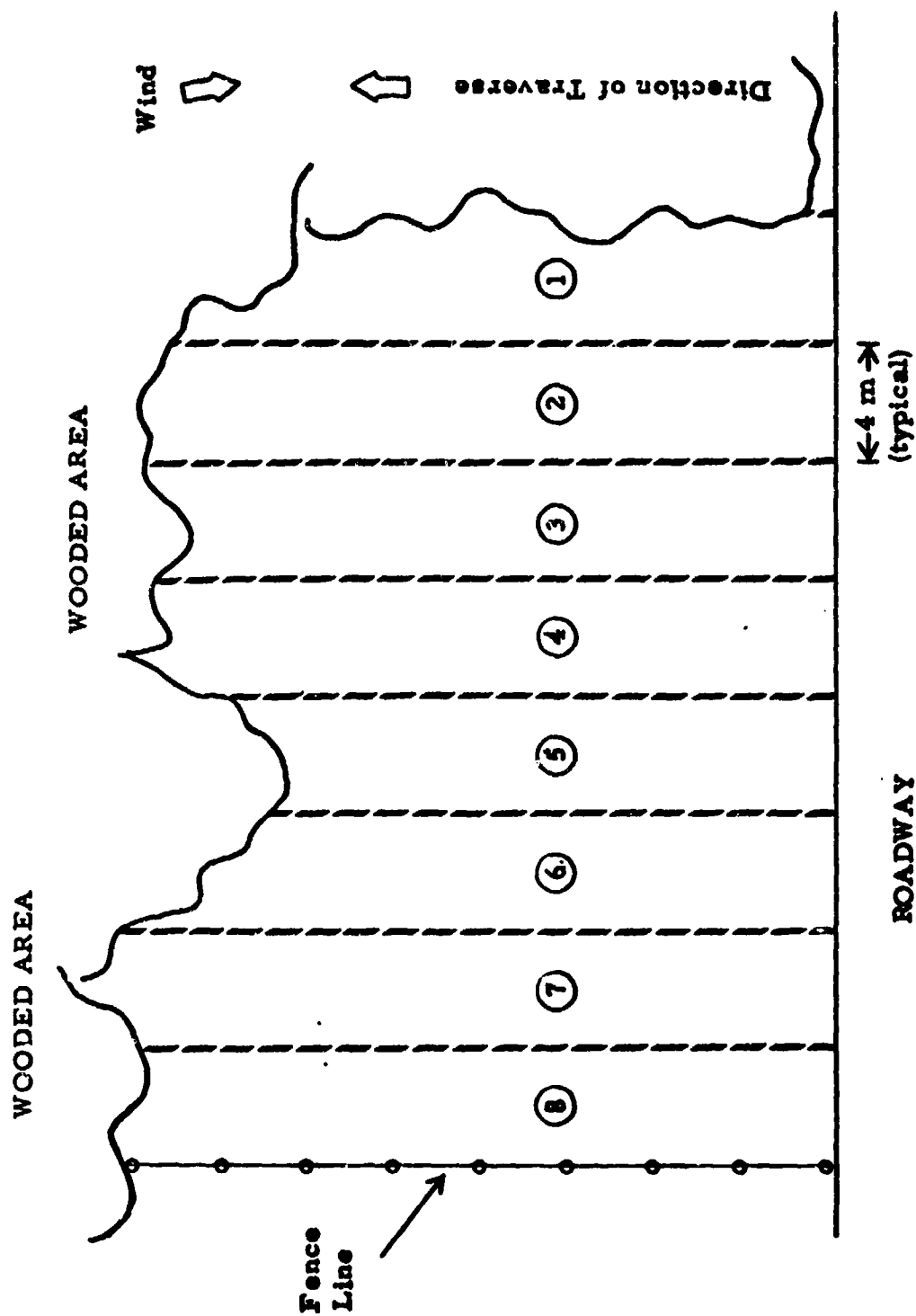


Fig. 20. Sectoring for clearance of open field. Circled numbers indicate correct order of sector clearance. Note wind bearing and indicated direction of traverse.

## HELICOPTOR LANDING AREAS

A standard sequence is employed during mine clearing of improvised helicopter landing areas and is discussed and diagrammed in U. S. Army FM 20-32 (6). A similar system may be used with mine detector dogs and is summarized below:

- 1) Clear and mark two diagonal strips each 10 m wide across the heliport area.
- 2) Clear and mark one helipad at the intersection of the diagonal strips.
- 3) Clear and mark a 5 m wide strip completely around the landing site.
- 4) Clear and mark additional helicopter landing pads as space allows.
- 5) Complete clearance of the remaining area enclosed by the perimeter strip.

## BUILDING SEARCHES

It is not uncommon for enemy forces to install land mines fitted with trip wires in abandoned buildings — especially during withdrawal operations. Properly trained dogs can be used to detect such devices, but you should bear in mind that building searches present a difficult problem for your dog. The ability of the dog to move about freely may



be restricted by stairways, size of the rooms, furnishings, and other clutter. Furnished buildings also offer many distracting influences.

Exterior areas surrounding the building must be searched first. Pay special attention to sidewalks, stairs, doorways and entrance thresholds, windows and the areas beneath them. Do not attempt to open doors or windows until they have been checked for trip wires. A team of dogs and handlers performing an exterior building search is shown in Figure 21.

Before entering a room, survey the entire area to determine likely areas for installation of booby-trapped devices. These areas must be screened with special care. Also, check for loose or suspicious looking floorboards or tiles before stepping into the room; mines or booby-trapped devices may be concealed beneath them.

As with wind in open area searches, you must be alert to wind currents inside buildings. Drafts, cross ventilation, and heating and air conditioning units all affect the drift of scent patterns and may be difficult to evaluate indoors.

Interior rooms must be searched in a systematic manner moving around the area in either a clockwise or counterclockwise direction depending on existing air currents; work into air currents whenever possible and watch your dog carefully for airborne alerts. All areas such as desks, cabinets, ventilation ducts, and other fixtures must be searched. Encourage your dog to search high on the walls, in cabinets

and lockers, on tables, etc., as well as low under chairs, along baseboards, and so on. Never touch suspicious items such as "discarded" weapons, field glasses, bottles of liquor, or other attractive souvenirs and artifacts until they have been carefully checked. These items may be booby-trapped.



Fig. 21. Exterior building search.

## CHAPTER V

### EVALUATING RESPONSES

During periods of service deployment you will generally have no immediate information as to whether a given alert on the part of your dog is correct (i. e. , a response to a live mine or booby trap) or false. Therefore, always assume that every response indicates the presence of a mine or trip wire. All response sites should be marked with a warning flag for subsequent verification by trained EOD personnel. No response may be dismissed as false unless the reasons are obvious; for example, artillery shell fragments, small arms cartridge cases, spent signal flares, etc.

The fact that you cannot readily determine whether a given response is correct or false during service deployment presents a special problem in reinforcement. INDISCRIMINATE REINFORCEMENT OF ALL RESPONSES WHETHER CORRECT OR FALSE IS NOT A PROPER PROCEDURE. You should recall from your training that a fundamental law of conditioning states that positive reinforcement increases the probability of ANY response which immediately precedes it. Therefore, frequent reward of false alerts will tend to increase future frequency of false responding. The only acceptable compromise is simply to not reinforce in the

conventional sense any responses which occur during field deployment. However, you may wish to pat your dog or the head, scratch its ears, or otherwise indicate that you are not displeased by its performance. In any event, you must not communicate a sense of disapproval following an in-service response. Most highly trained dogs can tolerate nonreinforcement for a work period of normal length without a serious adverse effect on performance.

Should you notice a decline in search efficiency due to nonreinforcement, temporarily interrupt the search and allow your dog to "detect" and respond to a substitute positive target, followed by lavish reinforcement. This procedure is often effective in restoring lost motivation.

Finally, if your dog has been required to work for long periods without reinforcement, a reinforced practice session should be conducted as soon as possible to counteract potential extinction effects.

## CHAPTER VI

### OPERATING CONSIDERATIONS

#### CONDITIONS AFFECTING SEARCH

The environmental conditions which may affect olfactory detection systems are so many in number and interact in such complex ways that comprehensive treatment of all possibilities is virtually impossible. However, the major factors include: wind, precipitation, temperature, humidity, and terrain features.

1) Wind: Wind is probably the single most important factor to be considered by the handler since it may carry the scent of a mine or booby trap a considerable distance from the actual source. Wind tends to disperse odor away from the point of origin in a V-shaped "cone" pattern. As shown in Figure 22, the angle of the "V" tends to be narrow in strong winds and wide in lighter breezes. Work your dog into the wind (i. e., toward the source of the scent) whenever possible. A downwind traverse represents a very risky procedure and should be avoided if possible since, in moderate to strong breezes, the odor cone will disperse downtrail relative to dog and handler. In such a case, it may not be possible for the dog to obtain an adequate olfactory stimulus until after its nose has passed over the mine or booby trap. Unfortunately, wind effects are notoriously capricious, highly affected by local surface conditions, and thus extremely difficult to assess or

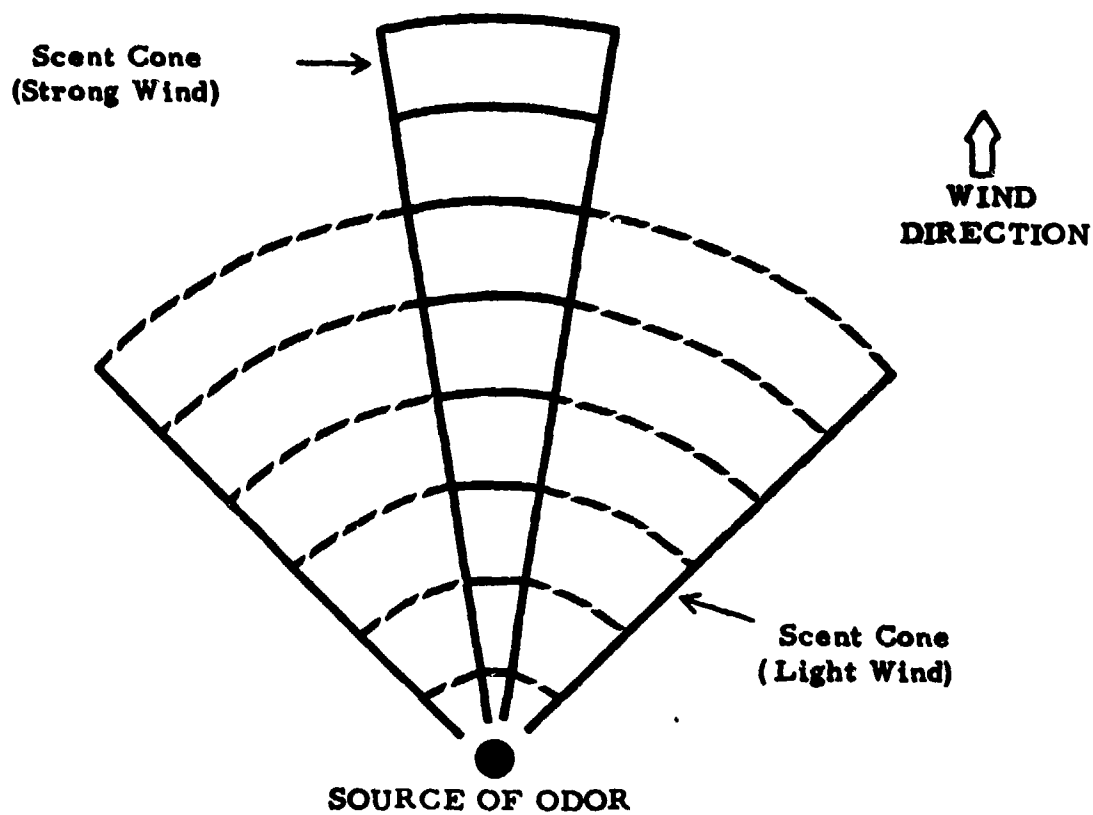


Fig. 22. Dispersal of scent in light and strong winds.

predict. Furthermore, the effects of surface eddy currents on the performance of land mine/booby trap detector dogs remain unclear. In any event, pay close attention to terrain features, ground cover, as well as natural and man-made obstacles which can influence dispersion of odor. For example, surface irregularities and vegetation may exert a significant effect on air flow patterns and distribution of scent. Learn to recognize these factors and use them to your advantage whenever possible.

You must also develop an accurate sense of wind direction and velocity. If sufficient light is available, wind direction and speed can be estimated by dropping small bits of grass and watching the direction of drift, or, alternatively, by dangling a 20-25 cm length of light yarn from one end and observing the angle of deflection. These procedures will be of little use in total darkness however. With practice, most people can learn to judge wind direction fairly accurately by turning the head from side to side and sensing the evaporative cooling effect on the forehead. The latter technique is effective both day and night.

2) Precipitation: The ideal surface for olfactory mine detection is an open field characterized by moderately loose, porous soil of medium moisture content and covered with short, damp vegetation. As a general rule, a hard-packed dry surface is thought to have an unfavorable effect on the retention of overlying scent. However,

data collected in tests at Yuma Proving Grounds indicate that well-trained land mine/booby trap detector dogs can perform very successfully despite extremely low soil moisture levels as long as the ground surface is not heavily crusted or compacted (1).

Finally, heavy rainfall will quickly wash away scent traces, whereas a damp surface due to light rain or dew tends to favor the retention of scent.

3)      Temperature and Humidity: Experimental studies of land mine/booby trap detector dogs suggest that, other factors equal, optimal detection performance can be expected when the ground surface and overlying air are moderate in temperature (1, 3). Furthermore, intermediate humidity tends to be associated with improved scent detection. If practical, search missions should be scheduled at times of day which are characterized by an optimal combination of temperature and humidity factors (e.g., early morning, or late afternoon/early evening hours).

## MOTIVATION

Attend carefully to the general performance and motivation of your dog. Declining motivation can frequently be improved by rest periods or the use of incentive or substitute positive targets. If motivation remains at a low level, the animal should be examined for illness or other symptoms of physical distress.



## THE SINGLE PURPOSE CONCEPT

Olfactory detection by canines of land mines and booby traps is an extremely complex task and requires extensive and sophisticated training. The consequences of a lapse in performance, however momentary, can be severe for both dog and handler; nothing in the dog's training or method of deployment should be permitted to allow this to occur.

### IMPORTANT REMINDER

While it is true that dogs can be trained to execute a variety of unrelated tasks, it is also true that maximal performance on any one task will be obtained if training is concentrated on that unique problem. For this reason, NEVER ATTEMPT TO TRAIN YOUR LAND MINE/BOOBY TRAP DETECTOR DOG FOR OTHER TASKS OR TO PERFORM UNRELATED "TRICKS." DOING SO MAY INTERFERE WITH HIS DETECTION EFFICIENCY. IN SHORT, A DOG SELECTED FOR LAND MINE/BOOBY TRAP DETECTION SERVICE SHOULD BE TRAINED FOR THAT PURPOSE AND THAT PURPOSE ONLY.

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