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Multipurpose Arcade Combat Simulator Development to Improve Soldier Shooting Skills With the M16A3 Rifle

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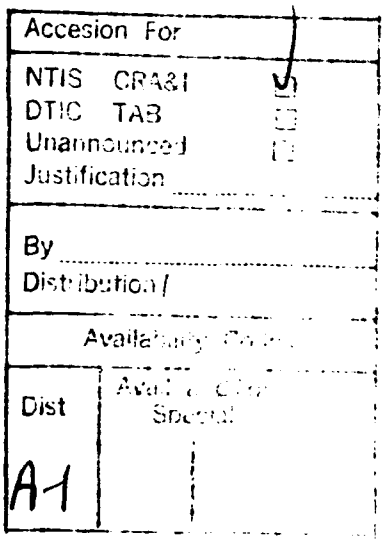

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This report provides details of the effort (February to December 1991) to produce a Multipurpose Arcade Combat Simulator (MACS) program for the M16 rifle with telescope (M16A3). Because the Army delayed selection of a telescope, all aspects of the program could not be completed; programs were developed using the telescope reticle with the highest probability of selection. The program may be fired with telescope or iron sights. It reviews basic marksmanship, the long-range engagement of stationary and moving targets, the effects of wind, and the combined effects of range, wind, and target movement.

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MULTIPURPOSE ARCADE COMBAT SIMULATOR DEVELOPMENT TO IMPROVE SOLDIER SHOOTING SKILLS WITH THE M16A3 RIFLE

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MULTIPURPOSE ARCADE COMBAT SIMULATOR DEVELOPMENT TO IMPROVE SOLDIER SHOOTING SKILLS WITH THE M16A3 RIFLE

INTRODUCTION

The Army plans to put an optical sight on the M16 rifle, modifying the M16A2 so an optical and/or iron sight may be affixed to the upper receiver. The rifle will be designated the M16A3.

This subtask was sponsored by the U.S. Army Infantry School, funded by the Army Materiel Command with funds designated for training development, and was monitored by the U.S. Army Resarch Institute (ARI).

When the statement of work for this contract subtask was developed, it was envisioned that by December 1991 the first units would be equipped with the new M16A3 rifles. The intent of this contract effort was to develop appropriate MACS software and training guidance to enhance soldier shooting skills with a telescope and deliver 15 MACS systems to support the testing and initial fielding of the telescoped rifles. The MACS rifles and telescopes were to have been provided by the Army.

With the termination of Litton's association with ARI concerning this effort on 31 December 1991, the telescope has not yet been selected by the Army. Three telescopes were tested at Fort Bragg during October and November 1991; test data are still being analyzed and it is too early to predict a winner. Additionally, none of the three reticles is designed to facilitate hold off for wind, lead for moving targets, or range estimation. The graphics developed for the MACS training program highlight the critical need for these features, and the Army has agreed to consider our recommendations in the final reticle design.

This situation makes it impossible to complete full development of any MACS program by 31 December 1991 because the reticle design and accompanying hold off/lead rule procedures are critical elements of the MACS training program. Also, the MACS rifle and telescope design cannot be finalized until a telescope has been selected. Accordingly, the purpose of this Research Note is to provide the information necessary to finalize MACS software programs, MACS hardware, and marksmanship training materials after final telescope decisions have been made by the Army.

MACS COMPUTER

For several years the Army has used the Commodore 64 Microcomputer for MACS. There are three problems currently associated with the Commodore: Commodore may stop production of the 64, a government regulation identifies the

Commodore 64 as automatic data processing (ADP) equipment and this makes it difficult to obtain it as a training device, and the 64 is old technology with much less capability than other available hardware.

Our previous experience programming MACS for the Army's Zenith 248 microcomputer revealed that additional memory capability is not necessarily an advantage, because this computer is not designed to handle the complex graphics and sound needed for marksmanship training. The hardware developed for games appears to be the most cost-effective for MACS applications.

Investigation of current gaming hardware found that Nintendo provided the widest range of capabilities at low cost. We purchased a Nintendo system and worked with the Fort Benning Training Support Center (TSC) to determine if the Nintendo hardware could be integrated into the current MACS system.

The primary software developer for Nintendo, Sculptured Software, developed a MACS demonstration program for Super Nintendo and presented it to the Infantry School. The Infantry School decided to continue distribution of Commodore systems until the current supply is exhausted and then convert MACS to Super Nintendo.

The Super Nintendo system provides much better graphics, stereo sound capability, much more memory, and is easier to program. Given that the Super Nintendo cartridge has memory capabilities equal to several Commodore cartridges, the Super Nintendo MACS system will be less expensive than the Commodore MACS system.

Given the limitations of time and money associated with this contract effort, we made an early decision to stay with Commodore and purchased 15 systems. All in-house programming associated with this effort will be for the Commodore system; however, a detailed programmer's packet was provided to Sculptured Software so the telescope program can be included on initial Super Nintendo MACS systems.

MACS MONITOR

A 13-inch Commodore monitor has been used with previous MACS rifle systems. A 26-inch monitor was used with our prototype MK 19 grenade machine gun program because the additional screen area was needed to represent long ranges and to allow for elevation of the gun. We considered a larger monitor for the telescope MACS system because moving targets could be better represented, long range targets would appear more realistic, it would enhance some scenarios and the entire screen could not be observed through the telescope. It was decided to stay with the small monitor, primarily so this MACS program would be interchangeable and compatible with other MACS programs which are currently in the field.

MACS RIFLE FOR TELESCOPE

The rifle used for the telescope MACS program should accommodate a telescope or iron sight. It seems appropriate for the MACS rifle to have a Weaver-type rail on top of the upper receiver which will accept a standard A3 telescope or the A3 iron sight. An actual upper receiver could be incorporated into demilitarized MACS rifles, but this is very expensive, cannot be integrated into many of the MACS rifles currently in use, and may require additional modification to prevent reconstruction of a firing weapon. The most reasonable solution appears to be the modification of a demilitarized rifle or a well-constructed model rifle, by sawing off the carrying handle and replacing it with a Weaver-type rail. This will accommodate the scope or iron sight. This procedure results in a suitable MACS rifle and retains the low cost which is an important feature of MACS. We modified one rifle in this manner and used it for our development work.

We worked with TSC on the establishment of new MACS rifle specifications and included requirements which will ensure sufficient rigidity of the upper receiver area so future MACS rifles can be modified for telescope use.

MACS TELESCOPE

None of the three candidate telescopes would work on MACS. They could not be focused at short range and parallax was so bad that they could not be used for training. During the previous testing of telescopes by the Army, the ELCAN scope had been favored. The ELCAN scope purchased by the Army for the most recent testing was the only one with a reticle which was identical to the Army's preferred reticle specifications. Therefore, we purchased an ELCAN scope which had been focused for 110 inches for our initial MACS development work.

This scope was adequate for MACS use, but a serious disadvantage was that the entire 13-inch screen could be viewed through the scope. An important task for emphasis during training is the visual identification of a target and then rapidly acquiring that target through the telescope. If all targets could be observed without moving the eye from the scope, this important shooting skill would suffer. Another real disadvantage of the actual scope is that it would add approximately $500 to the cost of the MACS system and the scope would not be usable on an actual rifle due to the internal modification required for the short range focus.

We experimented with the construction of a telescope which would be inexpensive and more training effective. While trying various combinations of lenses, we found a .22 rifle scope which could easily be modified for MACS purposes. To provide some visual credibility to the thin .22 scope, TSC developed a telescope housing and mount which will be longer, but will look similar to the actual telescope. The .22 scope is inserted into the telescope housing, the crosshair reticle is removed

and replaced with a reticle like the one used in the actual scope and the rear portion of the scope is adjusted to focus on the reticle and the screen at 110 inches. This eliminates all significant parallax and allows viewing of about one-third of the screen area. Using the Simmons rifle scope model number 1002 at a cost of $9.92, with the telescope housing and mount developed by TSC, should result in a very effective MACS telescope for a total cost of $20 to $25.

MACS LIGHTPEN

This contract required the delivery of 15 lightpens. Given that the horizontal jitter experienced with conventional lightpens would detract from effectively training long-range precision shooting, an effort was made to develop an improved lightpen -- one which would reduce horizontal variability from two pixels to one pixel. Futurity Technologies submitted a bid for the improved lightpen which was comparable in cost to what the Army has been paying for standard lightpens. The 15 improved lightpens must undergo field evaluation to determine their worth; however, they have been demonstrated to have no more than one pixel horizontal variability. In any case, during general use they appear to be as good as standard lightpens and they represent a significant step in the development of smaller, more reliable and more accurate lightpens for the MACS system. As part of their development effort, Futurity Technologies worked with one of our programmers to redesign the setup routine used for lightpen calibration. The old routine was a Basic program which did not take readings as fast as they are taken during the firing portions of the program. The new setup routine, in Assembler, allows the lightpen to be calibrated with the same frequency of readings as the firing exercises. This allows the new lightpen to be more stable but this new setup program enhances the performance of all MACS lightpens.

15 MACS SYSTEMS

This contract specifies the delivery of 15 complete MACS systems. However, rifles and telescopes were to have been furnished by the government and they have not been provided.

Initially, it was envisioned that 15 upper receivers and 15 telescopes would be provided to support this project. However, these were not available and now there appears to be a general consensus that it will be more cost effective to utilize modified MACS rifles and training telescopes described above. Also, since the telescope decision has been delayed, it seems inappropriate to provide rifles or telescopes until it is known what telescope design the Army will purchase. The possibility also exists that the Army may decide not to buy telescopes.

Given this situation, all components required to construct 15 MACS systems (computer, monitor, lightpen, trigger switch, wiring harness) are available at TSC for

assembly as soon as the telescope decision is made and rifles and telescopes are available for MACS use. The specifications required for assembly of a low-cost rifle and telescope are also available at TSC.

It should be noted that if the Army decides not to buy telescopes, the 15 MACS systems and software may be used with iron sights as an advanced marksmanship program.

MACS TELESCOPE SOFTWARE

The programming of the telescope MACS Commodore cartridge was very difficult. Using a programmer who was new to MACS, but a highly recommended and competent programmer, we were unable to produce a high-quality program after several weeks of work. The current Commodore MACS program was developed over many years, first in Basic and then Assembler was used to modify, speed up, and enlarge the program. Several quick-fixes have been incorporated and this has resulted in a program which is very difficult to maintain and programming on the Commodore is quite archaic, given what most current programmers are familiar with. If the Commodore system should be retained, all programs should be converted to a new language, probably "C." We considered this for the current program but decided it was too high risk, given the limited time and resources. Also, since it appears that the Commodore is being phased out and this is probably the last MACS program to be developed on Commodore, it appeared reasonable to make another "fix" to the existing Commodore format. Two previous Commodore programmers, who are available only on a part-time basis, were used to develop the Commodore programs.

Four software products are delivered as a result of this effort:

Cartridge/Basic Rifle Marksmanship with Reticle Option -- This is the current Basic Rifle Marksmanship (BRM) program, with two exceptions: the set-up routine has been replaced with a routine which was developed to enhance adjustment and performance of the lightpen and an option is provided to fire the program with iron sights or reticle. If a telescope is used on this program, all replays will show the reticle instead of iron sights. This cartridge is fully compatible with existing MACS systems which are in use and will allow soldiers to practice with the telescope while seeing their aiming point displayed as the appropriate reticle. It must be emphasized that the reticle used in this program is the current ELCAN reticle and must be replaced if that reticle is not selected by the Army or is modified prior to acquisition. Additionally, this program retains the words associated with the iron sight, e.g., leading edge, and these words must be modified to match the selected reticle. It should also be pointed out that the ballistics used in this program are applicable to the M16A1 with a 250-meter battlesight zero and M193 ammunition. While this program will be very useful in allowing soldiers to gain familiarity with the telescopes, these differences should be pointed out by trainers.

Cartridge/Moving Target Training with Reticle Option -- This program has undergone the same modifications as the BRM program discussed above.

Cartridge/Infantry Rifle Marksmanship (Telescope) Commodore Program -- This is a unique telescope program developed for the Commodore computer. Given the limitations of Commodore memory, it addresses only long-range targets, wind, long-range moving targets, and firing situations which require simultaneous adjustment for wind and movement. The detailed training material needed for development of the Trainer's Guide to support this program is contained in the following discussion of the programmer's packet.

Programmer's Packet/Infantry Rifle Marksmanship (Telescope) Nintendo Program -- The 130-page programmer's packet at Appendix A is the full MACS program developed to improve soldier's shooting skills with the scope rifle. This may be programmed by Sculptured Software but not associated with this contract effort. The remainder of this section is keyed to the Infantry Rifle Marksmanship (Telescope) Nintendo Program.

As with all other aspects of this effort, the software cannot be finalized until a telescope and reticle have been selected. The three reticles currently under consideration by the Army are shown at Appendix A, page 3. As an integral part of our training development effort associated with this program, we designed a reticle which we believe will greatly enhance the rifleman's performance. This reticle has been presented to the Infantry School for consideration but it is not used in the MACS program because the Army decision makers have indicated a preference for a circle and inverted V. Accordingly, the ELCAN reticle is used throughout the MACS program, along with the option of the iron sight. However, to assist in reticle selection and to promote discussion which may result in selection of the best reticle for the soldier, the ARI reticle is used throughout this paper. Again, it is important to note that when a final reticle has been selected it must be represented in this program and several word changes must occur as lead rules, hold off, etc. are discussed. In recognition of this requirement, the program has been designed so reticle replacement will be a relatively easy fix.

This program is designed to be fired with telescope or iron sights, so it is fully appropriate as a training tool for Infantry Rifle Marksmanship or other advanced marksmanship training with the M16A2 rifle, the M16A3 with iron sights, or the M16A3 with telescope. A replica M16A1 MACS rifle may be used, but the soldier should understand that the MACS program represents M16A2 ballistics.

Training developers and programmers should know that the Moving Target cartridge was developed subsequent to the Basic Rifle Marksmanship cartridge and as questions arise concerning the commonality of procedures between the current program and either of these two programs, priority should be given to the Moving Target Program.

The zero routine has been modified to force the soldier toward an excellent zero. To prevent this from being a stopper, after six attempts, the soldier may elect to advance with the last zero fired.

Level 1 is a review of the BRM cartridge. Given the training level of most soldiers, this condensed version of BRM provides a needed refresher of shooting fundamentals. Soldiers who have recently completed firing the standard BRM cartridge may skip this level. Note that the ballistic information on page 11 of Appendix A is applicable to the M16A2 rifle with a 300-meter zero. If the center of the selected telescope (line of sight) is more than 2.6 inches above rifle boreline, or if a sight setting other than 300 meters is used for battlesight, these data must be changed accordingly.

Level 2 is a condensed version of the current Moving Target cartridge. Again, it will be beneficial for soldiers unless they have recently fired the Moving Target cartridge, in which case they may want to skip this level. The reticle, when selected, is used for all demonstration and replay. Note that this paper provides the words which are appropriate for the iron sight, the ELCAN reticle, or the ARI reticle. The words will need to be adjusted to match the selected reticle and appropriate holdoff and lead rules.

Level 3 introduces the soldier to long-range shooting. The Army is currently exploring ways to improve ability to engage targets at extended ranges (e.g., to 550 meters). In this MACS program targets are displayed at ranges from 300 to 800 meters in 100-meter increments. Additionally, since the maximum effective range of the rifle is listed as 550 meters, a 550-meter target is included. While the Army has no established standards for extended range targets, the MACS criteria were established based on previous firing data, current observations, and our best judgement. The standards and ranges may require adjustment after soldiers have an opportunity to train and be evaluated using the new telescope.

Shooting at long range is a much more difficult task than shooting at short range, even though the fundamentals are the same. If a 200-meter target is missed, it is safe to assume that shooting fundamentals were not properly applied. However, the soldier may apply shooting fundamentals perfectly and miss a 500-meter target. This may be due to inherent inaccuracies of the rifle or ammunition, effects of wind, an improper range setting on the sight, an error in the estimated range to the target, a less-than-perfect zero, or several other factors. This level eliminates all of those variables and assumes a perfect zero with the sight set at the precise range to the target under no wind conditions. If fundamentals are applied perfectly, the bullet will be displaced from target center only by the inherent error in the lightpen and the MACS system. Any MACS system which is properly adjusted and in good working order will be more accurate than the typical rifle system. Accordingly, the purpose of the initial portion of this level is to provide practice on the very careful application of fundamentals required to hit distant targets under ideal conditions.

When the standard is not met for a particular range, the soldier is told to work on the fundamental for which he received the lowest rating during the engagement of the five targets. All fundamentals which are rated average or below will be shown.

Sometimes it may be appropriate for weak shooters who cannot meet a particular standard to advance through the program, hence at the end of each range, the soldier may elect the option of advancing to the next segment of the program. Trainers should provide additional guidance based upon their evaluation of the soldier's ability and shooting problems.

Soldiers should understand that the objective of suppressive fire is to come as close to targets as possible and that the failure to hit targets at 700 and 800 meters is normal, given the many variables and the very small visual angle represented by a single target at these ranges.

At screen 3-47 of Appendix A the point is made that sights should always remain at battlesight zero, 300 meters, unless a specific target is being engaged. The following firing exercises are intended to familiarize the soldier with the amount of hold off required to hit distant targets while sights remain on the battlesight setting.

Note that this MACS program has been developed under the assumption that sight changes for various ranges will always be made electronically and that the sights on the MACS rifle will not be physically moved. If it is considered desirable to have the soldiers make physical sight changes on the MACS rifle, that is an option which could be incorporated after a sight system has been selected and evaluated for this application on MACS. The training telescope discussed earlier does not incorporate the capability of moving sights. We believe that some problems could be experienced among various MACS systems due to the wide variety of MACS rifles which are in use. Additionally, a MACS sight which was adjustable would have to be as rugged and accurate as the actual sight, increasing cost and complexity of the system. Part of our consideration for this approach is that the adjustment of the sight is a relatively simple task which the soldier can practice on his actual rifle in a non-firing environment.

Since the maximum effective range of the M16A3 is 550 meters and no telescope candidate or the iron sights have a setting for 550 meters, the last targets on this level provide practice in shooting a target at 550 meters -- with both a 500 meter setting and a 600 meter setting.

Level 4 introduces the soldier to moving targets at long range. The current moving target range on Fort Benning has moving targets at a maximum range of 185 meters. These ranges are represented in Level 2 of this program. However, these targets on the defense test range were based on a threat analysis which gave high priority to close-in targets and failed to identify any significant requirements beyond 300 meters. The current effort with the telescope promotes attempts to engage stationary targets out to ranges of 550-600 meters and possible suppressive fire at

ranges to 800 meters. If this is deemed to be a suitable employment for the M16A3 rifle, it appears very unlikely that we would start engaging stationary personnel targets at ranges of 600 to 800 meters but not engage any moving personnel targets until they reach a range of 185 meters. Accordingly, this level establishes lead rules and provides practice in the engagement of moving targets to ranges of 300 meters. Given that the hit probability against stationary targets at ranges out to 500 and 600 meters will be relatively low under conditions of combat, one could make the case, given the many variables involved, that the hit rate against moving targets at these ranges may not represent a significant additional degradation. However, 300 meters was selected as the maximum range for this program because the probability of the Army committing resources to conduct effective training against moving targets beyond this range is considered highly unlikely.

The single lead rule was developed by ARI to simplify the engagement of moving targets; however, this rule must be expanded to hit fast-moving targets at extended ranges. Given the many variables, there is no simple set of rules which will hit target center at all possible speeds and all possible ranges. The single lead rule is established by placing the trailing edge of the front sight post at target center; therefore, this amount of lead is equal to one-half the perceived width of the front sight post. Referring to this as one lead, two leads are equal to the perceived width of the front sight post and three leads are equal to one and one-half times the perceived width of the front sight post. The ARI sight reticle has hash marks which equate to these leads but the ELCAN and other sights under evaluation do not have lead marks at this time. When a final reticle is selected, appropriate adjustments must be made to this program and to the aiming rule for moving targets. The following rules have been established as a memory aid to assist soldiers in the engagement of long-range moving targets:

- Use the single lead rule (one lead) for all targets within 125 meters.
- For targets beyond 125 meters, use the following:
  - -- walking, one lead
  - -- jogging, two leads
  - -- running, three leads

This memory aid should be easy to remember and it will provide good hits on the majority of moving targets encountered on the battlefield. The scale of targets and ballistics used in this program are very accurate, so when a soldier can fire a good score on this moving target section he will have greatly improved his ability to hit moving targets on the battlefield.

Level 5 addresses wind, a very important factor in long-range shooting. The current Army policy is to establish a no-wind zero on the rifle and use hold off to compensate for the effects of wind. A memory aid has been developed to assist soldiers in determine how much to hold off. The rule: 1, 5, 1, 2, 3, 5 is based upon the effects of a 10 mile per hour, full value wind. The numbers mean that the effects of a 10 mile-per-hour wind are 1 inch at 100 meters, 5 inches at 200 meters, 1 foot at 300 meters, 2 feet at 400 meters, 3 feet at 500 meters, and 5 feet at 600 meters. A 10 mile-per-hour wind is a relatively common wind, and knowing that the effects of wind are uniform in relation to speed, e.g., a 5 mile-per-hour wind moves the bullet half as far at each range and a 20 mile-per-hour wind moves the bullet twice as far at each range, the soldier can get a relatively good idea how much to hold off under various wind conditions if he just remembers 1, 5, 1, 2, 3, 5.

The Marksmanship Field Manual, FM 23-9, provides a discussion on wind measurement using the flag method, the pointing method, and the observation method. This MACS program incorporates another cue which may be present on the battlefield, a rising column of smoke.

This program accurately reflects the amount of bullet displacement caused by various winds. Of course, the soldier will never have an accurate measure of wind on the battlefield and the effects of wind will seldom be uniform between the firing position and the target area. While this MACS program is essential for learning how to compensate for the effects of wind, it is no substitute for rifle practice under various wind conditions with appropriate feedback.

The 5-shot replay at the end of each range allows the soldier to reflect on his performance for each shot while he sees the wind direction and speed for that shot. Note that the memory aid is used throughout this level to promote understanding and encourage its use.

Level 6 puts it all together. With rifle sights remaining on battlesight zero, stationary and moving targets are engaged at ranges from 75 to 400 meters under various wind conditions.

The individual target replay shows the aiming point necessary to hit target center when only one factor is considered. The aiming points needed to allow for range, wind, and target movement are shown individually as well as the correct aiming point which properly integrates these three factors. The soldier's aiming point is also shown for each target.

Hold off for range is not affected by wind or target movement, so it remains a constant. It will be noted that when wind and target movement are in opposite directions, the hold off required will be additive and when they are in the same direction, one will compensate the other to some degree. In an actual environment, the soldier should use what holdoff is necessary to compensate for wind -- it's always

in the same direction regardless of target movement and then lead the target the appropriate amount from the wind holdoff point. While this can appear to be a very complicated exercise, these are factors which must be mastered to be an effective battlefield marksman.

CONCLUSION

Given that an Army decision on telescope selection has been delayed beyond the time allotted for this contract effort, this Research Note provides information and guidance which will assist in finalizing MACS software, MACS hardware, and marksmanship training materials when final telescope decisions are made.

APPENDIX A

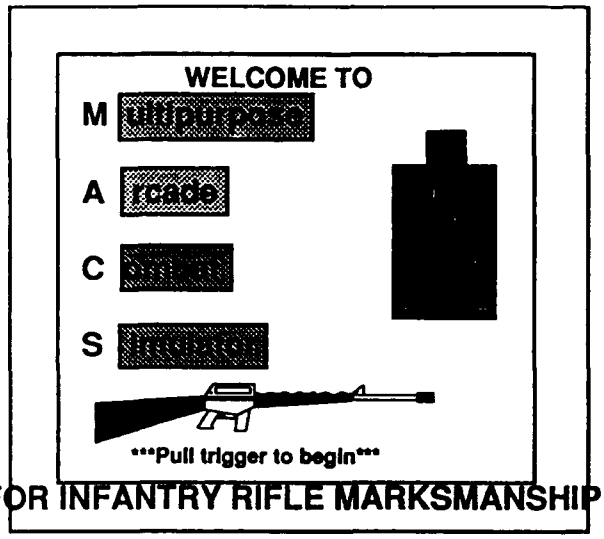
PROGRAMMER'S PACKET

MACS TELESCOPE PROGRAM SEQUENCE

SCREENS

This paper provides general guidance to programmers for the Infantry Rifle Marksmanship (Telescope) Program. The program is designed to support training with the M16A3 rifle (M16A2 with telescope).

0-1



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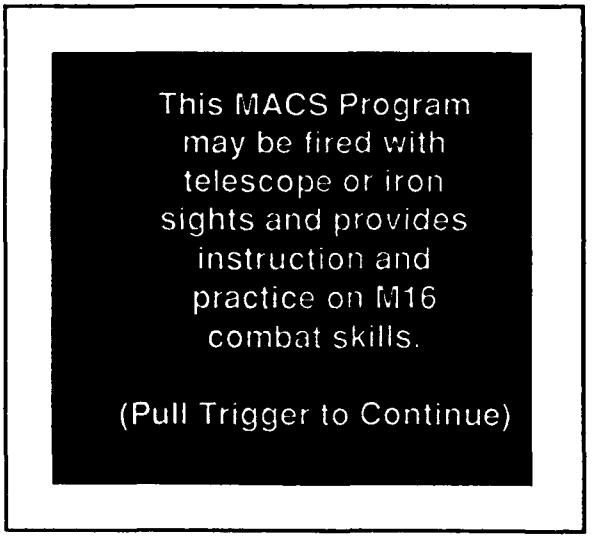

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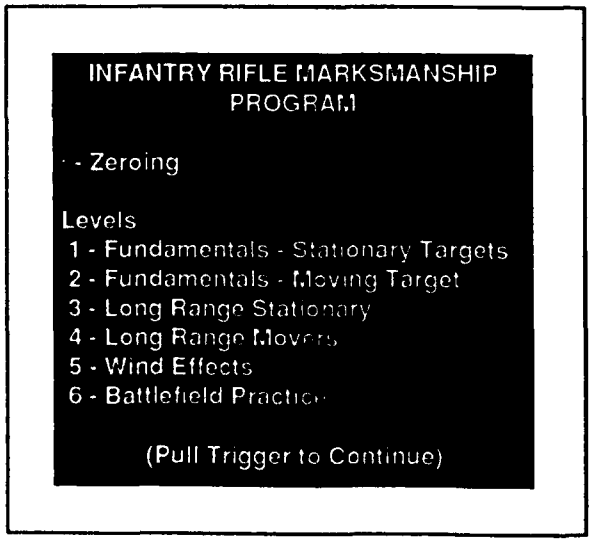


0-4

This program may be fired with telescope or iron sights.

Select the one you want.

TELESCOPE IRON SIGHTS

POINT RIFLE AND PULL TRIGGER TO SELECT SIGHT.

Selection will blink when rifle is pointed at it.

0-4a

You have selected to fire the program using (iron sights) or (a telescope). Is this correct?

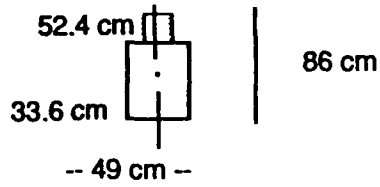
YES NO

POINT RIFLE AT ANSWER AND PULL TRIGGER.

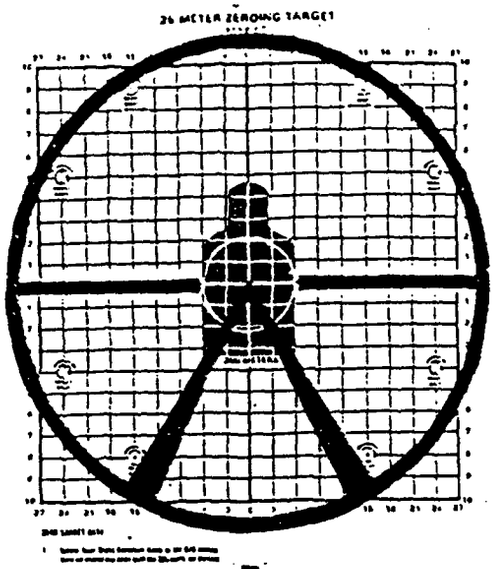
NOTE: Visual of iron or reticle. If "NO" is selected, return to 0-4.

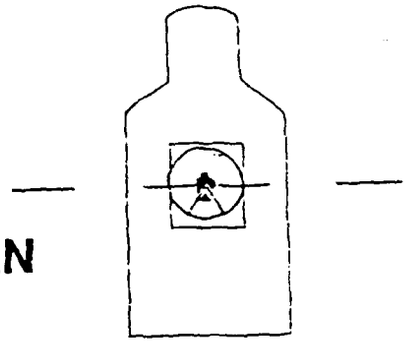
0-5

NOTE: The M16A2/M16A3 iron sight and the M16A3 reticle will be used on this program. However, we will not know which reticle the Army has selected until this program has been completed. The three reticles in scopes currently being tested are shown at Page 3, as they will appear on a zeroing target at 25 meters. At the center of Page 4 is an ARI reticle which has been approved by Dr. Smith. Note that this is a modification of the reticle used in the 15 July edition of this paper. The earlier reticle remains in some parts of this paper, but will not appear on the MACS screen. Given that the reticle decision remains somewhat open and that we must be able to substitute the final reticle as a last minute fix, use the ELCAN reticle and the A2/A3 iron sight in the primary program. This will allow the aiming point to always be the same for the center tip of the front sight post or the tip of the inverted "V." The aiming point for the ARI reticle will be different because it is based on a 250-meter battle-sight zero and no sight adjustment is required to engage targets at range. The initial MACS program will use the rule shown at Page 4. At Page 5 the iron sight and both reticles are shown the actual size that they should appear on the MACS screen.

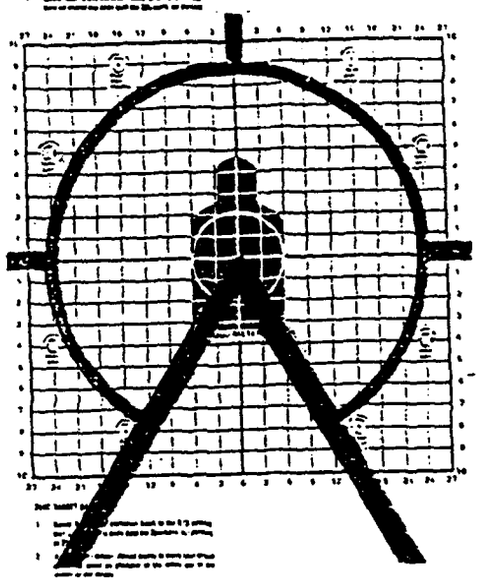


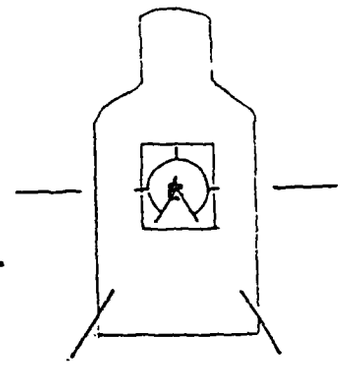
Graphic of 300-m target showing center mass spot. The same 300-meter zero will be used for iron and scope. The actual target size is 49x86 cm, with center-of-mass 33.6 cm from the bottom.



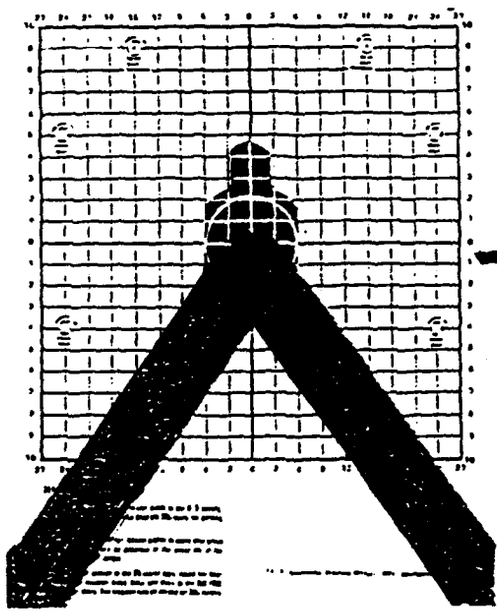


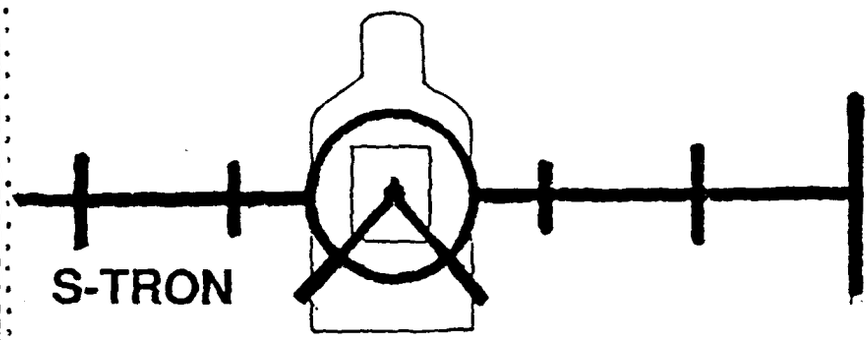
ELCAN



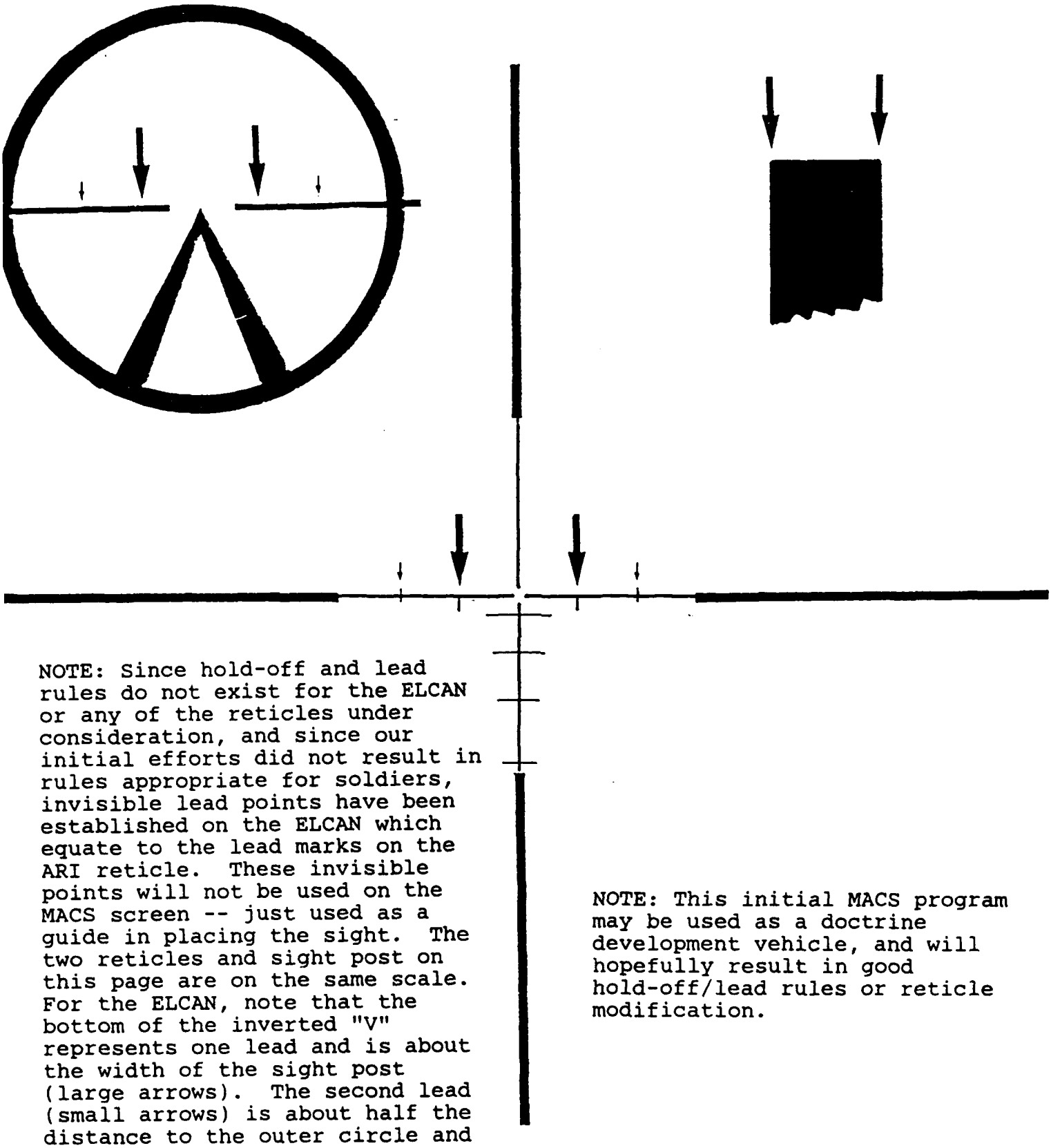


SUSAT





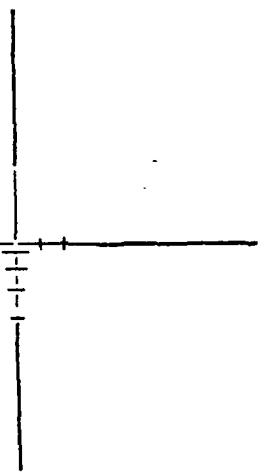
S-TRON

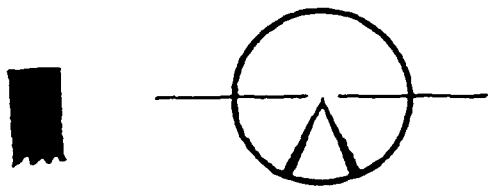


NOTE: Since hold-off and lead rules do not exist for the ELCAN or any of the reticles under consideration, and since our initial efforts did not result in rules appropriate for soldiers, invisible lead points have been established on the ELCAN which equate to the lead marks on the ARI reticle. These invisible points will not be used on the MACS screen -- just used as a guide in placing the sight. The two reticles and sight post on this page are on the same scale. For the ELCAN, note that the bottom of the inverted "V" represents one lead and is about the width of the sight post (large arrows). The second lead (small arrows) is about half the distance to the outer circle and the outer circle will serve as the third lead point.

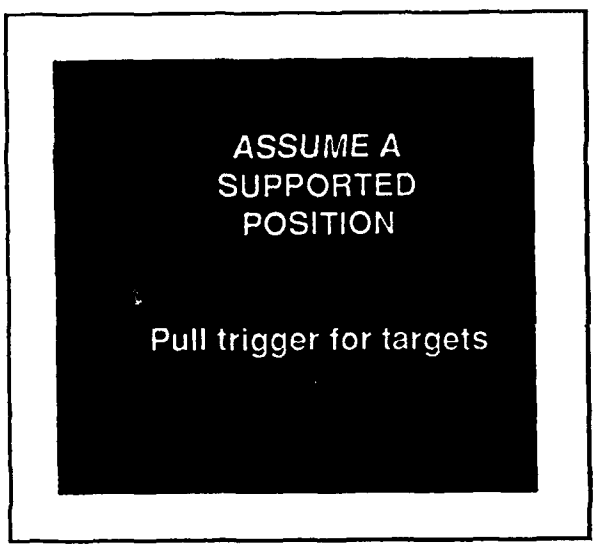
NOTE: This initial MACS program may be used as a doctrine development vehicle, and will hopefully result in good hold-off/lead rules or reticle modification.

NOTE:
ARI reticle,
M16A2/3
front sight
post, and
ELCAN reticle,
scaled to the
size they
should appear
on the MACS
screen.



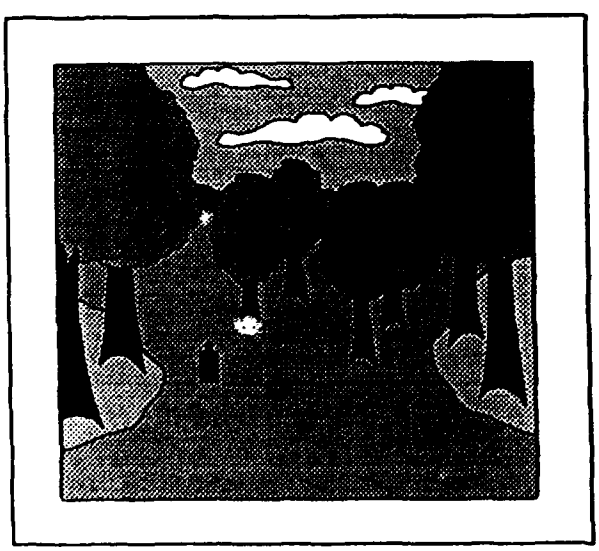


0-6



"Pull trigger for targets" in RED for all screens when the next screen is a firing requirement.

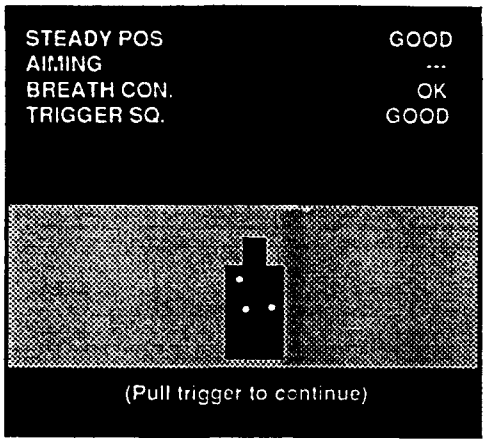
0-7



NOTE: Previous zero targets are scaled for 250 meters. This one is scaled for 300 meters.

Graphic scene of range - 3 targets presented - one at a time.

0-8

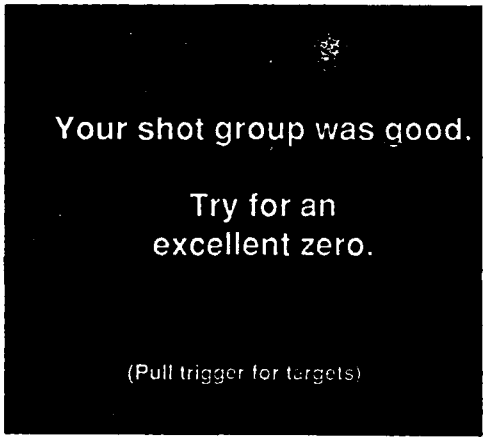


Graphic of target showing the spot locations of the three shots, now centered around the center of mass.

NOTE: No attempt is being made to assign the actual sequence number to each screen.

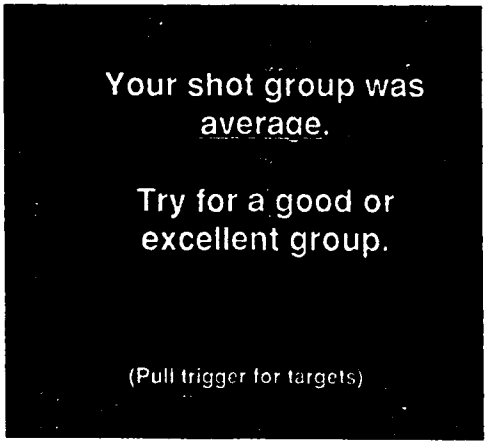
NOTE: For "Excellent" shot groups, the next screen is 1-1.

0-9



NOTE: Force the shooter to try for an "Excellent" shot group, but after the third unsuccessful attempt, show screen 0-10.

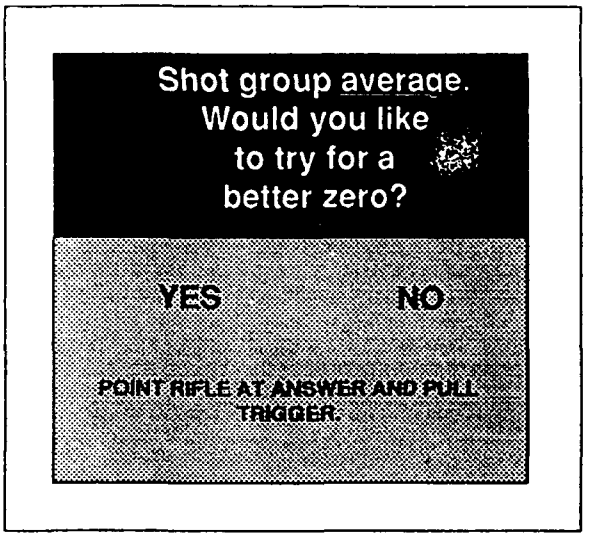
0-10



NOTE: Following the evaluation of a good or excellent group, screen 1-1 will be shown.

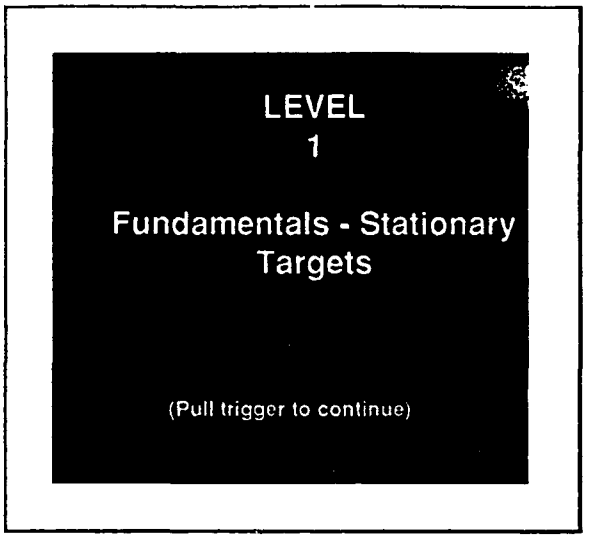
If a good or excellent group is not fired after a total of 6 groups, show 0-11 after each group.

0-11



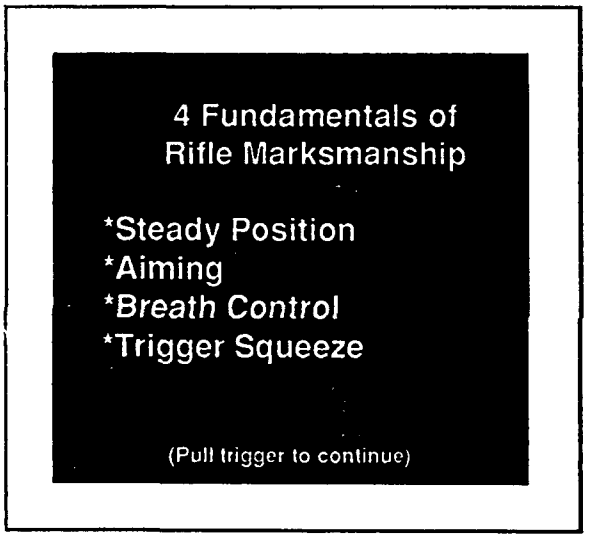
NOTE: Repeat this screen until a good or excellent group is obtained or "no" is selected.

1-1

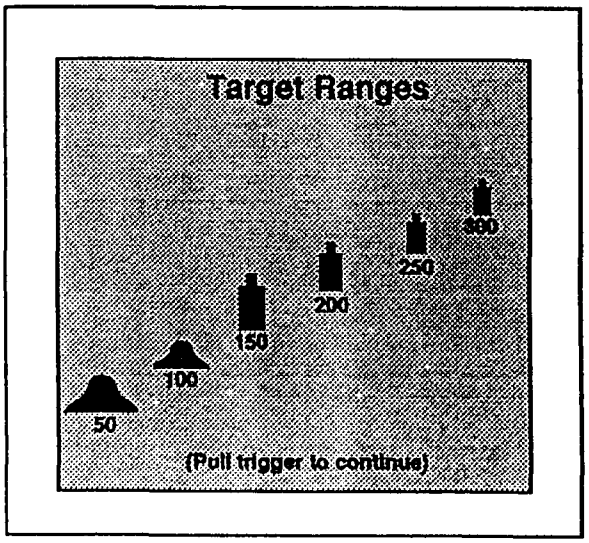


NOTE: Many screens can be lifted directly from BRM.

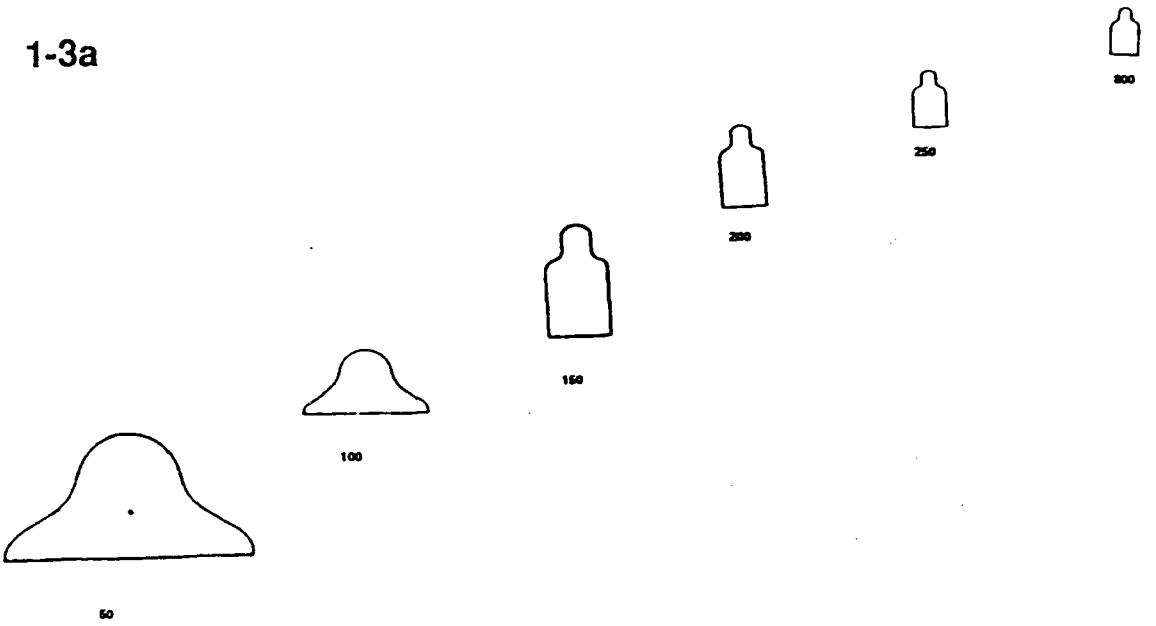
1-2



1-3

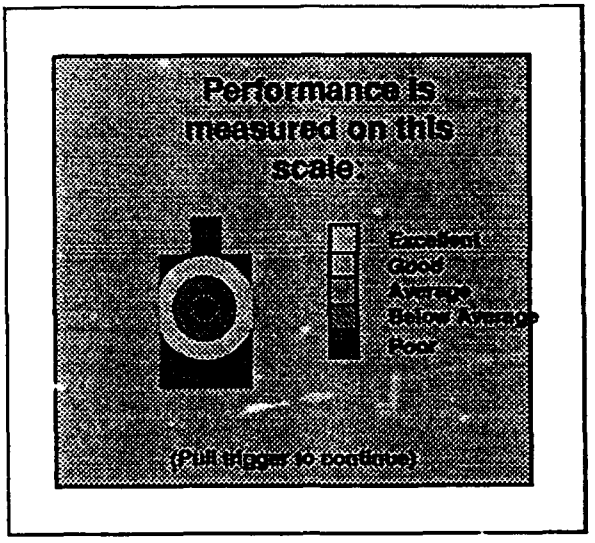


1-3a

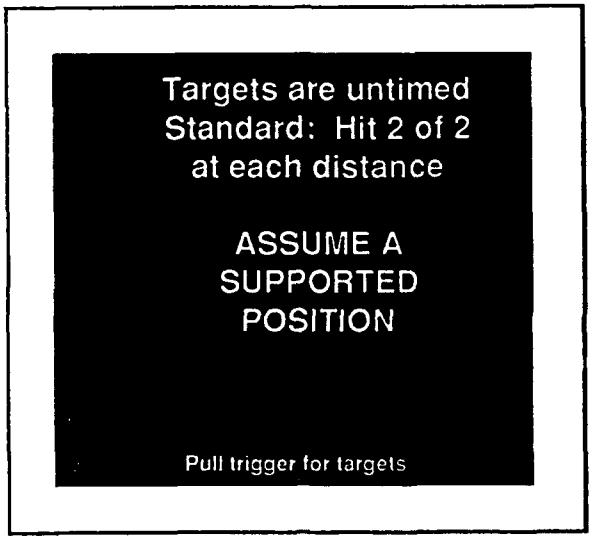


NOTE: Targets shown actual size
.hey will appear on MACS screen.

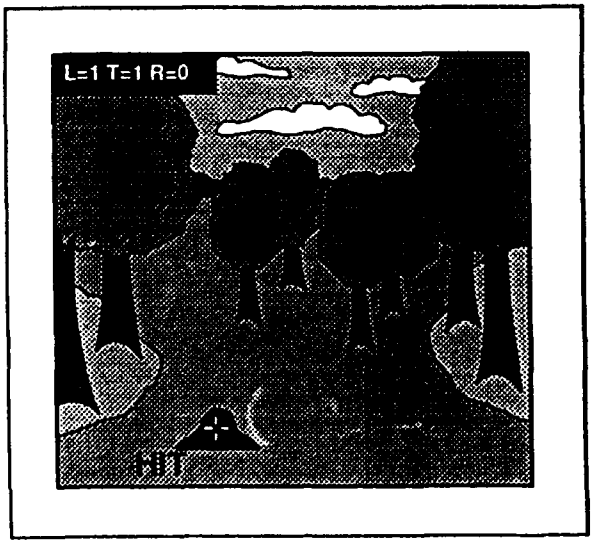
1-4



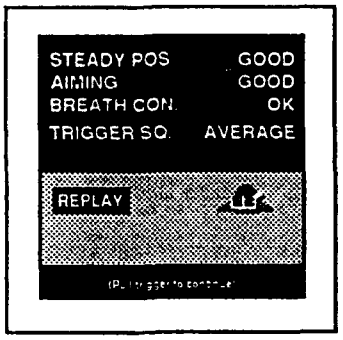
1-5

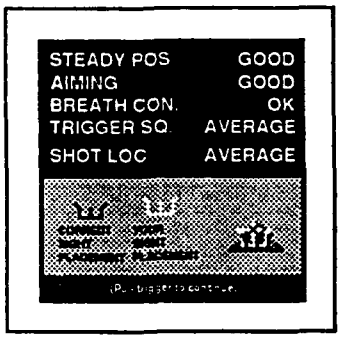


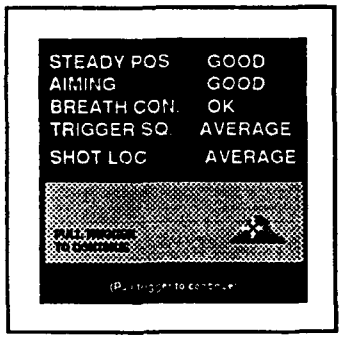
1-6 to 1-31



FEEDBACK SCREEN SEQUENCE





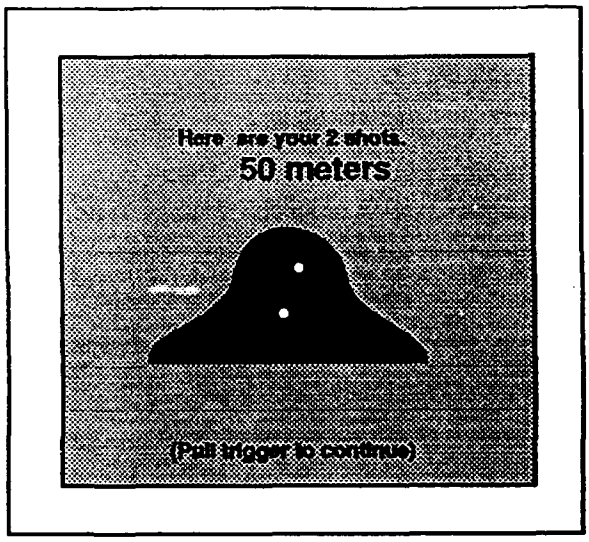


NOTE: For replay, show the correct sight placement below target center and show the bullet above point of aim as follows:

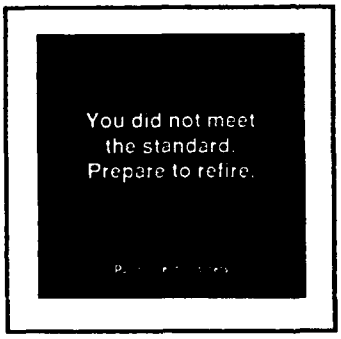
50 M - 3.5 cm
100 M - 11.0 cm
150 M - 15.0 cm
200 M - 14.7 cm
250 M - 9.9 cm
300 M - Same

Detailed Feedback provided -- (use iron sights or the appropriate reticle)

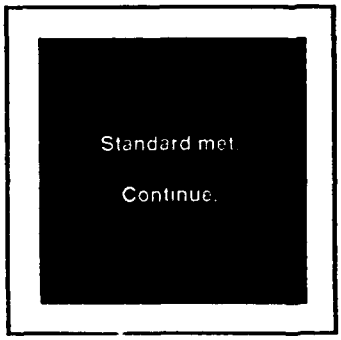
-- and a second target, followed by the summary and a 2-target summary screen.



If a target is missed --



When standard is met --



1-32

Stationary Target
Evaluation Exercise

20 Timed Targets
20 Shots

Shot Location for Misses Only

Standard: Hit 15 of 20

(Pull trigger to continue)

1-33

ASSUME A
SUPPORTED
POSITION

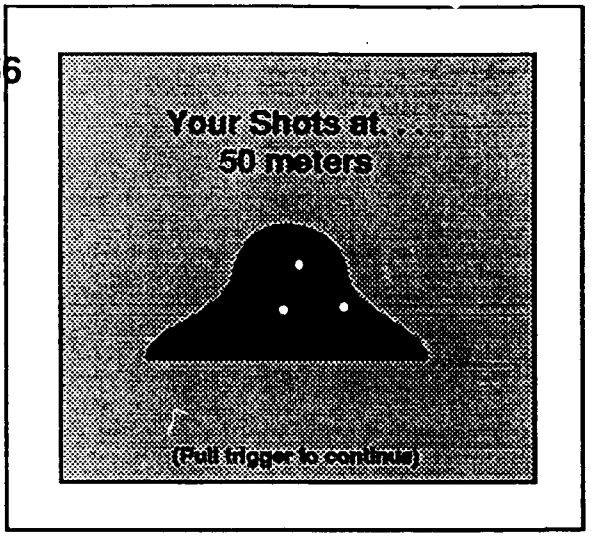
Pull trigger for targets

NOTE: Display 3 each of 50, 100, 150, and 200-meter targets and 4 each of 250 and 300-meter targets in a random fashion. Adjust exposure times to about 2, 3, 3, 4, 5, & 6 seconds for 10 single exposures and add times minus 25% for double exposures.

1-34 to 1-55

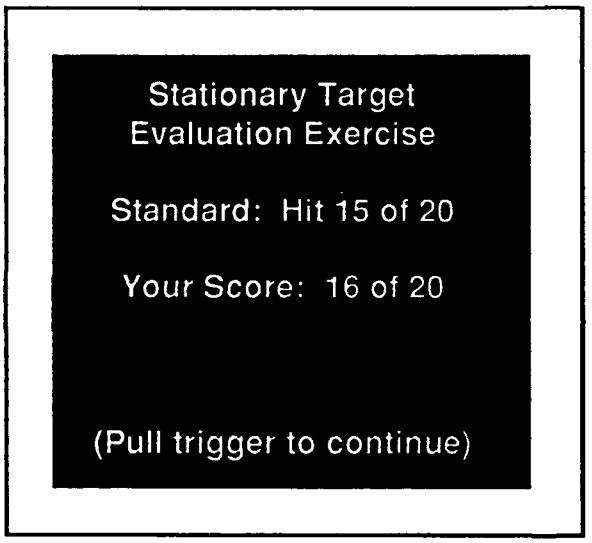
FIRING EXERCISE

1-51 to 1-56



NOTE: Repeat this screen for 100, 150, 200, 250, and 300 meters.

1-57

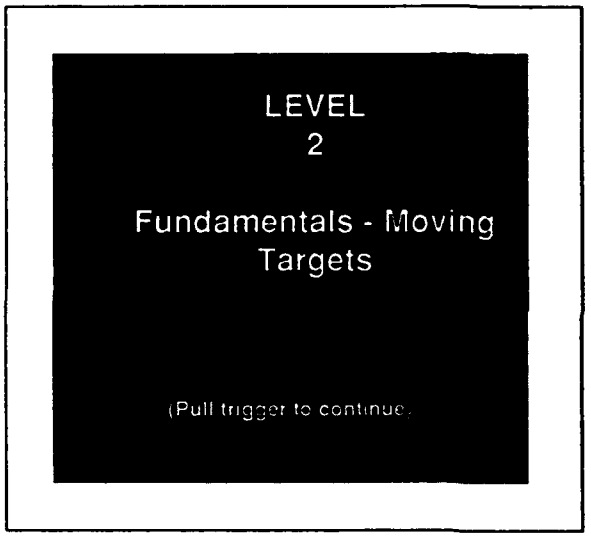


1-58


You did not meet
the standard.
Prepare to refire.

OR

2-1


LEVEL
2
Fundamentals - Moving
Targets
(Pull trigger to continue)

2-1

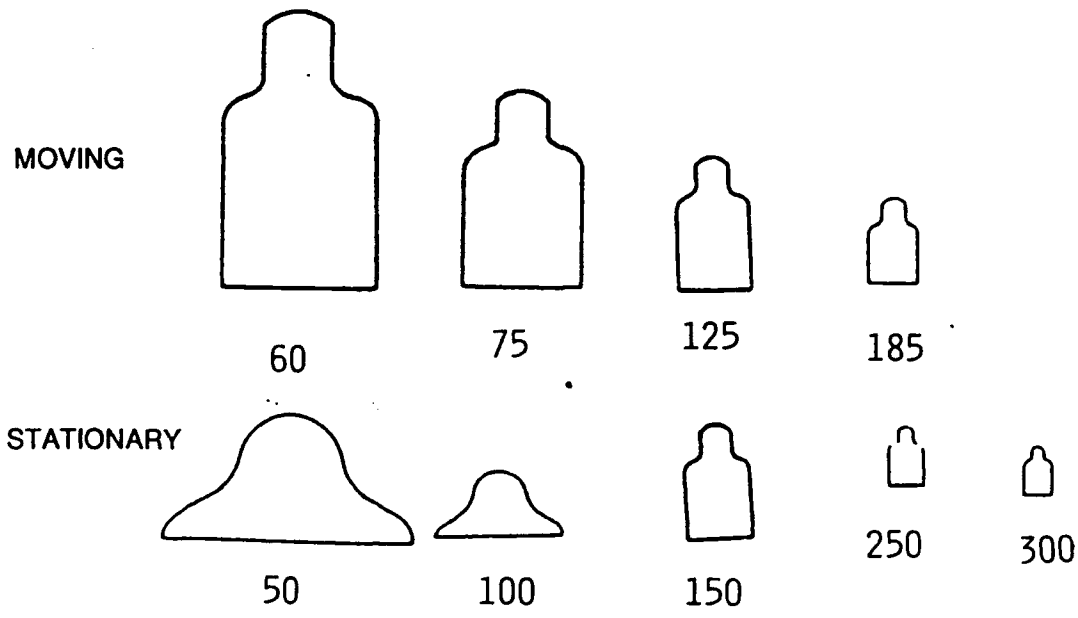
LEVEL
2

Fundamentals - Moving Targets

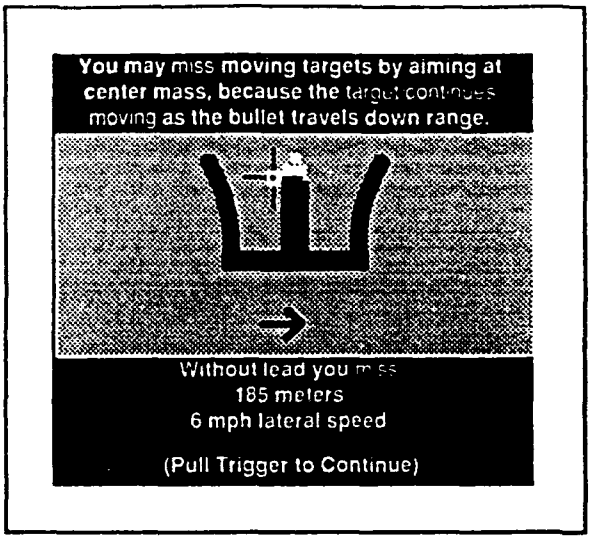
(Pull trigger to continue)

2-1a

TARGET RANGES



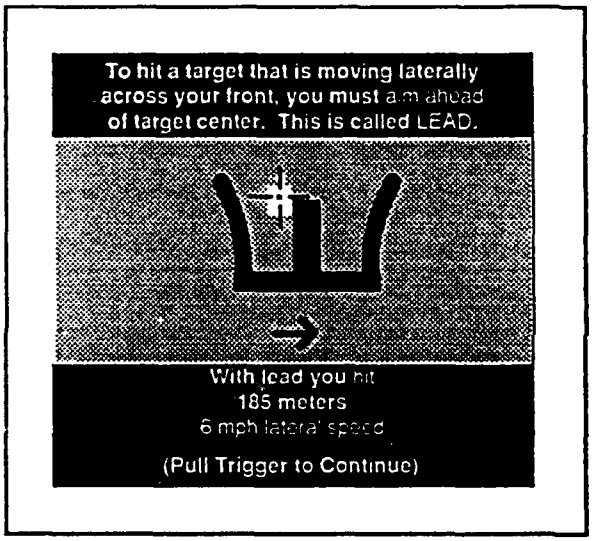
2-2



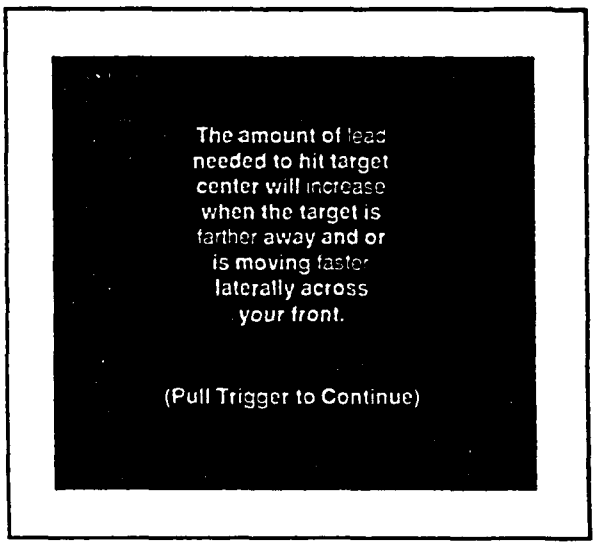
NOTE: Many of these screens are a direct lift from the moving target program.

Graphic showing a miss when aiming center mass

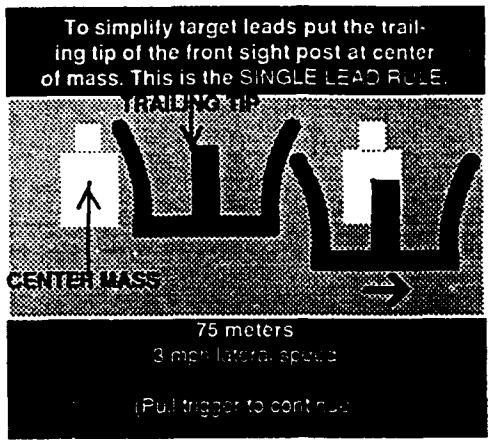
2-3



2-4



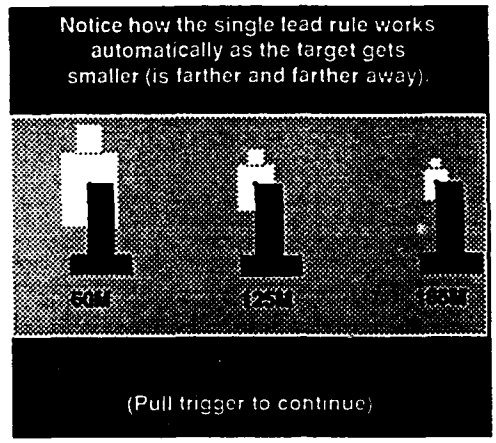
2-5



NOTE: When different words are needed for iron and reticles they will always be in this sequence: (iron) or (ELCAN reticle) or (ARI reticle).

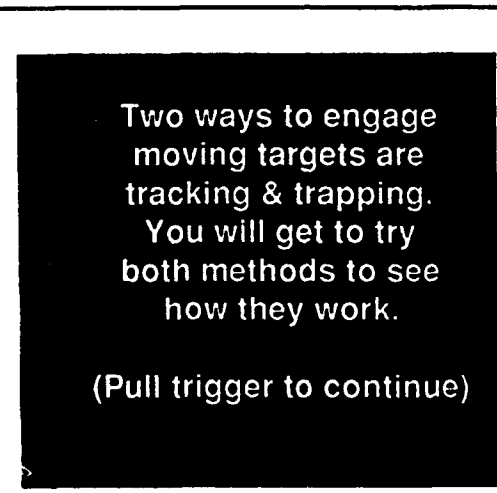
Graphic defining center of mass, and (trailing tip of the front sight post) or (first lead) or (trailing first hash mark; and then showing the proper single lead rule sight placement.

2-6

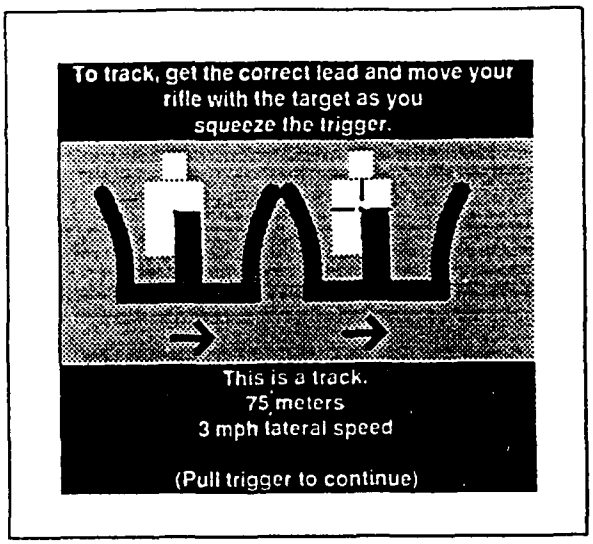


Graphic of 60m, 125m, and 185m targets showing how the single lead rule advances the center of the sight farther and farther forward on the target

2-7

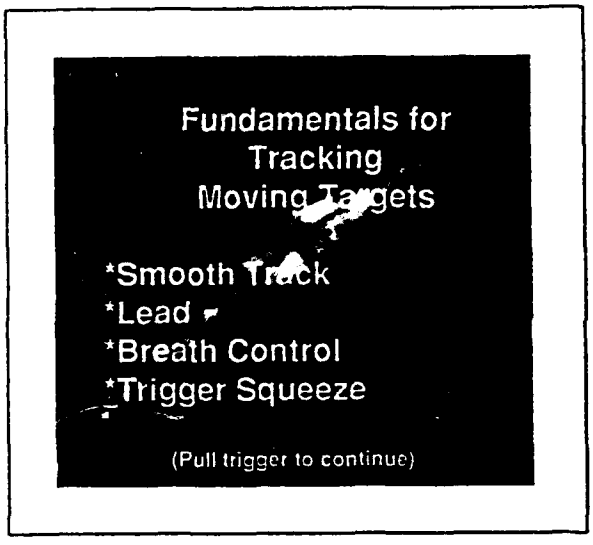


2-8

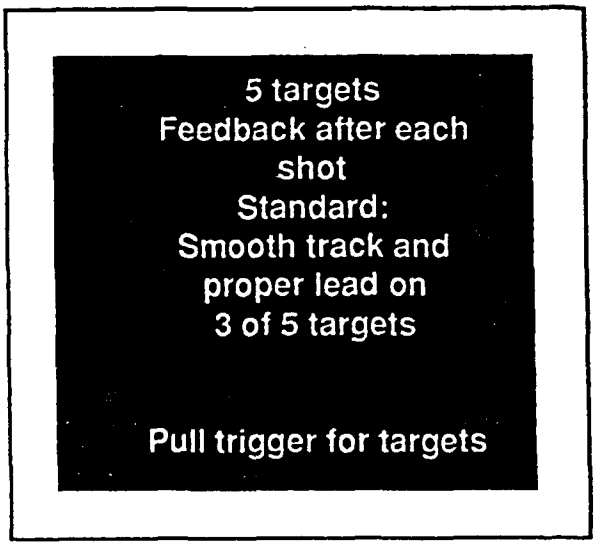


Graphic showing a proper smooth tracking sequence

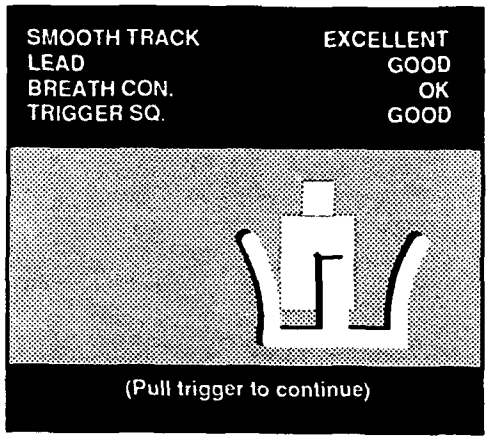
2-9



2-10

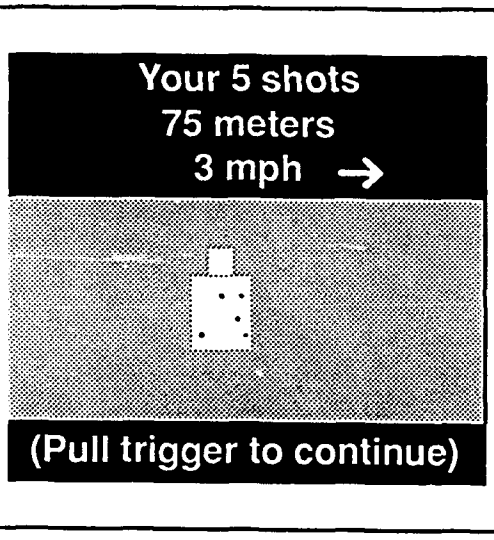


-11, -15



Five 75-meter targets moving at 3 mph from left to right with replay after each shot.

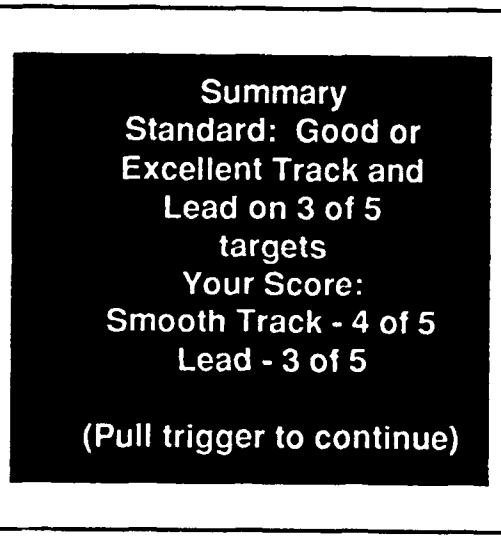
-16



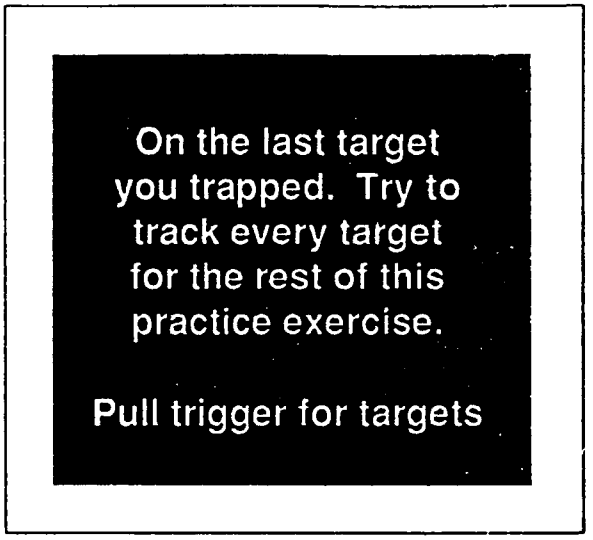
Summary screen showing 5 shots.

NOTE: Beginning here and wherever summary screens are given, the results should be separated by direction of target movement, wind direction, and combinations of these (if any) so mistake trends can be more clearly seen by the shooter.

-17



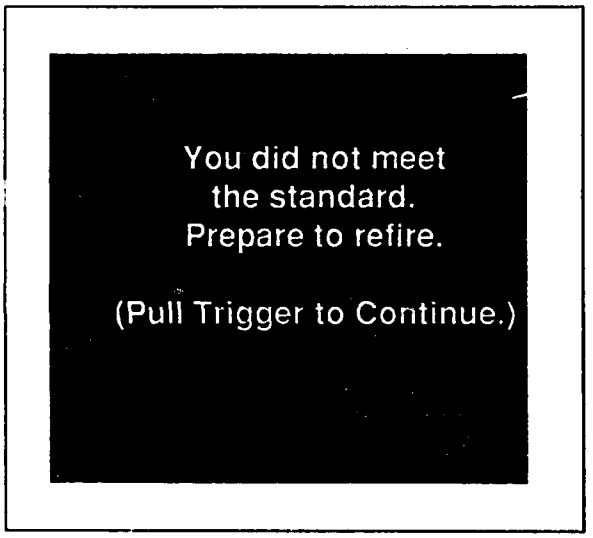
2-18



NOTE: If at any time the person does not track (traps instead), give this screen.

NOTE: When this occurs, cycle back to the same target.

2-19



If the standard is not met, display this screen:

2-20

For a smooth track,
move your rifle at
the same speed as
the target, trying
to keep the trailing
tip of the front
sight post at
target center mass.

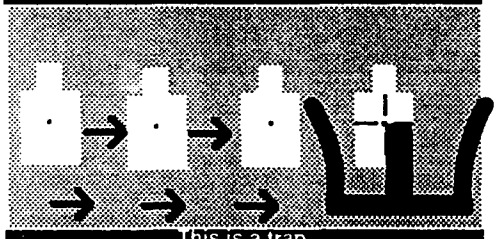
Pull trigger for targets.

Following 2-19., provide this screen and then repeat the five targets.

(trailing tip of the front sight post) or (first lead) or (trailing first hash mark).

2-21

To trap, establish a steady position in front of the target and pull the trigger when the target gets to the right spot.



This is a trap.
75 meters
3 mph lateral speed
(Pull trigger to continue)

Graphic showing a proper trap sequence

2-22

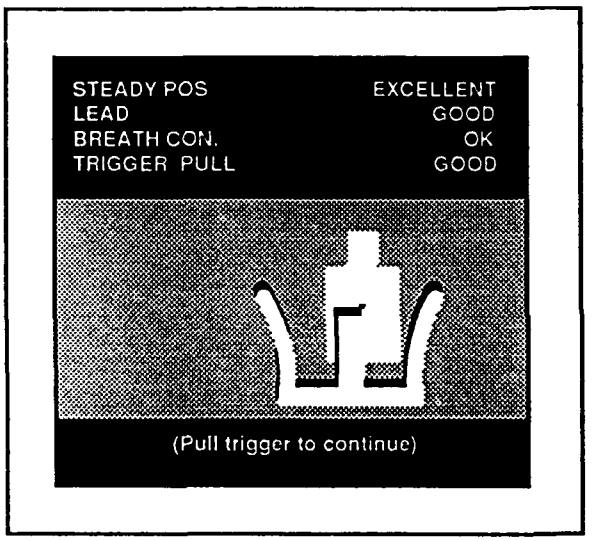
Fundamentals for
Trapping
Moving Targets

*Steady Position
*Lead
*Breath Control
*Trigger Pull

(Pull trigger to continue)

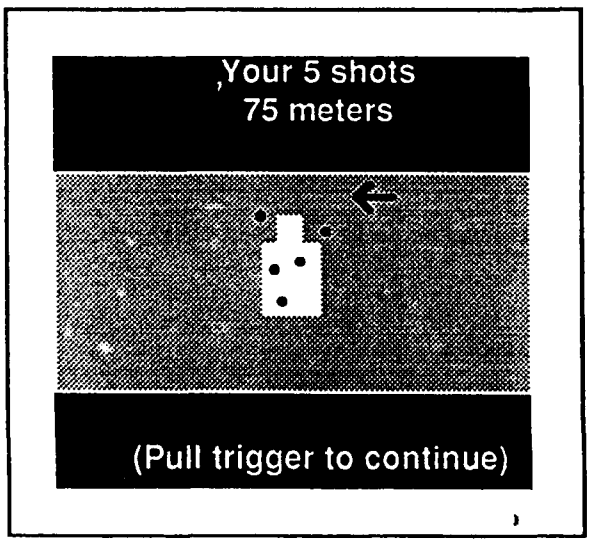
2-23

2-24



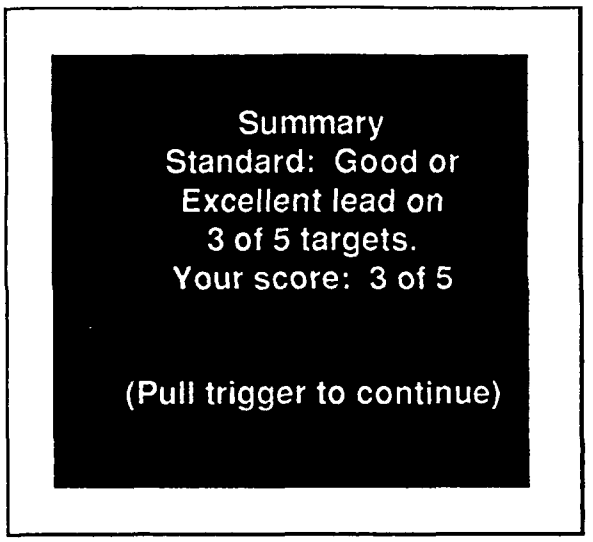
Five 75-meter targets moving at 3 mph from right to left, with replay after each shot.

2-25



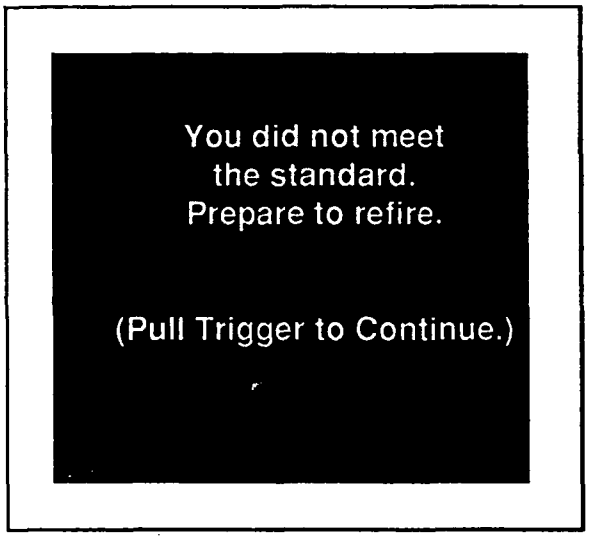
Target with five shots. (2-16.)

2-26

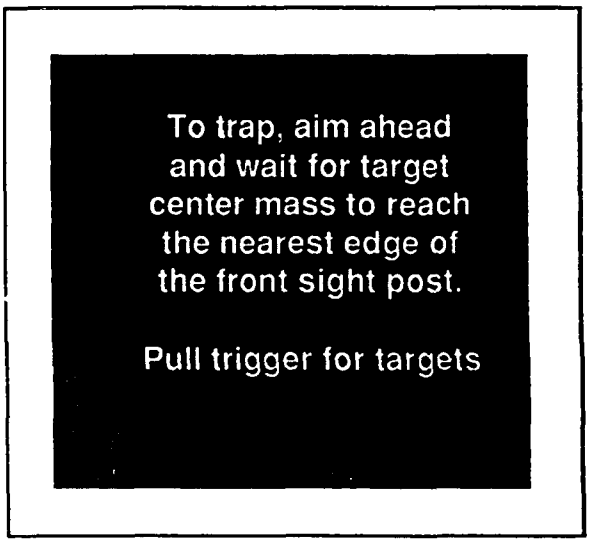


Following the summary, if a person has not met the standard, display 2-27.

2-27



2-28



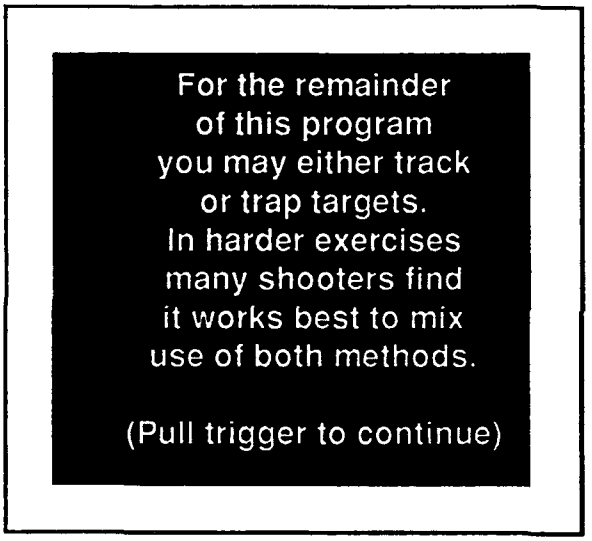
(nearest edge of the front sight post) or (first lead) or (nearest hash mark before center).

2-29

NOTE: If at any time the person does not trap (tracks instead), give this screen:

NOTE: Cycle back to the same target.

2-30

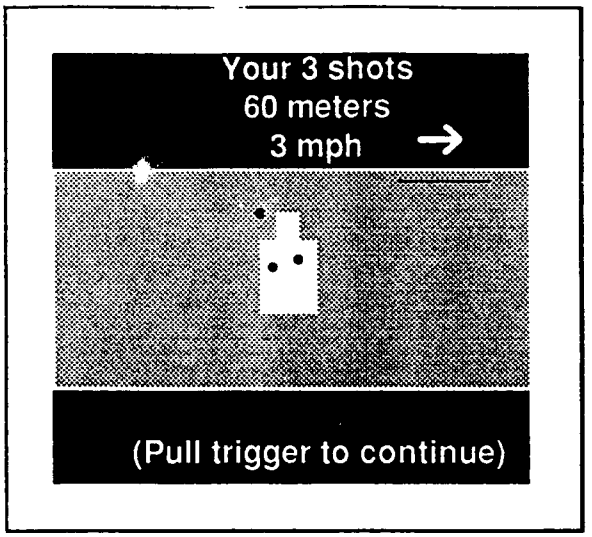


2-31

NOTE: 21 target presentation

Range	Direction	Speed	# Total
60	L to R	S, M, F	9
75	R to L	F	3
125	L to R	S F	6
185	R to L	M	3
			21

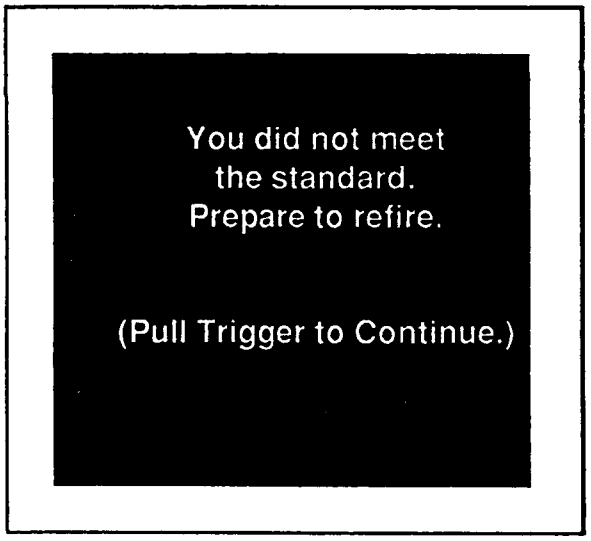
2-32,
2-51



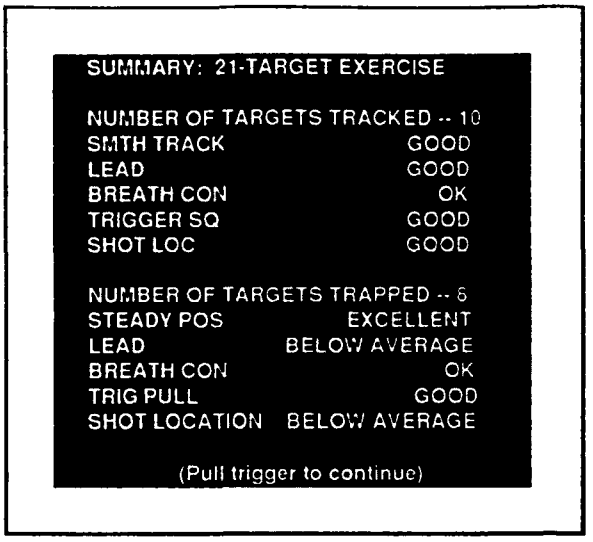
Graphic scene and moving target presentation of 21 targets with playback.

After each three shots, this summary is shown.

Failure to meet the standard gives this screen and requires a repeat of the three shots:



2-52



2-53

NOTE: 20 target presentation

Range	#	Exp* Time	Speed
50S	1	2 sec	
60M	4		S, M, F, F
75M	4		M, M, F, F
100S	1	3 sec	
125M	4		S, M, F, F
150S	1	3 sec	
185M	3		S, M, M
250S	1	4 sec	
300S	1	5 sec	

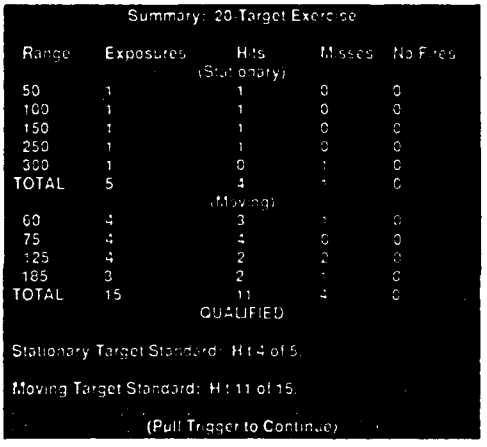
*Expose while a target is moving - leave up for this time - after the moving target is gone.

2-54, 2-74

Graphic scene with stationary and moving target presentation sequence - - Level 2.

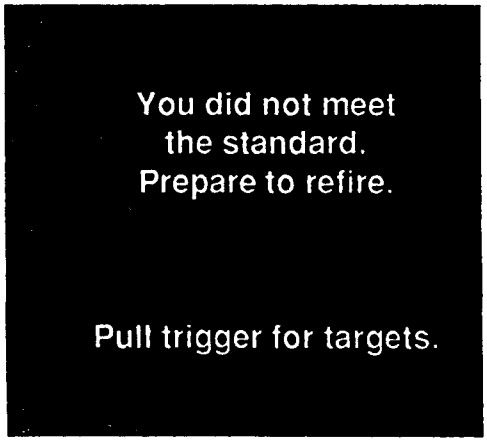
NOTE: OUT OF AMMO appears when shot allowance is expended.

2-75



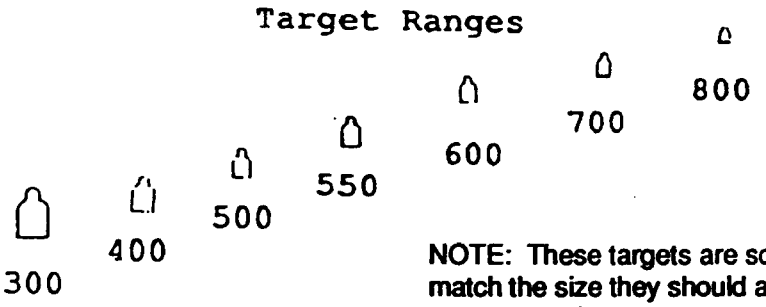
Upon completion of the scenario, this screen is shown.

NOTE: Failure to qualify requires a complete scenario refire, shows the word *UNQUALIFIED* and gives the following screen:

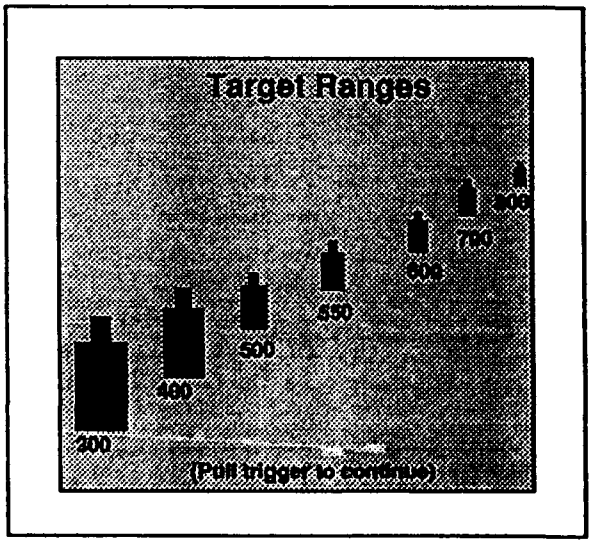


3-1

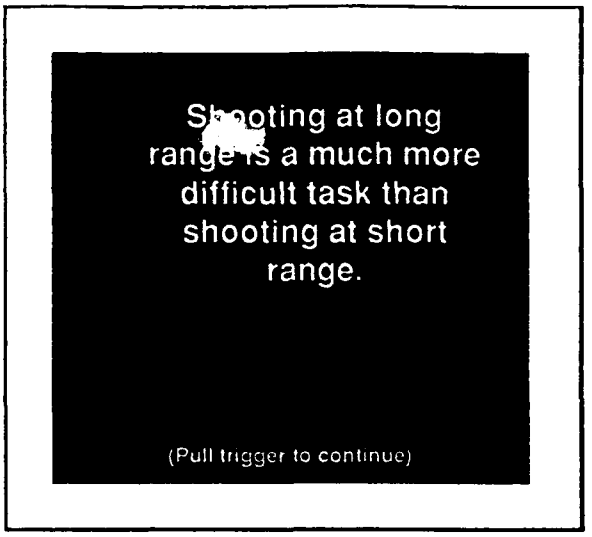
3-2



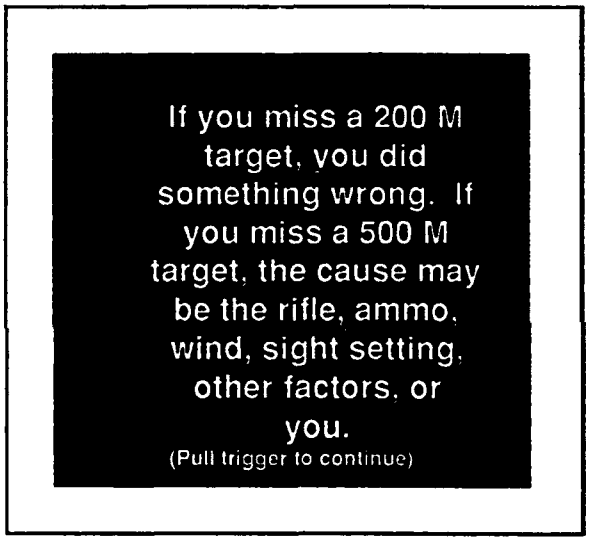
NOTE: These targets are scaled to match the size they should appear on the MACS screen.



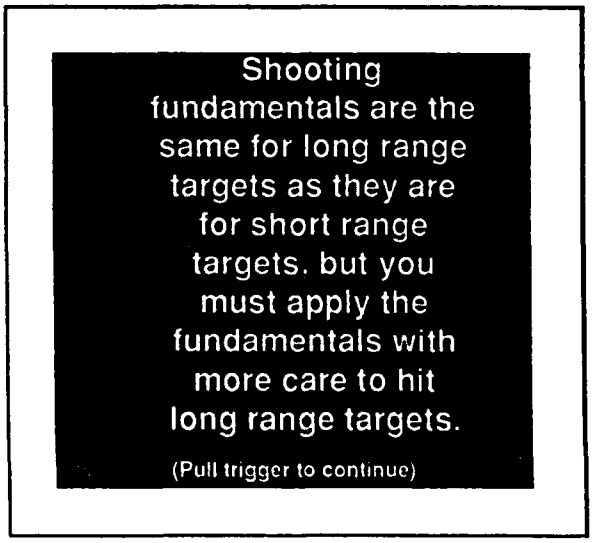
3-3


Shooting at long range is a much more difficult task than shooting at short range.
(Pull trigger to continue)

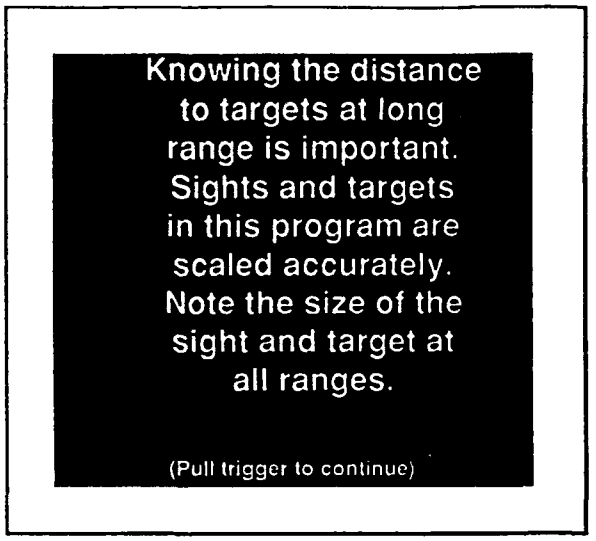
3-4


If you miss a 200 M target, you did something wrong. If you miss a 500 M target, the cause may be the rifle, ammo, wind, sight setting, other factors, or you.
(Pull trigger to continue)

3-5


Shooting fundamentals are the same for long range targets as they are for short range targets, but you must apply the fundamentals with more care to hit long range targets.
(Pull trigger to continue)

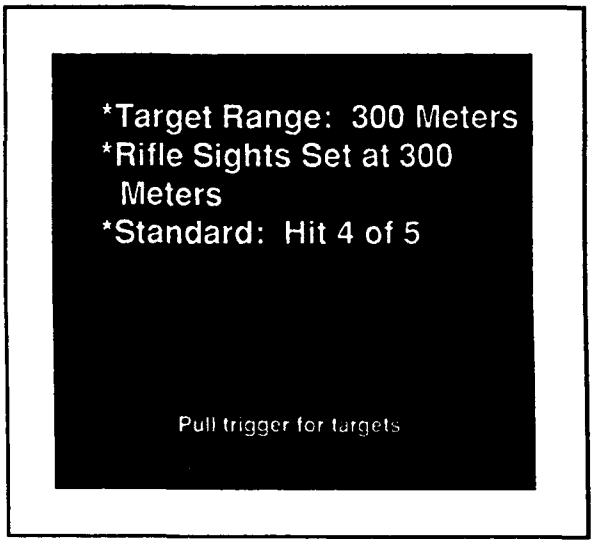
3-6


Knowing the distance to targets at long range is important. Sights and targets in this program are scaled accurately. Note the size of the sight and target at all ranges.
(Pull trigger to continue)

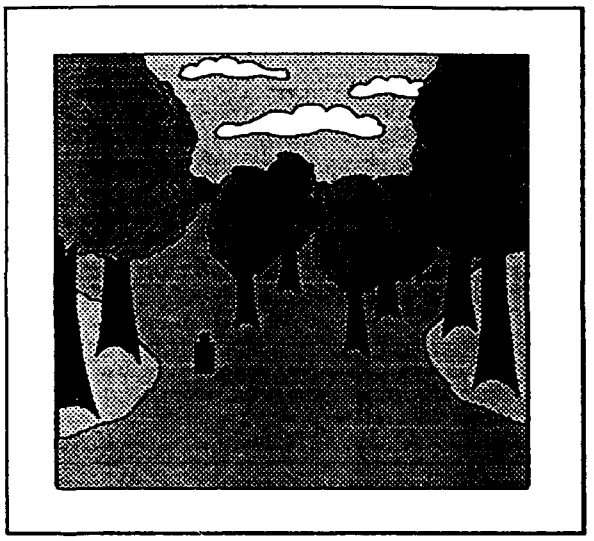
3-7


*Targets are untimed.
*Rifle Sights: Setting shown for each exercise.
*No wind.
*Fire from a supported position.
(Pull trigger to continue)

3-8


*Target Range: 300 Meters
*Rifle Sights Set at 300 Meters
*Standard: Hit 4 of 5
Pull trigger for targets

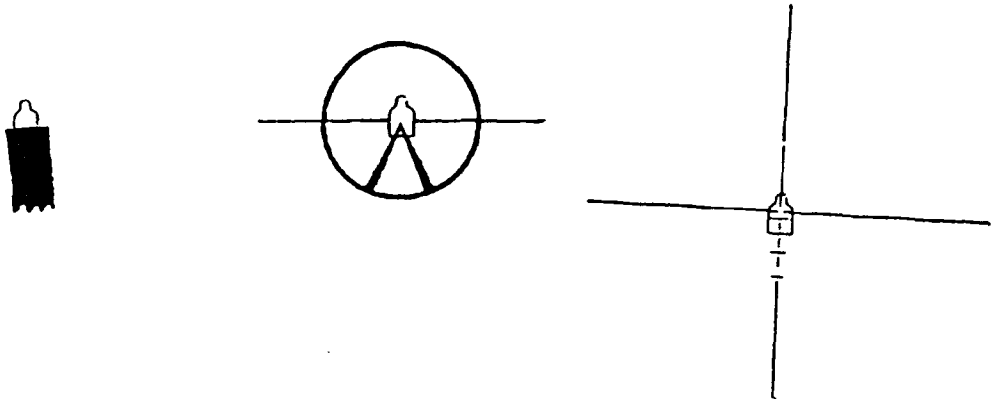
3-9



Scene with 300 M target.

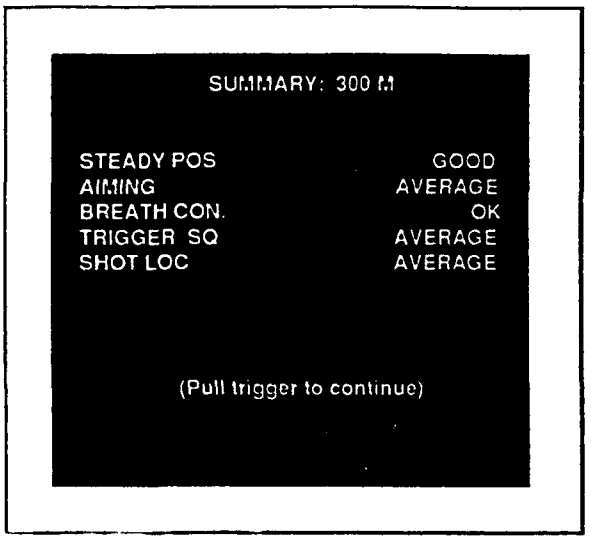
3-10

Graphic of target with correct sight and your sight.

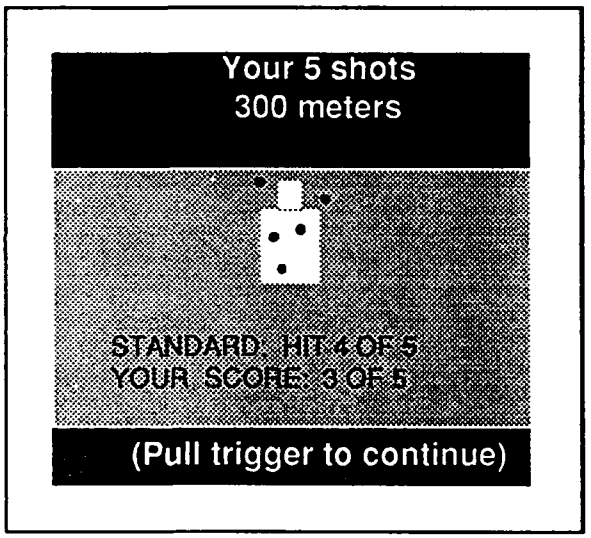


NOTE: Make the criterion for EXCELLENT and GOOD tighter - by about 40%. Repeat 3-9 and 3-10 four times.

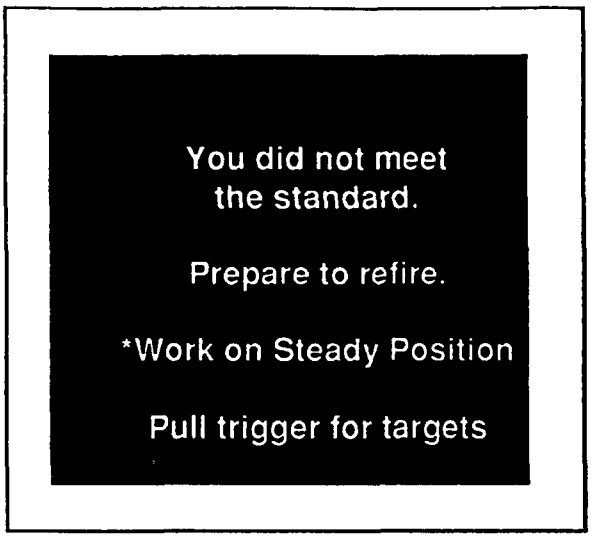
-11


SUMMARY: 300 M
STEADY POS GOOD
AIMING AVERAGE
BREATH CON. OK
TRIGGER SQ AVERAGE
SHOT LOC AVERAGE
(Pull trigger to continue)

-12


Your 5 shots
300 meters
STANDARD: HIT 4 OF 5
YOUR SCORE: 3 OF 5
(Pull trigger to continue)

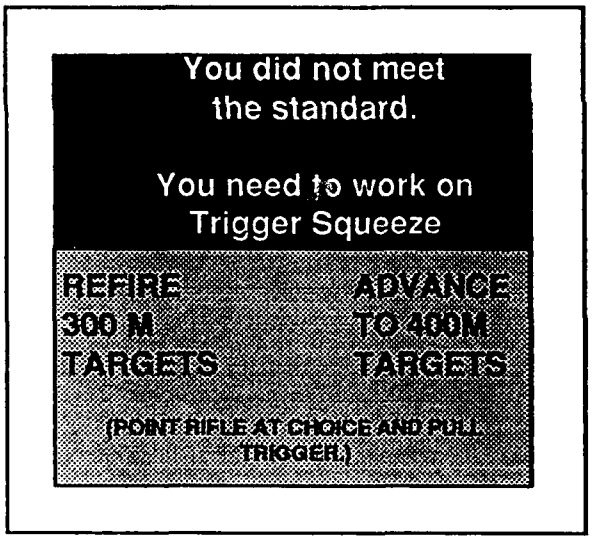
3-13



NOTE: *The lowest rating -- Steady Position, Aiming, or Trigger Squeeze. Show all which are "average" or below.

NOTE: After the third set of 5 targets, show the following.:

3-14



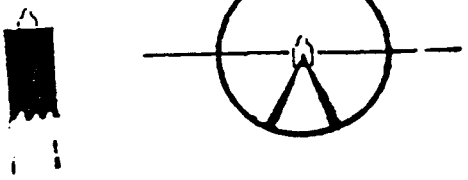
Use this procedure on most of the remaining exercises.

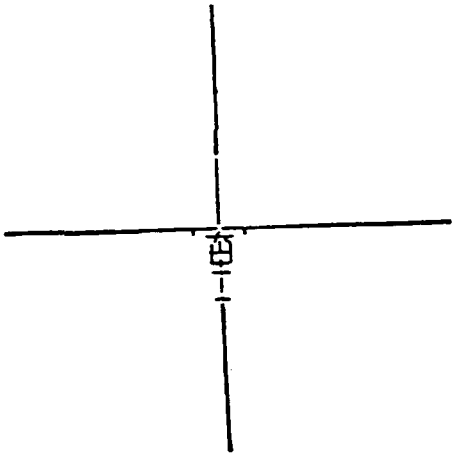
·15

*Target Range: 400 Meters
*Rifle Sights Set at 400 Meters
*Standard: Hit 3 of 5

Pull trigger for targets

·16 (400 Meters)
3-23 (Same as 300 Meters)



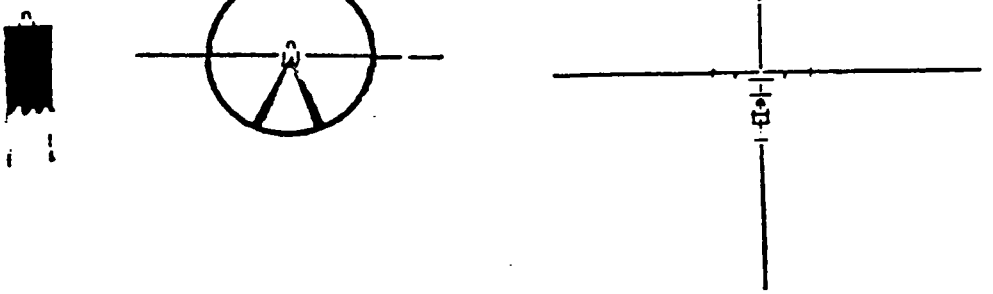


3-24

*Target Range: 500 Meters
*Rifle Sights Set at 500 Meters
*Standard: Hit 2 of 5

Pull trigger for targets

3-25 to 3-31 (500 Meters) (Same as 300 Meters)

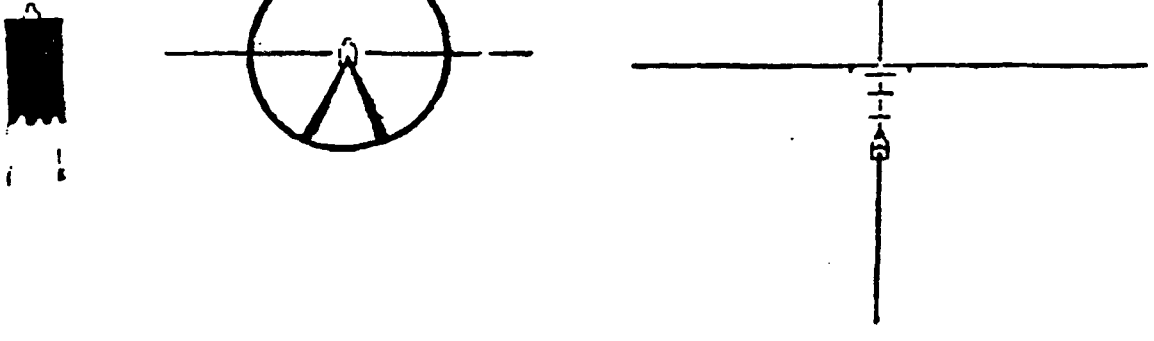


3-32

*Target Range: 600 Meters
*Rifle Sights Set at 600 Meters
*Standard: Hit 1 of 5

Pull trigger for targets

3-33 to 3-39 (600 Meters) (Same as 300 Meters)



3-40

Suppressive fire can be valuable in combat. Don't expect to hit targets at 700 or 800 meters -- just coming close may delay an enemy or disrupt an attack.

Pull trigger for targets

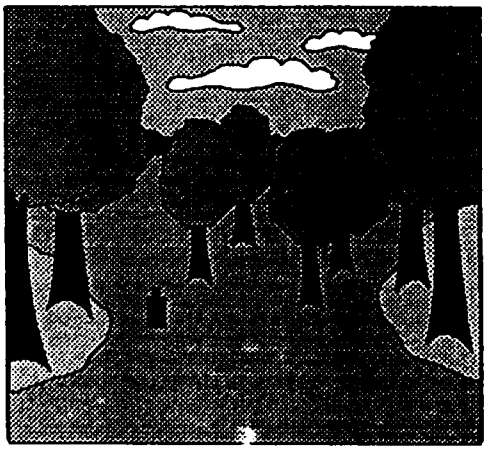
NOTE: When iron sights have been selected, skip to 3-47.

3-41

*Target Range: 700 Meters
*Rifle Sights Set at 700 Meters
*Standard: Suppressive Fire

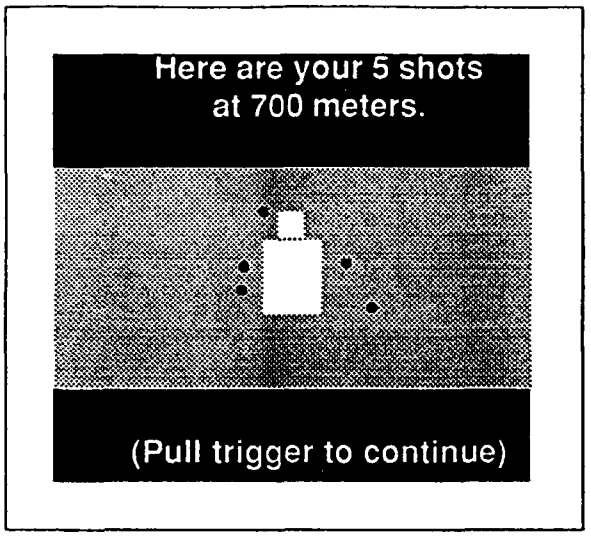
Pull trigger for targets

3-42



700 M targets (show "Miss" only -- no replay)

3-43

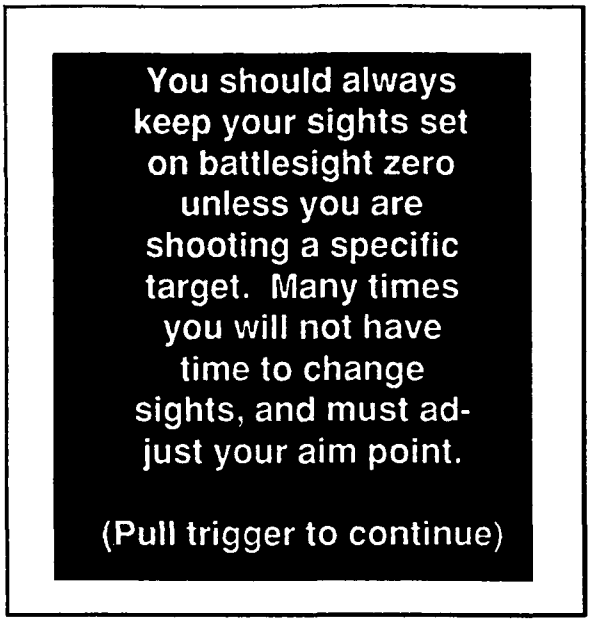


Target with 5 missed shots.

3-44

3-45 (800 Meters)
to 3-46 (Same as 700 Meters)

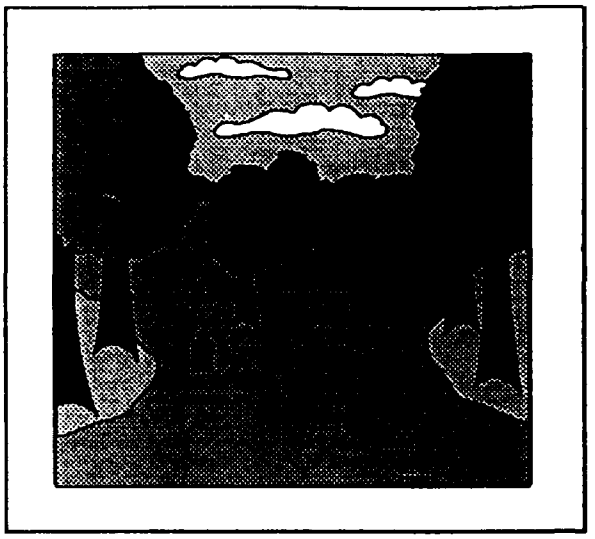
3-47



3-48

NOTE: Need to highlight 400 and 300 - maybe blink?

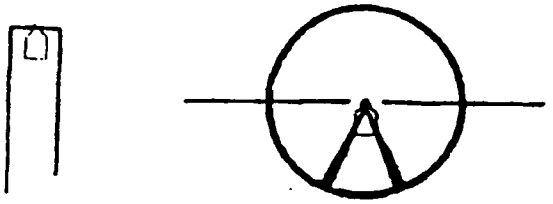
3-49

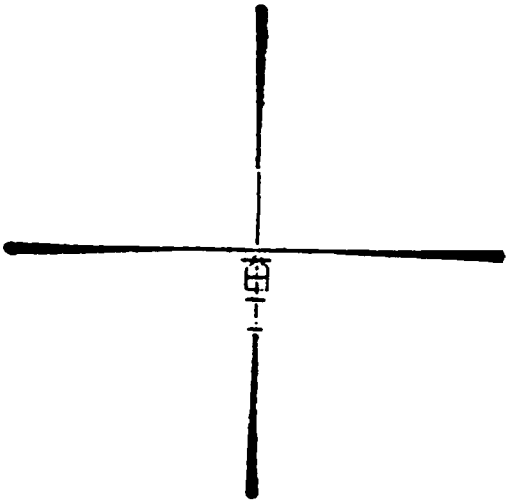


400 M targets

NOTE: Bullet hits 38 cm below the aiming point for the iron and ELCAN sights. The ARI sight has the 400 M aiming mark at target center, which is the bullet strike point.

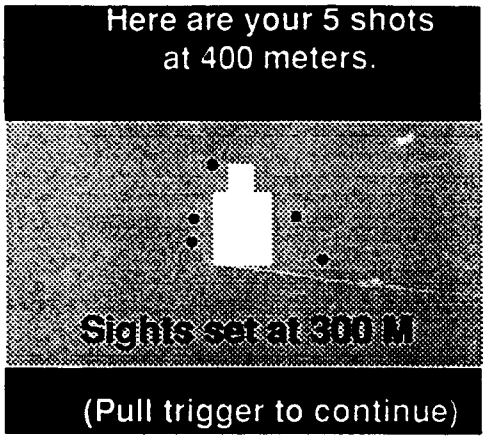
Detailed replay.





NOTE: Show range and sight setting on replay.

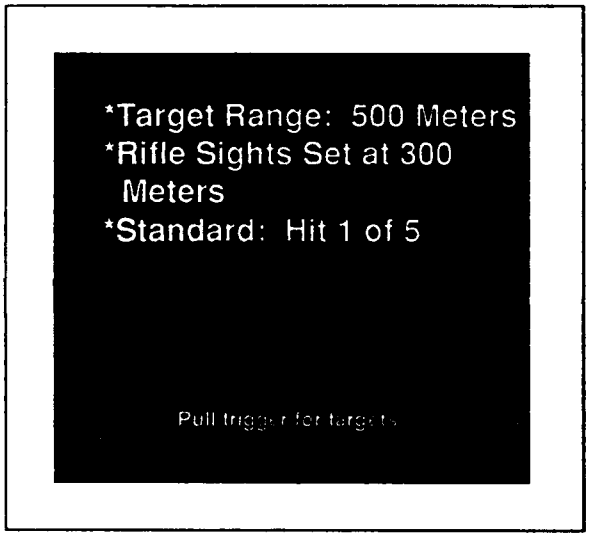
3-50



NOTE: After 5 targets

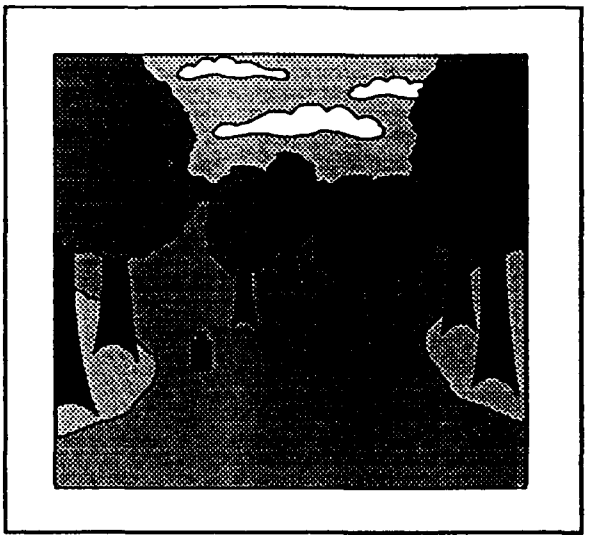
Replay 5 shots at 400 M -- Reshoot 400 M if 2 of 5 not hit.

3-51



NOTE: Need to highlight 500 and 300 .

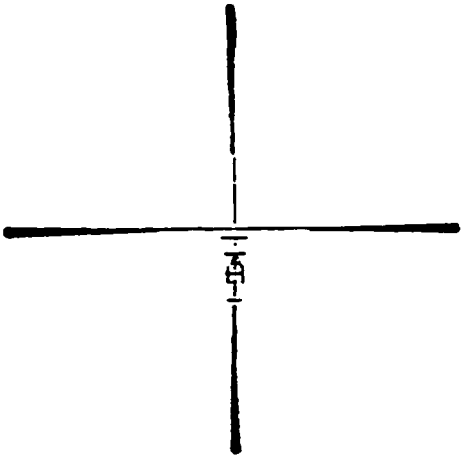
3-52



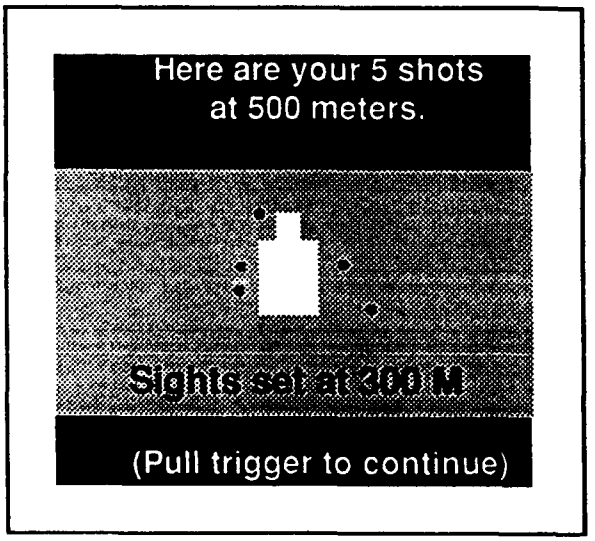
500 M targets

NOTE; Offset is 97 cm.

3-53



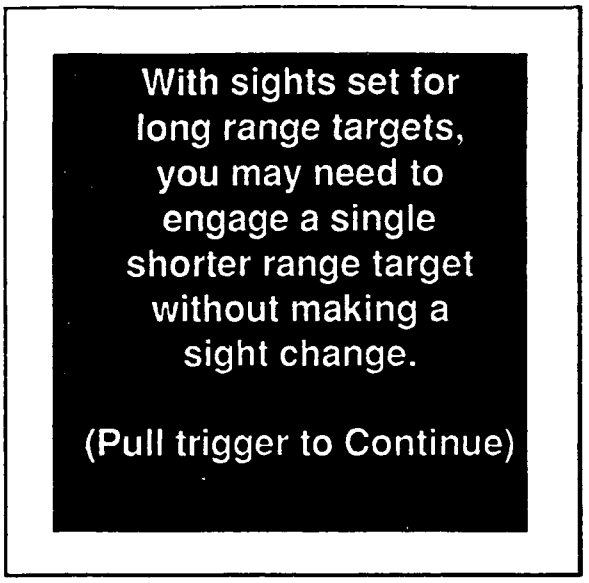
3-54



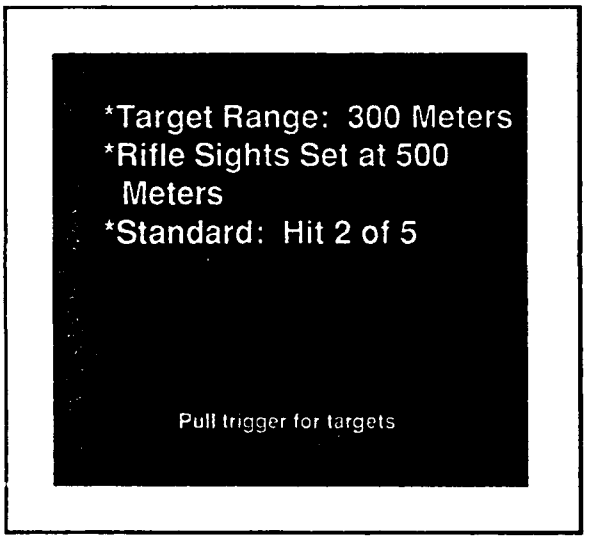
NOTE: After 5 targets

Replay 5 shots at 500 M -- Reshoot 500 M if 1 of 5 not hit.

3-55

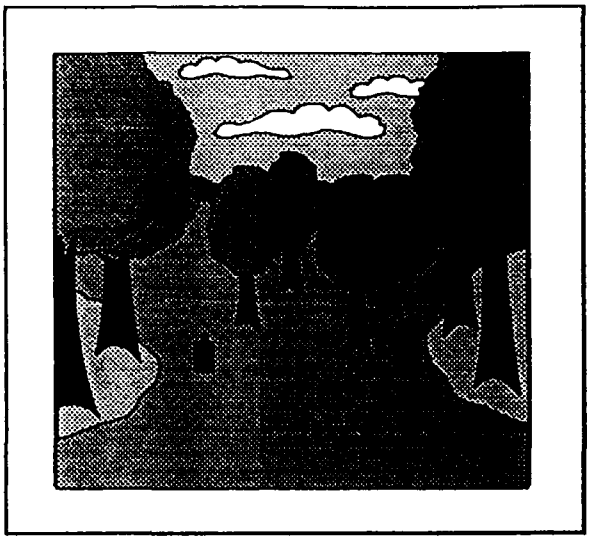


3-56



NOTE: Need to highlight 300 and 500

3-57

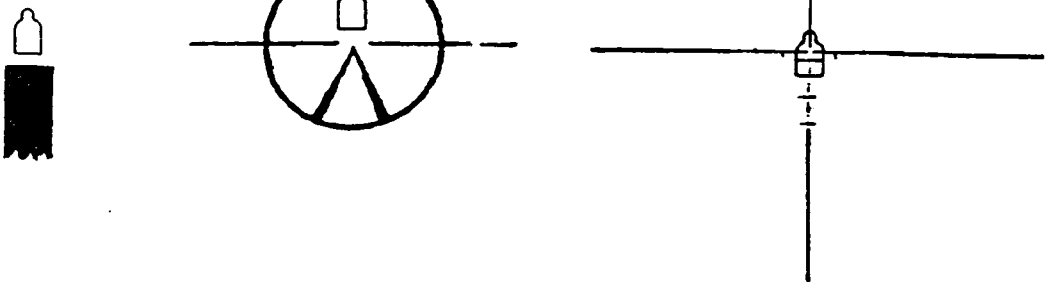


300 M targets

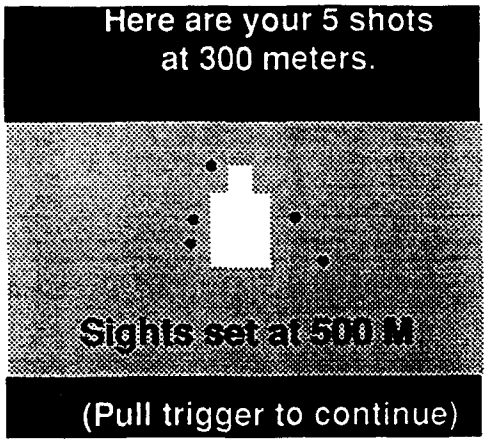
NOTE: Bullet hits 58 cm <u>above</u> aim point.

3-58

Detailed replay.



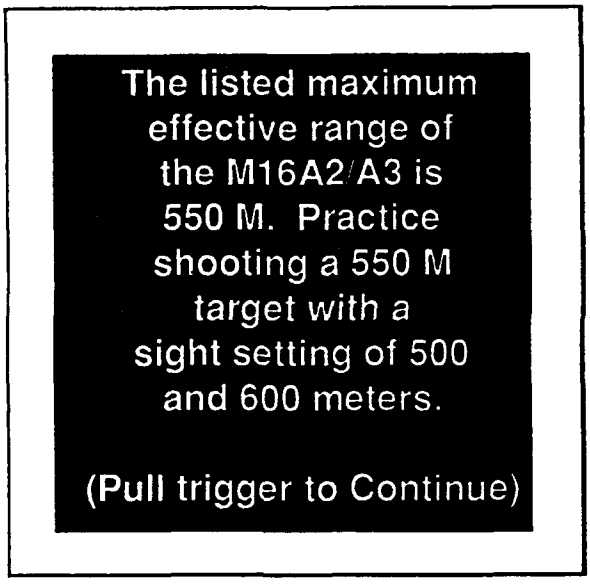
3-59



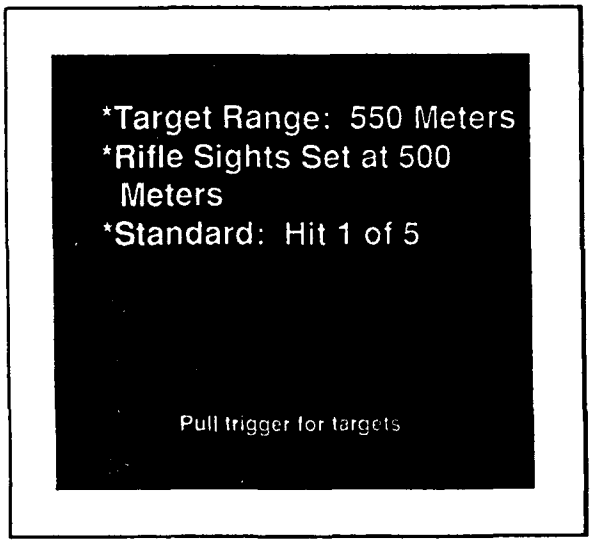
NOTE: After 5 targets

Replay 5 shots at 300 M -- Reshoot 400 M if 2 of 5 not hit.

3-60

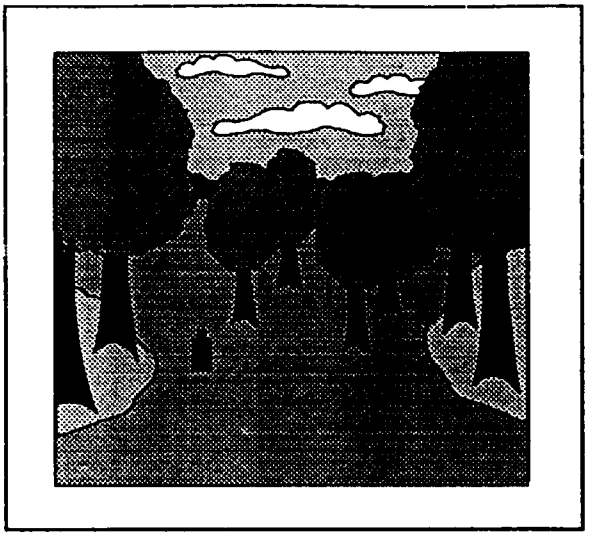


3-61



NOTE: Need to highlight 550 and 500

3-62

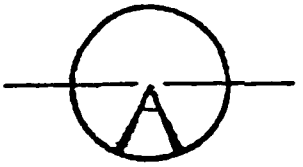


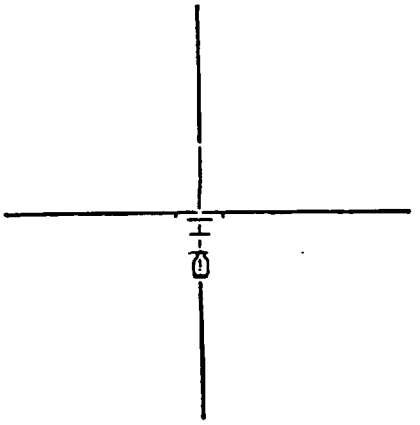
550 M targets

NOTE: Bullet hits 40 cm below aim point.

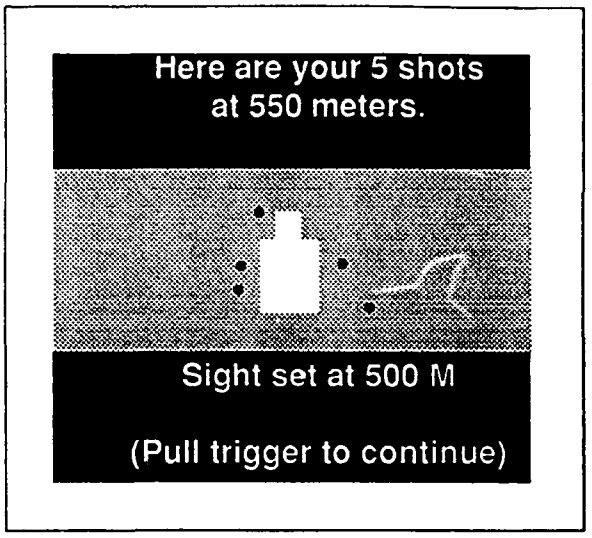
3-63

Detailed replay.





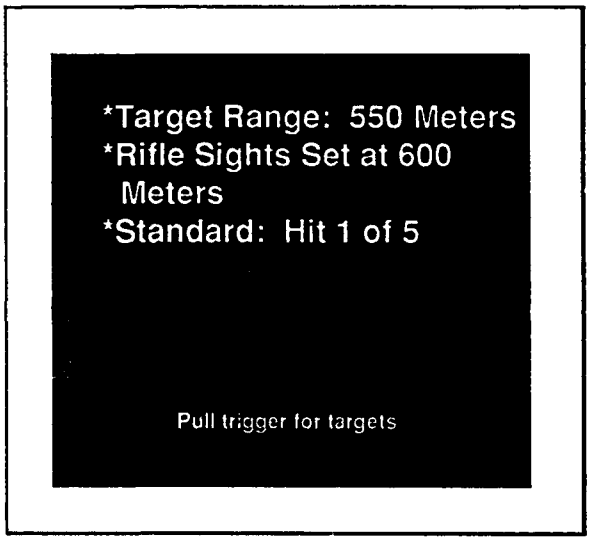
3-64



NOTE: After 5 targets

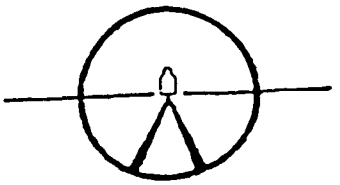
Replay 5 shots at 550 M -- Reshoot if 1 of 5 not hit.

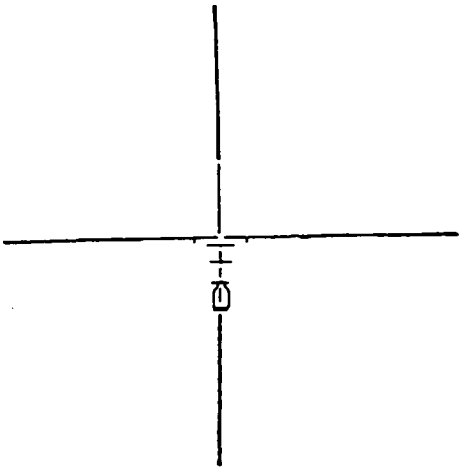
3-65



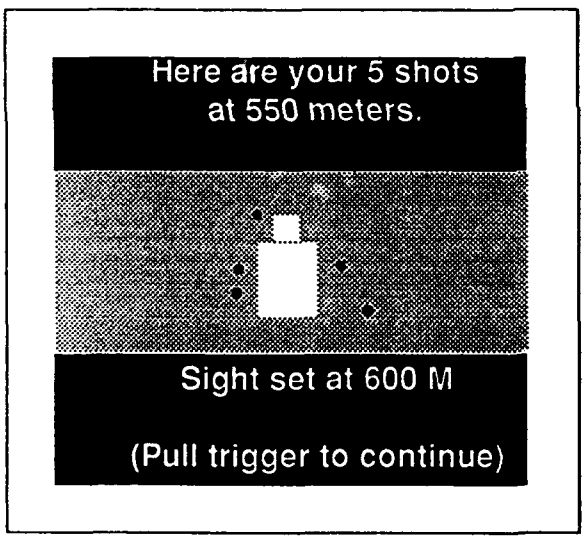
NOTE: Need to highlight 550 and 600

3-66 NOTE: Bullet hits 38 cm above aim point.





3-67

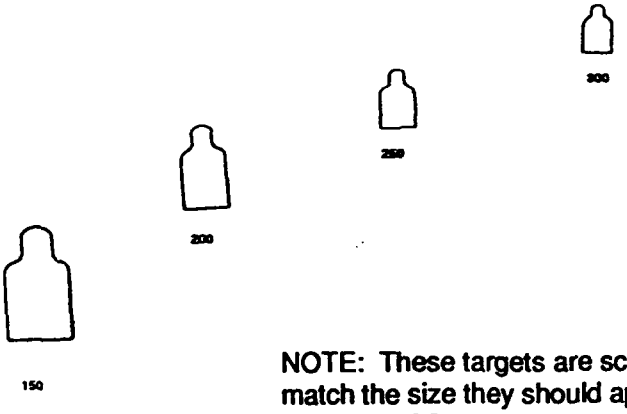


NOTE: After 5 targets

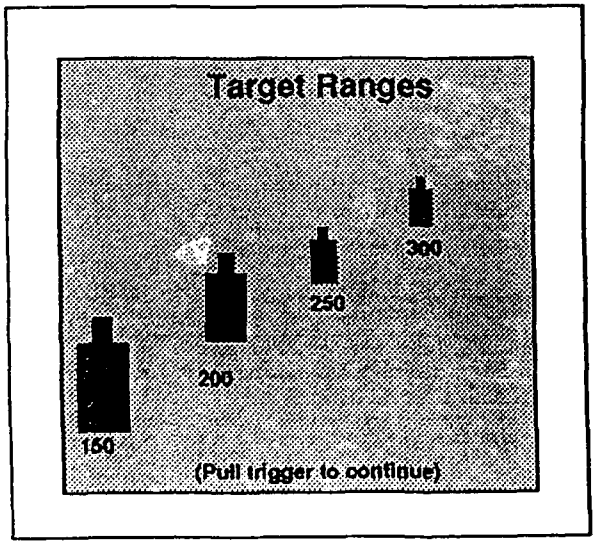
Replay 5 shots at 550 M -- Reshoot if 1 of 5 not hit.

4-1

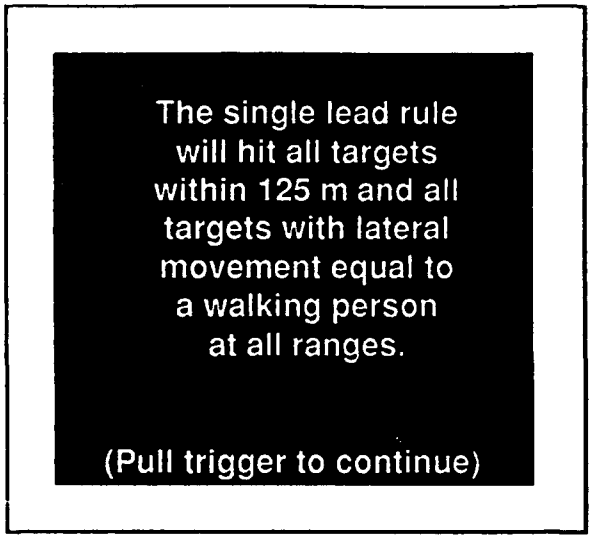
4-2



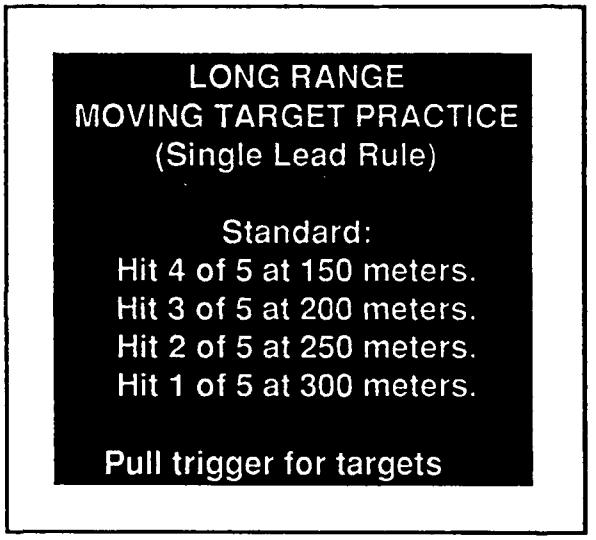
NOTE: These targets are scaled to match the size they should appear on the MACS screen.



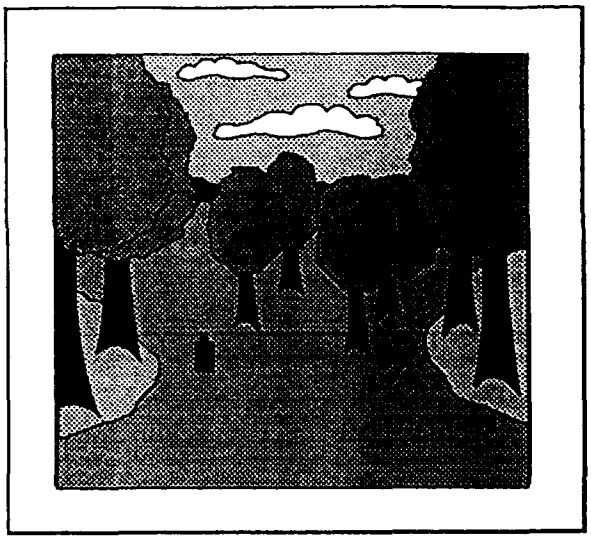
4-3


The single lead rule
will hit all targets
within 125 m and all
targets with lateral
movement equal to
a walking person
at all ranges.
(Pull trigger to continue)

4-4

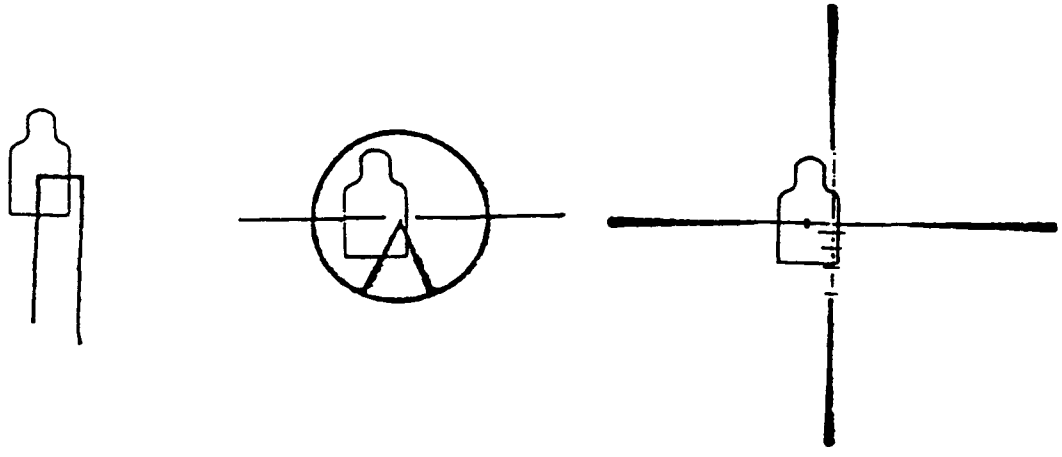

LONG RANGE
MOVING TARGET PRACTICE
(Single Lead Rule)
Standard:
Hit 4 of 5 at 150 meters.
Hit 3 of 5 at 200 meters.
Hit 2 of 5 at 250 meters.
Hit 1 of 5 at 300 meters.
Pull trigger for targets

4-5



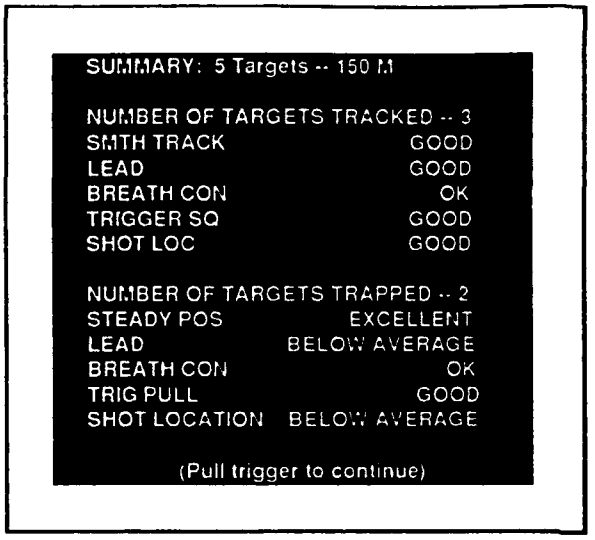
150-meter target moving at 3 mph.

4-6



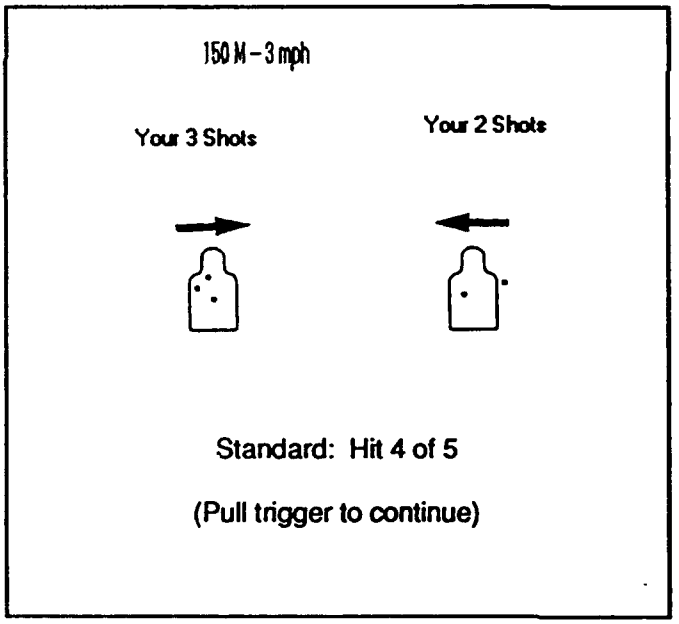
Detailed playback showing trap or track and the single lead rule as correct aiming point. While these are all close enough to show center hits when using the single lead rule, the bullets hit behind target center; 150 M -.6 cm; 200 M -1.9 cm; 250M -3.6 cm; 300 M -6 cm. Insure the aiming and shot location scores will reflect "EXCELLENT" for the above displacement. Use 5 targets at each range with the first 3 moving from left to right and the last 2 moving from right to left.

4-7

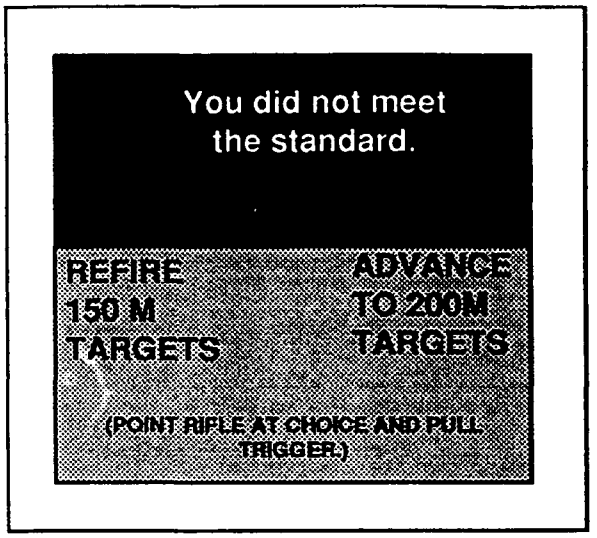


Detailed moving target review screen showing performance for targets tracked and trapped after 5 targets.

4-8

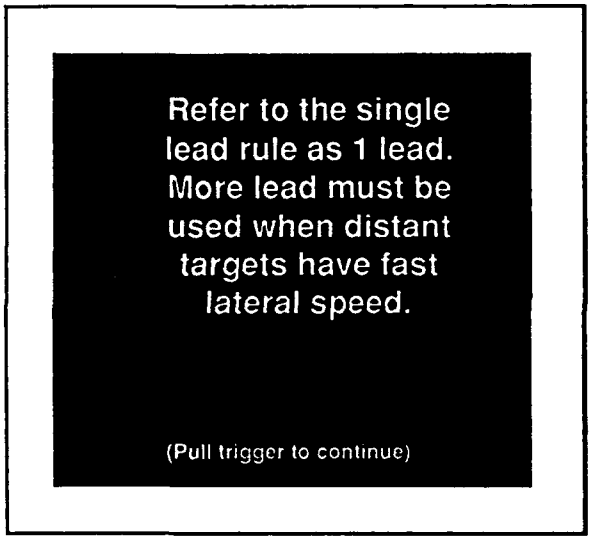


Following each range, if the standard is met, automatically move to the next range. If the standard is not met, show the following screen.

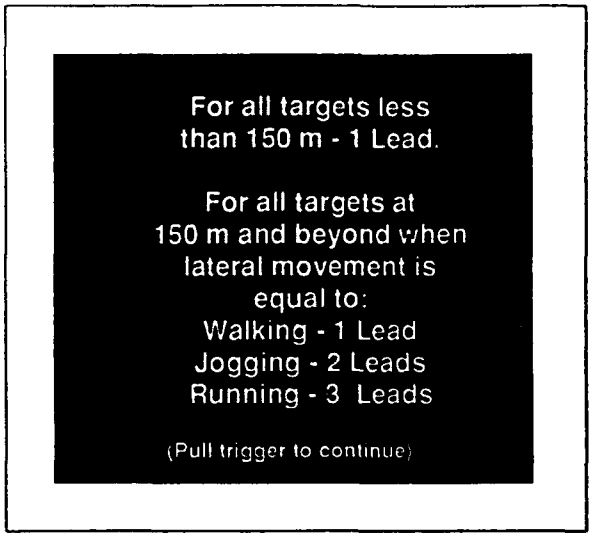


Use this screen if standard is not met.

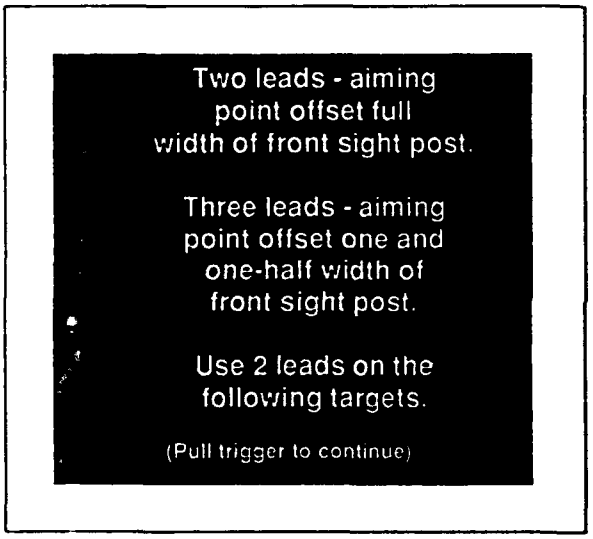
4-9



4-9a



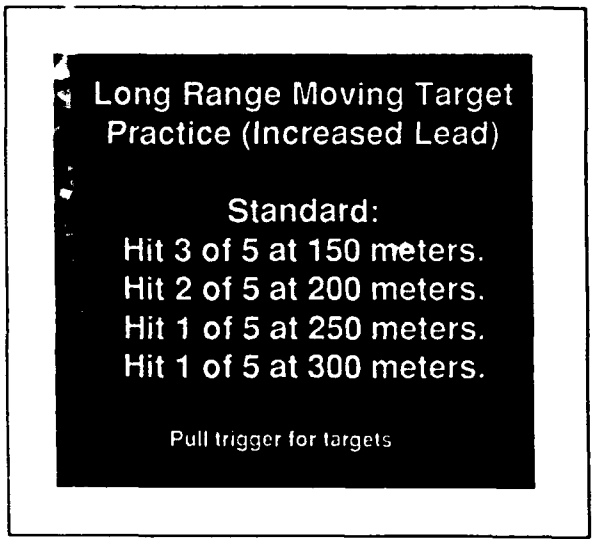
4-9b



offset or (to second lead point) or (to second hash mark).

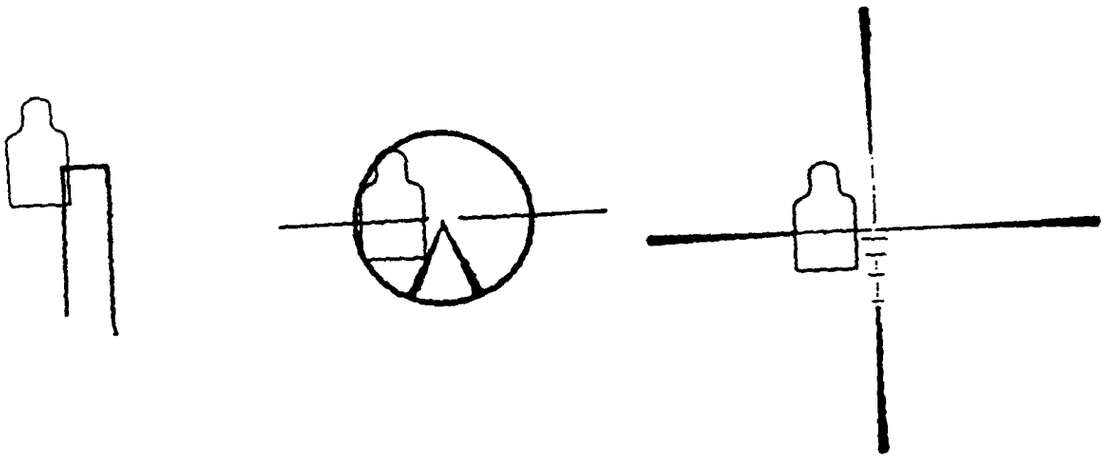
offset or (to third lead point) or (to heavy line)

4-10



Replay can show center hits again: 150 - 1 cm behind; 200 -3.8cm behind; 250 -7.7 cm behind; 300 -3.8 cm ahead. However, this displacement should result in "EXCELLENT" aiming and shot location scores.

NOTE: This is a repeat of the single lead rule exercise. Targets at 6 mph for 150, 200, and 250 -- at 5 mph for 300.



4-11

As target speed increases, more lead must be used. Use three leads on the following targets.

(Pull trigger to continue)

4-12

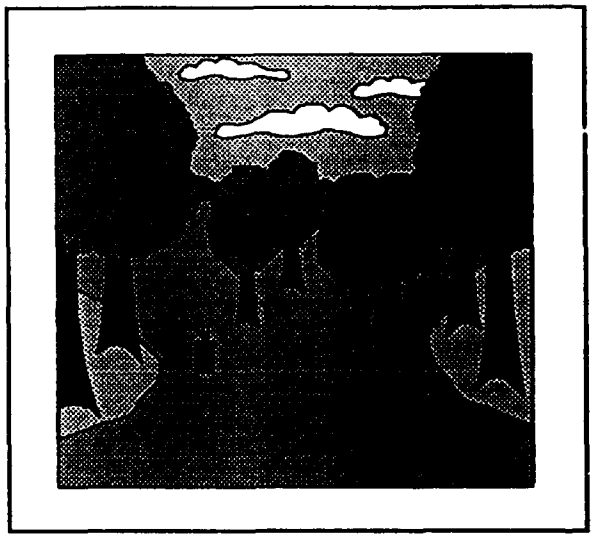
Long Range Moving Target Practice (Extended Lead)

Target: Silhouette at 300 meters with a lateral speed of 8 mph.

Standard: Hit 1 target in 10 passes.

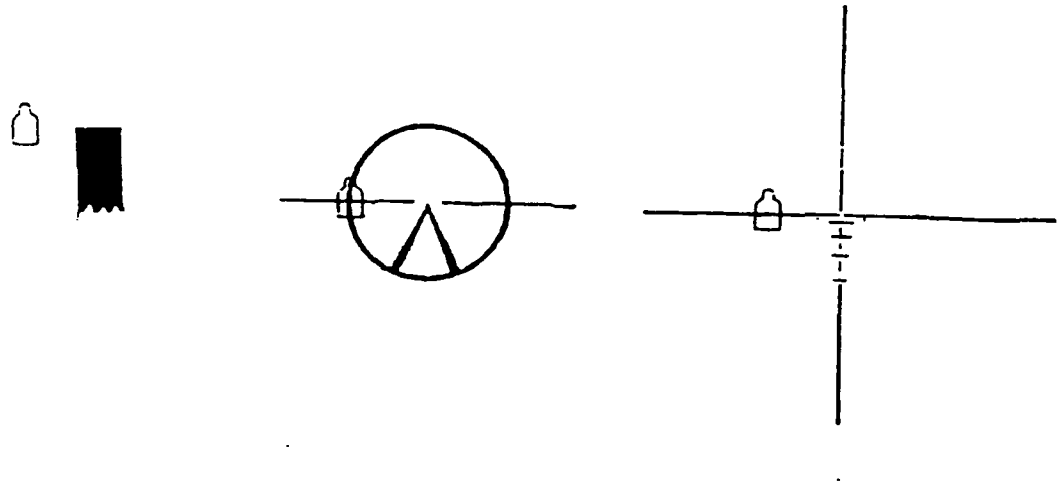
Pull trigger for targets

4-13

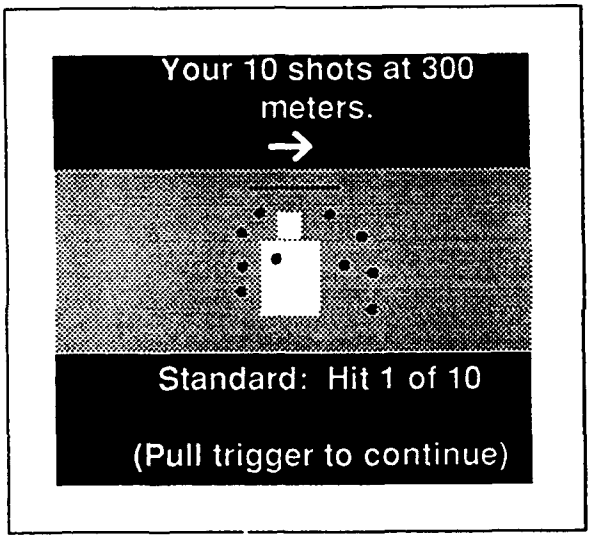


A silhouette at 300 meters moving 8 mph.

4-14

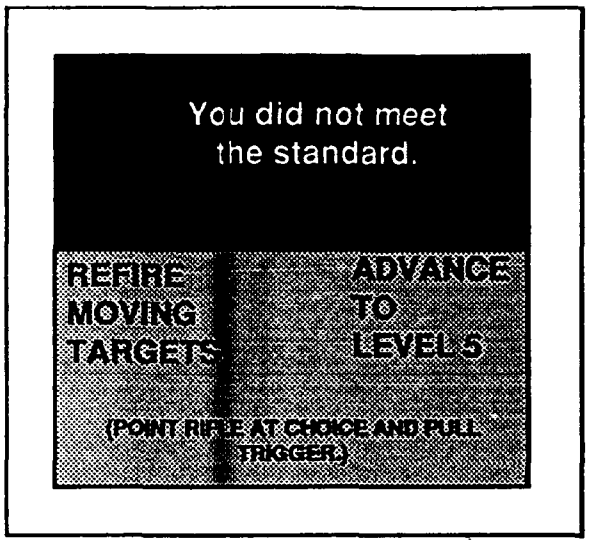


4-15

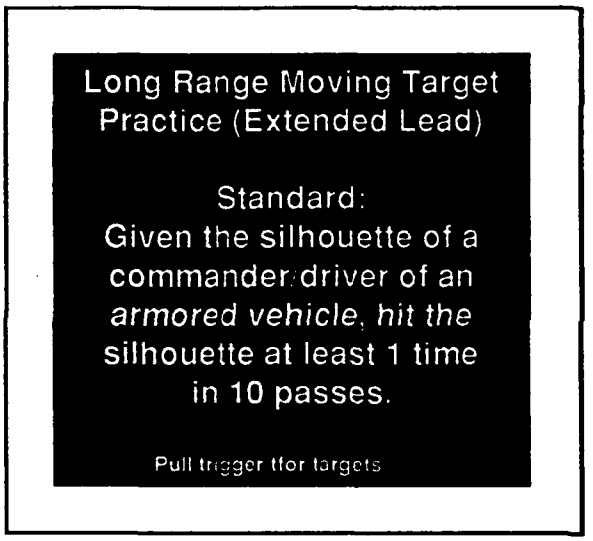


NOTE: Advance to Level 5 if standard is met.

4-16

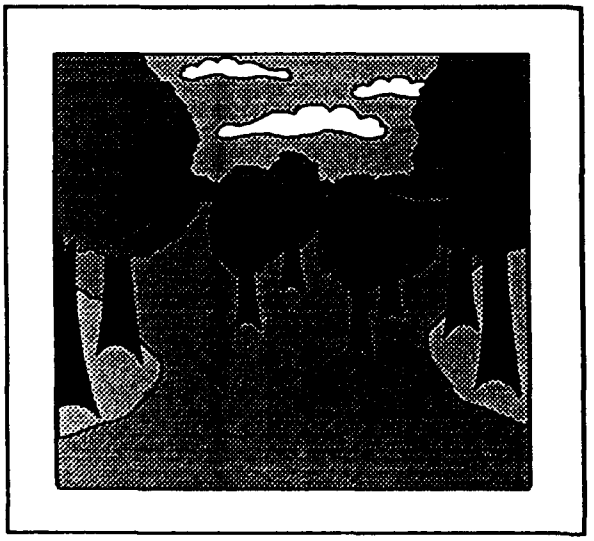


4-12a



NOTE: Consider using a BRDM type target for this requirement, but stay with the silhouette if the BRDM presents a problem.

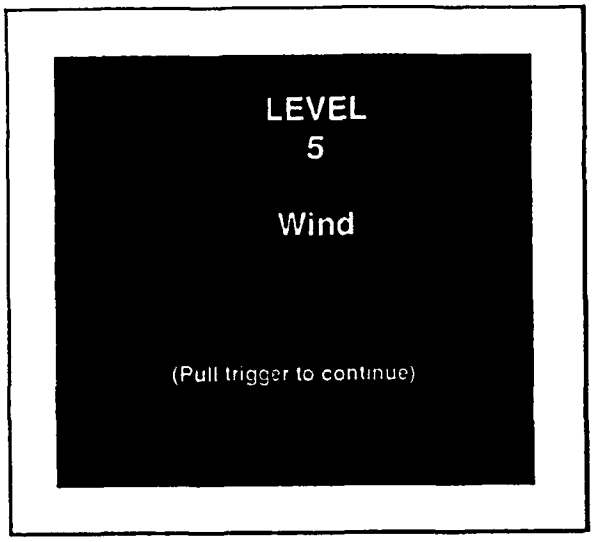
4-13a



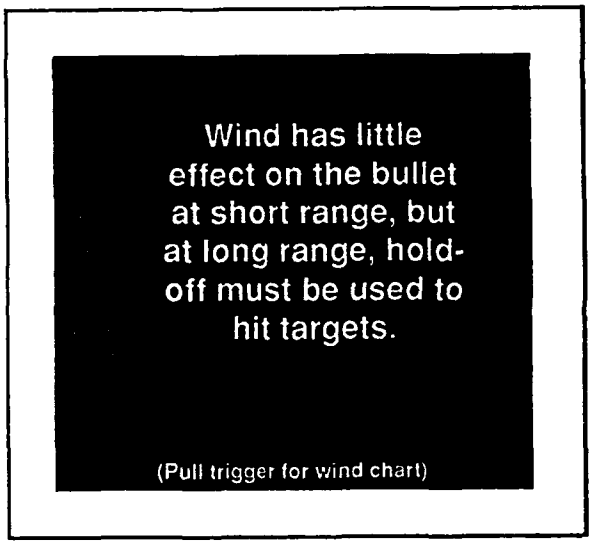
A BRDM with head and shoulders of the commander/driver exposed, at a distance of 300 meters, moving 8 mph.

NOTE: Use the same type of replay and review as above.

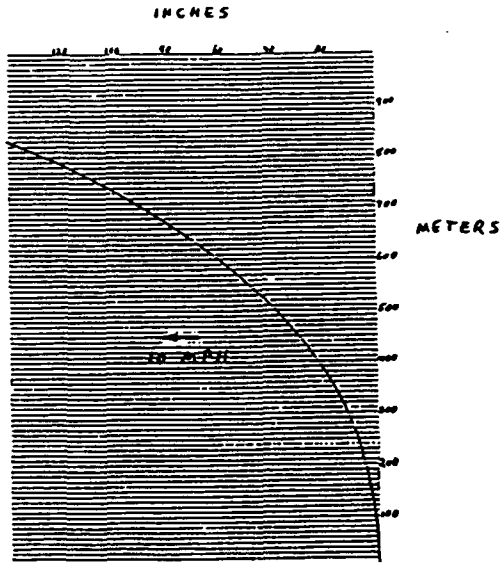
5-1


LEVEL
5
Wind
(Pull trigger to continue)

·2


Wind has little effect on the bullet at short range, but at long range, hold-off must be used to hit targets.
(Pull trigger for wind chart)

5-3



Effects of a 10 mph full value wind

(Pull trigger to continue)

NOTE: When this chart is developed for the MACS screen, highlight:

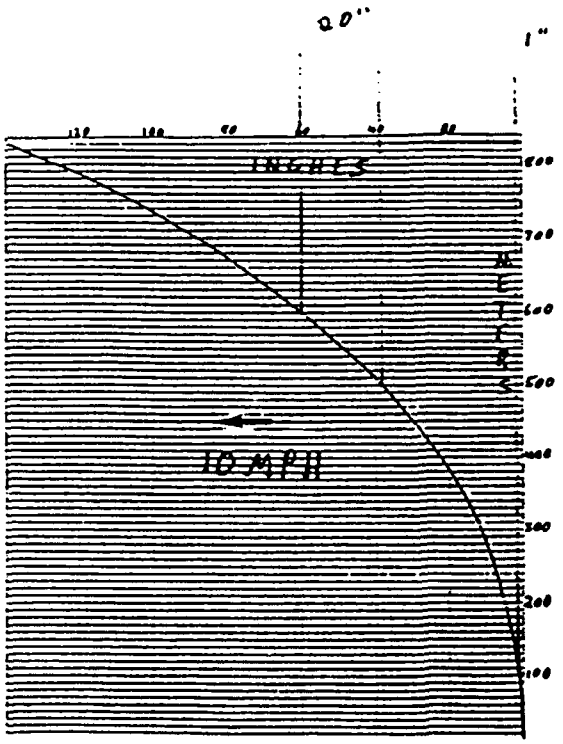
1" - 100 m
5" - 200 m
12" - 300 m
24" - 400 m
36" - 500 m
60" - 600m

5-4

Note that effects of wind are greater at range -- moving the bullet 1 inch in the first 100 meters and over 20 inches from 500 to 600 meters.

(Pull trigger for wind chart)

-5



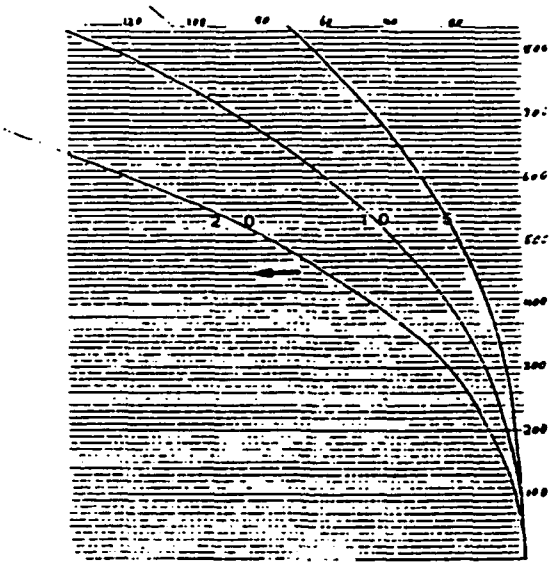
(Pull trigger to continue)

6

Note that effects of wind are uniform in relation to speed -- a 20 mph wind moving the bullet twice as much as 10, and a 5, half as much as 10.

(Pull trigger for wind chart)

5-7



Effects of full value 5 to 20 mph wind.

5-8

During this program wind speed will be indicated by smoke columns:

No wind:

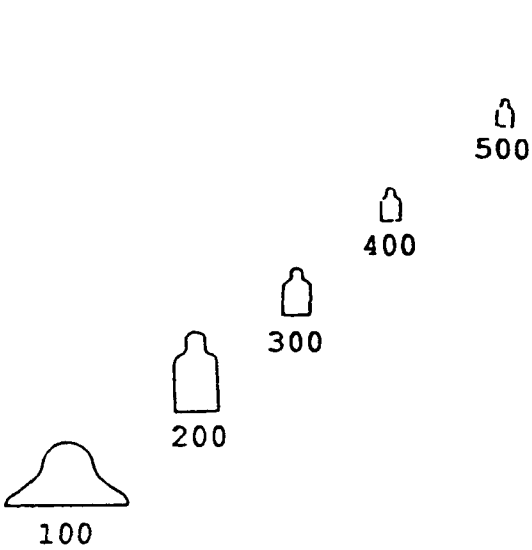
5 mph wind:

10 mph wind:

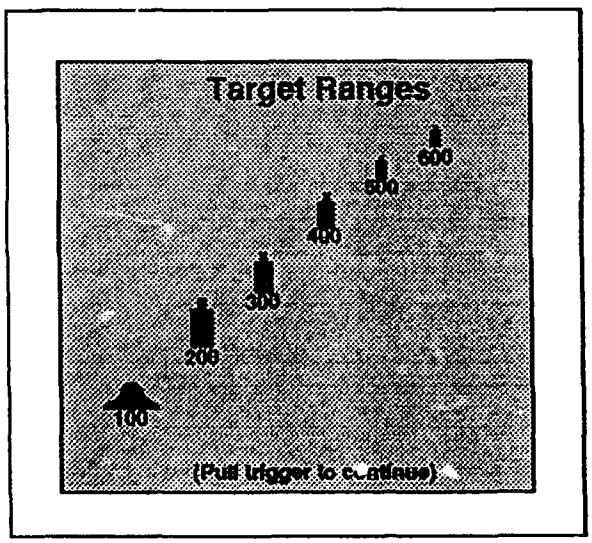
20+ mph wind:

(Pull trigger for wind chart)

5-9



NOTE: These targets are scaled to match the size they should appear on the MACS screen.



5-10

Targets are untimed.

Standard:
5 of 5 - 100 M
4 of 5 - 200 M
3 of 5 - 300 M
2 of 5 - 400 M
1 of 5 - 500 M
0 of 5 - 600 M

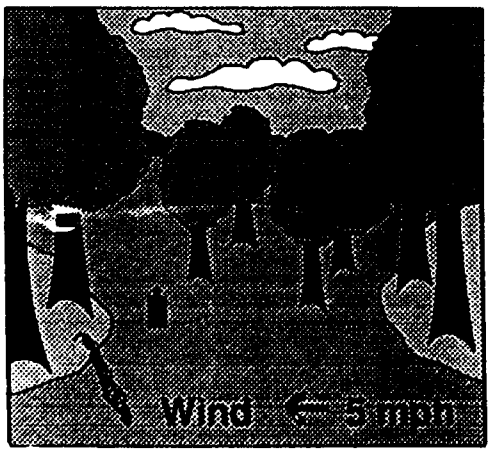
(Pull trigger to continue)

5-11

- Target Range: 100 Meters
- Rifle Sights Set at 300 Meters
- Wind speed shown with target
- Assume a supported position

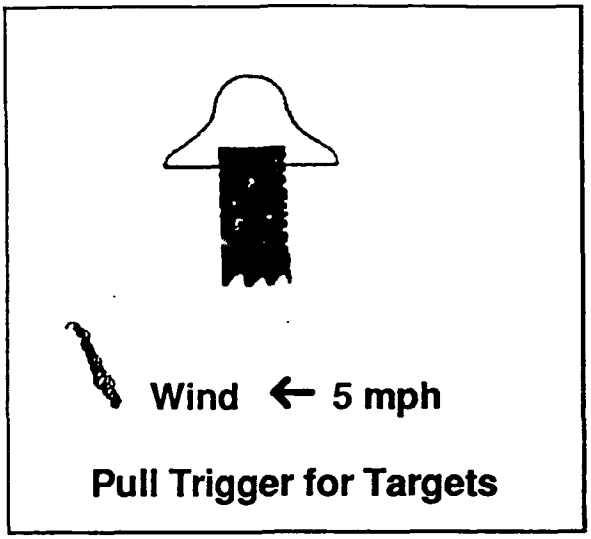
Pull trigger for targets

5-12



100 M target

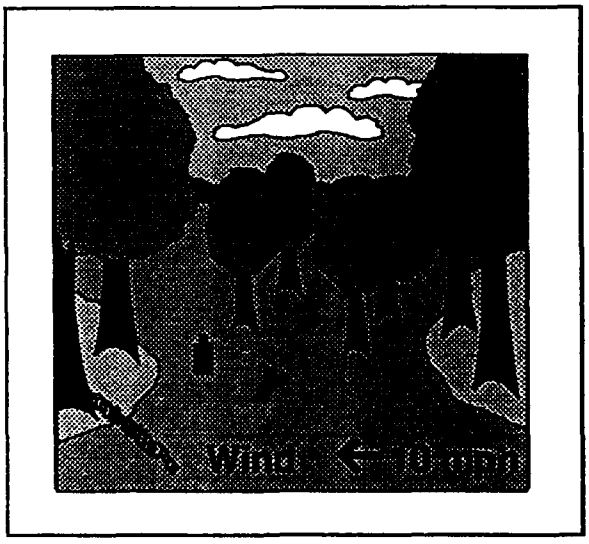
5-13



Detailed replay (aiming based on center). Bullet is 10 cm above aim point and 1.6 cm left.

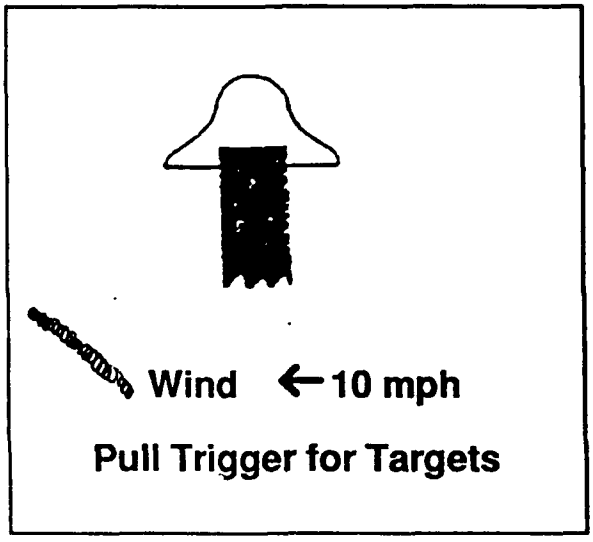
NOTE: Ajust the aiming score to be correct for center, the hold-off position, or anything in a straight line beween the two.

5-14



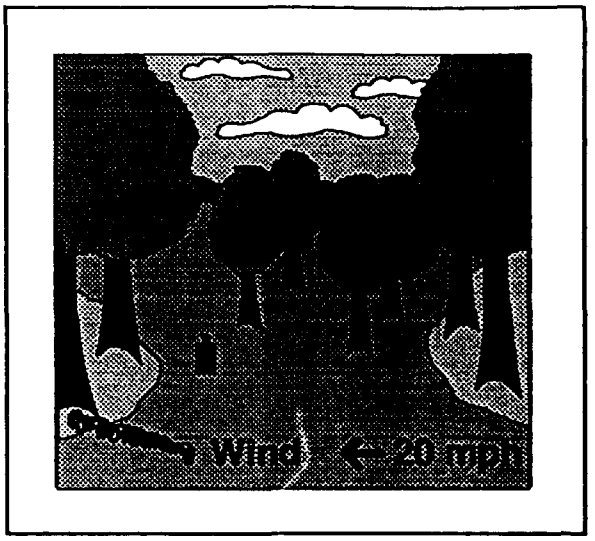
100 M target.

5-15



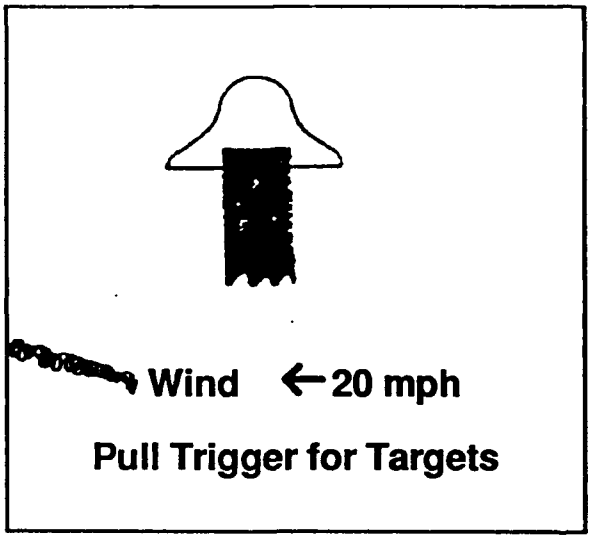
Detailed replay (aiming based on center). Bullet is 10 cm above and 3.2 cm left of aim point.

5-16



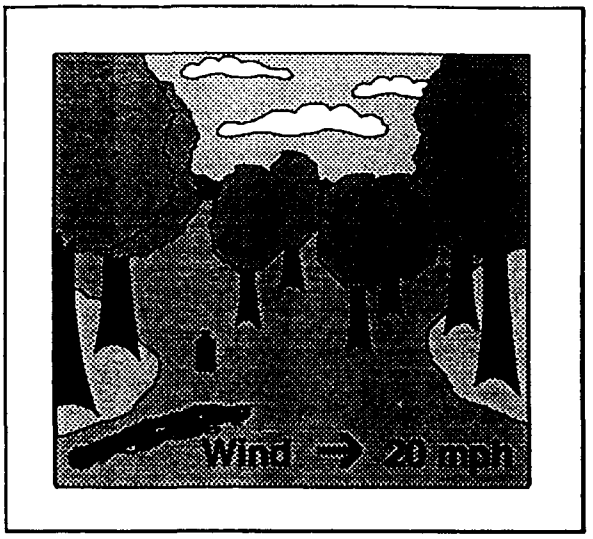
100 M target.

5-17



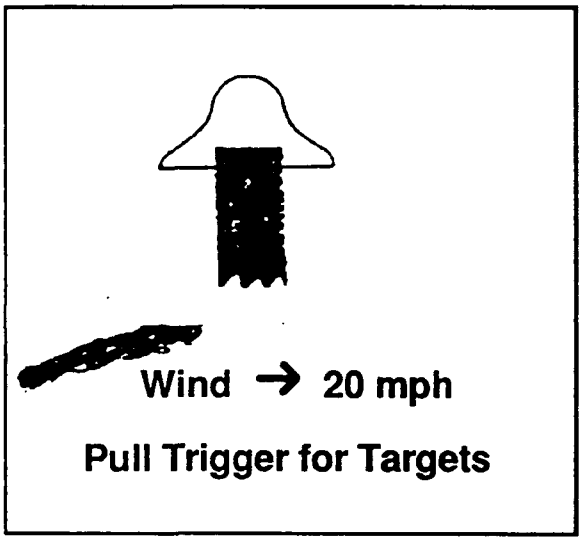
Detailed replay (aiming based on center). Bullet is 10 cm above and 3.2 cm left of aim point.

5-18



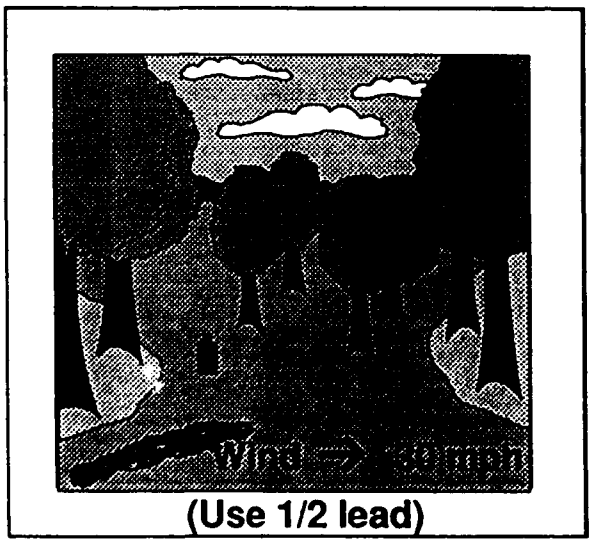
100 M target.

5-19



Detailed replay (aiming based on center). Bullet is 10 cm above and 6.4 cm right of aim point.

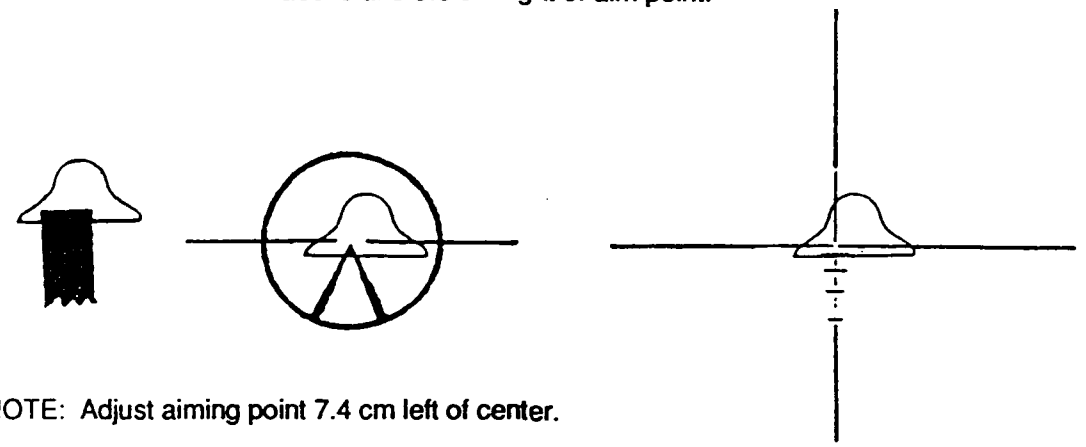
5-20



100 M target.

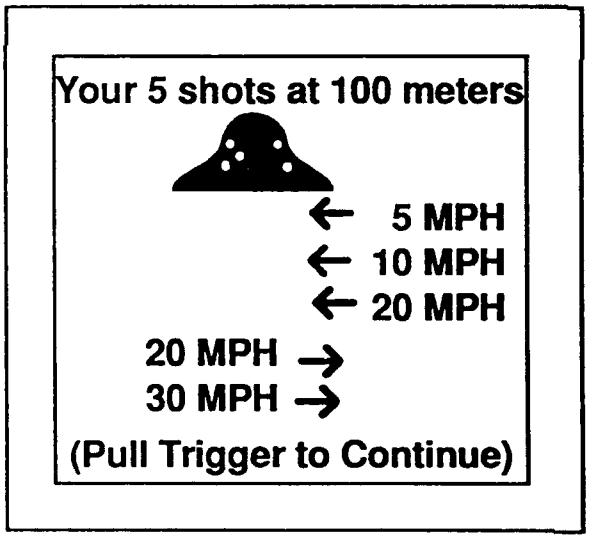
5-21

Detailed replay . Bullet is 10 cm above and 9.6 cm right of aim point.



NOTE: Adjust aiming point 7.4 cm left of center.

5-22



Target with 5 shot locations.

NOTE: In sequence, flash the bullet and the corresponding arrow for each shot.

5-23

As you can see, hold-off for wind at ranges of 100 meters or less is seldom required.

(Pull Trigger to Continue)

5-24

As a memory aid, try to remember the effects of a 10 mph wind - 1, 5, 1, 2, 3, 5:

100 M - 1 inch
200 M - 5 inches
300 M - 1 foot
400 M - 2 feet
500 M - 3 feet
600 M - 5 feet

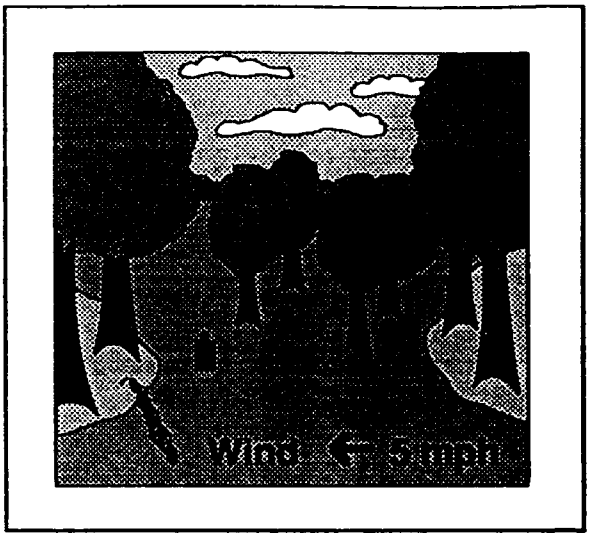
(Pull Trigger to Continue)

5-25

- Target Range: 200 Meters
- Rifle Sights Set at 300 Meters
- Wind speed shown with target
- Assume a supported position

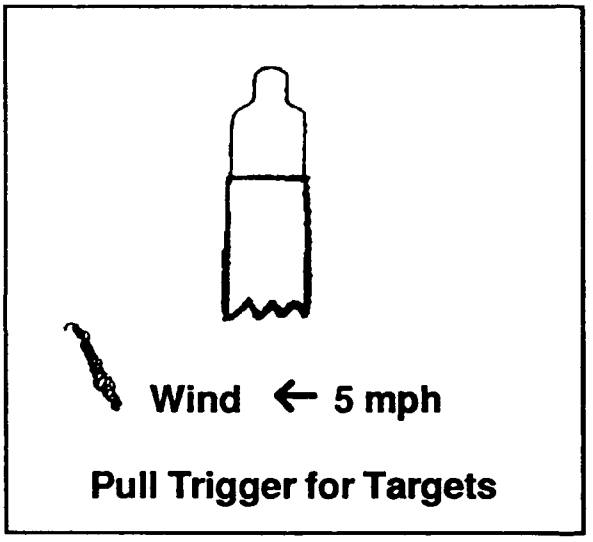
Pull trigger for targets

5-26



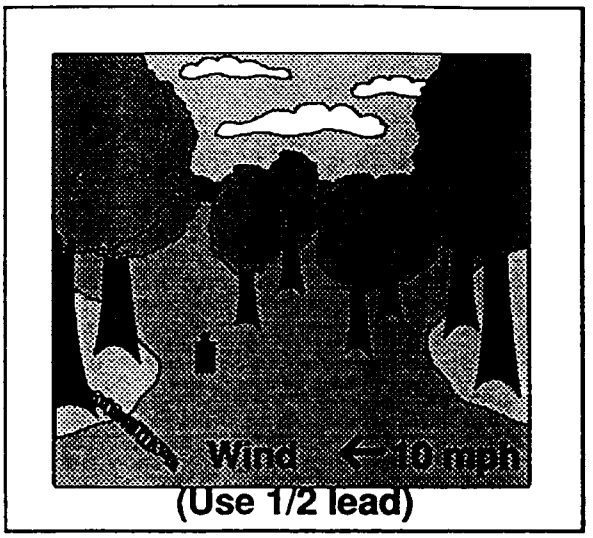
200 M target

5-27



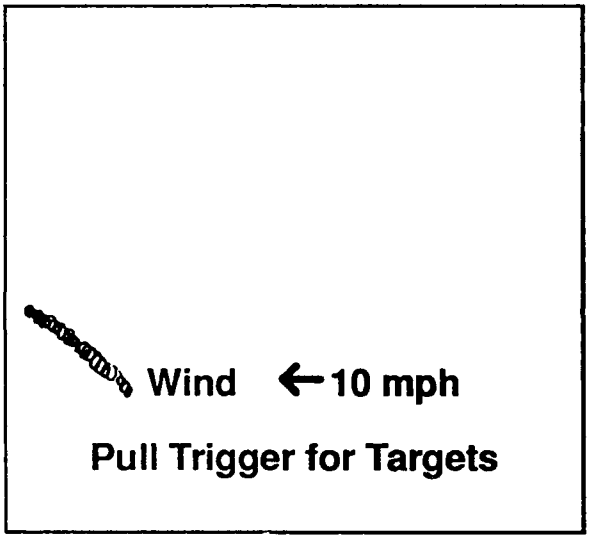
Detailed replay. Center aiming.. Bullet is 14 cm above and 6 cm left of aim point.

5-28

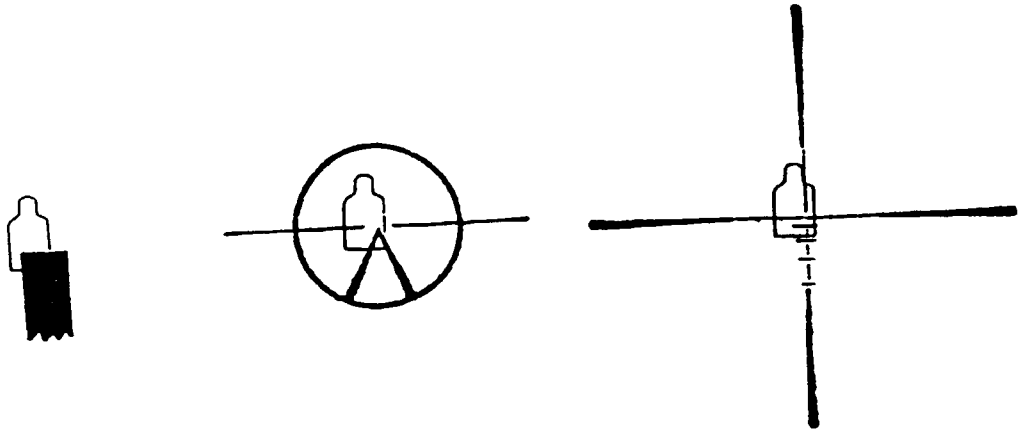


200 M target.

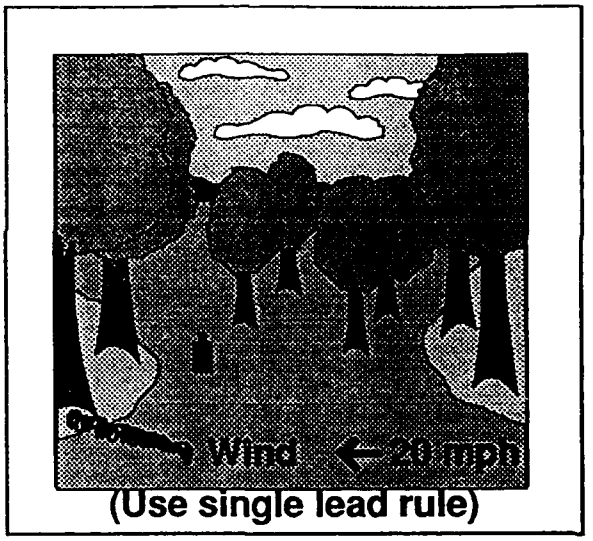
-29



Playback. Bullet 14 cm above and 13 cm left of aim point. Displace aim point 15 cm right.

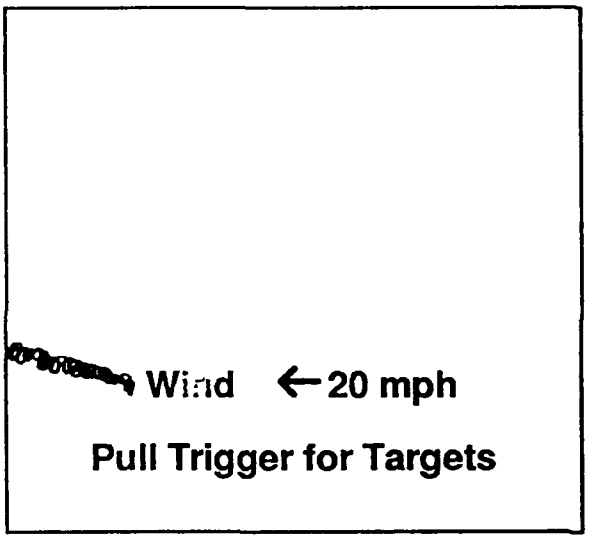


5-30

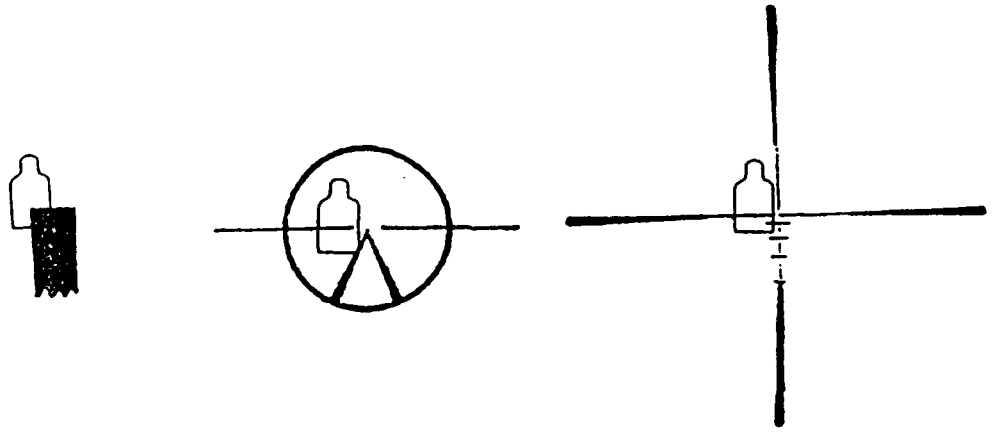


200 M target.

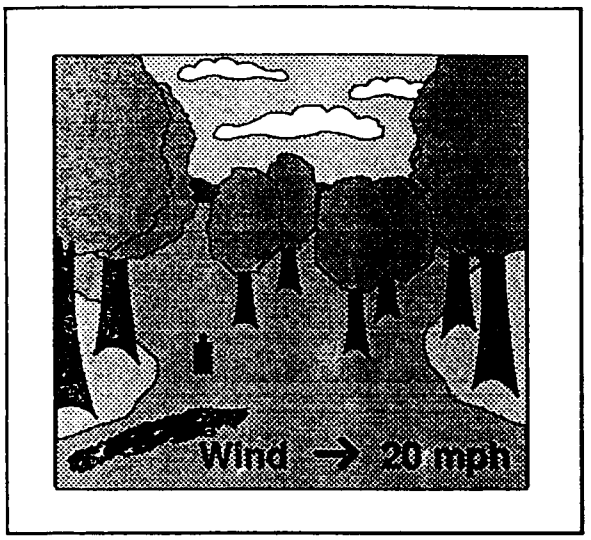
5-31



Playback. Displace aim point 29 cm right. Bullet hits 14 cm above and 26 cm left of aim point.

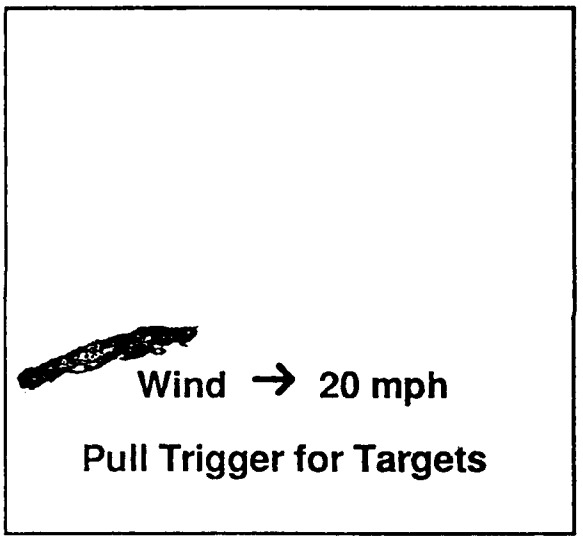


5-32



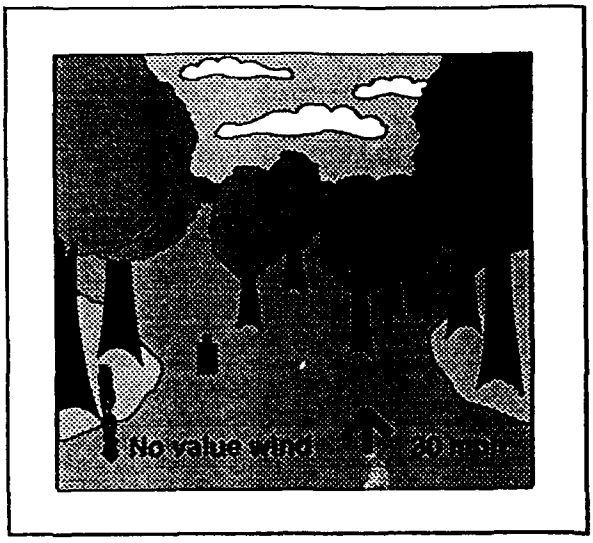
200 M target.

5-33



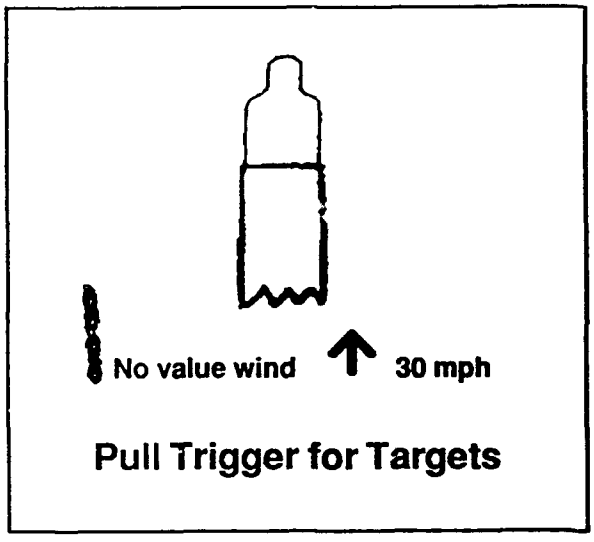
Playback. Reverse of 5-31. Displace aim point 29 cm left. Bullet hits 14 cm above and 26 cm right of aim point.

5-34



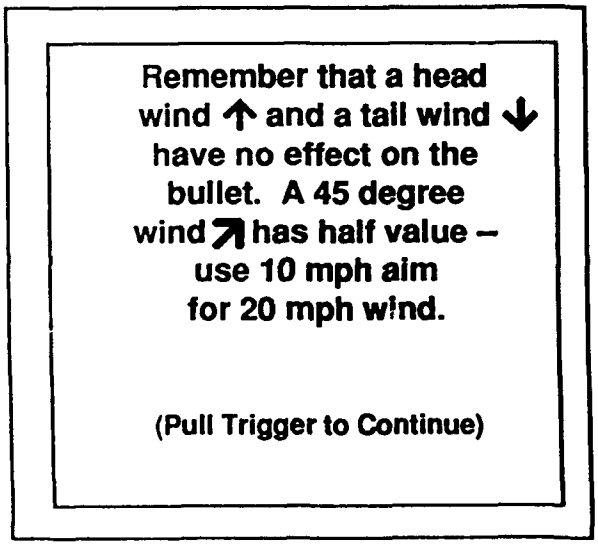
200 M target.

5-35



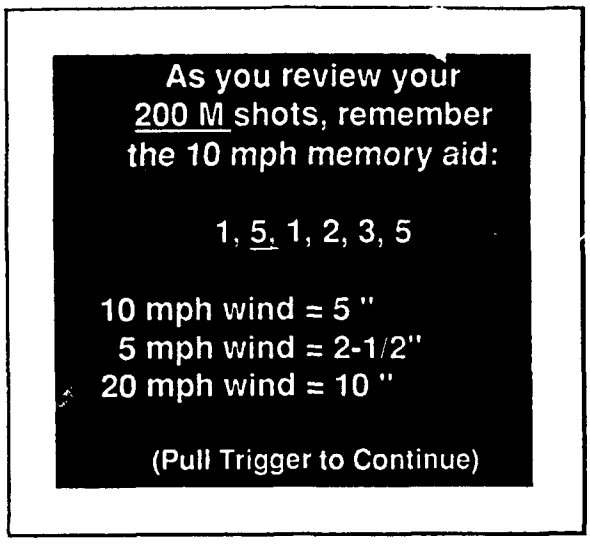
Playback. Center aim. Bullet hits 14 cm above aim point.

5-36

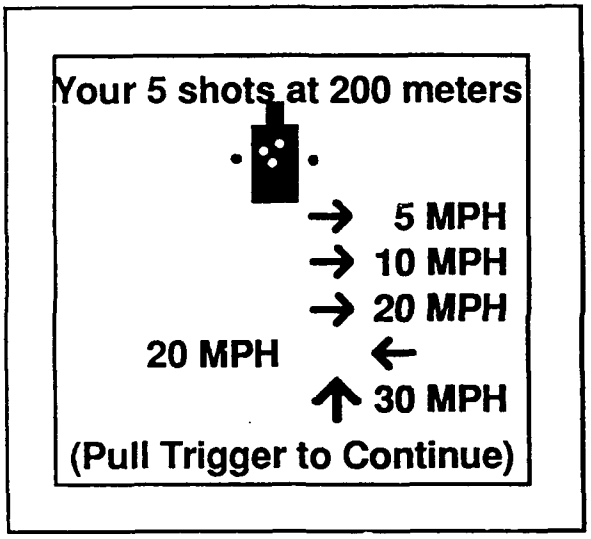


MAKE 45 DEGREE ARROWS TO GO IN HERE.

-36a



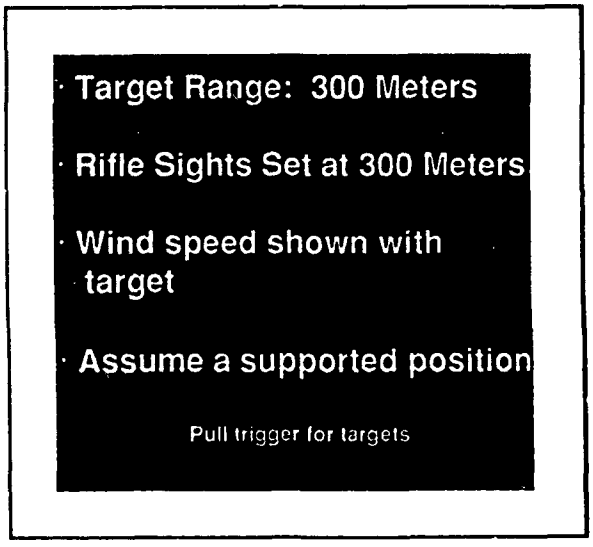
5-37



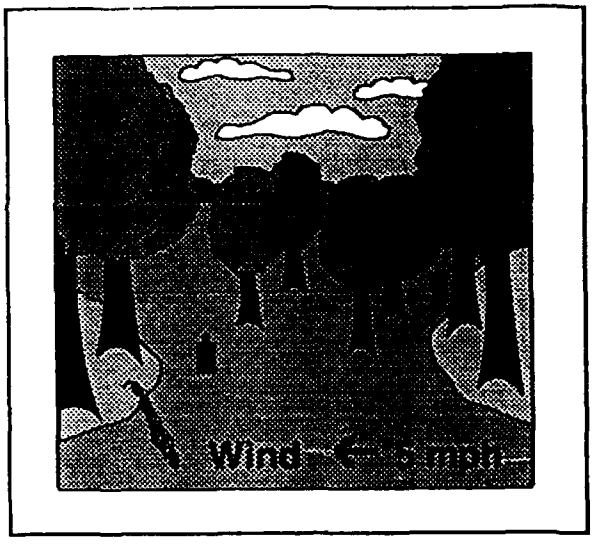
Target with 5 shot locations.

Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

5-38

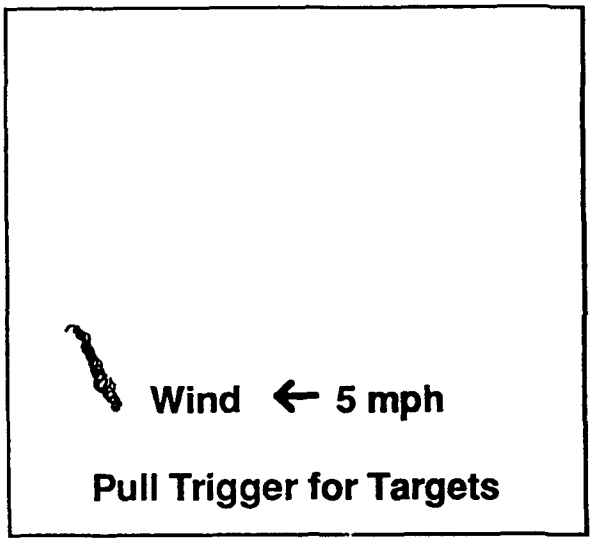


5-39

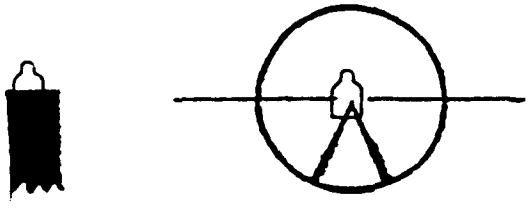


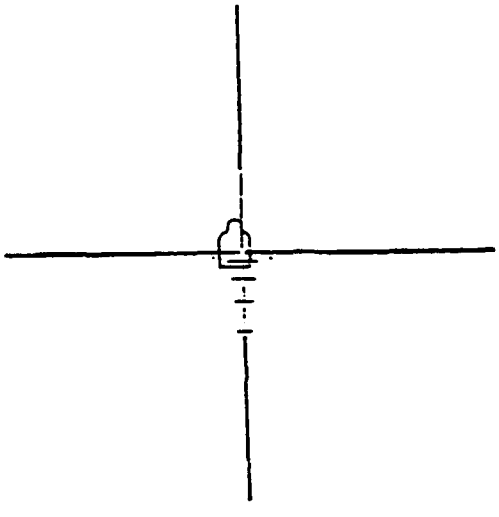
300 M target.

5-40

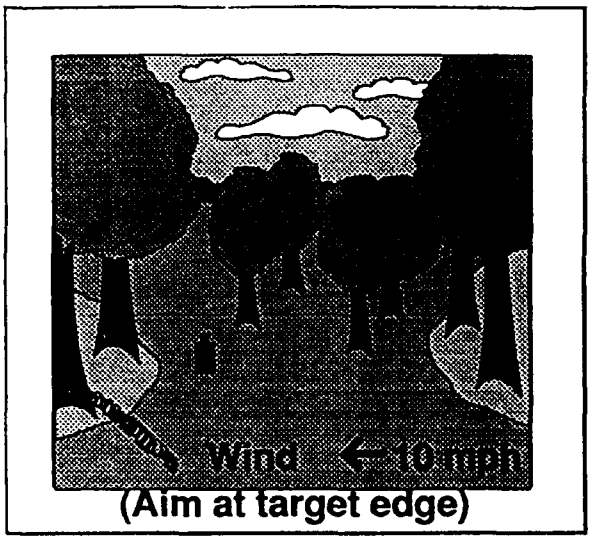


Playback. Displace aim point half way between target center and target edge. Bullet hits 15 cm left of aim point, 2 cm left of center.



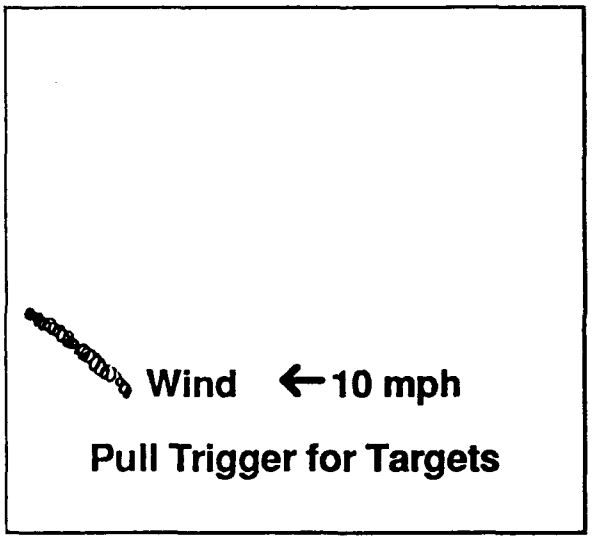


5-41

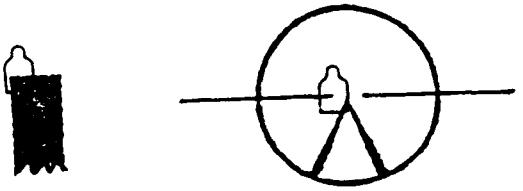


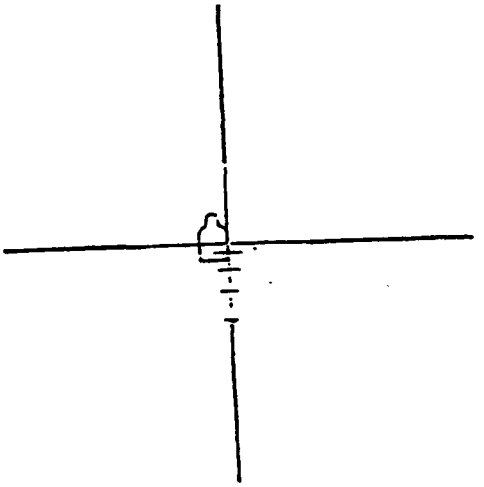
300 M target.

5-42

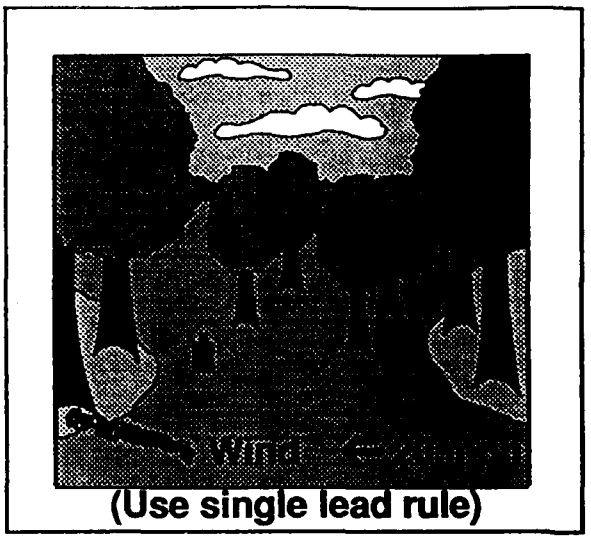


Playback. Displace aim point 25 cm right. Bullet hits 29 cm left of aim.



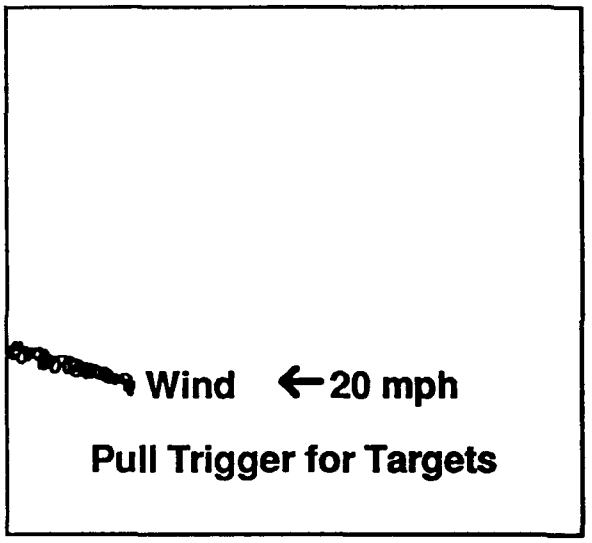


5-43

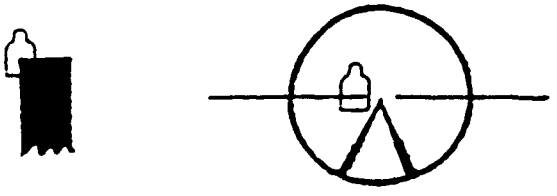


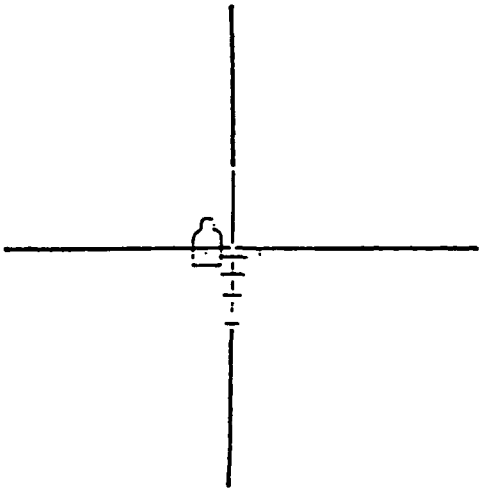
300 M target.

5-44

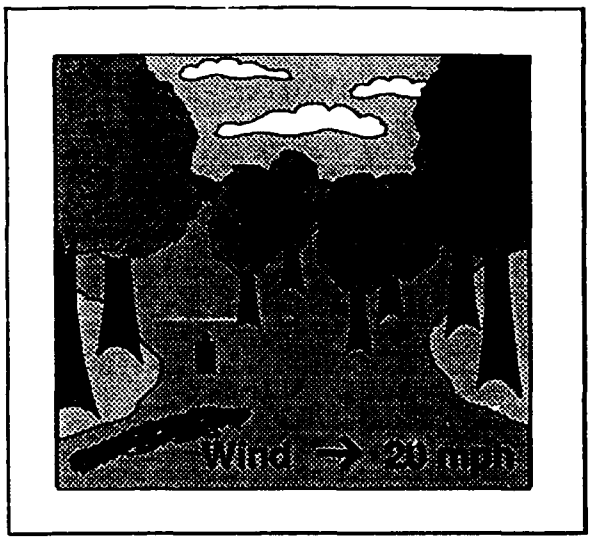


Playback. Displace sight 45 cm right. Bullet hits 58 cm left of aim.



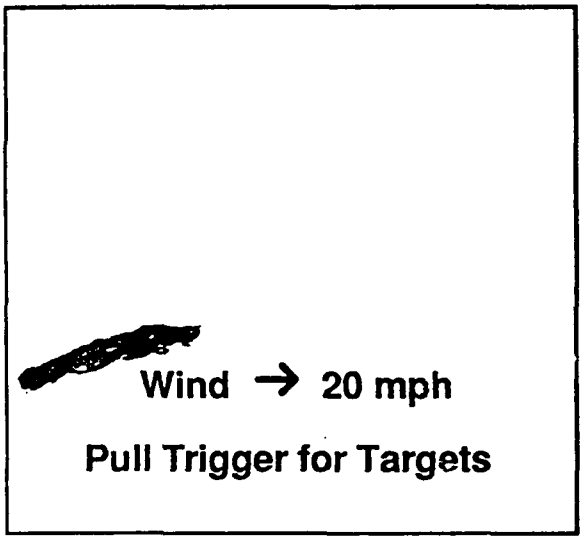


5-45



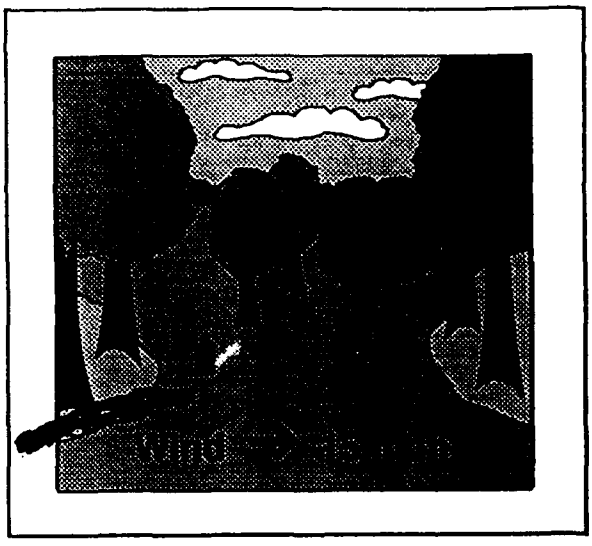
300 M target.

5-46



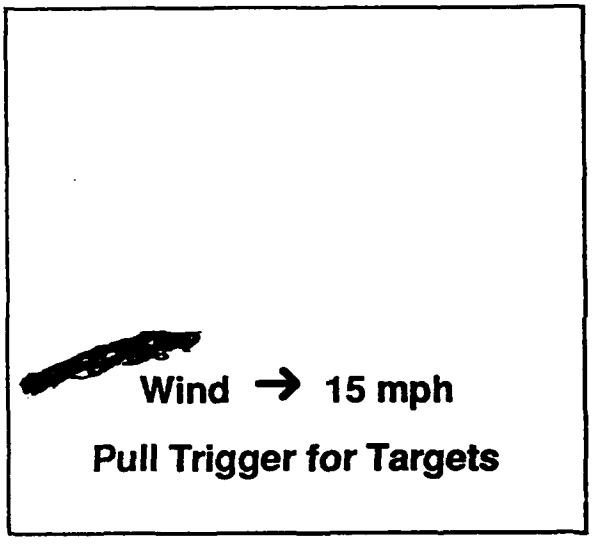
Playback. Displace sight left 45 cm. Bullet hits 58 cm right of aim. (Reverse of 5-44.)

5-47



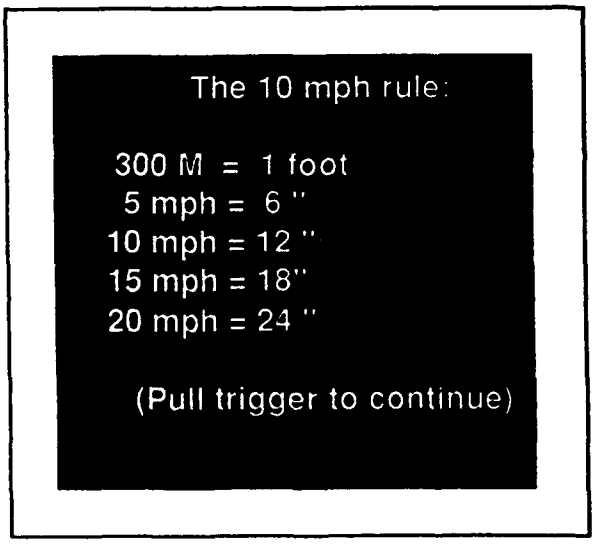
300 M target.

5-48

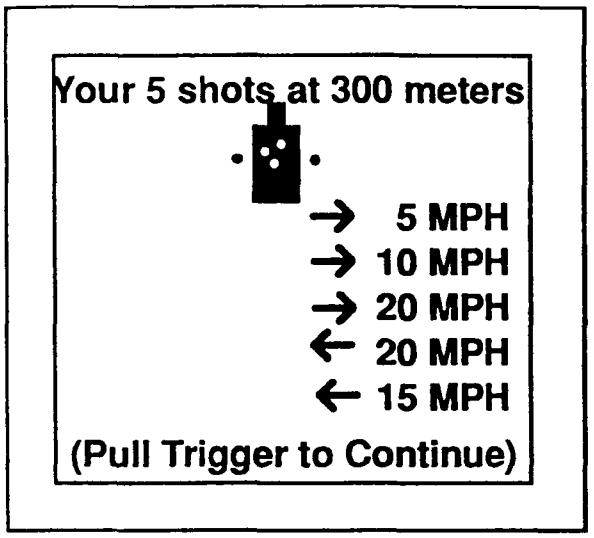


Playback. Single lead rule hits target center.

5-48a

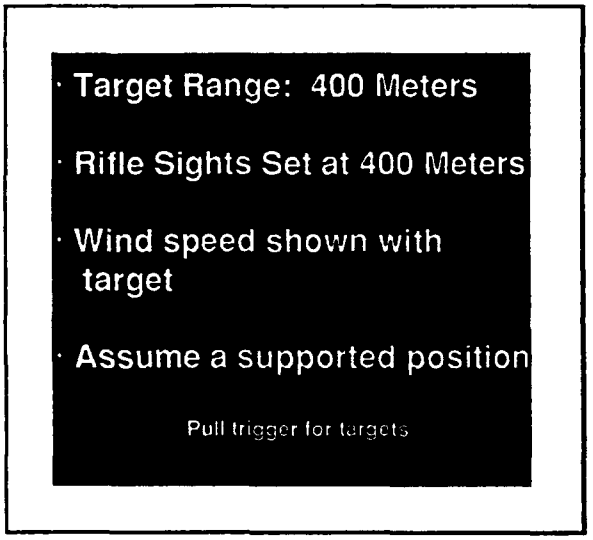


5-49

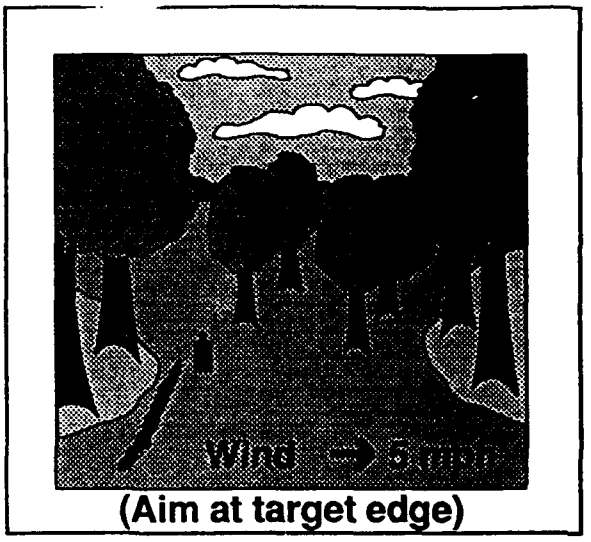


5-shot replay.

5-50

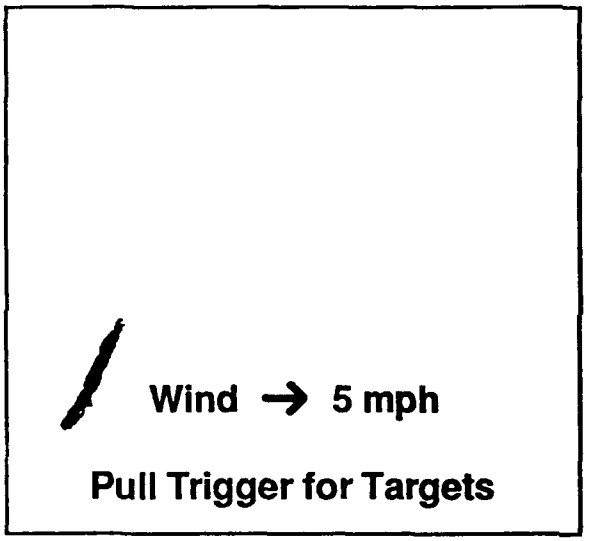


5-51

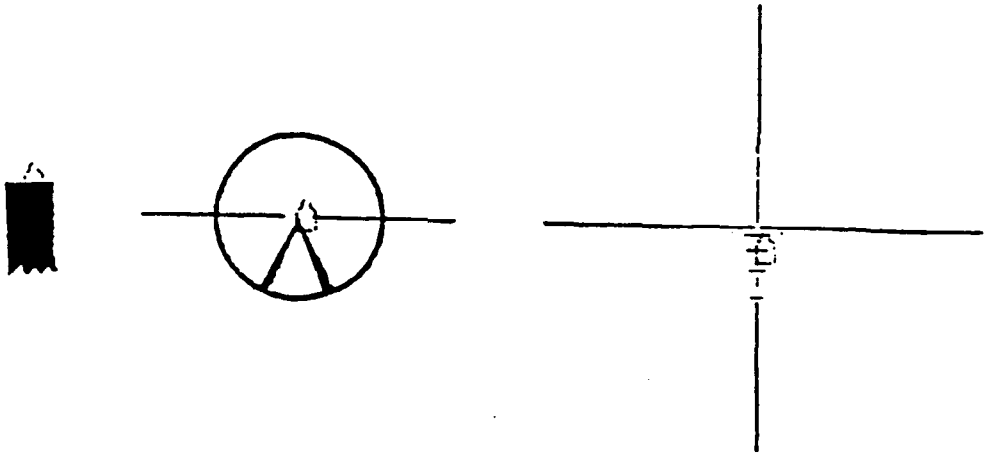


400 M target.

5-52



Playback. Displace sight 29 cm left. Bullet hits 29 cm right of aim.



5-53

(Use single lead rule)

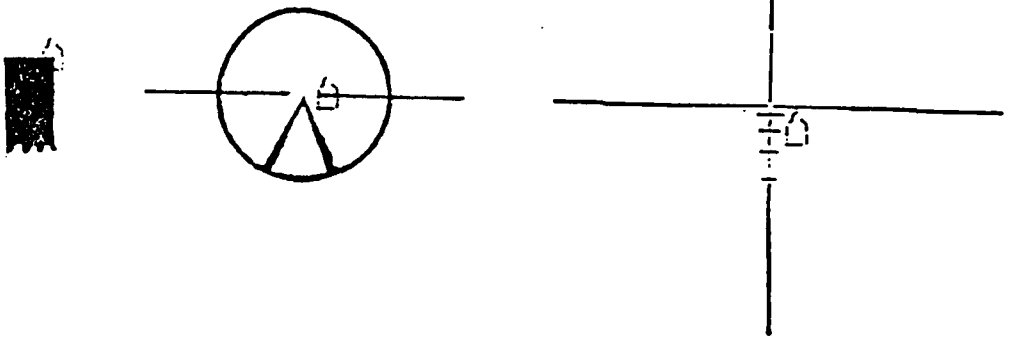
400 M target.

5-54

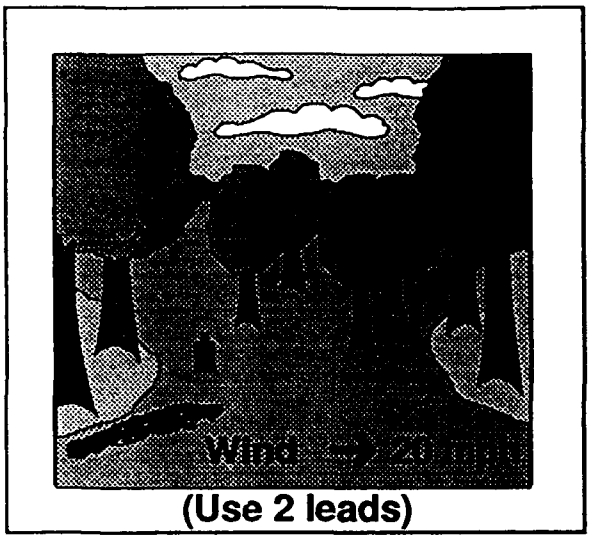
Wind → 10 mph

Pull Trigger for Targets

Playback. Displace sight 59 cmleft.
Bullet hits 58 cm right of aim.

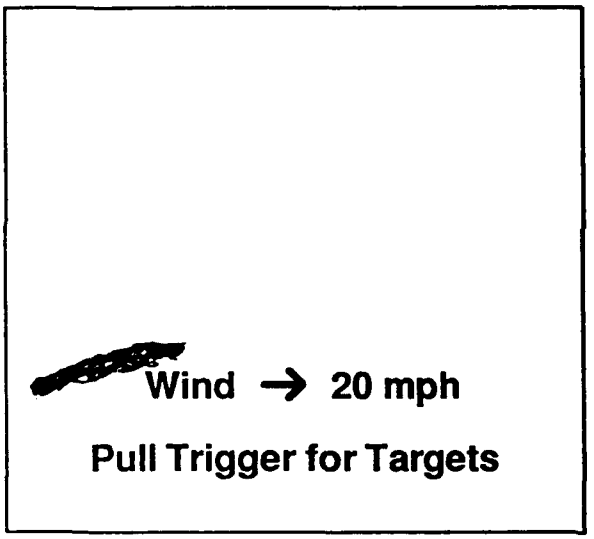


5-55

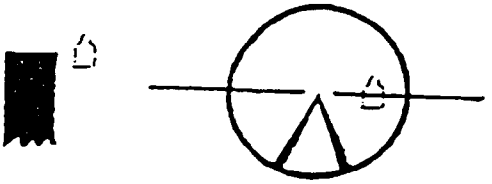


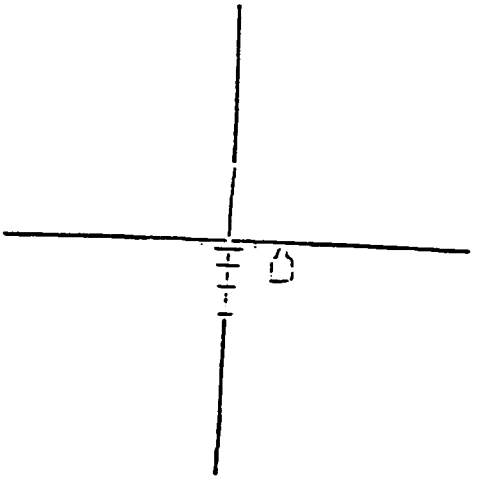
400 M target.

5-56



Playback. Displace sight 118 cm left. Bullet hits 116 cm right of aim.





-57

(Use single lead rule)

400 M target.

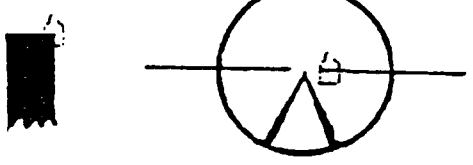
-58

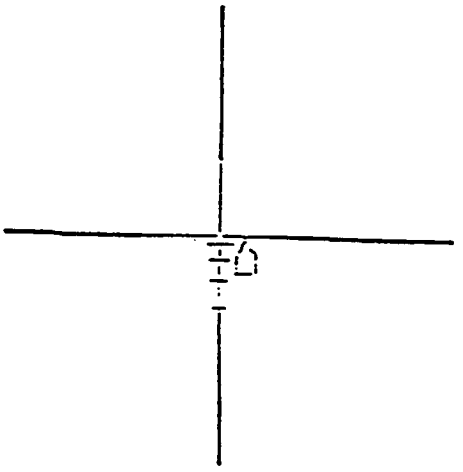
Wind ↗ 20 mph

(Same effect as 10 mph wind)

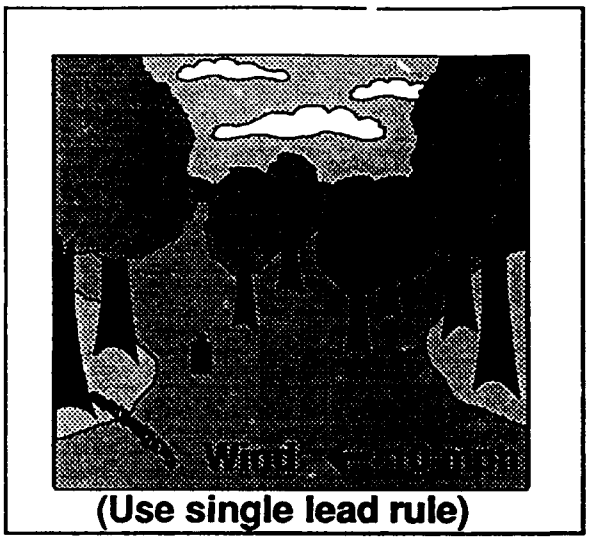
Pull Trigger for Targets

Playback. Displace sight 59 cm left. Bullet hits 58 cm right of aim.



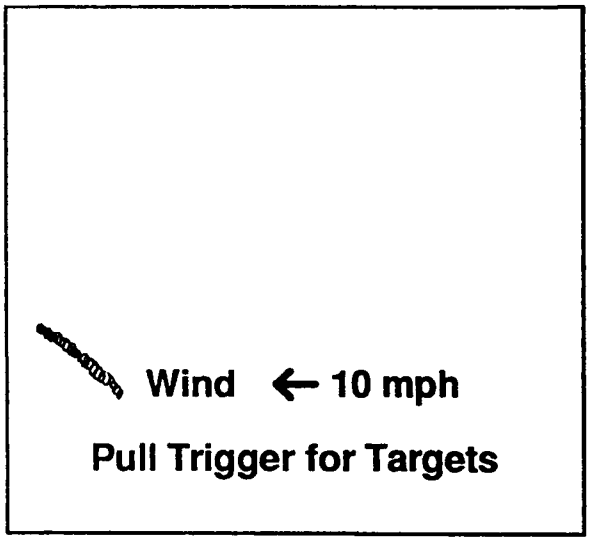


5-59

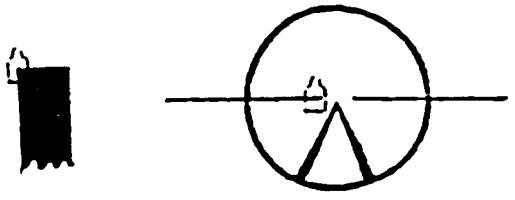


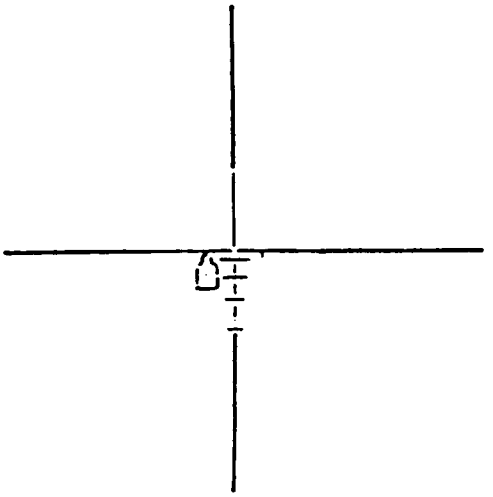
400 M target.

5-60



Playback. Displace sight 59 cm right. Bullet hits 58 cm left of aim.





5-60a

The 10 mph wind rule:

1, 5, 1, 2, 3, 5

400 M = 2 feet

5 mph = 12"
10 mph = 24"
20 mph = 48"

Assume targets are
15-20" wide.

(Pull Trigger to Continue)

5-61

Your 5 shots at 400 meters

→ 5 MPH
→ 10 MPH
→ 20 MPH
↗ 20 MPH
← 10 MPH

(Pull Trigger to Continue)

Target with 5 shot locations.

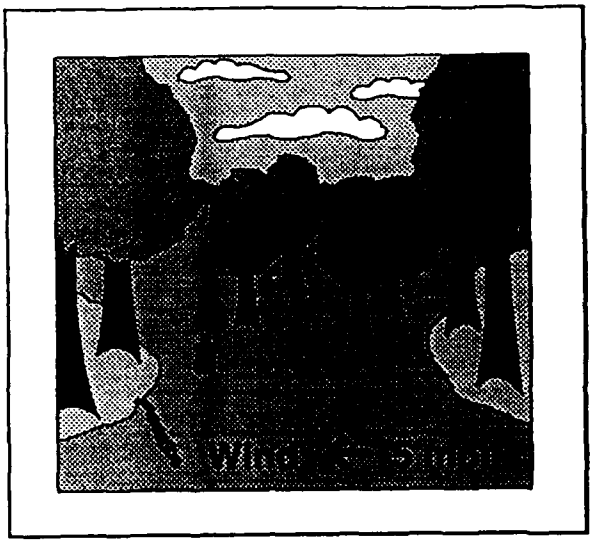
Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

5-62

- Target Range: 500 Meters
- Rifle Sights Set at 500 Meters
- Wind speed shown with target
- Assume a supported position

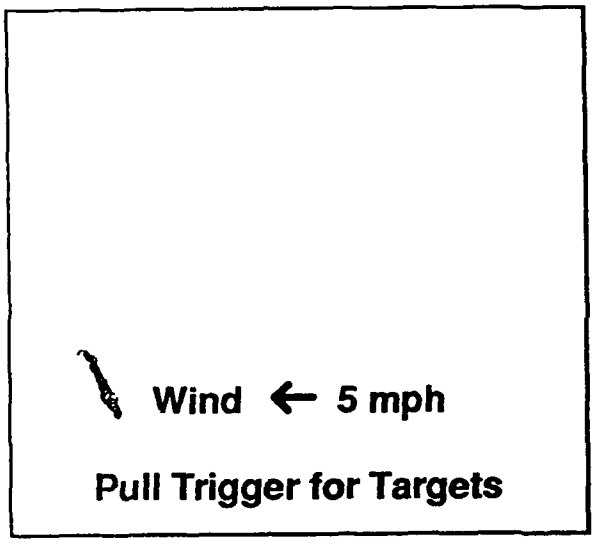
Pull trigger for targets

5-63

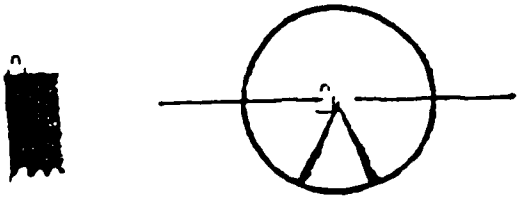


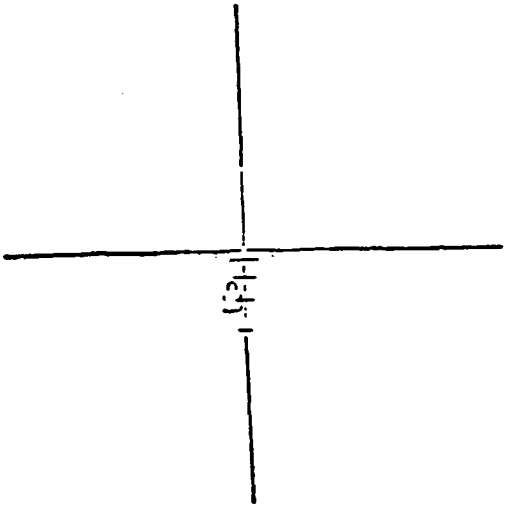
500 M target.

5-64

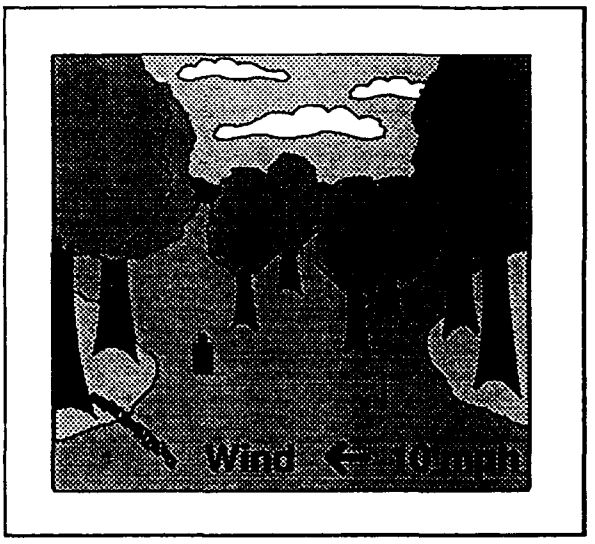


Playback. Displace sight 37 cm right. Bullet hits 48 cm left of aim.



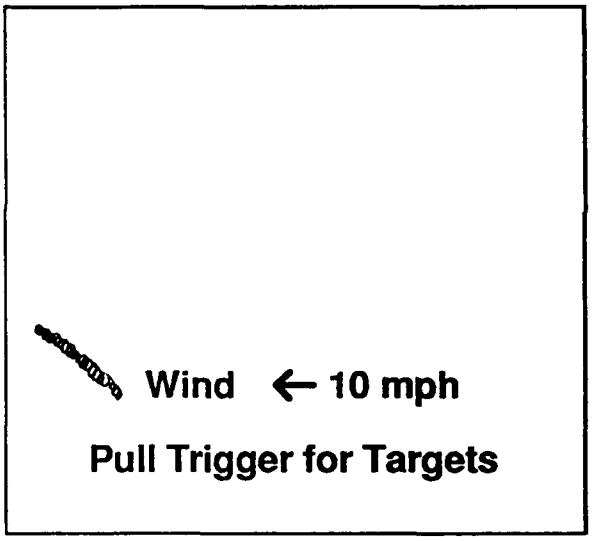


5-65

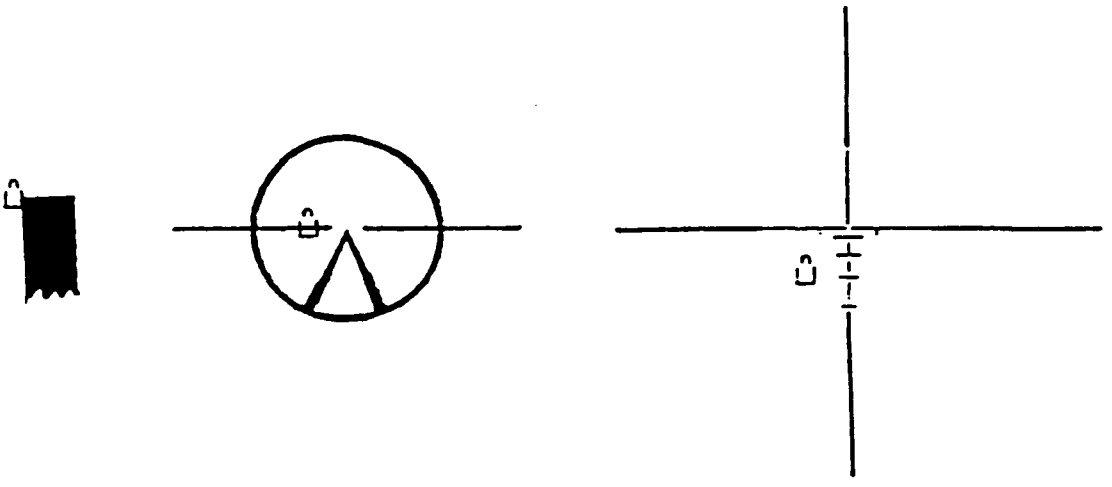


500 M target.

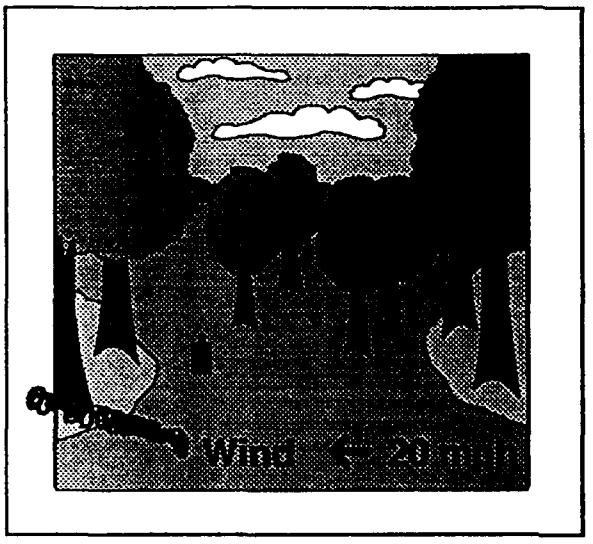
5-66



Playback. Displace sight 98 cm right. Bullet hits 97 cm left of aim.

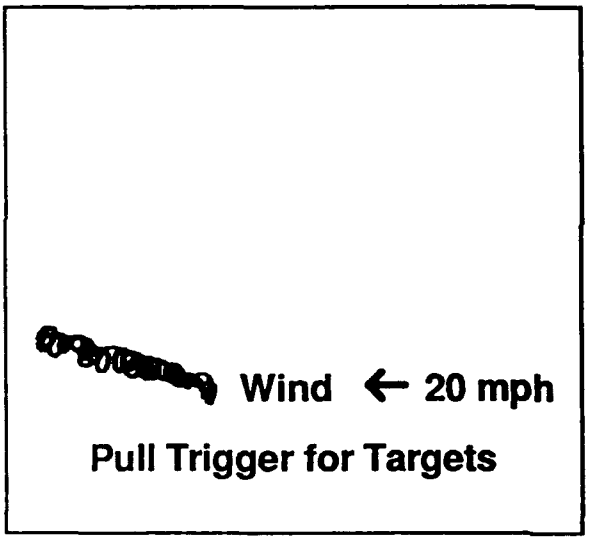


5-67

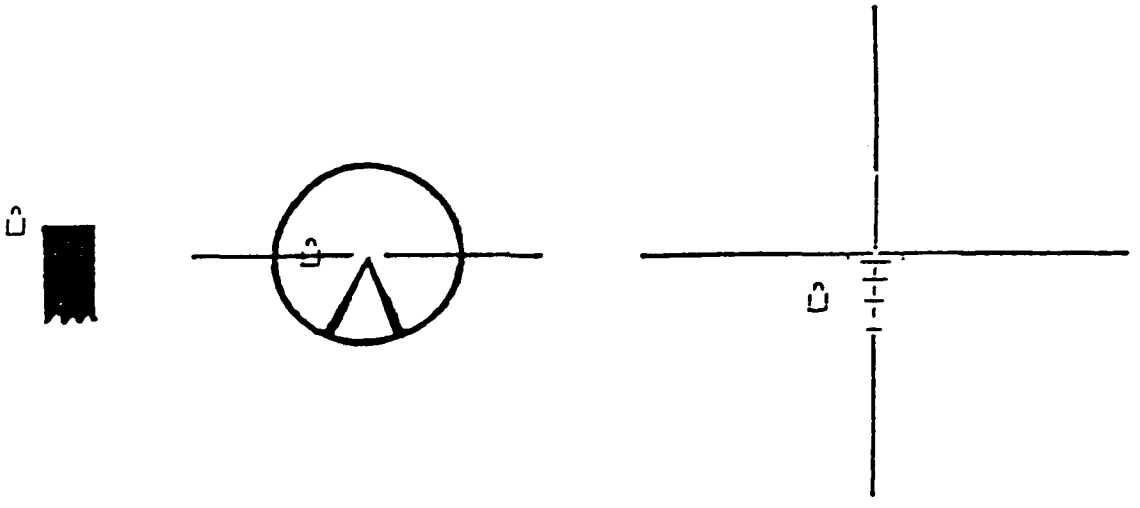


500 M target.

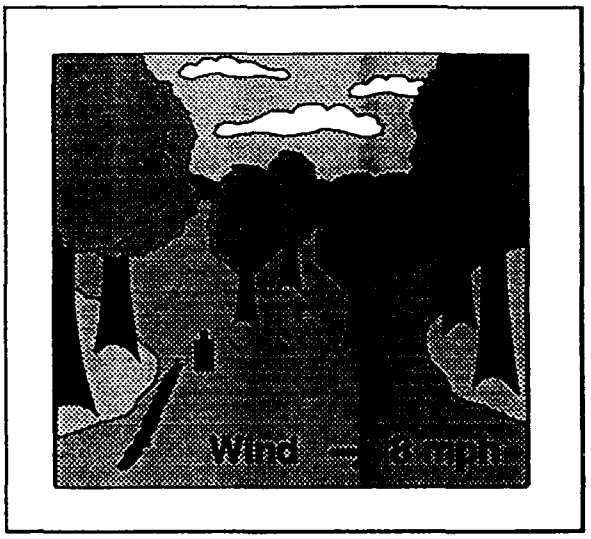
5-68



Playback. Displace sight 195 cm right. Bullet hits 193 cm left of aim.

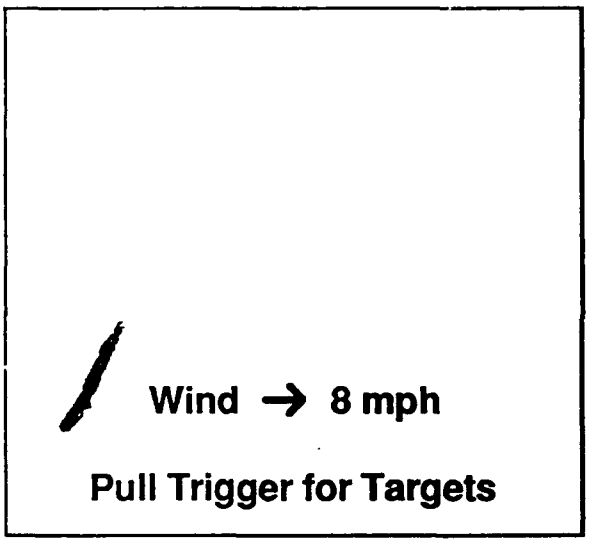


5-69

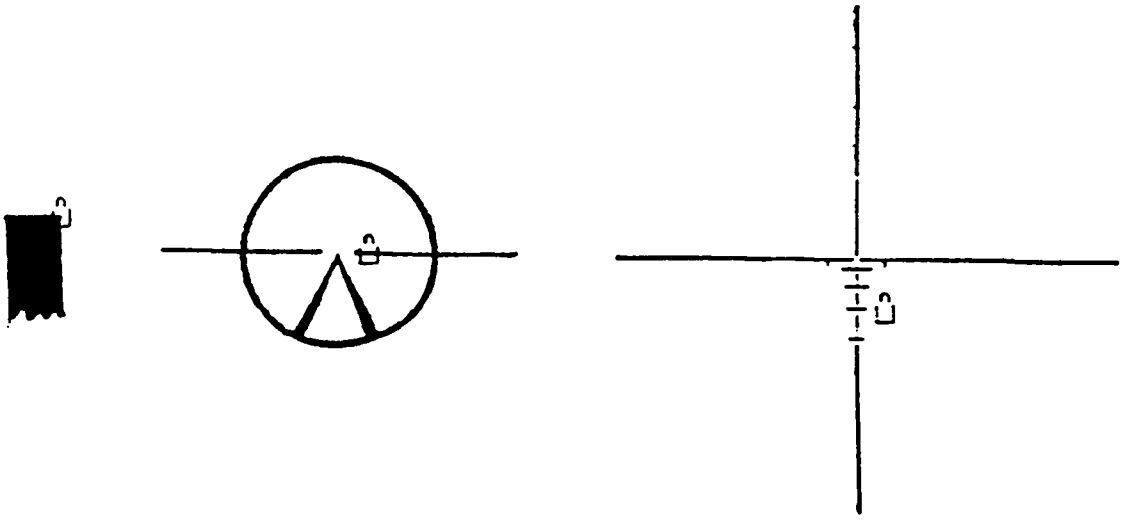


500 M target.

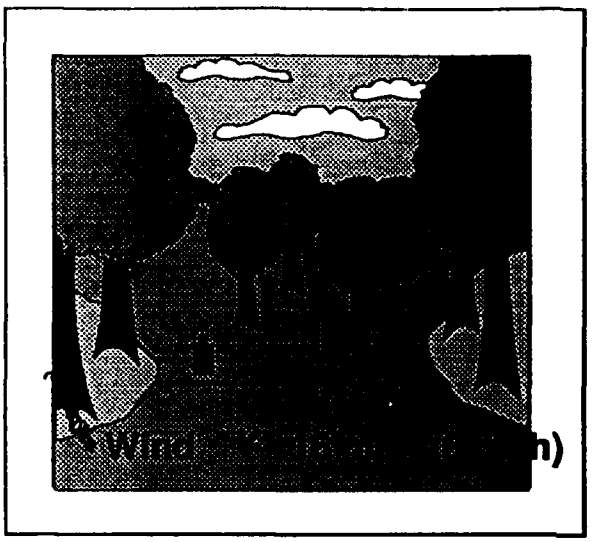
5-70



Playback. Displace sight 74 cm left. Bullet hits 77 cm right of aim.

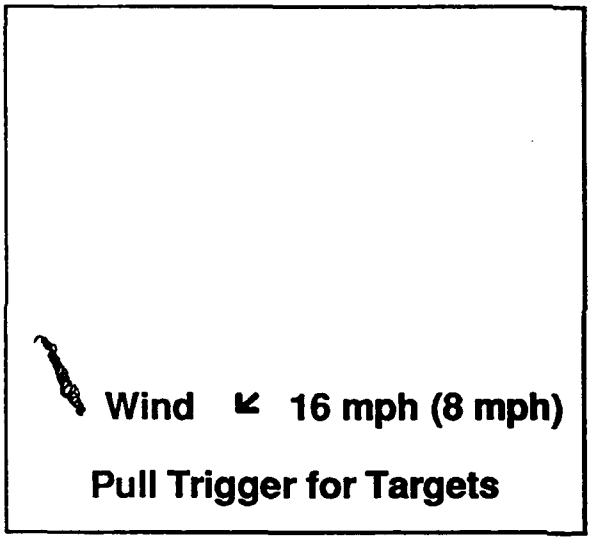


5-71



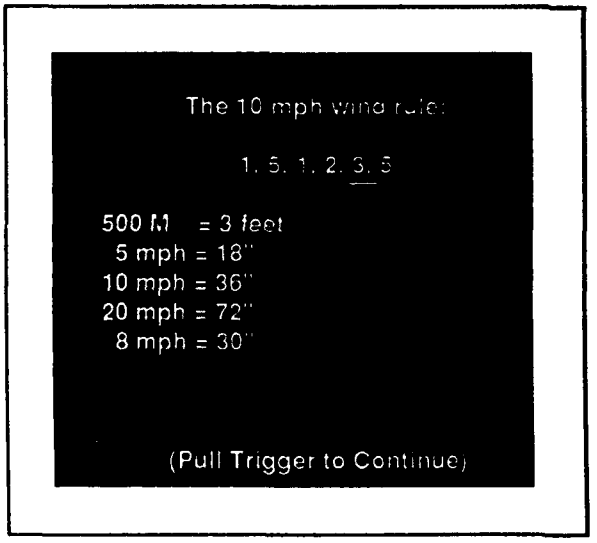
500 M target.

5-72

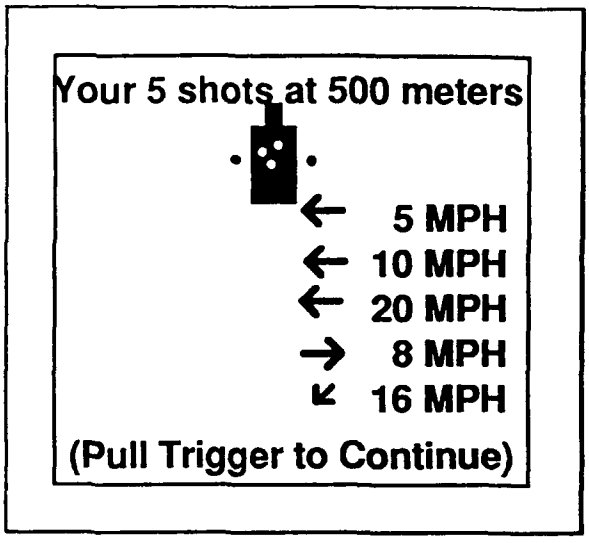


Playback. Reverse of 5-70.

5-60a



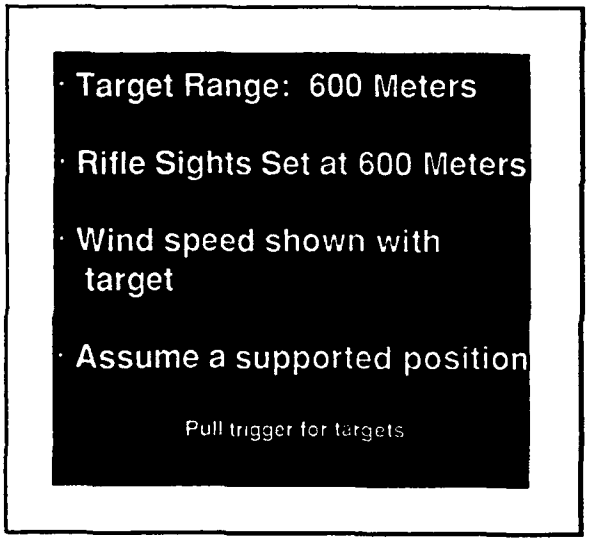
5-73



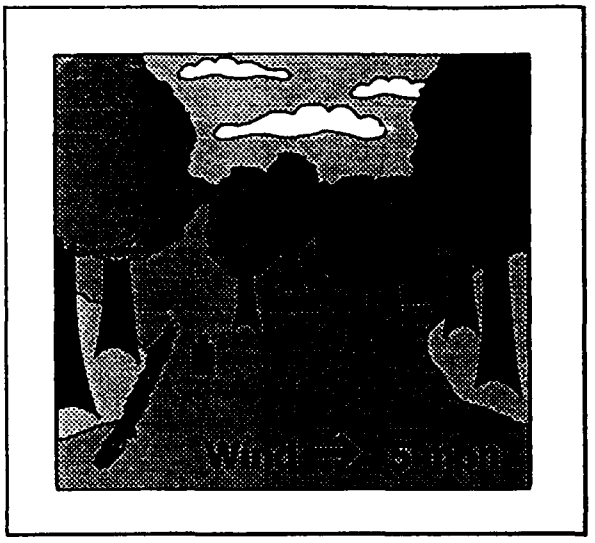
Target with 5 shot locations.

Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

5-74

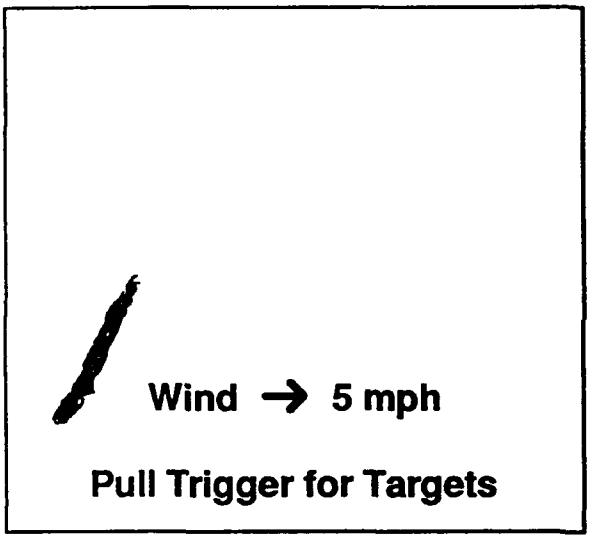


5-75

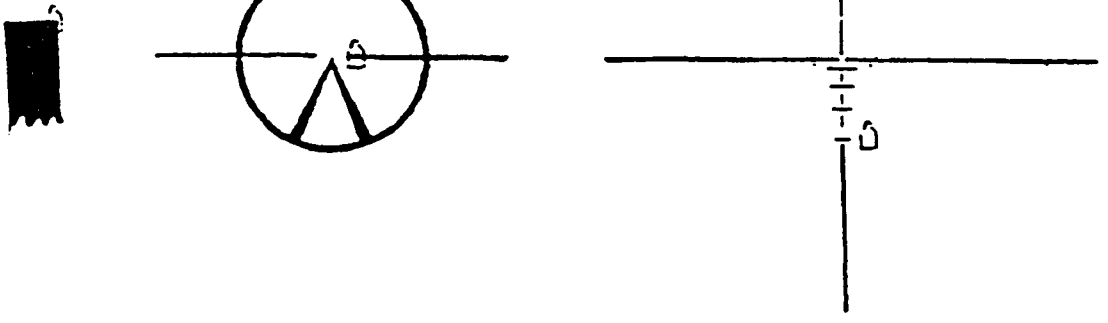


600 M target.

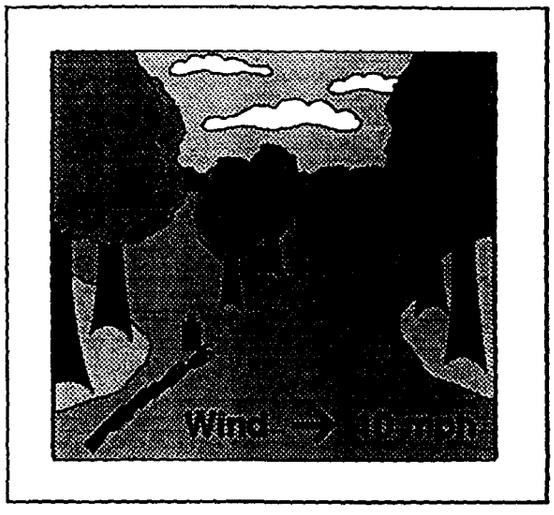
5-76



Playback. Displace sight 77 cm left. Bullet hits 77 cm right of aim.

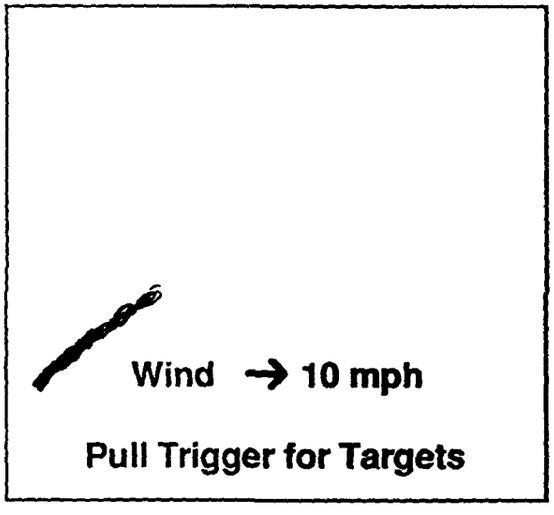


5-77

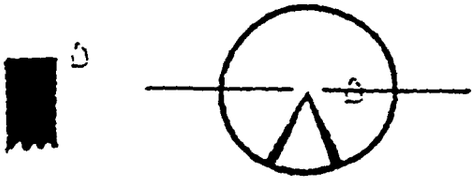


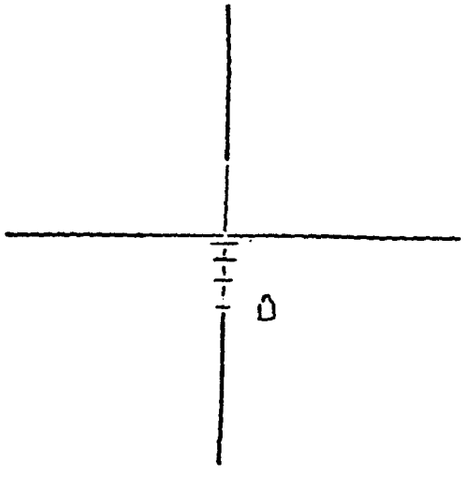
600 M target.

5-78

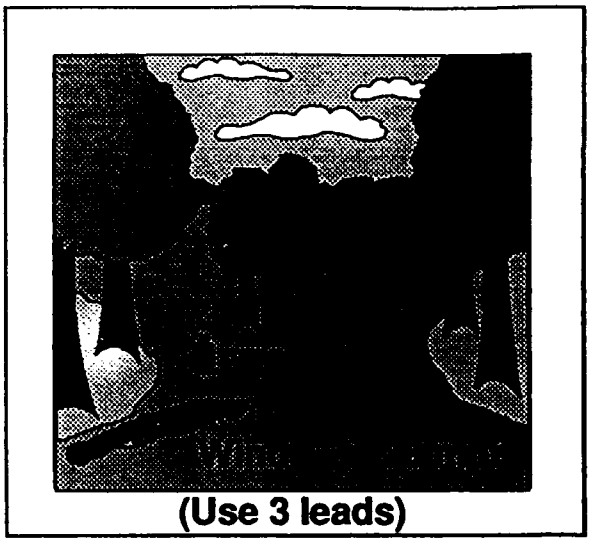


Playback. Displace sight 155 cm left. Bullet hits 155 cm right of aim.



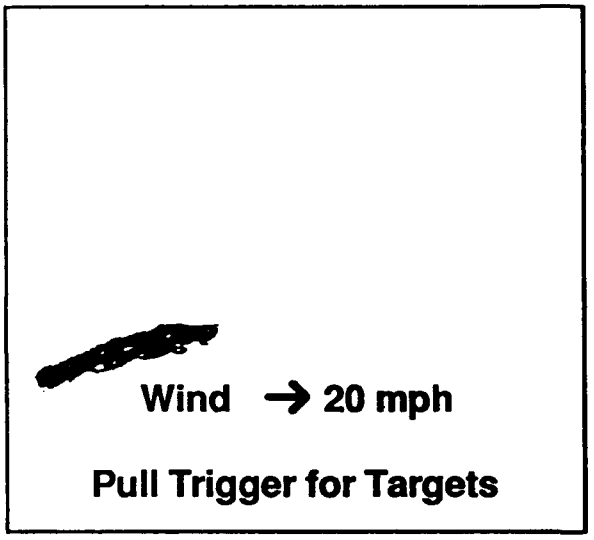


5-79

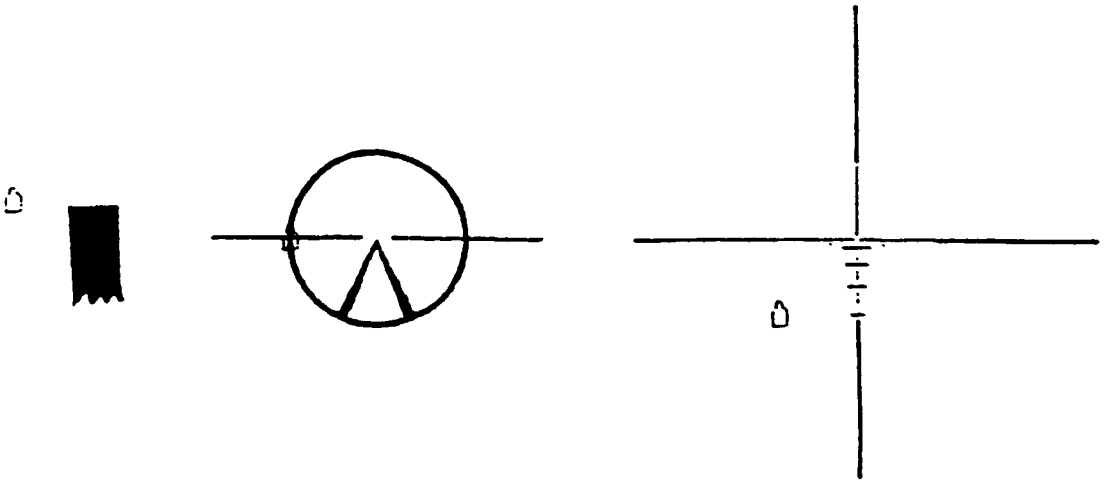


600 M target.

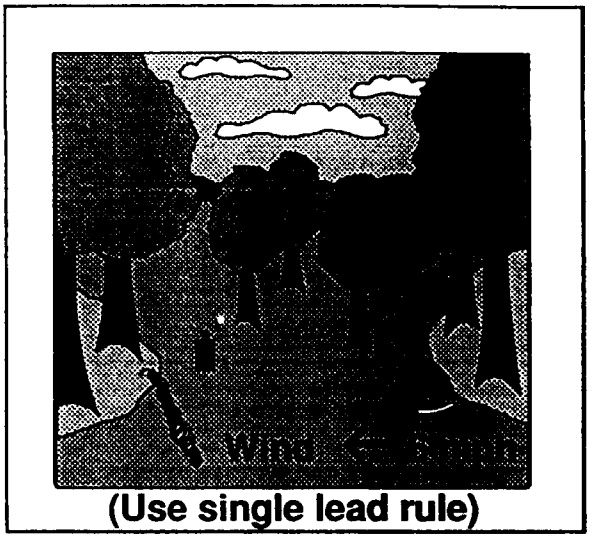
5-80



Playback. Displace sight 309 cm left. Bullet hits 309 cm right of aim.

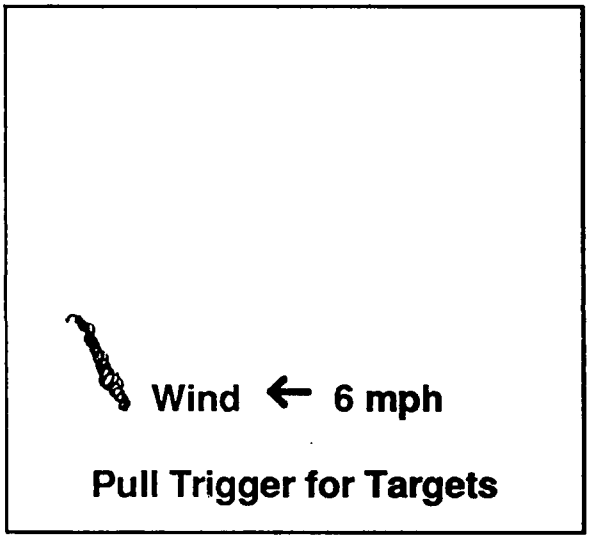


5-81

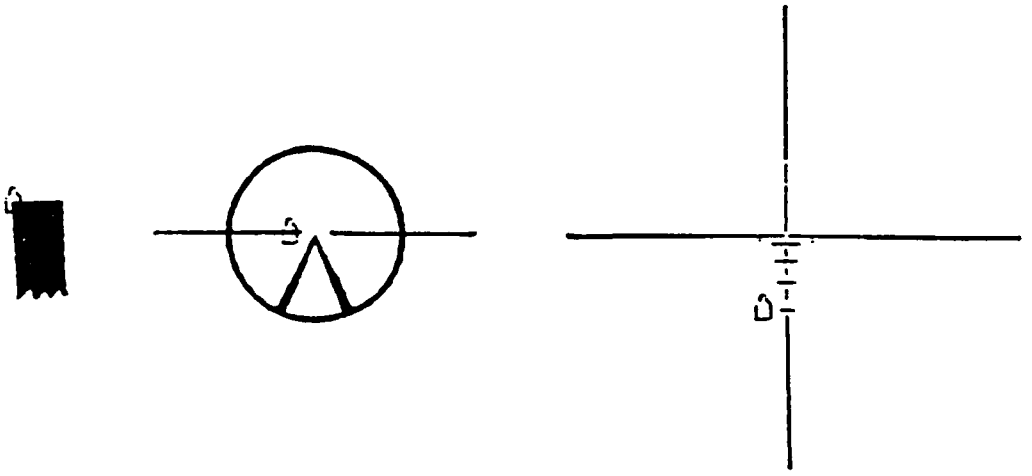


600 M target.

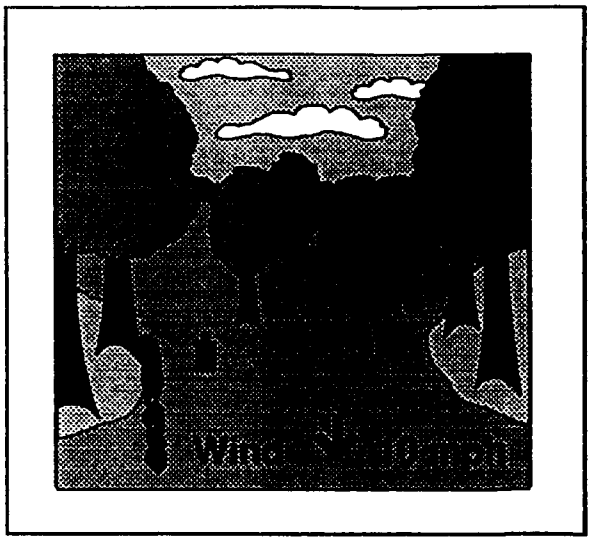
5-82



Playback. Displace sight 89 cm right. Bullet hits 92 cm left of aim.

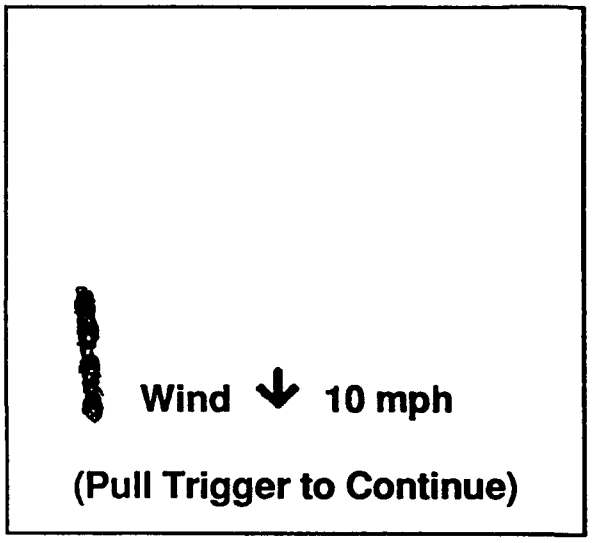


5-83

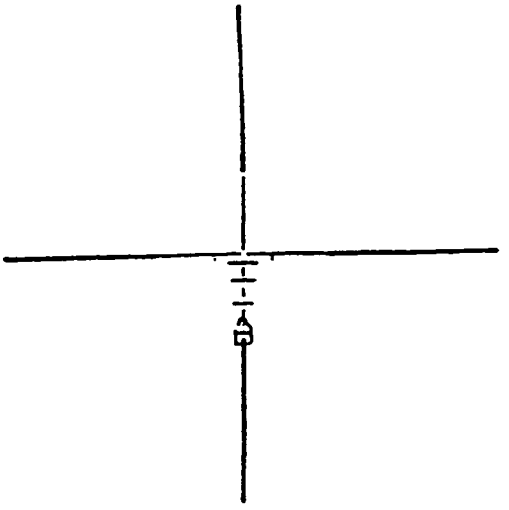


600 M target.

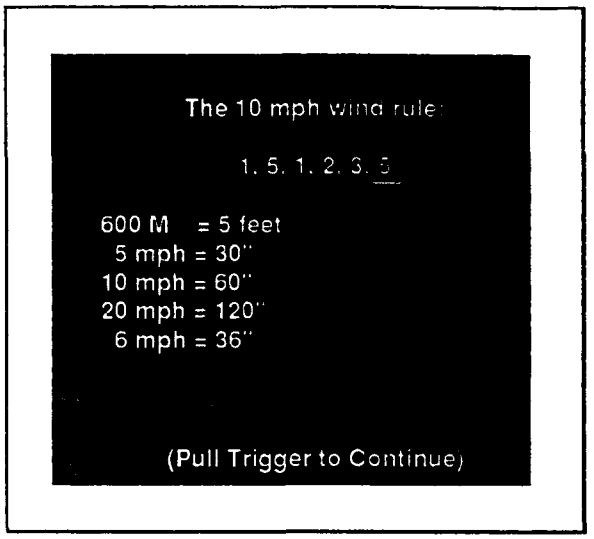
5-84



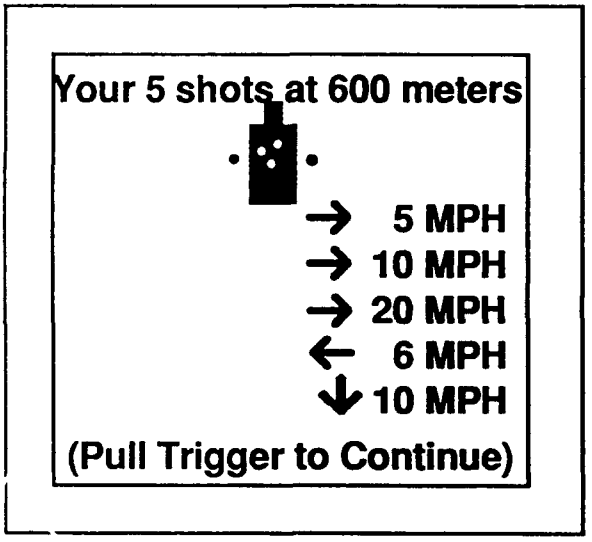
Playback. Center aim. Bullet hits aim point.



5-84a



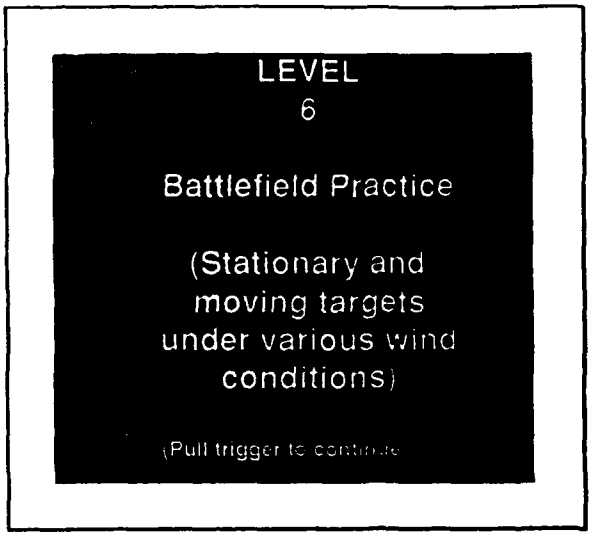
5-85



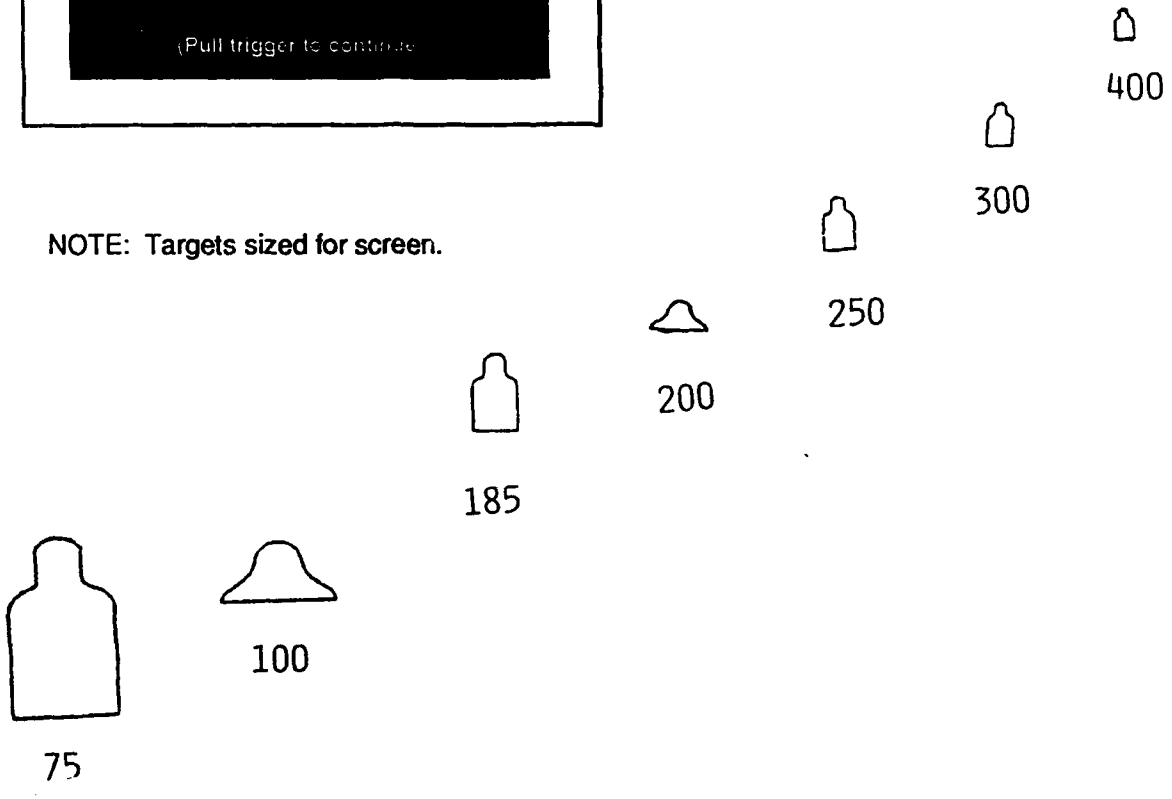
Target with 5 shot locations.

Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

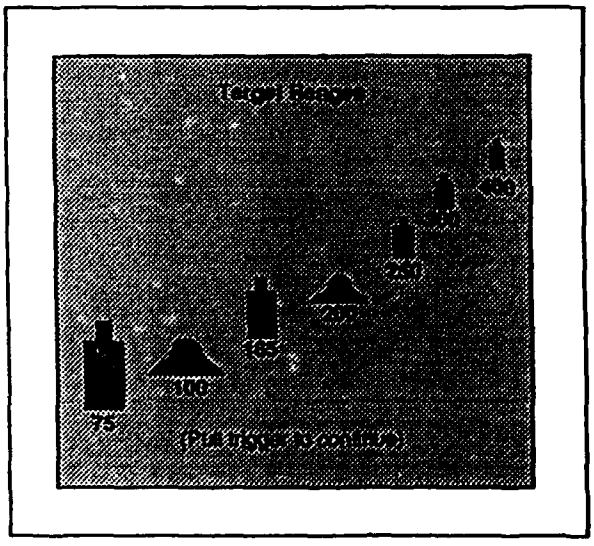
6-1



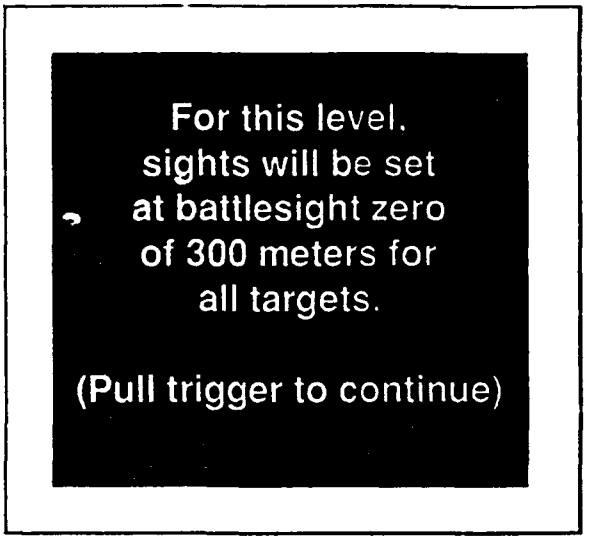
NOTE: Targets sized for screen.



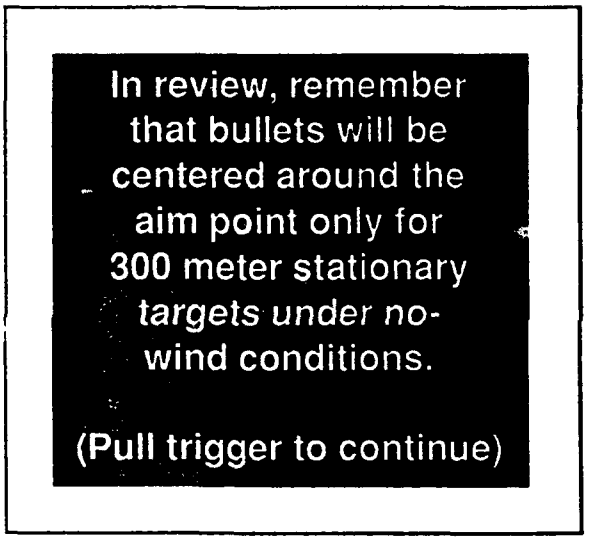
6-2



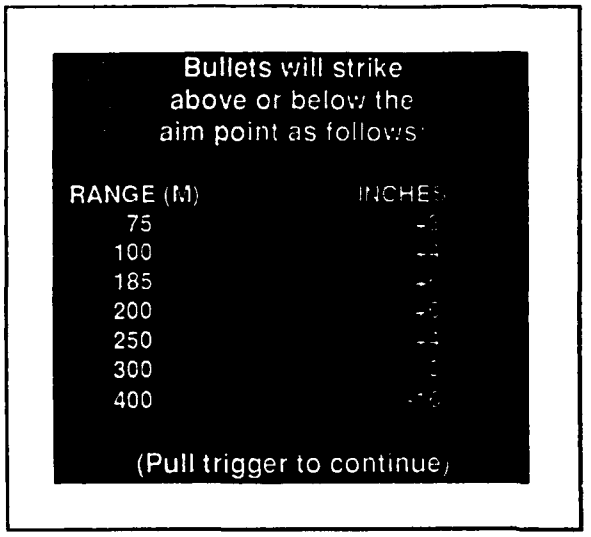
6-3


For this level, sights will be set at battlesight zero of 300 meters for all targets.
(Pull trigger to continue)

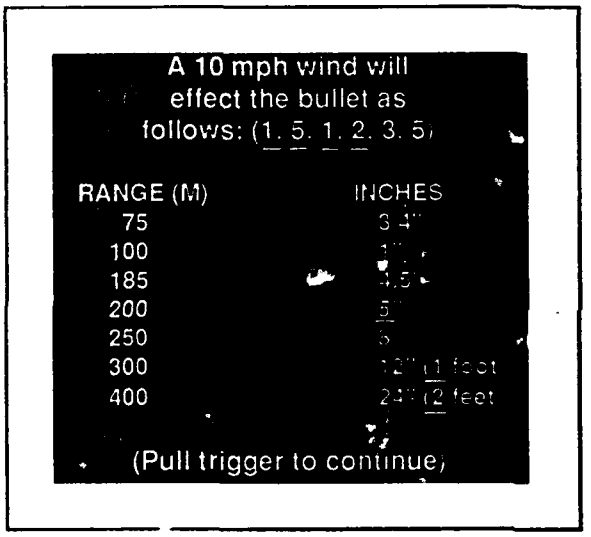
6-4


In review, remember that bullets will be centered around the aim point only for 300 meter stationary targets under no-wind conditions.
(Pull trigger to continue)

6-5


Bullets will strike above or below the aim point as follows:
RANGE (M)
INCHES
75
100
185
200
250
300
400
(Pull trigger to continue)

6-6


A 10 mph wind will effect the bullet as follows: (1. 5. 1. 2. 3. 5)
RANGE (M)
INCHES
75
100
185
200
250
300
400
(Pull trigger to continue)

6-7

The lead required for a moving target is:

Less than 150 m - 1 Lead

150 m or more:

1 - 3 mph - 1 Lead
4 - 6 mph - 2 Leads
7 - 8 mph - 3 Leads

(Pull trigger to continue)

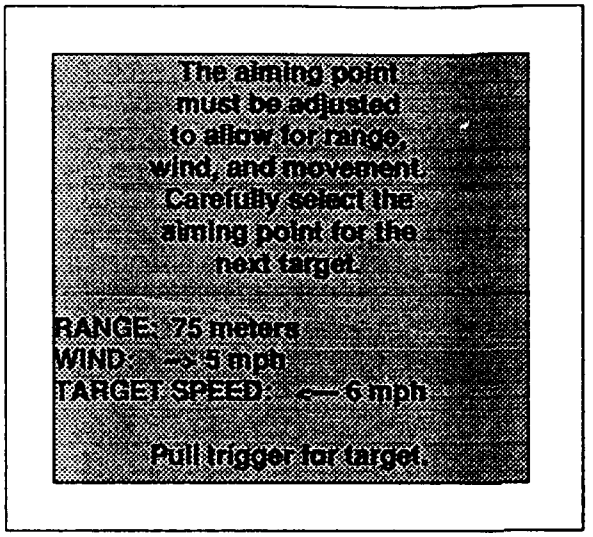
6-8

The amount of bullet displacement which results from leads:

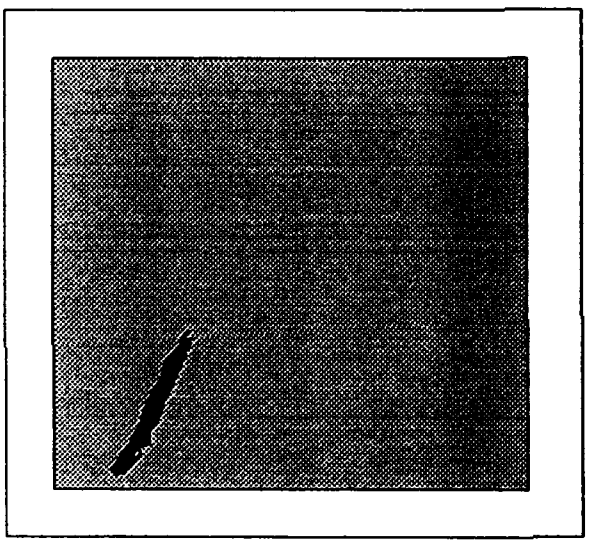
RANGE (M)	LEADS 1	2	3
75	4"	8"	12"
100	6"	12"	18"
185	11"	22"	33"
200	12"	24"	36"
250	15"	30"	45"
300	18"	36"	54"
400	23"	46"	69"

(Pull trigger to continue)

6-9



6-10



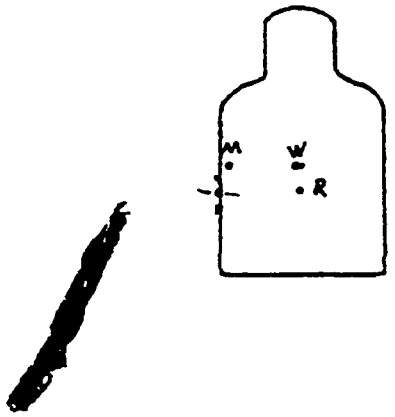
75M target moving Right to Left.

6-11

The next 10 replays will show separate aim points for range, wind, and movement, as well as the correct aim point to hit target center and your aim point.

(Pull trigger to continue)

6-12



RANGE: 75 M
WIND: ---> 5 MPH
MOVING: <--- 6 MPH

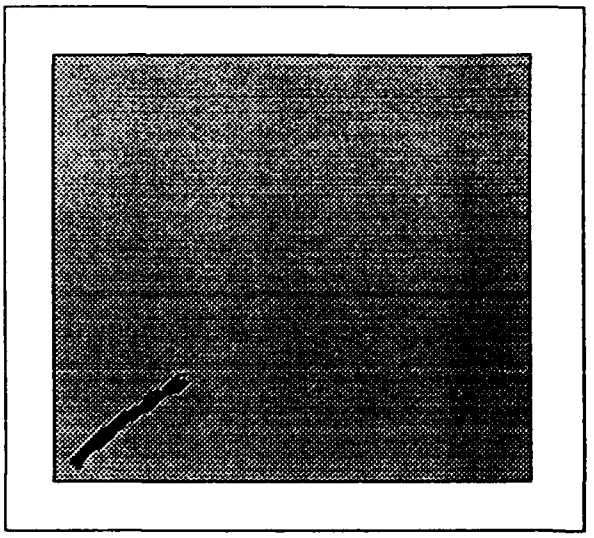
CORRECT AIM POINT

YOUR AIM POINT

(Pull trigger for target)

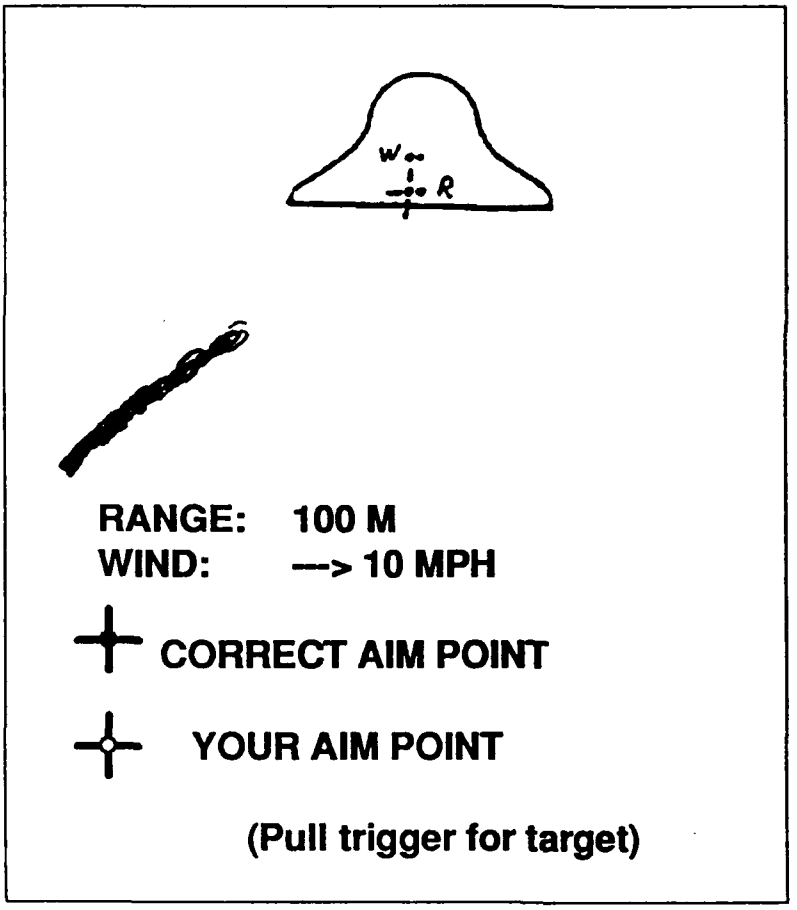
NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

6-13



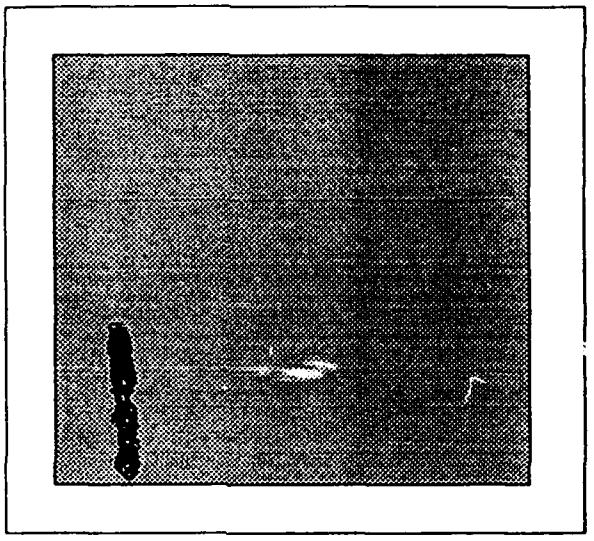
100 M target.

6-14



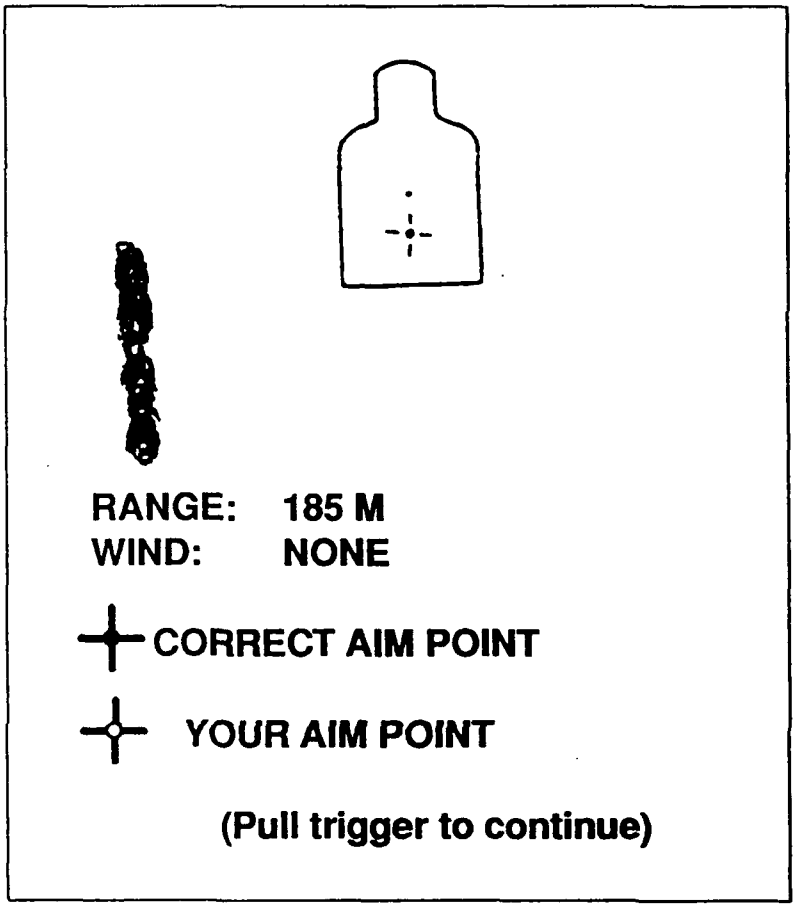
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-15



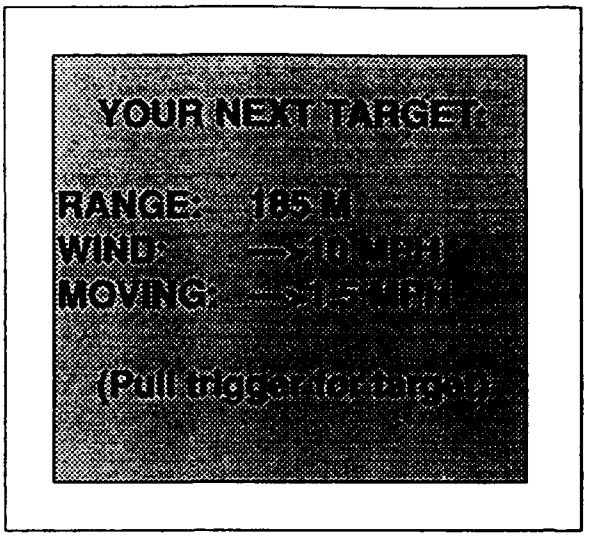
185 M target.

6-16

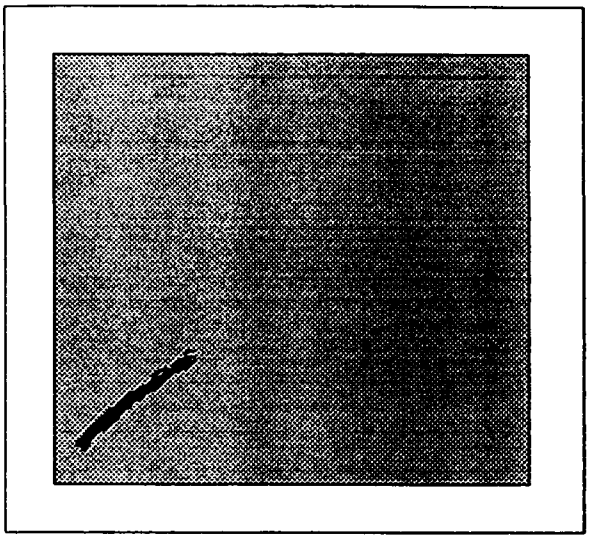


NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-17

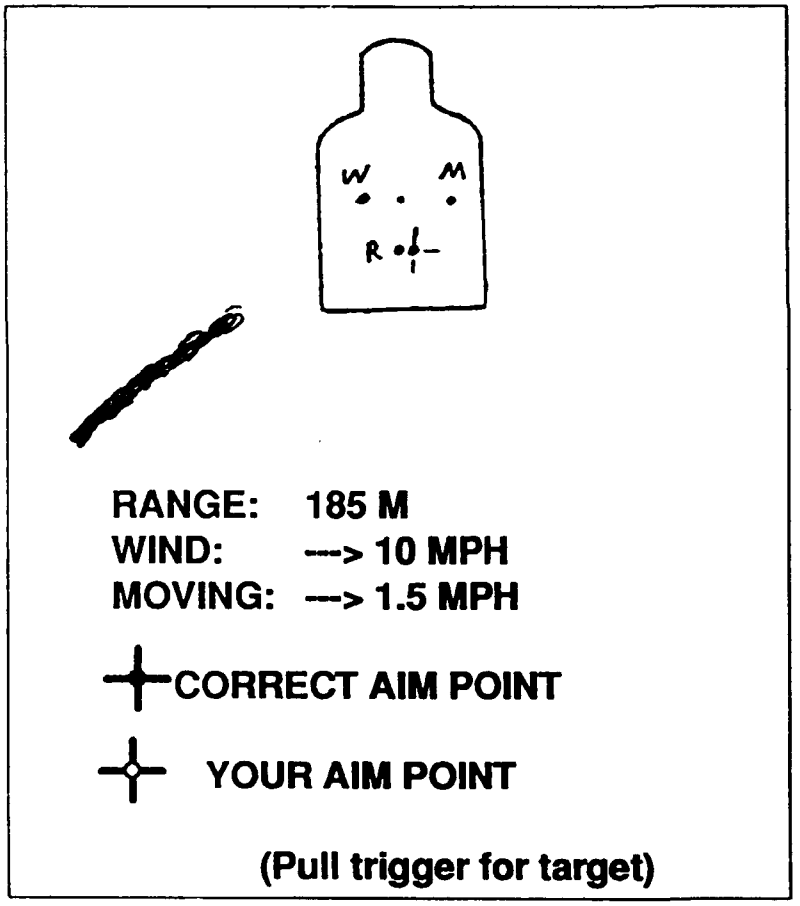


6-18



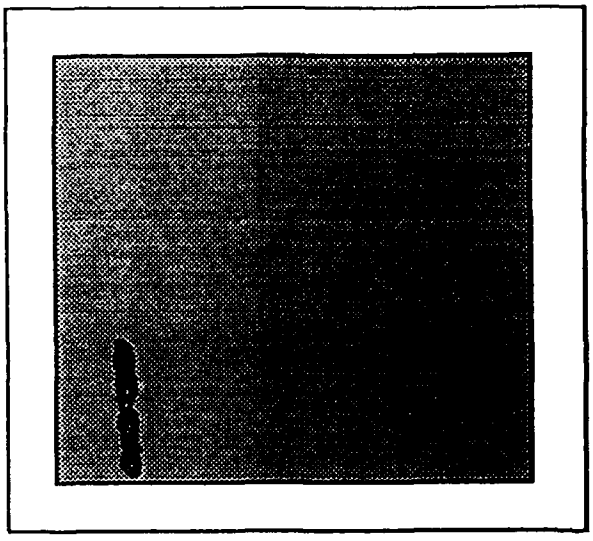
185 M target moving left to right at 1.5 mph.

6-19



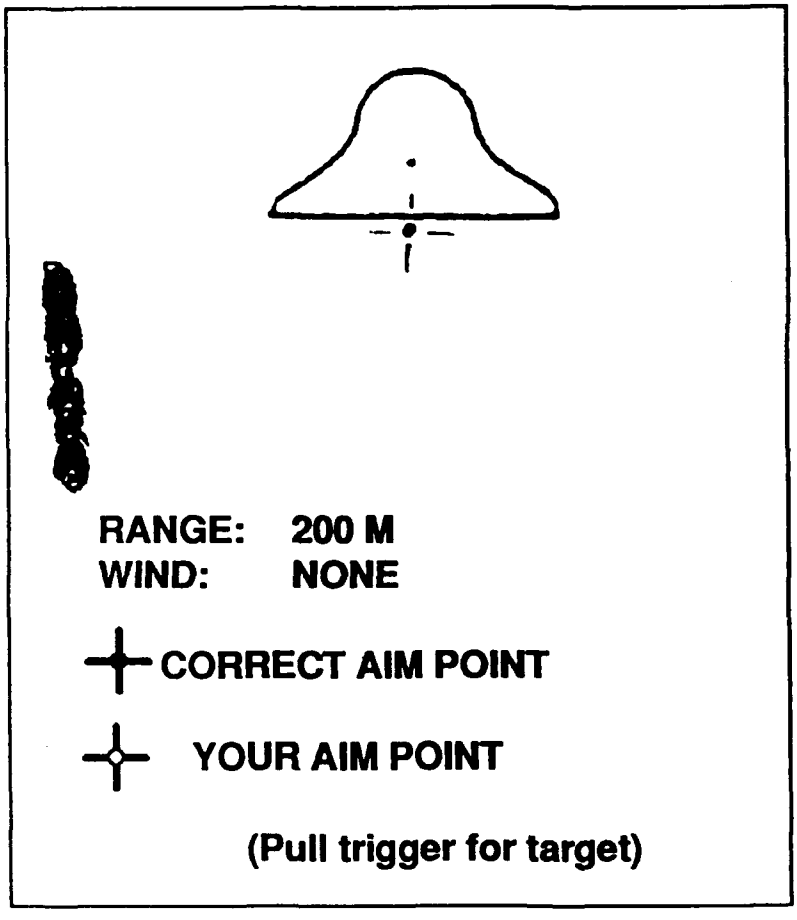
NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

6-20



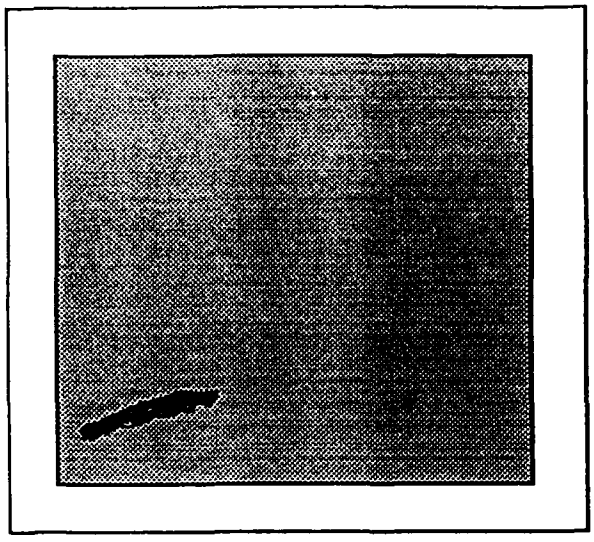
200 M target.

6-21



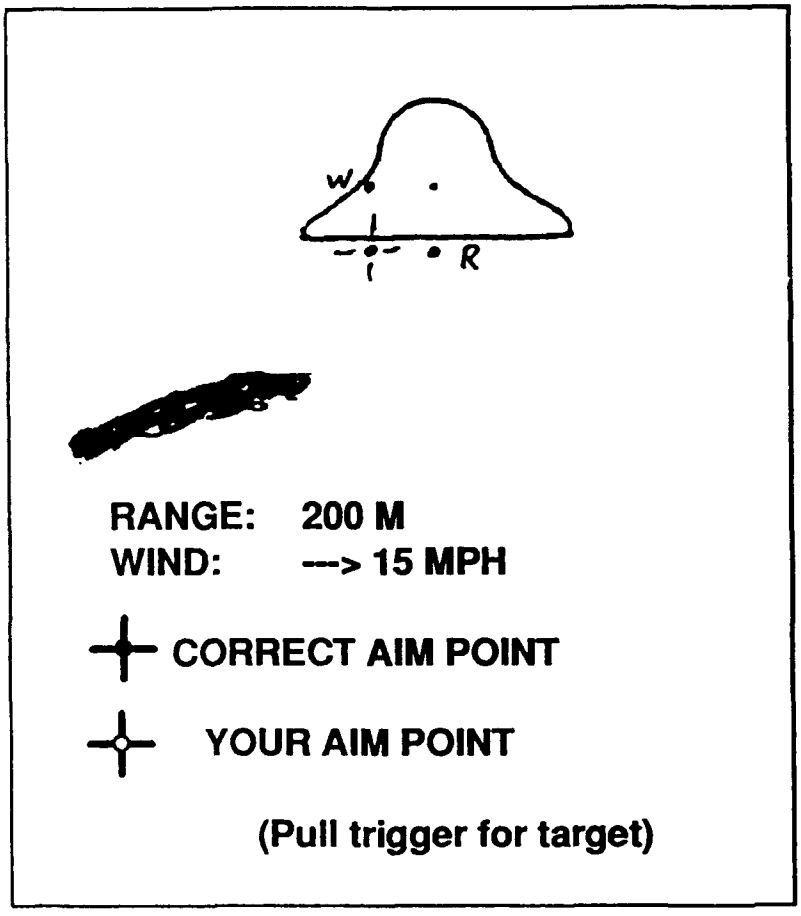
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-22



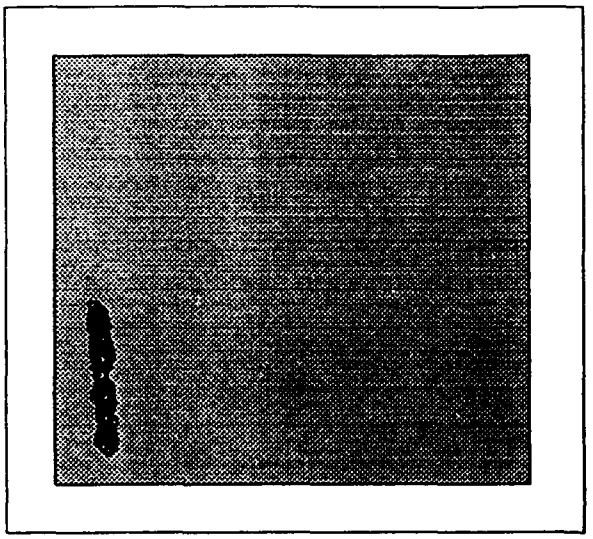
200 M target.

6-23



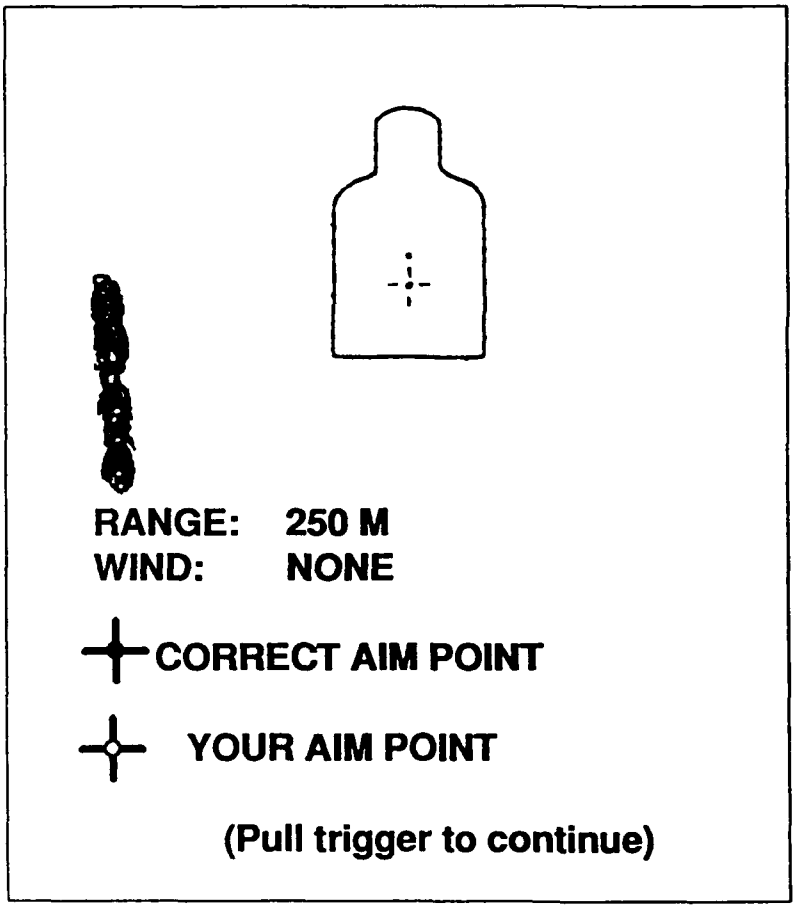
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-24



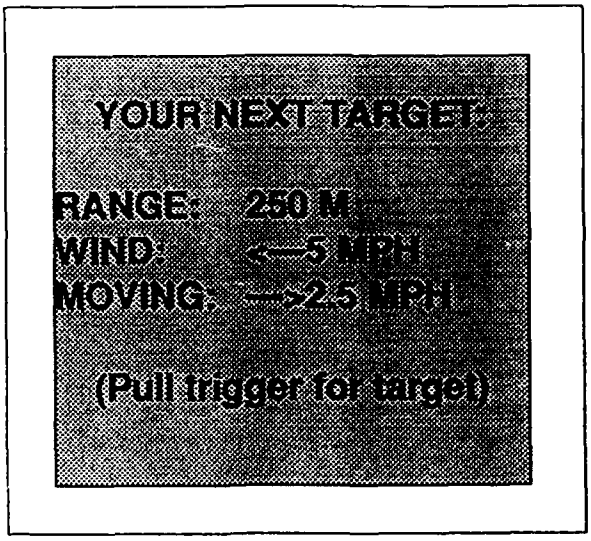
250 M target.

6-25

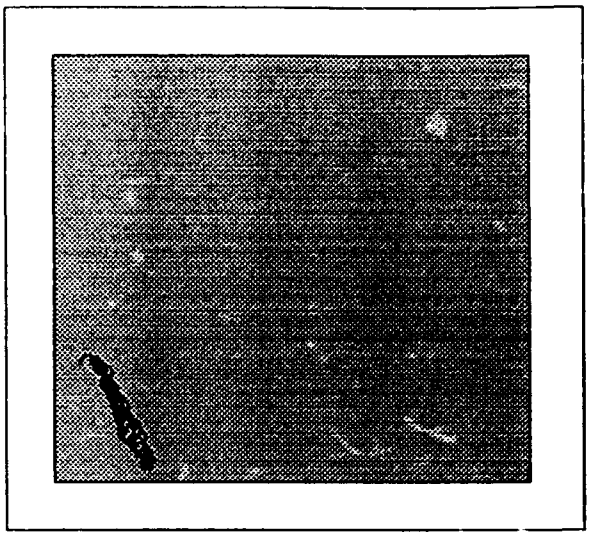


NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-26

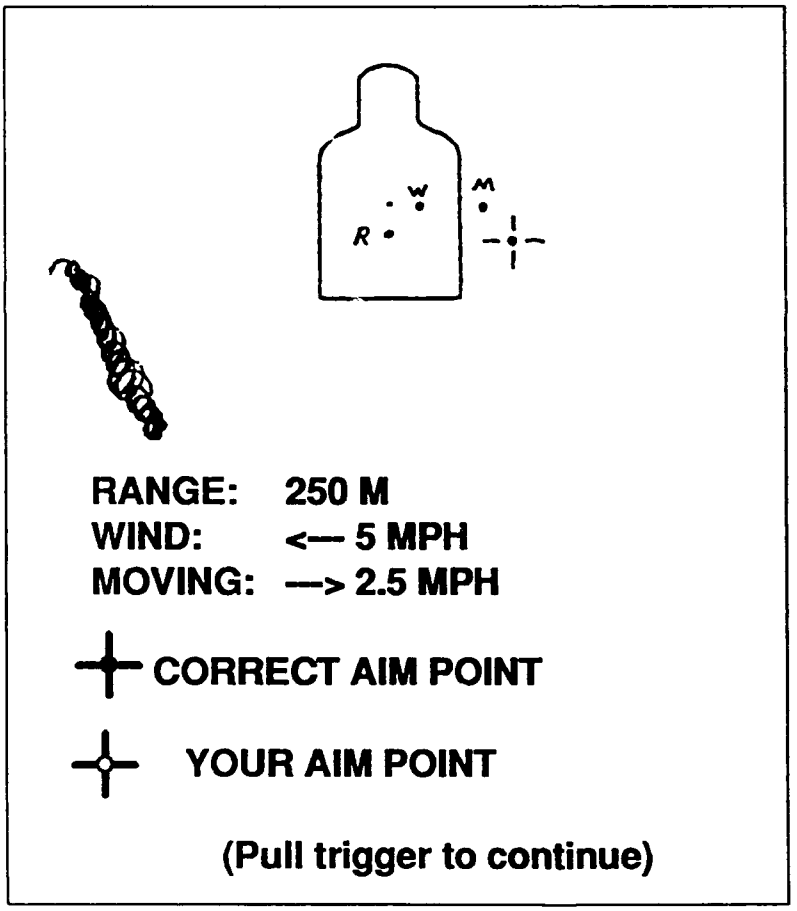

YOUR NEXT TARGET:
RANGE: 250 M
WIND: <—5 MPH
MOVING: —>2.5 MPH
(Pull trigger for target)

6-27



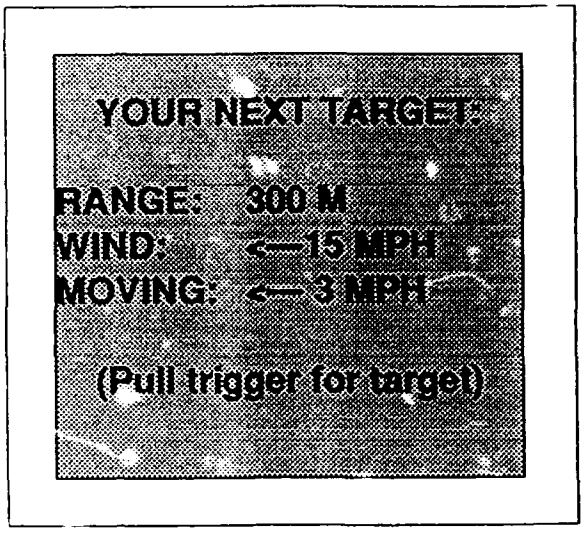
250 M target moving left to right at 2.5 mph.

6-28

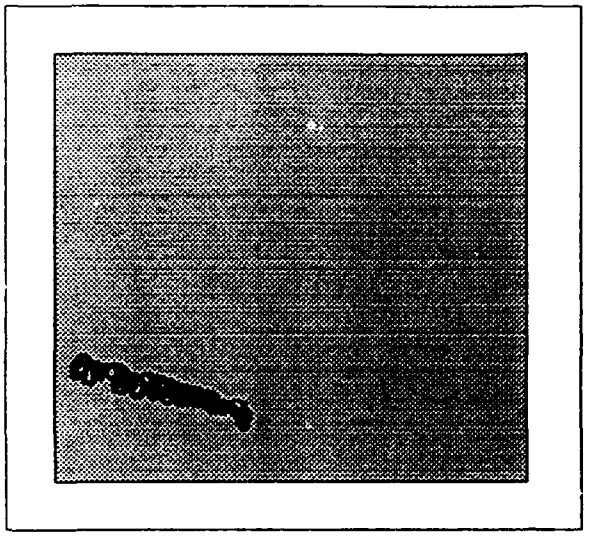


NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

6-29

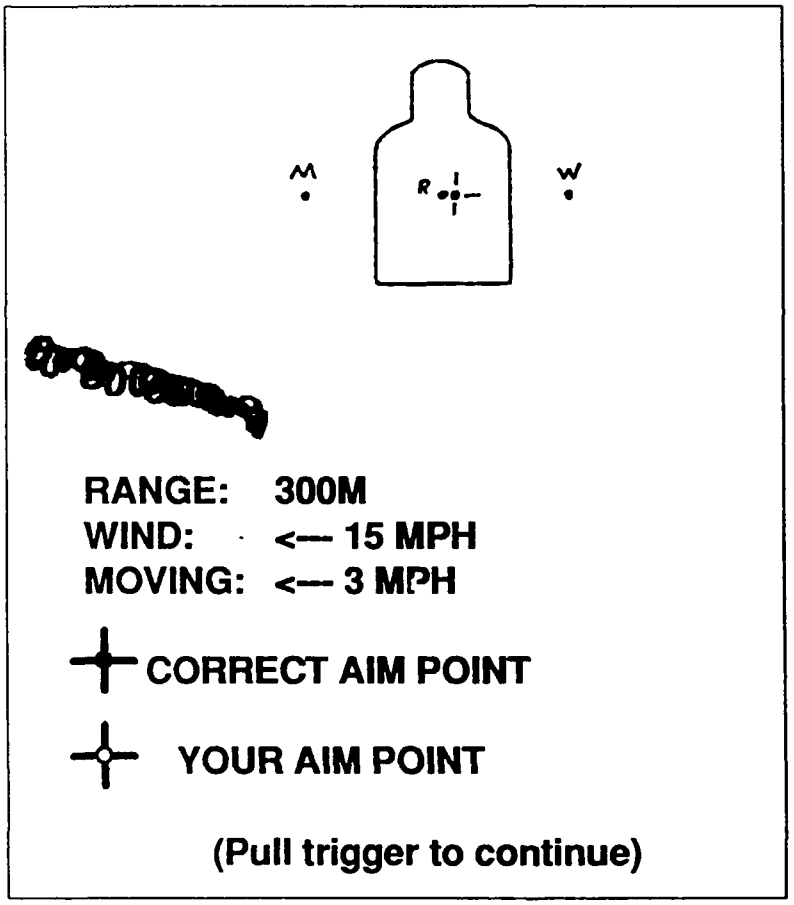

YOUR NEXT TARGET:
RANGE: 300 M
WIND: <—15 MPH
MOVING: <— 3 MPH
(Pull trigger for target)

6-30



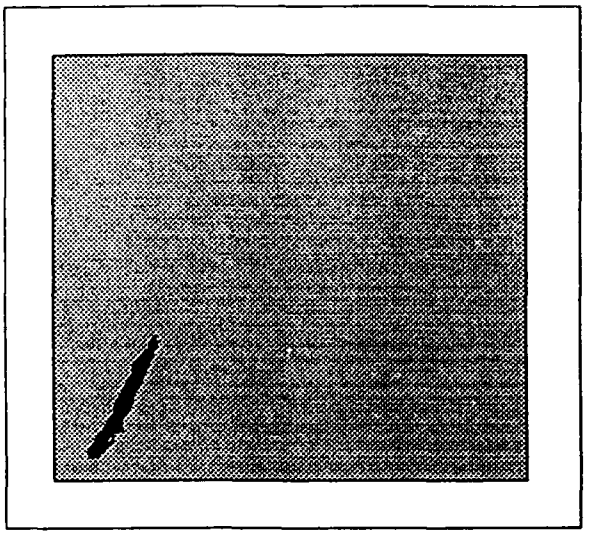
300 M target moving right to left at 3 mph.

6-31



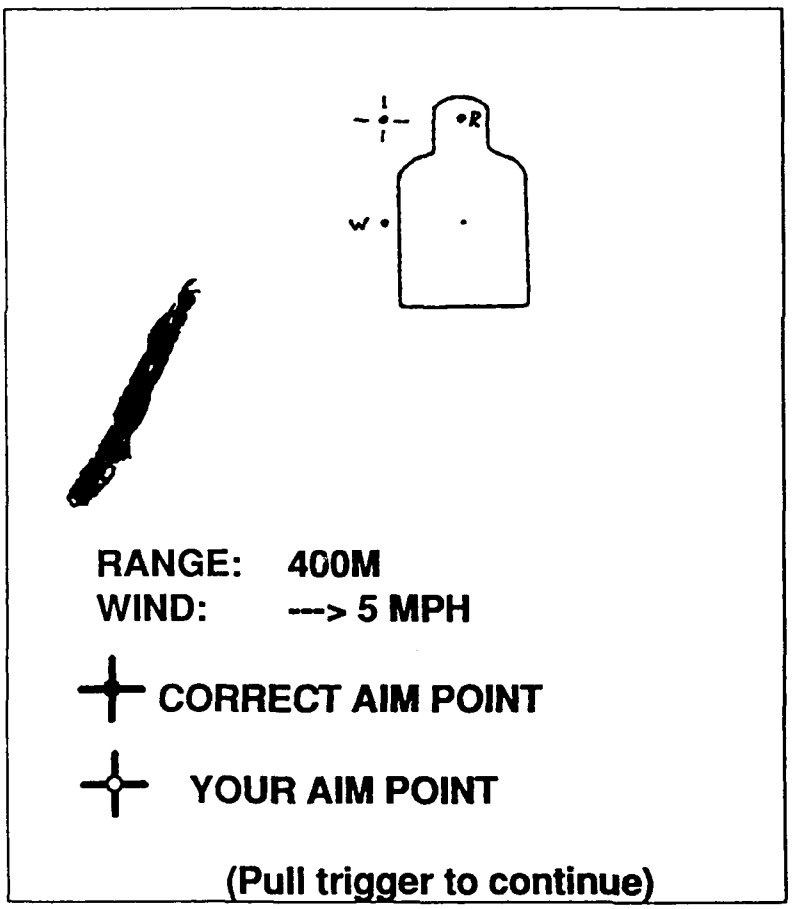
NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

6-32



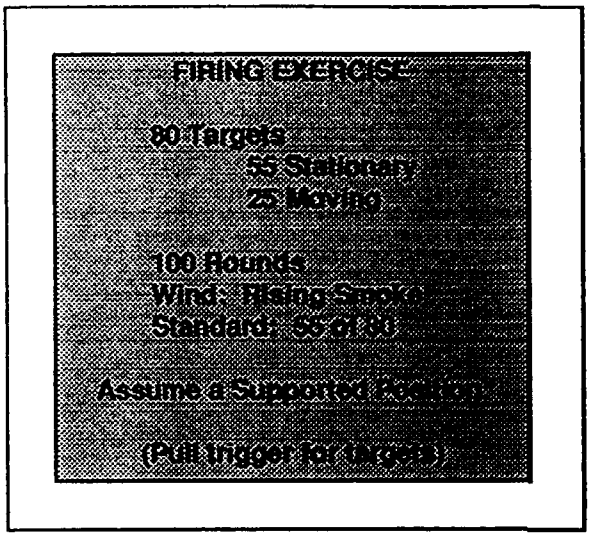
400 M target.

6-33



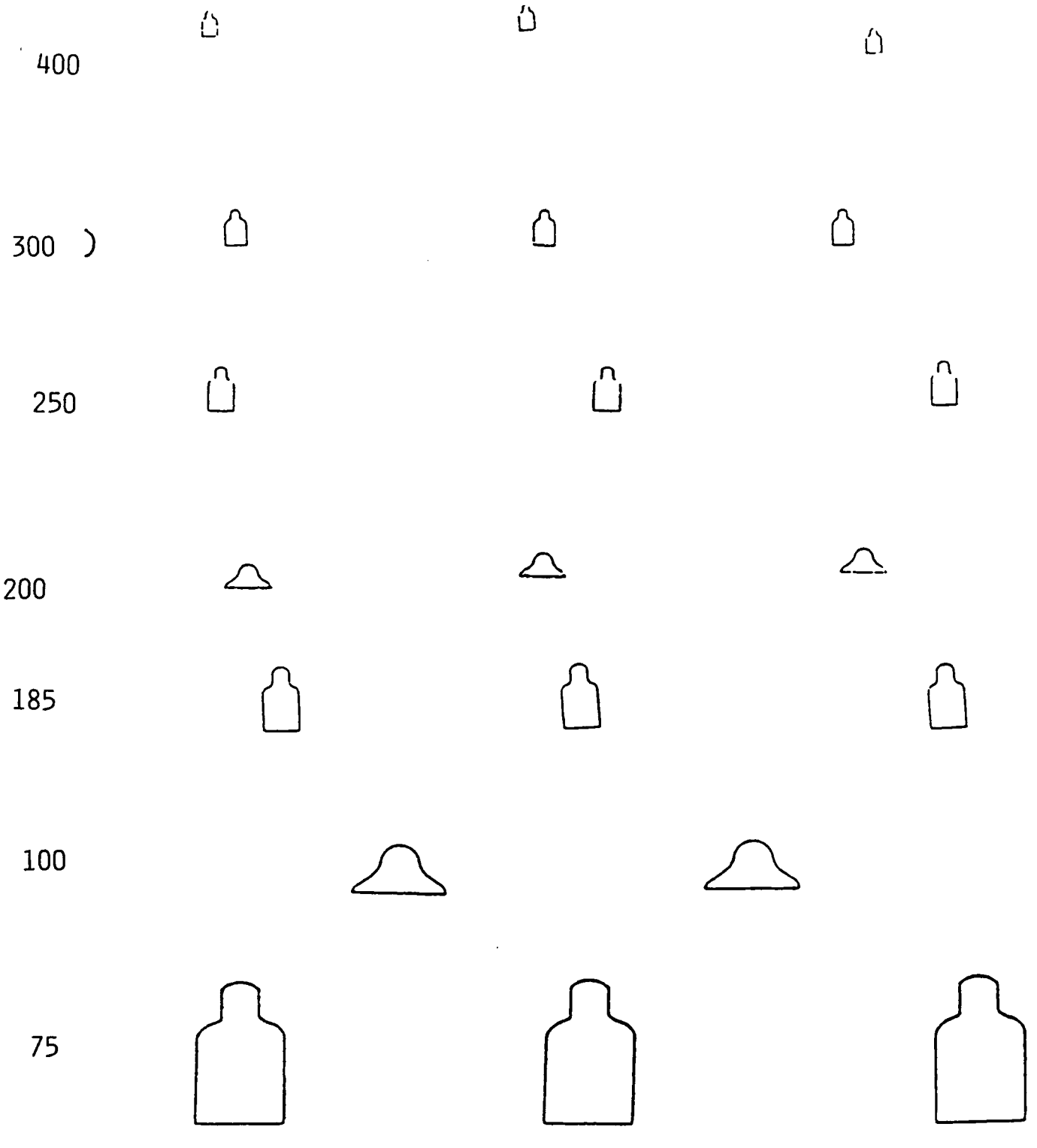
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-34



6-35 to 6-29

<--- Presentation of 80 targets -- general location of targets shown at next page. Following pages outline scenario.


400
300
250
200
185
100
75

	WIND	RANGE	LOC	TIME/MOVEMENT	SHOT DISPLACEMENT (cm) FROM AIMING POINT
1.	5 --->	400	C	S 6 sec	40 cm low, 30 cm right
2.	5 --->	300	R	S 6 sec	---, 15 cm right
		250		----> 4 mph	10 cm high, 43 cm left
3.	5 --->	200	L	S 5 sec	15 cm high, 6 cm right
		250		----> 4 mph	10 cm high, 43 cm left
4.	5 --->	185		<---- 6 mph	15 cm high, 60 cm right
		200	R	S 5 sec	15 cm high, 6 cm right
5.	10 -->	185		----> 6 mph	15 cm high, 56 cm left
		100	L	5 sec	10 cm high, 2 cm right
		100	R	5 sec	10 cm high, 2 cm right
6.	10 -->	400	L	S 8 sec	40 cm low, 60 cm right
		300		----> 6 mph	---, 80 cm left
7.	10 -->	400	R	S 8 sec	40 cm low, 60 cm right
		300		<---- 6 mph	---, 132 cm right
8.	5 --->	400	C	S 8 sec	40 cm low, 30 cm right
		185	L	S 5 sec	15 cm low, 10 cm right
		185	R	S 5 sec	15 cm low, 10 cm right
9.	5 --->	250		----> 1.5 mph	10 cm low, 10 cm left
10.	0	300		S 5 sec	None
11.	0	185		<---- 3 mph	15 cm low, 30 cm right
		200	L	6 sec	15 cm low, ---
		200	C	6 sec	15 cm low, ---
		200	R	6 sec	15 cm low, ---
12.	0	75		----> 6 mph	8 cm low, 22 cm left
		100	L	4 sec	10 cm low, ---
		100	R	4 sec	10 cm low, ---

	WIND	RANGE	LOC	TIME/MOVEMENT	SHOT DISPLACEMENT (cm) FROM AIMING POINT
13.	0	250		----> 1.5 mph	10 cm low, 20 cm left
		75	L	S 4 sec	8 cm low, —
		75	R	S 4 sec	8 cm low, —
14.	5 <---	300	R	S 5 sec	—, 15 cm left
15.	5 <---	400	L	S 7 sec	40 cm low, 30 cm left
		250	R	S 5 sec	10 cm high, 10 cm left
16	10 <--	300	C	S 5 sec	—, 30 cm left
17.	20 <--	400	C	S 7 sec	40 cm low, 120 cm left
		200	R	S 5 sec	15 cm high, 25 cm left
18.	20 <--	300		<---- 4 mph	—, 5 cm right
		250		----> 3 mph	10 cm high, 80 cm left
19.	20 <--	200	L	S 7 sec	15 cm high, 25 cm left
		100	R	S 6 sec	10 cm high, 5 cm left
		75		<---- 4 mph	8 cm high, —
20.	10 <--	200	R	S 7 sec	15 cm high, 12 cm left
		100	L	S 6 sec	10 cm high, 2 cm left
		75		----> 4 mph	8 cm high, 15 cm left
21.	5 <---	75	C	S 3 sec	8 cm high, —
22.	0	185		----> 6 mph	15 cm high, 58 cm left
		200	L	S 6 sec	15 cm high, —
23.	0	250		<---- 6 mph	10 cm high, 80 cm right
		300	L	S 6 sec	—, —
24.	0	250	C	S 6 sec	10 cm high, —
		200	L	S 4 sec	15 cm high, —
		200	R	S 4 sec	15 cm high, —
25	0	250		----> 3 mph	10 cm high, 40 cm left
		300	L	S 6 sec	—, —

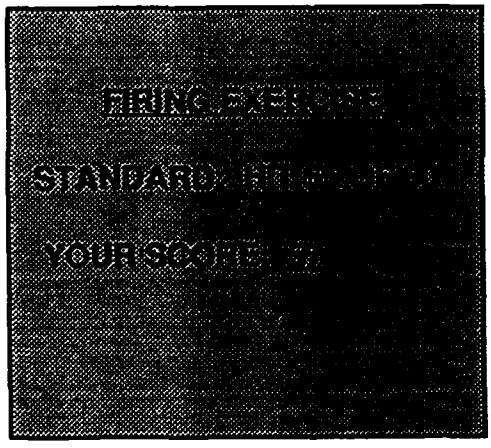
	WIND	RANGE	LOC	TIME/MOVEMENT	SHOT DISPLACEMENT (cm) FROM AIMING POINT
26.	0	400	L	S 7 sec	40 cm low, ---
		400	R	S 10 sec	40 cm low, ---
		300		---> 3 mph	---, 50 cm left
27.	0	400	L	S 9 sec	40 cm low, ---
		300	C	S 7 sec	---, ---
		250	R	S 5 sec	10 cm high, ---
28.	0	300		<--- 6 mph	---, 100 cm right
		200	L	S 5 sec	15 cm high, ---
		200	R	S 5 sec	15 cm high, ---
29.	0	250		<--- 3 mph	10 cm high, 40 cm right
		185	R	S 5 sec	15 cm high, ---
		75	L	S 3 sec	8 cm high, ---
30	0	185		---> 5 mph	15 cm high, 48 cm left
31.	0	75		<--- 6 mph	8 cm high, 22 cm right
32.	0	185		<--- 3 mph	15 cm high, 30 cm right
		100	L	S 5 sec	10 cm high, ---
		100	R	S 5 sec	10 cm high, ---
33.	0	185		---> 3 mph	15 cm high, 30 cm left
		200	L	S 6 sec	15 cm high, ---
		100	L	S 5 sec	10 cm high, ---
34.	0	75	L	S 4 sec	8 cm high, ---
		75	C	S 4 sec	8 cm high, ---
		75	R	S 4 sec	8 cm high, ---
35.	0	75		---> 6 mph	8 cm high, 22 cm left
		100	L	S	15 cm high, ---
		100	R	S	15 cm high, ---
		185	L	S	15 cm high, ---

6-70

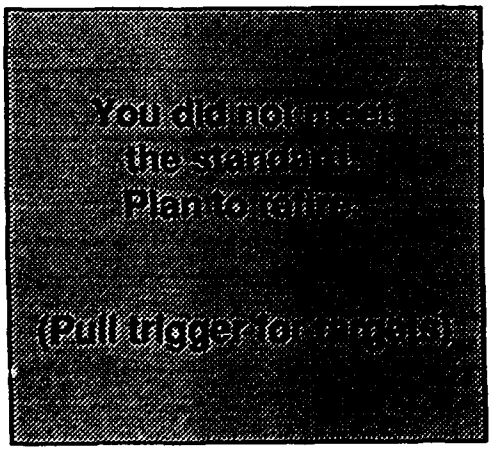
RANGE	STATIONARY # TGT	STATIONARY HIT	MOVING # TGT	MOVING HIT
75	7	5	5	4
100	11	10	-	-
185	4	4	7	5
200	14	12	-	-
250	3	2	8	5
300	7	4	5	-
400	9	3	-	-
	55	40	25	17

(Pull trigger to continue)

6-71

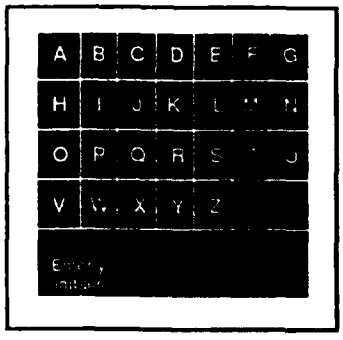


6-71

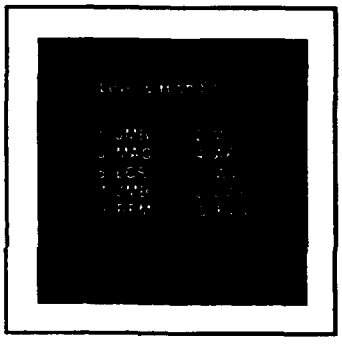


NOTE: If standard is not met.

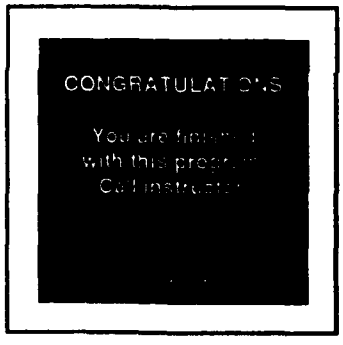
TOP GUN



- At the end of Level 6, high scorers may enter initials for display on high score screen. The high score screen will alternate with the MACS welcome screen until computer is turned off.



- Alternates with MACS welcome screen
- Activated after shooter fires high score on Level 6.



DESCRIPTION OF THE MACS MENU

The MACS Menu provides flexibility for the instructor using the MACS program.

To access the MACS program menu, press the RUN STOP key:

- At the MACS Introductory screen.
- At any Level screen.
- Repeatedly during a level when a target is on the screen.

THE MACS MENU FOR INFANTRY RIFLE MARKSMANSHIP

Level Order:
1 2 3 4 5 6
1 - Fundamentals -- Stationary Targets
2 - Fundamentals -- Moving Targets
3 - Long Range Stationary
4 - Long Range Movers
5 - Wind Effects
6 - Battlefield Practice

L: Change Level Order
N: New Firer
C: Set Crosshair for Level 6
LP: Light Pen Mount Adjustment

Select number or letter & press RETURN

? -

SELECT LEVELS

- Permits instructor to select level/s desired and to have shooter shoot them in the order designated.

Chose Level Order:
Type a number (1-6) for the desired level, in the desired order of presentation. Type 0 and press **RETURN** when done.

1: ?___
2:
3:
4:
5:
6:

NEW FIRER OPTION

- Program returns to Establish Zero Screen.
- Used when one firer has completed firing and a new firer begins.

---------- Select letter & press RETURN
? - N

SET CROSSHAIR STATUS FOR LEVEL 6

Choose Cross Hair option----- Select letter & press RETURN
? - C

Set Cross Hair for Level 6 screen appears.

1. Cross hair appears after each shot.
2. Cross hair appears only when target is missed.
3. No crosshair on Level 6.

Type the number (1-3) of your choice? _____

NOTE: When option 1 or 2 has been selected ,the menu screen will highlight the **SET CROSS HAIR FOR LEVEL 6** in yellow to indicate to the instructor that the program is operating in a mode other than Default (Option 3).

LIGHT PEN MOUNT ADJUSTMENT OPTION

- Follow procedures outlined on pages 2-1 through 2-8 of the MACS BRM Trainer's Guide.

APPENDIX B

NEW LIGHT PEN CALIBRATION PROGRAM

NEW LIGHT PEN CALIBRATION PROGRAM

The light pen calibration program currently in use in MACS cartridges is a BASIC program which reads the light pen port and displays information about the screen location of the light pen. Because this program is written in BASIC, it is slow and does not take readings at the same rate as the firing programs in the cartridges (60 readings per second).

A test calibration program has been developed in assembler so that the maximum number of readings per second may be obtained. However, at this speed, the computer is unable to print the X and Y cartesian coordinates in the upper left hand corner. Instead, a bar graph simulating light pen movement is displayed at the top of the screen whenever the light pen is reading within the designated box at the center of the screen. The top row indicated the X readings at 60/second while the second row indicates Y readings at 60/second.

As another part of this test, an averaging routine was developed in an attempt to make readings appear "smoother." Because of the speed at which the calculations must be performed, and because of the binary nature of the computer, it is necessary to create an average based on a number of readings which is divisible by a power of 2. 2, 4, 8, and 16 reduces the sampling rate to 30/second. Taking an average based on 2 readings per second reduces the sampling rate to 30/second. An average based on 4 readings per second reduces the sampling rate to 15/second. I don't feel that 2 readings will produce an adequate sampling, yet 4 readings reduces the sampling rate quite a bit. As a compromise, I have developed the following algorithm: (1) take the first 4 readings and find the average; (2) take the next 3 readings and average them with the previous average. This produces an average based on 4 readings, yet allows a sampling rate of 20/second. The following serves as additional illustration:

```
-------------------------------------------------------------------
-
Reading:
/   1  /   2  /   3  /   4  /   5  /   6  /   7  /   8  /   9  /  10
/
-------------------------------------------------------------------
-
/   A1=(R1+R2+R3+R4)/4      /
                            / A2=(A1+R5+R6+R7)/4 /
                                                  /A3=(A2+R8+R9+R10+)/4
/
-------------------------------------------------------------------
-
```

The third and fourth lines of the calibration screen display a bar graph depicting the results of averaging the X and Y values in this manner. A small 2X2 dot appears where the light pen is pointed, based on an unaltered 60 readings per second.

APPENDIX C

DOCUMENTATION -- MOVING TARGET PROGRAM WITH RETICLE OPTION (THE SAME DOCUMENTATION CHANGES APPLY TO THE BASIC RIFLE MARKSMANSHIP PROGRAM WITH RETICLE OPTION)

```
      *=3200
;ARM.3200.TXT FOR ARM PROGRAM
      JMP   ENABLE    ;3200
      JMP   DSABLE    ;3203
      JMP   ROTATE    ;3206
      JMP   ROTTRG    ;3209
      JMP   BANG      ;3212
      JMP   WHISTL    ;3215
      JMP   WAIT      ;3218
      JMP   SCENE     ;3221
      JMP   SEEVAL    ;3224
      JMP   COLORS    ;3227
      JMP   HITHIS    ;3230
      JMP   MATH      ;3233
      JMP   ADJLOC    ;3236
      JMP   TRKTRP    ;3239
      JMP   SHTGRP    ;3242
      JMP   BITPLT    ;3245
      .OPT  NOL
EXPTAB =32792
SELSUB =49162
SUBNO  =49168
;
;            CONVENTIONS USED
;PROCEDURE IXXXX
;PURPOSE OF PROCEDURE
;NECESSARY ACTIONS BEFORE CALL
;HOW TO CALL
;WHAT USER CAN EXPECT AFTER CALL
;
      .LIB  MACROS-VARS
      .OPT  NOL
;820-1023 IS UNUSED IF NO CASSETTE
CHOICE =820
STOP   =821
HOLD1  =823
HOLD2  =824
HSRT   =825
HOLDA  =826
HOLDX  =827
NUMRD  =828
NUMR20 =829
HOLD   =831
DELAY  =832
CUR1   =833
OFFX   =834
OFFY   =836
SHOTS  =838
H1IRQ  =839
H2IRQ  =840
H3IRQ  =841
H4IRQ  =842
H5IRQ  =843
H6IRQ  =844
H7IRQ  =845
H8IRQ  =846
XVAL   =847  ;X BULLET STRIKE
YVAL   =849  ;Y BULLET STRIKE
SORTAP =851  ;# RDGS TO SORT AFTER
STSIZE =852  ;# TO PUT IN SRTBUF
SRTBUF =853
CURSRT =863
HOLDY  =864
TRAJ   =866
IRQ    =867
SSCOL  =868
SDCOL  =869
FLAGS  =870
CODE1  =871
CODE2  =872
COLOR  =873
OFFSCR =874
HAFSEC =875
TERORD =876
CRSDLA =878
CURTF  =879
HOLD3  =880
HOLD4  =881
CURTAB =882
CUR2   =883
IRQ2   =884
COPY   =885
CODE3  =886
CODE4  =887
TARPRE =888
NUMR50 =889
HOLDAD =891
HITSPR =893
SUMX   =894
MSIZE  =896
TIMES  =897
PSTAT  =898
MAXSHT =899
LASTSH =900
HITS   =910
MISSES =911
PENAL  =912
PINFO  =913
MAXVAL =928
WIND   =929
WDRIFT =930
SHOTRK =932
KEYMSK =933
CURNUM =934
BORCOL =936
LPCHPX =937
LPCHPY =938
METHEN =939
X1     =940
Y1     =942
X2     =944
Y2     =946
;NEXT ONE AT 948
CENX   =15872
CENY   =15880
TARNUM =15888
SPECIL =15896
YDRIFT =15904
XDRIFT =15912
TLIN1  =15920
TLIN2  =15928
TIMFL1 =15936
TIMFL2 =15944
INSTX  =15952
COLSTK =15960
DLSTK1 =15968
DLSTK2 =15976
;NEXT ONE AT 15984
;
LENSTR =16383
ADD    =SB86F
CHKIN  =SFFC6
CHKOUT =SFFC9
CHRIN  =SFFCF
CLOSE  =SFFC3
CLRCHN =SFFCC
CHROUT =SFFD2
DIVIDE =SBB12
FAI5C  =SBBC7
FAIFA2 =SBC0F
FAIMEM =SBBD4
FLOAT  =SB391
GETIN  =SFFE4
LOAD   =SFFD5
MEMFA1 =SBBA2
MEMFA2 =SBA8C
MLTPLY =SBA2B
OPEN   =SFFC0
SETLFS =SFFBA
SETNAM =SFFBD
SQRT   =SBF71
SUBTRT =SB853
UNFLOT =SB1BF
V      =SD000
SID    =SD400
TEMP   =16192
XLPB20 =40960 ;UNDERNEATH ROM
YLPB20 =41472 ;UNDERNEATH ROM
XTGB20 =41984 ;UNDERNEATH ROM
YTGB20 =42496 ;UNDERNEATH ROM
XLPB60 =43008 ;UNDERNEATH ROM
YLPB60 =43264 ;UNDERNEATH ROM
XTGB60 =43520 ;UNDERNEATH ROM
YTGB60 =43776 ;UNDERNEATH ROM
XLPA60 =44032 ;UNDERNEATH ROM
YLPA60 =44062 ;UNDERNEATH ROM
XTGA60 =44092 ;UNDERNEATH ROM
YTGA60 =44122 ;UNDERNEATH ROM
INFO   =44152 ;UNDERNEATH ROM
INFO2  =44496 ;UNDERNEATH ROM
HLDBUF =44840 ;UNDERNEATH ROM
;NEXT ONE AT 44840
RAMTAB =52224
       .MAC  DINC    ;DOUBLE
       INC   ?1      ;PRECISION
       BNE   ?2      ;INCREMENT
       INC   ?1+1
?2     .END
       .MAC  ADDR    ;MOVE LOW
       LDA   #(?2    ;BYTE OF ?2
       STA   ?1      ;INTO ?1 AND
       LDA   #)?2    ;HIGH BYTE OF
       STA   ?1+1    ;?2 INTO ?1+1
       .END
       .MAC  MOVE
       LDA   ?2
       STA   ?1
       LDA   ?2+1
       STA   ?1+1
       .END
       .MAC  DISK    ;DISK
       LDA   #8      ;OPERATIONS
       TAX           ;LOAD"?2",8
       LDY   #?1     ;?1 IS END OF
       JSR   SETLFS  ;FILE NAME.
       LDA   #?3-?2  ;THUS LENGTH
       LDX   #(?2    ;OF FILE NAME
       LDY   #)?2    ;IF ?3-?2
       JSR   SETNAM
       LDA   #0
       .END
       .MAC  PRINT
       LDA   #(?1
       LDY   #)?1
       JSR   SAVIT   ;PRINT
       .END
       .MAC  PUTR
       PHA
       TYA
       PHA
       TXA
       PHA
       .END
       .MAC  GETR
       PLA
       TAX
       PLA
       TAY
       PLA
       .END
       .MAC  DADD
       LDA   ?1
       CLC
       ADC   ?2
       STA   ?1
       LDA   ?1+1
       ADC   ?2+1
       STA   ?1+1
       .END
       .MAC  DSUB
       LDA   ?1
       SEC
       SBC   ?2
       STA   ?1
       LDA   ?1+1
       SBC   ?2+1
       STA   ?1+1
       .END
       .MAC  PLOT
       LDY   #?1
       LDX   #?2
       CLC
       JSR   $FFF0
       .END
       .MAC  DSPL
       LDA   #?2-?1
       STA   LENSTR
       LDA   #(?1
       STA   $E3
       LDA   #)?1
       STA   $E4
       JSR   LETNL
       .END
       .OPT  LIST
       .END
       .OPT  NOL
       .LIB  IRQSTUFF
;IRQSTUFF FOR ARM PROGRAM
;PROCEDURE ENABLE
;PREPARES IRQ TO TAKE READINGS
;B:HOME
;C:SYS ENABLE
;A:HOME
ENABLE SEI
       LDA   #0
       STA   56334
       LDA   53265
       AND   #127
       STA   53265
       LDA   #250
       STA   53266
       LDA   #5
       STA   53274
       LDA   53273
       STA   53273
       ADDR  $314,START
```

```
      LDA  #0
      STA  CUR1     :20 RDGS SP
      STA  CUR2     :60 RDGS SP
      STA  IRQ
      STA  BORCOL
      STA  NUMRD    :# RDGS BEF
      STA  SORTEP   :# SORT AF
      LDA  #5
      STA  STSIZE
      LDA  #1
      STA  HAFSEC
      STA  B7IRQ
      CLI
      RTS
;
:PROCEDURE DSABLE
:RETURNS IRQ VECTOR TO NORMAL
;B:NONE
:C:SYS DSABLE
:A:NONE
DSABLE SEI
      LDA  #1
      STA  56334
      LDA  #240
      STA  53274
      LDA  53273
      STA  53273
      ADDR S314.SEA31
      CLI
      RTS
;
;PROCEDURE START (IRQ)
;INTERRUPT CONTROLLER ROUTINE
;
:IRQ HAS THE FOLLOWING VALUES:
:128: TAKE READINGS BEFORE
; 64: TAKE READINGS AFTER
; 32: GET COLLISION DATA
; 16: SOUND NEEDED
;  8: WAITING FOR TRIGGER RELEASE
;  4: SHOT HAS BEEN FIRED
;  2: NEW TARGET DISABLE
;  1: NO BULLETS LEFT
;
:IRQ2 HAS THE FOLLOWING VALUES:
:128: RETURN AFTER ONE SHOT FIRED
; 64: RETURN WHEN NO TARGETS UP
; 32: NO HIT/MISS DETECTION
; 16: NO CROSS DISPLAYED
;  8: CROSS FOR MISS ONLY
;  4: NO DATA SAVE TO INFO2
;  2: DISPLAY TARGET NUMBER
;  1: REPLAY
;
:TARORD (TARGET ORDER) IS SET UP
:IN THE FOLLOWING MANNER:
:BYTE 0:# TARGETS THIS HALF SECOND
;     1:STARTING X COORDINATE
;     2:STARTING Y COORDINATE
;     3:TARGET # (FOR ID)
;     4:TARGET SPRITE POINTER
;     5:BIT 7:SET TO EXPAND X
;           6:SET TO EXPAND Y
;           5:RIGHT X
;           0-3:SPRITE COLOR
;     6:TIME LIMIT (SECONDS)
;       LOW NYB :1ST MVMT
;       HIGH NYB:2ND MVMT
;     7:DELAY. 1ST MVMT
;     8:INCREMENT (FOR INSTR'
;     9:TIME/FLIGHT (#PIXELS/BYTE)
;       LOW NYB :1ST MVMT
;       HIGH NYB:2ND MVMT
;    10:X DRIFT
;    11:Y DRIFT
;    12:BIT 7:NOT A TARGET
;           6:REVERSE DIRECTION
;           5:TAR MORE THAN 1 SPR
;           4:DON'T ADD TO TARPRE
;    13:X CENTER OF MASS OFFSET/2
;    14:Y CENTER OF MASS OFFSET
;    15:DELAY. 2ND MVMT
;
:INFO IS SAVED AS FOLLOWS:
:BYTE 0:TARGET # (FOR ID)
;     1:BULLET X/2
;     2:BULLET Y
;     3:TARGET X/2
;     4:TARGET Y
;     5:NUMRD (LOW)
;     6:NUMRD (HIGH)
START  LDA  #4
       BIT  53273
       BEQ  CONTIN
       LDA  53273
       STA  53273
       JMP  SEEBC
CONTIN LDA  53265
       AND  #127
       STA  53265
       LDA  #250
       STA  53266
       LDA  53273
       STA  53273
       LDA  IRQ2
       AND  #1
       BEQ  IRQ010
       JMP  REPLAY
IRQ010 LDX  V+30     :SPR/SPR
       LDY  V+31     :SPRITE/DATA
       LDA  IRQ
       AND  #32      :COLLISION
       BEQ  IRQ020
       STX  SSCOL
       STY  SDCOL
       LDA  IRQ      :CLEAR
       AND  #223     : COLLISION
       STA  IRQ      : FLAG
IRQ020 LDA  IRQ
       AND  #16
       BEQ  IRQ030
:PLAY ANY SOUNDS HERE
IRQ030 LDA  IRQ      :WAITING FOR
       AND  #8       : TRIGGER
       BEQ  IRQ040   : RELEASE?
       LDA  56321    :YES:HAS IT
       CMP  #247     : BEEN
       BEQ  IRQ040   : RELEASED
       LDA  IRQ      :YES:CLEAR
       AND  #247     : FLAG
       STA  IRQ
IRQ040 LDA  CRSDLA   :CROSS ON?
       BEQ  IRQ060
       DEC  CRSDLA
       BNE  IRQ050
       LDA  HITSPR   :TURN OFF
       EOR  #255     : CROSS AND
       AND  V+21     : ANY HIT
       STA  V+21     : TARGET UP
       BIT  IRQ2
       BVC  IRQ050
       CMP  #0
       BNE  IRQ050
       LDA  IRQ
       AND  #63
       STA  IRQ
       JMP  SEA31    :NORMAL IRQ
IRQ050 LDA  #0
       STA  HITSPR
IRQ060 LDA  IRQ      :TAKE ANY
       AND  #192     : READINGS?
       BNE  IRQ070
       LDA  #0
       STA  CUR1
       STA  CUR2
       STA  BORCOL
       JMP  SEA31    :NORMAL IRQ
IRQ070 LDA  SFB      :SAVE
       PHA           : SFB & SFC
       LDA  SFC
       PHA
       DEC  HAFSEC   :NEW TARGET?
       BEQ  IRQ080   : /TIME LIM?
       JMP  IRQ270   :NOT TIME
IRQ080 LDA  #30      :RESTORE
       STA  HAFSEC   : HALF SEC
       MOVE SFB.TARORD
IRQ090 LDY  #255
       LDA  IRQ      :IS TARGET
       AND  #2       : CHECK
       BNE  IRQ140   : DISABLED?
       LDY  #0
       LDA  (SFB),Y  :# TARGETS
       CMP  #255
       BNE  IRQ100
       LDA  #32
       STA  FSTAT
       DINC TARORD
       LDA  IRQ      :DON'T TAKE
       AND  #63      : ANY MORE
       STA  IRQ      : RDGS IF
       JMP  IRQ360   : NO TARGETS
IRQ100 CMP  #254
       BNE  IRQ110
       LDA  IRQ
       ORA  #2
       STA  IRQ
       JMP  IRQ140
IRQ110 CMP  #253     :WHISTLE?
       BNE  IRQ130
       LDA  OFFSCR   :SET FLAG
       ORA  #1
       STA  OFFSCR
IRQ120 DINC SFB
       JMP  IRQ090
IRQ130 CMP  #128     :DELAY
       BCC  IRQ150
       SEC
       SBC  #1
       STA  (SFB),Y
       CMP  #128
       BEQ  IRQ120
       DEY
IRQ140 LDA  #0
IRQ150 STA  B5IRQ    :TARGETS
       INY
       LDX  #7
       LDA  #128
       STA  B7IRQ    :SPRITE BIT
IRQ160 LDA  B3IRQ
       EOR  #255     :NOT SPRITE
       STA  B4IRQ    : BIT
       LDA  V+21
       AND  B3IRQ
       BEQ  IRQ190   :SPRITE OFF
       LDA  TLIM1.X
       BMI  IRQ180   :NO LIMIT
       DEC  TLIM1.X
       BNE  IRQ180   :MORE TIME
       LDA  TLIM2.X  :LIMIT FOR
       BEQ  IRQ170   : 2ND MVMT
       STA  TLIM1.X
       LDA  #0
       STA  TLIM2.X
       LDA  TIMFL1.X
       STA  TIMFL1.X
       LDA  DLSTE2.X
       STA  DLSTE1.X
       STA  CDLSTE.X
       JMP  IRQ180
IRQ170 LDA  B3IRQ    :TIME LIMIT
       ORA  OFFSCR   : EXPIRED
       STA  OFFSCR
       LDA  #128
       STA  TLIM1.X
       LDA  OFFSCR   :HAS TIME
       EOR  #255     : EXPIRED
       AND  V+21     : ON ALL
       BNE  IRQ180   : TARGETS?
       LDA  #64
       STA  FSTAT
IRQ180 JMP  IRQ250
IRQ190 LDA  B5IRQ    :TARGET NEED
       BEQ  IRQ180   : TO GO UP?
       DEC  B5IRQ    :1 LESS TAR
       LDA  B4IRQ    :CLEAR
       AND  V+23     : EXPAND Y
       STA  V+23
       LDA  B4IRQ    :CLEAR
       AND  V+29     : EXPAND X
       STA  V+29
       LDA  B4IRQ    :CLEAR
       AND  V+16     : RIGHT X
       STA  V+16
       TXA           :X=X*2
       ASL  A
       TAX
       LDA  (SFB),Y  :X COORD
       STA  V,X
       INY
       LDA  (SFB),Y  :Y COORD
       STA  V+1,X
       INY
       TYA           :X=X/2
       LSR  A
       TAX
       LDA  (SFB),Y
       STA  TARNUM,X
       INY
       LDA  (SFB),Y  :SPRITE PTR
       STA  2040,X
       INY
       LDA  (SFB),Y  :EXPAND X?
       BPL  IRQ200
       LDA  V+29     :YES
       ORA  B3IRQ
```

```
        STA  V+29
IRQ200  LDA  (SFB),Y  :EXPAND X?
        AND  #64
        BEQ  IRQ210
        LDA  V+23     :YES?
        ORA  H3IRQ
        STA  V+23
IRQ210  LDA  (SFB),Y  :RIGHT X?
        AND  #32
        BEQ  IRQ220
        LDA  V+16
        ORA  H3IRQ
        STA  V+16
IRQ220  LDA  (SFB),Y  ;SPR COLOR
        AND  #15
        STA  V+39,X
        INY
        LDA  (SFB),Y  :TIME LIMIT
        CMP  #255     ;NO LIMIT?
        BEQ  IRQ230
        LSR  A        ;TIME LIMIT
        LSR  A        ; 2ND NYBT
        LSR  A
        AND  #254
        STA  TLIM2,X
        LDA  (SFB),Y  :TIME LIMIT
        AND  #15      ; 1ST NYBT
        ASL  A
IRQ230  STA  TLIM1,X
        INY
        LDA  (SFB),Y  :DELAY FOR
        STA  DLSTK1,X ; 1ST NYBT
        STA  CDLSTK,X
        INY
        LDA  (SFB),Y  :INCREMENT
        STA  INSTK,X
        INY
        LDA  (SFB),Y  :FLIGHT TIME
        LSR  A        ; 2ND NYBT
        LSR  A
        LSR  A
        LSR  A
        STA  TIMFL2,X
        LDA  (SFB),Y  :FLIGHT TIME
        AND  #15      ; 1ST NYBT
        STA  TIMFL1,X
        INY
        LDA  (SFB),Y  :X DRIFT
        STA  XDRIFT,X
        INY
        LDA  (SFB),Y
        STA  YDRIFT,X
        INY
        LDA  (SFB),Y  ;SPECIAL
        STA  SPECIL,X
        AND  #16      :COUNT AS
        BNE  IRQ240   ; TARGET?
        INC  TARGET
        TXA
        JSR  INCNUM
        TAX
IRQ240  INY
        LDA  (SFB),Y  :CEN X OFFST
        STA  CENX,X
        INY
        LDA  (SFB),Y  :CEN Y OFFST
        STA  CENY,X
        INY
        LDA  (SFB),Y  :DELAY FOR
        STA  DLSTK2,X :2ND NYBT
        INY
        LDA  V+21     :TURN ON
        ORA  H3IRQ    ; SPRITE
        STA  V+21
IRQ250  LSR  H3IRQ
        DEX           :NEXT SPRITE
        BEQ  IRQ260   :FINISHED?
        JMP  IRQ160
IRQ260  TYA           ;SET UP
        CLC           ; TARGRD
        ADC  SFB      ; FOR NEXT
        STA  TARGRD   ; TIME
        LDA  SFC
        ADC  #0
        STA  TARGRD+1
        LDA  IRQ?     ;SHOW NUMBER
        AND  #2       ; OF TARGTS?
        BEQ  IRQ270
        JSR  SHONUM
IRQ270  LDA  IRQ
        BMI  BEFORE
        JMP  AFTER
BEFORE  AND  #5       ;READY TO
        BEQ  IRQ290   ; PROCESS?
IRQ280  JMP  IRQ360
IRQ290  JSR  ONSCRN
        ADDR SFB.XLPB20
        LDA  CUR2
        AND  #127
        TAY
        LDA  SHOTS
        AND  #1
        BEQ  IRQ300
        TYA
        ORA  #128
        TAY
        INC  SFC
IRQ300  LDA  H1IRQ
        STA  XLPB60,Y
        LDA  H2IRQ
        STA  YLPB60,Y
        LDA  V+15     :RIGHT X FOR
        ASL  A        ; SPRITE 7
        LDA  V+14     :XVAL: S7
        ROR  A        ; /2
        STA  XTGB60,Y
        INY
        STY  CUR2
        DINC NUMR60
        DEC  H7IRQ
        BNE  IRQ280
        LDA  #3
        STA  H7IRQ
        LDY  CUR1
        LDA  H1IRQ
        STA  (SFB),Y
        INC  SFC
        INC  SFC
        LDA  H2IRQ
        STA  (SFB),Y
        INC  SFC
        INC  SFC
        LDA  V+15     :RIGHT X FOR
        ASL  A        ; SPRITE 7
        LDA  V+14     :XVAL: S7
        ROR  A        ; /2
        STA  (SFB),Y
        INY
        STY  CUR1
        DINC NUMR20
        LDY  CURSRT
        INC  CURSRT
        CPY  #5
        BCC  IRQ310
        LDY  #0
        STY  CURSRT
IRQ310  LDA  H1IRQ
        STA  SRTBUF,Y
        TYA
        CLC
        ADC  #5
        TAY
        LDA  H2IRQ
        STA  SRTBUF,Y
        LDA  IRQ      :HAS TRIGGER
        AND  #12      ; BEEN
        BNE  IRQ320   ; RELEASED?
        LDA  56321    :TRIGR PULL
        CMP  #247
        BNE  IRQ320
        BIT  BOXCOL   :LIGHTPEN
        BPL  SWPULL   ; ON SCREEN?
        LDA  #4
        STA  53280
IRQ320  JMP  IRQ360
SWPULL  JSR  BANG
        LDA  #0       :IF ANYONE
        STA  XVAL     ; HAS THE
        STA  XVAL+1   ; REVELATION
        STA  YVAL     ; THAT SORT-
        STA  YVAL+1   ; ING REALLY
        LDA  H1IRQ    ; IS THE
        BEQ  IRQ340   ; ANSWER.
        ASL  A        ; REMOVE
        LDX  #0       ; THESE
        BCC  IRQ330   ; LINES AND
        INX           ; REINSERT
IRQ330  CLC           ; THE CALL
        ADC  OFFX     ; TO GETXY
        STA  XVAL     ; IN CYRHOV
        TXA           ; ---
        ADC  OFFX+1   ; ---
        STA  XVAL+1   ; ---
        LDA  H2IRQ    ; ---
        CLC           ; ---
        ADC  OFFY     ; ---
        STA  YVAL     ; ---
IRQ340  LDA  IRQ
        AND  #127
        ORA  #76
        STA  IRQ
        LDA  #0       :FORMERLY 3
        STA  SORTAF
        LDA  #20
        STA  NUMRD
        JSR  INFOFB
        LDY  #5
        LDA  NUMR20
        STA  (SFB),Y
        STA  LASTSH,Y
        INY
        LDA  NUMR20+1
        STA  (SFB),Y
        STA  LASTSH,Y
        LDA  NUMR60
        STA  LASTSH+7
        LDA  NUMR60+1
        STA  LASTSH+8
        LDA  #0
        STA  CUR1
        STA  CUR2
        STA  NUMR20
        STA  NUMR20+1
        STA  NUMR60
        STA  NUMR60+1
IRQ360  PLA
        STA  SFC
        PLA
        STA  SFB
        JMP  SETJI    :NORMAL IRQ
AFTER   LDY  CUR2     :STACK PTR
        INC  CUR2
        LDA  53267    :X LOCATION
        STA  H1IRQ
        STA  XLPB60,Y
        LDA  53268    :Y LOCATION
        STA  H2IRQ
        STA  YLPB60,Y
        LDA  V+16     :RIGHT X FOR
        ASL  A        ; SPRITE 7
        LDA  V+14     :XVAL: S7
        ROR  A        ; /2
        STA  XTGB60,Y
        LDA  SORTAF
        BEQ  IRQ380
        LDY  CURSRT
        INC  CURSRT
        CPY  #5
        BCC  IRQ370
        LDY  #0
        STY  CURSRT
IRQ370  LDA  H1IRQ
        STA  SRTBUF,Y
        TYA
        CLC
        ADC  #5
        TAY
        LDA  H2IRQ
        STA  SRTBUF,Y
        DEC  SORTAF
IRQ380  DEC  NUMRD    :# READINGS
        BNE  IRQ400   ; TO TAKE
        LDA  IRQ
        EOR  #192
        STA  IRQ
        LDA  #0       :ZERO STACK
        STA  CUR1     :PTR IF DONE
        STA  CUR2
        STA  CURSRT
        LDA  #1
        STA  H7IRQ
        BIT  IRQ2
        BMI  IRQ390
        BVC  IRQ400
        LDA  V+21
        AND  #254
        BNE  IRQ400
IRQ390  LDA  IRQ
        AND  #63
        STA  IRQ
IRQ400  JMP  IRQ360
ONSCRN  LDA  53267    :X READINGS
        STA  H1IRQ
        LDA  53268    :Y READINGS
        STA  H2IRQ
        CMP  LPCMPI
```

```
      BNE   ONSC30
      CPX   LPCHPY
      BNE   ONSC30
      BIT   BORCOL
      BMI   ONSC20
      INC   BORCOL
      LDA   BORCOL
      CMP   #30
      BCS   ONSC10
      RTS
ONSC10 LDA  53280
      ORA   #128
      STA   BORCOL
;ONSC20 LDA  #0
;       STA  H1IRQ
;       STA  H2IRQ
ONSC20 RTS
ONSC30 STA  LPCHPX
      STX   LPCHPY
      BIT   BORCOL
      BPL   ONSC40
      LDA   BORCOL
      STA   53280
ONSC40 LDA  #0
      STA   BORCOL
      RTS
INFOFB LDA  #0
      STA   SFC
      LDA   SHOTS
      ASL   A
      ASL   A
      ASL   A
      ROL   SFC
      CLC
      ADC   #<INFO
      STA   SFB
      LDA   SFC
      ADC   #>INFO
      STA   SFC
      RTS
INCHUM LDX  CURNUM+1
      INX
      CPX   #10
      BCC   INC020
      LDX   CURNUM
      INX
      CPX   #10
      BCC   INC010
      LDX   #0
INC010 STX  CURNUM
      LDX   #0
INC020 STX  CURNUM+1
      RTS
SHONUM LDY  #0
      LDX   #80      :LEAD SPACE
      LDA   CURNUM
      BEQ   SHN010
      ASL   A
      ASL   A
      ASL   A
      TAX
SHN010 LDA  NUMDAT.X
      STA   #256.Y
      INX
      INY
      CPY   #8
      BCC   SHN010
      LDA   CURNUM+1
      ASL   A
      ASL   A
      TAX
SHN020 LDA  NUMDAT.X
      STA   #256.Y
      INI
      INY
      CPY   #16
      BCC   SHN020
      RTS
NUMDAT .BYTE
195.153.145.137.153.153.195.255.231.23
1.199.231.231.231.129
      .BYTE
255.195.153.249.243.207.159.129.255.19
5.153.249.227.249.153
      .BYTE
195.255.249.241.225.153.128.249.249.25
5.129.159.131.249.249
      .BYTE
153.195.255.195.153.159.131.153.153.19
5.255.129.153.243.231
      .BYTE
231.231.231.255.195.153.153.195.153.15
3.195.255.195.153.153
      .BYTE
193.249.153.195.255.255.255.255.255.25
5.255.255.255
      .END
      .LIB  REPLAY
:REPLAY FOR ARM PROGRAM
;POKE H1IRQ & H2IRQ WITH PERFECT
: SPOST I OFFSET (LOW/HIGH).  POKE
: H3IRQ WITH TARGET Y.
REPLAY DEC   H7IRQ
      BEQ   RPL010
      JMP   SER31   :NORMAL IRQ
RPL010 LDA  #3
      STA   H7IRQ
      LDY   CUR1
      CPY   STOP    :LAST RDG?
      BCC   RPL030
      LDA   LASTSH  :NO FIRE?
      CMP   #255
      BEQ   RPL020
      JSR   BANG
      LDA   V+21    :TURN ON
      ORA   #1      : CROSS
      STA   V+21
RPL020 LDA  #0
      STA   IRQ2
      JMP   SER31   ;NORMAL IRQ
RPL030 LDA  13184.Y :BEFORE TPULL
      JSR   PUTTAR
      LDA   METHEN  :WAS IT A
      CMP   #2      ; TRAP?
      BEQ   RPL060
      LDX   #0      :PERFECT SP
      SEC
      LDA   13184.Y
      ROL   A
      BCC   RPL040
      INX
RPL040 CLC
      ADC   H1IRQ   :SP I OFF LOW
      STA   V+4
      TXA
      ADC   H2IRQ   :SP I OFF HI
      BNE   RPL050
      LDA   V+16
      AND   #251
      STA   V+16
      JMP   RPL060
RPL050 LDA  V+16
      ORA   #4
      STA   V+16
RPL060 LDA  12928.Y :BULY
      CLC
      ADC   OFFY
      STA   H6IRQ
      LDX   #0
      LDA   12572.Y :BULX
      ASL   A
      BCC   RPL070
      LDX   #1
RPL070 CLC
      ADC   OFFX
      STA   H4IRQ
      TXA
      ADC   OFFX+1
      STA   H5IRQ
      LDA   H4IRQ
      CLC           :SPOST X
      SBC   #23     ; OFFSET
      STA   V+2
      LDA   H5IRQ
      SBC   #0
      BNE   RPL080
      LDA   V+16
      AND   #253
      STA   V+16
      JMP   RPL090
RPL080 LDA  V+16
      ORA   #2
      STA   V+16
RPL090 LDA  H6IRQ   :BULY
      SEC
      SBC   #25     :SPOST Y
      STA   V+3     ; OFFSET
      INY
      STY   CUR1
      JMP   SER31   :NORMAL IRQ
PUTTAR SEC
      ROL   A
      TAX
      BCC   RPL100
      LDA   V+16
      ORA   #192
      STA   V+16
      JMP   RPL110
RPL100 LDA  V+16
      AND   #63
      STA   V+16
RPL110 STX  V+14    :X:SPRITE 7
      LDA   LASTSH
      AND   #127
      CMP   #7
      BCC   RPL120
      STX   V+12    :X:SPRITE 6
RPL120 RTS
      .END
;
;PROCEDURE ROTATE
;TAKES READINGS BEFORE TRIGGER
;  PULL AND MOVES THEM SO THAT
;  THE OLDEST READINGS ARE FIRST.
;C:STS ROTATE
;A:RDGS IN BUFFERS ARE ADJUSTED.
ROTATE LDA  !
      PHA
      LDA   #54
      STA   !
      LDA   LASTSH+4
      BEQ   ROT030
      LDY   LASTSH+5
      BEQ   ROT010
      ADDR  SFB.ILPB20
      ADDR  SFB.FLPB20
      LDX   #0
      LDA   SHOTS
      AND   #1
      BEQ   ROT010
      INC   SFC
      INC   SFE
ROT010 LDA  (SFB),Y
      STA   HLDBUF.X
      LDA   (SFD),Y
      STA   HLDBUF+256.X
      INY
      INX
      BNE   ROT010
      LDY   #0
ROT020 LDA  HLDBUF.Y
      STA   (SFB),Y
      LDA   HLDBUF+256.Y
      STA   (SFD),Y
      INY
      BNE   ROT020
ROT030 LDA  LASTSH+7
      ASL   A
      BEQ   ROT050
      LDA   LASTSH+8
      BNE   ROT040
      BCC   ROT050
ROT040 ADDR  SFB.ILPB60
      JSR   ROTHOV
      ADDR  SFB.FLPB60
      JSR   ROTHOV
      ADDR  SFB.ITGB60
      JSR   ROTHOV
ROT050 PLA
      STA   !
      RTS
ROTHOV LDX  #0
      LDA   LASTSH+7
      AND   #127
      TAY
      LDA   SHOTS
      AND   #1
      BEQ   ROTH10
      LDA   SFB
      CLC
      ADC   #128
      STA   SFB
      LDA   SFC
      ADC   #0
      STA   SFC
ROTH10 LDA  (SFB),Y
      STA   HLDBUF.X
      INY
      TYA
      AND   #127
      TAY
      INX
      BPL   ROTH10
      LDY   #0
ROTH20 LDA  HLDBUF.Y
```

```
        STA  (SFB),Y
        INY
        BPL  ROTE20
        RTS
NOTTRG  LDA  56321    :REPEAT
        CMP  #255     : UNTIL
        BNE  NOTTRG   : TRIGGER IS
        RTS           : RELEASED
BANG    LDA  #15
        STA  54296
        LDA  #10
        STA  54277
        LDA  #30
        STA  54273
        LDA  #128
        STA  54276
        LDA  #129
        STA  54276
        RTS
WHISTL  LDY  #23
        LDA  #0
WHSL10  STA  SID,Y
        DEY
        BPL  WHSL10
        LDA  #18
        STA  DELAY
WHSL20  LDA  #180
        STA  SID+1
        LDA  #46
        STA  SID
        LDA  #15
        STA  SID+5
        STA  SID+24
        LDY  #7
WHSL30  LDX  #255
WHSL40  DEX
        BNE  WHSL40
        DEY
        BNE  WHSL30
        LDA  #170
        STA  SID+1
        LDA  #6
        STA  SID
        LDA  #21
        STA  SID+4
        LDY  #30
WHSL50  LDX  #255
WHSL60  DEX
        BNE  WHSL60
        DEY
        BNE  WHSL50
        DEC  DELAY
        BNE  WHSL20
        LDY  #23
        LDA  #0
WHSL70  STA  SID,Y
        DEY
        BPL  WHSL70
        RTS
;
;PROCEDURE WAIT
;CAUSES A DELAY
;B:LDY WITH AN APPROPRIATE DELAY
;C:JSR WAIT
;A:NONE
WAIT    LDX  #255
WAIT1   DEX
        BNE  WAIT1
        DEY
        BNE  WAIT1
        RTS
SCENE   LDA  SFB      :CEIP #/BANK
        STA  SDFFF
        LDY  #0
        LDA  (SFD),Y
        STA  SFB      :CRUNCH CODE
        DINC SFD
        LDA  #43
        STA  53265
        LDA  #29
        STA  53272
        ADDR SA3,1024
SCL010  LDA  (SFD),Y
        STA  (SA3),Y
        DINC SFD
        DINC SA3
        LDA  SA3
        CMP  #<2024
        BNE  SCL010
        LDA  SA4
        CMP  #>2024
        BNE  SCL010
        ADDR SA3,8192
SCL020  LDA  SFB      :CRUNCH CODE
        STA  (SA3),Y
        DINC SA3
        LDA  SA3
        CMP  #<16192
        BNE  SCL020
        LDA  SA4
        CMP  #>16192
        BNE  SCL020
        ADDR SA3,8192
SCL030  LDA  (SFD),Y
        CMP  SFB      :CRUNCH CODE
        BNE  SCL040
        DINC SFD
        LDA  (SFD),Y
        STA  SA3
        DINC SFD
        LDA  (SFD),Y
        CLC
        ADC  #>8192
        STA  SA4
        JMP  SCL050
SCL040  STA  (SA3),Y
        DINC SA3
SCL050  DINC SFD
        LDA  SA3
        CMP  #<16192
        BNE  SCL030
        LDA  SA4
        CMP  #>16192
        BNE  SCL030
        LDA  #59
        STA  53265
        LDA  #32      :RAM
        STA  SDFFF
        RTS
;PROCEDURE SEEVAL
;MOVE VALUES FROM UNDER ROM
; SINCE SHOTS WILL HAVE ALREADY
; BEEN INCREMENTED. THIS ROUTINE
; MOVES THE HIGH BUFFER IF SHOTS
; IS EVEN.  IT MOVE THE LOW
; BUFFER IF SHOTS IS ODD
SEEVAL  LDA  1
        PHA
        LDA  #54      :SELECT RAM
        STA  1        ; AT $A000
        ADDR SFB,XLPB20
        LDY  #0
        LDA  SHOTS
        AND  #1
        BNE  SEE010
        INC  SFC
SEE010  LDA  (SFB),Y  :BULLET X
        STA  12672,Y
        INY
        BNE  SEE010
        INC  SFC
        INC  SFC
SEE020  LDA  (SFB),Y
        STA  12928,Y  :BULLET Y
        INY
        BNE  SEE020
        INC  SFC
        INC  SFC
SEE030  LDA  (SFB),Y  :TARGET X
        STA  13184,Y  : BEFORE
        INY
        BNE  SEE030
        LDY  #128
SEE040  LDA  XTGA60,Y :TARGET X
        STA  13440,Y  : AFTER
        DEY
        BPL  SEE040
        LDY  #32
SEE050  LDA  XLPA60,Y :BULLET X
        STA  13568,Y  : AFTER
        LDA  YLPA50,Y :BULLET Y
        STA  13600,Y  : AFTER
        DEY
        BPL  SEE050
        PLA
        STA  1
        RTS
;PROCEDURE COLORS
;CHANGES COLOR OF PART OF BITMAP
;POKE HOLD1 WITH START LINE
;  POKE HOLD2 WITH # OF LINES
;  POKE SFD WITH THE COLOR
COLORS  ADDR SFB,1024
        LDX  HOLD1    :START LINE
        BEQ  COL020
COL010  JSR  ADD40
        DEX
        BNE  COL010
COL020  LDX  HOLD2    :HOW MANY
COL030  LDY  #39
COL040  LDA  SFD      :COLOR
        STA  (SFB),Y
        DEY
        BPL  COL040
        JSR  ADD40
        DEX
        BNE  COL030
        RTS
ADD40   LDA  SFB      :ADD 40 TO
        CLC           : SFB FOR
        ADC  #40      : NEXT LINE
        STA  SFB
        LDA  SFC
        ADC  #0
        STA  SFC
        RTS
;PROCEDURE HITHIS
;RETURNS HITS IN TEMP+TARGET #
; MISSES IN TEMP+64+TARGET #
; EXPOSURES IN TEMP+128+TARGET #
HITHIS  LDY  #192
        LDA  #0
HHL010  STA  TEMP-1,Y
        DEY
        BNE  HHL010
        LDA  SHOTS
        BEQ  HHL070
        STA  HOLD1
        LDA  1
        PHA
        LDA  #54
        STA  1
        ADDR SFB,INFO
        LDY  #0
HHL020  LDA  (SFB),Y
        TAX
        AND  #127
        CMP  #7
        BCC  HHL030
        TXA
        AND  #248
        TAX
HHL030  TXA
        BMI  HHL040
        AND  #63
        TAX
        INC  TEMP,X
        JMP  HHL050
HHL040  CMP  #255
        BEQ  HHL060
        AND  #63
        TAX
        INC  TEMP+64,X
HHL050  INC  TEMP+128,X
HHL060  LDA  SFB
        CLC
        ADC  #8
        STA  SFB
        LDA  SFC
        ADC  #0
        STA  SFC
        DEC  HOLD1
        BNE  HHL020
        PLA
        STA  1
HHL070  RTS
        .LIB  MATHFUNCTIONS
;MATHFUNCTIONS FOR ARM PROGRAM
MATH    JSR  UNPLOT
        LDA  47
        STA  SFB
        LDA  48
        STA  SFC
MAT010  LDY  #0
        LDA  (SFB),Y
        BNE  MAT020
        RTS           :NO SF ARRAY
MAT020  CMP  #'S
        BNE  MAT030
        INY
        LDA  (SFB),Y
        CMP  #'B
        BEQ  MAT040
MAT030  INY           :ADD OFFSET
        LDA  (SFB),Y  : TO NEXT
        CLC           : ARRAY
```

```
      ADC   SFB      ; (BYTES 2-
      TAX            ; 3) TO SFB
      INY
      LDA   (SFB),Y
      ADC   SFC
      STX   SFB
      STA   SFC
      JMP   MAT010
MAT040 LDA  SFB      ;ASSUME A
      CLC            ; 2-DIM'D
      ADC   #9       ; ARRAY
      STA   HOLDAD   ; WHERE 1ST
      LDA   SFC      ; DIM HOLDS
      ADC   #0       ; EACH SCORE
      STA   HOLDAD+1
      LDX   101      ;SCORE #
      BEQ   MAT060
MAT050 LDA  HOLDAD   ;ASSUMING
      CLC            ; 1ST DIM
      ADC   #20      ; IS 4.
      STA   HOLDAD   ; ADDING 20
      LDA   HOLDAD+1 ; (4*5) WILL
      ADC   #0       ; BE THE
      STA   HOLDAD+1 ; NEXT SCORE
      DEX
      BNE   MAT050
;
;STEADY POSITION SCORE
;
MAT060 LDA  #128     ;DOUBLE X
      STA   HOLD     ; READING
      JSR   MXA010
      SEC
      SBC   SFB
      CLC
      ADC   #1
      CMP   #2
      BCS   MAT070
      LDA   #255
      TAY
      JSR   FLOAT
      JMP   MAT080
MAT070 PHA
      JSR   STDEV
      LDX   HOLDAD
      LDY   HOLDAD+1
      JSR   FAIMEM
      INC   SFE
      LDA   SFB
      STA   MSIZE
      LDA   SFC
      STA   TIMES
      LDA   #0       ;NO DOUBLE
      STA   HOLD     ; Y READING
      PLA
      JSR   STDEV
      JSR   FAIFA2
      LDA   #<CONST
      LDY   #>CONST
      JSR   MEMFAI
      JSR   MLTPLY
      JSR   FAIFA2
      LDA   HOLDAD
      LDY   HOLDAD+1
      JSR   MEMFAI
      JSR   ADD
MAT080 LDX  HOLDAD
      LDY   HOLDAD+1
      JSR   FAIMEM
;
;AIMING SCORE
;
      LDA   #128     ;DOUBLE X
      STA   HOLD     ; READING
      JSR   MXA7AR
      SEC
      SBC   SFB
      CLC
      ADC   #1
      CMP   #2
      BCS   MAT090
      LDA   #255
      TAY
      JSR   FLOAT
      JMP   MAT110
MAT090 STA  MSIZE
      JSR   AVG
      TYA            ;AVG X LOW
      CLC
      ADC   OFFX
      TAY
      TXA            ;AVG X HIGH
      ADC   OFFX+1
      TAX
      TYA
      CLC
      ADC   WDRIFT
      STA   TEMP
      TXA
      ADC   WDRIFT+1
      STA   TEMP+1
      LDX   #0
      LDA   LASTSH+3 ;TARGET X
      ASL   A
      BCC   MAT100
      INX
MAT100 SEC
      SBC   TEMP     ;BULLET X
      TAY
      TXA
      SBC   TEMP+1
      STY   HOLD1
      STA   HOLD1+1
      JSR   FLOAT
      JSR   FAIFA2
      LDY   HOLD1
      LDA   HOLD1+1
      JSR   FLOAT
      JSR   MLTPLY
      LDX   HOLDAD
      LDY   HOLDAD+1
      JSR   FAIMEM
      INC   SFE
      LDA   #0       ;NO DOUBLE
      STA   HOLD     ; Y READING
      JSR   AVG
      TYA
      CLC
      ADC   OFFY
      CLC
      ADC   TRAJ
      STA   TEMP+2
      LDA   LASTSH+4 ;TARGET Y
      SEC
      SBC   TEMP+2   ;BULLET Y
      TAY
      LDA   #0
      SBC   #0
      STY   HOLD1
      STA   HOLD1+1
      JSR   FLOAT
      JSR   FAIFA2
      LDY   HOLD1
      LDA   HOLD1+1
      JSR   FLOAT
      JSR   MLTPLY
      JSR   FAIFA2
      LDA   #<CONSQ
      LDY   #>CONSQ
      JSR   MEMFAI
      JSR   MLTPLY
      JSR   FAIFA2
      LDA   HOLDAD
      LDY   HOLDAD+1
      JSR   MEMFAI
      JSR   ADD
      LDA   102      ;FAI SIGN
      AND   #127
      STA   102      ;ABS
      JSR   SQRT
MAT110 LDX  HOLDAD
      LDY   HOLDAD+1
      JSR   FAIMEM
;
;TRIGGER SQUEEZE SCORE
;
      JSR   MEXTAR
      CMP   SFB
      BNE   MAT120
      LDA   #255
      TAY
      JSR   FLOAT
      JMP   MAT130
MAT120 JSR  RANGE
      LDA   MSIZE
      PHA
      LDA   TIMES
      PHA
      INC   SFE
      LDA   #0       ;NO DOUBLE
      STA   HOLD     ; Y READING
      JSR   RANGE
      ADDR  SFD.YLPA60
      LDA   #0
      STA   SFB
      LDA   #2
      STA   SFC
      JSR   RAN010
      JSR   FAIFA2
      LDA   #<CONST
      LDY   #>CONST
      JSR   MEMFAI
      JSR   MLTPLY
      JSR   FAIFA2
      PLA
      STA   TIMES
      PLA
      STA   MSIZE
      LDA   #128     ;DOUBLE X
      STA   HOLD     ; READING
      ADDR  SFD.XLPA60
      JSR   RAN010
      JSR   ADD
MAT130 LDX  HOLDAD
      LDY   HOLDAD+1
      JSR   FAIMEM
;
;GET LOCATION SCORE
;
      LDA   LASTSE
      CMP   #255
      BNE   MAT140
      JSR   FLOAT
      JMP   MAT150
MAT140 JSR  MEXTAR
      JSR   RADERR
MAT150 LDX  HOLDAD
      LDY   HOLDAD+1
      JSR   FAIMEM
      LDA   TEMP     :X AVG
      LSR   TEMP+1
      ROR   A
      LDY   TEMP+2   :Y AVG
      JSR   FLOAT
      RTS
MEXTAR LDA  HOLDAD   :SET UP
      CLC            : FOR NEXT
      ADC   #5       : ELEMENT
      STA   HOLDAD   : IN ARRAY
      LDA   HOLDAD+1 : ---
      ADC   #0       : ---
      STA   HOLDAD+1 : ---
MXA010 ADDR SFD.XLPB50
      LDA   SHOTS    :WHICH
      AND   #1       : LIGHTPEN
      BNE   MXA020   : BUFFER?
      LDA   SFD
      CLC
      ADC   #128
      STA   SFD
      LDA   SFE
      ADC   #0
      STA   SFE
MXA020 LDA  HOLDAD
      LDY   HOLDAD+1
      JSR   MEMFAI
      JSR   GWFLOT
      LDA   100
      STA   SFB
      STA   MSIZE
      LDA   101
      STA   SFC
      STA   TIMES
      RTS
MUL2  LDX   #0
      BIT   HOLE
      BPL   ML2010
      ASL   A
      BCC   ML2010
      INX
ML2010 RTS
:CONSTANTS (AND CONSTANTS SQUARED)
:FOR SCALING THE Y COORDINATE
:(320/23.5)/(200/19.5)
:1.33 = 129.170.61.112.164
:1.36 = 129.225.71.174.20
:320/200
:1.6  = 129.76.204.204.205
:2.56 = 130.163.215.10.61
CONST  .BYTE 129,76,204,204,205
CONSQ  .BYTE 130,163,215,10,61
ADJLOC LDA  71
       STA  HOLDAD
       LDA  72
       STA  HOLDAD+1
;
```

```
        LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  #23
ADJ010  LDA  INFO.Y
        STA  TEMP.Y
        DEY
        BPL  ADJ010
        PLA
        STA  1
        LDX  #0
        STX  HOLDX
ADJ020  LDA  HOLDAD
        LDY  HOLDAD+1
        JSR  MEMFA1
        JSR  UNFLOT
        LDA  100      :X VALUE
        ASL  A
        LDY  #0
        BCC  ADJ030
        INY
ADJ030  CLC
        ADC  OFFX
        STA  LASTSH+1 :BULLET X
        TYA
        ADC  OFFX+1
        LSR  A
        ROR  LASTSH+1
        LDA  101      :Y VALUE
        CLC
        ADC  OFFY
        STA  LASTSH+2 :BULLET Y
        LDX  HOLDX
        LDA  TEMP+3.X
        STA  LASTSH+3
        LDA  TEMP+4.X
        STA  LASTSH+4
        JSR  RADERR
        LDX  HOLDAD
        LDY  HOLDAD+1
        JSR  FAIMEM
        LDA  HOLDAD   ;SET UP
        CLC           ; FOR
        ADC  #10      ; SHOT LOC
        STA  HOLDAD   ; SCORE
        LDA  HOLDAD+1
        ADC  #0
        STA  HOLDAD+1
        LDX  HOLDX
        LDA  TEMP+1.X :BULLET X
        ASL  A
        LDY  #0
        BCC  ADJ040
        INY
ADJ040  CLC
        ADC  OFFX
        STA  TEMP+1.X
        TYA
        ADC  OFFX+1
        LSR  A
        ROR  TEMP+1.X
        LDA  TEMP+1.X
        STA  INFO+1.X
        STA  INFO2+1.X
        STA  LASTSH+1
        LDA  TEMP+2.X :BULLET Y
        CLC
        ADC  OFFY
        STA  INFO+2.X
        STA  INFO2+2.X
        STA  LASTSH+2
        JSR  RADERR
        LDX  HOLDAD
        LDY  HOLDAD+1
        JSR  FAIMEM
        LDA  HOLDAD   :SET UP
        CLC           : FOR NEXT
        ADC  #10      : AIMING
        STA  HOLDAD   ; SCORE
        LDA  HOLDAD+1
        ADC  #0
        STA  HOLDAD+1
        LDA  HOLDX
        CLC
        ADC  #8
        STA  HOLDX
        CMP  #24
        BCS  ADJ050
        JMP  ADJ020
ADJ050  RTS
STDEV   PHA
        LDA  #0
        TAY
        JSR  FLOAT
        JSR  FA15C
        LDA  #0
        STA  SUMX
        STA  SUMX+1
        STA  HOLD3
        STA  HOLD4
STDL10  LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  TIMES
        LDA  (SFD).Y
        TAX
        BIT  HOLD4
        BMI  STDL20
        STA  HOLD3
        LDA  #128
        STA  HOLD4
        TXA
STDL20  CMP  HOLD3
        BEQ  STDL30
        LDA  HOLD4
        ORA  #54
        STA  HOLD4
        TXA
STDL30  JSR  MUL2
        STA  HOLD1
        STX  HOLD2
        CLC
        ADC  SUMX
        STA  SUMX
        LDA  SUMX+1
        ADC  HOLD2
        STA  SUMX+1
        PLA
        STA  1
        LDY  HOLD1
        LDA  HOLD2
        JSR  FLOAT
        JSR  FA1FA2
        LDY  HOLD1
        LDA  HOLD2
        JSR  FLOAT
        JSR  MLTPLY
        LDA  #55C
        LDY  #0
        JSR  MEMFA2
        JSR  ADD
        JSR  FA15C
        DEC  TIMES
        LDY  TIMES
        BNE  STDL40
        CPY  MSIZE
        BCS  STDL10
STDL40  PLA
        STA  MSIZE
        BIT  HOLD4
        BVS  STDL50
        LDA  #0
        TAY
        JSR  FLOAT
        RTS
STDL50  LDY  SUMX
        LDA  SUMX+1
        JSR  FLOAT
        JSR  FA1FA2
        LDY  SUMX
        LDA  SUMX+1
        JSR  FLOAT
        JSR  MLTPLY
        JSR  FA1FA2
        LDA  #0
        LDY  MSIZE
        JSR  FLOAT
        JSR  DIVIDE
        LDA  #55C
        LDY  #0
        JSR  MEMFA2
        JSR  SUBTRT
        JSR  FA1FA2
        LDA  #0
        LDY  MSIZE
        DEY
        JSR  FLOAT
        JSR  DIVIDE
        LDA  102      :FA1 SIGN
        AND  #127
        STA  102      :ABS
        JSR  SQRT
        RTS
AVG     LDA  #0
        STA  SUMX
        STA  SUMX+1
        STA  HOLD1
        STA  HOLD1+1
        LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  SFC
AVG010  LDA  (SFD).Y
        JSR  MUL2
        CLC
        ADC  SUMX
        STA  SUMX
        TXA
        ADC  SUMX+1
        STA  SUMX+1
        DEY
        BNE  AVG020
        CPY  SFB
        BCS  AVG010
AVG020  PLA
        STA  1
AVG030  LDA  SUMX+1
        BNE  AVG040
        LDA  MSIZE
        CMP  SUMX
        BCC  AVG040
        BNE  AVG050
AVG040  LDA  SUMX
        SEC
        SBC  MSIZE
        STA  SUMX
        LDA  SUMX+1
        SBC  #0
        STA  SUMX+1
        DEC  HOLD1
        JMP  AVG030
AVG050  LDY  HOLD1
        LDX  HOLD1+1
        RTS
RANGE   LDA  #0
        STA  MSIZE
        LDA  #255
        STA  TIMES
RAN010  LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  SFC
RAN020  LDA  (SFD).Y
        CMP  TIMES
        BCS  RAN030
        STA  TIMES
RAN030  CMP  MSIZE
        BCC  RAN040
        STA  MSIZE
RAN040  DEY
        BNE  RAN050
        CPY  SFB
        BCS  RAN020
RAN050  PLA
        STA  1
        LDA  MSIZE
        SEC
        SBC  TIMES
        JSR  MUL2
        TAY
        TXA
        JSR  FLOAT
        RTS
RADERR  LDX  #0
        LDA  LASTSH+1 :BULLET X
        ASL  A
        BCC  RAD010
        INX
RAD010  STA  CODE3
        STX  CODE4
        LDX  #0
        LDA  LASTSH+3 :TARGET X
        ASL  A
        BCC  RAD020
        INX
RAD020  SEC
        SBC  CODE3
        STA  CODE3
        TXA
        SBC  CODE4
        STA  CODE4
        LDY  CODE3
```

```
        JSR   FLOAT
        JSR   FAIFA2
        LDY   CODE3
        LDA   CODE4
        JSR   FLOAT
        JSR   MLTPLY
        JSR   FA15C
        LDX   #0
        LDA   LASTSH+2 ;BULLET Y
        SEC
        SBC   LASTSH+4 ;TARGET Y
        BCS   RAD030
        DEX
RAD030  STA   CODE3
        STX   CODE4
        LDY   CODE3
        LDA   CODE4
        JSR   FLOAT
        JSR   FAIFA2
        LDY   CODE3
        LDA   CODE4
        JSR   FLOAT
        JSR   MLTPLY
        JSR   FAIFA2
        LDA   #<CONSQ
        LDY   #>CONSQ
        JSR   MEMFAI
        JSR   MLTPLY
        LDA   #55C
        LDY   #0
        JSR   MEMFA2
        JSR   ADD
        LDA   102       ;FAI SIGN
        AND   #127
        STA   102       ;ABS
        JSR   SQRT
        RTS
TRKTRP  ADDR  SFD.XLPB60
        LDY   #0
        LDA   SHOTS
        AND   #1
        BNE   TRK010
        LDA   SFD
        CLC
        ADC   #128
        STA   SFD
        LDA   SFE
        ADC   #0
        STA   SFE
        LDY   #128
TRK010  LDA   #0
        STA   HOLD
        STY   TEMP+2
        JSR   UNPLOT
        LDA   100
        STA   SFB
        STA   MSIZE
        LDA   101
        STA   SFC
        STA   TIMES
        SEC
        SBC   SFB
        CLC
        ADC   #1
        CMP   #2
        BCS   TRK020
        LDY   #2
        JMP   TRK060
TRK020  PHA
        JSR   GETSTD
        STX   TEMP
        STA   TEMP+1
        LDA   SFB
        STA   MSIZE
        LDA   SFC
        STA   TIMES
        LDA   1
        PHA
        LDA   #54
        STA   1
        LDY   TEMP+2
        LDX   #0
TRK030  LDA   XLPB60.Y :LPX=(LPX-
        SEC             ;(TARX+CENX)
        SBC   XTGB60.Y ;+FINALTARX
        SEC
        SBC   CENX+7
        CLC
        ADC   LASTSH+3
        STA   XTGB60.X
        INY
        INX
        BPL   TRK030
        PLA
        STA   1
        ADDR  SFD.XTGB60
        PLA
        JSR   GETSTD
        LDY   #1
        CPX   TEMP
        BCC   TRK060
        BEQ   TRK040
        BCS   TRK050
TRK040  CMP   TEMP+1
        BCC   TRK060
TRK050  INY
TRK060  STY   METHEM
        CPY   #1
        BNE   TRK070
        JSR   SETTRK
        LDY   #1
TRK070  LDA   #0
        JSR   FLOAT
        RTS
SETTRK  LDA   1
        PHA
        LDA   #54
        STA   1
        LDX   #0
        LDY   #0
        LDA   SHOTS
        AND   #1
        BNE   STK010
        LDY   #128
STK010  LDA   XTGB60.X
        STA   XLPB60.Y
        INY
        INX
        BPL   STK010
        PLA
        STA   1
        RTS
GETSTD  JSR   STDEV
        JSR   FAIFA2
        LDY   #10
        LDA   #0
        JSR   FLOAT
        JSR   MLTPLY
        JSR   UNPLOT
        LDX   100
        LDA   101
        RTS
        .END
        .LIB  SHOTGROUPS
:PROCEDURE SHTGRP (SHOTGROUPS)
:POKE SFB WITH START ADDRESS.
: POKE X1.Y1 WITH TARGET CENTER
: POKE HOLD3.TARG
: POKE HOLD4.WITH # OF SHOTS.
: AT END: HITS. MISSES ARE SET.
: HOLD1 WILL HAVE # UNGRAPHABLE
: SHOTS. HOLD2 WILL HAVE TOTAL
: # SHOTS FIRED AT THIS TARGET
SHTGRP  LDA   X1
        CMP   #160
        BCC   SHT010
        BEQ   SHT020
        LDA   #84
        LDX   #156
        JMP   SHT030
SHT010  LDA   #4
        LDX   #76
        JMP   SHT030
SHT020  LDA   #4
        LDX   #155
SHT030  STA   MSIZE
        STX   MSIZE+1
        LDA   #255
        STA   CHOICE
        LDA   #0
        STA   HITS
        STA   MISSES
        STA   HOLD1
        STA   HOLD2
        STA   HOLDY
        LDA   HOLD3
        AND   #127
        TAX
        CMP   #7
        BCC   SHT040
        LSR   A
        LSR   A
        LSR   A
        CLC
        ADC   #6
SHT040  SEC
        SBC   #1
        ASL   A
        ASL   A
        ASL   A
        TAY
        LDA   EXPDAT+4.Y
        STA   CODE2
        STX   CODE1
        LDY   #100
        LDA   #255
SHT050  STA   TEMP.Y
        DEY
        BPL   SHT050
        LDA   1
        PHA
        LDA   #54
        STA   1
SHT060  LDY   #0
        LDA   (SFB).Y
        AND   #127
        CMP   CODE1
        BEQ   SHT070
        JMP   SHT160
SHT070  INC   HOLD2
        LDA   (SFB).Y
        BMI   SHT080
        INC   HITS
        JMP   SHT090
SHT080  INC   MISSES
SHT090  LDY   #4
SHT100  LDA   (SFB).Y
        STA   LASTSH.Y
        DEY
        BPL   SHT100
        LDA   #0
        STA   XVAL
        STA   XVAL+1
        STA   YVAL
        STA   YVAL+1
        LDA   LASTSH+3 :TARX
        LDX   #0
        ASL   A
        BCC   SHT110
        INX
SHT110  STA   SFD
        STX   SFE
        LDA   LASTSH+1 :BULY
        LDX   #0
        ASL   A
        BCC   SHT120
        INX
SHT120  SEC
        SBC   SFD
        STA   SFD
        TXA
        SBC   SFE
        STA   SFE
        LDX   CODE2
SHT130  LDA   XVAL
        CLC
        ADC   SFD
        STA   XVAL
        LDA   XVAL+1
        ADC   SFE
        STA   XVAL+1
        DEX
        BNE   SHT130
        LDA   XVAL
        CLC
        ADC   X1
        STA   XVAL
        TAX
        LDA   XVAL+1
        ADC   #0
        STA   XVAL+1
        LSR   A
        TAY
        ROR   A
        CMP   MSIZE
        BCC   SHT150
        CMP   MSIZE+1
        BCS   SHT150
        LDY   HOLDY
        STA   TEMP.Y
        LDA   LASTSH+2 :BULY
        SEC
        SBC   LASTSH+4 :TARY
        STA   SFD
        LDA   #0
        SBC   #0
```

```
        STA   $FE
        LDX   CODE2
SHT140  LDA   YVAL
        CLC
        ADC   $FD
        STA   YVAL
        LDA   YVAL+1
        ADC   $FE
        STA   YVAL+1
        DEX
        BNE   SHT140
        LDA   YVAL
        CLC
        ADC   Y1
        STA   YVAL
        TAX
        LDA   YVAL+1
        ADC   #0
        STA   YVAL+1
        BNE   SHT150
        CPX   #176
        BCS   SHT150
        CPX   #24
        BCC   SHT150
        LDY   HOLDY
        INY
        TXA
        STA   TEMP.Y
        INY
        STY   HOLDY
        JMP   SHT150
SHT150  INC   HOLD1
SHT160  LDA   $FB
        CLC
        ADC   #8
        STA   $FB
        LDA   $FC
        ADC   #0
        STA   $FC
        DEC   HOLD4
        BEQ   SHT170
        JMP   SHT060
SHT170  PLA
        STA   1
        LDY   #0
SHT180  LDX   #0
        LDA   TEMP.Y
        CMP   #255
        BEQ   SHT230
        STA   $FB
        ASL   A
        BCC   SHT190
        INX
SHT190  SEC
        SBC   #1
        STA   XVAL
        STA   HOLDA
        TXA
        SBC   #0
        STA   XVAL+1
        STA   HOLDX
        LDA   TEMP+1.Y
        STA   $FC
        SEC
        SBC   #1
        STA   YVAL
        LDA   #3
        STA   CODE3
        STA   CODE4

SHT200  JSR   BITPLT
        DINC  XVAL
        DEC   CODE3
        BNE   SHT200
        LDA   HOLDA
        STA   XVAL
        LDA   HOLDX
        STA   XVAL+1
        INC   YVAL
        LDA   #3
        STA   CODE3
        DEC   CODE4
        BNE   SHT200
        INY
        INY
        TYA
        TAX
SHT210  LDA   TEMP.X
        CMP   #255
        BEQ   SHT180
        CMP   $FB
        BNE   SHT220
        LDA   TEMP+1.X
        CMP   $FC
        BNE   SHT220
        INC   TEMP.X
        INC   TEMP+1.X
SHT220  INX
        INX
        JMP   SHT210
SHT230  LDA   #(EXPTAB
        STA   SUBNO
        JSR   SELSUB
        RTS
;
BITPLT  STY   HOLDY
        LDA   #0
        STA   $FD
        STA   $FE
        STA   $A4
        STA   YVAL+1
        LDA   YVAL
        AND   #248    :INT(Y/8)*320
        LDX   #3
PL010   ASL   A
        ROL   $A4
        DEX
        BNE   PL010
        STA   $A3
        LDX   #5
PL020   LDA   $FD
        CLC
        ADC   $A3
        STA   $FD
        LDA   $FE
        ADC   $A4
        STA   $FE
        DEX
        BNE   PL020
        LDA   XVAL    :8*INT(X/8)
        AND   #248
        CLC
        ADC   $FD
        STA   $FD
        LDA   XVAL+1
        ADC   $FE
        CLC
        ADC   #>8192 ;+8192
        STA   $FE

        LDA   YVAL    :Y AND 7
        AND   #7
        TAY
        LDA   XVAL    :X AND 7
        AND   #7
        STA   $A3
        LDA   #7
        SEC
        SBC   $A3     :7-(X AND 7)
        TAX
        LDA   #1
        CPY   #0
        BEQ   PL040
PL030   ASL   A       :2^(7-(X
        DEY           : AND 7))
        BNE   PL030
PL040   BIT   CHOICE
        BPL   PL050
        ORA   ($FD),Y
        JMP   PL060
PL050   EOR   ($FD),Y
PL060   STA   ($FD),Y
        LDY   HOLDY
        RTS
EXPDAT  .BYTE 39.48.33.2.1.11.0.0
;50 M (G)
        .BYTE 41.48.74.4.2.0.0.0
;100 M
        .BYTE 35.34.37.3.3.0.0.0
;150 M
        .BYTE 36.46.58.4.4.0.0.0
;200 M
        .BYTE 37.57.77.5.5.0.0.0
;250 M
        .BYTE 38.69.99.6.6.0.0.0
;300 M
        .BYTE 47.24.20.2.1.12.0.0
;50 M (B)
        .BYTE 46.24.25.2.1.0.0.0
;75 M
        .BYTE 45.48.66.4.2.0.0.0
;125 M
        .BYTE 44.46.54.4.4.0.0.0
;185 M
        .BYTE 40.0.33.2.1.0.0.0
;50 M (R)
        .BYTE 48.24.62.2.1.0.0.0
;60 M (T)
        .END
        .END
```

```
      *=32768
:MLCHOBK1.TXT FOR ARM PROGRAM
      JMP   CTRMOV    ;32768 (0)
      JMP   DESCRP    ;32771 (3)
      JMP   RANDOM    ;32774 (6
      JMP   DODATA    ;32777 (9)
      JMP   REKEEP    ;32780 (12
      JMP   YESNO     ;32783 (15)
      JMP   GETIY     ;32786 (18)
      JMP   RNDIZE    ;32789 (21)
      JMP   EXPTAR    ;32792 (24)
      JMP   CRITER    ;32795 (27)
      JMP   YESNO2    ;32798 (30)
      .LIB  MACROS-VARS
      .END
      .OPT  NOL
BANG  =3212
BITPLT =3245
DSABLE =3203
ENABLE =3200
NOTTRG =3209
ROTATE =3206
WAIT  =3218
WHISTL =3215
LETHL =49185
PRGNUM =49161
      .LIB  CTRMOV
:PROCEDURE CTRMOV
:POKE KEYMSK WITH THE CODE FOR
: KEYS TO PERMIT FROM THE MATRIX
: AT 56321.  FOR EXAMPLE. 128
: ALLOWS BREAK. 4 ALLOWS CTRL.
: 132 ALLOWS BOTH.  THE KEYS FROM
: BITS 0-7 ARE: 1. .CTRL.2.SPACE.
; COMMODORE.Q.BREAK
CTRMOV JSR   ENABLE
       LDA   #0
       STA   HITSPR
       STA   NUMR20
       STA   NUMR20+1
       STA   NUMR60
       STA   NUMR60+1
       STA   FSTAT
       JSR   SBIRP
       LDA   101
       STA   IRQ
       LDA   100
       STA   IRQ2
CTR010 LDA   #0
       STA   OFFSCR
CTR020 JSR   MOVESP
       JSR   PAUSE
       BCS   CTR030
       JMP   CTR420
CTR030 LDA   SORTAF
       BNE   CTR030
;      JSR   GETIY   :NO MORE SORT
       JSR   CLOSES
       STA   CURTAR
       TAX
       BNE   CTR040
       JMP   CTR100
CTR040 LDA   SPECIL.X
       STA   SPECIL
       LDA   #0
       STA   XDRIFT+1
       LDA   WIND
       AND   #96
       BEQ   CTR060
       LDA   XDRIFT.I
       ASL   A       :2ANGE*8
       ASL   A
       ASL   A
       STA   XDRIFT
       LDA   WIND    :GET SPEED
       AND   #7
       CLC           :ADD TARGET
       ADC   XDRIFT  ; OFFSET
       TAY
       LDA   WIND    :FULL OR
       AND   #32     : HALF VALUE?
       BNE   CTR050
       LDA   YTABLE.Y
       LSR   A
       LSR   A
       LSR   A
       LSR   A
       JMP   CTR060
CTR050 LDA   YTABLE.Y
       AND   #15
CTR060 STA   YDRIFT
       BIT   WIND    :NEGATIVE
       BPL   CTR070  ; DIRECTION?
       DEC   YDRIFT+1
       EOR   #255
       STA   YDRIFT
       DINC  YDRIFT
CTR070 LDA   YDRIFT.I
       STA   TRAJ
       LDA   TINFL1.I
       BEQ   CTR100
       STA   CURTF
       LDA   DLSTK1.I
       BEQ   CTR100
       LDX   HOLD1
       LDA   V.X
CTR080 STA   HOLD2
       JSR   MOVESP
       JSR   PAU010
       LDA   OFFSCR
       BEQ   CTR090
       EOR   #255
       AND   V+21
       STA   V+21
       LDA   #0
       STA   OFFSCR
CTR090 LDA   V+21
       AND   HOLD3
       BEQ   CTR100
       LDX   HOLD1
       LDA   V.X
       CMP   HOLD2
       BEQ   CTR080
       DEC   CURTF
       BNE   CTR080
CTR100 LDA   XVAL
       CLC
       ADC   XDRIFT
       STA   XVAL
       STA   V
       LDA   XVAL+1
       ADC   XDRIFT+1
       STA   XVAL+1
       LDA   YVAL
       CLC
       ADC   TRAJ
       STA   YVAL
       STA   V+1
       LDA   V+16
       AND   #254
       LDX   XVAL+1
       BEQ   CTR110
       ORA   #1
CTR110 STA   V+16
       LDA   V+28    :TURN OFF
       AND   #254    : MULTICOLOR
       STA   V+28    : FOR SPR 0
       LDA   #34     :BULLET
       STA   2040
       LDA   #12     :MED GRAY
       STA   V+39
       LDA   #0
       STA   SSCOL
       LDA   IRQ2    :NO CHECK
       AND   #32     : FOR
       BNE   CTR140  : COLLISION?
       LDA   V+21    :TURN ON FOR
       ORA   #1      : COLLISION
       STA   V+21    : CHECK
       LDX   #2
CTR120 LDA   IRQ     :CHECK FOR
       ORA   #32     : COLLISION
       STA   IRQ
CTR130 LDA   IRQ
       AND   #32
       BNE   CTR130
       DEX
       BNE   CTR120
       LDA   V+21    :TURN OFF
       AND   #254    : BULLET
       STA   V+21
CTR140 LDA   #0
       STA   SFC
       LDA   SHOTS
       ASL   A
       ASL   A
       ASL   A
       ROL   SFC
       CLC
       ADC   #<INFO
       STA   SFB
       LDA   SFC
       ADC   #>INFO
       STA   SFC
       LDA   SSCOL
       AND   #254
       TAY
       LDA   #2
       STA   CODE3   :2^(HIT SPR#)
       LDX   #1      ;HIT SPR#
CTR150 TYA
       STX   CODE2
       AND   CODE3
       CLC
       BNE   CTR160
       INX
       ASL   CODE3
       BCC   CTR150
       LDX   #0
       STX   CODE2
       LDX   CURTAR
CTR160 LDA   TARNUM.X
       BCC   CTR170
       ORA   #128
       JMP   CTR180
CTR170 INC   HITS
CTR180 LDY   #0
       STA   TARNUM
       STA   (SFB),Y :TARGET #
       STX   LASTSE.Y
       INY
       LDA   XVAL+1
       LSR   A
       LDA   XVAL
       ROR   A
       STA   (SFB),Y :BULLET
       STX   LASTSE.Y
       INY
       LDA   YVAL
       STA   (SFB),Y :BULLET
       STX   LASTSE.Y
       INY
       LDA   SPECIL.X
       STA   SPECIL
       LDA   CENX.X
       STA   CENX
       LDA   CENY.X
       STA   CENY
       TXA
       ASL   A       :FOR SPR IY
       PHA
       LDA   V+16
CTR190 LSR   A       :PUT RIGHT
       DEX           : X IN
       BPL   CTR190  : CARRY
       PLA
       TAX
       LDA   V.X
       ROR   A       :RIGHT X
       CLC           :ADD CENTER X
       ADC   CENX    : OFFSET
       STA   (SFB),Y :TARX/2
       STA   LASTSE.Y
       INY
       LDA   V+1.X
       CLC           :ADD CENTER Y
       ADC   CENY    : OFFSET
       STA   (SFB),Y :TARY
       STA   LASTSE.Y
       LDA   IRQ2    :IS THIS SHOT
       AND   #4      : A REPEAT?
       BNE   CTR210
       LDA   SFB     :STORE IN
       CLC           : 2ND INFO
       ADC   #<344   : BUFFER
       STA   SFB     : (DISK
       LDX   SFC     : RECORDS
       ADC   #>344   : ONLY HAVE
       STA   SFC     : ORIGINAL
       LDA   SHOTS   : SHOT)
       CLC
       ADC   #1
       STA   SHOTNR
       LDY   #7
CTR200 LDA   LASTSE.Y
       STA   (SFB),Y
       DEY
       BPL   CTR200
CTR210 LDA   IRQ2    :NO CROSS?
       AND   #16
       BNE   CTR240
       LDA   IRQ2
       AND   #8
       BEQ   CTR220
       LDA   LASTSE
       BPL   CTR240
```

```
CTR220 LDA   XVAL    :PUT UP CROSS
       SEC
       SBC   #10
       STA   V
       LDA   XVAL+1
       SBC   #0
       TAX
       LDA   V+16
       AND   #254
       CPX   #0
       BEQ   CTR230
       ORA   #1
CTR230 STA   V+16
       LDA   YVAL
       SEC
       SBC   #9
       STA   V+1
       LDA   #42
       STA   2040
       LDA   V+28    :MULTICOLOR
       ORA   #1      ; MODE ON
       STA   V+28
       LDA   #1      :WHITE
       STA   V+39
       LDA   V+21
       ORA   #1
       STA   V+21
CTR240 LDA   SSCOL   :WAS CLOSEST
       AND   HOLD3   ; TARGET HIT?
       BNE   CTR250  :YES
       LDX   CURTAR
       BEQ   CTR250
       LDA   SPECIL,X
       AND   #64     ;REVERSE
       BEQ   CTR250  ; DIRECTION?
       LDA   INSTK,X
       EOR   #255
       CLC
       ADC   #1
       STA   INSTK,X
CTR250 LDA   SPECIL
       BPL   CTR260
       JMP   CTR350
CTR260 AND   #32     ;IS THIS
       BEQ   CTR290  ; TARGET MORE
       LDA   #128    ; THAN 1 SPR?
       STA   CODE1
       LDX   #7
CTR270 LDA   V+21
       AND   CODE1
       BEQ   CTR280
       LDA   TARNUM,X
       CMP   TARNUM
       BNE   CTR280
       LDA   CODE1
       ORA   CODE3
       STA   CODE3
CTR280 LSR   CODE1
       DEX
       BNE   CTR270
CTR290 LDA   HITSPR  :TURN OFF ANY
       EOR   #255    ; TARGET PRE-
       ORA   #1      ; VIOUSLY HIT
       AND   V+21
       STA   V+21
       LDX   LASTSH
       LDA   IRQ2
       AND   #16
       BEQ   CTR300
       CPX   #128
       BCC   CTR310
       JMP   CTR320
CTR300 LDA   IRQ2    :SPECIAL
       AND   #8      ; CROSS?
       BEQ   CTR330
       CPX   #128    :MISS?
       BCS   CTR330
CTR310 LDA   CODE3   :TURN OFF
       EOR   #255    ; HIT TARGET
       AND   V+21    ; NOW
       STA   V+21
CTR320 LDA   #0
       STA   HITSPR
       JMP   CTR360
CTR330 LDA   CODE3   :SET UP TO
       ORA   #1      ; TURN OFF
       STA   HITSPR  ; HIT TARGET
       LDX   #7      :STOP HIT
       LDA   #128    ; TARGET
       STA   CODE1
CTR340 LDA   CODE3
       AND   CODE1
       BEQ   CTR350
       LDA   #0
       STA   INSTK,X
CTR350 LSR   CODE1
       DEX
       BNE   CTR340
       LDA   #30
       STA   CRSDLA
CTR360 BIT   TARNUM
       BVS   CTR390
       LDX   #7      :CHECK FOR
       LDA   #128    ; PENALTIES
       STA   CODE1
CTR370 LDA   V+21    :SPRITE MUST
       AND   CODE1   ; BE ON
       BEQ   CTR380
       LDA   TARNUM  :HIT TARGET
       AND   #127
       CMP   TARNUM,X
       BCC   CTR380  :MUST BE LESS
       BEQ   CTR380  ; OR EQUAL
       INC   PENAL
       JMP   CTR390
CTR380 LSR   CODE1
       DEX
       BPL   CTR370
CTR390 JSR   ROTATE
       INC   SHOTS
       LDA   IRQ
       AND   #251
       STA   IRQ
       SEC
       JSR   CKSPCL
       BCS   CTR470
       LDA   SHOTS
       CMP   MAXSHT
       BCC   CTR420
       LDA   IRQ
       ORA   #1
       STA   IRQ
       LDY   #87
CTR400 LDA   MOVMEO,Y
       STA   15776,Y
       DEY
       BPL   CTR400
       LDY   #10
       LDA   #13
CTR410 STA   1972,Y
       DEY
       BPL   CTR410
       JMP   CTR020
CTR420 LDA   IRQ
       AND   #192
       BEQ   CTR470
       LDA   56321
       EOR   #255
       AND   KEYMSK
       BEQ   CTR430
       STA   FSTAT   :KEY FLAG
       JMP   CTR470
CTR430 LDA   OFFSCR
       BNE   CTR440
       JMP   CTR020
CTR440 AND   #1      :WHISTLE
       BEQ   CTR450  ; FLAG
       LDA   V+21    :SPRITE ON?
       AND   #254
       BEQ   CTR450
       JSR   WHISTL
CTR450 LDA   OFFSCR  :CLEAR FLAG
       AND   #254
       STA   OFFSCR
CTR460 LDA   OFFSCR
       EOR   #255
       AND   V+21
       STA   V+21
       CLC
       JSR   CKSPCL
       BCS   CTR470
       JMP   CTR010
CTR470 LDA   IRQ
       AND   #15
       STA   IRQ
       MOVE  SFB.TARORD
       LDY   #0
       LDA   (SFB),Y
       CMP   #254
       BNE   CTR480
       DINC  TARORD
CTR480 LDA   #0
       LDY   FSTAT
       JSR   SB391
       RTS
CKSPCL LDA   IRQ2    :RETURN WHEN
       BMI   CKSP10  ; NO TARGETS
       AND   #64     ; UP?
       BEQ   CKSP40
       LDA   V+21
       AND   #254
       BNE   CKSP40
CKSP10 BCC   CKSP30
CKSP20 LDA   IRQ
       AND   #192
       BNE   CKSP20
CKSP30 SEC
       RTS
CKSP40 CLC
       RTS
MOVESP LDY   #14
       LDX   #7
       LDA   #128
       STA   HOLD
MOV010 LDA   V+21
       AND   HOLD
       BEQ   MOV050
       LDA   #13
       LDA   DLSTK1,X :STATIONARY?
       BEQ   MOV060
       DEC   CDLSTK,X :MOVE ???
       BNE   MOV050
       LDA   HOLD
       AND   OFFSCR
       BNE   MOV060
       LDA   DLSTK1,X
       STA   CDLSTK,X
       LDA   HOLD    :CHECK
       AND   V+16    ; RIGHT ?
       BEQ   MOV020
       LDA   #1
MOV020 STA   HOLDX
       LDA   INSTK,X :ADD
       STA   HOLDY   ; INCREMENT
       CLC
       ADC   V,Y
       STA   V,Y
       LDA   #0
       BIT   HOLDY   :INCREMENT<0?
       BPL   MOV030
       LDA   #255
MOV030 ADC   HOLDX
       BEQ   MOV040
       LDA   HOLD
       ORA   V+16
       STA   V+16
       LDA   V,Y
       CMP   #80
       BCS   MOV050
       JMP   MOV060
MOV040 LDA   HOLD
       EOR   #255
       AND   V+16
       STA   V+16
       LDA   V,Y
       CMP   #20
       BCS   MOV060
MOV050 LDA   HOLD
       ORA   OFFSCR
       STA   OFFSCR
MOV060 DEY
       DEY
       LSR   HOLD
       DEX
       BNE   MOV010
       RTS
PAUSE  LDA   IRQ     :TRIG PULL
       AND   #4
       BEQ   PAU010
       SEC
       RTS
PAU010 LDA   #166
PAU020 SEC
       SBC   #1
       BNE   PAU020
       CLC
       RTS
CLOSES LDA   #255
       STA   HOLDX   :LOW DISTANCE
       LDA   #128
       STA   CODE1   :SPRITE CODE
       STA   TARNUM  ; FOR MISS
       LDX   XVAL+1
       LSR   A
       LDA   XVAL
       ROR   A
       STA   HOLDX   :BULLET X
```

```
       LDA   #0
       STA   HOLD1
       STA   HOLD3
       LDX   #14
CL0010 LDA   V+21    :SPRITE ON?
       AND   CODE1
       BEQ   CL0050
       LDA   V+1,X
       SEC
       SBC   YVAL
       BCS   CL0020
       EOR   #255
       CLC
       ADC   #1
CL0020 STA   HOLDY   :YARY-BULY
       LDA   V+16
       AND   CODE1
       CLC
       BEQ   CL0030
       SEC
CL0030 LDA   V,X
       ROR   A
       SEC
       SBC   HOLDX
       BCS   CL0040
       EOR   #255
       CLC
       ADC   #1
CL0040 CLC
       ADC   HOLDY   :XDIF+YDIF
       ROR   A       :(XDIF+YDIF)/2
       CMP   HOLDA
       BCS   CL0050
       STA   HOLDA
       STX   HOLD1
       LDA   CODE1
       STA   HOLD3
CL0050 LSR   CODE1
       DEX
       DEX
       BNE   CL0010
       LDA   HOLD1
       LSR   A
       RTS
YTABLE .BYTE 0,16,17,33,49,66,66,0
       .BYTE 0,17,33,50,66,83,115,0
       .BYTE 0,17,49,66,99,116,148,0
       .BYTE 0,33,66,83,116,148,181,0
       .BYTE 0,33,66,99,148,181,215,0
       .BYTE 0,49,83,132,181,231,248,0
       .BYTE 0,16,33,33,50,66,82,0
       .BYTE 0,16,17,33,49,66,66,0
       .BYTE 0,17,49,66,83,115,132,0
       .BYTE 0,33,50,82,115,132,165,0
XOANNO .BYTE
60,102,102,102,102,102,60,0,0,102,102,10
2,102,102,102,60,0,0,126
       .BYTE
24,24,24,24,24,24,0,0,0,0,0,0,0,0,0,60
,102,102,102,102,102
       .BYTE
60,0,0,126,96,96,120,96,96,96,0,0,0,0,0,
0,0,0,0,24,60,102,126
       .BYTE
102,102,102,0,99,119,127,107,99,99,99,
0,99,119,127,107,99,99
       .BYTE
99,0,60,102,102,102,102,102,60,0
       .END
```

```
       .OPT  NOL
       .LIB  DATAITEMS
:DATAITEMS FOR ARM PROGRAM
DODATA JSR   VECDAT
       LDA   #<DITEMS
       CLC
       ADC   STOP
       STA   STOP
       LDA   #>DITEMS
       ADC   STOP+1
       STA   STOP+1
       ADDR  SFD,RANTAR
       LDY   #0
DOD010 LDA   (SFB),Y
       STA   (SFD),Y
       INC   SFB
       INC   SFD
       LDA   SFB
       CMP   STOP
       BCC   DOD010
       LDA   SFC
       CMP   STOP+1
       BCC   DOD010
       RTS
:PROCEDURE RANDOM
:POKE STOP WITH THE STARTING LOC
; IN STACK (X=START-16325)
; AND 16325-IXXXX WITH THE DATA
; ITEMS.  POKE HOLD1,HOLD2 WITH
; ADDRESS OFFSET OF DATA TO BE
; MOVED.
RANDOM LDX   STOP
       ADDR  SFD,RANTAR
RAN010 JSR   VECDAT
       LDA   16325,X
       BNI   RAN020
       JSR   SEARCH
       INX
       BNE   RAN010
RAN020 LDY   #0
       LDA   #255
       STA   (SFD),Y
       RTS
SEARCH STA   SA3
       STX   SA4
       LDY   #0
       LDX   #0
       CMP   #0
       BEQ   RAN060
RAN030 LDA   (SFB),Y
       DINC  SFB
       TAX
RAN040 LDA   SFB
       CLC
       ADC   #15
       STA   SFB
       LDA   SFC
       ADC   #0
       STA   SFC
       DEX
       BNE   RAN040
       LDA   (SFB),Y
       BPL   RAN050
       DINC  SFB
RAN050 DEC   SA3
       BNE   RAN030
RAN060 LDA   (SFB),Y
       STA   SA3
       STA   (SFD),Y
       INY
RAN070 LDX   #15
RAN080 LDA   (SFB),Y
       STA   (SFD),Y
       INY
       DEX
       BNE   RAN080
       DEC   SA3
       BNE   RAN070
       LDA   (SFB),Y
       BPL   RAN090
       STA   (SFD),Y
       INY
RAN090 TYA
       CLC
       ADC   SFB
       STA   SFB
       LDA   SFC
       ADC   #0
       STA   SFC
       LDX   SA4
       RTS
VECDAT LDA   #<DITEMS
       CLC
       ADC   HOLD1
       STA   SFB
       LDA   #>DITEMS
       ADC   HOLD1+1
       STA   SFC
       RTS
:ZERO DATA (0-17)
DITEMS .BYTE
1,0,150,5,37,12,255,0,0,0,4,0,0,6,15,0
,254,255
;LEV 1-5 (18-515). LEV 7 (18-533)
   .BYTE 2. 41.153.  8. 47.204.  5.
41.  2.  1.  6.254. 32. 12. 19.  0
   .BYTE    41.121.  8. 48.204.  5.
41.  2.  1.  6.254. 48. 12. 61.  0.254
   .BYTE 2. 41.163. 10. 47.204.  5.
21.  2.  3.  6.254. 32. 12. 19.  0
   .BYTE    41.121. 10. 48.204.  5.
21.  2.  3.  6.254. 48. 12. 61.  0.254
   .BYTE 2. 41.163. 12. 47.204.  5.
10.  2.  5.  6.254. 32. 12. 19.  0
   .BYTE    41.121. 12. 48.204.  5.
10.  2.  5.  6.254. 48. 12. 61.  0.254
   .BYTE 1.141.159. 16. 46.204.  5.
52.  2.  1.  7.254.  0. 12. 24.  0.254
   .BYTE 1. 51.159. 18. 46.204.  5.
26.  2.  3.  7.254.  0. 12. 24.  0.254
   .BYTE 1. 31.159. 20. 46.204.  5.
13.  2.  5.  7.254.  0. 12. 24.  0.254
   .BYTE 1.155.147. 24. 45.204.  5.
86.  2.  1.  8.254.  0. 12. 32.  0.254
   .BYTE 1. 55.147. 26. 45.204.  5.
43.  2.  3.  8.254.  0. 12. 32.  0.254
   .BYTE 1. 51.147. 28. 45.204.  5.
21.  2.  5.  8.254.  0. 12. 32.  0.254
   .BYTE 1.193.155. 32. 44. 12.
5.128.  2.  1.  9.255.  0.  6. 13.
0.254
   .BYTE 1.121.155. 34. 44. 12.  5.
54.  2.  3.  9.255.  0.  6. 13.  0.254
   .BYTE 1. 51.155. 35. 44. 12.  5.
32.  2.  5.  9.255.  0.  6. 13.  0.254
:RIGHT TO LEFT BEGINS HERE
   .BYTE 2. 23.163.  9. 47.236.  5.
41.254.  1.  6.254. 32. 12. 19.  0
   .BYTE    23.121.  9. 48.236.  5.
41.254.  1.  6.254. 48. 12. 61.  0.254
   .BYTE 2. 23.163. 11. 47.236.  5.
21.254.  3.  6.254. 32. 12. 19.  0
   .BYTE    23.121. 11. 48.236.  5.
21.254.  3.  6.254. 48. 12. 61.  0.254
   .BYTE 2. 23.163. 13. 47.236.  5.
10.254.  5.  6.254. 32. 12. 19.  0
   .BYTE    23.121. 13. 48.236.  5.
10.254.  5.  6.254. 48. 12. 61.  0.254
   .BYTE 1.179.159. 17. 46.204.  5.
52.254.  1.  7.254.  0. 12. 24.  0.254
   .BYTE 1. 33.159. 19. 46.236.  5.
26.254.  3.  7.254.  0. 12. 24.  0.254
   .BYTE 1. 33.159. 21. 46.236.  5.
13.254.  5.  7.254.  0. 12. 24.  0.254
   .BYTE 1.155.147. 25. 45.204.  5.
86.254.  1.  8.254.  0. 12. 32.  0.254
   .BYTE 1.  9.147. 27. 45.236.  5.
43.254.  3.  8.254.  0. 12. 32.  0.254
   .BYTE 1. 13.147. 29. 45.236.  5.
21.254.  5.  8.254.  0. 12. 32.  0.254
   .BYTE 1.127.155. 33. 44. 12.
5.128.254.  1.  9.255.  0.  6. 13.
0.254
   .BYTE 1.199.155. 35. 44. 12.  5.
54.254.  3.  9.255.  0.  6. 13.  0.254
   .BYTE 1. 13.155. 37. 44. 44.  5.
32.254.  5.  9.255.  0.  6. 13.  0.254
:STATIONARY TARGETS FOR LEVEL 7
   .BYTE 2.  0.165.  1. 39.204.  2.  0
0.  0.  0.255. 32. 24. 34.  0
   .BYTE    0.165.  1. 40.204.  2.  0
0.  0.  0.255. 48.  0. 34.  0.254
   .BYTE 1.  0.153.  2. 41.204.  3.  0
0.  0.  1.254.  0. 12. 37.  0.254
   .BYTE 1.  0.162.  3. 35. 12.  3.  0
0.  0.  2.254.  0.  6. 13.  0.254
   .BYTE 1.  0.150.  4. 36. 12.  4.  0
0.  0.  3.255.  0.  6. 15.  0.254
   .BYTE 1.  0.138.  5. 37. 12.  5.  0
0.  0.  4.  0.  0.  6. 15.  0.254
   .BYTE 1.  0.126.  6. 38. 12.  5.  0
0.  0.  5.  1.  0.  6. 16.  0.254
   .BYTE 255 (END LEVEL 7)
:LEVEL 8 (634-1197)
       .BYTE 144
   .BYTE 1. 77.152. 36. 44. 12.  5. 32
2.  5. 10.255.  0.  6. 13.  0.138
   .BYTE 135 (END 1)
   .BYTE 3.251.115.  6. 38. 12.  4.  0
0.  0.  5.  1.  0.  6. 16.  0
   .BYTE    83.130.  5. 37. 12.  3.  0
0.  0.  5.  0.  0.  6. 15.  0
   .BYTE   225.152. 35. 44. 12.  6.
54.254.  3. 10.255.  0.  6. 13.  0.140
   .BYTE 135 (END 2)
   .BYTE 2.121.145.  4. 36. 12.  4.  0
0.  0.  4.255.  0.  6. 15.  0
   .BYTE   251.145.  4. 36. 12.  4.  0
0.  0.  4.255.  0.  6. 15.  0.132
   .BYTE 1.109.152. 33. 44. 12.
4.128.254.  1. 10.255.  0.  6. 13.
0.136
   .BYTE 1.251.115.  6. 38. 12.  4.  0
0.  0.  6.  1.  0.  6. 16.  0.136
   .BYTE 145 (END 3)
   .BYTE 1. 79.160.  3. 35. 12.  4.  0
0.  0.  3.254.  0.  6. 13.  0.132
```

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   .BYTE 1.223.154.  2. 41.294.  4.
0.  0.  0.  2.254.  0. 12. 37.  0.136
   .BYTE 2. 73.146. 28. 45.204.  3.
21.  2.  1.  9.254.  0. 12. 32.  0
   .BYTE   73.146. 24. 45.204.  6.
86.  2.  1.  9.254.  0. 12. 32.  0.140
   .BYTE 1.165.152. 35. 44. 12.  4.
64.254.  3. 10.255.  0.  6. 13.  0.136
   .BYTE 1. 31.146. 28. 45.204.  4.
21.  2.  5.  9.254.  0. 12. 32.  0.136
   .BYTE 139 (END 4)
   .BYTE 1. 75.161. 19. 46.236.  4.
26.254.  3.  8.254.  0. 12. 24.  0.136
   .BYTE 2. 31.170. 10. 47.204.  4.
21.  2.  3.  7.254. 32. 12. 19.  0
   .BYTE   31.128. 10. 48.204.  4.
21.  2.  3.  7.254. 48. 12. 61.  0.136
   .BYTE 1. 75.161. 19. 46.236.  4.
26.254.  3.  8.254.  0. 12. 24.  0.136
   .BYTE 2. 49.161. 18. 46.204.  4.
26.  2.  3.  8.254.  0. 12. 24.  0
   .BYTE   75.170. 11. 47.236.  4.
21.254.  3.  7.254. 32. 12. 19.  0
   .BYTE   75.178. 11. 48.236.  4.
21.254.  3.  7.254. 48. 12. 61.  0,136
   .BYTE 133 (END 5)
   .BYTE 3. 89.154.  2. 41.204.  4.
0.  0.  0.  2.254.  0. 12. 37.  0
   .BYTE  205.169.  1. 39.204.  4.
0.  0.  0.  1.255. 32. 24. 34.  0
   .BYTE  253.169.  1. 40.204.  4.
0.  0.  0.  1.255. 48. 24. 34.  0.136
   .BYTE 1. 53.161. 20. 46.204.  2.
13.  2.  5.  8.254.  0. 12. 24.  0.132
   .BYTE 1. 75.146. 29. 45.236.  4.
21.254.  5.  9.254.  0. 12. 32.  0.136
   .BYTE 2. 57.161. 20. 46.204.  2.
13.  2.  5.  8.254.  0. 12. 24.  0
   .BYTE   57.161. 18. 46.204.  4.
26.  2.  3.  8.254.  0. 12. 24.  0.136
   .BYTE 133 (END 6)
   .BYTE 2. 31.170. 12. 47.204.  2.
10.  2.  5.  7.254. 32. 12. 19.  0
   .BYTE   31.128. 12. 48.204.  2.
10.  2.  5.  7.254. 48. 12. 61.  0.132
   .BYTE 1.159.161. 17. 46.204.  3.
52.254.  1.  8.254.  0. 12. 24.  0.134
   .BYTE 1.166.146. 26. 45.204.  4.
43.  2.  3.  9.254.  0. 12. 32.  0.136
   .BYTE 1.171.160.  3. 35. 12.  3.
0.  0.  0.  3.254.  0.  6. 13.  0.134
   .BYTE 1. 75.152. 37. 44. 44.  5.
32.254.  5. 10.255.  0.  6. 13.  0.140
   .BYTE 255 (END 7, END LEVEL 8)
;LEVEL 9 (1198-2009)
   .BYTE 1.101.130.  5. 37. 12.  5.
0.  0.  0.  4.  0.  0.  6. 15.  0.144
   .BYTE 2.127.152. 33. 44. 12.
5.128.254.  1.  9.255.  0.  6. 13.  0
   .BYTE   71.115.  6. 38. 12.  7.
0.  0.  0.  5.  1.  0.  6. 16.  0.148
   .BYTE 1  9.146. 27. 45.236.  4.
43.254.  3.  8.254.  0. 12. 32.  0.142
   .BYTE 1.241.115.  6. 38. 12.  5.
0.  0.  0.  5.  1.  0.  6. 16.  0.144
   .BYTE 2.193.152. 32. 44. 12.
5.128.  2.  1.  9.255.  0.  6. 13.  0
   .BYTE   71.145.  4. 36. 12.  7.
0.  0.  0.  3.255.  0.  6. 14.  0.148
   .BYTE 1. 33.161. 21. 46.236.  3.
13.254.  5.  7.254.  0. 12. 24.  0.140
   .BYTE 1. 55.146. 25. 45.204.  4.
43.  2.  3.  8.254.  0. 12. 32.  0.142
   .BYTE 2. 31.161. 20. 46.204.  3.
13.  2.  5.  7.254.  0. 12. 24.  0
   .BYTE   71.154.  2. 41.204.  7.
0.  0.  0.  1.254.  0. 12. 36.  0.148
   .BYTE 2. 23.170. 13. 47.236.  3.
10.254.  5.  6.254. 32. 12. 19.  0
   .BYTE   23.128. 13. 48.236.  3.
10.254.  5.  6.254. 48. 12. 61.  0.140
   .BYTE 1. 31.161. 20. 46.204.  3.
13.  2.  5.  7.254.  0. 12. 24.  0.140
   .BYTE 1. 57.146. 26. 45.204.  4.
43.  2.  3.  8.254.  0. 12. 32.  0.142
   .BYTE 2. 27.170. 13. 47.236.  3.
10.254.  5.  6.254. 32. 12. 19.  0
   .BYTE   27.128. 13. 48.236.  3.
10.254.  5.  6.254. 48. 12. 61.  0.140
   .BYTE 2. 43.170. 12. 47.204.  3.
10.  2.  5.  6.254. 32. 12. 19.  0
   .BYTE   43.128. 12. 48.204.  3.
10.  2.  5.  6.254. 48. 12. 61.  0.140
   .BYTE 2. 33.161. 21. 46.236.  3.
13.254.  5.  7.254.  0. 12. 24.  0
   .BYTE  227.169.  1. 39.204.  7.
0.  0.  0.  0.255. 32. 24. 32.  0
   .BYTE   19.169.  1. 40.236.  7.
0.  0.  0.  0.255. 48.255. 32.  0.148
   .BYTE 2. 43.170. 12. 47.204.  3.
10.  2.  5.  6.254. 32. 12. 19.  0
   .BYTE   43.128. 12. 48.204.  3.
10.  2.  5.  6.254. 48. 12. 61.  0.140
   .BYTE 3. 31.161. 20. 46.204.  3.
13.  2.  5.  7.254.  0. 12. 24.  0
   .BYTE  127.169.  1. 39.204.  7.
0.  0.  0.  0.255. 32. 24. 32.  0
   .BYTE  175.169.  1. 40.204.  7.
0.  0.  0.  0.255. 48.255. 32.  0.148
   .BYTE 2. 31.161. 20. 46.204.  3.
13.  2.  5.  7.254.  0. 12. 24.  0
   .BYTE  247.154.  2. 41.204.  7.
0.  0.  0.  1.254.  0. 12. 36.  0.148
   .BYTE 2. 43.170. 12. 47.204.  3.
10.  2.  5.  6.254. 32. 12. 19.  0
   .BYTE   43.128. 12. 48.204.  3.
10.  2.  5.  6.254. 48. 12. 61.  0.140
   .BYTE 1.111.160.  3. 35. 12.  5.
0.  0.  0.  2.254.  0.  6. 12.  0.144
   .BYTE 2. 27.170. 13. 47.236.  3.
10.254.  5.  6.254. 32. 12. 19.  0
   .BYTE   27.128. 13. 48.236.  3.
10.254.  5.  6.254. 48. 12. 61.  0.140
   .BYTE 1. 33.161. 21. 46.236.  3.
13.254.  5.  7.254.  0. 12. 24.  0.140
   .BYTE 1.  9.146. 27. 45.236.  4.
43.254.  3.  8.254.  0. 12. 32.  0.142
   .BYTE 2. 31.161. 20. 46.204.  3.
13.  2.  5.  7.254.  0. 12. 24.  0
   .BYTE  131.130.  5. 37. 12.  7.
0.  0.  0.  4.  0.  0.  6. 15.  0.148
   .BYTE 2. 27.170. 13. 47.236.  3.
10.254.  5.  6.254. 32. 12. 19.  0
   .BYTE   27.128. 13. 48.236.  3.
10.254.  5.  6.254. 48. 12. 61.  0.140
   .BYTE 1. 33.161. 21. 46.236.  3.
13.254.  5.  7.254.  0. 12. 24.  0.140
   .BYTE 1. 55.146. 25. 45.204.  4.
43.  2.  3.  8.254.  0. 12. 32.  0.142
   .BYTE 2.127.152. 33. 44. 12.
5.128.254.  1.  9.255.  0.  6. 13.  0
   .BYTE   23.115.  6. 38. 44.  7.
0.  0.  0.  5.  1.  0.  6. 16.  0.148
   .BYTE 1. 71.145.  4. 36. 12.  5.
0.  0.  0.  3.255.  0.  6. 14.  0.144
   .BYTE 255 (END LEVEL 9)
:LEVEL 10 (2010-2572)
   .BYTE 1.175.145.  4. 36. 12.  3.
0.  0.  0.  4.255.  0.  6. 15.  0.136
   .BYTE 2. 55.152. 37. 44. 44. 82.
0.254. 80. 10.255.  0.  6. 13. 32
   .BYTE  155.160.  3. 35. 12.  3.
0.  0.  0.  3.254.  0.  6. 13.  0.142
   .BYTE 2. 35.146. 29. 45.236. 50.
0.254. 80.  9.254.  0. 12. 32. 21
   .BYTE  135.154.  2. 41.204.  2.
0.  0.  0.  2.254.  0. 12. 37.  0.138
   .BYTE 1. 89.146. 26. 45.204.  5.
43.  2.  3.  9.254.  0. 12. 32.  0.138
   .BYTE 131 (END 1)
   .BYTE 2. 45.161. 21. 46.236.  2.
13.254.  5.  8.254.  0. 12. 24.  0
   .BYTE   45.161. 19. 46.236.  4.
26.254.  3.  8.254.  0. 12. 24.  0.136
   .BYTE 1. 57.146. 28. 45.204. 49.
0.  2. 80.  9.254.  0. 12. 32. 21.136
   .BYTE 2. 29.170. 11. 47.236.  3.
21.254.  3.  7.254. 32. 12. 19.  0
   .BYTE   29.128. 11. 48.236.  3.
21.254.  3.  7.254. 48. 12. 61.  0.132
   .BYTE 2.197.169.  1. 39.204.  7.
0.  0.  0.  1.255. 32. 24. 34.  0
   .BYTE  245.169.  1. 40.204.  3.
0.  0.  0.  1.255. 48. 24. 34.  0.134
   .BYTE 135 (END 2)
   .BYTE 2. 49.161. 20. 46.204.  2.
13.  2.  5.  8.254.  0. 12. 24.  0
   .BYTE   49.161. 18. 46.204.  4.
26.  2.  3.  8.254.  0. 12. 24.  0.136
   .BYTE 1. 37.146. 29. 45.236. 49.
0.254. 80.  9.254.  0. 12. 32. 21.136
   .BYTE 4.123.170. 12. 47.204. 17.
0.  2. 80.  7.254. 32. 12. 19. 10
   .BYTE  123.128. 12. 48.204. 17.
0.  2. 80.  7.254. 48. 12. 61. 10
   .BYTE   73.154.  2. 41.204.  5.
0.  0.  0.  2.254.  0. 12. 37.  0
   .BYTE  253.154.  2. 41.204.  5.
0.  0.  0.  2.254.  0. 12. 37.  0.138
   .BYTE 139 (END 3)
   .BYTE 2. 65.170. 13. 47.236.  2.
10.254.  5.  7.254. 32. 12. 19.  0
   .BYTE   65.128. 13. 48.236.  2.
10.254.  5.  7.254. 48. 12. 61.  0.130
   .BYTE 1. 49.161. 18. 46.204.  4.
26.  2.  3.  8.254.  0. 12. 24.  0.136
   .BYTE 1. 49.146. 29. 45.236.  3.
21.254.  5.  9.254.  0. 12. 32.  0.136
   .BYTE 1. 57.161. 18. 46.204.  4. 26.
2.  3.  8.254.  0. 12. 24.  0.136
   .BYTE 1. 35.146. 29. 45.236.  3.
21.254.  5.  9.254.  0. 12. 32.  0.132
   .BYTE 1.185.160.  3. 35. 12.  3.  0.
0.  0.  3.254.  0.  6. 13.  0.134
   .BYTE 135 (END 4)
   .BYTE 1.227.146. 24. 45.204.  3. 86.
2.  1.  9.254.  0. 12. 32.  0.130
   .BYTE 1.187.146. 27. 45.204.  3.
43.254.  3.  9.254.  0. 12. 32.  0.136
   .BYTE 1. 85.145.  4. 36. 12.  2.  0.
0.  0.  4.255.  0.  6. 15.  0.136
   .BYTE 1. 27.152. 33. 44. 44.
50.128.254. 81. 10.255.  0.  6. 13.
32.138
   .BYTE 1.173.130.  5. 37. 12.  2.  0.
0.  0.  5.  0.  0.  6. 15.  0.132
   .BYTE 1. 99.152. 36. 44. 12. 50. 32.
2. 21. 10.255.  0.  6. 13.128.138
   .BYTE 1.111.115.  6. 38. 12.  3.  0.
0.  0.  6.  1.  0.  6. 16.  0.136
   .BYTE 255 (END 5, END LEVEL 10)
:OLD LEVEL 6 (634-1215)
:  .BYTE 1. 87.115.  6. 38. 12.  7.  0
0.  0.  6.  1.  0.  6. 15.  0.132
:  .BYTE 1.251.115.  6. 38. 12.  5.  0.
0.  0.  6.  1.  0.  6. 16.  0.138
:  .BYTE 133 (END 1)
:  .BYTE 2. 77.152. 36. 44. 12.  5. 32.
2.  5. 10.255.  0.  6. 13.  0
:  .BYTE  151.130.  5. 37. 12.  5.  0.
0.  0.  4.  0.  0.  6. 15.  0.138
:  .BYTE 135 (END 2)
:  .BYTE 1.191.145.  4. 36. 12.  3.  0
0.  0.  4.255.  0.  6. 15.  0.132
:  .BYTE 1.251.152. 32. 44. 12.  4.128.
2.  1. 10.255.  0.  6. 13.  0.134
:  .BYTE 1. 51.146. 29. 45.236.  6.
21.254.  5.  9.254.  0. 12. 32.  0.140
:  .BYTE 145 (END 3)
:  .BYTE 2.249.160.  3. 35. 12.  4.  0.
0.  0.  3.254.  0.  6. 13.  0
:  .BYTE  131.130.  5. 37. 12.  4.  0
0.  0.  4.  0.  0.  6. 15.  0.136
:  .BYTE 141 (END 4)
:  .BYTE 1. 47.152.  4. 44. 12. 11. 64
2.  3. 10.255.  0.  6. 13.  0.134
:  .BYTE 1. 75.161. 19. 46.236.  4.
26.254.  3.  8.254.  0. 12. 24.  0.134
:  .BYTE 1.165.146. 24. 45.204.  8. 86
2.  1.  9.254.  0. 12. 32.  0.132
:  .BYTE 1. 51.161. 18. 46.204.  4. 26
2.  3.  8.254.  0. 12. 24.  0.136
:  .BYTE 149 (END 5)
:  .BYTE 1. 71.161. 21. 46.236.  2.
13.254.  5.  8.254.  0. 12. 24.  0.132
:  .BYTE 1. 47.146. 26. 45.204.  7. 43
2.  3.  9.254.  0. 12. 32.  0.138
:  .BYTE 1.157.154.  2. 41.204.  3.  0
0.  0.  2.254.  0. 12. 37.  0.134
:  .BYTE 3. 41.170. 10. 47.204.  4. 21
2.  3.  7.254. 32. 12. 19.  0
:  .BYTE   41.128. 10. 48.204.  4. 21
2.  3.  7.254. 48. 12. 61.  0
:  .BYTE  121.161. 16. 46.204.  6. 52
2.  1.  8.254.  0. 12. 24.  0.140
:  .BYTE 131 (END 6)
```

```
; .BYTE 2. 15.161. 17. 45.236. 6.
52.254. 1. 8.254. 0. 12. 24. 0
; .BYTE 85.154. 2. 41.204. 4.
0. 0. 0. 2.254. 0. 12. 37. 0.140
; .BYTE 2. 41.170. 10. 47.204. 4.
21. 2. 3. 7.254. 32. 12. 19. 0
; .BYTE 41,128. 10. 48.204. 4.
21. 2. 3. 7.254. 48. 12. 51. 0.136
; .BYTE 1,111.161. 16. 45.204. 4.
52. 2. 1. 8.254. 0. 12. 24. 0.136
; .BYTE 2. 53.146. 27. 45.236. 6.
43.254. 3. 9.254. 0. 12. 32. 0
; .BYTE 85.154. 2. 41.204. 7.
0. 0. 0. 2.254. 0. 12. 37. 0.142
;(END 7)
; .BYTE 2.101.169. 1. 39.204. 3.
0. 0. 0. 1.255. 32. 24. 34. 0
; .BYTE 149.169. 1. 40.204. 3.
0. 0. 0. 1.255. 48. 24. 34. 0.134
; .BYTE 2.199.170. 8. 47.204. 3.
41. 2. 1. 7.254. 32. 12. 19. 0
; .BYTE 199.128. 8. 48.204. 3.
41. 2. 1. 7.254. 48. 12. 61. 0.134
; .BYTE 1. 71.161. 19. 46.236. 4.
26.254. 3. 8.254. 0. 12. 24. 0.136
; .BYTE 135 (END 8)
; .BYTE 2. 71.170. 10. 47.204. 3.
21. 2. 3. 7.254. 32. 12. 19. 0
; .BYTE 71,128. 10. 48.204. 3.
21. 2. 3. 7.254. 48. 12. 61. 0.134
; .BYTE 1. 55.146. 29. 45.236. 3.
21.254. 5. 9.254. 0. 12. 32. 0.134
; .BYTE 1,161.152. 34. 44. 12. 6.
64. 2. 3. 10.255. 0. 6. 13. 0.142
; .BYTE 255 (END 9. END LEVEL 6)
  .END
    .LIB REKEEP
;REKEEP IN MLCHOBK1.TXT OF ARM
REKEEP LDA #0
       JSR SETNAM
       LDA #1
       LDX #8
       LDY #15
       JSR SETLFS
       JSR OPEN
       BCS NODISK
       LDX #1
       JSR CHKOUT
       BCC DISKON
NODISK LDA #1
       JSR CLOSE
       JSR CLRCHN
       LDA #0
       TAY
       JSR FLOAT
       JMP YSK080
DISKON LDA #1
       JSR CLOSE
       JSR CLRCHN
       ADDR SA3.S1
       LDA #S2-S1
       STA LENSTR
       JSR LETHL
YESKO  ADDR SA3.S2
       LDA #S3-S2
       STA LENSTR
       JSR LETHL
       ADDR SA3,S3)
       LDA #S4-S3
       STA LENSTR
       JSR LETHL
       LDA #1
       STA V+39
       STA V+28
       LDA #42
       STA 2040
       LDY #240
       LDA #13
YSK010 STA 1583,Y
       DEY
       BNE YSK010
       LDY #200
YSK020 STA 1823,Y
       DEY
       BNE YSK020
YSK030 LDX #0
       LDA 53267   ;X READING
       SEC
       SBC #5
       ASL A
       BCC YSK040
       INX
YSK040 CLC
       ADC OFFX
       STA V
       TXA
       ADC OFFX+1
       TAX
       AND #1
       BEQ YSK050
       ORA V+16
       JMP YSK060
YSK050 LDA V+16
       AND #254
YSK060 STA V+16
       LDA 53268   ;Y READING
       SEC
       SBC #9
       CLC
       ADC OFFY
       STA V+1
       LDA #1
       STA V+21
       CPX #0
       BNE YSK070
       LDA V
       CMP #182
       BCS YSK070
       LDA #13
       JSR COLYES
       LDA #253
       JSR COLNO
       LDY #255
       JMP YSK080
YSK070 LDA #253
       JSR COLYES
       LDA #13
       JSR COLNO
       LDY #0
YSK080 LDA 56321
       CMP #247
       BEQ YSK090
       LDY #100
       JSR WAIT
       JSR GETIN
       CMP #0
       BEQ YSK030
       LDY #255
       CMP #'Y
       BEQ YSK090
       INY
       CMP #'N
       BEQ YSK090
       JMP YSK030
YSK090 TYA
       PHA
       JSR FLOAT
       LDA #0
       STA V+21
       LDA #5
       STA SA3
       PLA
       BEQ YSK110
YSK100 LDA #221
       JSR COLNO
       JSR COLYES
       LDY #100
       JSR WAIT
       DEC SA3
       BNE YSK100
       JMP YSK120
YSK110 LDA #221
       JSR COLYES
       JSR COLNO
       LDY #100
       JSR WAIT
       LDA #13
       JSR COLNO
       LDY #100
       JSR WAIT
       DEC SA3
       BNE YSK110
YSK120 JSR NOTTRG
       RTS
YESKO2 ADDR SA3.S2
       LDA #S3-S2
       STA LENSTR
       JSR LETHL
       ADDR SA3.S4
       LDA #STEND-S4
       STA LENSTR
       JSR LETHL
       LDA #1
       STA V+39
       STA V+28
       LDA #42
       STA 2040
YS2030 LDX #0
       LDA 53267   ;X READING
       SEC
       SBC #5
       ASL A
       BCC YS2040
       INX
YS2040 CLC
       ADC OFFX
       STA V
       TXA
       ADC OFFX+1
       AND #1
       BEQ YS2050
       ORA V+16
       JMP YS2060
YS2050 LDA V+16
       AND #254
YS2060 STA V+16
       LDA 53268   ;Y READING
       SEC
       SBC #9
       CLC
       ADC OFFY
       STA V+1
       LDA #1
       STA V+21
       LDA V+1
       CMP #150
       BCS YS2070
       LDA #13
       JSR COLUP
       LDA #253
       JSR COLDN
       LDY #1
       JMP YS2080
YS2070 LDA #253
       JSR COLUP
       LDA #13
       JSR COLDN
       LDY #2
YS2080 LDA 56321
       CMP #247
       BEQ YS2090
       LDY #100
       JSR WAIT
       JMP YS2030
YS2090 TYA
       PHA
       LDA #0
       JSR FLOAT
       LDA #0
       STA V+21
       LDA #5
       STA SA3
       PLA
       CMP #1
       BNE YS2110
YS2100 LDA #221
       JSR COLDN
       JSR COLUP
       LDY #100
       JSR WAIT
       LDA #13
       JSR COLUP
       LDY #100
       JSR WAIT
       DEC SA3
       BNE YS2100
       JMP YS2120
YS2110 LDA #221
       JSR COLUP
       JSR COLDN
       LDY #100
       JSR WAIT
       LDA #13
       JSR COLDN
       LDY #100
       JSR WAIT
       DEC SA3
       BNE YS2110
YS2120 JSR NOTTRG
       RTS
COLYES LDX #5
CY1    STA 1754,X
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       STA  1794,X
       DEX
       BPL  CY1
       RTS
COLNO  LDX  #3
CN1    STA  1770,X
       STA  1810,X
       DEX
       BPL  CN1
       RTS
COLUP  LDX  #1
CU1    STA  1300,X
       STA  1340,X
       DEX
       BPL  CU1
       RTS
COLDN  LDX  #1
CD1    STA  1780,X
       STA  1820,X
       DEX
       BPL  CD1
       RTS
       .OPT NOL
S1     .BYTE 137,'0617'.196.'O YOU
WANT TO KEEP RECORDS?'
S2     .BYTE 144.137.'0124'.208.'OINT
RIFLE AT ANSWER AND PULL TRIGGER'
S3     .BYTE
133,137,'1018',217.197,211,137.'2618',
206.207
S4     .BYTE
133.137.'3606'.138.'07',137.'3618',138
,'07'
STEND  =*
       .OPT  LIST
       .END
       .OPT NOL
       .LIB  DESCRIPTIONS
;DESCRIPTIONS IN MLCH0BK1.TXT
; OF ARM CARTRIDGE
DESCRP ADDR  SFB.DESC
       LDX   HOLD1
       BEQ   DES050
       LDY   #0
DES010 DEX
       BEQ   DES020
       LDA   (SFB),Y
       CLC
       ADC   #1
       CLC
       ADC   SFB
       STA   SFB
       LDA   SFC
       ADC   #0
       STA   SFC
       JMP   DES010
DES020 LDA   #40
       SEC
       SBC   (SFB),Y
       LSR   A
       TAY
       LDX   #0
DES030 LDA   #32
       STA   TEMP,X
       INX
       DEY
       BNE   DES030
       LDA   (SFB),Y
       STA   HOLD1
       INY
DES040 LDA   (SFB),Y
       STA   TEMP,X
       INX
       INY
       DEC   HOLD1
       BNE   DES040
       STX   LENSTR
       ADDR  SA3,TEMP
       JSR   LETHL
       RTS
DES050 INC   HOLD1
       LDA   HOLD1
DES060 CMP   SFD     ;START
       BNE   DES070
       LDX   #14     ;LIGHT BLUE
       STX   646
DES070 CMP   SFE     ;FINAL
       BCC   DES080
       BEQ   DES080
       LDX   #0      ;BLACK
       STX   646
DES080 LDX   #32
       STX   TEMP
       STX   TEMP+3
       ORA   #48
       STA   TEMP+1
       CMP   #58
       BNE   DES090
       LDA   #'1
       STA   TEMP
       LDA   #'0
       STA   TEMP+1
DES090 LDA   #':
       STA   TEMP+2
       LDY   #0
       LDA   (SFB),Y
       PHA
       TAY
DES100 LDA   (SFB),Y
       STA   TEMP+3,Y
       DEY
       BNE   DES100
       PLA
       TAY
       INC   SFB
       CLC
       ADC   SFB
       PHA
       LDA   SFC
       ADC   #0
       PHA
       LDA   SFD
       PHA
       LDA   SFE
       PHA
       LDA   #13
       STA   TEMP+4,Y
       INY
       INY
       INY
       INY
       ADDR  SA3,TEMP
       STY   LENSTR
       JSR   LETHL
       PLA
       STA   SFE
       PLA
       STA   SFD
       PLA
       STA   SFC
       PLA
       STA   SFB
       INC   HOLD1
       LDA   HOLD1
       CMP   #11
       BEQ   DES110
       JMP   DES060
DES110 RTS
DESC   .BYTE 17.212.'RACKING
'.197.'XERCISE'
       .BYTE 17.212.'RAPPING
'.197.'XERCISE'
       .BYTE 27.'60 M '.205.'OVING
'.212.'ARGET '.208.'RACTICE'
       .BYTE 27.'75 M '.205.'OVING
'.212.'ARGET '.208.'RACTICE'
       .BYTE 28.'125 M '.205.'OVING
'.212.'ARGET '.208.'RACTICE'
       .BYTE 28.'185 M '.205.'OVING
'.212.'ARGET '.208.'RACTICE'
       .BYTE 27.198.'IELD '.198.'IRE -
'.211.'INGLE '.212.'ARGETS'
       .BYTE 29.198.'IELD '.198.'IRE -
'.205.'ULTIPLE '.212.'ARGETS'
       .BYTE 14.196.'EFENSIVE
'.198.'IRE'
       .BYTE 11.195.'OMBAT '.198.'IRE'
       .END
       .LIB  GETXYSORT
:PROCEDURE GETXY
:DETERMINES BULLET STRIKE
:B:NONE
:C:SYS GETXY
:A:PUTS THE BULLET STRIKE (X AND Y
;  VALUES) IN XVAL AND YVAL.
GETXY  LDA   STSIZE
       STA   NSRT
       JSR   SORT
       LDA   STSIZE  ;FIND THE
       LSR   A       ; MEDIAN OF
       TAX           ; THE SRTBUF
       LDA   SRTBUF,X
       ASL   A       ;*2
       STA   XVAL    ;SET UP FOR
       LDA   #0      ; ADDITION OF
       BCC   GTY10   ; OFFSET X
       LDA   #1      ;BULLET RIGHT
GTY10  STA   XVAL+1
       DADD  XVAL,OFFX
       LDA   STSIZE  ;FIND MEDIAN
       LSR   A       ; OF THE
       CLC           ; Y HALF OF
       ADC   STSIZE  ; THE SRTBUF
       TAX
       LDA   SRTBUF,X
       STA   YVAL    ;Y MEDIAN
       LDA   #0      ;SET UP FOR
       STA   YVAL+1  ;OFFSET ADD Y
       DADD  YVAL,OFFY
       RTS
;
:PROCEDURE SORT
:SORTS NSRT ELEMENTS IN SRTBUF
;B:POKE NSRT,(# OF ELEMENTS)
:C:SYS SORT
:A:ELEMENTS IN SRTBUF ARE SORTED
SORT   ADDR  SFD,SRTBUF
       LDY   NSRT
       BEQ   SRT30
       DEY
       BEQ   SRT30
       STY   HOLD
       LDY   #0
SRT10  LDA   (SFD),Y
       INY
       CMP   (SFD),Y
       BCC   SRT20   :DON'T SORT
       TAX           :SWAP 2 VALS
       LDA   (SFD),Y
       DEY
       STA   (SFD),Y
       INY
       TXA
       STA   (SFD),Y
       TYA           :SWAP CORRE-
       CLC           : SPONDING Y
       ADC   NSRT    : VALUES
       TAY
       DEY
       LDA   (SFD),Y
       TAX
       INY
       LDA   (SFD),Y
       DEY
       STA   (SFD),Y
       INY
       TXA
       STA   (SFD),Y
       TYA
       SEC
       SBC   NSRT
       TAY
SRT20  CPY   HOLD
       BNE   SRT10
       LDY   #0
       DEC   HOLD
       BNE   SRT10
SRT30  RTS
       .END
       .LIB  RANDOMIZE
;PROCEDURE RNDIZE (RANDOMIZE)
;PUT START BYTE OF BUFFER AND
; STOP BYTE IN FAC.
RNDIZE JSR   SB1BF
       LDA   100     ;HIGH BYTE IS
       STA   STOP    ; BUF START
       STA   HOLD
       LDA   101     ;LOW BYTE IS
       STA   STOP+1  ; BUF STOP
       TAY
       SEC
       SBC   STOP
       STA   HOLD1
       INY
       INY
       INC   STOP+1
       LDA   #255
RNZ010 STA   16324,Y
       DEY
       BNE   RNZ010
RNZ020 LDY   SA2     :CLOCK
       LDA   #0
       JSR   SB391   :FLOAT
       JSR   SE26B   :SINE
       JSR   SBC0F   :PUT IN FA2
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      LDY   HOLD1   ;STOP-START
      LDA   #0
      JSR   SB391   ;FLOAT
      JSR   SBA2B   ;MULTIPLY
      LDA   102     ;ABS
      AND   #127
      STA   102
      LDY   #SE2    ;ADD .25
      LDA   #SEA
      JSR   SBA8C   ;LOAD FA2
      JSR   SB86A   ;ADD
      JSR   SB1BF   ;UNFLOAT
      LDA   101     ;LOW BYTE
      CLC
      ADC   STOP
      TAY
RNZ030 LDA  16325,Y
      CMP   #255
      BNE   RNZ040
      LDA   HOLD
      STA   16325,Y
      JMP   RNZ060
RNZ040 INY
      CPY   STOP+1
      BCC   RNZ050
      LDY   STOP
RNZ050 JMP  RNZ030
RNZ060 INC  HOLD
      LDA   HOLD
      CMP   STOP+1
      BCC   RNZ020
      RTS
      .END
      .LIB  EXPTAR
;EXPTAR IN ARM.3200.TXT
;PROCEDURE EXPTAR
;POKE HOLD3,FAF.  POKE X1 WITH
; THE CENTER X, Y1 WITH CENTER Y
; THE OFFSETS ARE CALCULATED AS:
; (CENX*FACTOR-FACTOR/2,
;  CENY*FACTOR-FACTOR/2)
; EXPDATA IS SPRITE POINTER.
; OFFX,OFFY,FACTOR.
EXPTAR LDA  #0
      STA   XVAL+1
      STA   CHOICE
      LDA   HOLD3
      AND   #127
      CMP   #7
      BCC   EXP010
      LSR   A
      LSR   A
      LSR   A
      CLC
      ADC   #6
EXP010 SEC
      SBC   #1
      ASL   A
      ASL   A
      ASL   A
      STA   HOLD3
      TAY
      LDA   X1
      SEC
      SBC   EXPDAT+1,Y
      STA   XVAL
      STA   HOLD1
      LDA   Y1
      SEC
      SBC   EXPDAT+2,Y
      STA   YVAL
      LDA   EXPDAT+3,Y
      STA   CODE2
      LDA   #0
      STA   S5D
      LDA   EXPDAT,Y
      LDY   #6
EXP020 ASL  A
      ROL   S5D
      DEY
      BNE   EXP020
      STA   S5C
EXP030 LDY  #0
EXP040 LDA  #3
      STA   HOLDA
EXP050 LDA  #128
      STA   CODE1
EXP060 LDA  (S5C),Y
      AND   CODE1
      BEQ   EXP080
      LDA   CODE2
      STA   CODE3
      STA   CODE4
EXP070 JSR  BITPLT
      DINC  XVAL
      DEC   CODE3
      BNE   EXP070
      LDA   XVAL
      SEC
      SBC   CODE2
      STA   XVAL
      LDA   XVAL+1
      SBC   #0
      STA   XVAL+1
      LDA   CODE2
      STA   CODE3
      INC   YVAL
      DEC   CODE4
      BNE   EXP070
      LDA   YVAL
      SEC
      SBC   CODE2
      STA   YVAL
EXP080 LDA  XVAL
      CLC
      ADC   CODE2
      STA   XVAL
      LDA   XVAL+1
      ADC   #0
      STA   XVAL+1
      LSR   CODE1
      BNE   EXP060
      INY
      CPY   #63
      BCS   EXP090
      DEC   HOLDA
      BNE   EXP050
      LDA   HOLDI
      STA   XVAL
      LDA   #0
      STA   XVAL+1
      LDA   YVAL
      CLC
      ADC   CODE2
      STA   YVAL
      JMP   EXP040
EXP090 LDY  HOLD3
      LDA   EXPDAT+5,Y
      BEQ   EXP100
      STA   HOLD3
      JMP   EXP010
EXP100 RTS
:SPRITE PTR.STARTX.STARTY.TARGET
FACTOR.BULLET FACTOR.NEXT
EXPDAT .BYTE 39.48.33.2.1.11.0.0
;50 M (L)
      .BYTE 41.48.74.4.2.0.0.0
:100 M
      .BYTE 35.34.37.3.3.0.0.0
:150 M
      .BYTE 36.46.58.4.4.0.0.0
:200 M
      .BYTE 37.57.77.5.5.0.0.0
:250 M
      .BYTE 38.69.99.6.6.0.0.0
:300 M
      .BYTE 47.24.20.2.1.12.0.0
:60 M (B)
      .BYTE 46.24.25.2.1.0.0.0
:75 M
      .BYTE 45.48.66.4.2.0.0.0
:125 M
      .BYTE 44.46.54.4.4.0.0.0
:185 M
      .BYTE 40.0.33.2.1.0.0.0
:50 M (R)
      .BYTE 48.24.62.2.1.0.0.0
:60 M (T)
      .END
      .LIB  CRITERION
:PROCEDURE CRITER
; POKE HOLD1,TARGET (0=STA. 1-12)
; POKE HOLD2,SCORE DESIRED
; PUT THE SCORE IN FA1
CRITER JSR  UNPLOT
      LDY   #1
      LDA   100
      BNE   CRI050
      ADDR  SFD,CRDATA
      LDY   HOLD1
      BEQ   CRI020
CRI010 LDA  SFD
      CLC
      ADC   #20
      STA   SFD
      LDA   SFE
      ADC   #0
      STA   SFE
      DEY
      BNE   CRI010
CRI020 LDA  HOLD2
      ASL   A
      ASL   A
      TAY
      LDX   #5
      LDA   101
CRI030 CMP  (SFD),Y
      BCC   CRI040
      BEQ   CRI040
      DEX
      INY
      CPX   #1
      BNE   CRI030
CRI040 TXA
      TAY
CRI050 LDA  #0
      JSR   FLOAT
      RTS
:STATIONARY
CRDATA .BYTE 3.5.8.11    :SF
      .BYTE 3.5.8.11     :SF
      .BYTE 2.4.7.9      :AIM
      .BYTE 3.5.8.11     :TS
      .BYTE 2.4.7.9      :SL
;60 M 1.5 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
;60 M 3 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
;60 M 6 MPH
      .BYTE 10.20.32.42  :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
;75 M 1.5 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
;75 M 3 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
;75 M 6 MPH
      .BYTE 10.20.32.42  :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
:125 M 1.5 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
:125 M 3 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5,11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
:125 M 6 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
:185 M 1.5 MPH
      .BYTE 5.10.16.21   :TRACK
      .BYTE 3.8.14.19    :TRAP
      .BYTE 5.11.18.24   :AIM
      .BYTE 6.11.18.24   :TS
      .BYTE 3.7.13.18    :SL
:185 M 3 MPH
      .BYTE 5.10.16.21   :TRACK
```

```
      .BYTE 3.8.14.19   ;TRAP
      .BYTE 5.11.18.24  ;AIM
      .BYTE 6.11.18.24  ;TS
      .BYTE 3.7.13.18   ;SL
:185 M 6 MPH
      .BYTE 5.10.16.21  ;TRACK
      .BYTE 3.8.14.19   ;TRAP
      .BYTE 5.11.18.24  ;AIM
      .BYTE 6.11.18.24  ;TS
      .BYTE 3.7.13.18   ;SL
      .END
      .OPT  LIST
      .END
```

```
      *=32768
;MLCH0BK2.TXT FOR ARM CARTRIDGE
      JMP   DEMO
      JMP   SPCDEM
      JMP   SPCINS
      .LIB  MACROS-VARS
      .END
      .OPT  NOL
BANG  =3212
BITPLT =3245
COLORS =3227
DSABLE =3203
EXABLE =3200
HOTTRG =3209
ROTATE =3206
WAIT  =3218
WHISTL =3215
YESNO  =32783
YESNO2 =32798
LETNL  =49185
PRGNUM =49161
SELSUB =49162
BANKSB =49163
SUBNO  =49168
BANKRT =49171
      .LIB  DEMOMAIN
;DEMOMAIN IN MLCH0BK2.TXT OF ARM
DEMO  DSPL  DDES03.DDES04
      LDA   #(YESNO2
      JSR   BANK1
      JSR   UNPLOT
      LDA   101
      CMP   #2
      BNE   DEM010
      RTS
DEM010 JSR  DEMSB4
      DSPL  DDES04.DDES05
      LDA   #3      :185 M
      LDX   #2      :6 MPH
      JSR   DEMSB5
      LDA   #0
      LDX   #0
      JSR   DEMSB1
      CMP   #255
      BNE   DEM020
      RTS
DEM020 JSR  DEMSB4
      DSPL  DDES05.DDES06
      LDA   #3      :185 M
      LDX   #2      :6 MPH
      JSR   DEMSB5
      LDA   #1
      LDX   #1
      JSR   DEMSB1
      CMP   #255
      BNE   DEM030
      RTS
DEM030 DSPL DDES06.DDES07
      JSR   DEMSB3
      BEQ   DEM040
      RTS
DEM040 JSR  DEMSB4
      LDA   #0      :60 M
      LDX   #0      :1.5 MPH
      JSR   DEMSB6
      LDA   #2
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM050
      RTS
DEM050 JSR  DEMSB4
      LDA   #0      :50 M
      LDX   #1      :3 MPH
      JSR   DEMSB6
      LDA   #3
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM060
      RTS
DEM060 JSR  DEMSB4
      LDA   #0      :50 M
      LDX   #2      :6 MPH
      JSR   DEMSB6
      LDA   #4
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM070
      RTS
DEM070 JSR  DEMSB4
      LDA   #1      :75 M
      LDX   #0      :1.5 MPH
      JSR   DEMSB6
      LDA   #5
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM080
      RTS
DEM080 JSR  DEMSB4
      LDA   #1      :75 M
      LDX   #1      :3 MPH
      JSR   DEMSB6
      LDA   #6
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM090
      RTS
DEM090 JSR  DEMSB4
      LDA   #1      :75 M
      LDX   #2      :6 MPH
      JSR   DEMSB6
      LDA   #7
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM100
      RTS
DEM100 JSR  DEMSB4
      LDA   #2      :125 M
      LDX   #0      :1.5 MPH
      JSR   DEMSB6
      LDA   #8
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM110
      RTS
DEM110 JSR  DEMSB4
      LDA   #2      :125 M
      LDX   #1      :3 MPH
      JSR   DEMSB6
      LDA   #9
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM120
      RTS
DEM120 JSR  DEMSB4
      LDA   #2      :125 M
      LDX   #2      :6 MPH
      JSR   DEMSB6
      LDA   #10
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM130
      RTS
DEM130 JSR  DEMSB4
      LDA   #3      :185 M
      LDX   #0      :1.5 MPH
      JSR   DEMSB6
      LDA   #11
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM140
      RTS
DEM140 JSR  DEMSB4
      LDA   #3      :185 M
      LDX   #1      :3 MPH
      JSR   DEMSB6
      LDA   #12
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM150
      RTS
DEM150 JSR  DEMSB4
      LDA   #3      :185 M
      LDX   #2      :6 MPH
      JSR   DEMSB6
      LDA   #13
      LDX   #99
      JSR   DEMSB1
      CMP   #255
      BNE   DEM155
      RTS
DEM155 DSPL DDES15.DDES16
      LDA   #(YESNO
      JSR   BANK1
      JSR   UNPLOT
      LDA   101
      BEQ   DEM160
      JMP   DEM040
DEM160 JSR  DEMSB4
      LDA   #1      :75 M
      LDX   #1      :3 MPH
      JSR   DEMSB5
      LDA   #14
      LDX   #4
      JSR   DEMSB1
      CMP   #255
      BNE   DEM170
DEM170 JSR  DEMSB4
      DSPL  DDES08.DDES09
      LDA   #43
      STA   2041
      STA   2042
      STA   2043
      LDA   #47
      STA   2044
      LDA   #48
      STA   2045
      LDA   #45
      STA   2046
      LDA   #44
      STA   2047
      LDX   #13
DEM180 LDA  DDATXY.X
      STA   V+2.X
      DEX
      BPL   DEM180
      LDA   #0
      STA   V+16
      STA   V+40
      STA   V+41
      STA   V+42
      LDA   #12
      STA   V+43
      STA   V+44
      STA   V+45
      STA   V+46
      LDA   #126
      STA   V+23
      STA   V+29
      LDA   #254
      STA   V+21
      DSPL  DDES01.DDES02
      JSR   DEMSB3
      LDX   #0
      STX   V+21
      CMP   #0
      BEQ   DEM190
      RTS
DEM190 DSPL DDES09.DDES10
      JSR   DEMSB3
      BEQ   DEM200
      RTS
DEM200 JSR  DEMSB4
      LDA   #0      :50 M
      LDX   #0      :1.5 MPH
      JSR   DEMSB6
      LDA   #15
      LDX   #101
      JSR   DEMSB1
      CMP   #255
      BNE   DEM210
      RTS
DEM210 JSR  DEMSB4
      LDA   #0      :60 M
      LDX   #1      :3 MPH
      JSR   DEMSB6
      LDA   #16
      LDX   #101
      JSR   DEMSB1
      CMP   #255
      BNE   DEM220
      RTS
DEM220 JSR  DEMSB4
      LDA   #0      :50 M
      LDX   #2      :6 MPH
      JSR   DEMSB6
      LDA   #17
      LDX   #101
      JSR   DEMSB1
      CMP   #255
      BNE   DEM230
      RTS
DEM230 JSR  DEMSB4
      LDA   #1      :75 M
      LDX   #0      :1.5 MPH
      JSR   DEMSB6
```

```
        LDA  #18
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM240
        RTS
DEM240  JSR  DEMSB4
        LDA  #1       ;75 M
        LDX  #1       ;3 MPH
        JSR  DEMSB6
        LDA  #19
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM250
        RTS
DEM250  JSR  DEMSB4
        LDA  #1       ;75 M
        LDX  #2       ;6 MPH
        JSR  DEMSB6
        LDA  #20
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM260
        RTS
DEM260  JSR  DEMSB4
        LDA  #2       ;125 M
        LDX  #0       ;1.5 MPH
        JSR  DEMSB6
        LDA  #21
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM270
        RTS
DEM270  JSR  DEMSB4
        LDA  #2       ;125 M
        LDX  #1       ;3 MPH
        JSR  DEMSB6
        LDA  #22
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM280
        RTS
DEM280  JSR  DEMSB4
        LDA  #2       ;125 M
        LDX  #2       ;6 MPH
        JSR  DEMSB6
        LDA  #23
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM290
        RTS
DEM290  JSR  DEMSB4
        LDA  #3       ;185 M
        LDX  #0       ;1.5 MPH
        JSR  DEMSB6
        LDA  #24
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM300
        RTS
DEM300  JSR  DEMSB4
        LDA  #3       ;185 M
        LDX  #1       ;3 MPH
        JSR  DEMSB6
        LDA  #25
        LDX  #101
        JSR  DEMSB1
        CMP  #255
        BNE  DEM305
        RTS
DEM305  DSPL DDES16.DDES17
        LDA  #(YESNO
        JSR  BANK1
        JSR  UNPLOT
        LDA  101
        BEQ  DEM310
        JMP  DEM200
DEM310  JSR  DEMSB4
        DSPL DDES10.DDES11
        LDA  #3       ;185 M
        LDX  #2       ;6 MPH
        JSR  DEMSB5
        LDA  #26
        LDX  #6
        JSR  DEMSB1
        CMP  #255
        BNE  DEM320
        RTS
DEM320  JSR  DEMSB4
        DSPL DDES11.DDES12
        LDA  #3       ;185 M
        LDX  #2       ;6 MPH
        JSR  DEMSB5
        LDA  #27
        LDX  #6
        JSR  DEMSB1
        CMP  #255
        BNE  DEM330
        RTS
DEM330  DSPL DDES12.DDES13
        JSR  DEMSB3
        RTS
SPCDEM  JSR  UNPLOT
        LDA  101
        BNE  DSP010
        JSR  DEMSB4
        DSPL DDES13.DDES14
        LDA  #1       ;75 M
        LDX  #1       ;3 MPH
        JSR  DEMSB5
        LDA  #28
        LDX  #7
        JSR  DEMSB1
        JMP  DSP020
DSP010  JSR  DEMSB4
        DSPL DDES14.DDES15
        LDA  #1       ;75 M
        LDX  #1       ;3 MPH
        JSR  DEMSB5
        LDA  #29
        LDX  #8
        JSR  DEMSB1
DSP020  TAY
        JSR  FLOAT
        RTS
        .END
        .LIB  DEMOSUBS
;DEMOSUBS FOR MLCHOBK2.TXT
DEMSB1  STA  HOLD1
        STX  HOLD2
        LDA  #48      ;60H TOP
        STA  2046
        LDA  #42      :CROSS
        STA  2040
        LDA  #34      :BULLET
        STA  2041
        LDA  #43      :SPOST
        STA  2042
        LDA  #12      :MED GRAY
        STA  V+45
        STA  V+46
        LDA  #1       :WHITE
        STA  V+39
        STA  V+40
        ADDR SA3.DDESMM
        LDY  #0
        LDA  HOLD2
        AND  #31
        TAX
        BEQ  S1L020
S1L010  LDA  (SA3).Y
        CLC
        ADC  #1
        CLC
        ADC  SA3
        STA  SA3
        LDA  SA4
        ADC  #0
        STA  SA4
        DEX
        BNE  S1L010
S1L020  LDA  (SA3).Y
        STA  LENSTR
        DIRC SA3
        JSR  LETHL
        JSR  DSABLE
        LDA  #59
        STA  53265
        BIT  HOLD2
        BVS  S1L030
        JSR  HOLDIT
S1L030  LDA  #0
        STA  CHOICE
S1L040  JSR  DEMSB2
        LDY  HOLD3
        BNI  S1L110
        LDA  HOLD2
        AND  #32
        BNE  S1L050
        DSPL DDES01.DDES02
S1L050  LDA  #255
        STA  CHOICE
        LDA  #2
        STA  HOLDY
S1L060  LDA  #255
        STA  HOLDA
        STA  HOLDI
S1L070  LDA  56321
        CMP  #247
        BNE  S1L080
        LDY  #128
        JMP  S1L110
S1L080  CMP  #127
        BNE  S1L090
        LDY  #255
        JMP  S1L110
S1L090  DEC  HOLDA
        BNE  S1L070
        DEC  HOLDI
        BNE  S1L070
        DEC  HOLDY
        BNE  S1L100
        LDY  #0
        LDA  HOLD2
        AND  #32
        BNE  S1L110
        JMP  S1L040
:S1L100 LDA  #0       :BLACK
:       STA  V+38     : CROSS
:       LDA  V+21
:       AND  #249
:       STA  V+21
S1L100  JMP  S1L060
S1L110  LDA  56321
        CMP  #255
        BNE  S1L110
        LDA  #0
        STA  V+38
        STA  V+21
        LDA  #12
        STA  V+39
        TYA
        RTS
DEMSB2  LDY  #0
        ADDR SFB.DDAT
        LDX  HOLD1
        BEQ  S2L020
S2L010  LDA  SFB
        CLC
        ADC  #15
        STA  SFB
        LDA  SFC
        ADC  #0
        STA  SFC
        DEX
        BNE  S2L010
S2L020  LDA  #0
        STA  V+41     :BLACK
        STA  V+16
        STA  V+21
        LDA  #1
        STA  V+28     :MULTICOLOR
        STA  V+38     :WHITE
        LDA  #6
        STA  V+23     :EXPAND Y
        STA  V+29     :EXPAND X
        LDA  #78      ;SET UP
        STA  V+2      ; BULLET FOR
        LDA  #185     ; CH DEMO
        STA  V+3
        LDA  (SFB).Y :X VALUE
        STA  V+14
        STA  V+12
        INY
        LDA  (SFB).Y :Y VALUE
        STA  V+15
        SEC
        SBC  #42
        STA  V+13
        INY
        LDA  (SFB).Y :SPRITE PTR
        STA  2047
        INY
        LDA  (SFB).Y :EXPAND X?
        BPL  S2L030
        LDA  V+29
        ORA  #192
        STA  V+29
S2L030  LDA  (SFB).Y :EXPAND Y?
        AND  #64
```

```
       BEQ   S2L040
       LDA   V+23
       ORA   #192
       STA   V+23
S2L040 LDA   (SFB),Y :RIGHT X?
       AND   #32
       BEQ   S2L050
       LDA   V+16
       ORA   #196
       STA   V+16
S2L050 INY
       LDA   (SFB),Y ;# READINGS
       STA   TLIM1+7
       STA   TLIM1+6
       INY
       LDA   (SFB),Y ;DELAY
       STA   DLSTK1+7
       STA   DLSTK1+6
       STA   DLSTK1+2
       STA   DLSTK1+1
       STA   CDLSTK+7
       STA   CDLSTK+6
       STA   CDLSTK+2
       STA   CDLSTK+1
       INY
       LDA   (SFB),Y ;TARGET
       STA   INSTK+7 ; INCREMENT
       STA   INSTK+6
       STA   INSTK+1
       INY
       LDA   (SFB),Y ;FLIGHT TIME
       STA   TIMFL1
       INY
       LDA   (SFB),Y ;SPOST
       STA   INSTK+2 ; INCREMENT
       INY
       LDA   (SFB),Y ;SPOST
       STA   CODE1   ; PAUSE
       BEQ   S2L060
       LDA   DLSTK1+2
       STA   CODE2
       LDA   #0
       STA   DLSTK1+2
S2L060 INY
       LDA   (SFB),Y ;SPOST X OFF
       CLC
       ADC   V+14
       STA   V+4
       INY
       LDA   (SFB),Y ;SPOST Y OFF
       CLC
       ADC   V+15
       STA   V+5
       INY
       LDA   (SFB),Y ;CROSS X/2
       ASL   A
       STA   Y
       BCC   S2L070
       LDA   V+16
       ORA   #1
       STA   V+16
S2L070 INY
       LDA   (SFB),Y ;CROSS Y
       STA   V+1
       INY
       LDA   (SFB),Y ;WHICHSPRITES
       STA   V+21
       INY
       TYA
       CLC
       ADC   SFB
       STA   TARORD
       LDA   SFC
       ADC   #0
       STA   TARORD+1
       LDA   HOLD1
       CMP   #14
       BNE   S2L080
       LDA   #134
       STA   V+27
       DSPL  DDES07.DDES08
       JSR   HOLDIT
       LDA   #13
       STA   HOLD1
       LDA   #8
       STA   HOLD2
       LDA   #221
       STA   SFD
       JSR   COLORS
       LDA   #14
       STA   HOLD1
       LDA   #0
       STA   V+27
S2L080 LDA   V+14
       STA   HOLD3
       JSR   MOVESP
       JSR   DEMPAU
       BCS   S2L110
       LDA   V+14
       CMP   HOLD3
       BEQ   S2L080
       LDA   CODE1
       BEQ   S2L090
       DEC   CODE1
       BNE   S2L090
       LDA   CODE2
       STA   DLSTK1+2
S2L090 DEC   TLIM1+7
       BNE   S2L080
       JSR   BANG
       LDA   #0
       STA   INSTK+2
       LDA   V+21
       ORA   #1
       STA   V+21
:S2L100 LDA   V+14
;      STA   HOLD3
;      JSR   MOVESP
;      JSR   DEMPAU
;      BCS   S2L110
;      LDA   V+14
;      CMP   HOLD3
;      BEQ   S2L100
;      DEC   TIMFL1
;      BNE   S2L100
S2L100 LDA   #0
       STA   HOLD3
S2L110 RTS
DEMPAU LDX   #255
       LDA   56321
       CMP   #127
       BEQ   DMP010
       LDX   #128
       CMP   #247
       BNE   DMP020
       BIT   CHOICE
       BPL   DMP020
DMP010 STX   HOLD3
       SEC
       RTS
DMP020 LDA   #$66
DMP030 SEC
       SBC   #1
       BNE   DMP030
       CLC
       RTS
:SUBROUTINE TO SET ZERO FLAG FOR
; TRIGGER PULL OR NEG FLAG FOR
; BREAK
DEMSB3 LDX   #0
       LDA   56321
       CMP   #247
       BEQ   S3L010
       DEX
       CMP   #127
       BNE   DEMSB3
S3L010 LDA   56321
       CMP   #255
       BNE   S3L010
       TXA
       RTS
:SUBROUTINE TO CLEAR SCREEN
; AND SET COLORS
DEMSB4 DSPL  DDES02.DDES03
       LDA   #12
       STA   HOLD1
       STA   HOLD2
       LDA   #221
       STA   SFD
       JSR   COLORS
       RTS
:SUBROUTINE TO PRINT RANGE (A) &
; MPH (X) AT BOTTOM LEFT
; A=0 (60).  1 (75).
;   2 (125). 3 (185)
; X=0 (1.5). 1 (3). 2 (6)
DEMSB5 ASL   A
       ASL   A
       STA   HOLD3
       TXA
       ASL   A
       ASL   A
       STA   HOLD4
       LDX   HOLD3
       LDA   TGTDS1.X
       STA   TEMP
       LDA   TGTDS1+1.X
       STA   TEMP+1
       LDA   TGTDS1+2.X
       STA   TEMP+2
       LDA   TGTDS1+3.X
       TAY
       LDX   #0      :'METERS'
S5L010 LDA   TGTDS2.X
       STA   TEMP.Y
       INY
       INX
       CPX   #9
       BNE   S5L010
       LDX   HOLD4
       LDA   TGTDS1+16.X
       STA   TEMP.Y
       LDA   TGTDS1+17.X
       STA   TEMP+1.Y
       LDA   TGTDS1+18.X
       STA   TEMP+2.Y
       TYA
       CLC
       ADC   TGTDS1+19.X
       TAY
       LDX   #0      :'MPH...'
S5L020 LDA   TGTDS3.X
       STA   TEMP.Y
       INY
       INX
       CPX   #18
       BNE   S5L020
       STY   LENSTR
       ADDR  S23.TEMP
       JSR   LETNL
       LDA   #19     :HOME
       JSR   SFFD2
       LDA   #14     :LT BLUE
       STA   646
       RTS
:SUBROUTINE TO PRINT RANGE (A) &
; MPH (X) AT TOP
; A=0 (60).  1 (75).
;   2 (125). 3 (185)
; X=0 (1.5). 1 (3). 2 (6)
DEMSB6 ASL   A
       ASL   A
       STA   HOLD3
       TXA
       ASL   A
       ASL   A
       STA   HOLD4
       LDA   #133
       STA   TEMP
       LDA   #137
       STA   TEMP+1
       LDX   HOLD3
       LDA   TGTDS4.X
       STA   TEMP+2
       LDA   TGTDS4+1.X
       STA   TEMP+3
       LDA   TGTDS4+2.X
       STA   TEMP+4
       LDA   TGTDS4+3.X
       STA   TEMP+5
       LDA   TGTDS1.X
       STA   TEMP+6
       LDA   TGTDS1+1.X
       STA   TEMP+7
       LDA   TGTDS1+2.X
       STA   TEMP+8
       LDA   TGTDS1+3.X
       CLC
       ADC   #6
       TAY
       LDX   #0      :'METERS'
S6L010 LDA   TGTDS2.X
       STA   TEMP.Y
       INY
       INX
       CPX   #9
       BNE   S6L010
       LDX   HOLD4
       LDA   #137
       STA   TEMP.Y
       INY
       LDA   TGTDS5.X
       STA   TEMP.Y
       INY
       LDA   TGTDS5+1.X
       STA   TEMP.Y
```

```
        INY
        LDA   TGTDS5+2,I
        STA   TEMP,Y
        INY
        LDA   TGTDS5+3,I
        STA   TEMP,Y
        INY
        LDA   TGTDS1+16,I
        STA   TEMP,Y
        LDA   TGTDS1+17,I
        STA   TEMP+1,Y
        LDA   TGTDS1+18,I
        STA   TEMP+2,Y
        TYA
        CLC
        ADC   TGTDS1+19,I
        TAY
        LDX   #0      ;'MPH...'
S6L020  LDA   TGTDS6,X
        STA   TEMP,Y
        INY
        INX
        CPX   #22
        BNE   S6L020
        STY   LENSTR
        ADDR  SA3,TEMP
        JSR   LETML
        LDA   #19     ;HOME
        JSR   SPED2
        LDA   #14     ;LT BLUE
        STA   646
        RTS
MOVESP  LDY   #14
        LDX   #7
        LDA   #128
        STA   HOLD
MOV010  LDA   V+21
        AND   HOLD
        BEQ   MOV060
        LDA   DLSTK1,X ;STATIONARY?
        BEQ   MOV060
        DEC   CDLSTK,X ;MOVE IT?
        BNE   MOV060
        LDA   HOLD
        AND   OFFSCR
        BNE   MOV060
        LDA   DLSTK1,X
        STA   CDLSTK,X
        LDA   HOLD    ;CHECK
        AND   V+16    ; RIGHT X
        BEQ   MOV020
        LDA   #1
MOV020  STA   HOLDX
        LDA   INSTK,X ;ADD
        STA   HOLDY   ; INCREMENT
        CLC
        ADC   V,Y
        STA   V,Y
        LDA   #0
        BIT   HOLDY   ;INCREMENT<0?
        BPL   MOV030
        LDA   #255
MOV030  ADC   HOLDX
        BEQ   MOV040
        LDA   HOLD
        ORA   V+16
        STA   V+16
        LDA   V,Y
        CMP   #80
        BCS   MOV050
        JMP   MOV060
MOV040  LDA   HOLD
        EOR   #255
        AND   V+16
        STA   V+16
        LDA   V,Y
        CMP   #20
        BCS   MOV060
MOV050  LDA   HOLD
        ORA   OFFSCR
        STA   OFFSCR
MOV060  DEY
        DEY
        LSR   HOLD
        DEX
        BNE   MOV010
        RTS
HOLDIT  LDA   #255
        TAX
        LDY   #10
HOLD01  SEC
        SBC   #1
        BNE   HOLD01
        DEX
        BNE   HOLD01
        DEY
        BNE   HOLD01
        RTS
BANK1   STA   SUBNO
        LDA   #1
        STA   BANKSB
        LDA   BANKRT
        PHA
        LDA   #2
        STA   BANKRT
        JSR   SELSUB
        PLA
        STA   BANKRT
        RTS
TGTDS1 .BYTE '60 '.2.'75
'.2.'125'.3.'185'.3.'1.5'.3,'3  '.1.'6
'.1
TGTDS2 .BYTE ' METERS'.140.32
TGTDS3 .BYTE ' MPH LATERAL SPEED'
TGTDS4 .BYTE
'1102','1102','1002','1002'
TGTDS5 .BYTE '1305'.'1505'.'1505'
TGTDS6 .BYTE ' MPH'.137.'0707LATERAL
SPEED'
DDAT   .BYTE
51.152.44.0.100.32.2.5.2.0.244.245.121
.156.132      ;185M8NL
       .BYTE
51.152.44.0.100.32.2.5.2.0.254.245.126
.156,132      ;185M8PF
       .BYTE
41.170.47.192.100.41.2.1.2.0.2.250.127
.178.196      ;60M2PF
       .BYTE
23.170.47.224.100.21.254.3.254.0.250.2
50.46.178.196 ;60M4PF
       .BYTE
41,170,47.192.100.10.2.5.2.0.10.250.12
7.178.196     ;60M8PF
       .BYTE
180.161.46.192.50.52.254.1.254.0.254.2
55.46.174.132 ;75M2PF
       .BYTE
52.161.46.192.100.26.2.3.2.0.6.255.132
.174.132      ;75M4PF
       .BYTE
16.161.46.224.100.13.254.5.254.0.246.2
55.42.174.132 ;75M8PF
       .BYTE
165.146.45.192.50.86.2.1.2.0.2.7.139.1
67.132        ;125M2PF
       .BYTE
23.146.45.224.50.43.254.3.254.0.250.7.
96.167.132    ;125M4PF
       .BYTE
61.146.45.192.50.21.2.5.2.0.10.7.87.16
7.132         ;125M8PF
       .BYTE
147.152.44.0.25.128.254.1.254.0.242.24
5.49.156.132  ;185M2PF
       .BYTE
141.152.44.0.25.64.2.3.2.0.250.245.96.
156.132       ;185M4PF
       .BYTE
33.152.44.32.50.32.254.5.254.0.234.245
.95.156.132   ;185M8PF
       .BYTE
56.161.46.192.100.26.2.3.2.20.46.255.1
34,174.134    ;75M4SLDM
       .BYTE
41.170.47.192.100.41.2.1.2.0.6.250.129
.178.196      ;60M2SL
       .BYTE
23.170.47.224.100.21.254.3.254.0.250.2
50.46.178.196 ;60M4SL
       .BYTE
41.170.47.192.100.10.2.5.2.0.6.250.125
.178.196      ;60M8SL
       .BYTE
180.161.46.192.50.52.254.1.254.0.248.2
55.43.174.132 ;75M2SL
       .BYTE
52.161.46.192.100.26.2.3.2.0.6.255.132
.174.132      ;75M4SL
       .BYTE
16.161.46.224.100.13.254.5.254.0.248.2
55.43.174.132 ;75M8SL
       .BYTE
165.146.45.192.50.86.2.1.2.0.6.7.141.1
67.132        ;125M2SL
       .BYTE
23.146.45.224.50.43.254.3.254.0.250.7.
96.167.132    ;125M4SL
       .BYTE
61.146.45.192.50.21.2.5.2.0.6.7.85.167
.132          ;125M8SL
       .BYTE
147.152.44.0.25.128.254.1.254.0.238.24
5.47.156.132  ;185M2SL
       .BYTE
141.152.44.0.25.64.2.3.2.0.250.245.96.
156.132       ;185M4SL
       .BYTE
33.152.44.32.50.32.254.5.254.0.239.245
.98.156.132   ;185M8SL
       .BYTE
33.152.44.32.50.32.254.5.254.0.234.245
.95.156.132   ;185M8PF
       .BYTE
52.161.46.192.75.26.2.3.2.0.6.255.107.
174.132       ;75M4TK
       .BYTE
52.161.46.192.75.26.2.3.0.0.156.255.10
174.132       ;75M4TR
DDATZY .BYTE
57.154.156.154.244.154.60.160.60.118.15
.147.250.165
DDESHK .BYTE 126.133.29.217.'OU HAY
'.28.'HISS'.154.' MOVING'.140
       .BYTE 'TARGETS BY AIMING AYCENT
MASS. BECAUSE'
       .BYTE 'THE '.28.'TARGET
CONTINUES'
       .BYTE 'MOVING'.154.' AS THE
BULLET TRAVELS DOWN RANGE.'
       .BYTE 125.133.212.'O HIT A TARG
THAT'
       .BYTE 29.'IS MOVING
LATERALLY'.140.'ACROSS YOUR FRONT.'.14
       .BYTE ' YOU MUST '.28.'AIM
AHEAD'.154.140.'  OF TARGET CENTER.'
       .BYTE 140.212.'HIS IS CALLED
'.28.204.197.193.196.154.'.'
       .BYTE 122.133.32.212.'BE AMOUNT
OF LEAD'.140.' NEEDED TO HIT NEAR'
       .BYTE 140.' THE CENTER
CHANGES'.140
       .BYTE 'FOR DIFFERENT
TARGET'.29.'RANGES. SPEEDS. AND'.140.2
       .BYTE 'ANGLES OF MOVEMENT.'
       .BYTE 1.32
       .BYTE 122.133.32.212.'O SIMPLIF
TARGET'.140
       .BYTE 'LEADS PUT THE TRAIL-ING
TIP OF THE FRONT'
       .BYTE 'SIGHT POST AT CENTEROF
MASS. '.212.'HIS IS THE '.29
       .BYTE
28.211.201.205.199.204.197.32.204.197.
3.196.32
       .BYTE 210,213.204.197.154.'.'
       .BYTE 1.32
;      .BYTE 125.32.133.32.212.'O USE
THE SINGLE'.140
;      .BYTE 29.'LEAD RULE.
REMEMBER'.140
;      .BYTE 29.'TO PUT THE
'.28.'TRAILING'.140.'  TIP'.154
;      .BYTE ' OF THE FRONT'.140.'SIGE
POST AT '.28.'CENTER'.29
;      .BYTE 'MASS'.154.' OF THE
TARGET.'
       .BYTE 125.133.212.'HE SINGLE LE
RULEWILL HIT MOST COMBAT'
       .BYTE 'TARGETS. '.212.'O HIT
'.28.'FAST'.154.' LATERAL TARGETS AT'
       .BYTE 140.28.'MORE THAN 100
METERS'.154.29.'YOU NEED MORE LEAD.'
       .BYTE 104.133.29.32.212.'O
'.28.'TRACE'.154.'. GET THE'.140
       .BYTE '  CORRECT LEAD AND',140
       .BYTE 'MOVE YOUR RIFLE WITH'.29
THE TARGET AS YOU'.140
       .BYTE 28.'SQUEEZE'.154.' THE
TRIGGER.'
       .BYTE 126.133.212.'O
'.28.'TRAP'.154.'. ESTABLISH A'
       .BYTE ' STEADY POSITION IN'.14
       .BYTE 29.'FRONT OF THE
TARGET'.140.'AND '.28.'PULL'.154.' TH
       .BYTE 'TRIGGERWHEN THE TARGET
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GETS',29.' TO THE RIGHT SPOT.'
DDES01 .BYTE 144.137.'0723('.208.'ULL
TRIGGER TO CONTINUE)'
       .BYTE 19.154.134.'00'
DDES02 .BYTE
134.'09'.139.'00'.147.135.'00'.136.'00
',28,137,'0121'
DDES03 .BYTE
134,'09'.139.'00'.135.'13'.136.'13'.14
7,144.133.137.'0204'
       .BYTE 205,'OVING
',212,'ARGET'.140.32.201.'NSTRUCTION
AND'.140
       .BYTE
32.196,'EMONSTRATION',137.'0216'.211.'
TART',140
       .BYTE
32,198,'IRING'.140.32.197.'XERCISES'.1
34,'00'
DDES04 .BYTE
144.137,'1020'.215.'ITHOUT LEAD YOU
'.28.'MISS'.140.32
DDES05 .BYTE 144,137.'1120'.215,'ITH
LEAD YOU '.28.'HIT'.140.32
DDES06 .BYTE
134,'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
       .BYTE 32.212.'HE AMOUNT OF
'.28.'LEAD'.140.154
       .BYTE 'NEEDED TO HIT
TARGETCENTER WILL ',28.'INCREASE'.154
       .BYTE ' WHEN THE TARGET
IS'.140,29.28.'FARTHER ',154.'AWAY
AND/OR'
       .BYTE 140.'  IS MOVING
'.28.'FASTER'.140,154
       .BYTE '  LATERALLY
ACROSS'.140.29.'    YOUR FRONT.',140
       .BYTE 29,'12 EXAMPLES
FOLLOW.'.133.137.'0523'
       .BYTE 12?,'(.208.'ULL TRIGGER
FOR 12 EXAMPLES)'.134.'04'
DDES07 .BYTE 144.137.'0219'.195,'ENTER
OF',137,'0420MASS'
       .BYTE 137.'1113',212,'RAILING
TIP OF'.137.'1114FRONT SIGHT POST'
       .BYTE
133,137,'0617',138,'01',137.'1115',138
.'05'
DDES08 .BYTE 19.154.133,'
',206,'OTICE HOW THE',140.'  SINGLE
LEAD RULE'
       .BYTE 140.29,'WORKS
AUTOMATICALLY'.140,' AS THE TARGET
GETS'.140
       .BYTE 29,'SMALLER (IS
FARTHER'.140.' AND FARTHER AWAY).'.144
       .BYTE
137,'1012',138,'03',137.'2013'.138,'03
',137,'3113'.138.'03'
       .BYTE 133,137,'062060
M',137,'1719125 M'.137,'2819185 M'
DDES09 .BYTE
134,'09'.139.'00'.135.'00',136.'00'.14
7.154,133,140
       .BYTE 198,'OLLOWING ARE
ELEVEN',29.'  EXAMPLES OF THE'.140
       .BYTE 28.29.' SINGLE LEAD
RULE',154,'.'.140
       .BYTE 29.' SHOWING WHERE
THE'.140.29.'BULLET WILL HIT THE'.140
       .BYTE 29.'TARGET. '.206.'OTICE
THAT'.140
       .BYTE 29.'THE '.28.'TRAILING
TIP'.154.' OF'.140
       .BYTE 'THE SIGHT POST IS AT
'.28.'CENTER MASS'.154.'.'.133
       .BYTE 137.'0423'.'('.208.'ULL
TRIGGER TO SEE 11 EXAMPLES)'.134.'04'
;DDES10 .BYTE 28.137.'0220'.198.'AR
AND FAST TARGETS NEED MORE LEAD.'
;      .BYTE 140.32
;DDES11 .BYTE 28.137.'1220'.212.'HIS
IS A '.212.210.193.195.203.'.'.140.32
DDES10 .BYTE
144.137.'0420'.201.'NSUFFICIENT LEAD
CAUSES A '
       .BYTE 28.'MISS'.140.32
DDES11 .BYTE
144.137.'0920'.201.'NCREASED LEAD - A
'
       .BYTE 28.'HIT'.140.32
DDES12 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
       .BYTE 32.212.'NO WAYS TO
ENGAGE'.140.' MOVING TARGETS ARE'
       .BYTE
140.28.212.210.193.195.203.201.206.199
.154.32.38.32
       .BYTE
28.212.210.193.208.208.201.206.199.154
.'.'.29
       .BYTE 217.'OU WILL GET TO
TRY'.140.29.'BOTH METHODS TO SEE'.140
       .BYTE '   HOW THEY
WORK.'.133.153
       .BYTE 137.'0723('.208.'ULL
TRIGGER TO CONTINUE)'.134.'00'
DDES13 .BYTE 144.137.'1220'.212.'HIS
IS A '.28
       .BYTE
212.210.193.195.203.144,'.'.140.32.28
DDES14 .BYTE 144.137.'1220'.212.'HIS
IS A '.28
       .BYTE
212.210.193.208.144.'.'.140.32.28
DDES15 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
       .BYTE 32.196.'O YOU WANT TO
SEE'.140
       .BYTE 29.'  THE 12
EXAMPLES'.140.29.'
AGAIN?'.134.'08'
DDES16 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
       .BYTE 32.196.'O YOU WANT TO
SEE'.140
       .BYTE ' THE 11 EXAMPLES
OF'.140.'THE SINGLE LEAD RULE'
       .BYTE '       AGAIN?'.134.'08'
DDES17 =*
       .END
       .LIB  SPECINSTR
;SPECINSTR IN MLCHOBK2.TXT
SPCINS JSR   UNFLOT
       LDA   101
       BNE   SPC010
       ADDR  SA3.INST02
       LDA   #INST02-INST02
       BNE   SPC040
SPC010 CMP   #1
       BNE   SPC020
       ADDR  SA3.INST03
       LDA   #INST04-INST03
       BNE   SPC040
SPC020 CMP   #2
       BNE   SPC030
       ADDR  SA3.INST04
       LDA   #INST05-INST04
       BNE   SPC040
SPC030 ADDR  SA3.INST05
       LDA   #INST06-INST05
       STA   LENSTR
       JSR   LETHL
       ADDR  SA3.INST06
       LDA   #INST07-INST06
SPC040 STA   LENSTR
       JSR   LETHL
       DSPL  INST01.INST02
SPC050 LDY   #0
       LDA   56321
       CMP   #247
       BEQ   SPC060
       DEY
       CMP   #127
       BNE   SPC050
SPC060 TYA
       JSR   FLOAT
SPC070 LDA   56321
       CMP   #255
       BNE   SPC070
       RTS
INST01 .BYTE 137.'0723('.208.'ULL
TRIGGER TO CONTINUE)'.134.'00'
INST02 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
.'0402'.28
       .BYTE 198.'UNDAMENTALS
FOR'.137.'0205'.211.'TATIONARY '
       .BYTE 212.'ARGETS'.30
       .BYTE 137.'0108'.133.'.
'.133.211.'READY '.208.'OSITION'
       .BYTE 137.'0111'.133.'.
'.133.193.'INING'
       .BYTE 137.'0114',133.'.
'.133.194.'REATH '.195.'ONTROL'
       .BYTE 137.'0117'.133.'.
',133.212.'RIGGER
'.211.'QUEEZE'.133.153
INST03 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
.'0402'.28
       .BYTE 198.'UNDAMENTALS
FOR'.137.'1205'.212.'RACKING'.137.'120
7'
       .BYTE
163.163.163.163.163.163.163.163
       .BYTE 137.'0608'.205.'OVING
'.212.'ARGETS',30
       .BYTE 137,'0111'.133.'.
'.133.211.'HOOTH '.212.'RACK'
       .BYTE 137,'0114'.133.'.
'.133.204.'EAD'
       .BYTE 137.'0117'.133.'.
'.133.194.'REATH '.195.'ONTROL'
       .BYTE 137.'0120'.133.'.
'.133.212.'RIGGER '.211.'QUEEZE'.133.15
INST04 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
0402'.28
       .BYTE 198.'UNDAMENTALS
FOR'.137.'1205'.212.'RAPPING'.137.'120
       .BYTE
163.163.163.163.163.163.163.163
       .BYTE 137.'0608'.205.'OVING
'.212.'ARGETS'.30
       .BYTE 137.'0111'.133.'.
'.133.211.'READY '.208.'OSITION'
       .BYTE 137.'0114'.133.'.
'.133.204.'EAD'
       .BYTE 137.'0117'.133.'.
'.133.194.'REATH '.195.'ONTROL'
       .BYTE 137.'0120'.133.'.
'.133.212 'RIGGER '.208.'ULL'.133.153
INST05 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
0402'.28
       .BYTE 198.'UNDAMENTALS
OF'.137.'0805'.205.'ARKSMANSHIP'
       .BYTE
133.30.137.'0010'.211.'TATIONARY  '
       .BYTE 205.'OVING (.212.'RACK
'.205.'OVING (.212.'RAP)'
       .BYTE
183.183.183.183.183.183.183.183.183.18
32.32
       .BYTE
183.183.183.183.183.183.183.183.183 18
183.183.183.183
       .BYTE
32.183.183.183.183.183.183.183.183.183
83.183.183.183
INST06 .BYTE 211.'READY '.208.'OS
'.211.'HOOTH '.212.'RACK '
       .BYTE 211.'READY
'.208.'OS'.140.193.'INING '
       .BYTE 204.'EAD
'.204.'EAD'.140
       .BYTE 194.'REATH '.195.'ON
'.194.'REATH '.195.'ON '
       .BYTE 194.'REATH '.195.'ON'.140
       .BYTE 212.'RIGGER '.211.'Q
'.212.'RIGGER '.211.'Q '
       .BYTE 212.'RIG '.208.'ULL'.153
INST07 =*
       .END
       .OPT  LIST
       .END
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      *=49152
      .OPT  NOL
      .LIB  MACROS-VARS
      .OPT  NOL
ENABLE =3200
DSABLE =3203
SCENE  =3221
CTRREG =16192
SCRCT1 =16193
SCRCT2 =16194
GUNDL  =16195
LETBUF =58789
      .WORD ESTART-16384,$FEBC
      .BYTE 195,194,205,56,48
PRGNUM .BYTE 0
;
;PROCEDURE SELSUB
; SELECTS SUBROUTINE ON CHOBK1
; BY POKING ADDRESS FROM BASIC
SELSUB LDA  #1
      STA  $DFFF
      JSR  32768
      LDA  #32
      STA  $DFFF
      RTS
      JMP  ARM     ;ARM PROG
      JMP  PRGSEL  ;PRGSEL
      JMP  LETERS
      JMP  LETHL
ESTART STX $D016
      JSR  $FDA3   ;IOINIT
      JSR  $FD50   ;RANTAS
      JSR  $FD15   ;RESTOR
      JSR  $FF5B   ;CINT
      CLI
      JSR  $E453   ;COPY VECTORS
      JSR  $E3BF   ;INIT
      ADDR $FD,57344
      ADDR STOP,LETBUF
      ADDR $A3,39515
      JSR  MOVEIT-16384
ARM   LDA  #0
      STA  53280
      STA  53281
      STA  $DFFF
      LDA  #43
      STA  53265
      ADDR $FD,49152
      ADDR STOP.FIN
      ADDR $A3,$8000
      JSR  MOVEIT-16384
      JMP  NEWLOC
NEWLOC LDA #234    ;DISABLE STOP
      STA  808     ; KEY
      LDA  #128    ;DISABLE CDR/
      STA  657     ; SHIFT KEYS
      LDA  #<16384 ;BASIC START
      STA  641     ;OS BOTTOM L
      LDA  #>16384
      STA  44      ;BASIC BOT H
      STA  642     ;OS BOTTOM H
      LDA  #<16385
      STA  43      ;BASIC BOT L
      ADDR 55,40960 ;BASIC TOP
      LDA  #0
      STA  PRGNUM
      STA  198
      STA  V+16
      STA  V+21
      LDX  #0
      JSR  PREPAR
      JSR  DSABLE
      LDA  #0
      STA  V+39
      STA  V+28
      STA  V+29
      STA  V+23
      LDA  #34
      STA  2040
      ADDR $FD,35154
      LDA  #0
      STA  $FB     ;CHIP #/BANK
      JSR  SCENE
      SEI
      ADDR $314,START
      ADDR $FB,FN16
      LDA  #40
      STA  SCRCT1
      LDA  #1
      STA  CTRREG
      LDA  #0
      STA  $A1
      STA  $A2
      CLI
      JMP  MVL020
PRGSEL LDX #CALIB-DATA
      JSR  PREPAR
MVL010 LDA #21     ;TEXT SCREEN
      STA  53272
      LDA  #27
      STA  53265
      LDA  #147    ;CLEAR SCREEN
      JSR  $FFD2
MVL020 LDA #32     ;RAM
      STA  $DFFF
      LDA  #0
      STA  198
      JSR  $A871
      JMP  $A7AE   ;RUN
PREPAR LDA DATA,X
      STA  101
      AND  #63
      STA  $DFFF
      INX
      LDA  DATA,X
      STA  $FD
      INX
      LDA  DATA,X
      STA  $FE
      INX
      LDA  DATA,X
      STA  STOP
      BIT  101
      BPL  PREP20
      STA  45
PREP20 INX
      LDA  DATA,X
      STA  STOP+1
      BIT  101
      BPL  PREP30
      STA  46
PREP30 INX
      LDA  DATA,X
      STA  $A3
      INX
      LDA  DATA,X
      STA  $A4
      INX
      JSR  MOVEIT
      BIT  101
      BVC  PREPAR
      RTS
MOVEIT LDY #0
MVL030 LDA (SA3),Y
      STA  ($FD),Y
      INC  $A3
      INC  $FD
      LDA  $FD
      CMP  STOP
      BNE  MVL030
      LDA  $FE
      CMP  STOP+1
      BNE  MVL030
      RTS
SECLET JSR GETIN
      CMP  #0
      BEQ  SECLET
      RTS
LETERS JSR LETSB1
      JSR  57344
      JSR  LETSB2
      RTS
LETHL LDY  LENSTR
LET010 LDA (SA3),Y
      STA  LETBUF,Y
      DEY
      CPY  #255
      BNE  LET010
      ADDR $A3,LETBUF
      JSR  LETSB1
      JSR  57347
      JSR  LETSB2
      RTS
LETSB1 JSR DSABLE
      SEI
      LDA  1
      AND  #253
      STA  1
      RTS
LETSB2 LDA 1
      ORA  #7
      STA  1
      JSR  ENABLE
      RTS
DATA  .BYTE 7      ;ARM.3200
      .WORD 3200,7996,32768
      .BYTE 2      ;ARM.SPRITES
      .WORD 2176,3200,39936
      .BYTE 4      ;ARM.BAS (1)
      .WORD 16384,24576,32768
      .BYTE 5      ;ARM.BAS (2)
      .WORD 24576,32768,32768
      .BYTE 198    ;ARM.BAS (3)
      .WORD 32768,37188,32768
CALIB .BYTE 193    ;CALIBRATION
      .WORD 16384,17213,40131
      .LIB  INTRO
;INTRO FOR ARM CARTRIDGE INTRO
START LDA  $A2
      AND  #3
      BNE  INL040
      ADDR $A3,1226
      LDX  #12
INL010 LDY #3
INL020 LDA ($A3),Y
      CLC
      ADC  #16
      STA  ($A3),Y
      DEY
      BPL  INL020
      LDA  $A3
      CLC
      ADC  #40
      STA  $A3
      LDA  $A4
      ADC  #0
      STA  $A4
      DEX
      BNE  INL010
INL040 LDA $A1
      AND  #2
      BEQ  INL070
      LDA  #15     ;GUN BANG
      STA  54296
      LDA  #10
      STA  54277
      LDA  #30
      STA  54273
      LDA  #128
      STA  54276
      LDA  #129
      STA  54276
      LDA  #15
      STA  V       ;X: SPRITE 0
      LDA  #208
      STA  V+1     ;Y: SPRITE 0
      LDA  #1
      STA  V+16    ;RIGHT X
      STA  V+21    ;SPRITE CTRRG
      LDA  #0
      STA  $A1
      LDA  CTRREG
      ORA  #8
      STA  CTRREG
      ADDR $A3,1334
      LDX  #9
INL050 LDY #6
      LDA  #17
INL060 STA ($A3),Y
      DEY
      BPL  INL060
      LDA  $A3
      CLC
      ADC  #40
      STA  $A3
      LDA  $A4
      ADC  #0
      STA  $A4
      DEX
      BNE  INL050
      LDA  #<13960
      STA  $FB
      LDA  #<13968
      STA  $C3
      LDA  #>13968
      STA  $FE
      STA  $C4
      LDA  #5
      STA  GUNDL
INL070 LDA CTRREG
      AND  #1
      BEQ  INL130
      LDA  $A2     ; SCROLL
      AND  #7
      BNE  INL130
      LDY  #0
```

```
INL080 LDA  15880,Y
       STA  15872,Y
       INY
       BNE  INL080
INL090 LDA  16136,Y
       STA  16128,Y
       INY
       CPY  #56
       BNE  INL090
       LDY  #7
INL100 LDA  (SFB),Y
       CMP  #254
       BEQ  INL110
       STA  16184,Y
       DEY
       BPL  INL100
       LDA  SFB
       CLC
       ADC  #8
       STA  SFB
       LDA  SFC
       ADC  #0
       STA  SFC
       JMP  INL130
INL110 LDA  #0
       STA  16184,Y
       DEY
       BPL  INL110
       DEC  SCRCT1
       BNE  INL130
       LDA  #3
       STA  SCRCT2
       EOR  CTRREG
       STA  CTRREG
       LDY  #39
       LDA  #33
INL120 STA  1984,Y
       DEY
       BPL  INL120
INL130 LDA  CTRREG
       AND  #2
       BEQ  INL150
       LDY  #232    ;BLINK
INL140 LDA  PTTB-1,Y
       STA  15919,Y
       DEY
       BNE  INL140
       LDA  #180
       STA  SCRCT1
       LDA  CTRREG
       EOR  #66
       STA  CTRREG
INL150 LDA  CTRREG
       AND  #8
       BEQ  INL170
       LDY  #0      ;KICK LEFT
       JSR  SPRUPD
INL160 LDA  ($C3),Y
       STA  ($FD),Y
       INY
       CPY  #240
       BNE  INL160
       LDA  $C3
       CLC
       ADC  #64
       STA  $C3
       LDA  $C4
       ADC  #1
       STA  $C4
       LDA  $FD
       CLC
       ADC  #64
       STA  $FD
       LDA  $FE
       ADC  #1
       STA  $FE
       DEC  GUNDL
       BNE  INL170
       LDA  #10
       STA  GUNDL
       LDA  CTRREG
       EOR  #24
       STA  CTRREG
INL170 LDA  CTRREG
       AND  #16
       BEQ  INL180
       JSR  SPRUPD
       DEC  GUNDL   ;GUN DELAY
       BNE  INL180
       LDA  CTRREG
       EOR  #48
       STA  CTRREG
       LDA  #5
       STA  GUNDL
       LDA  #<13952
       STA  $FD
       LDA  #>13960
       STA  $C3
       LDA  #>13960
       STA  $FE
       STA  $C4
INL180 LDA  CTRREG
       AND  #32
       BEQ  INL220
       LDY  #240    ;KICK RIGHT
       JSR  SPRUPD
INL190 LDA  ($FD),Y
       STA  ($C3),Y
       DEY
       CPY  #255
       BNE  INL190
       LDA  $C3
       CLC
       ADC  #64
       STA  $C3
       LDA  $C4
       ADC  #1
       STA  $C4
       LDA  $FD
       CLC
       ADC  #64
       STA  $FD
       LDA  $FE
       ADC  #1
       STA  $FE
       DEC  GUNDL
       BNE  INL220
       LDA  CTRREG
       AND  #223
       STA  CTRREG
       LDA  #0
       STA  V+21    ;SPRITE CTRRG
       ADDR $13.1334
       LDX  #9
INL200 LDY  #6
       LDA  #177
INL210 STA  ($13),Y
       DEY
       BPL  INL210
       LDA  $13
       CLC
       ADC  #40
       STA  $13
       LDA  $14
       ADC  #0
       STA  $14
       DEX
       BNE  INL200
INL220 LDA  CTRREG
       AND  #64
       BEQ  INL280
       DEC  SCRCT1  ;DELAY FSB
       BNE  INL280
       DEC  SCRCT2
       BNE  INL240
       LDA  CTRREG
       EOR  #55
       STA  CTRREG
       ADDR SFB,FN15
       LDY  #40
       STY  SCRCT1
       DEY
       LDA  #177
INL230 STA  1984,Y
       DEY
       BPL  INL230
       JMP  INL260
INL240 LDA  SCRCT2
       AND  #1
       BEQ  INL250
       LDA  CTRREG
       EOR  #66
       STA  CTRREG
       JMP  INL280
INL250 LDA  #50
       STA  SCRCT1
INL260 LDY  #247
       LDA  #0
INL270 STA  15912,Y
       DEY
       BNE  INL270
INL280 JMP  SEA31
SPRUPD INC  V       ;X: SPRITE 0
       INC  V
       INC  V
       RTS
FN15   .BYTE
126,96,96,120,96,96,96,0,0,0,60,102,10
2,102,60,0,0,0,124,102
       .BYTE
96,96,96,0,0,0,0,0,0,0,0,0,99,119,127,
107,99,99,99,0,0,0,60
       .BYTE
102,102,102,60,0,0,0,102,102,102,60,24
,0,0,24,0,56,24,24,60
       .BYTE
0,0,0,124,102,102,102,102,0,0,0,62,102
,102,62,6,124,0,0,0
       .BYTE
0,0,0,0,0,126,24,24,24,24,24,24,0,0,0,
60,6,62,102,62,0,0,0
       .BYTE
124,102,96,96,96,0,0,0,62,102,102,62,6
,124,0,0,0,60,102,126
       .BYTE
96,60,0,0,0,24,126,24,24,24,24,24,0,0,0,0
,0,0,0,0,0,126,24,24,24
       .BYTE
24,24,24,0,0,0,124,102,96,96,96,0,0,0,
,6,62,102,62,0,0,24
       .BYTE
0,56,24,24,60,0,0,0,124,102,102,102,10
0,0,24,0,56,24,24
       .BYTE
60,0,0,0,0,124,102,102,102,102,0,0,0,62
,102,62,6,124
       .BYTE
254,254,254,254,254,254,254,254
       .BYTE
0,102,60,255,60,102,0,0,0,102,60,255,
102,0,0,0,102
       .BYTE
60,255,60,102,0,0,0,0,0,0,0,0,0,0,0,124
2,102,124,96
       .BYTE
96,96,0,0,0,102,102,102,102,62,0,0,56,
,24,24,24,60
       .BYTE
0,0,56,24,24,24,24,60,0,0,0,0,0,0,0,0
0,24,126,24,24
       .BYTE
24,14,0,0,0,124,102,96,96,96,0,0,24,0,
,24,24,60,0,0
       .BYTE
0,62,102,102,62,6,124,0,0,62,102,102,
6,124,0,0,60
       .BYTE
102,126,96,60,0,0,0,124,102,96,96,96,
,0,0,0,0,0,0
       .BYTE
0,0,24,126,24,24,24,14,0,0,0,60,102,1
102,60,0,0,0
       .BYTE
0,0,0,0,0,0,96,96,124,102,102,124,0
0,60,102,126
       .BYTE
96,60,0,0,0,62,102,102,62,6,124,0,24,
6,24,24,60,0
       .BYTE
0,0,124,102,102,102,102,0,0,0,0,0,0,0
0,0,102,60,255
       .BYTE
60,102,0,0,0,102,60,255,60,102,0,0,0,
,60,255,60,102,0,0,0
       .END
FIN    =*
       .OPT  LIST
       .END
```

```
      *=57344
      .OPT  NOL
;F1 TOGGLE SIZE (1X, 2X)
;F2 SET CURSOR (X,Y NEXT 4 BYTES)
;F3 SPECIAL INSTRUCTIONS
;   BIT 0 SET:BLANK SCREEN
;   BIT 0 CLR:UNBLANK SCREEN
;   BIT 1 SET:ENTER TEXT MODE
;   BIT 1 CLR:ENTER GRAPHICS MODE
;   BIT 2 SET:SET UPPER CASE MODE
;   BIT 2 CLR:NO CHANGE
;   BIT 3 SET:SET LOWER CASE MODE
;   BIT 3 CLR:NO CHANGE
;F5 SCREEN COLOR (IN NEXT 2 BYTES)
;F6 BORDER COLOR (IN NEXT 2 BYTES)
;F7 CHARACTER COLOR (NEXT 2 BYTES)
;F8 RETURN
CODE1  =16376
CODE2  =16377
COLOR  =16378
FLAGS  =16379
HOLDA  =16380
HOLDY  =16382
LENSTR =16383
       .MAC  ADDR
       LDA   #<?2
       STA   ?1
       LDA   #>?2
       STA   ?1+1
       .END
       .MAC  DINC
       INC   ?1
       BNE   ?2
       INC   ?1+1
?2     .END
       JMP   LETERS
       JMP   LETHL
LETERS LDA   71
       STA   SFD
       LDA   72
       STA   SFE
       LDY   #0
       LDA   (SFD),Y  ;LENGTH OF
       BNE   LET010   ; STRING
       RTS
LET010 STA   LENSTR
       INY
       LDA   (SFD),Y  ;ADDRESS OF
       STA   $A3      ; STRING NOW
       INY            ; IN $A3 AND
       LDA   (SFD),Y  ; $A4
       STA   $A4      ; ---
LETHL  LDY   #0
       STY   FLAGS    ;CLEAR FLAGS
       LDA   53272    ;WHICH SET?
       AND   #2
       BEQ   LET020   ;SET 1
       LDA   #4       ;SET 2
       STA   FLAGS
LET020 LDA   1        ;SWITCH IN
       AND   #251     ; CHARACTER
       STA   1        ; ROM
LET030 LDA   #0
       STA   HOLDA
       LDA   214      ;LINE NUMBER
       STA   SFE      ;LINE*256
       ASL   A        ;LINE*2
       ASL   A        ;LINE*4
       ASL   A        ;LINE*8
       ASL   A        ;LINE*16
       BCC   LET040
       INC   HOLDA
LET040 ASL   HOLDA
       ASL   A        ;LINE*32
       BCC   LET050
       INC   HOLDA
LET050 ASL   HOLDA
       ASL   A        ;LINE*64
       BCC   LET060
       INC   SFE
LET060 STA   SFD      ;LINE*320
       LDA   HOLDA
       CLC
       ADC   SFE
       STA   SFE
       LDA   211      ;COLUMN
       ASL   A        ;COLUMN*2
       ASL   A        ;COLUMN*4
       ASL   A        ;COLUMN*8
       BCC   LET070
       INC   SFE
       CLC
LET070 ADC   SFD
       STA   SFD      ;L*320+C*8
       LDA   SFE
       ADC   #32      ;+8192
       STA   SFE
LET080 LDA   ($A3),Y
       STY   HOLDY
       CMP   #142     ;SET 1
       BNE   LET090
       LDA   FLAGS
       AND   #251
       STA   FLAGS
       JMP   LET690
LET090 CMP   #14      ;SET 2
       BNE   LET100
       LDA   FLAGS
       ORA   #4
       STA   FLAGS
       JMP   LET690
LET100 CMP   #133     ;F1-ENLARGE
       BNE   LET110   ;OR
       LDA   FLAGS    ;NORMAL
       EOR   #1
       STA   FLAGS
       JMP   LET690
LET110 CMP   #137     ;F2-CURSOR
       BNE   LET150
       JSR   BYTE2
       BCC   LET130
LET120 JMP   LET700
LET130 CMP   #40
       BCS   LET140
       STA   211      ;X
LET140 JSR   BYTE2
       BCS   LET120
       CMP   #25
       BCS   LET150
       STA   214
       LDY   #4
       STY   210
       ASL   A
       ASL   A
       ASL   A
       STA   HOLDA
       STA   209
MUL5   LDA   HOLDA
       CLC
       ADC   209
       STA   209
       LDA   210
       ADC   #0
       STA   210
       DEY
       BNE   MUL5
LET150 JMP   LET690
LET160 CMP   #134     ;F3-SPCINSTR
       BEQ   LET170
       JMP   LET310
LET170 JSR   BYTE2
       BCC   LET180
       JMP   LET700
LET180 LDA   1        ;VIC CHIP
       ORA   #4       ;BACK IN FOR
       STA   1        ;A SECOND
       LDA   HOLDA
       AND   #1
       BEQ   LET190
       LDA   53265    ;BLANK SCRN
       AND   #239
       STA   53265    ;SCREEN
       JMP   LET200
LET190 LDA   53265    ;UNBLANK
       ORA   #16      ;SCREEN
       STA   53265
LET200 LDA   HOLDA
       AND   #2
       BEQ   LET210
       LDA   53265    ;SET
       AND   #223     ;TEXT
       STA   53265    ;MODE
       LDA   53272
       AND   #247
       STA   53272
       JMP   LET220
LET210 LDA   53265    ;SET
       ORA   #32      ;BIT MAP
       STA   53265    ;MODE
       LDA   53272
       ORA   #8
       STA   53272
LET220 LDA   HOLDA
       AND   #4
       BEQ   LET230
       LDA   53272    ;SET UPPER
       AND   #253     ;CASE
       STA   53272
       LDA   FLAGS
       AND   #251
       STA   FLAGS
LET230 LDA   HOLDA
       AND   #8
       BEQ   LET240
       LDA   53272    ;SET LOWER
       ORA   #2       ;CASE
       STA   53272
       LDA   FLAGS
       ORA   #4
       STA   FLAGS
LET240 LDA   1        ;VIC CHIP
       AND   #251     ;OUT AGAIN
       STA   1
       LDA   HOLDA    ;CLEAR PART
       AND   #16      ; OF SCREEN?
       BEQ   LET290
       JSR   BYTE2
       CLC
       ADC   209
       STA   209
       LDA   210
       ADC   #0
       STA   210
       TXA
       TAY
       LDA   #<8192
       STA   SFD
       LDA   #>8192
       STA   SFE
       CPY   #0
       BEQ   LET260
       CPY   #25
       BCS   LET290
LET250 LDA   SFD
       CLC
       ADC   #<320
       STA   SFD
       LDA   SFE
       ADC   #>320
       STA   SFE
       DEY
       BNE   LET250
LET260 LDY   #0
       LDA   #0
LET270 STA   (SFD),Y
       INY
       BNE   LET270
       INC   SFE
LET280 STA   (SFD),Y
       INY
       CPY   #64
       BCC   LET280
       LDA   SFD
       CLC
       ADC   #64
       STA   SFD
       LDA   SFE
       ADC   #0
       STA   SFE
       CPX   #25
       BCS   LET290
       CPX   HOLDA
       BCC   LET260
       BEQ   LET260
LET290 JMP   LET690
LET300 JMP   LET700
       JMP   LET690
LET310 CMP   #18      ;REVERSE
       BNE   LET320   ;ON
       LDA   FLAGS
       ORA   #2
       STA   FLAGS
       JMP   LET690
LET320 CMP   #146     ;REVERSE
       BNE   LET330   ;OFF
       LDA   FLAGS
       AND   #253
       STA   FLAGS
       JMP   LET690
LET330 CMP   #138     ;F4-ARROWS
       BNE   LET360
       JSR   BYTE2
       BCC   LET350
LET340 JMP   LET700
LET350 SEC
       SBC   #1
       CMP   #8
       BCS   LET300
       LDX   HOLDA    ;START LINE
       JSR   BYTE2    ;LAST LINE
       BCS   LET300
       TXA
       TAY
       LDA   #<8192
       STA   SFD
       LDA   #>8192
       STA   SFE
       CPY   #0
       BEQ   LET260
       CPY   #25
       BCS   LET290
       CPX   HOLDA
       BCC   LET250
       BEQ   LET250
       JMP   LET690
```

```
      BC   LET340
      ASL  A
      ASL  A
      ASL  A
      CLC
      ADC  #<ARROWS
      STA  $FB
      LDA  #>ARROWS
      ADC  #0
      STA  $FC
      JMP  LET610
LET360 CMP  #135    ;F5-COLOR
      BNE  LET380
      JSR  BYTE2
      BCC  LET370
      JMP  LET700
LET370 LDA  #240
      STA  CODE1
      JSR  ADJSCR
      JMP  LET690
LET380 CMP  #139    ;F6-BORDER
      BNE  LET400   ;COLOR
      JSR  BYTE2
      BCC  LET390
      JMP  LET700
LET390 TAX
      LDA  1        ;SWITCH IN
      ORA  #4       ; VIC CHIP
      STA  1        ; A SECOND
      STX  53280    ;BORDER
      LDA  1        ;SWITCH OUT
      AND  #251     ; VIC CHIP
      STA  1        ; AGAIN
      JMP  LET690
LET400 CMP  #147    :CLEAR SCRN
      BNE  LET430
      LDA  #<8192
      STA  $FD
      LDA  #>8192
      STA  $FE
      LDY  #0
LET410 LDA  #0
      STA  ($FD),Y
      INC  $FD
      LDA  $FD
      CMP  #<16192
      BNE  LET410
      LDA  $FE
      CMP  #>16192
      BNE  LET410
LET420 LDA  #>1024
      STA  210
      LDA  #0
      STA  209
      STA  211
      STA  214
      JMP  LET690
LET430 CMP  #29     ;RIGHT ARROW
      BNE  LET440
      JSR  TLINE
      JMP  LET690
LET440 CMP  #17     ;DOWN ARROW
      BNE  LET450
      JSR  LET710
SKIP  JMP  LET690
LET450 CMP  #145    ;UP ARROW
      BNE  LET460
      LDA  FLAGS
      AND  #1
      STA  $FF
BIG1  LDA  214
      BEQ  SKIP
      DEC  214
      LDA  209
      SEC
      SBC  #40
      STA  209
      LDA  210
      SBC  #0
      STA  210
      DEC  $FF
      BEQ  BIG1
      JMP  LET690
LET460 CMP  #157    ;LEFT ARROW
      BNE  LET480
      LDA  FLAGS
      AND  #1
      STA  $FF
BIG2  LDA  211
      BNE  LET470
      LDA  214
      BEQ  SKIP
      DEC  214
      LDA  #40
      STA  211
      LDA  209
      SEC
      SBC  #40
      STA  209
      LDA  210
      SBC  #0
      STA  210
LET470 DEC  211
      DEC  $FF
      BEQ  BIG2
      JMP  LET690
LET480 CMP  #13
      BNE  LET500
LET490 LDA  #40
      STA  211
      JSR  TLINE
      JMP  LET690
LET500 CMP  #136    ;F7-CHAR COL
      BNE  LET520
      JSR  BYTE2
      BCC  LET510
      JMP  LET700
LET510 LDA  #15
      STA  CODE1
      LDA  HOLDA
      ASL  A
      ASL  A
      ASL  A
      ASL  A
      STA  HOLDA
      JSR  ADJSCR
      JMP  LET690
LET520 CMP  #140    ;F8-RETURN
      BEQ  LET490
      CMP  #19      :HOME
      BNE  LET530
      JMP  LET420
LET530 LDX  #0
LET540 LDA  SPCIAL.X
      BEQ  LET560
      CMP  (SA3),Y
      BEQ  LET550
      INX
      INX
      JMP  LET540
LET550 INX
      LDA  SPCIAL.X
      STA  $46
      JMP  LET690
LET560 LDA  (SA3),Y
      CMP  #96
      BCS  LET570
      AND  #191     ;X<96
      JMP  LET590
LET570 CMP  #161
      BCS  LET580
      AND  #223     ;96<X<161
      JMP  LET590
LET580 AND  #127     ;161<X<256
      ORA  #64
LET590 STA  $FB
      LDA  #0
      STA  $FC
      LDX  #3       ;*8
LET500 ASL  $FB
      ROL  $FC
      DEX
      BNE  LET600
      LDA  $FC
      CLC
      ADC  #$D0
      STA  $FC
      LDA  FLAGS    ;WHICH SET?
      AND  #4
      BEQ  LET610   ;SET 1
      LDA  $FC      ;SET 2
      CLC
      ADC  #8
      STA  $FC
LET610 LDA  209
      CLC
      ADC  211
      STA  $C3
      LDA  210
      ADC  #0
      STA  $C4
      LDX  #8
      LDA  $46
      ASL  A
      ASL  A
      ASL  A
      ASL  A
      STA  COLOR
LET620 LDY  #0
      LDA  ($FB),Y  :CHARS
      STA  HOLDA
      LDA  FLAGS
      BEQ  LET640
      AND  #1
      BEQ  LET630
      JSR  DOUBLE
LET630 LDA  FLAGS
      AND  #2
      BEQ  LET640
      LDA  HOLDA
      EOR  #255
      STA  HOLDA
      LDA  HOLDA+1
      EOR  #255
      STA  HOLDA+1
LET640 LDA  HOLDA
      STA  ($FD),Y  ;BIT MAP
      INX
      JMP  LET540
LET550 INX
      LDA  SPCIAL.X
      STA  $46
      JMP  LET690
LET560 LDA  ($A3),Y
      CMP  #96
      BCS  LET570
      AND  #191     ;X<96
      JMP  LET590
LET570 CMP  #161
      BCS  LET580
      AND  #223     ;96<X<161
      JMP  LET590
LET580 AND  #127     ;161<X<256
      ORA  #64
LET590 STA  $FB
      LDA  #0
      STA  $FC
      LDX  #3       ;*8
LET500 ASL  $FB
      ROL  $FC
      DEX
      BNE  LET600
      LDA  $FC
      CLC
      ADC  #$D0
      STA  $FC
      LDA  FLAGS    ;WHICH SET?
      AND  #4
      BEQ  LET610   ;SET 1
      LDA  $FC      ;SET 2
      CLC
      ADC  #8
      STA  $FC
LET610 LDA  209
      CLC
      ADC  211
      STA  $C3
      LDA  210
      ADC  #0
      STA  $C4
      LDX  #8
      LDA  $46
      ASL  A
      ASL  A
      ASL  A
      ASL  A
      STA  COLOR
LET620 LDY  #0
      LDA  ($FB),Y  :CHARS
      STA  HOLDA
      LDA  FLAGS
      BEQ  LET640
      AND  #1
      BEQ  LET630
      JSR  DOUBLE
LET630 LDA  FLAGS
      AND  #2
      BEQ  LET640
      LDA  HOLDA
      EOR  #255
      STA  HOLDA
      LDA  HOLDA+1
      EOR  #255
      STA  HOLDA+1
LET640 LDA  HOLDA
      STA  ($FD),Y  ;BIT MAP
      LDA  ($C3),Y  :COLOR
      AND  #15
      ORA  COLOR
      STA  ($C3),Y
      LDA  FLAGS
      AND  #1
      BEQ  LET650
      LDA  214
      CMP  #24
      BEQ  LET660
      INY
      LDA  HOLDA
      STA  ($FD),Y
      LDA  ($C3),Y  :COLOR
      AND  #15
      ORA  COLOR
      STA  ($C3),Y
      LDY  #40
      STA  ($C3),Y
      INY
      STA  ($C3),Y
      LDY  #8
      LDA  HOLDA+1
      STA  ($FD),Y
      INY
      STA  ($FD),Y
      INC  $FB
      INC  $FD
      INC  $FD
      DEX
      BNE  LET650
      INC  211
      DEC  $FE
      LDA  $FD
      SEC
      SBC  #64
      STA  $FD
      LDA  $FE
      SBC  #0
      STA  $FE
      JMP  LET680
LET650 CPX  #4
      BNE  LET670
      LDA  $FD
      CLC
      ADC  #56
      STA  $FD
      LDA  $FE
      ADC  #1
      STA  $FE
      JMP  LET620
LET660 INC  $FD     ;BIT MAP
      INC  $FB      ;CHARS
      DEX
      BEQ  LET680
LET670 JMP  LET620
LET680 JSR  TLINE
LET690 LDY  HOLDY
      INY
      DEC  LENSTR
      BEQ  LET700
      JMP  LET030
LET700 RTS
TLINE  INC  211
      LDA  211
      CMP  #40
      BCC  LET730
      LDA  #0
      STA  211
```

```
LET710 LDA   FLAGS
       AND   #1
       STA   SFF
LET720 LDA   214
       CMP   #24
       BEQ   LET730
       INC   214
       LDA   209
       CLC
       ADC   #40
       STA   209
       LDA   210
       ADC   #0
       STA   210
       DEC   SFF
       BEQ   LET720
LET730 RTS
ADJSCR LDY   #<1024
       STY   SFD
       LDY   #>1024
       STY   SFE
ADJ01  LDY   #0
       LDA   (SFD),Y
       AND   CODE1
       ORA   HOLDA
       STA   (SFD),Y
       DINC  SFD
       LDY   SFD
       CPY   #<2024
       BNE   ADJ01
       LDY   SFE
       CPY   #>2024
       BNE   ADJ01
       RTS
DOUBLE TXA
       PHA
       LDA   HOLDA
       LDX   #0
       STX   HOLDA
       STX   HOLDA+1
       TAX
       LDA   #128
       STA   CODE1
       LDA   #192
       STA   CODE2
DBL1   TXA
       AND   CODE1
       BEQ   DBL2
       LDA   CODE2
       ORA   HOLDA
       STA   HOLDA
DBL2   LSR   CODE1
       LSR   CODE2
       LSR   CODE2
       BNE   DBL1
       LDA   #192
       STA   CODE2
DBL3   TXA
       AND   CODE1
       BEQ   DBL4
       LDA   CODE2
       ORA   HOLDA+1
       STA   HOLDA+1
DBL4   LSR   CODE2
       LSR   CODE2
       LSR   CODE1
       BNE   DBL3
       PLA
       TAX
       RTS
BYTE2  JSR   UPDATE
       BCS   BYL20
       SEC
       SBC   #'0
       ASL   A
       STA   HOLDA
       LDY   #4
BYL10  CLC
       ADC   HOLDA
       DEY
       BNE   BYL10
       STA   HOLDA
       JSR   UPDATE
       BCS   BYL20
       SEC
       SBC   #'0
       CLC
       ADC   HOLDA
       STA   HOLDA
       CLC
BYL20  RTS
UPDATE LDY   HOLDY
       INY
       DEC   LENSTR
       BNE   UP10
       SEC
       RTS
UP10   LDA   (SA3),Y
       STY   HOLDY
       CLC
       RTS
       .OPT  NOL
SPCIAL .BYTE
144,0,5,1,28,2,159,3,156,4,30,5,31,6
       .BYTE
158,7,129,8,149,9,150,10,151,11,152,12
       .BYTE 153,13,154,14,155,15,0,0
ARROWS .BYTE
0,24,60,126,24,24,24,24,0,24,120,56,10
4,96,192,192
       .BYTE
0,4,6,255,255,6,4,0,0,192,192,96,104,5
6,120,24
       .BYTE
0,24,24,24,24,126,60,24,0,3,3,6,22,28,
30,24
       .BYTE
0,32,96,255,255,96,32,0,0,24,30,28,22,
6,3,3
       .OPT  LIST
       .END
```

```
10 POKE 808,237:V=53248:POKE 53281,0:POKE V+21,0:POKE V+38,0:POKE 
20 BS="  ":LS=0:NU=0:WI=0:I1=44152:I2=44496:RN=40:CH=3:C=2
30 DIM SD(3,36),H%(8),D1%(10,6),D2%(10,5),DS$(2,4),CR$(5),CR%(3),LV% 
40 DEF FNH(X)=INT(X/256):DEF FNL(X)=X-INT(X/256)*256
50 DEF FNW(X)=PEEK(X)+PEEK(X+1)*256:DEF FNZ(X)=INT((ABS(X)>0)*X)+.5
60 EN=3200:DS=3203:RT=3206:BANG=3212:WH=3215:SC=3221:SV=3224
70 CO=3227:HM=3230:MA=3233:TR=3239:GP=3242
80 FOR I=0 TO 10:LV%(I)=I:NEXT I:LV%(11)=-1
90 IF PEEK(56321)=127 THEN SYS DS:GOSUB 3350:GOTO 140
100 IF PEEK(56321)=247 THEN POKE 53280,0:SYS DS:GOTO 140
110 GET A$:IF A$="" THEN 90
120 BS=RIGHT$(BS,1)+A$:Z=-(BS="lp"):IF Z=0 THEN 90
130 SYS DS:POKE 53265,27:POKE 53272,23:PRINT"{CLR}"::POKE 49161,Z:SYS 49179
140 A$="{F3|09|F6|00|F5|00|F7|00|CLR}{LBLU}{F2|0500}{F1}The {RED}MACS Moving{F2|0102}Target Program{LBLU} will"
150 A$=A$+"{F2|0004}give instruction and{F2|0806}practice on:{F8}"
160 A$=A$+"{GRN}{F1}. {F1}How to lead moving  targets{F8}{F1}. {F1}A single lead rule{F8}"
170 A$=A$+"{F1}. {F1}Tracking targets{F8}{F1}. {F1}Trapping targets{F8}"
180 A$=A$+"{F1}. {F1}Engaging multiple{F8} targets{LGRN}{F3|00}":GOSUB 3000:A$=
190 FOR I=1 TO 10:FOR J=0 TO 6:READ D1%(I,J):NEXT J,I
200 FOR I=0 TO 2:FOR J=0 TO 4:READ DS$(I,J):NEXT J,I
210 FOR I=1 TO 5:READ CR$(I):NEXT I:GOSUB 3170
212 A$="{F3|09|F1}{CLR}{LBLU}{F2|0101}This program may be{F2|0003}fired with {G  scope{LBLU}{F2|0505"
213 A$=A$+"or {GRN}iron sights.{RED}{F2|0708}Are you using{F2|0610}the {GRN}telescope?{F3|08}"
214 GOSUB 3000:SB=15:GOSUB 5440:I=(PEEK(2774)=255):IF Z-I=0 THEN 220
215 FOR I=2752 TO 2815:Z=PEEK(I+384):POKE I+384,PEEK(I):POKE I,Z:NEXT I
220 A$="{F3|09|F5|00|F7|00|CLR}{GRN}{F2|0702}{F1}MOVING TARGET{F2|0404}TRAINING PROGRAM{LBLU}{F8}{F1}{F8}  .  Zeroing{F8}"
230 A$=A$+" .  Instruction and Demonstration{F8}{F8}{F2|0199}{GRN}Levels:{LBLU}{F8}":GOSUB3000:A$="{LGRN}"
240 POKE 253,1:POKE 254,10:POKE 823,0:SB=3:GOSUB 5430:GOSUB 3170
250 POKE 929,0:LS=0:CL=0:GOSUB 1000:LS=1:CL=LV%(LS):POKE 929,WI
260 GOSUB 3220:BC=BL:CL=LV%(LS):IF LS=0 THEN 250
270 ON CL GOSUB 1440,1440,2070,2070,2070,2070,2450,2630,2630,2630
280 IF LV%(LS)<>-1 THEN 260
290 A$="{F3|09|F6|05|CLR}{F5|05|F7|05|BLK}{F2|0502}{F1}CONGRATULATIONS{F8}{F8}  You are finished{F8}  with this "
300 A$=A$+"program.{F8}{F8}  Call instructor.{F1}{F2|0823}Pull trigger to continue{F3|00}"
310 GOSUB 3000:LS=0:POKE 198,0:RESTORE:GOTO 90
1000 H%(0)=0:S1=32768:S2=3:TA=5:ME=0:POKE 940,160:POKE 942,100
1010 A$="{F3|09|F6|00|F5|13|F7|00|CLR}{BLK}{F1}{F2|0701}First 3 shots{F2|0503}establish zero."
1020 A$=A$+"{F2|0105}Aim center of mass.{F2|0517}White dot shows{F2|1319}center.":GOSUB3000
1030 POKE 880,3:SB=24:GOSUB 5430:FOR Z=12196 TO 12199:POKE Z,15:NEXT Z
1040 POKE 1524,1:A$="{F2|0723}<Pull trigger to continue>{F3|00}":GOSUB 3000
1050 IF PEEK(56321)=247 THEN 1080
1060 GET A$:IF A$<>"@" THEN 1050
1070 TN=-1
1080 GOSUB 3200:IF WI=0 THEN 1110
1090 A$="{F3|09|F5|00|F7|00|F1}{GRN}{F2|0904}There is no{F2|0607}wind while you{F2|0410}are establishing"
1100 A$=A$+"{F2|0913}shot group.{LGRN}{F1}":GOSUB 3160
1110 BC=0:POKE 899,42:POKE 883,60:POKE 838,0:FOR Z=834 TO 837:POKE Z,0:NEXT Z
1120 OX=0:OY=0:POKE 838,0:POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180
1130 POKE 823,0:POKE 824,0:POKE 821,17:POKE 822,0:SB=9:GOSUB5430:GOSUB 3200:S=0
1140 IF (S<>0) AND (S<>3) THEN 1180
1150 FOR Z=0 TO 3:SD(Z,36)=0:NEXT Z:PS=INT(S/3)
1160 A$="{F3|09|CLR}{F6|00|F5|00|F1}{WHT}{F2|1209}ASSUME A{F2|1112}SUPPORTED{F2|1215}POSITION{F1}"
1170 GOSUB 3160:GOSUB 3010
1180 POKE 876,0:POKE 877,204:X=((INT(RND(1)*75))*2)+71:IF TN THEN X=165
1190 POKE 52225,X:GOSUB 3200:POKE 933,0
1200 Z=-20352:SB=0:GOSUB 5440:POKE V+21,0:IF Z=128 THEN 1180
1210 N=FNW(907):N=N+(N>128)*(N-128):GOSUB 3020
1220 IF S>2 THEN 1250
1230 X1=(X+11)-FNW(847):Y1=165-FNW(849):OX=OX+X1:OY=OY+Y1:SD(1,S)=Z
1240 IF (X1)-73) OR (X1(-148) OR (Y1)-17) OR (Y1(-47) THEN BC=1
1250 SD(0,36)=SD(0,36)+SD(0,S):SD(2,36)=SD(2,36)+SD(2,S)
1260 GOSUB 3200:IF S<>2 THEN 1410
1270 BC=0:IF BC=0 THEN 1330
1280 A$="{F3|09|CLR}{RED}{F5|00|F7|00|F1}{F2|0204}Invalid shot group{F2|1107}try again":IF H%(0)=0 THEN1300
1290 A$=A$+"{F2|0310}or check lightpen{F2|0513}mount alignment{F2|0816}(see manual)"
1300 A$=A$+"{F1}{LGRN}":H%(0)=1:GOSUB 3170
1310 IF BR THEN Z=1:GOTO 130
1320 GOTO 1110
1330 OX=INT((OX/3)+1):OX=INT(OX/2)*2:X=OX-(OX<0)*65536
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1340 OY=INT((OY/3)+0.5):Y=OY-(OY<0)*65536
1350 POKE 834,FNL(X):POKE 835,FNH(X):POKE 836,FNL(Y):POKE 837,FNH(Y)
1360 SD(1,0)=SD(1,0):SYS 3236:FOR Z=0 TO 2:SD(1,36)=SD(1,36)+SD(1,Z)
1370 SD(3,36)=SD(3,36)+SD(3,Z):NEXT Z:Z=I1:GOSUB 4740:IF CRS=CRS(5) THEN 1410
1380 A$="{F3|05|CLR||F5|00|F7|00|F1||WHT|shot group"+CR$+"{SWLC||LBLU||F2|0304Would you like to{F2|1107try for a"
1390 A$=A$+"{F2|0810better zero?{F3|08"
1400 GOSUB 3000:SB=15:GOSUB 5440:POKE 53265,43:IF Z THEN 1110
1410 S=S+1:IF S<3 THEN 1140
1420 SB=0:GOSUB 5460
1430 RETURN
1440 IF CL=2 THEN 1490
1450 Z=0:SB=3:GOSUB 5470:SB=6:Z=1:GOSUB 5470
1460 A$="{F3|09|CLR||F5|00|F7|00|F1||GRN||F2|0203Use the non-firing"
1470 A$=A$+"{F2|0406hand as a pivot.{F2|0209Smoothly track the{F2|0412target by moving"
1480 A$=A$+"{F2|0415your upper body.{F1||LGRN|":GOSUB 3170:GOTO 1500
1490 Z=1:SB=3:GOSUB 5470:SB=6:Z=2:GOSUB 5470
1500 A$="{F3|09|CLR||F1||GRN||F2|100110 targets{F2|0105Feedback after each{F2|1507shot.{F2|1111Standard:"
1510 IF CL=2 THEN 1540
1520 A$=A$+"{F2|0413Smooth track and{F2|0615proper lead on{F2|06173 of 5 targets"
1530 GOTO 1550
1540 A$=A$+"{F2|0313Apply proper trap{F2|07151ead for 3 of{F2|11175 targets"
1550 A$=A$+"{F2|0219in each direction.{F1|":GOSUB 3160:TN=8:TA=18
1560 POKE 53265,43:POKE 876,0:POKE 877,204:POKE 883,200:POKE 838,0
1570 AD=16325:FOR I=0 TO 4:POKE AD,4:AD=AD+1:NEXT I
1580 FOR I=0 TO 4:POKE AD,16:AD=AD+1:NEXT I
1590 POKE AD,255:POKE 823,18:POKE 824,0:POKE 821,0:SB=6:GOSUB 5430
1600 POKE 899,42:MV=-1:S1=32768:S2=3:IR=-32640:GOSUB 5360:GOSUB 5370
1610 H=0:RP=0:GOSUB 3070:POKE 53280,0:Z=0
1620 S=PEEK(838):POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180:POKE 900,255
1630 GOSUB 3010:A$="L="+STR$(CL)+"]T="+STR$(S+1)+"]R="+STR$(RP)
1640 GOSUB 5230:AD=FNW(876):PO=6:TF=PEEK(AD+9)*2
1650 IF PEEK(AD+8)>127 THEN TF=-TF:PO=-PO
1660 Y=PEEK(AD+2):TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:POKE I2+/+S*8,RP
1670 GOSUB 4020:POKE 933,128
1680 Z=IR:SB=0:GOSUB 5440:POKE 878,0:IF Z=128 THEN POKE V+21,0:GOTO 2060
1690 IF PEEK(900)=255 THEN SYS WH:GOTO 1810
1700 A$="miss":IF PEEK(900)<128 THEN A$="hit"
1710 A$="{F2|0123{F1||BLK|   "D$(1'2)+A$:GOSUB 3000
1720 GOSUB 4040:IF Z=128 TH
1730 IF (CR%(0)>3) AND (ME=CL) THEN H=H+1
1740 IF (CR%(1)>3) AND (ME=CL) THEN H=H+16
1750 IF ME=CL THEN 1820
1760 B$="tracked":IF ME=2 THEN B$="trapped"
1770 A$="{F3|09|CLR||F5|00|F7|00|F1||F2|0204|GRN|On the last target{F2|0007you |RED|"+B$+"|GRN|.  Try to{F2|0210|RED|"
1780 B$="{C/RT|trap":IF ME=2 THEN B$="track"
1790 A$=A$+B$+"|GRN| every target{F2|0013for the rest of this"
1800 A$=A$+"{F2|0216practice exercise.{F1|":GOSUB 3160
1810 POKE 838,S:Z=FNW(876)-17:POKE 876,FNL(Z):POKE 877,FNH(Z):GOTO 1620
1820 S=S+1:POKE 838,S:IF S/5<>INT(S/5) THEN 1620
1830 N=5:Z=I1+H%(1)*8:Z4=1:GOSUB 4500
1840 A$="{F3|09|P6|00|F5|00|F7|00|CLR||LBLU||SWLC||F1||F2|1303Summary"+"|GRN||F2|0306Standard: Good or"
1850 IF CL=2 THEN 1890
1860 A$=A$+"{F2|0108Excellent Track and{F2|0610lead on 3 of 5"
1870 A$=A$+"{F2|1212targets.{F2|0915Your Score:{F2|0017Smooth Track:"
1880 A$=A$+STR$(H AND 15)+" of 5{F2|0819Lead:"+STR$(INT(H/16))+" of 5{F1||LGRN|":GOTO 1910
1890 A$=A$+"{F2|0308Excellent lead on{F2|05103 of 5 targets.{F2|0913Your Score:{F2|1215"
1900 A$=A$+STR$(INT(H/16))+" of 5{F1||LGRN|"
1910 GOSUB 3170
1920 IF (((H AND 15)>2) OR (CL=2)) AND (INT(H/16)>2) THEN 2050
1930 GOSUB 3090:A$="{F3|09|F6|00|F5|00|F7|00|CLR||RED||SWLC||F1||F2|0407You did not meet{F2|0710the standard."
1940 A$=A$+"{F2|0213Prepare to refire.{F1||LGRN|":GOSUB 3170:BC=2
1950 IR=-31616:RP=RP+1:A$="{F3|09|F6|00|F5|00|F7|00|CLR||GRN||SWLC||F1|"
1960 IF CL<>1 THEN 2010
1970 A$=A$+"{F2|0102For a smooth track,{F2|0204move your rifle at"
1980 A$=A$+"{F2|0306the same speed as{F2|0208the target, trying"
1990 A$=A$+"{F2|0010to keep the trailing{F2|0412tip of the front"
2000 A$=A$+"{F2|0014sight post at target{F2|0516center of mass.{F1|":GOTO 2040
2010 A$=A$+"{F2|0202To |RED|trap|GRN|, aim ahead{F2|0105and wait for target"
2020 A$=A$+"{F2|0008center mass to reach{F2|0111the nearest edge of"
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2030 A$=A$+"|F2|0514the front sight|F2|1517post.|F1|"
2040 H=0:GOSUB 3160:GOTO 1620
2050 IR=-32640:BC=BL:TA=TA+1:IF S<10 THEN 1610
2060 LS=LS-(Z<>128):RETURN
2070 IF CL<>3 THEN 2110
2080 Z=3:SB=6:GOSUB 5470:A$="|F3|09|CLR||F5|00|F7|00|F1||F8||F8||GRN|You may either track"
2090 A$=A$+"or trap targets, but|C/RT|in harder exercises|F8|many shooters find a"
2100 A$=A$+"  |C/RT|mixture of both|F8||C/RT|methods works best.|F1||LGRN|":GOSUB 3170
2110 A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|100118 targets|F2|0105Feedback after each|F2|1607shot"
2120 A$=A$+"|F2|1111Standard:|F2|0213Hit 2 of 3 targets|F2|0715at each speed"
2130 A$=A$+"|F2|0717and direction|F1|":GOSUB 3160
2140 TN=CL+4:POKE 53265,43:POKE 876,0:POKE 877,204:POKE 883,200:POKE 838,0
2150 AD=16325:Z=(CL-3)*3:FOR I=0 TO 5
2160 FOR J=0 TO 2:POKE AD,Z+INT(I/2)+((I/2)-INT(I/2))*24:AD=AD+1:NEXT J,I
2170 POKE AD,255:POKE 823,18:POKE 824,0:POKE 821,0:SB=6:GOSUB 5430:POKE 899,42
2180 MV=-1:S1=32768:S2=3:IR=-32640:TA=(CL-2)*8-1:GOSUB 5360:GOSUB 5370
2190 FOR Z=0 TO 4:D2%(Z,0)=0:D2%(Z,1)=0:NEXT Z
2200 H=0:TA=TA+1:RP=0:GOSUB 3070:POKE 53280,0:Z=0:IF TA>(CL-1)*8-3 THEN 2440
2210 FOR Z=0 TO 4:D2%(Z,2)=0:D2%(Z,3)=0:NEXT Z
2220 POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180:POKE 900,255
2230 S=PEEK(838):GOSUB 3010:A$="L="+STR$(CL)+"]T="+STR$(S+1)+"|R="+STR$(RP)
2240 GOSUB 5230:AD=FNW(876)
2250 PO=6:TF=PEEK(AD+9)*2:IF TA>=36 THEN PO=TF:REM 185M 6 MPH
2260 IF PEEK(AD+8)>127 THEN TF=-TF:PO=-PO
2270 Y=PEEK(AD+2):TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:POKE I2+7+S*8,RP
2280 GOSUB 4020:POKE 933,128
2290 Z=IR:SB=0:GOSUB 5440:POKE 878,0
2295 IF Z=128 THEN POKE V+21,0:GOSUB 4845:GOTO 2440
2300 IF PEEK(900)=255 THEN SYS WH:GOTO 2370
2310 A$="miss":IF PEEK(900)<128 THEN A$="hit"
2320 A$="|F2|0123|F1||BLK|"+CHR$(142)+A$:GOSUB 3000
2330 IF PEEK(900)=255 THEN POKE 907,PEEK(829):POKE 908,PEEK(830)
2340 IF PEEK(900)<128 THEN H=H+1
2350 GOSUB 4040:FOR I=0 TO 3:D2%(I,1+ME)=D2%(I,1+ME)+CR%(I):NEXT I
2360 D2%(4,1+ME)=D2%(4,1+ME)+1:IF Z=128 THEN GOSUB 4845:GOTO 2440
2370 S=S+1:POKE 838,S:IF S/3<>INT(S/3) THEN 2220
2380 M=3:Z=I1+H%(1)*8:Z4=1:GOSUB 4500
2390 IF H>1 THEN 2420
2400 GOSUB 3090:IR=-31616:RP=RP+1:H=0:AD=I1+PEEK(838)*8
2410 FOR Z=0 TO 2:POKE AD,255:AD=AD+8:NEXT Z:GOSUB 5210:GOTO 2210
2420 GOSUB 4845:IR=-32640:BC=BL:GOTO 2200
2440 A=Z:GOSUB 4850:LS=LS-(A<>128):RETURN
2450 Z=3:SB=6:GOSUB 5470:A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|040336 timed targets|F2|1007Replay for"
2460 A$=A$+"|F2|0909misses only|F2|1113Standard:|F2|0115Hit 8/12 stationary"
2470 A$=A$+"|F2|0417Hit 16/24 moving|F1|":GOSUB 3160:RP=0
2480 POKE 53265,43:GOSUB 5370:B=0:E=35:Z=B*256+E:SB=21:GOSUB 5440
2490 IR=(CH=0)*32640+(CH=1)*30592+(CH=2)*28544+(CH=3)*32640
2500 FOR Z=B TO E:Z1=PEEK(16325+Z):IF Z1>29 THEN POKE 16325+Z,Z1-6
2510 NEXT Z:POKE 821,0:POKE 823,18:POKE 824,0:SB=6:GOSUB 5430:S1=37445
2520 S2=3:GOSUB 5360:FOR Z=1 TO 10:FOR Z1=0 TO 2:D2%(Z,Z1)=0:NEXT Z1,Z
2530 I=0:POKE 876,0:POKE 877,204:POKE 883,200:POKE 933,128:Z=32
2540 I=I+1:IF I>36 THEN F=-1:GOTO 2590
2550 IF Z=32 THEN GOSUB 3010
2560 GOSUB 4580:POKE V+21,0:IF Z=128 THEN 2590
2570 IF Z=64 THEN SYS WH
2580 GOTO 2540
2590 A=-2*(Z=128):POKE 53265,43:N=PEEK(838):IF N=0 THEN 2610
2600 POKE 838,36:A$="|P6|00|CLR||F5|00|F7|00|LBLU||SWLC||F2|1201Summary: Level 7":GOSUB 5000
2610 IF A=0 THEN GOSUB 5210:RP=RP+1:GOTO 2480
2620 LS=LS+(A AND 1):RETURN
2630 IF CL<>9 THEN 2670
2640 A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|100340 targets|F2|110740 rounds"
2650 A$=A$+"|F2|1111Standard:|F2|0013Hit 10/14 stationary|F2|0415Hit 20/26 moving|F1|"
2660 GOTO 2690
2670 A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|100330 targets|F2|0907"+STR$(RN)+" rounds"
2680 A$=A$+"|F2|1111Standard:|F2|0113Hit 7/10 stationary|F2|0415Hit 15/20 moving|F1|"
2690 GOSUB 3160:RP=0:Z=RN+(CL=9)*(RN-40):POKE 899,Z
2700 POKE 53265,43:GOSUB 5360:GOSUB5370
2710 IF CH=3 THEN IR=-(CL=8)*2688-(CL>8)*4736:GOTO 2730
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2720 IR=-(CH=0)*640-(CH=1)*2688-(CH=2)*4736
2730 Z=-(CL=8)*634-(CL=9)*1198-(CL=10)*2011:POKE 823,FNL(Z):POKE 824,FNH(Z)
2740 Z=-(CL=8)*1198-(CL=9)*2011-(CL=10)*2574:POKE 821,FNL(Z):POKE 822,FNH(Z)
2750 SB=9:GOSUB 5430:S1=38042:S2=7:POKE 933,128:POKE 876,0:POKE 877,204
2760 POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180
2770 POKE 838,0:POKE 883,60:POKE 934,0:POKE 935,0
2780 GOSUB 3010:A$="L="+RIGHT$(STR$(CL),2)+"]T=   ]R="+STR$(RP):GOSUB 5230
2790 Z=IR:SB=0:GOSUB 5440:POKE V+21,0:A=-2*(Z=128)
2800 POKE 53265,43:N=PEEK(838):IF N=0 THEN 2820
2810 A$="{F6}{00}{CLR}{F5}{00}{F7}{00}{LBLU}{SWLC}{F2}{20}Summary: Level"+STR$(CL):GOSUB 5000
2820 IF A=0 THEN GOSUB 5210:RP=RP+1:GOTO 2700
2830 LS=LS+(A AND 1):RETURN
3000 A$=A$:SYS 49182:RETURN
3010 POKE 253,FNL(S1):POKE 254,FNH(S1):POKE 251,S2:SYS SC:RETURN
3020 SD(0,S)=-1:IF N>6 THEN SD(0,S)=(N-45)*256+(N-7):IF N<45 THEN SD(0,S)=N-7
3030 SD(1,S)=SD(0,S)
3040 SD(2,S)=-1:IF N>5 THEN SD(2,S)=(N-6)*256+(N-1)
3050 POKE 785,FNL(MA):POKE 786,FNH(MA):Z=USR(S)
3060 RETURN
3070 H%(1)=PEEK(838):H%(2)=PEEK(876):H%(3)=PEEK(877):H%(4)=PEEK(889)
3080 H%(5)=PEEK(890):H%(6)=PEEK(891):H%(7)=PEEK(892):H%(8)=PEEK(899):RETURN
3090 POKE 838,H%(1):POKE 876,H%(2):POKE 877,H%(3):POKE 889,H%(4)
3100 POKE 890,H%(5):POKE 891,H%(6):POKE 892,H%(7):POKE 899,H%(8):RETURN
3110 Z4=-(TA>6)*(INT(TA/2)-INT(TA/8)-2):Z5=J-(J>0)-((J=0) AND (ME<>1))
3120 Z=INT(SD(J,S)+.5):POKE 823,Z4:POKE 824,Z5:SB=27:GOSUB 5440
3130 CR$=CR$(Z):CR%(J)=Z:IF (CL<>0) OR (NU=0) THEN RETURN
3140 B$=STR$(39-LEN(STR$(SD(J,S)))):B$=RIGHT$(B$,2)
3150 CR$="{F1}{F2}2499"+MID$(CR$,6,10)+"{F8}{F2}"+B$+"99"+STR$(SD(J,S))+"{F8}{F1}":RETURN
3160 A$=A$+"{RED}{F2}0723<Pull trigger for targets>{F3}00":GOSUB 3000:GOTO 3180
3170 A$=A$+"{F2}0723<Pull trigger to continue>{F3}00":GOSUB 3000
3180 BR=RND(1):BR=0:IF PEEK(56321)=127 THEN BR=-1:GOTO 3200
3190 IF PEEK(56321)<>247 THEN 3180
3200 IF PEEK(56321)<>255 THEN 3200
3210 RETURN
3220 CL=LV%(LS):A$="{F3}09{F6}00{CLR}{F5}00{F7}00{F1}{LBLU}{F2}1505LEVEL{F2}1709":B$=STR$(CL):Z=CL+(CL=10)*10
3230 IF CL=10 THEN B$="C/RT"10"
3240 A$=A$+B$+"{GRN}{F2}0014":GOSUB 3000:POKE 823,CL:SB=3:GOSUB 5430
3250 IF CL<3 THEN A$="":GOTO 3300
3260 IF CL<7 THEN 3290
3270 A$="{F2}0117Moving & stationary targets presented"
3280 A$=A$+"{F2}0418at random from 50 to 300 meters":GOTO 3300
3290 A$="{F2}0617Slow, medium & fast targets{F2}1118from left & right"
3300 A$=A$+"{LGRN}{F2}0723<Pull trigger to continue>{F3}00":GOSUB 3000
3310 IF PEEK(56321)=247 THEN RETURN
3320 IF PEEK(56321)<>127 THEN 3310
3330 GOSUB 3350:IF LS=0 THEN RETURN
3340 GOTO 3220
3350 POKE 53265,43:POKE 53272,31:POKE 198,0:A$="{F6}{00}{F5}{00}{F7}{00}{CLR}{GRN}Level order:"
3360 A$=A$+"{GRY1}{F2}3299ARI9112{GRN}{F8}":FOR Z=1 TO 10:A$=A$+CHR$(30+(Z=LS)*2)
3370 B$="":IF LV%(Z)<>-1 THEN B$=STR$(LV%(Z))
3380 A$=A$+B$:NEXT Z
3390 REM A$=A$+"{F8}{GRN}Wind speed: ":IF (WI AND 16) THEN A$=A$+" Variable"::GOTO3420
3400 REM A$=A$+STR$((WI AND 7)*5)+" MPH ":IF ((WI AND 7)=0) THEN 3420
3410 REM B$=STR$(INT(WI/32)+1):B$="0"+RIGHT$(B$,1):A$=A$+"{F4}"+B$
3420 A$=A$+"{BLK}{F8}{F8}":GOSUB 3000:POKE 253,1:POKE 254,10:POKE 823,0:SB=3:GOSUB 5430
3430 A$="{F8}{LBLU} D: View Moving Target Demo{F8} L: Change Level Order{F8}"
3440 A$=A$+" N: New firer{F8}":REM" W: Set Wind Speed{F8}"
3450 A$=A$+CHR$(158+(CH=3)*4):A$=A$+" C: Set Crosshair status for Levels 7-10{LBLU}"
3460 A$=A$+"LP: Light Pen Mount Adjustment{F8}{F8}"
3470 IF NU THEN A$=A$+"{GRN}(Pretest diagnostic scores are numeric){F8}"
3480 B$="number or letter":IF LS=0 THEN B$="letter"
3490 A$=A$+"{F2}0023{RED}Select "+B$+" & press RETURN{LBLU}{F8}{F3}00":GOSUB 3000
3500 A$="":GOSUB 5270:Z=INT(VAL(A$))
3510 I=1:IF (Z<1) OR (Z>10) OR (LS=0) THEN 3570
3520 IF LV%(I)<>Z THEN I=I+1:IF I<11 THEN 3520
3530 IF I<11 THEN LS=I:BL=0:RETURN
3540 POKE 53265,59:POKE 823,2:POKE 824,23:POKE 253,0:SYS CO
3550 A$="{F2}0010The level you choose must be in the{F8}current sequence.{F8}{F8}"
3560 A$=A$+"Press RETURN to continue":GOSUB 5270:GOTO 3350
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3570 IF A$="D" THEN GOSUB 1420:RETURN
3580 IF A$="NU" THEN NU=NOT(NU):GOTO 3350
3590 IF A$="N" THEN LS=0:RETURN
3600 IF A$<>"L" THEN 3760
3610 I=1:A$="{F3|09|CLR|{GRN|Choose level order:{F8|{F8|Type a number (1-10) for the desired{F8|"
3620 A$=A$+"level, in the desired order of{F8|presentation.  Type 0 and press{F8|"
3630 A$=A$+"RETURN when done.{F8|{F8|{F3|00{LBLU|"
3640 FOR Z=1 TO 10:Z$=STR$(Z):IF Z<10 THEN Z$=" "+Z$
3650 A$=A$+Z$+": "+"{F8|":NEXT Z:GOSUB3000
3660 Z$=STR$(I+6):Z$=RIGHT$(Z$,LEN(Z$)-1):IF I<4 THEN Z$="0"+CHR$(I+54)
3670 A$="{BLUE|{F2|04"+Z$:GOSUB 5270:IF (Z<0) OR (Z>10) THEN 3660
3680 A$="{LBLU|{F2|04"+Z$+"      {F2|0599"+STR$(Z):GOSUB 3000
3690 IF Z>0 THEN 3720
3700 IF I=1 THEN 3350
3710 FOR Z=I TO 10:LV%(Z)=-1:NEXT Z:GOTO 3730
3720 LV%(I)=Z:I=I+1:IF I<11 THEN 3660
3730 A$="{GRN|{F2|0018Is everything correct (type Y or N and{F8|press RETURN!"
3740 GOSUB 5270:IF A$<>"Y" THEN 3610
3750 LS=-(LS>0):GOTO 3350
3760 GOTO 3880:IF A$<>"W" THEN 3880
3770 A$="{F3|09|CLR|Wind Effects:{F8|{F8|Type a number (1-3) for wind speed:{F8|{F8|"
3780 A$=A$+" 1:  0 MPH{F8|{F8| 2: 10 MPH{F8|{F8| 3: 20 MPH{F8|{F8|{F3|00":GOSUB 3000
3790 A$="":GOSUB 5270:IF (Z<1) OR (Z>3) THEN 3790
3800 WI=(Z-1)*2:IF WI=6 THEN WI=16:GOTO 3350
3810 IF WI=0 THEN 3350
3820 A$="{F3|09|CLR|Wind Effects:{F8|{F8|Type a number (1-8) for wind direction:{F8|{F8|"
3830 A$=A$+" 1: {F4|01 (No value){F8|{F8| 2: {F4|02 (Half value){F8|{F8| 3: {F4|03 (Full value){F8|{F8|"
3840 A$=A$+" 4: {F4|04 (Half value){F8|{F8| 5: {F4|05 (No value){F8|{F8| 6: {F4|06 (Half value){F8|{F8|"
3850 A$=A$+" 7: {F4|07 (Full value){F8|{F8| 8: {F4|08 (Half value){F8|{F8|{F3|00":GOSUB 3000
3860 A$="":GOSUB 5270:IF (Z<1) OR (Z>8) THEN 3860
3870 WI=WI+((Z-1)*32):GOTO 3350
3880 IF A$<>"C" THEN 3990
3890 A$="{F3|09|CLR|Set Crosshair status for Levels 7-10:{F8|{F8|"
3900 A$=A$+CHR$(158+(CH<>0)*4)+" 1: Crosshair appears after each shot.{F8|{LBLU|"
3910 A$=A$+CHR$(158+(CH<>1)*4)+" 2: Crosshair appears only when target{F8|"
3920 A$=A$+"    is missed.{F8|{LBLU|"
3930 A$=A$+CHR$(158+(CH<>2)*4)+" 3: No Crosshair on Levels 7-10.{LBLU|{F8|":GOSUB 3000
3940 A$=CHR$(158+(CH<>3)*4)+" 4: Level 7:  Crosshair after each shot."
3950 A$=A$+"    Level 8:  Crosshair for misses only."
3960 A$=A$+"    Levels 9 & 10: No crosshair.{F8|{F8|{LBLU|{F3|00":GOSUB 3000
3970 A$="Type the number (1-4) of your choice":GOSUB 5270
3975 IF (Z<1) OR (Z>4) THEN 3970
3980 CH=Z-1:GOTO 3350
3990 Z=-(A$="LP"):IF Z>0 THEN 130
4000 GOTO 3500
4010 REM SETUP FOR REPLAY: CALL ONCE BEFORE ANY TARGETS PRESENTED
4020 POKE 2041,43:POKE 2042,43:POKE V+23,6:POKE V+29,6
4030 POKE V+40,1:POKE V+41,0:RETURN
4040 N=PNW(907):N=N+(N>128)*(N-128):Z=(N-30)*256+(N-1):IF N<30 THEN Z=N
4050 ME=0:IF TN>6 THEN POKE 785,PNL(TK):POKE 786,PNH(TK):ME=USR(Z)
4060 POKE 939,ME:IF PEEK(900)=255 THEN ME=-ME
4070 GOSUB 3020:HI=PEEK(900)<128
4080 J=0:GOSUB 3110:A$="{F3|05|CLR|{F5|00|F1|"+DS$(ME,0)+CR$:Z$=MID$(CR$,6,1)
4090 J=1:GOSUB 3110:A$=A$+DS$(ME,1):Z1$=CR$
4100 CR$="{F2|3099"+Z$+"check":IF CR%(0)>2 THEN CR$="{F2|3699"+Z$+"ok"
4110 B$=DS$(ME,2)+CR$
4120 J=2:GOSUB 3110:B$=B$+DS$(ME,3)+CR$:GOSUB 3200
4130 J=3:GOSUB 3110:TG=TG+Z:IF HI=0 THEN CR$="{F2|3299|RED|miss":TG=TG-Z
4140 IF (CR%(0)>3)AND(CR%(1)>3)AND(HI=0) THEN Z1$=CR$(3):CR%(1)=3
4150 CR$="{F3|160809{F1|{F2|0008"+DS$(ME,4)+CR$:A$=A$+Z1$+B$
4160 IF ME<>2 THEN 4200
4170 Z=6+(TA>=36)*(6-ABS(TF)):IF TF<0 THEN Z=-Z
4180 Z=PEEK(903)*2+Z-23-TF:POKE V+4,ABS(PNL(Z))
4190 POKE V+16,((PEEK(V+16) AND 251) OR ((Z>255)*4)):GOTO 4210
4200 PO=PO+D1%(TN,0)-23:PO=PO-(PO<0)*65536:POKE 839,PNL(PO):POKE 840,PNH(PO)
4210 POKE 841,Y+D1%(TN,1):POKE V+5,Y+D1%(TN,1)-25-TJ
4220 IF TN<7 THEN Z=8:GOTO 4250
4230 B$="tracked.":IF ME=2 THEN B$="trapped."
4240 A$=A$+"{F3|170809{WHT|{F2|0908you "+B$:Z=10
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4250 GOSUB 3000:WS=128-(TN=1)*64-(TN=7)*64
4260 X=PEEK(V)+(PEEK(V+16) AND 1)*256-TF:POKE V,FNL(X)
4270 POKE V+16,((PEEK(V+16) AND 254) OR FNH(X))
4280 POKE 823,Z:POKE 824,25-Z:POKE 253,221:SYS CO:POKE 845,1:P=-1:SYS SV
4290 IF TN<7 THEN Z=TN*50:AS="":GOTO 4320
4300 Z=INT((2^(INT((TA AND 7)/2)+1))/.133)/10:AS="|F8|"+STRS(Z)
4310 AS=AS+" mph lateral speed":Z=-(TN=7)*60-(TN=8)*75-(TN=9)*125-(TN=10)*185
4320 AS="|BLK||F2|0023"+STRS(Z)+" meters"+AS:GOSUB 3000
4330 POKE V+21,WS OR 6:AS="|BLK||F2|2823|F1||RVON|replay|RVOF||F3|00":GOSUB 3000:N=FNW(905)
4340 N=N+(N>255)*(N-255):POKE 821,N:N=N-60:POKE 833,-N*(N>0):POKE 884,1
4350 IF (PEEK(884) AND 1)=0 THEN 4380
4360 IF (PEEK(56321)=247) AND (F=0) THEN POKE 884,0:Z=0:GOTO 4490
4370 GOTO 4350
4380 POKE 823,8:POKE 824,2:POKE 253,0:SYS CO:AS=CRS:GOSUB 3000
4390 F=1:Z=1
4400 IF PEEK(56321)=247 THEN Z=0:GOTO 4490
4410 IF PEEK(56321)=127 THEN Z=128:GOTO 4490
4420 Z=Z+1:IF Z<50 THEN 4400
4430 F=F+1:IF F<>2 THEN 4460
4440 AS="|BLK||F2|2823pull trigger|F2|2824to continue "
4450 GOSUB 3000:POKE V+21,WS OR 1:Z=0:GOTO 4400
4460 F=0:IF TN<7 THEN POKE 823,8:POKE 824,2:POKE 253,221:SYS CO:GOTO 4330
4470 BS="tracked.":IF ME=2 THEN BS="trapped."
4480 AS="|F1||F3|160809|WHT||F2|0908you "+BS:GOSUB 3000:GOTO 4330
4490 GOSUB 3200:POKE V+21,0:RETURN
4500 AS="|F3|09|F6|00|CLR||F5|13|F7|00|BLK|":GOSUB 3000:Z1=TA:Z2=0:Z3=0
4510 POKE 785,FNL(GP):POKE 786,FNH(GP):POKE 940,160:POKE 942,100
4520 FOR Z5=1 TO Z4:POKE 251,FNL(Z):POKE 252,FNH(Z):POKE 880,Z1:POKE 881,N
4530 Z=USR(0):Z1=Z1+2:Z2=Z2+PEEK(824):Z3=Z3+PEEK(823):NEXT Z5:IFZ2=0THEN RETURN
4540 AS="|F2|1302Your"+STRS(Z2)+" shot(s)"
4550 IF Z3>0 THEN AS=AS+"|F2|1003"+STRS(Z3)+" shot(s) missing"
4560 Z2=-(TN=7)*60-(TN=8)*75-(TN=9)*125-(TN=10)*185
4570 AS=AS+"|F2|1404"+STRS(Z2)+" meters":BS="":IF (Z4<>1) OR (TA<7) THEN 4575
4571 Z=INT((2^(INT((TA AND 7)/2)+1))/.133)/10:BS=STRS(Z)+" mph"
4572 IF Z=1.5 THEN BS="|C/LF|"+BS
4574 AS=AS+"|F2|1605"+BS:BS="|F2|1205|F4|07":IF (TA AND 1)=0 THEN BS="|F2|2605|F4|03"
4575 AS=AS+BS:GOSUB 3170:POKE 53265,43:RETURN
4580 AD=FNW(876):TN=PEEK(AD+3):TA=TN:IF TN>6 THEN TN=INT(TN/8)+6
4590 X=PEEK(AD+1):Y=PEEK(AD+2):MV=(PEEK(AD+8)>0):IF MV THEN 4610
4600 X=((INT(RND(1)*65))*2)+71:POKE AD+1,X:IF TN=1 THEN POKE AD+16,X+48
4610 TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:Z1=D2%(TN,2):S=((TN-1)*2)+Z1
4620 PO=0:TF=PEEK(AD+9)*2:IF MV THEN S=PEEK(AD+3)+6-INT(PEEK(AD+3)/8)*2:PO=6
4630 IF TA>=36 THEN PO=TF:REM 185M 6MPH
4640 IF PEEK(AD+8)>128 THEN TF=-TF:PO=-PO
4650 POKE 838,S:POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180
4660 AD=I1+S*8:POKE AD+7,I:POKE 900,255:POKE AD,255:GOSUB 4020
4670 AS="L="+STRS(CL)+"]T="+STRS(I)+"]R="+STRS(RP):GOSUB 5230:POKE I2+7+S*8,RP
4680 Z=IR:SB=0:GOSUB 5440:POKE 878,0
4690 IF Z<>128 THEN D2%(TN,2)=D2%(TN,2)+1
4700 Z=Z+((PEEK(900)=255) AND (Z<>128))*(Z-64):IF Z>63 THEN RETURN
4710 Z1=(PEEK(900)<128):Z2=NOT(Z1):D2%(TN,0)=D2%(TN,0)-Z1
4720 D2%(TN,1)=D2%(TN,1)-Z2:IF Z2 THEN GOSUB 4040:IF Z<>128 THEN Z=32
4730 RETURN
4740 FOR J=0 TO 3:SD(J,36)=SD(J,36)/3:NEXT J
4750 A=S:B=Z:S=36:J=0:GOSUB 3110:AS="|F3|05|F6|00|F5|00|F7|00|CLR||F1|"+DSS(0,0)+CRS
4760 ZS=MIDS(CRS,6,1):J=1:GOSUB 3110:AS=AS+DSS(0,1)+"|F2|3499---"
4770 CRS="|F2|3099"+ZS+"check":IF CR*(0)>2 THEN CRS="|F2|3699"+ZS+"ok"
4780 AS=AS+DSS(0,2)+CRS
4790 J=2:GOSUB 3110:AS=AS+DSS(0,3)+CRS:J=3:GOSUB 3110
4800 S=A:Z=B:GOSUB 3000:POKE 785,FNL(GP):POKE 786,FNH(GP):POKE 251,FNL(Z)
4810 POKE 252,FNH(Z):POKE 880,5:POKE 881,3:Z=USR(0):AS=""
4820 IF PEEK(823)>0 THEN AS=AS+"|BLK||F2|0921"+STRS(PEEK(823))+" shot(s) off screen"
4830 POKE 823,8:POKE 824,15:POKE 253,13:SYS CO:AS=AS+"|SWLC||LGRN|":GOSUB 3170
4840 POKE 53265,43:RETURN
4845 FOR I=0 TO 4:D2%(I,0)=D2%(I,0)+D2%(I,2):D2%(I,1)=D2%(I,1)+D2%(I,3):NEXT I
4846 RETURN
4850 IF PEEK(838)=0 THEN RETURN
4860 Z=-(CL=3)*60-(CL=4)*75-(CL=5)*125-(CL=6)*185
4870 AS="|F3|09|CLR||F6|00|F5|00|F7|00|LBLU||F2|0801Summary:"+STRS(Z)+"-meter targets|F8||F8|"
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4880 A$=A$+"{GRN}{F2}0599Number of targets tracked --"+STR$(D2%(4,0))+"{F8}{F8}":GOSUB 3000
4890 A$="":ME=1:Z=0:GOSUB 4940:ZS=MID$(CR$,6,1):Z=1:GOSUB 4940:GOSUB 4970
4900 Z=3:GOSUB 4940:Z=4:GOSUB 4940:GOSUB 3000
4910 A$="{F8}{F8}{F8}{GRN}{SWLC}{F2}0599Number of targets trapped --"+STR$(D2%(4,1))+"{F8}{F8}":GOSUB 3000
4920 A$="":ME=2:Z=0:GOSUB 4940:ZS=MID$(CR$,6,1):Z=1:GOSUB 4940:GOSUB 4970
4930 Z=3:GOSUB 4940:Z=4:GOSUB 4940:A$=A$+"{LGRN}{SWLC}":GOSUB 3170:RETURN
4940 A$=A$+CHR$(142)+"{F2}0899"+DSS(ME,Z):Z1=D2%(4,ME-1):Z=Z+(Z>2)
4945 IF Z1=0 THEN A$=A$+"{F2}2999{WHT}---{F8}":RETURN
4950 Z1=INT(D2%(Z,ME-1)/Z1+.5):CR$=CR$(Z1):B$=RIGHT$(STR$(38-LEN(CR$)),2)
4960 A$=A$+"{F2}"+B$+"99"+RIGHT$(CR$,LEN(CR$)-5)+"{F8}":D2%(Z,ME-1)=Z1:RETURN
4970 A$=A$+"{F2}0899"+DSS(ME,2):IF D2%(4,ME-1)=0 THEN A$=A$+"{F2}2999{WHT}---{F8}":RETURN
4980 CR$="{F2}2799"+Z$+"check":IF D2%(0,ME-1)>2 THEN CR$="{F2}3099"+Z$+"ok"
4990 A$=A$+CR$+"{F8}":RETURN
5000 A$=A$+"{F2}0203{LBLU}Range {BRN}Exposures {GRN}Hits {RED}Misses{YELO} No Fires{F8}"
5010 A$=A$+"{LBLU}{F2}1499{Stationary}{F8}":GOSUB 3000:HI=0
5020 FOR I=0 TO 5:H%(I)=0:NEXT I:SYS HM:FOR I=1 TO 10:Z=I:Z1=I*50
5030 IF I>6 THEN Z=(I-6)*8:Z1=-(I=7)*60-(I=8)*75-(I=9)*125-(I=10)*185
5040 Z2=PEEK(16192+Z):Z3=PEEK(16256+Z):Z4=PEEK(16320+Z):A$="{LBLU}{F2}0299"+STR$(Z1)
5050 A$=A$+"{F2}1199{BRN}"+STR$(D1%(I,CL-5)):H%(HI)=H%(HI)+Z2:H%(HI+2)=H%(HI+2)+Z3
5060 Z4=D1%(I,CL-5)-Z4:Z4=Z4+(Z4<0)*Z4:H%(HI+4)=H%(HI+4)+Z4
5070 A$=A$+"{GRN}{F2}1899"+STR$(Z2)+"{RED}{F2}2499"+STR$(Z3)+"{YELO}{F2}3299"+STR$(Z4)+"{F8}"
5080 GOSUB 3000:IF I<>6 THEN 5110
5090 Z1=-12*(CL=7)-10*(CL=8)-14*(CL=9)-10*(CL=10):H%(7)=Z1
5100 HI=H%(0):MI=H%(2):NF=H%(4):GOSUB 5410:HI=1:A$="{SWLC}{LBLU}{F2}1699{Moving}{F8}":GOSUB3000
5110 NEXT I:Z1=-24*(CL=7)-20*(CL=8)-26*(CL=9)-20*(CL=10):H%(8)=Z1
5120 HI=H%(1):MI=H%(3):NF=H%(5):GOSUB 5410
5130 Z1=-36*(CL=7)-30*(CL=8)-40*(CL=9)-30*(CL=10)
5140 HI=H%(0)+H%(1):MI=H%(2)+H%(3):NF=H%(4)+H%(5)
5150 A$="{SWLC}{F2}1499{RED}UNQUALIFIED":Z1=-8*(CL=7)-7*(CL=8)-10*(CL=9)-7*(CL=10)
5160 Z2=-16*(CL=7)-15*(CL=8)-20*(CL=9)-15*(CL=10)
5170 IF (H%(0)>=Z1) AND (H%(1)>=Z2) THEN A$="{SWLC}{F2}1599{GRN}QUALIFIED":A=A+1
5180 A$=A$+"{F8}{F8}{LBLU}Stationary Target Standard:Hit"+STR$(Z1)+" of"+STR$(H%(7))+"{F8}"
5190 A$=A$+"Moving Target Standard:Hit"+STR$(Z2)+" of"+STR$(H%(8))+"{LGRN}"
5200 GOSUB 3170:RETURN
5210 A$="{F3}09{F6}00{F5}00{F7}00{CLR}{RED}{SWLC}{F1}{F2}0407You did not meet{F2}0710the standard."
5220 A$=A$+"{F2}0213Prepare to refire.{F1}":GOSUB 3160:BC=2:RETURN
5230 B$="":IF ((WI AND 7)*5)=0 THEN5260
5240 B$=STR$(((WI AND 224)/32)+1)
5250 B$="{F2}3400W="+STR$((WI AND 7)*5)+"{F4}0"+RIGHT$(B$,1)
5260 A$="{HOME}{BLK}{RVON}{SWLC}"+A$+B$+"{F6}0"+CHR$(BC+48)+"{BLUE}":GOSUB 3000:RETURN
5270 A$=A$+"? /   {C/LF}{C/LF}{C/LF}{C/LF}":GOSUB3000:B$=""
5280 GET A$:IF A$="" THEN 5280
5290 IF (A$=CHR$(13)) OR (LEN(B$)>2) THEN PRINT"{C/UP}":A$=B$:Z=INT(VAL(A$)):RETURN
5300 IF A$<>CHR$(20) THEN 5330
5310 IF B$<>"" THEN B$=LEFT$(B$,LEN(B$)-1):A$="  {C/LF}{C/LF} {C/LF}/{C/LF}":GOSUB 3000
5320 GOTO 5280
5330 A$=CHR$(ASC(A$) AND 127):IF (A$<"0") OR (A$>"z") THEN 5280
5340 IF (A$>="a") AND (A$<="z") THEN A$=CHR$(ASC(A$) OR 128)
5350 B$=B$+A$:A$=A$+"/{C/LF}":GOSUB 3000:GOTO 5280
5360 FOR Z=I1 TO I1+343 STEP 8:POKE Z,255:NEXT Z:RETURN
5370 FOR Z=I2 TO I2+343 STEP 8:POKE Z,255:NEXT Z:RETURN
5380 A$="{F3}09{F6}00{CLR}{F5}00{F7}00":GOSUB 3000
5390 POKE 823,12:POKE 824,12:POKE 253,221:SYS CO
5400 A$=B$+"{HOME}{LBLU}":GOSUB 3000:Z=USR(Z1+Z2*256):RETURN
5410 A$="{SWLC}{F2}0299{GRY2}TOTAL{F2}1199{BRN}"+STR$(Z1)+"{F2}1899{GRN}"+STR$(HI)+"{F2}2499{RED}"+STR$(MI)
5420 A$=A$+"{F2}3299{YELO}"+STR$(NF)+"{F8}":GOSUB 3000:RETURN
5430 POKE 49163,1:POKE 49168,SB:POKE 49171,32:SYS 49162:RETURN
5440 POKE 785,10:POKE 786,192:POKE 49163,1:POKE 49168,SB:POKE 49171,32
5450 Z=USR(Z):RETURN
5460 POKE 49163,2:POKE 49168,SB:POKE 49171,32:SYS 49162:RETURN
5470 POKE 785,10:POKE 786,192:POKE 49163,2:POKE 49168,SB:POKE 49171,32
5480 Z=USR(Z):RETURN
6000 DATA 47,32,2,1,1,1,2, 23,36,2,3,2,3,3, 11,12,2,1,2,2,2
6010 DATA 11,14,2,1,2,2,3, 11,15,2,2,1,1,1, 11,16,2,2,2,1,3
6020 DATA 23,19,6,4,3,3,8, 23,24,6,7,7,6,10, 23,32,6,5,5,8,5, 11,13,6,4,5,3,3
6030 DATA "{WHT}steady pos","{WHT}aiming","{WHT}breath con","{WHT}trigger sq","{LBLU}shot loc"
6040 DATA "{WHT}smth track","{WHT}lead","{WHT}breath con","{WHT}trigger sq","{LBLU}shot loc"
6050 DATA "{WHT}steady pos","{WHT}lead","{WHT}breath con","{WHT}trig pull","{LBLU}shot loc"
6060 DATA "{F2}3299{RED}poor","{F2}2299{ORNG}below avg","{F2}2699{YELO}average","{F2}3299{LGRN}good"
```

```
6070 DATA "|F2|2299|GRN|excellent"
```

E-PROM Addresses

ITEM	COPY ADDRESS		CHIP ADDRESS		SIZE	
Chip 0, Bank 0						
STARTUP	49152	50704	32768	34320	1,553	
OPENING.SCENARIO	8192	40949	35154	39514	4,361	
LETTERS	57344	58788	39515	40949	1,435	
Total						7,349
Chip 0, Bank 1						
MLCHOBK1	32768	39229	32768	39229	6,462	
CALIBRATION	16384	17212	40131	40959	829	
Total						7,291
Chip 0, Bank 2						
MLCHOBK2	32768	38782	32768	38782	6,015	
ARM.SPRITES	2176	3199	39936	40959	1,024	
Total						7,039
Chip 0, Bank 3						
ARM.SCENARIO.1	8192	16191	32768	37444	4,677	
ARM.SCENARIO.2	8192	16191	37445	40483	3,039	
Total						7,716
Chip 1, Bank 0						
ARM.BAS (1)	16384	24575	32768	40959	8,192	
Total						8,192
Chip 1, Bank 1						
ARM.BAS (2)	24576	32767	32768	40959	8,192	
Total						8,192
Chip 1, Bank 2						
ARM.BAS (3)	32768	37184	32768	37184	4,417	
Total						4,417
Chip 1, Bank 3						
ARM.3200	3200	7995	32768	37563	4,796	
ARM.SCENARIO.3	8192	16191	38042	40959	2,918	
Total						7,714
Total Size						57,910

Lines 1-310: Main program.
Lines 1-80: Program and variable initialization.
Lines 90-130: Checks for certain keypresses and/or trigger pull.
Line 90: Runs menu if RUN/STOP key is pressed.
Line 100: Begins the program is the trigger is pulled.
Line 110-130: Runs the lightpen calibration program if "lp" is pressed.
Lines 140-210: Displays a text screen and initializes the arrays.
Lines 212-214: Asks the firer if telescope or iron sights will be used and sets up the appropriate sprite.
Lines 220-240: Displays a text screen.
Line 250: Calls the zero routine.
Line 260: Calls the routine that displays the level introduction screen.
Line 270: Calls the appropriate level based on the value of CL.
Line 280: Checks to see if the program is ready to be terminated.
Lines 290-310: Displays the congratulations screen.

Lines 1000-1410: Zeroing routine.
Lines 1000-1170: Introduction screens and initialization.
Lines 1180-1190: If the @ key was pressed at line 1060, the target will always appear in the center of the screen rather than at random locations.
Line 1200: Display the target and check for the RUN/STOP key.
Line 1210: Get the diagnostic scores for the shot.
Lines 1220-1250: Compute the lightpen offset and see if the readings are within acceptable bounds around the target.
Line 1260: Make sure the trigger has been released and go to line 1410 if only one or two shots have been fired.
Lines 1270-1320: If any shot was out of the acceptable bounds, the invalid shot group screen is displayed. If this is the second time, the additional message to see the manual is shown.
Lines 1330-1350: Computes the lightpen offset based on the center of the three-round shot group.
Lines 1360-1370: Displays the three-round shot group and waits for the trigger to be pulled.
Lines 1380-1410: Unless the shot group was excellent, the firer is asked if he wants to try for a better group.

Lines 1420-1430: Calls the machine language demonstration routine.

Lines 1440-2060: Levels 1-2.
Lines 1440-1550: Introductory screens.
Lines 1560-1620: Get the appropriate targets.
Line 1630: Put up the background the status line.
Lines 1640-1670: Determine the proper sight post offset, time of flight, and trajectory.
Line 1680: Display the target and check for the RUN/STOP key.
Line 1690: Blow the whistle if time expired.
Lines 1700-1710: Display hit or miss.
Line 1720: Call the replay routine.
Lines 1730-1740: Adds a hit to the proper counter (track or trap).
Lines 1750-1810: If the correct method of engagement was not employed, notify the firer.
Line 1820: Add 1 to the shot counter and repeat if not time to show a

group.
Line 1830: Display the shot group.
Lines 1840-1910: Show the firer's performance and the standards.
Lines 1920-1950: Display the "You did not meet the standard" screen.
Lines 1960-2000: Hint for smooth tracking.
Lines 2010-2030: Hint for proper trapping.
Line 2040: Reset the counters and refire.
Line 2050: Prepare to shoot the second set of five targets.
Line 2060: Advance to the next level unless the break key was pressed.

Lines 2070-2440: Levels 3-6.
Lines 2070-2130: Introductory screens.
Lines 2140-2170: Get the appropriate targets.
Lines 2180-2220: Initialization.
Lines 2230-2240: Put up the background the status line.
Lines 2250-2280: Determine the proper sight post offset, time of flight, and trajectory and set up for replay.
Lines 2290-2295: Display the target and check for the RUN/STOP key.
Line 2300: Sound the whistle if time expired.
Lines 2310-2320: Display hit or miss.
Line 2330: Handle the case of a no fire.
Line 2340: Update the hit counter.
Lines 2350-2360: Call the replay routine and update the counters for the diagnostic scores.
Line 2370: Add 1 to the shot counter and repeat if not time to show a group.
Line 2380: Display the shot group.
Lines 2390-2410: Restore the counters and display the "You did not meet the standard" screen.
Line 2420: Prepare for the next group of shots.
Line 2440: Display the summary and advance to the next level unless the break key was pressed.

Lines 2450-2620: Level 7.
Lines 2450-2470: Introductory screens.
Lines 2480-2530: Initialization.
Line 2540: Check number of shots and branch to end if done.
Line 2550: Display the background scene if necessary.
Line 2560: Call the subroutine at 4580 and branch if break key was pressed.
Lines 2570-2580: Sound the whistle if time expired, otherwise repeat loop.
Lines 2590-2600: Display the summary screen.
Line 2610: Check for failure to meet the standards and branch if necessary.
Line 2620: Update the current level pointer and return.

Lines 2630-2830: Levels 8-10.
Lines 2630-2680: Introductory screens.
Lines 2690-2770: Initialization.
Lines 2780-2790: Display the background scene and call the assembly language subroutine to handle the target scenario.
Lines 2800-2810: Display the summary screen.
Line 2820: Check for failure to meet the standards and branch if necessary.
Line 2830: Update the current level pointer and return.

Lines 3000-5480: Supporting Subroutines.
Line 3000: Display the string in A$ on the graphic screen.
Line 3010: Display a background scene where S1 contains the EPROM address and S2 contains the chip number.
Lines 3020-3060: Set up and call the assembly language routine which calculates the scores. Initially, the values in the SD array are the starting (high byte) and stopping (low byte) addresses for the light pen readings buffers. On return, they contain the scores.
Lines 3070-3080: Save certain key variables in the H% array.
Lines 3090-3100: Restore certain key variables that were stored in the H% array.
Lines 3110-3150: Determine the appropriate word scores for the values in the SD array.
Lines 3160-3210: Display appropriate "Pull trigger..." message and wait for trigger pull or stop key.
Lines 3220-3340: Display the level introduction screen and call the menu subroutine if the break key is pressed.
Lines 3350-4000: Display the menu and accept appropriate input.
Lines 4010-4030: Initialization for the replay.
Lines 4040-4490: Calculate and display the diagnostic scores and replay the shot.
Lines 4040-4070: Call the routines which compute the scores and determine the method of engagement (tracking or trapping) for moving targets.
Lines 4080-4150: Get the verbal scores based on the numeric scores.
Lines 4160-4210: Determine the proper time of flight, perfect sight offset, and trajectory.
Lines 4220-4240: Add the words "You trapped" or "You trapped" to the string to be displayed.
Lines 4250-4340: Initialize sprites where the positions are known, set the target area of the screen to green, display other information, and start the replay.
Lines 4350-4490: Timing loops for displaying proper wording and showing the replay again if necessary.
Lines 4500-4575: Show a shot group for a target at a particular range.
Lines 4580-4730: Level 7 target scenario.
Lines 4740-4840: Display the diagnostic scores and shot group for the zeroing procedure.
Lines 4845-4846: Add the diagnostic scores and number of engagements for the current group to the diagnostic scores and number of engagements for previous groups.
Lines 4850-4930: Summary screen for levels 3-6.
Lines 4940-4990: Subroutines to check special cases of scoring.
Lines 5000-5200: Summary screen for levels 7-10.
Lines 5210-5220: Display "You did not meet the standard...".
Lines 5230-5260: Display the status line at the upper left corner of the firing scenario.
Lines 5270-5350: Get input for the menu.
Line 5360: Initialize the INFO1 buffer to no fires.
Line 5370: Initialize the INFO2 buffer to no fires.
Lines 5380-5400: Clear graphic screen and set the center portion to green.

Lines 5410-5420: Used by the subroutine at 5000 to print the total line.
Line 5430: Call the assembly language subroutine in bank 1 of EPROM chip 0 referenced by the address in SB.
Lines 5440-5450: Call the assembly language subroutine in bank 1 of EPROM chip 0 referenced by the address in SB with a parameter in Z.
Line 5460: Call the assembly language subroutine in bank 2 of EPROM chip 0 referenced by the address in SB.
Lines 5470-5480: Call the assembly language subroutine in bank 2 of EPROM chip 0 referenced by the address in SB with a parameter in Z.
Lines 6000-6070: Data
- Lines 6000-6020: Target specific data read into the D1% array.
- Lines 6030-6050: The names of the diagnostic scores read into the DS$ array.
- Lines 6060-6070: The verbal scores read into the CR$ array.

APPENDIX D

DOCUMENTATION -- INFANTRY RIFLE MARKSMANSHIP COMMODORE PROGRAM

MACS Infantry Rifle Marksmanship
Line description of BASIC module
27 December 1991

Lines 1-310: Main program.
- Lines 1-80: Program and variable initialization.
- Lines 90-130: Keyboard/trigger-pull check.
  - Line 90: Display menu if RUN/STOP key is pressed.
  - Line 100: Begin program if trigger is pulled.
  - Line 110-130: Run the lightpen calibration if "lp" is pressed.
- Lines 140-210: Display text screen and initialize program arrays.
- Lines 220-240: Display a text screen.
- Line 250: Call the lightpen zeroing routine.
- Line 260: Call the level introduction screen.
- Line 270: Call the appropriate level based on CL variable.
- Line 280: Check to see if program ready to be terminated.
- Lines 290-310: Display the congratulations screen.

Lines 1000-1410: Lightpen zeroing routine.
- Lines 1000-1170: Introduction screens and initialization.
- Lines 1180-1190: If the '@' key was pressed, the zeroing target will always be displayed in the center of the screen.
- Line 1200: Display target and check for RUN/STOP key.
- Line 1210: Get the diagnostic scores for the shot.
- Lines 1220-1250: Compute the lightpen offset and verify reading are within acceptable bounds of target.
- Line 1260: Verify trigger release and goto 1410 if all three shots have not been fired.
- Lines 1270-1320: If an shot location is outside of the acceptable bounds, display the invalid shot group screen. If this is the second occurance, the firer is asked to refer to the MACS manual.
- Lines 1330-1350: Compute the lightpen offset based on the center of the three-round shot group.
- Lines 1360-1370: Display the adjusted three-round shot group and wait for the trigger to be pulled.
- Lines 1380-1410: Unless the shot group was excellent, the firer is asked if he/she wants to try for a better shot group.

Lines 1440-2070: All levels.
- Lines 1420-1447: Calls introductory screens for all levels.
  - Line 1440: Initializes all level variables.
  - Lines 1442-1443: Call level 2 introductory screens.
  - Line 1445: Call level 1 introductory screens.
  - Line 1446: Call level 3 introductory screens.
  - Line 1447: Call level 4 intruductory screens.
- Lines 1450-1490: Load appropriate targets for current level.
- Lines 1500-1610: Initialize variables for target presentation.
- Line 1611: Call the routine to display shooting requirements for the current level.
- Lines 1615-1627: If applicable, calculate wind variables.
- Line 1630: Display the background scenario and status line.
- Line 1640-1670: Calculate the proper sight-post offset, time of flight, and bullet trajectory for current level.
- Line 1680: Display the target and check keyboard for RUN/STOP key.
- Line 1690: Blow the whistle if time has expired.
- Lines 1700-1710: Display HIT or MISS on screen.

Line 1720: Call the replay routine.
Lines 1810-1815: If time had expired, reload the previous target.
Line 1820: Add 1 to the shot counter and repeat if not time to show shot group for current target.
Lines 1824-1826: Display the shot group if appropriate for current target set.
Lines 1840-1910: Display the firer's performance and expected standards for current level.
Lines 1920-1950: Display the standard not met screen and wait for trigger pull to continue.
Lines 1955-2060: Adjust appropriate variables for current level and repeat necessary logic to complete the current level.
Line 2070: Advance the firer to the next level unless the BREAK key was pressed.

Lines 3000-5480: Supporting routines.
Line 3000: Display the text string stored in a$ variable on the graphic screen.
Line 3010: Display a background scenario where S1 contains the EPROM address of the scene and S2 contains the appropriate chip-reference number. The chip-reference number specifies the physical chip and bank number which contains the scene to be displayed. The formula is: (chip#) * 4 + bank number.
Lines 3020-3060: Setup and call the assembly language routine which calculates the scores for the last target. Initially, the SD array contains the starting (high byte) and stopping (low byte) addresses for the light-pen readings. On return, the SD array is filled with the scores calculated.
Lines 3070-3080: Save certain key variables related to the current shot in the h% array. These are needed when a target needs to be repeated.
Lines 3090-3100: Restore the variables previously stored in the h% array.
Lines 3110-3150: Translate the scores stored in the SD array to text string.
Lines 3160-3210: Display pull trigger message and wait for trigger pull to continue.
Lines 3220-3340: Display the appropriate level introductory screen and call the menu routine if the BREAK key is pressed.
Lines 3350-4000: Display the menu and accept user input.
Lines 4010-4030: Initialize variables for the replay.
Lines 4040-4490: Calculate the display and diagnostic scores and replay the last shot.
  Lines 4040-4070: Call routines to compute scores and, if appropriate, determine whether the shot was a TRAP or a TRACK.
  Lines 4080-4150: Translate numeric scores to verbal scores.
  Lines 4160-4210: Determine the proper time of flight, perfect sight offset, and bullet trajectory.
  Lines 4220-4240: If appropriate, add the words TRAP or TRACK to the string to be displayed.
  Lines 4250-4340: Initialize necessary sprites and begin the target replay.
  Lines 4350-4490: Control and timing loops for the replay logic.
Lines 4500-4575: Display a shot group for a target at the current range.
Lines 4740-4840: Display the diagnostic scores and shot group for

the zeroing routine.

Lines 4845-4846: Add the current diagnostic scores and engagement count to previous diagnostic scores and engagement count.

Lines 4850-4930: Display the TRACK vs. TRAP summary screen. This routine is currently unused.

Lines 4940-4990: Special subroutines required for some cases of scoring.

Lines 5210-5220: Display standard not met screen.

Lines 5230-5260: Display the status line in the upper left corner of the current scene and, if appropriate, the wind in the upper right hand corner.

Lines 5270-5350: Retrieve input for the menu.

Line 5360: Initialize the INFO1 buffer to no fires.

Line 5370: Initialize the INFO2 buffer to no fires.

Lines 5380-5400: Clear the graphic screen.

Line 5430: Call the assembly language routine in BANK 1 of EPROM chip 0. The SB variable identifies the routine to call.

Lines 5440-5450: Call the assembly language routine in BANK 1 of EPROM chip 0. The SB variable identifies the routine to call and the Z variable is passed as a parameter.

Line 5460: Call the assembly language routine in BANK 2 of EPROM chip 0. The SB variable identifies the routine to call.

Lines 5470-5480: Call the assembly language in BANK 2 of EPROM chip 0. The SB variable identifies the routine to call and the Z variable is passed as a parameter.

Lines 6000-6070: Data.

- Lines 6000-6020: Target specific data read into the d1% array.
- Lines 6030-6050: The names of the diagnostic scores to be read into the ds% array.
- Lines 6060-6070: The verbal scores to be read into the cr% array.

Lines 8000-9570: Supporting screens.

Lines 8000-8080: Load reticle sprite data.

Lines 8100-8270: Introductory screens for level 3.

Lines 8300-8365: Load 400, 500, and 600 meter sprite data.

Lines 8370-8430: Load 60, 75, and 125 meter sprites required by the demonstration routine.

Lines 8450-8459: Overlay 300 meter sprite data with appropriate 300+ sprite data for proper shot group display.

Lines 8460-8463: Restore 300 meter sprite data.

Lines 8500-8710: Introductory screens for level 1.

Lines 8800-8885: Introductory screens for level 2.

Lines 9000-9350: Required standards screen for all levels.

Lines 9500-9530: Introductory screens for level 4.

Lines 9540-9570: Wind notice screen for level 4 displayed prior to the incorporation of wind.

BASIC BURNING PROCEDURE:

```
+-------------------------------------------------------+
  ¦ If the BASIC program changes size, the end-of-BASIC ¦
¦ value must be updated in the STARTUP.TXT program.    ¦
+-------------------------------------------------------+
poke 56, 31
load "PROMO*", 8
run
poke 44, 64
poke 16384, Ø
load "ARM.Z", 8
π 16384, 24575, Ø     , 23Ø, 6
π 24576, 32767, 8192  , 23Ø, 6
π 32768, 4Ø959, 16384, 23Ø, 6

;
;       Reserve BASIC-safe memory for PROMOS before loading.
;
        poke 56,31
        load "PROMO*",8
        run
;
;       Reset pointer to start of BASIC text.  The start of BASIC
;       text must match the parameters for BASIC as defined in the
;       STARTUP.TXT program (16384).  This MUST be done because the
;       program will be tokenized when loaded and all references
;       will be "hard-coded".
;
        poke 44, 64
        poke 16384, Ø
;
;       Now load the BASIC program.
;
        load "ARM.AL",8
;
;       PROMOS burn commands follow. (assuming 12.5 volt chips)
;
        π 16384, 24575, Ø     , 23Ø, 6
        π 24576, 32767, 8192  , 23Ø, 6
        π 32768, 4Ø959, 16384, 23Ø, 6
```

CHIP BANK MEMORY LOCATIONS:

```
(Ø)     Ø       start of BANK Ø
(1)     8192    start of BANK 1
(2)     16384   start of BANK 2
(3)     24576   start of BANK 3
```

BASIC ROUTINES:

gosub 3000 Display a$ on graphics screen (LETTERS). If function keys

are included in the string to be displayed, they will be interpreted in the following manner:

```
<F1>  toggle size (1x or 2x)
<F2>  (+4 bytes) set cursor position (column row)
<F3>  (+2 bytes) encoded bits
        bit Ø  (1)  set=blank screen    clr=unblank screen
        bit 1  (2)  set=text mode       clr=graphics mode
        bit 2  (4)  set=upper case      clr=no change
        bit 3  (8)  set=lower case      clr=no change
<F5>  (+2 bytes) screen color
<F6>  (+2 bytes) border color
<F7>  (+2 bytes) character color
<F8>  insert carriage return
* Also accepts color, cursor keys, and clear keys.
```

gosub 543Ø Call a specific assembly language routine via MLCHØBK1. The SB variable denotes the desired routine:

SB	ASSEMBLY LANGUAGE ROUTINE
Ø	ctrmov
3	descrp
6	random
9	dodata
12	rekeep
15	yesno
18	getxy
21	rndize
24	exptar
27	criter
3Ø	yesno2