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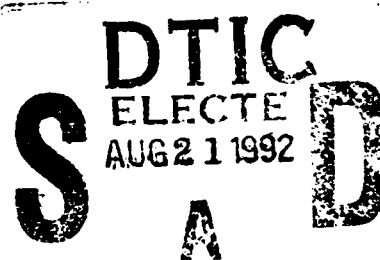
Multipurpose Arcade Combat Simulator Development to Improve Soldier Shooting Skills With the M16A3 Rifle

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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 Research 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

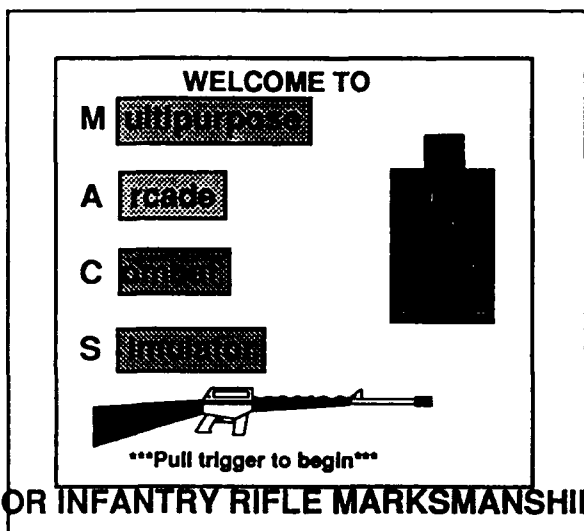
Given that an Army decision on telescope selection has been delayed beyond the time allotted for this contract effort, this Research Note provides information and guidance which will assist in finalizing MACS software, MACS hardware, and marksmanship training materials when final telescope decisions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

APPENDIX A
PROGRAMMER'S PACKET

MACS TELESCOPE PROGRAM SEQUENCE

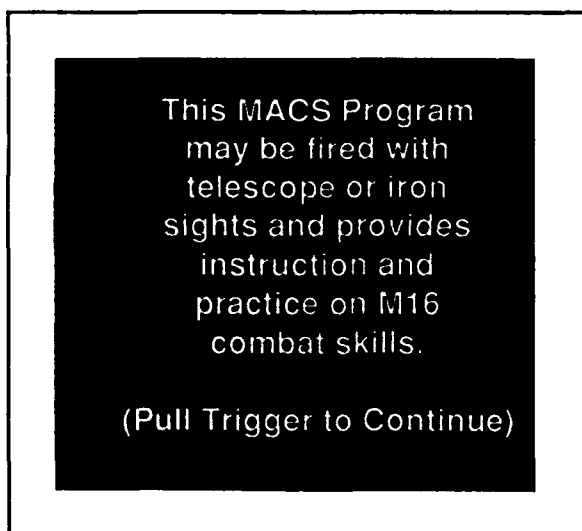
SCREENS

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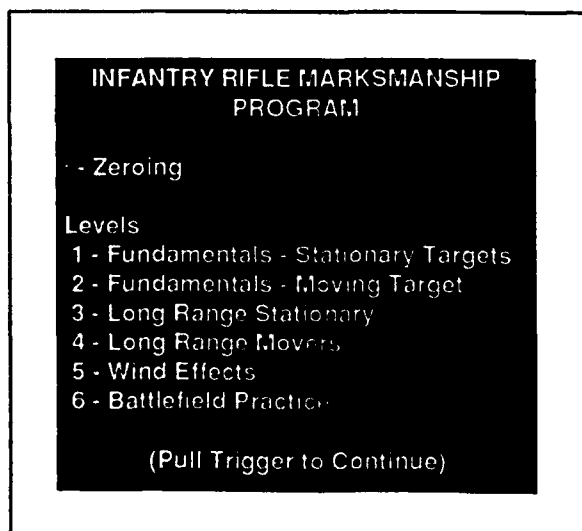


This paper provides general guidance to programmers for the Infantry Rifle Marksmanship (Telescope) Program. The program is designed to support training with the M16A3 rifle (M16A2 with telescope).

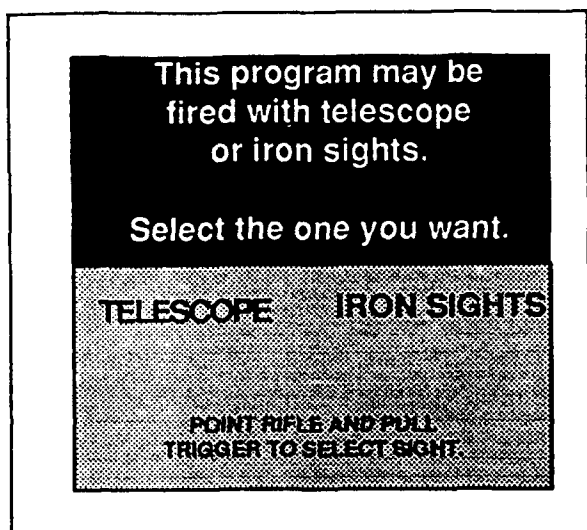
0-2



0-3

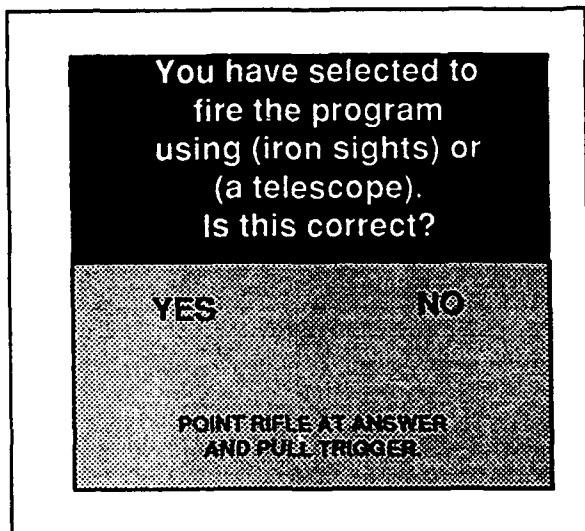


0-4



Selection will blink when rifle is pointed at it.

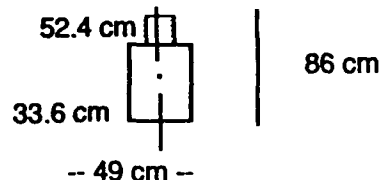
0-4a



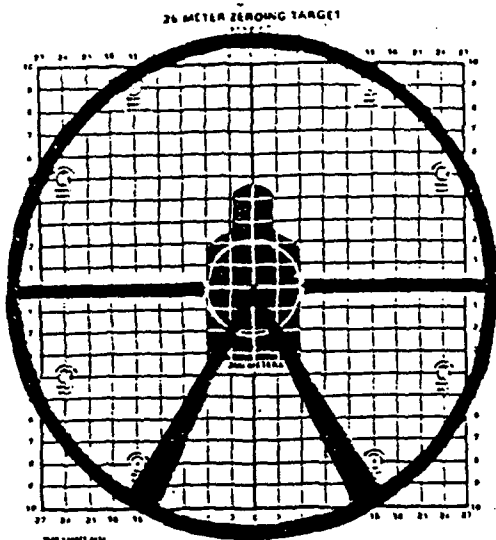
NOTE: Visual of iron or reticle. If "NO" is selected, return to 0-4.

0-5

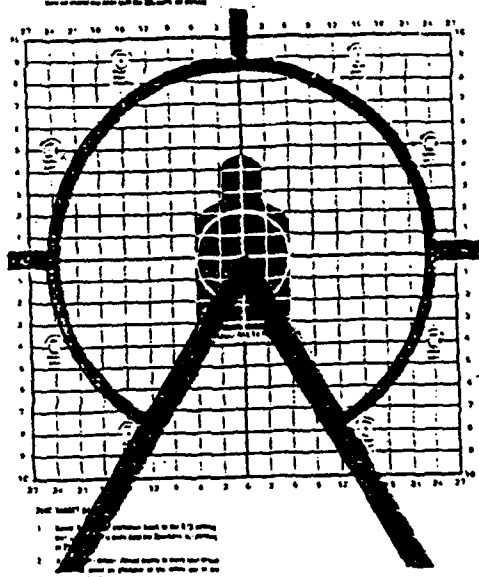
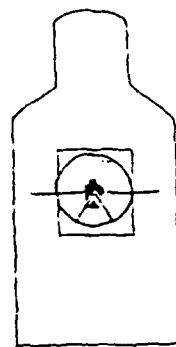
NOTE: The M16A2/M16A3 iron sight and the M16A3 reticle will be used on this program. However, we will not know which reticle the Army has selected until this program has been completed. The three reticles in scopes currently being tested are shown at Page 3, as they will appear on a zeroing target at 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.



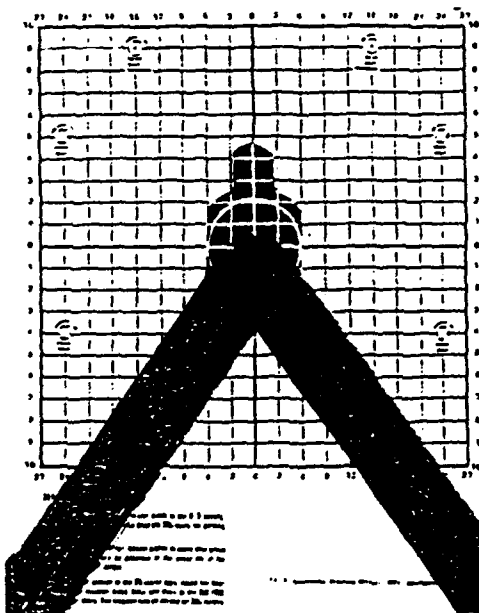
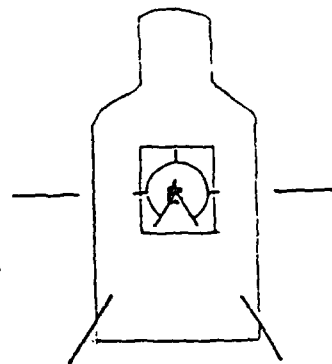
Graphic of 300-m target showing center mass spot. The same 300-meter zero will be used for iron and scope. The actual target size is 49x86 cm, with center-of-mass 33.6 cm from the bottom.



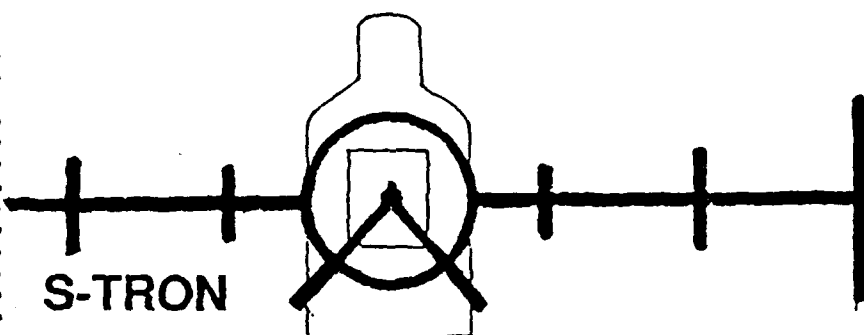
ELCAN



SUSAT



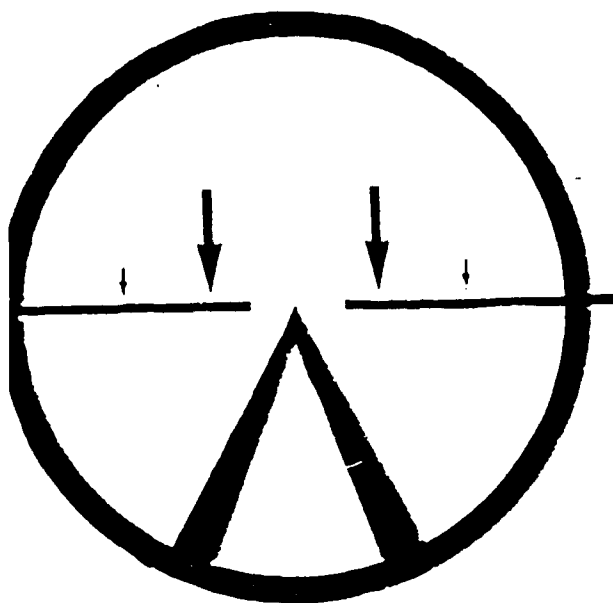
S-TRON



MACS INFANTRY RIFLE MARKSMANSHIP (TELESCOPES)

30 August 1991

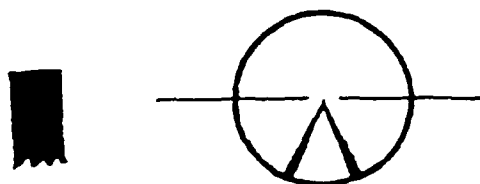
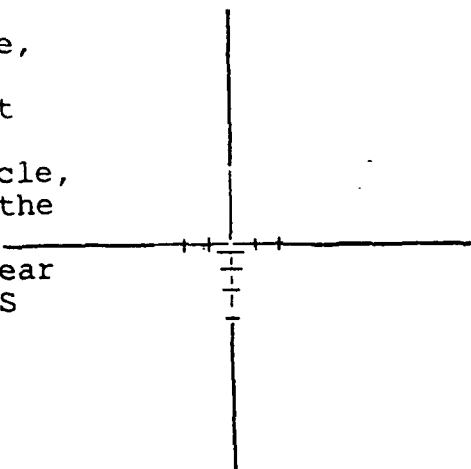
Page 3



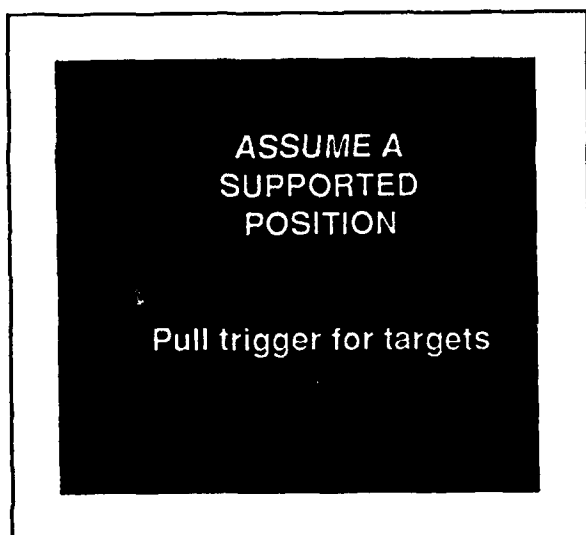
NOTE: Since hold-off and lead rules do not exist for the ELCAN or any of the reticles under consideration, and since our initial efforts did not result in rules appropriate for soldiers, invisible lead points have been established on the ELCAN which equate to the lead marks on the ARI reticle. These 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 re-
quirement.

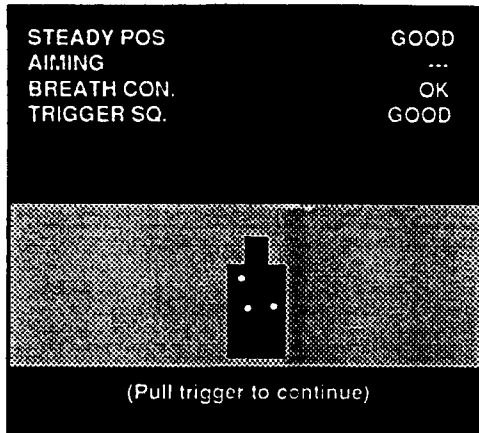
0-7



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

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

0-8

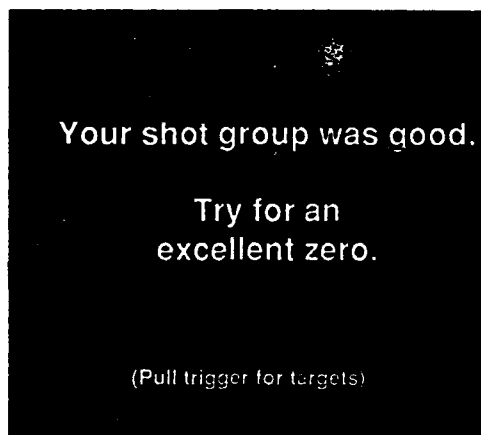


Graphic of target showing the spot locations of the three shots, now centered around the center of mass.

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.

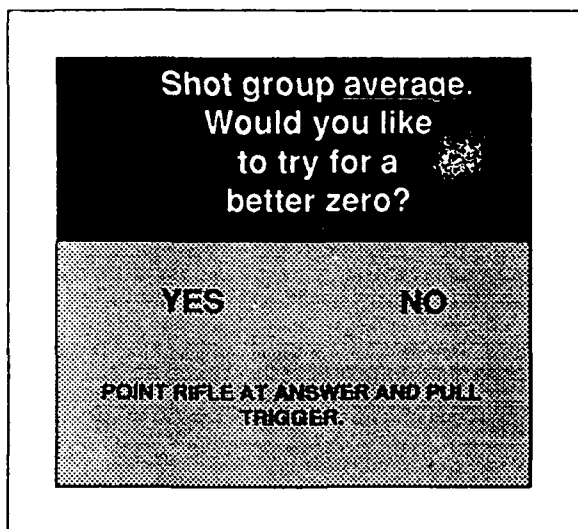
0-10



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

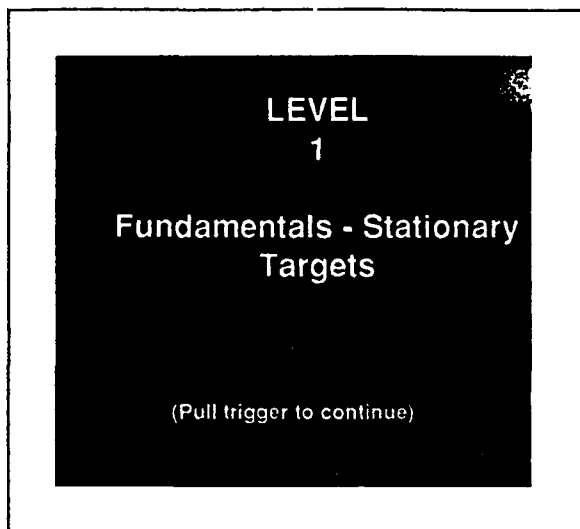
If a good or excellent group is not fired after a total of 6 groups, show 0-11 after each group.

0-11



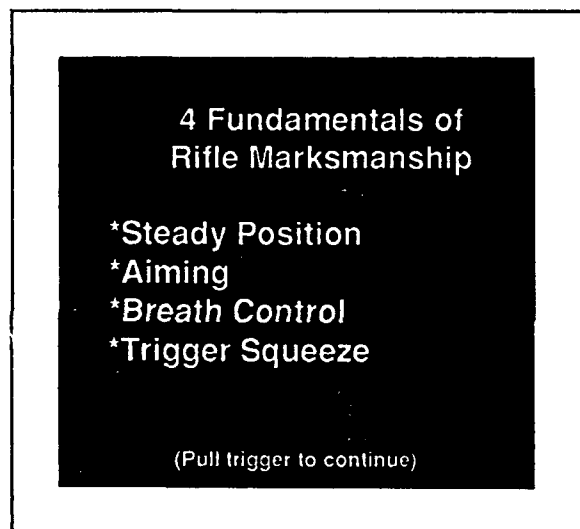
NOTE: Repeat this screen until a good or excellent group is obtained or "no" is selected.

1-1

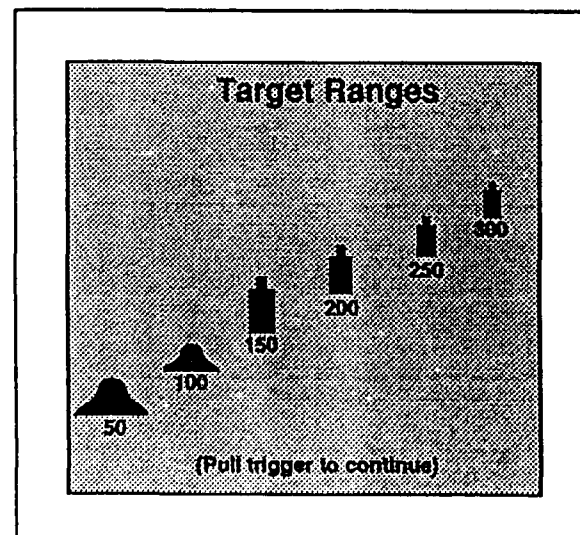


NOTE: Many screens can be lifted directly from BRM.

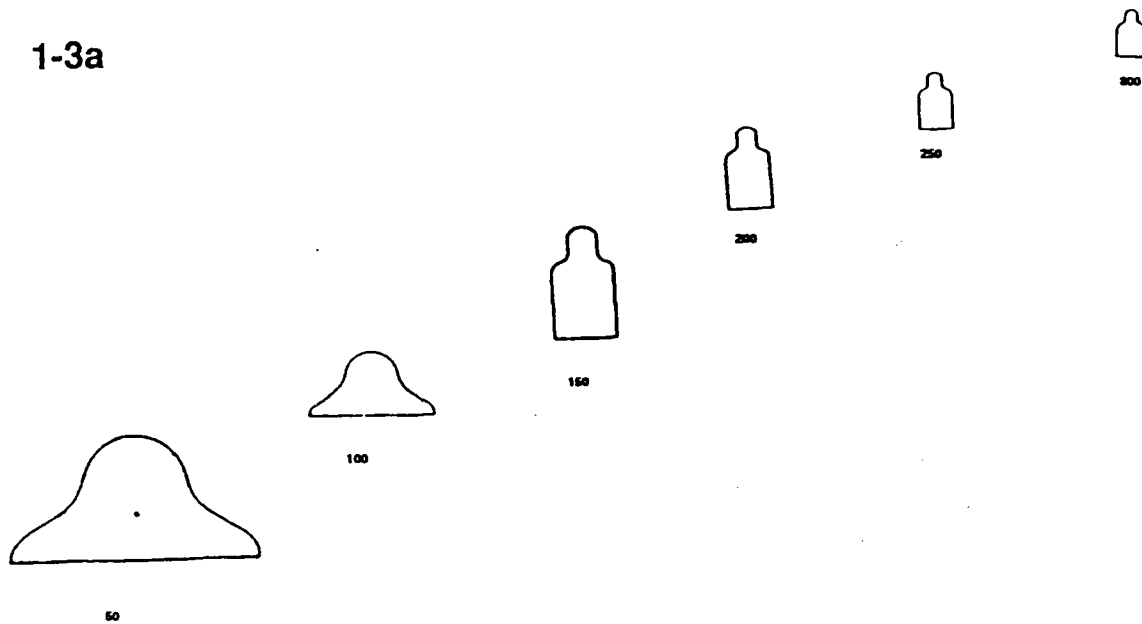
1-2



1-3

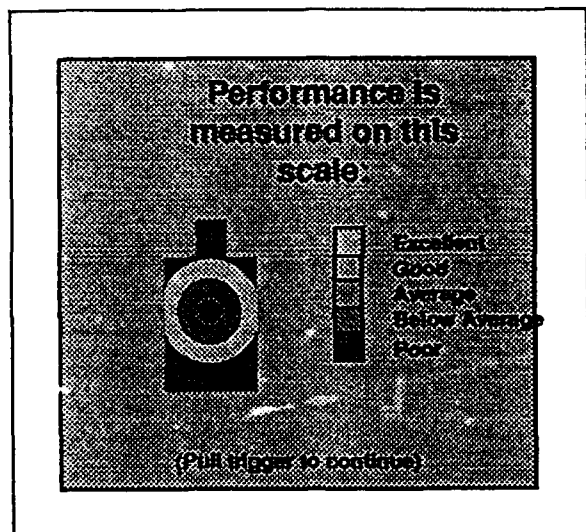


1-3a

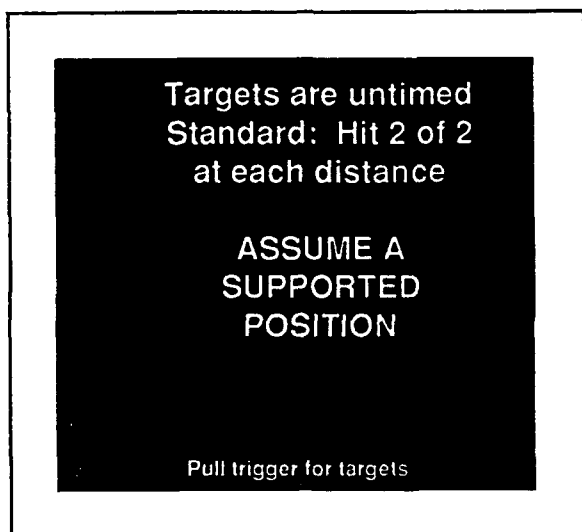


NOTE: Targets shown actual size
they will appear on MACS screen.

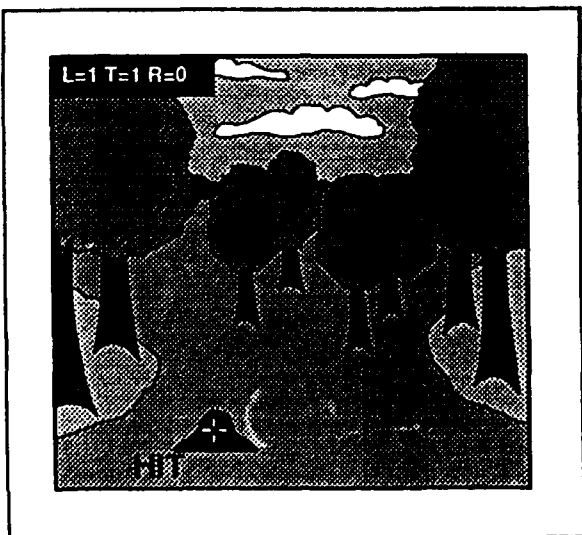
1-4



1-5



1-6 to
1-31



FEEDBACK SCREEN SEQUENCE

STEADY POS GOOD
AIMING GOOD
BREATH CON. OK
TRIGGER SQ. AVERAGE

REPLAY



(Pull trigger to continue)

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

STEADY POS GOOD
AIMING GOOD
BREATH CON. OK
TRIGGER SQ. AVERAGE
SHOT LOC AVERAGE



(Pull trigger to continue)

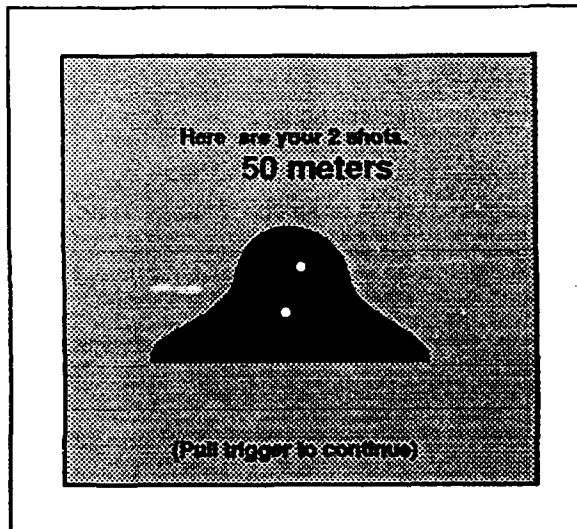
STEADY POS GOOD
AIMING GOOD
BREATH CON. OK
TRIGGER SQ. AVERAGE
SHOT LOC AVERAGE



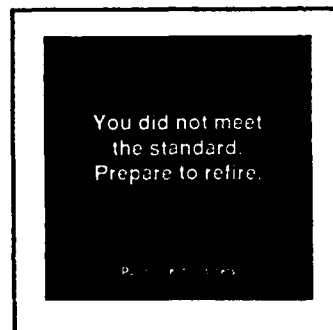
(Pull trigger to continue)

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

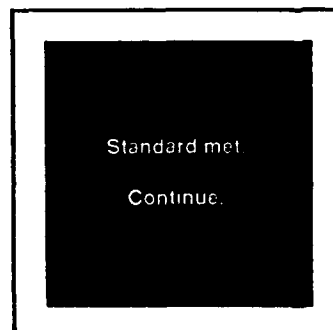
-- and a second target, followed by the summary and a 2-target summary screen.



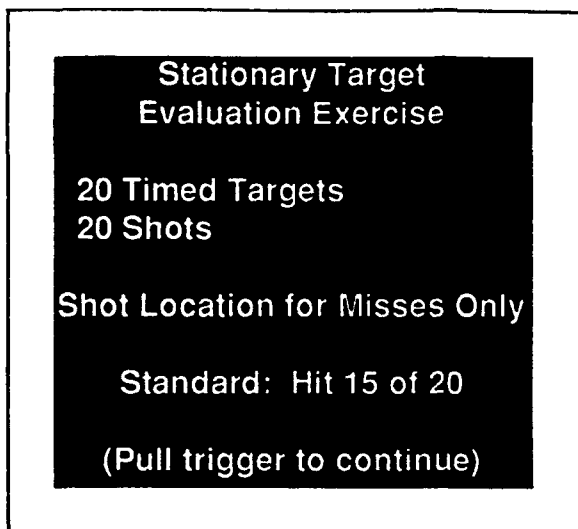
If a target is missed --



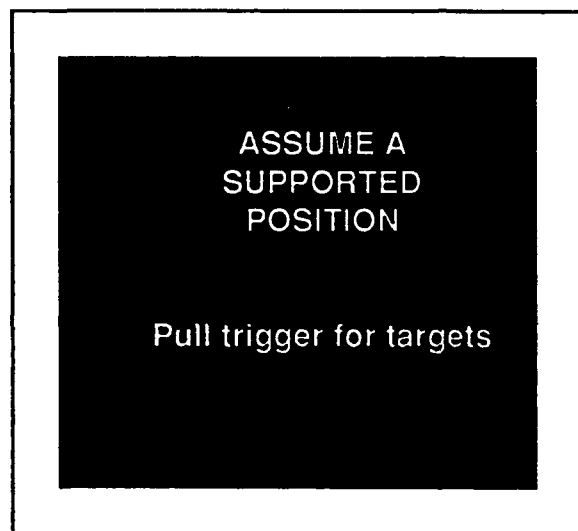
When standard is met --



1-32

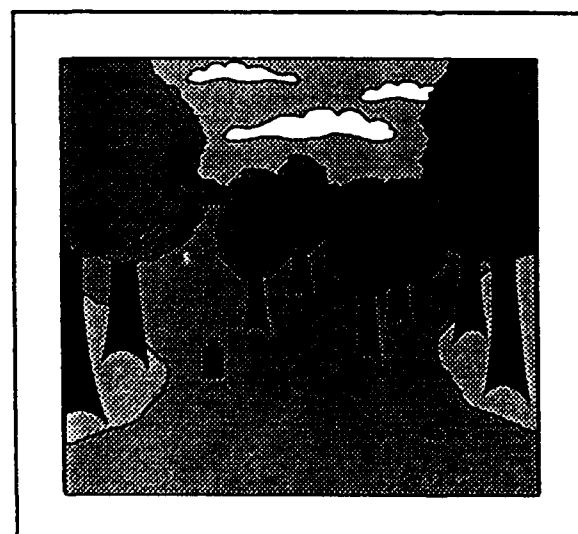


1-33



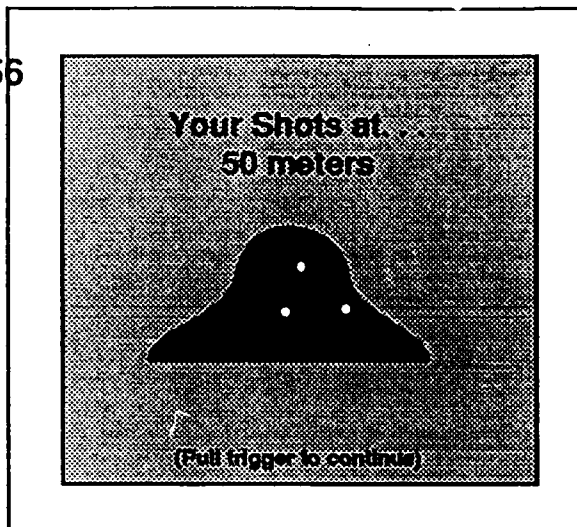
NOTE: Display 3 each of 50, 100, 150, and 200-meter targets and 4 each of 250 and 300-meter targets in a random fashion. Adjust exposure times to about 2, 3, 3, 4, 5, & 6 seconds for 10 single exposures and add times minus 25% for double exposures.

1-34 to 1-55



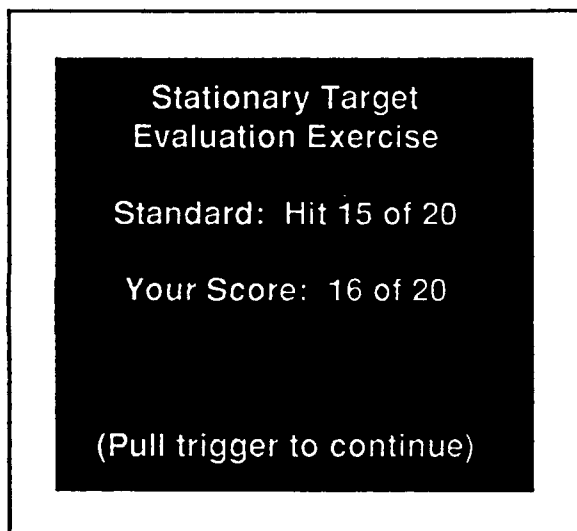
FIRING EXERCISE

1-51 to 1-56



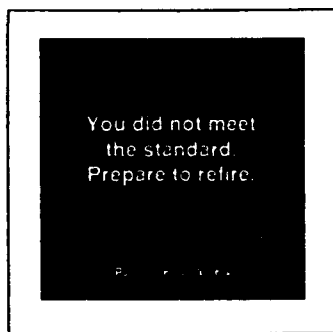
NOTE: Repeat this screen for 100, 150, 200, 250, and 300 meters.

1-57

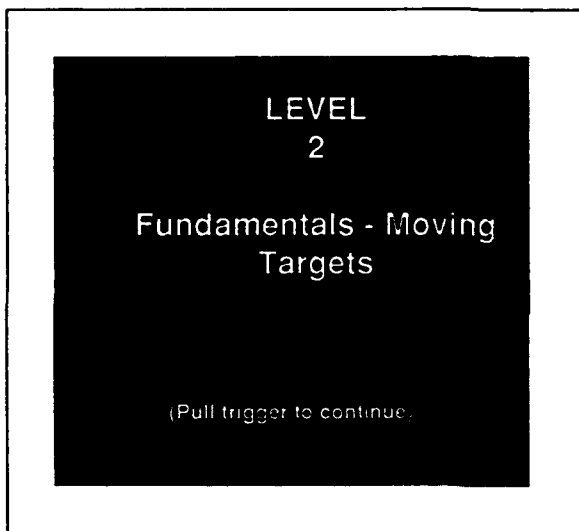


1-58

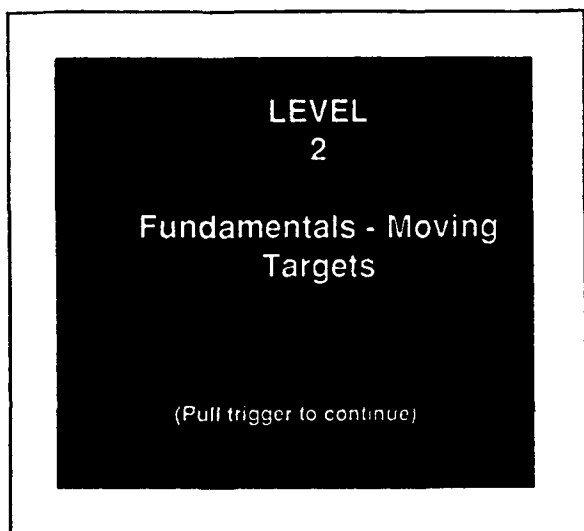
OR



2-1

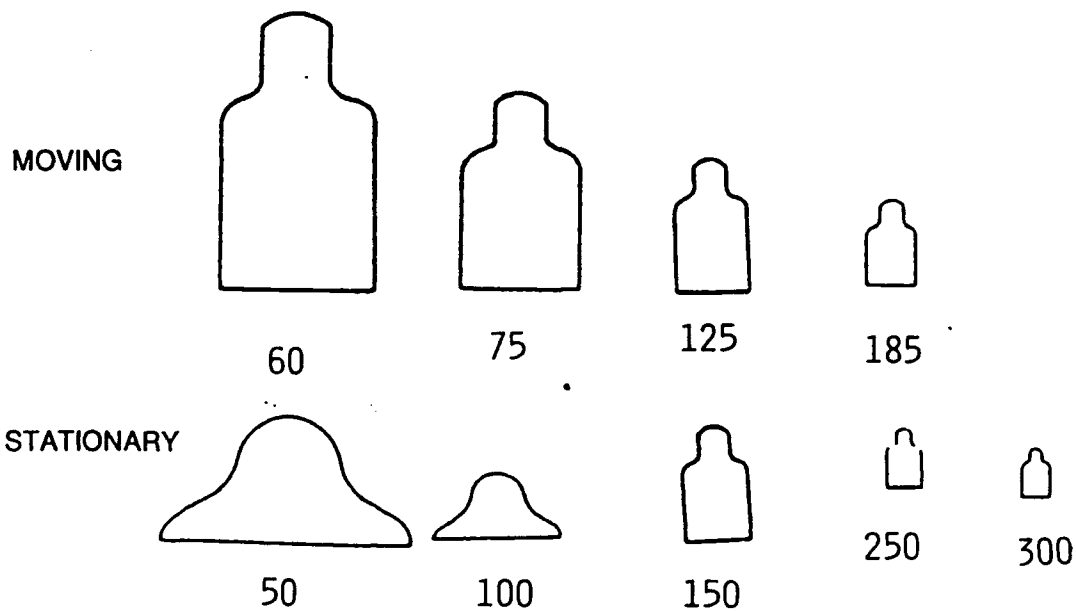


2-1

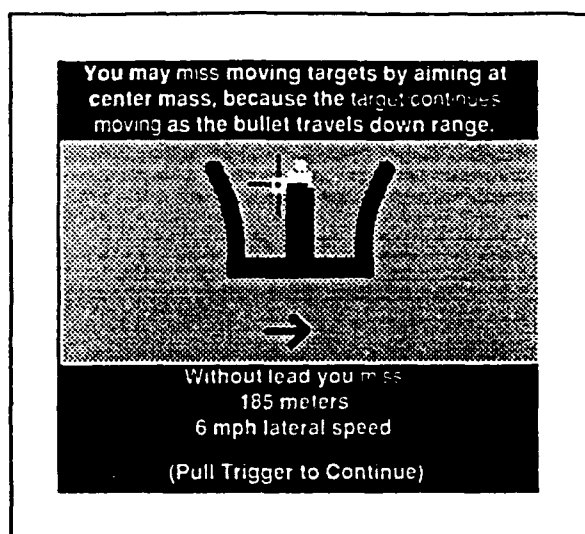


2-1a

TARGET RANGES



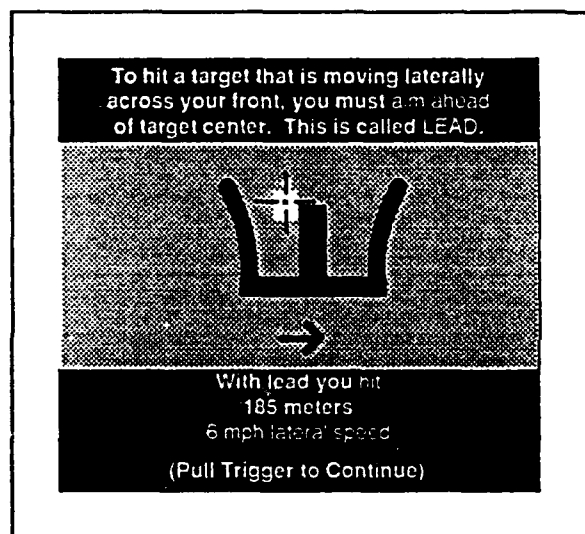
2-2



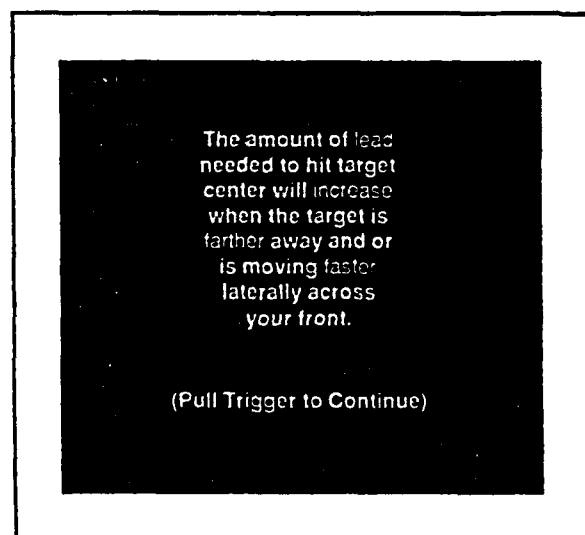
NOTE: Many of these screens are a direct lift from the moving target program.

Graphic showing a miss when aiming center mass

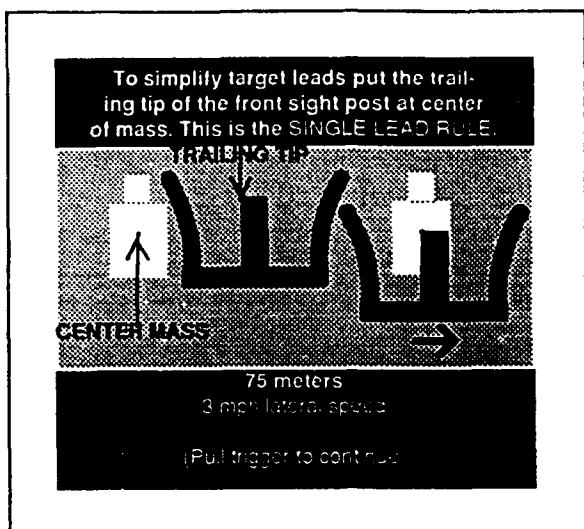
2-3



2-4



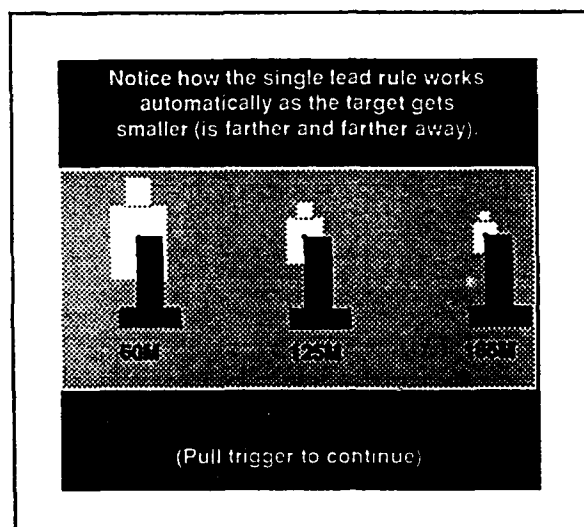
2-5



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

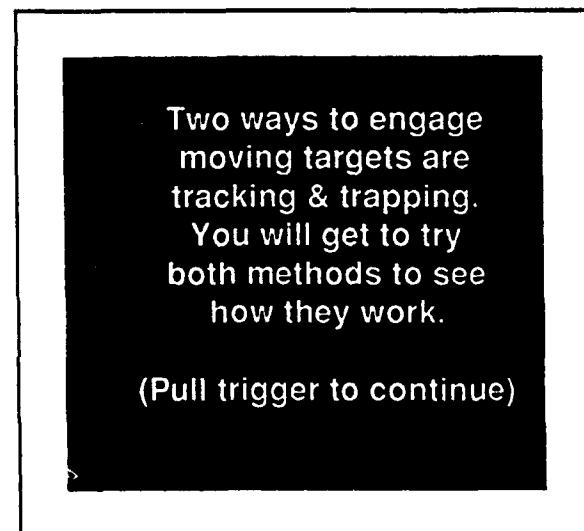
Graphic defining center of mass, and (trailing tip of the front sight post) or (first lead) or (trailing first hash mark) and then showing the proper single lead rule sight placement.

2-6

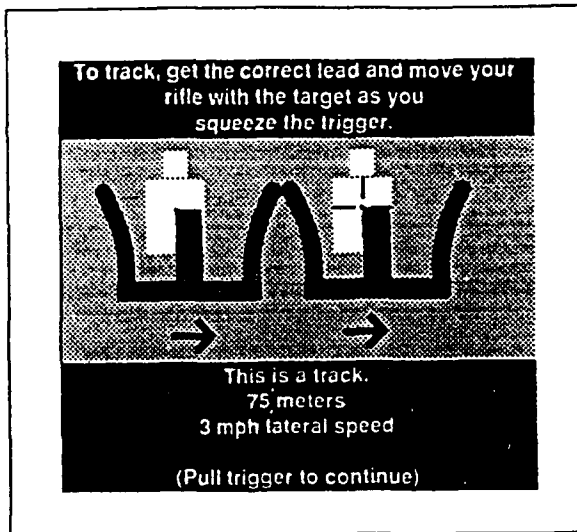


Graphic of 60m, 125m, and 185m targets showing how the single lead rule advances the center of the sight farther and farther forward on the target

2-7

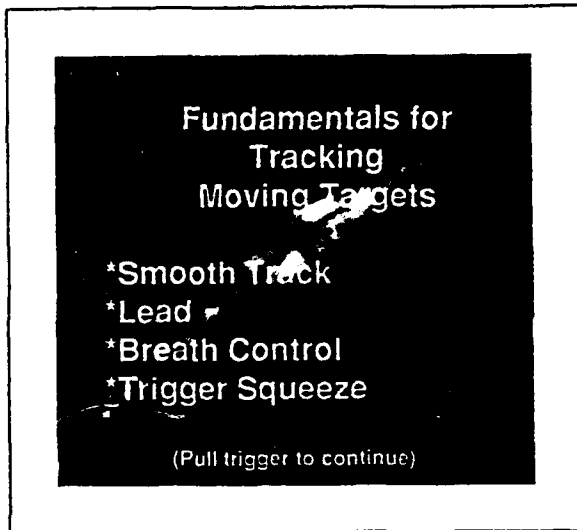


2-8

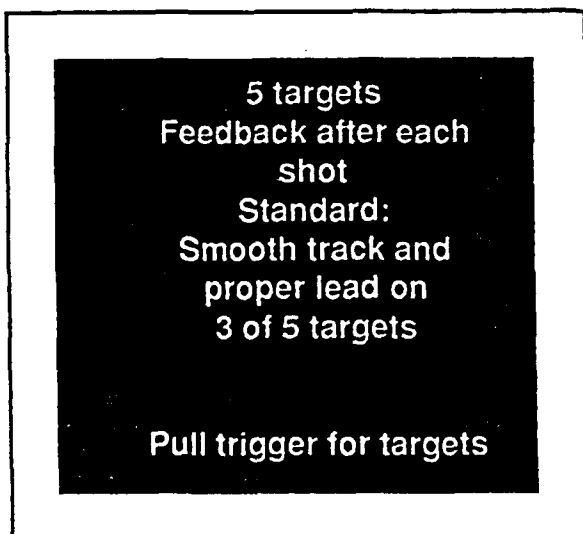


Graphic showing a proper smooth tracking sequence

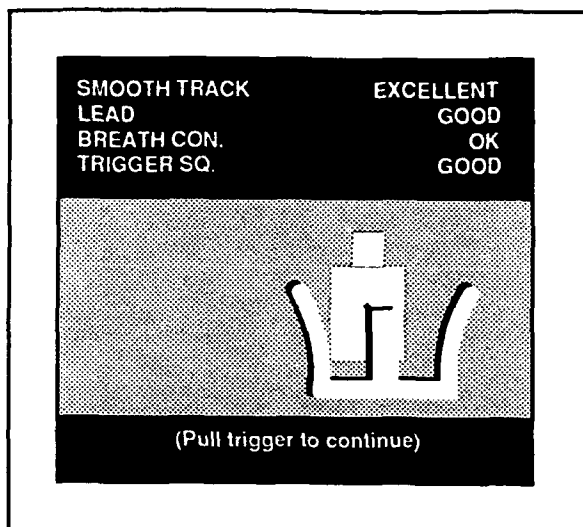
2-9



2-10

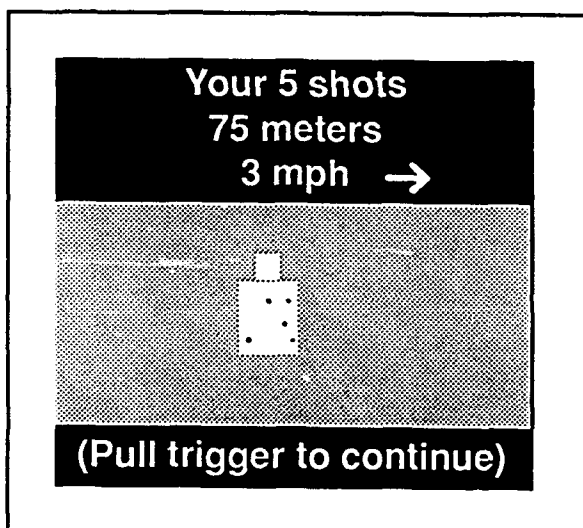


-11,
-15



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

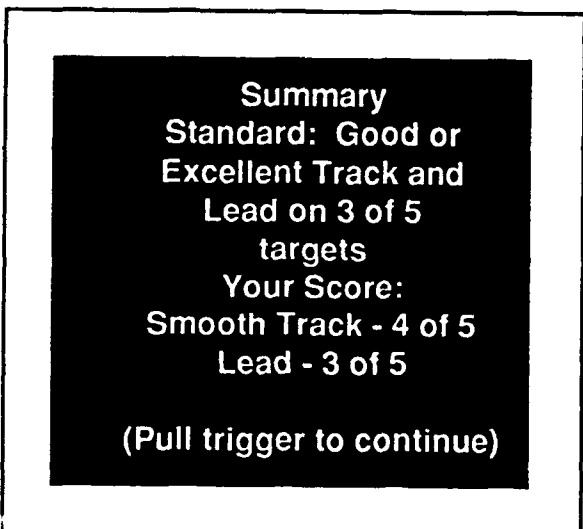
-16



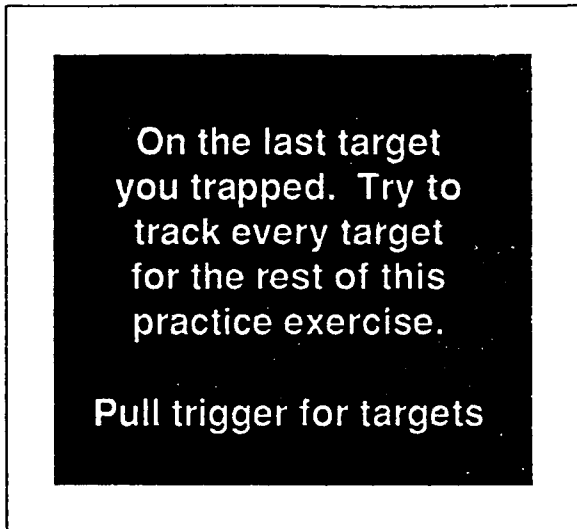
Summary screen showing 5 shots.

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



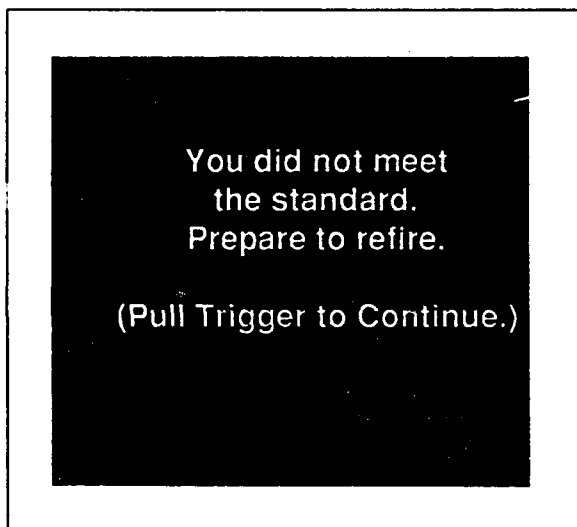
2-18



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.

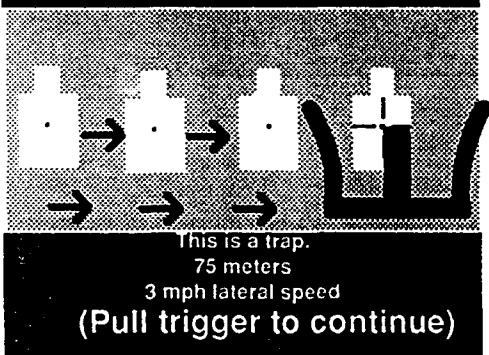
Pull trigger for targets.

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.



Graphic showing a proper trap se-
quence

2-22

Fundamentals for Trapping Moving Targets

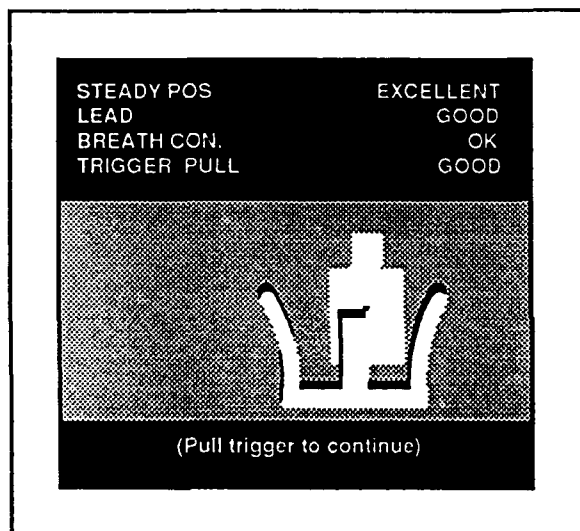
- *Steady Position
- *Lead
- *Breath Control
- *Trigger Pull

(Pull trigger to continue)

2-23

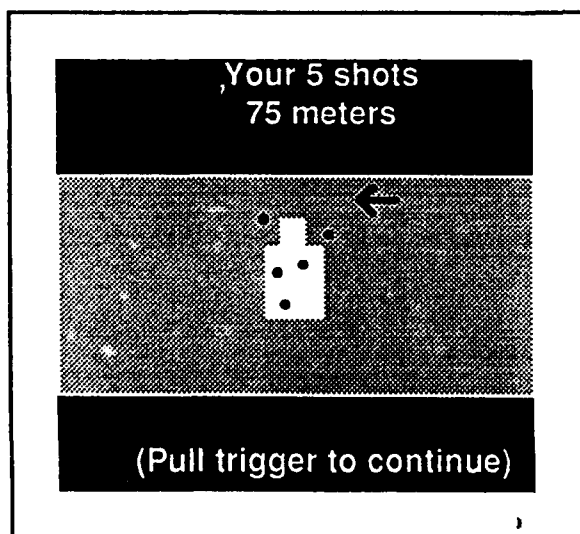


2-24



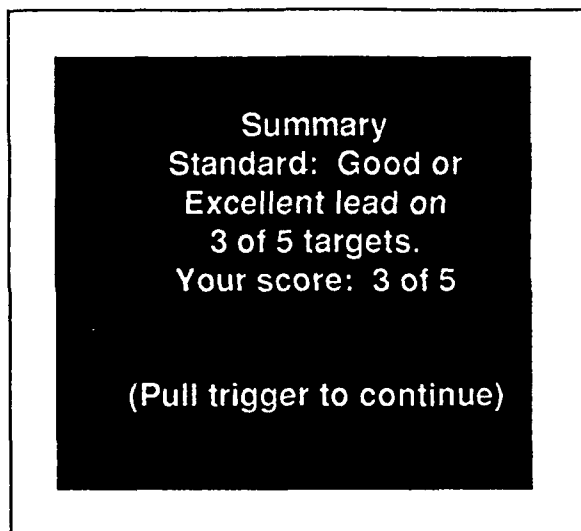
Five 75-meter targets moving at 3 mph from right to left, with replay after each shot.

2-25



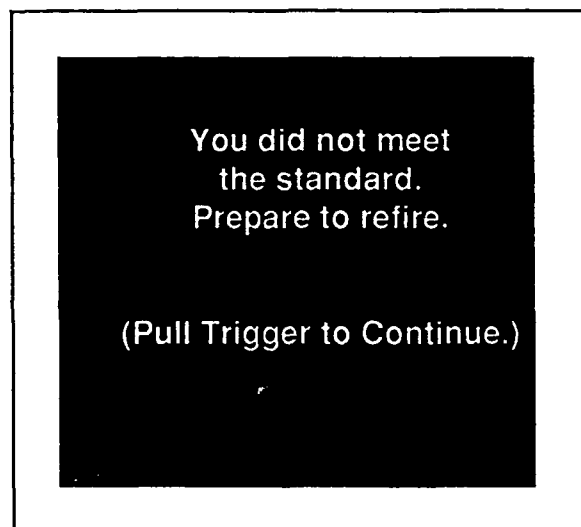
Target with five shots. (2-16.)

2-26

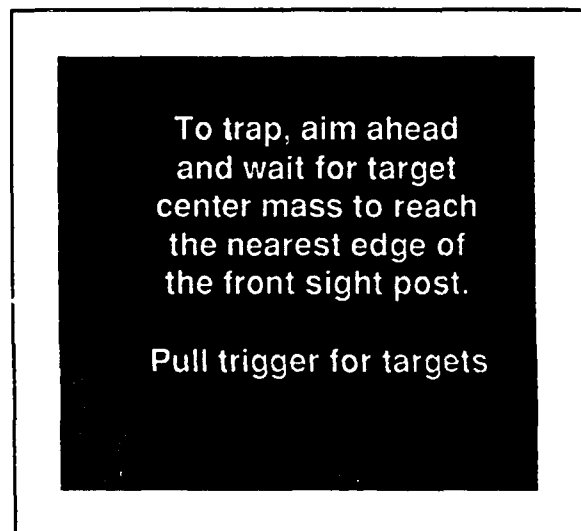


Following the summary, if a person has not met the standard, display 2-27.

2-27

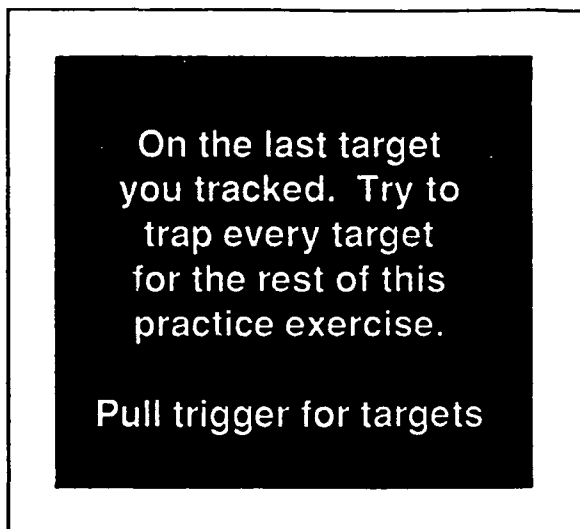


2-28



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

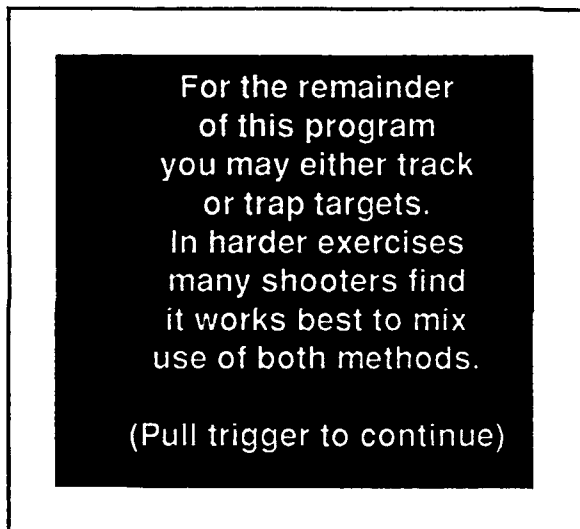
2-29



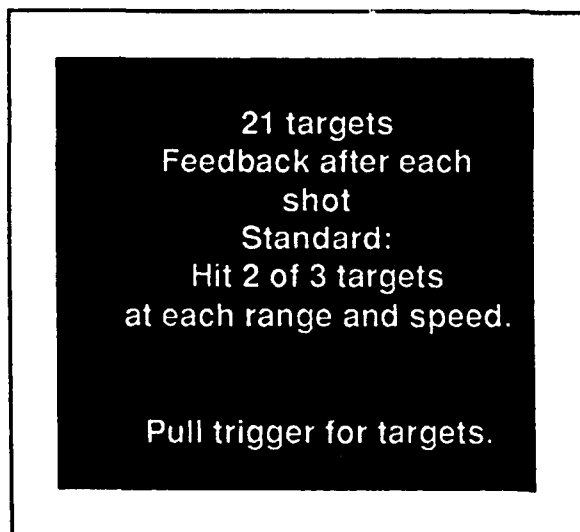
NOTE: If at any time the person does not trap (tracks instead), give this screen:

NOTE: Cycle back to the same target.

2-30



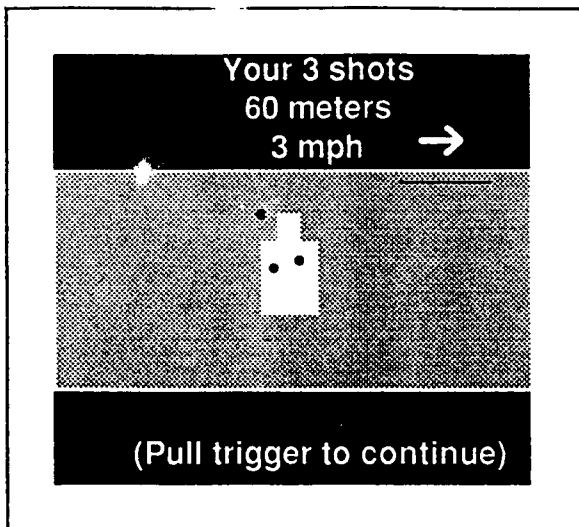
2-31



NOTE: 21 target presentation

<u>Range</u>	<u>Direction</u>	<u>Speed</u>	<u># Total</u>
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	<u>3</u>
			21

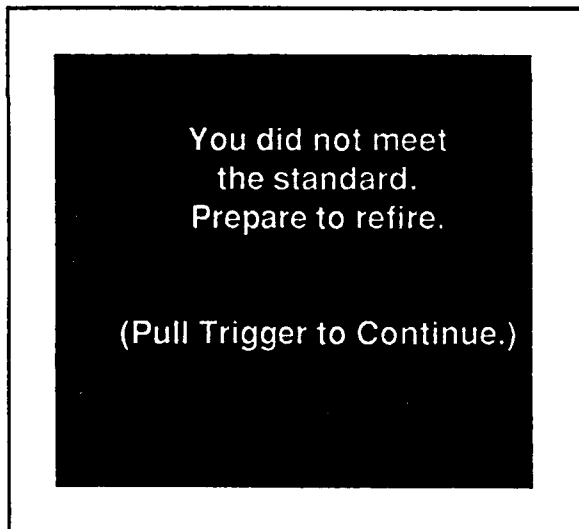
2-32,
2-51



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

SUMMARY: 21-TARGET EXERCISE

NUMBER OF TARGETS TRACKED -- 10

SMTH TRACK GOOD

LEAD GOOD

BREATH CON OK

TRIGGER SQ GOOD

SHOT LOC GOOD

NUMBER OF TARGETS TRAPPED -- 6

STEADY POS EXCELLENT

LEAD BELOW AVERAGE

BREATH CON OK

TRIG PULL GOOD

SHOT LOCATION BELOW AVERAGE

(Pull trigger to continue)

2-53

20 timed targets.

20 shots.

Shot location for misses only.

Standard:

Hit 4/5 stationary

Hit 11/15 moving

Pull trigger for targets.

NOTE: 20 target presentation

<u>Range</u>	<u>#</u>	<u>Exp* Time</u>	<u>Speed</u>
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

Summary: 20-Target Exercise

Range	Exposures	Hits (Stationary)	Misses	No Fires
50	1	1	0	0
100	1	1	0	0
150	1	1	0	0
250	1	1	0	0
300	1	0	1	0
TOTAL	5	4	1	0
		(Moving)		
60	4	3	1	0
75	4	4	0	0
125	4	2	2	0
185	3	2	1	0
TOTAL	15	11	4	0
		QUALIFIED		

Stationary Target Standard: H:4 of 5.
Moving Target Standard: H:11 of 15.
(Pull Trigger to Continue)

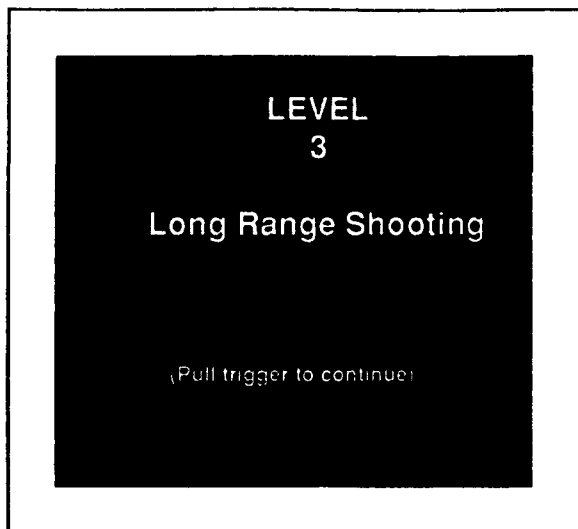
Upon completion of the scenario, this screen is shown.

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

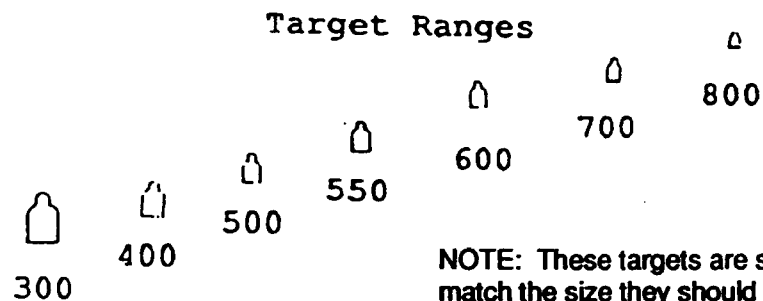
You did not meet
the standard.
Prepare to refire.

Pull trigger for targets.

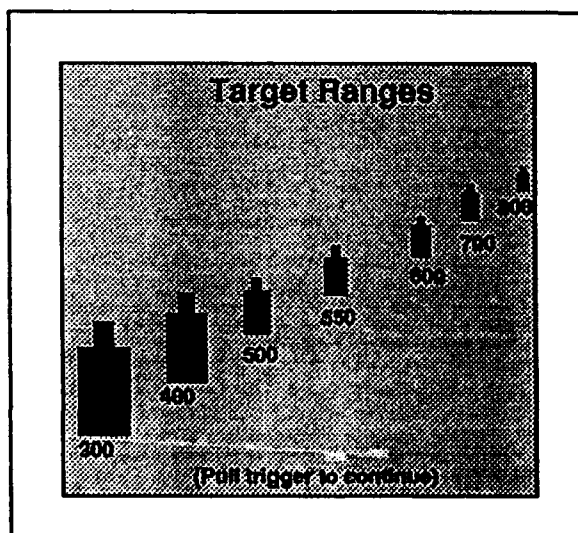
3-1



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

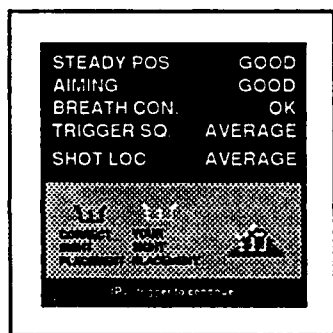
Pull trigger for targets

3-9

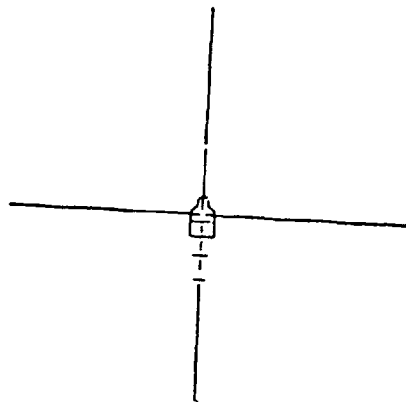
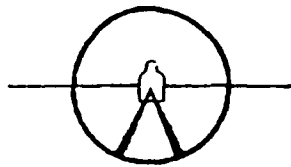


Scene with 300 M target.

3-10

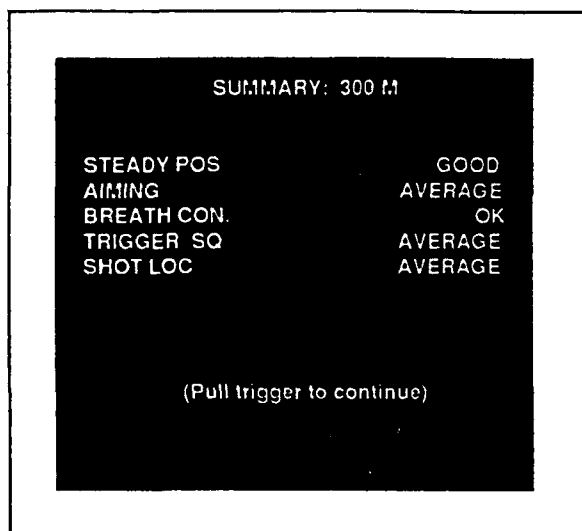


Graphic of target with correct sight and your sight.

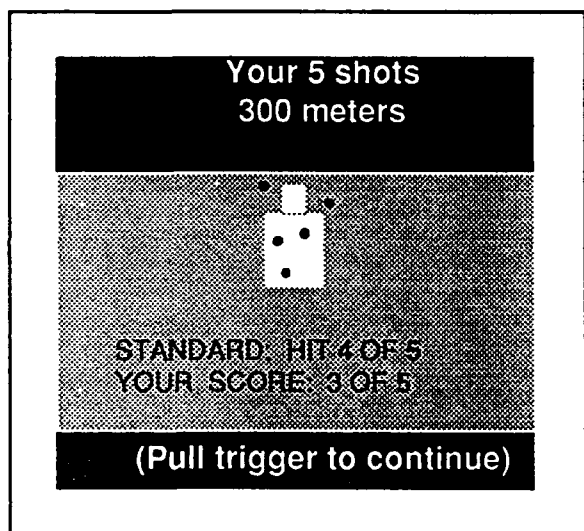


NOTE: Make the criterion for EXCELLENT and GOOD tighter - by about 40%. Repeat 3-9 and 3-10 four times.

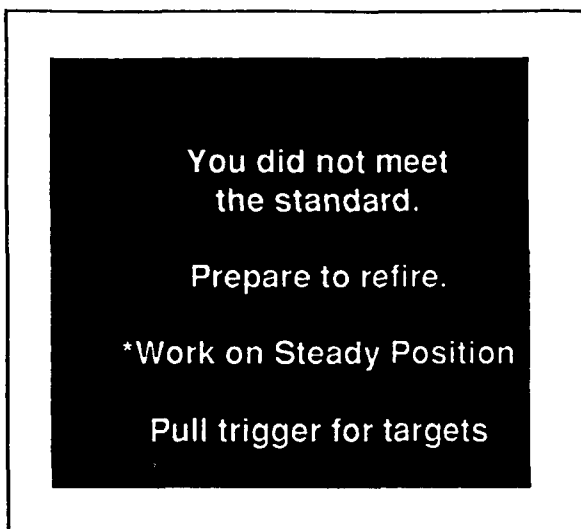
-11



-12



3-13

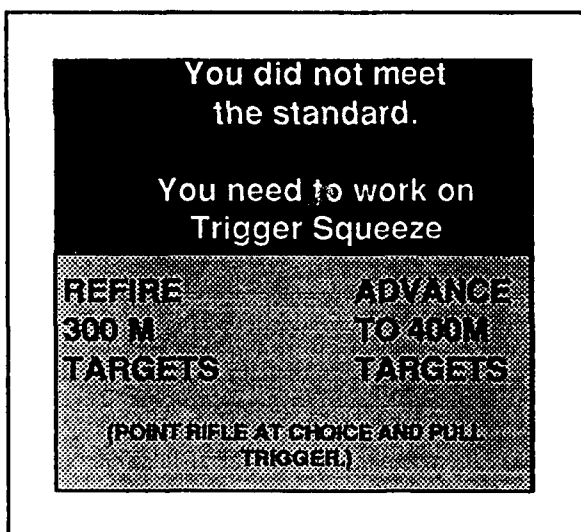


NOTE: *The lowest rating -- Steady
Position, Aiming, or Trigger
Squeeze. Show all which are
"average" or below.



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

3-14



Use this procedure on most of the remaining exercises.

-15

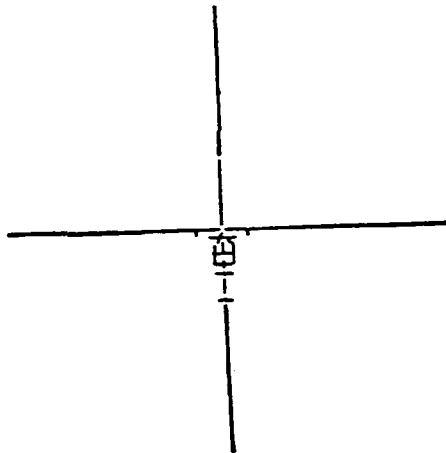
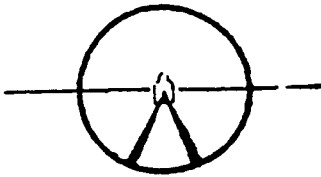
*Target Range: 400 Meters
*Rifle Sights Set at 400
Meters
*Standard: Hit 3 of 5

Pull trigger for targets

16

(400 Meters)
(Same as 300 Meters)

3-23

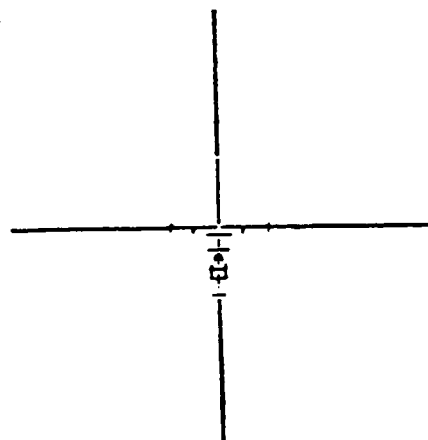
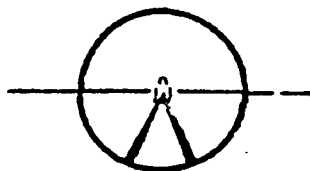


3-24



3-25
to 3-31

(500 Meters)
(Same as 300 Meters)



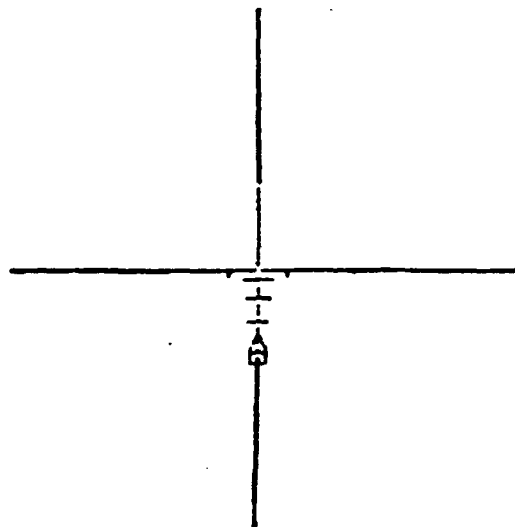
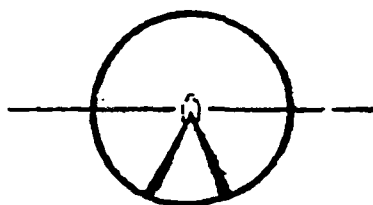
3-32



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

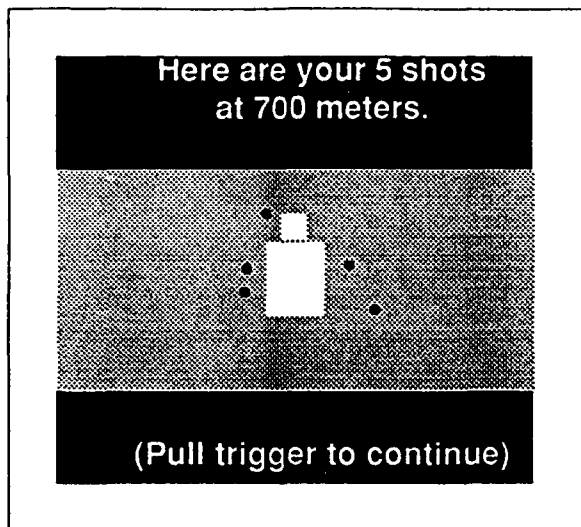
Pull trigger for targets

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

→ You should always keep your sights set on battlesight zero unless you are shooting a specific target. Many times you will not have time to change sights, and must adjust your aim point.

(Pull trigger to continue)

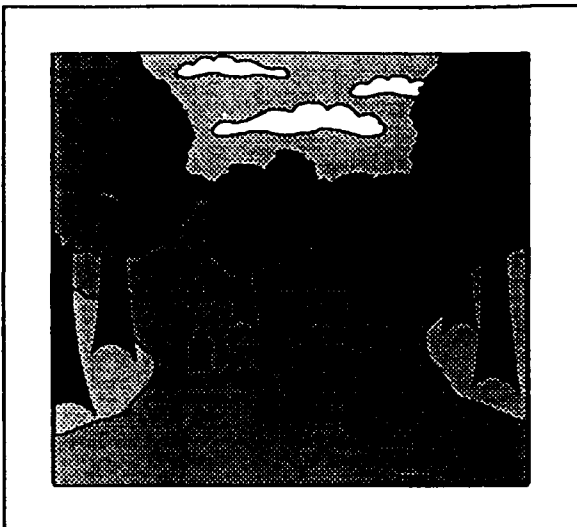
3-48

*Target Range: 400 Meters
*Rifle Sights Set at 300 Meters
*Standard: Hit 2 of 5

Pull trigger for targets

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

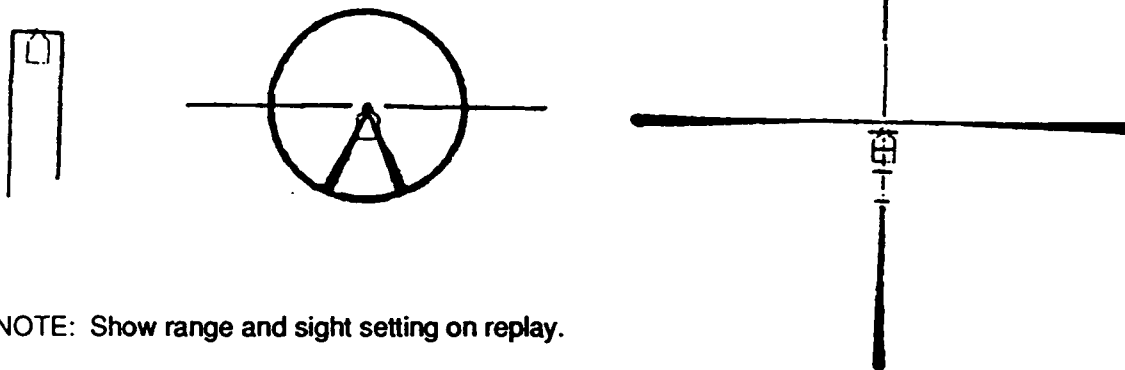
3-49



400 M targets

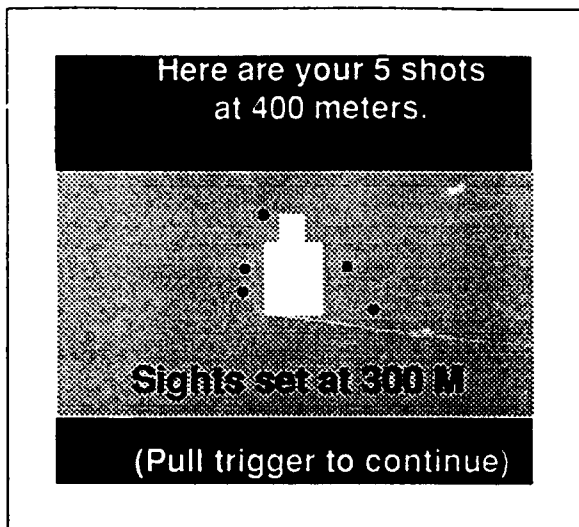
NOTE: Bullet hits 38 cm below the aiming point for the iron and ELCAN sights. The ARI sight has the 400 M aiming mark at target center, which is the bullet strike point.

Detailed replay.



NOTE: Show range and sight setting on replay.

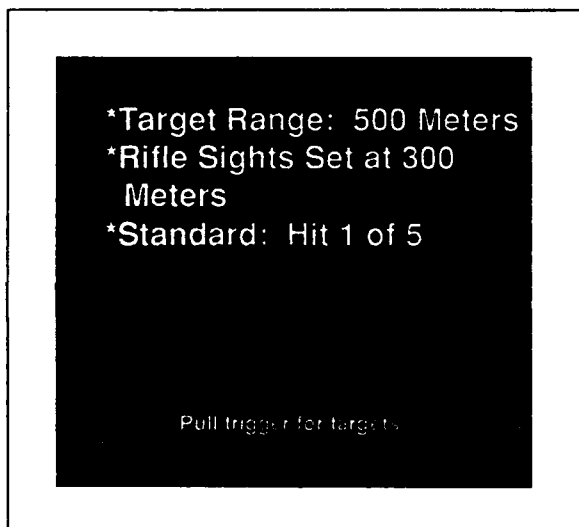
3-50



NOTE: After 5 targets

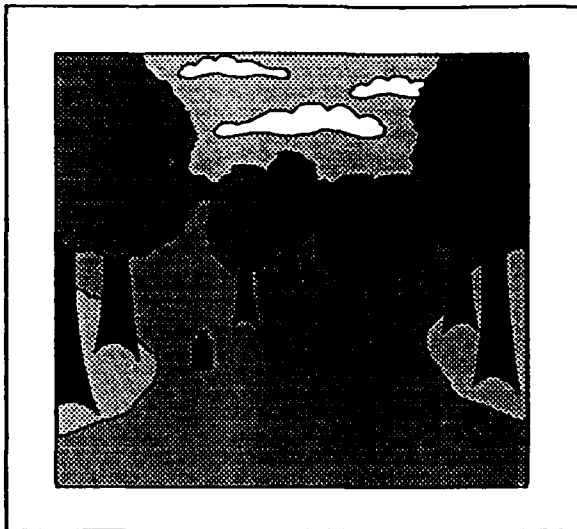
Replay 5 shots at 400 M -- Reshoot
400 M if 2 of 5 not hit.

3-51



NOTE: Need to highlight 500 and
300 .

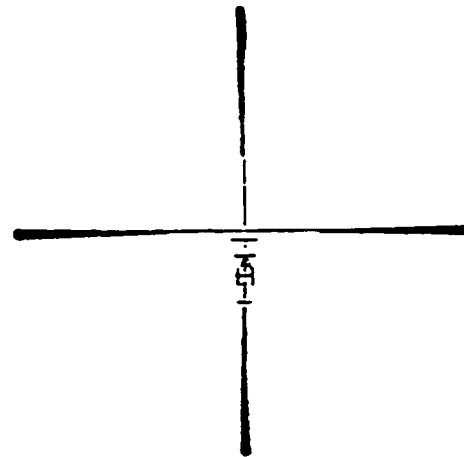
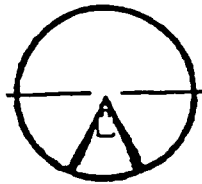
3-52



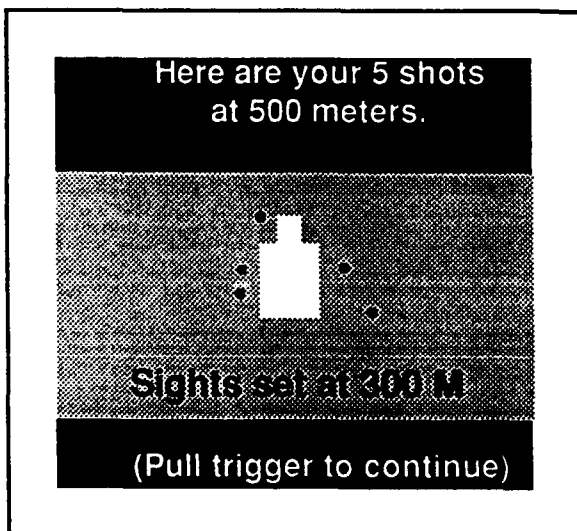
500 M targets

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

With sights set for long range targets, you may need to engage a single shorter range target without making a sight change.

(Pull trigger to Continue)

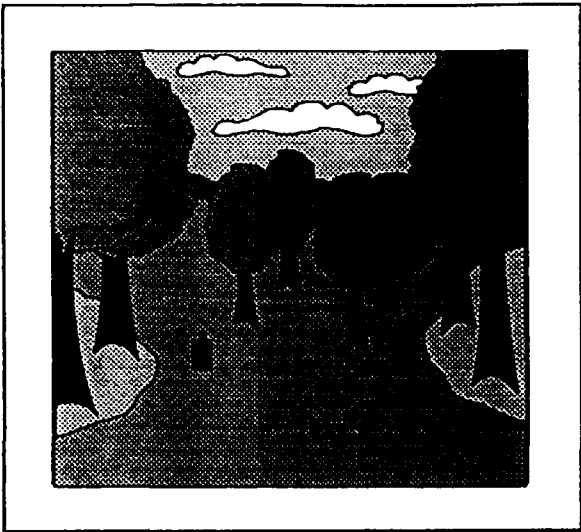
3-56

*Target Range: 300 Meters
*Rifle Sights Set at 500 Meters
*Standard: Hit 2 of 5

Pull trigger for targets

NOTE: Need to highlight 300 and 500

3-57

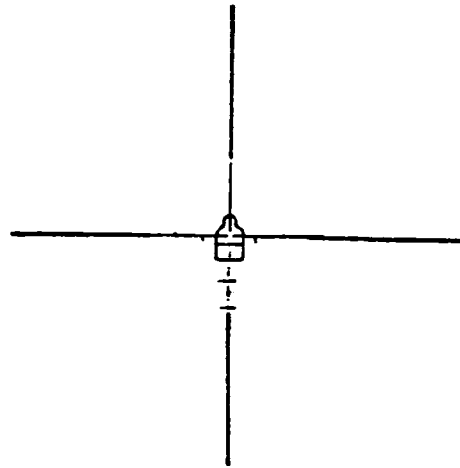
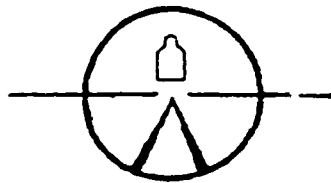


300 M targets

NOTE: Bullet hits 58 cm above aim point.

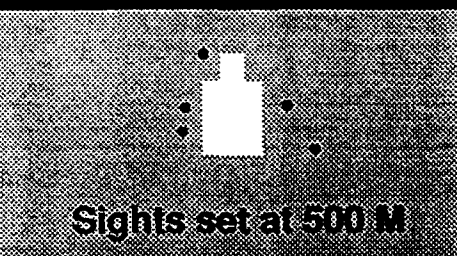
3-58

Detailed replay.



3-59

Here are your 5 shots
at 300 meters.



Sights set at 500 M

(Pull trigger to continue)

NOTE: After 5 targets

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

3-60

The listed maximum
effective range of
the M16A2/A3 is
550 M. Practice
shooting a 550 M
target with a
sight setting of 500
and 600 meters.

(Pull trigger to Continue)

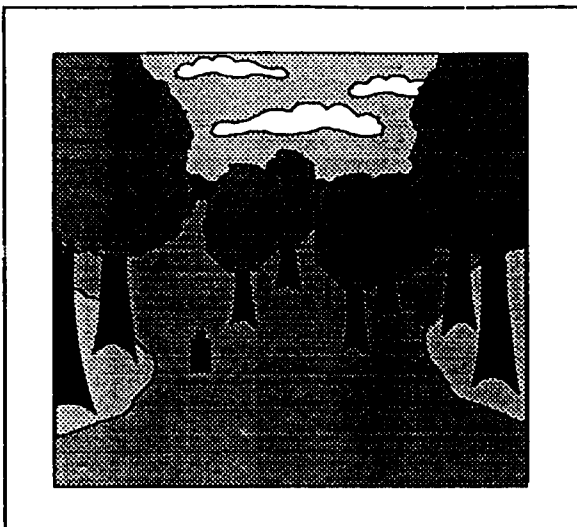
3-61

*Target Range: 550 Meters
*Rifle Sights Set at 500
Meters
*Standard: Hit 1 of 5

Pull trigger for targets

NOTE: Need to highlight 550 and
500

3-62

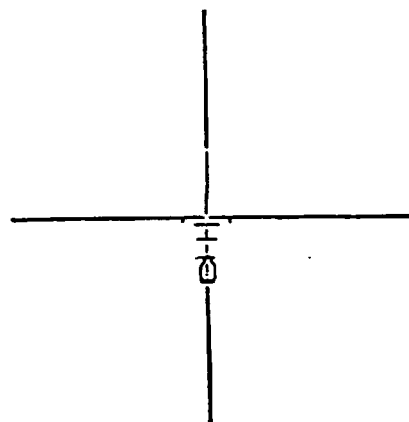
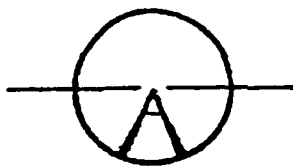


550 M targets

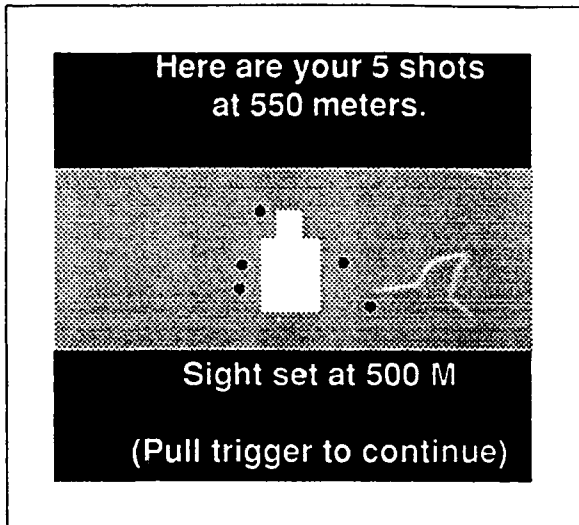
NOTE: Bullet hits 40 cm below aim point.

3-63

Detailed replay.



3-64



NOTE: After 5 targets

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

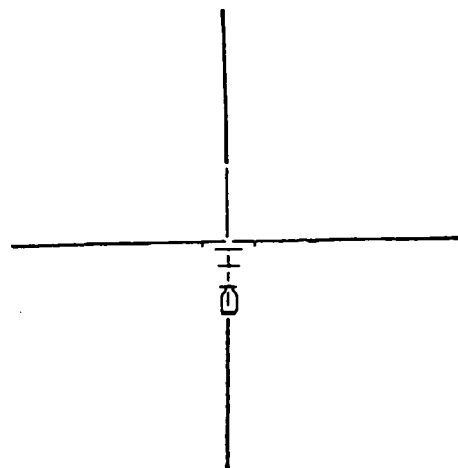
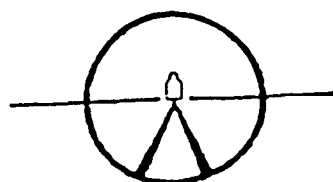
3-65



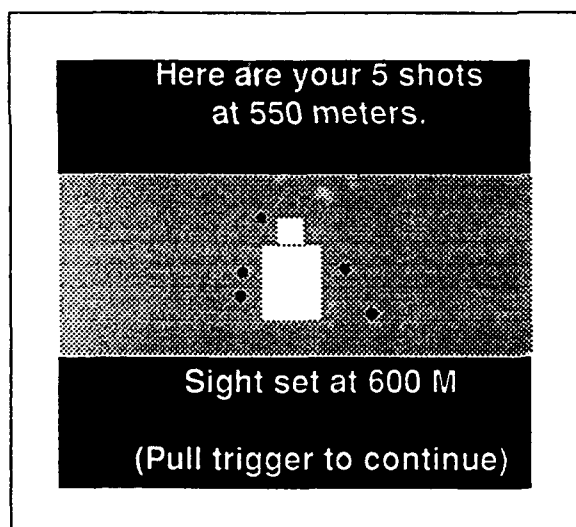
NOTE: Need to highlight 550 and
600

3-66

NOTE: Bullet hits 38 cm above aim point.



3-67



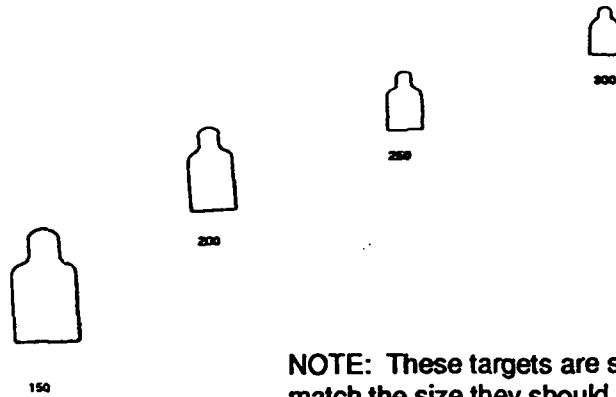
NOTE: After 5 targets

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

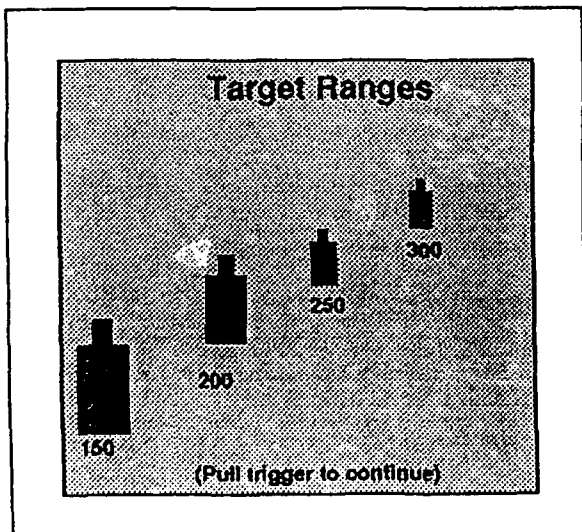
4-1



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



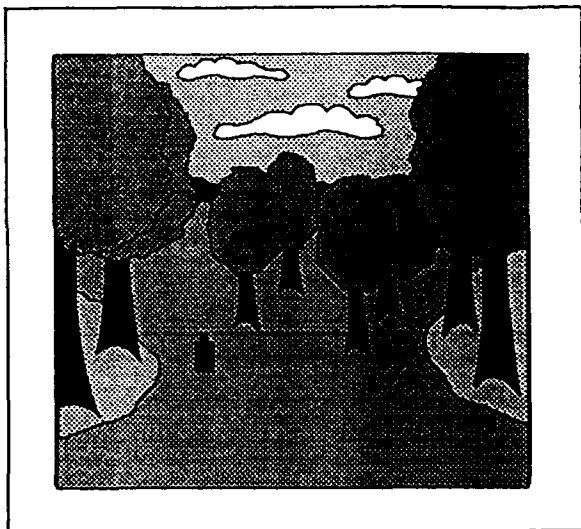
**LONG RANGE
MOVING TARGET PRACTICE
(Single Lead Rule)**

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.

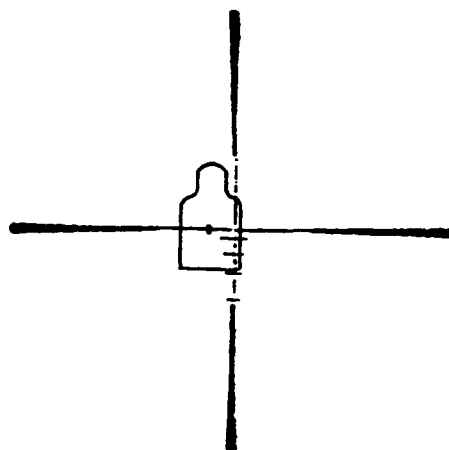
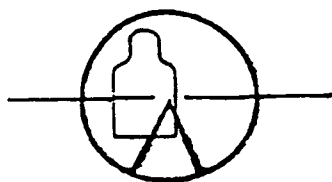
Pull trigger for targets

4-5



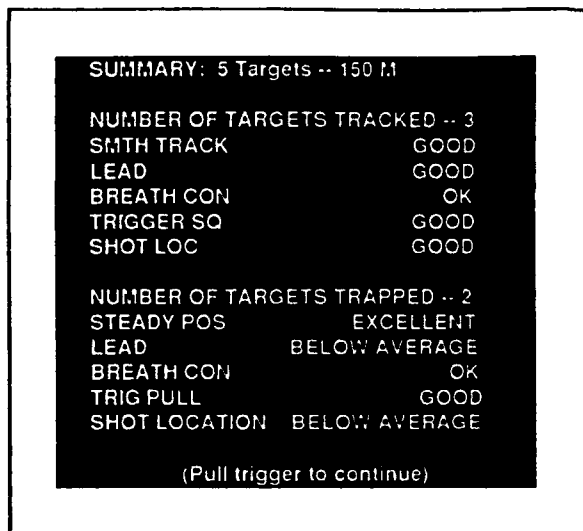
150-meter target moving at 3 mph.

4-6



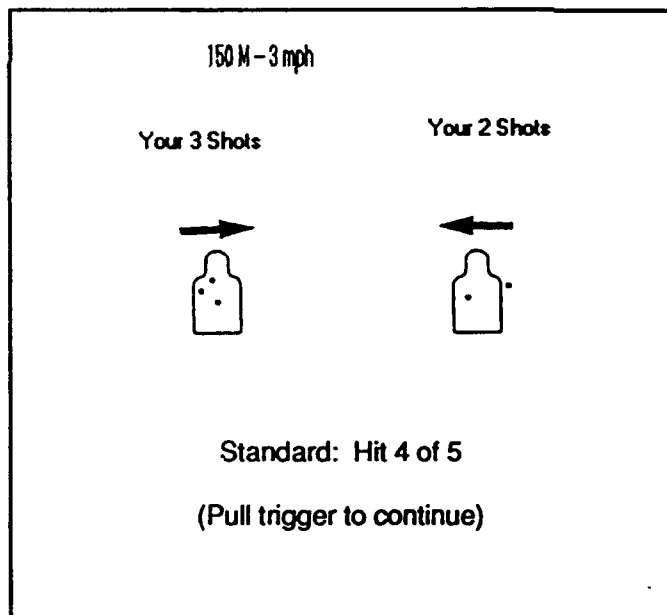
Detailed playback showing trap or track and the single lead rule as correct aiming point. While these are all close enough to show center hits when using the single lead rule, the bullets hit behind target center; 150 M -.6 cm; 200 M -1.9 cm; 250M -3.6 cm; 300 M -6 cm. Insure the aiming and shot location 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



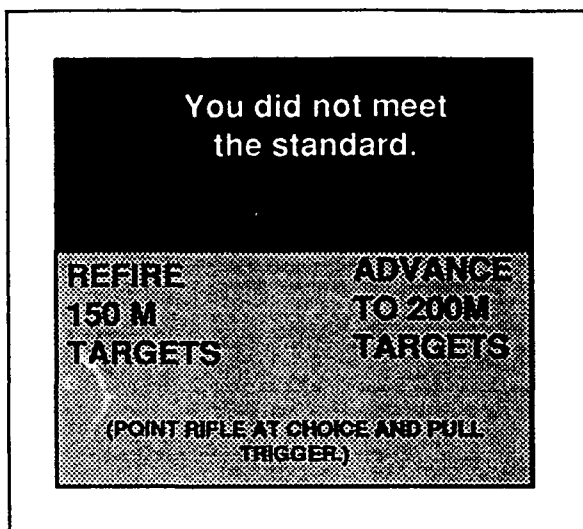
Detailed moving target review screen showing performance for targets tracked and trapped after 5 targets.

4-8

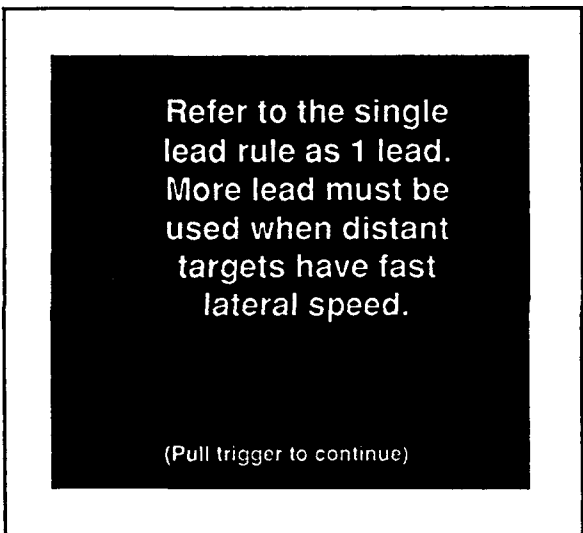


Following each range, if the standard is met, automatically move to the next range. If the standard is not met, show the following screen.

Use this screen if standard is not met.



4-9



4-9a



For all targets less
than 150 m - 1 Lead.

For all targets at
150 m and beyond when
lateral movement is
equal to:

Walking - 1 Lead
Jogging - 2 Leads
Running - 3 Leads

(Pull trigger to continue)

4-9b

Two leads - aiming
point offset full
width of front sight post.

Three leads - aiming
point offset one and
one-half width of
front sight post.

Use 2 leads on the
following targets.

(Pull trigger to continue)

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

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

4-10

Long Range Moving Target Practice (Increased Lead)

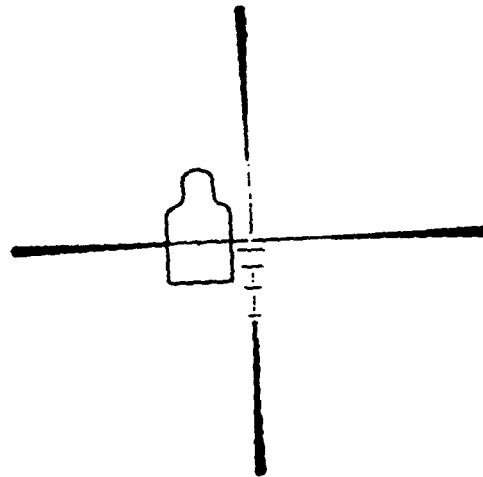
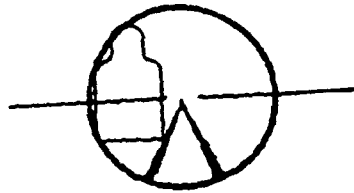
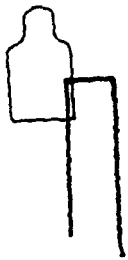
Standard:

Hit 3 of 5 at 150 meters.
Hit 2 of 5 at 200 meters.
Hit 1 of 5 at 250 meters.
Hit 1 of 5 at 300 meters.

Pull trigger for targets

Replay can show center hits again: 150 -
1 cm behind; 200 -3.8cm behind; 250 -7.7
cm behind; 300 -3.8 cm ahead. How-
ever, 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

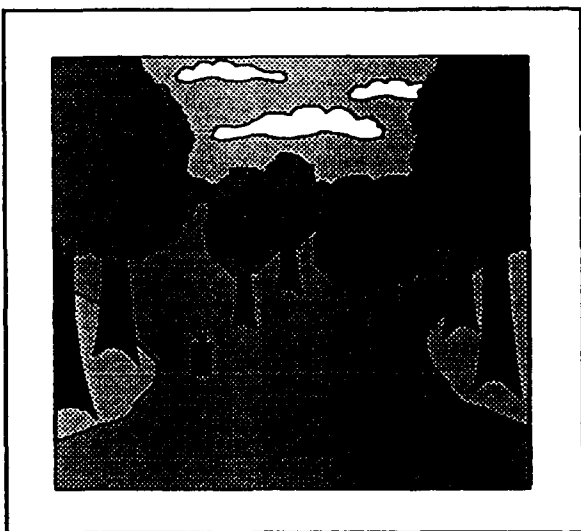
Long Range Moving Target Practice (Extended Lead)

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

Standard:
Hit 1 target in 10 passes.

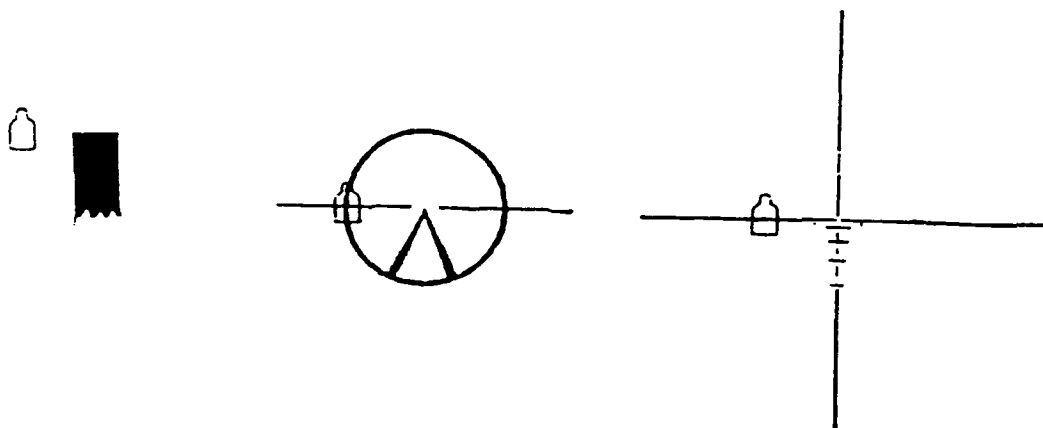
Pull trigger for targets

4-13

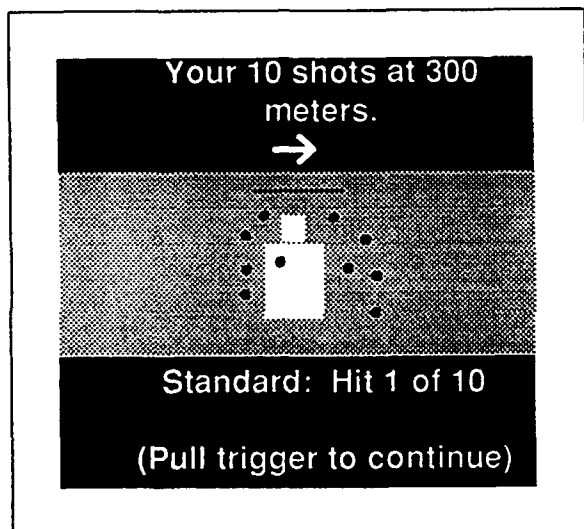


A silhouette at 300 meters moving 8 mph.

4-14

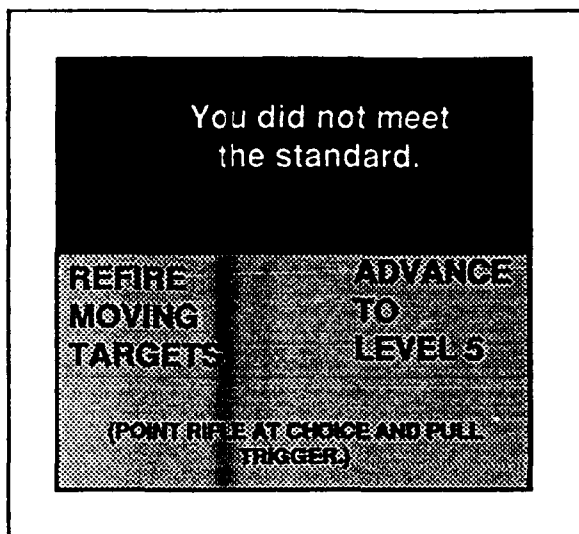


4-15

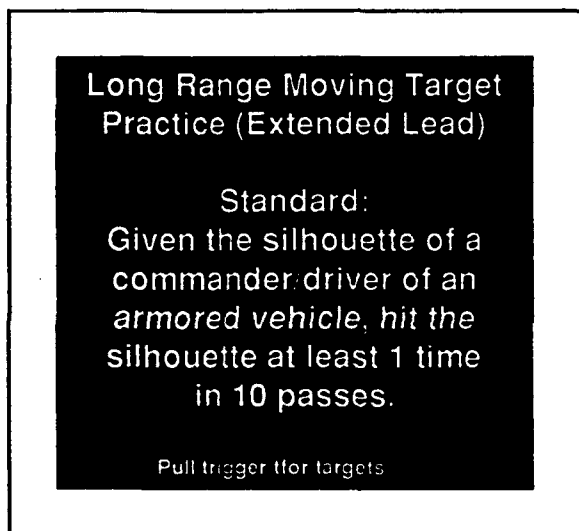


NOTE: Advance to Level 5
if standard is met.

4-16

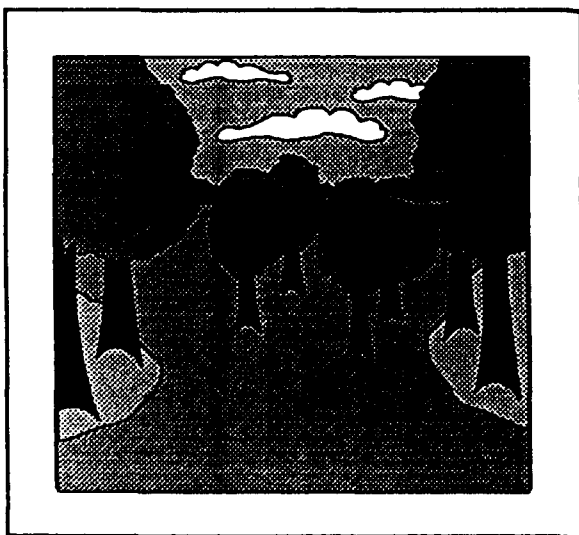


4-12a



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

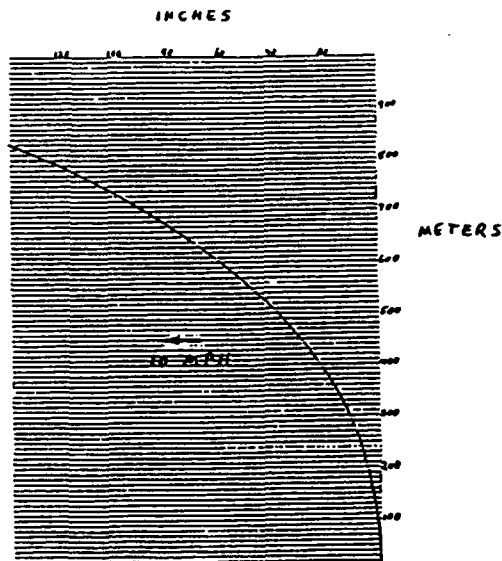
(Pull trigger to continue)

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

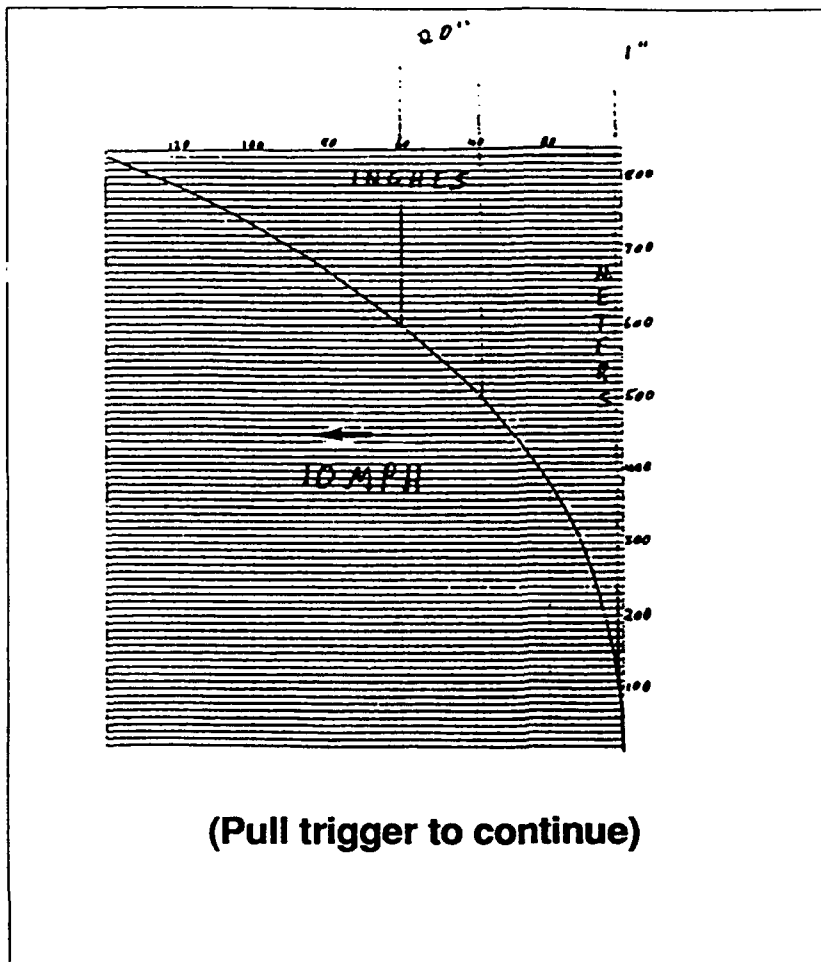


5-4

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

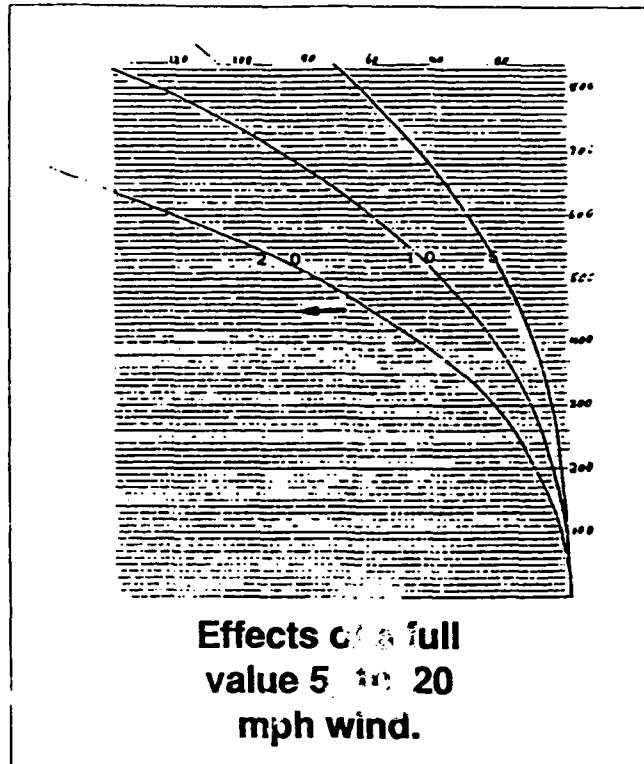


6

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



5-8

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

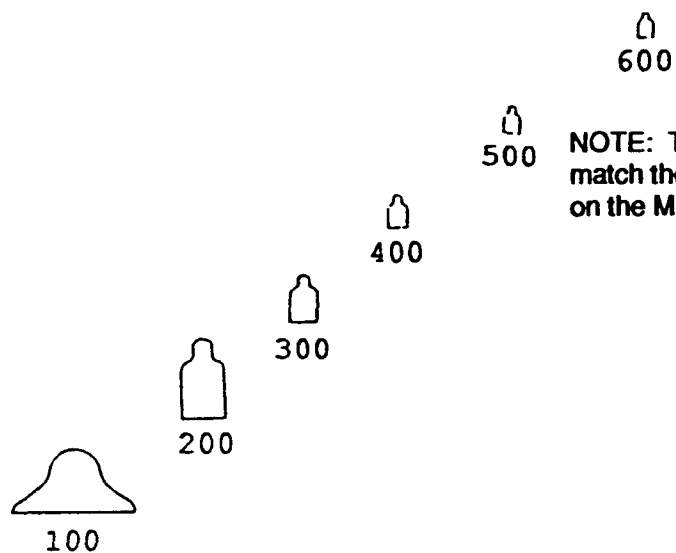
No wind: 

5 mph wind: 

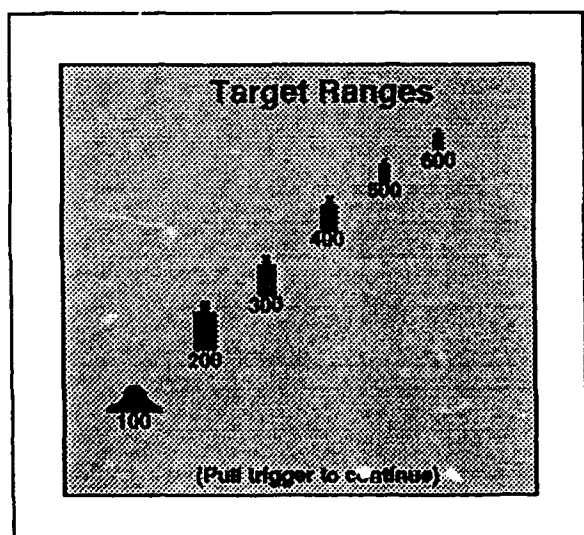
10 mph wind: 

20+ mph wind: 

(Pull trigger for wind chart)



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

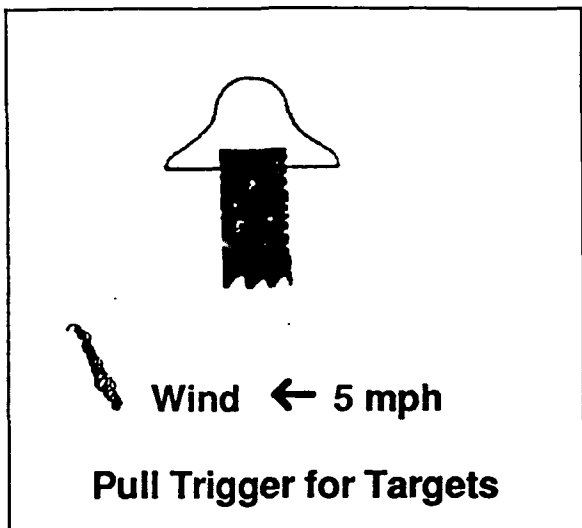
Pull trigger for targets

5-12



100 M target

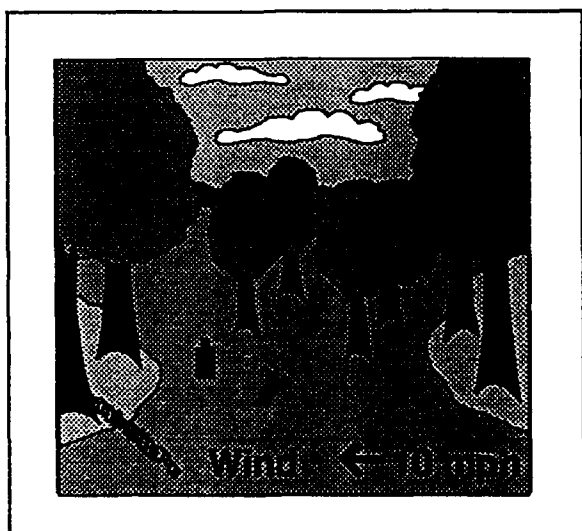
5-13



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

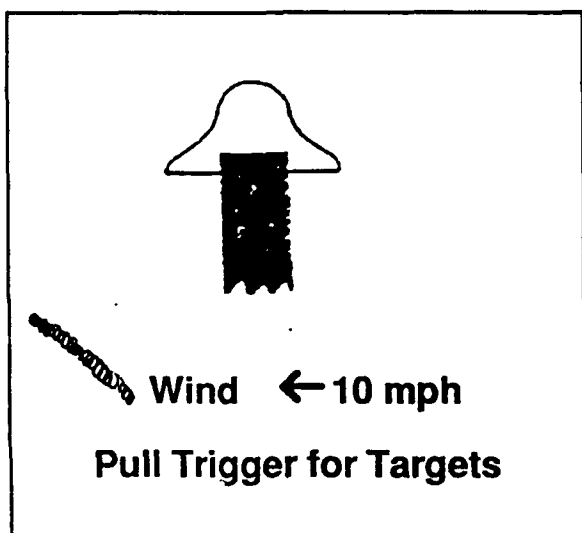
NOTE: Adjust the aiming score to be correct for center, the hold-off position, or anything in a straight line between the two.

5-14



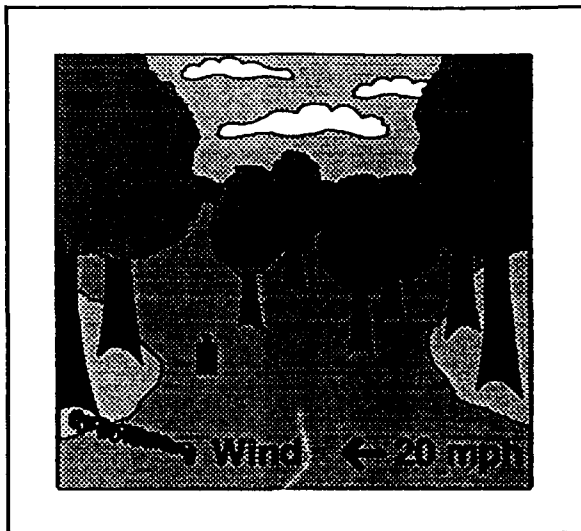
100 M target.

5-15



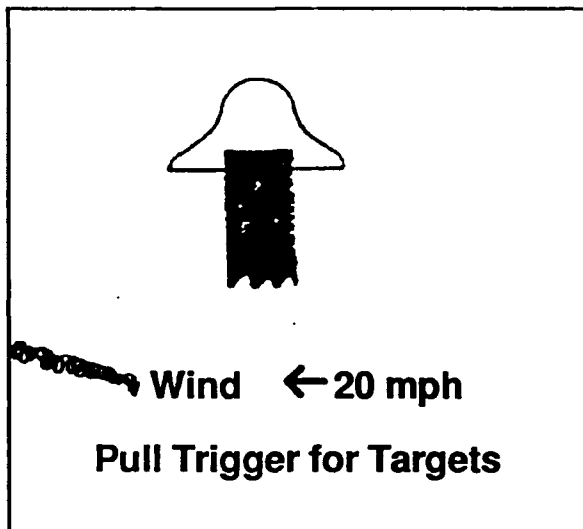
Detailed replay (aiming based on center). Bullet is 10 cm above and 3.2 cm left of aim point.

5-16



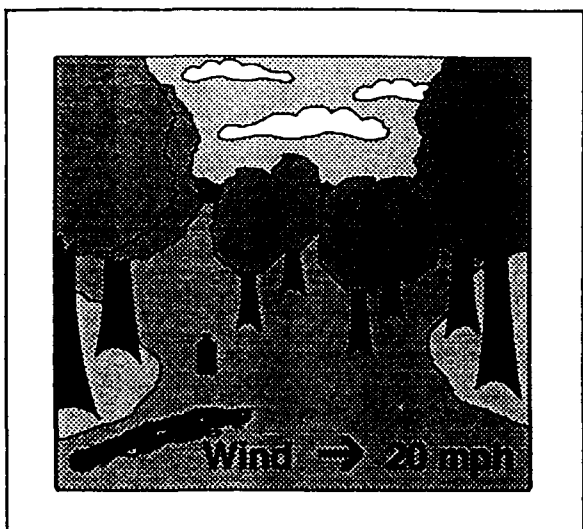
100 M target.

5-17



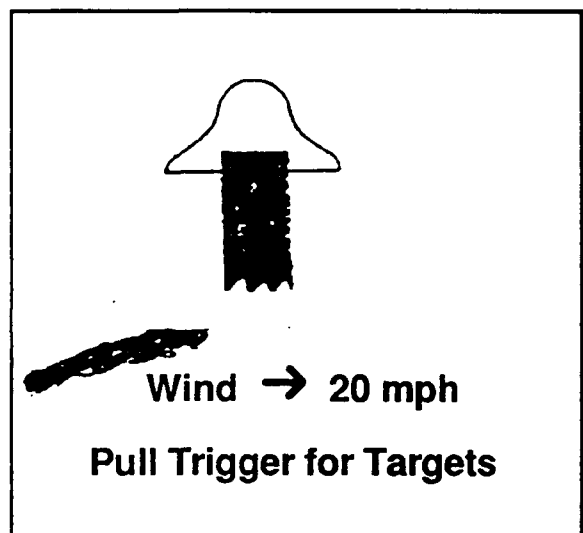
Detailed replay (aiming based on center). Bullet is 10 cm above and 3.2 cm left of aim point.

5-18



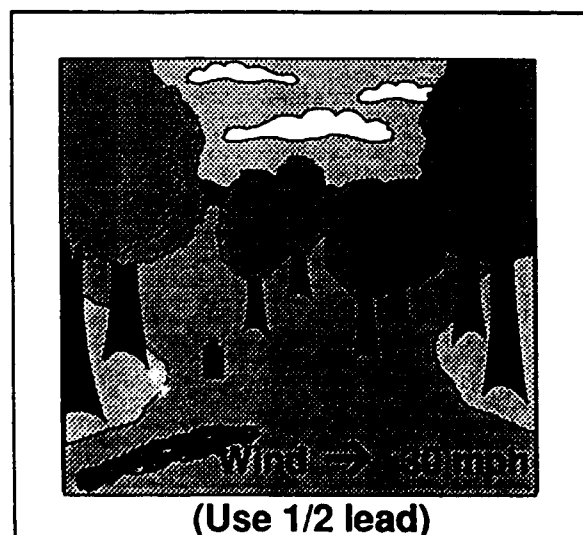
100 M target.

5-19



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

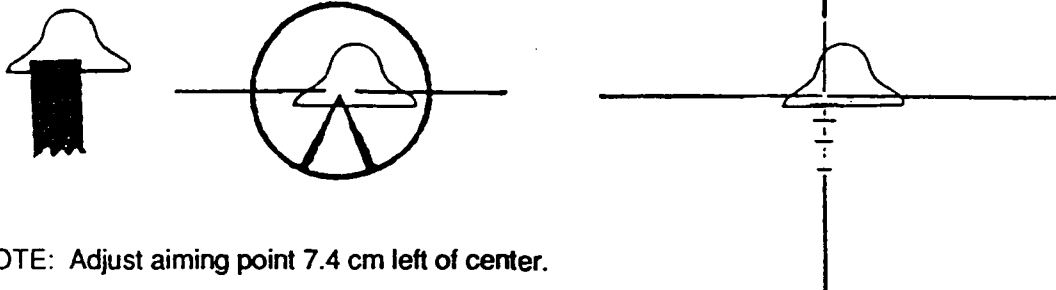
5-20



100 M target.

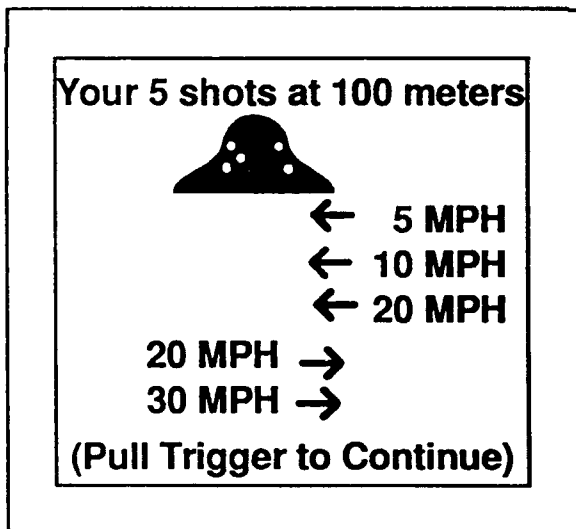
5-21

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

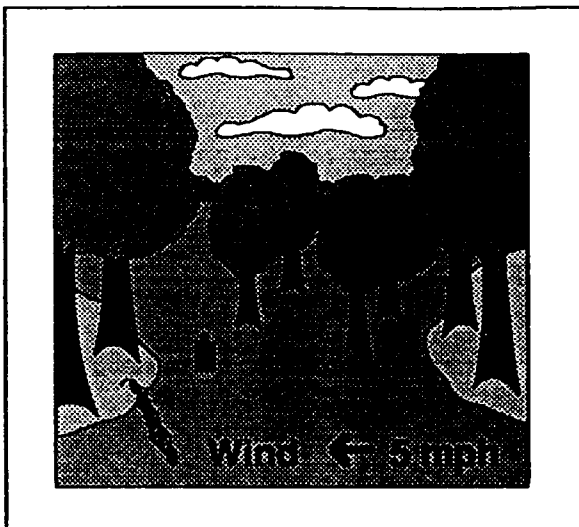
Rifle Sights Set at 300 Meters

Wind speed shown with
target

Assume a supported position

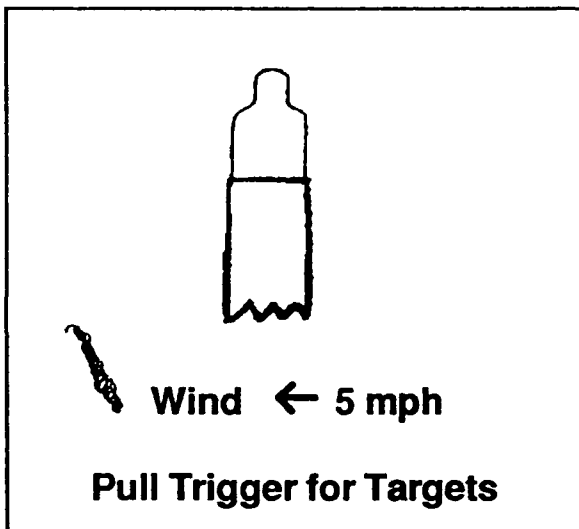
Pull trigger for targets

5-26



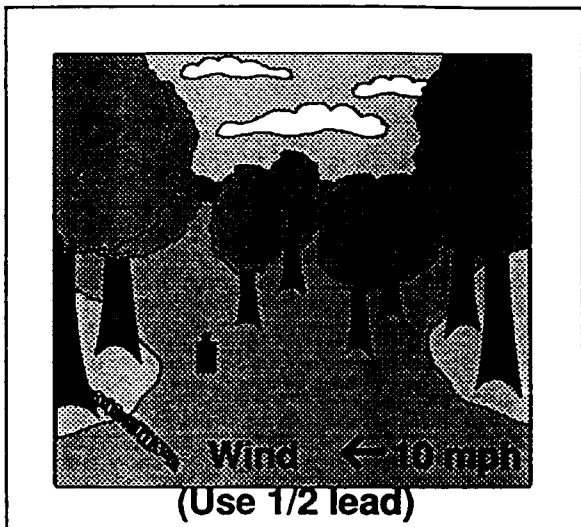
200 M target

5-27



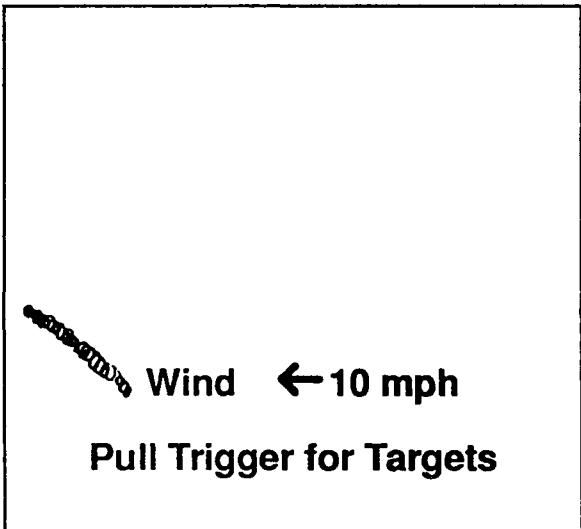
Detailed replay. Center aiming..
Bullet is 14 cm above and 6 cm left
of aim point.

5-28

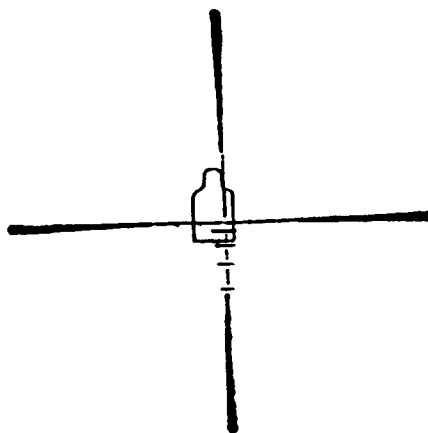
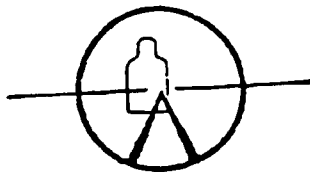


200 M target.

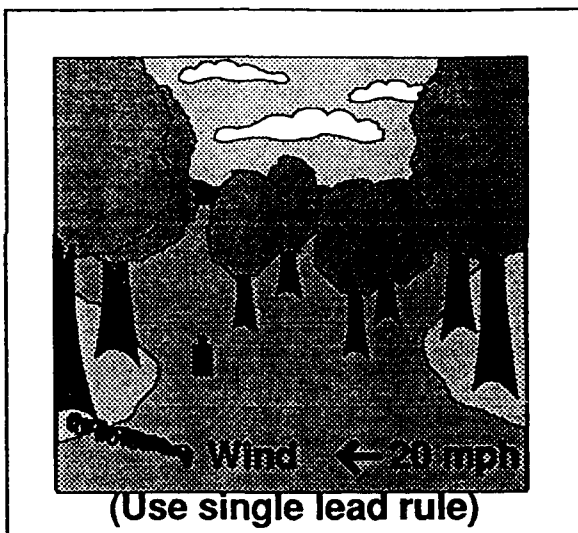
-29



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

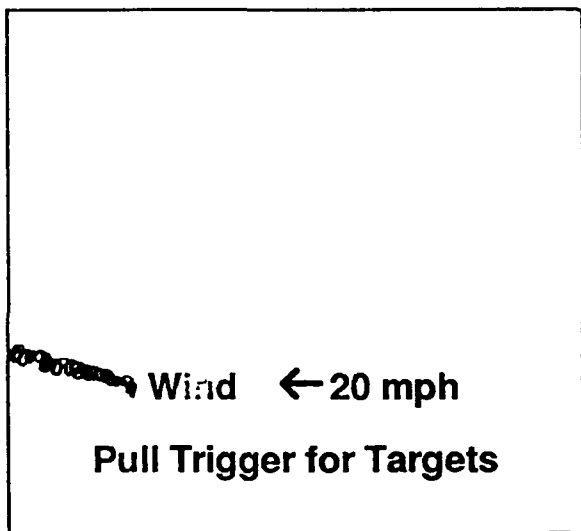


5-30

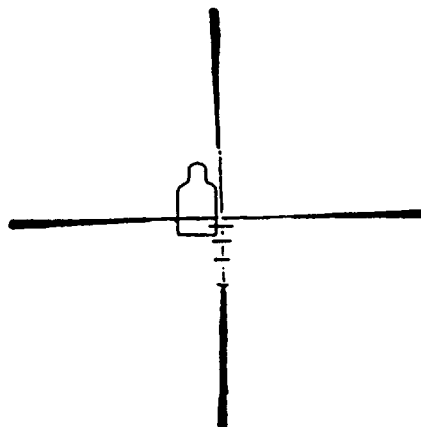
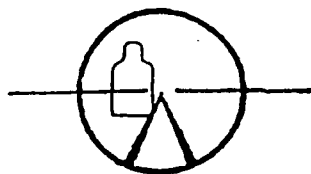


200 M target.

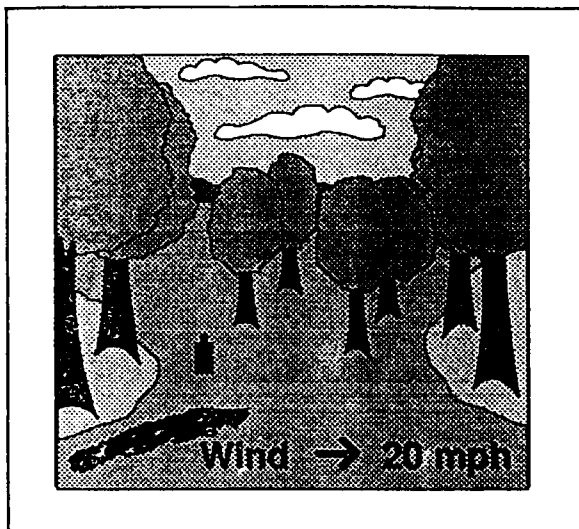
5-31



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

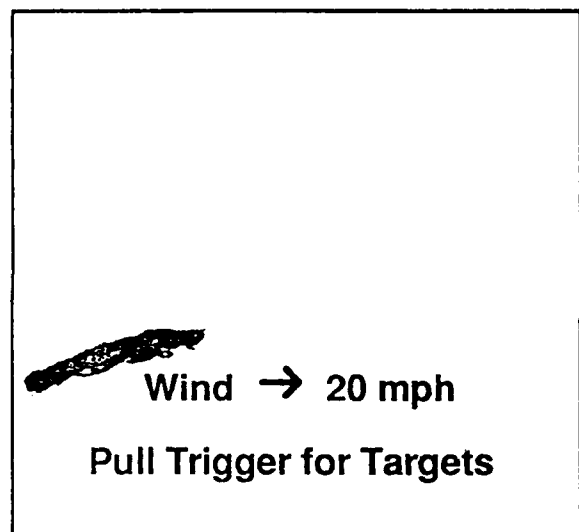


5-32



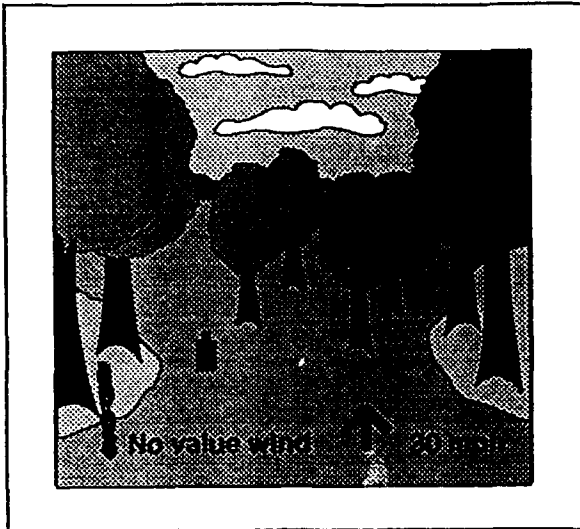
200 M target.

5-33



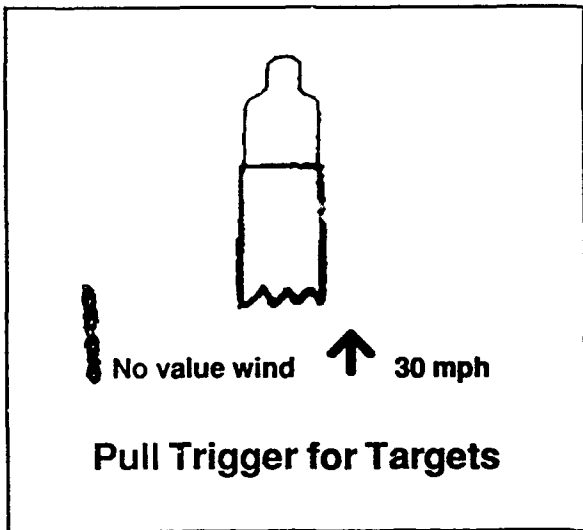
Playback. Reverse of 5-31. Displace aim point 29 cm left. Bullet hits 14 cm above and 26 cm right of aim point.

5-34



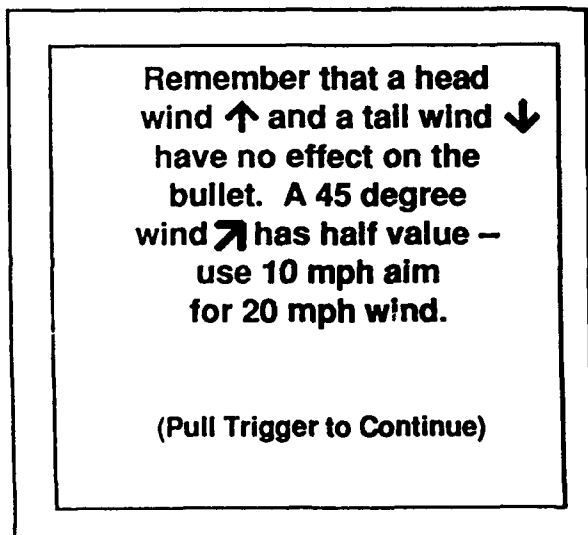
200 M target.

5-35



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

5-36



MAKE 45 DEGREE ARROWS TO GO IN HERE.

5-36a

As you review your
200 M shots, remember
the 10 mph memory aid:

1, 5, 1, 2, 3, 5

10 mph wind = 5 "

5 mph wind = 2-1/2"

20 mph wind = 10 "

(Pull Trigger to Continue)

5-37

Your 5 shots at 200 meters



→ 5 MPH

→ 10 MPH

→ 20 MPH

20 MPH



↑ 30 MPH

(Pull Trigger to Continue)

Target with 5 shot locations.

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

5-38

Target Range: 300 Meters

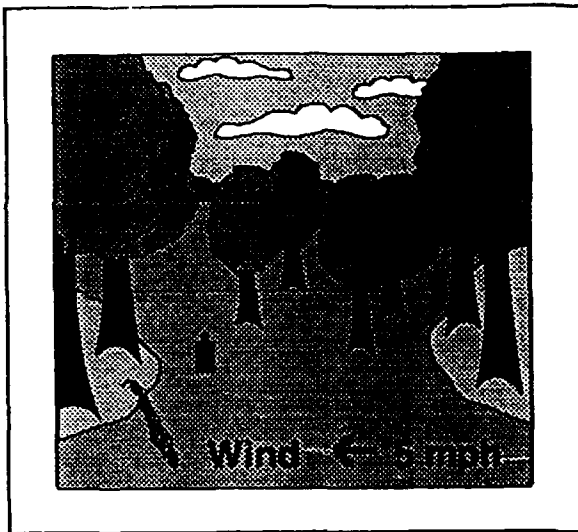
Rifle Sights Set at 300 Meters

Wind speed shown with
target

Assume a supported position

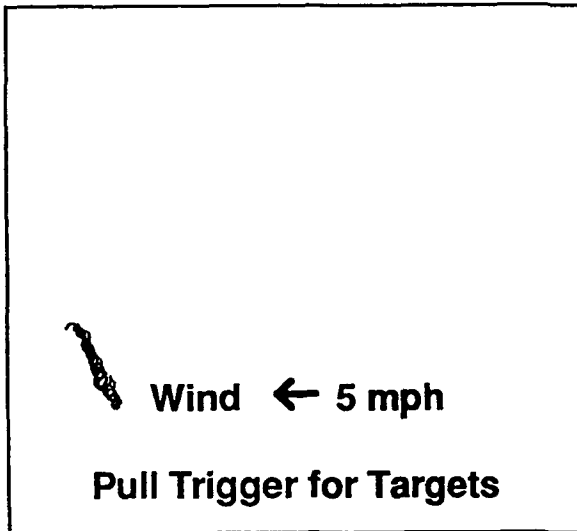
Pull trigger for targets

5-39

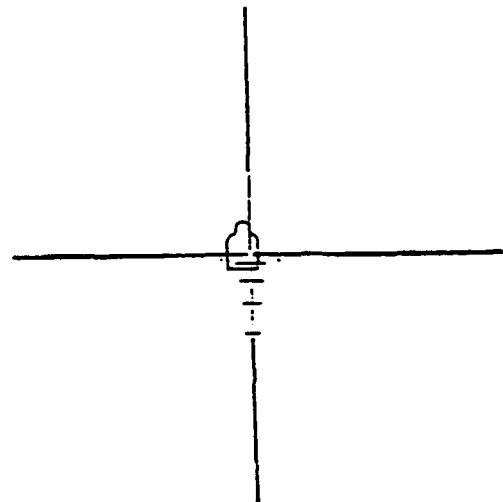
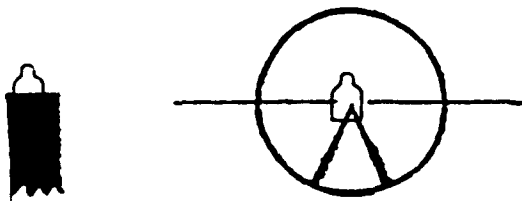


300 M target.

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.

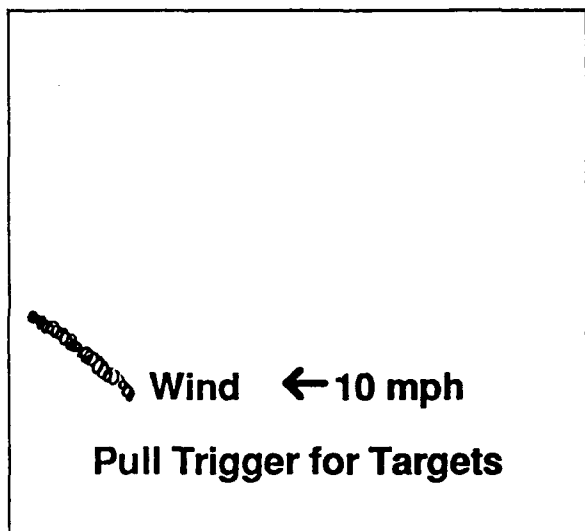


5-41

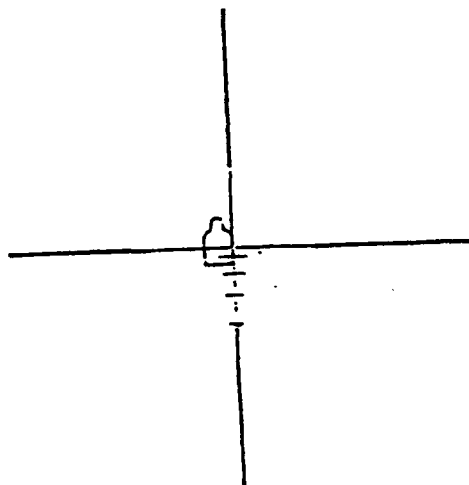
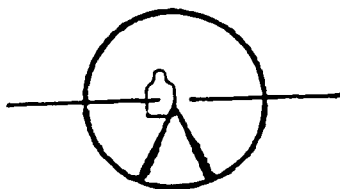


300 M target.

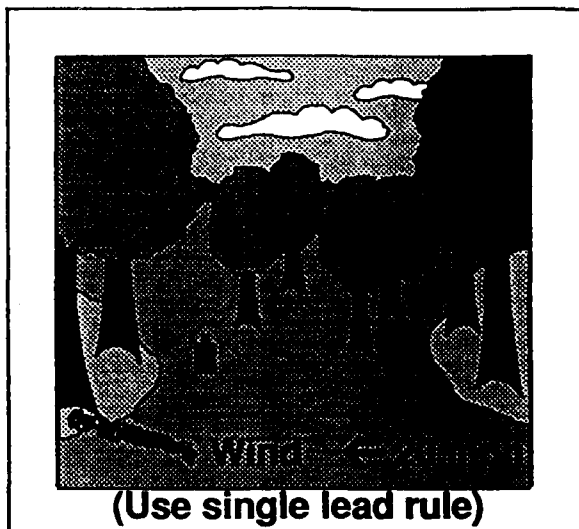
5-42



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

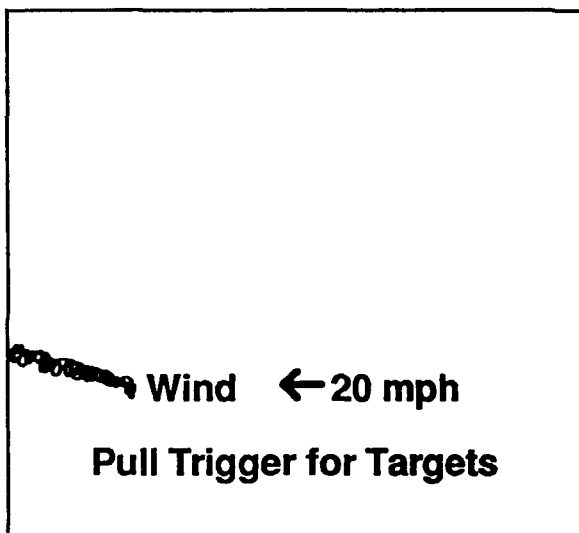


5-43

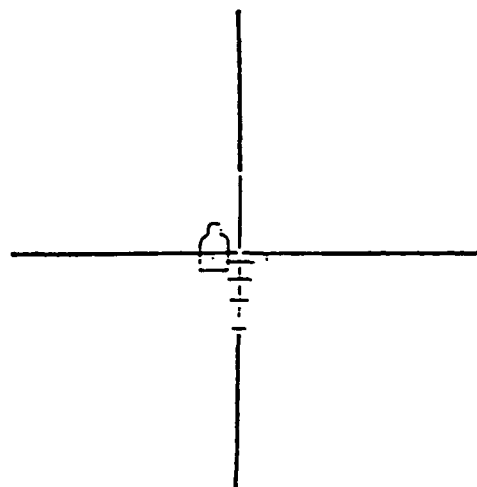
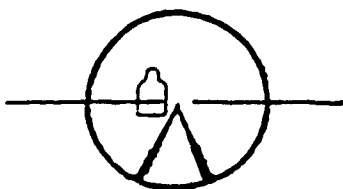


300 M target.

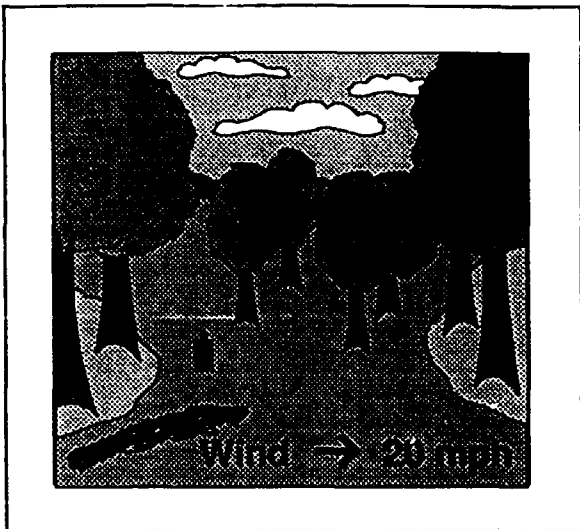
5-44



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

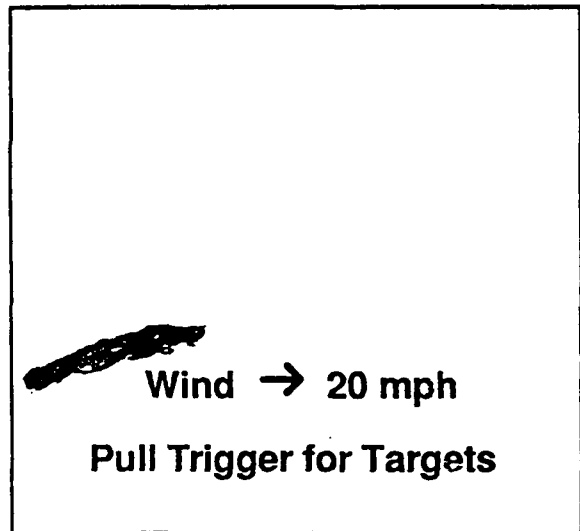


5-45



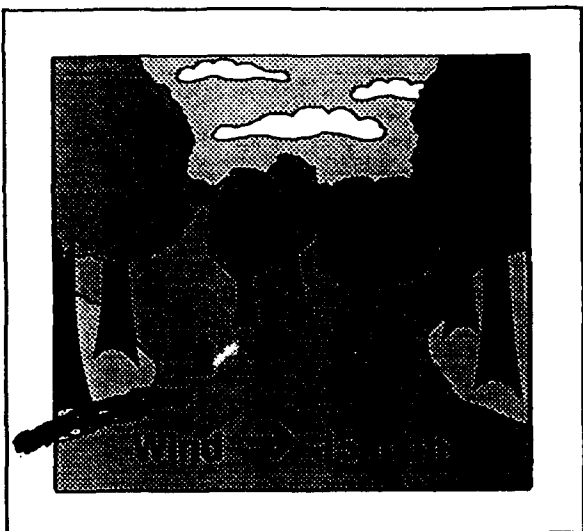
300 M target.

5-46



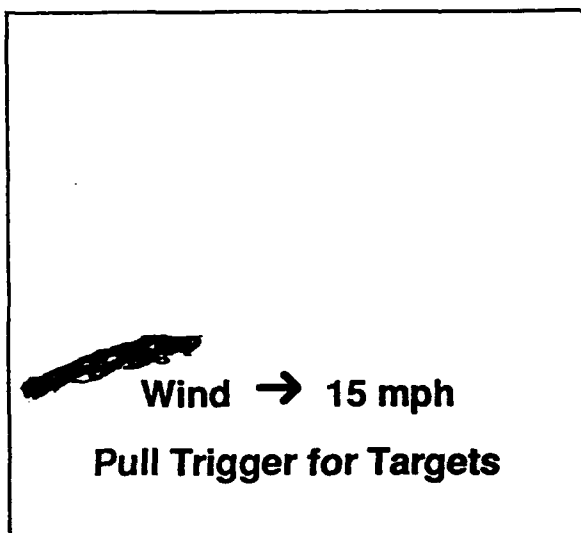
Playback. Displace sight left 45 cm. Bullet hits 58 cm right of aim. (Reverse of 5-44.)

5-47



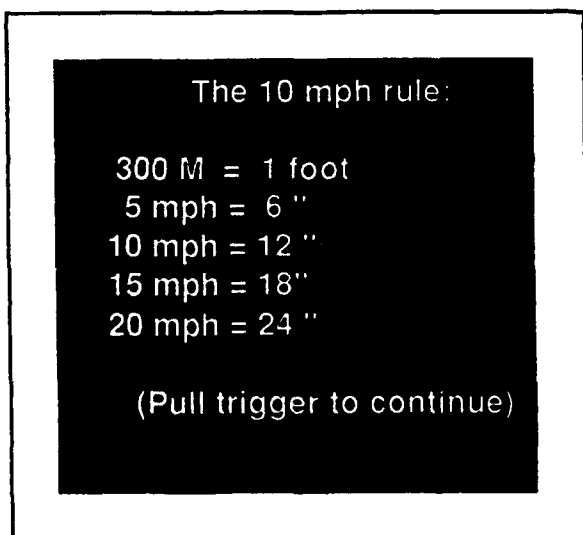
300 M target.

5-48

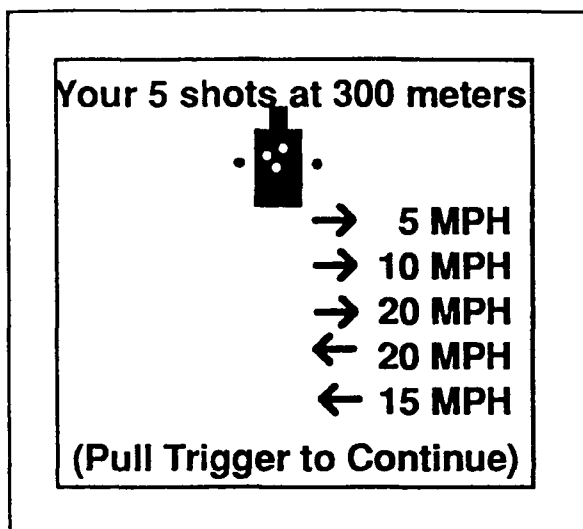


Playback. Single lead rule hits target center.

5-48a



5-49

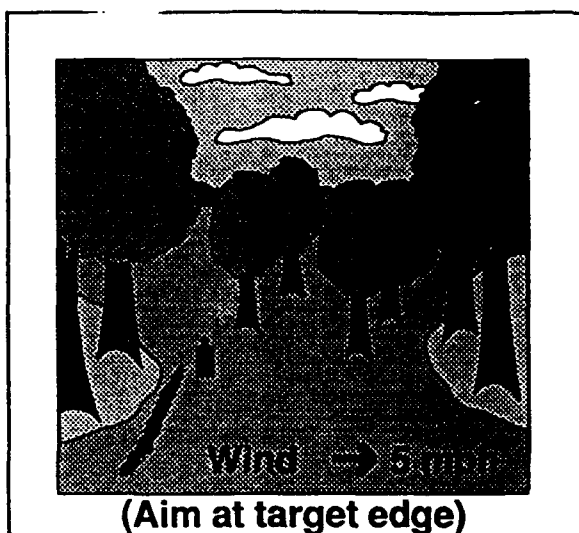


5-shot replay.

5-50

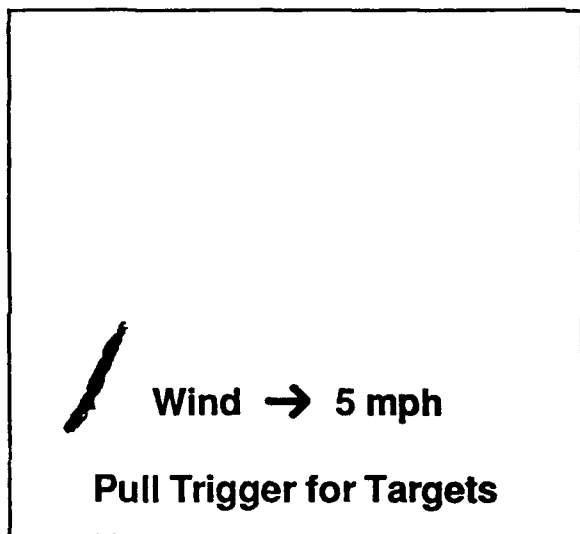


5-51

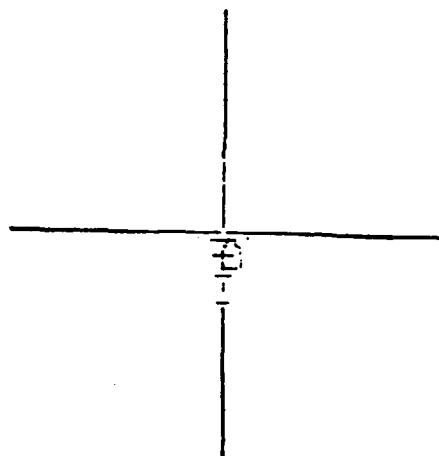
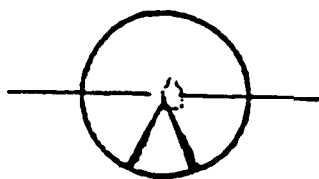


400 M target.

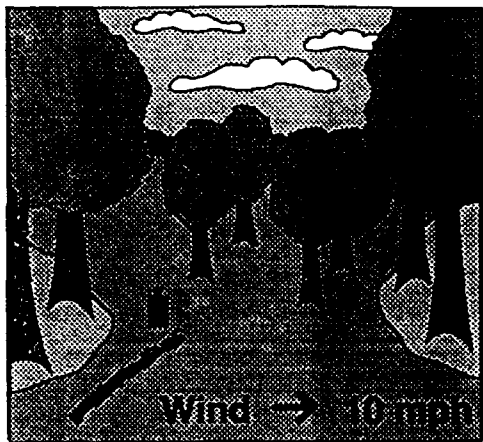
5-52



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



5-53



(Use single lead rule)

400 M target.

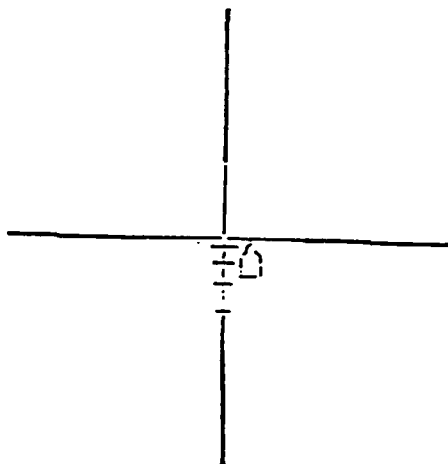
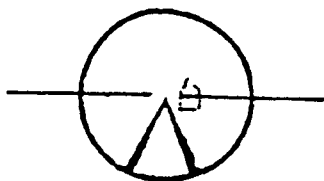
5-54



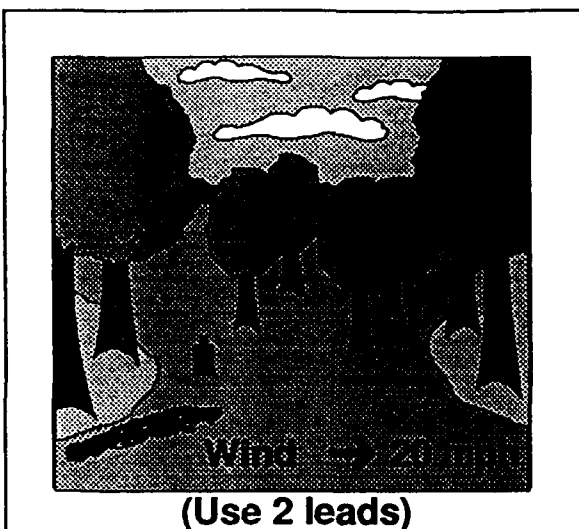
Wind → 10 mph

Pull Trigger for Targets

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

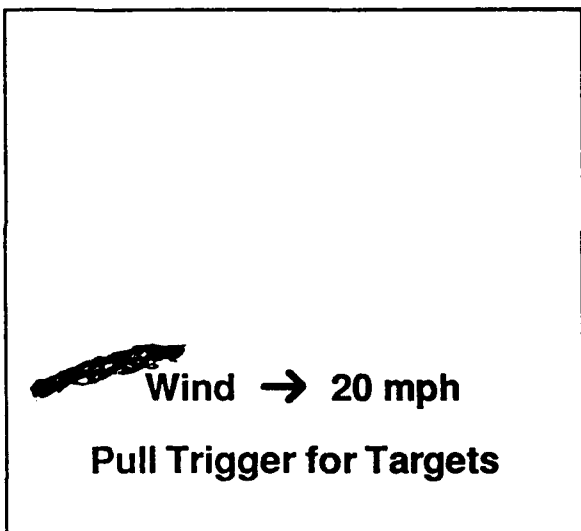


5-55

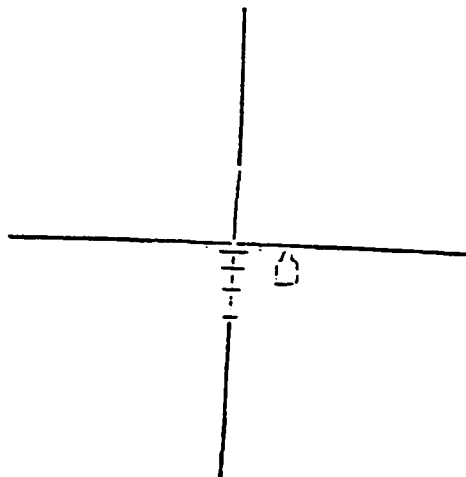
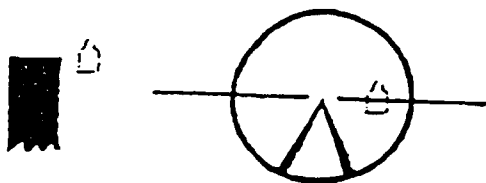


400 M target.

5-56



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

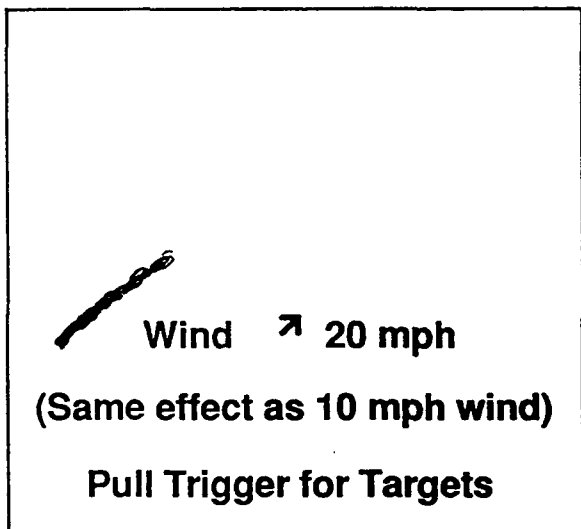


-57

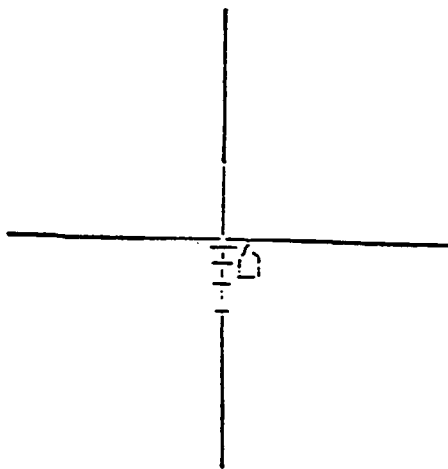
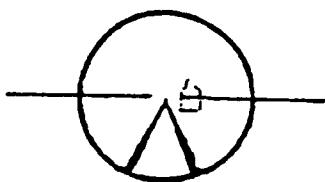


400 M target.

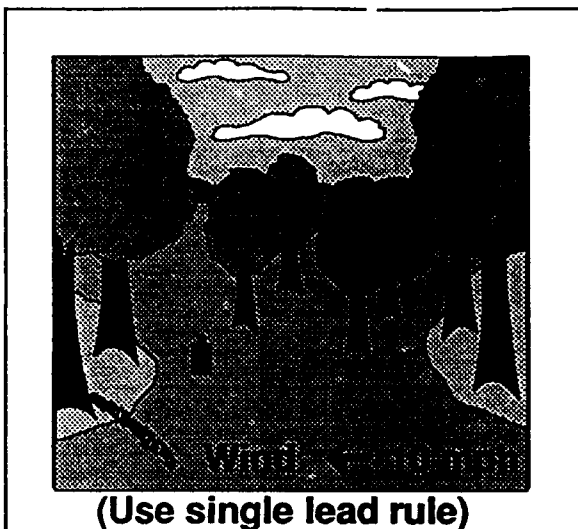
-58



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

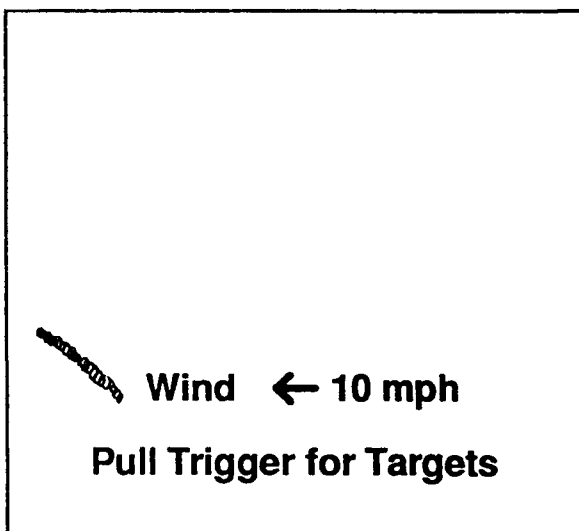


5-59

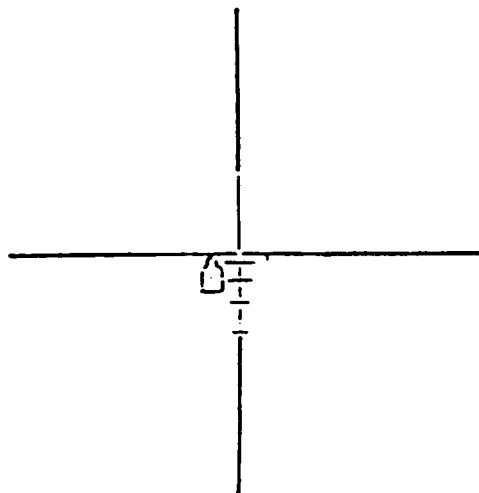
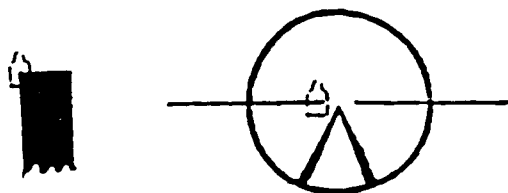


400 M target.

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

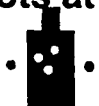
5 mph = 12"
 10 mph = 24"
 20 mph = 48"

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.

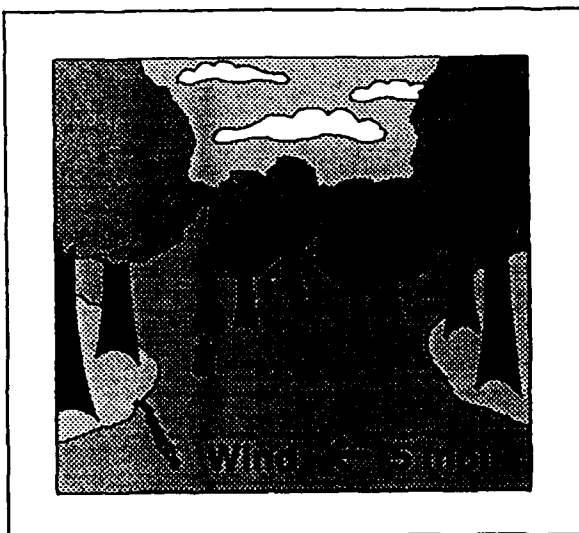
Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

5-62

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

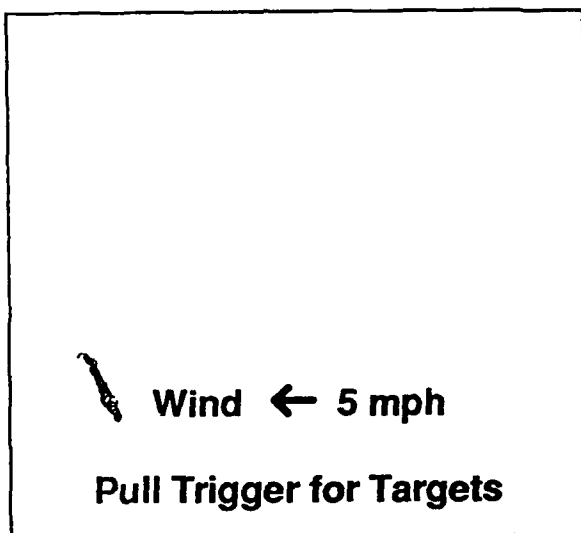
Pull trigger for targets

5-63

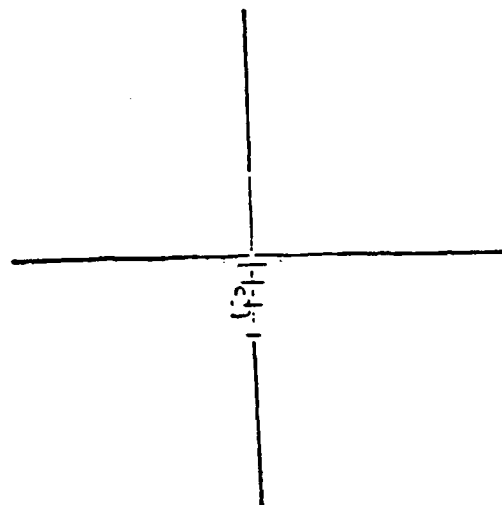
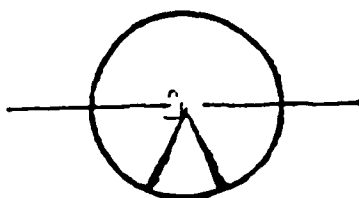


500 M target.

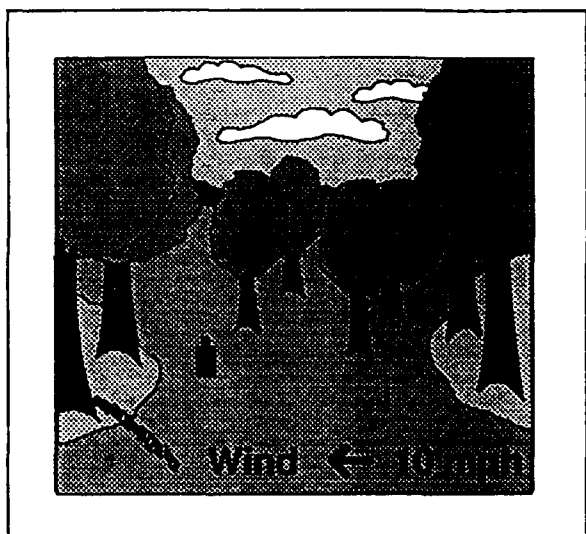
5-64



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

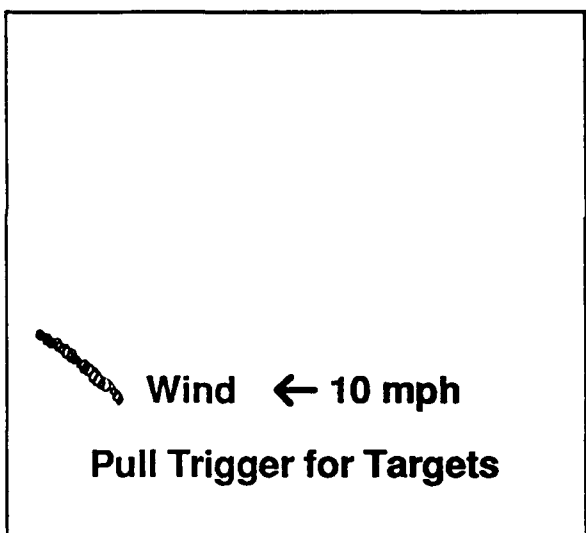


5-65

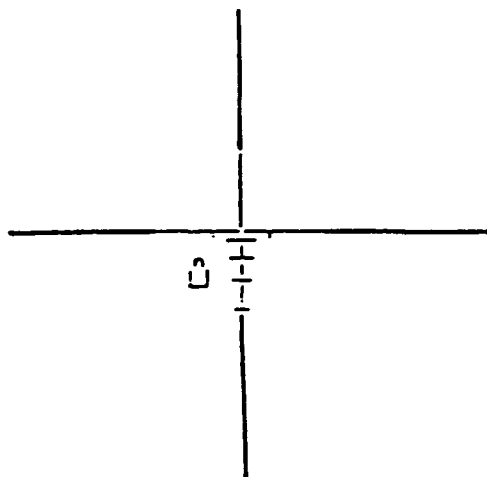
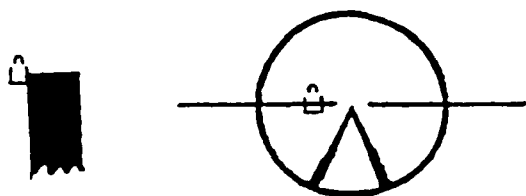


500 M target.

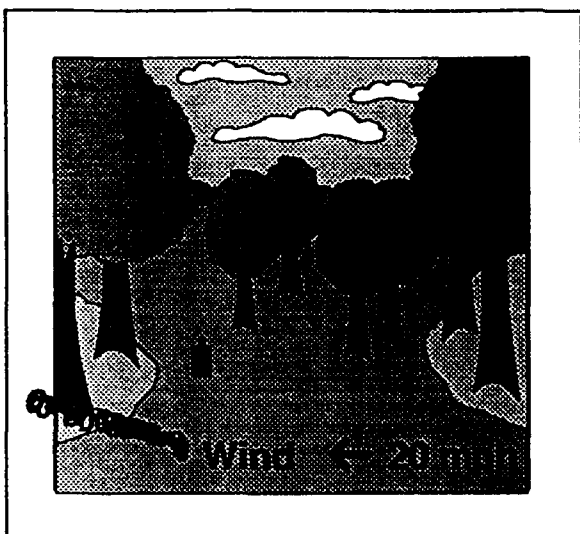
5-66



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

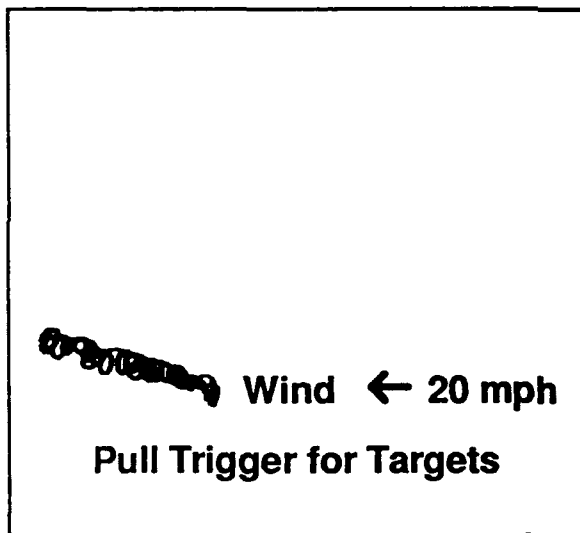


5-67

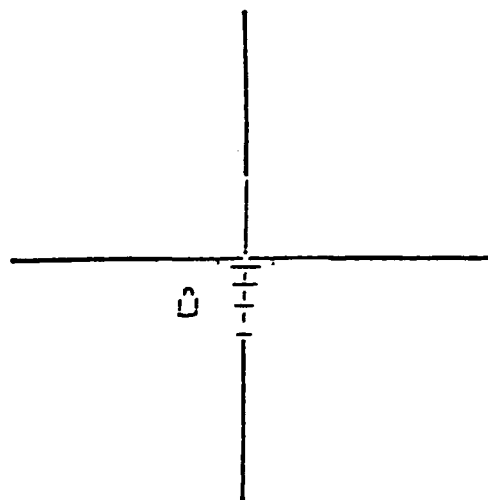
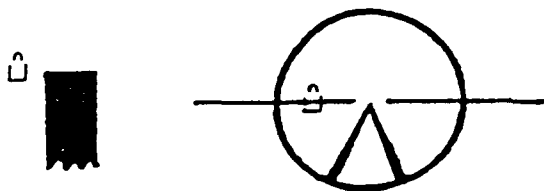


500 M target.

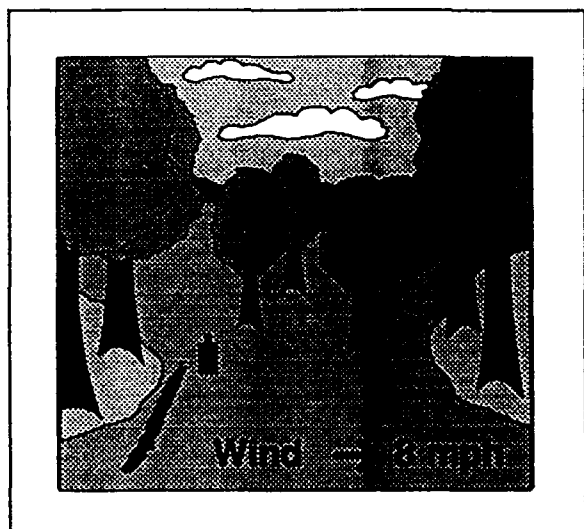
5-68



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

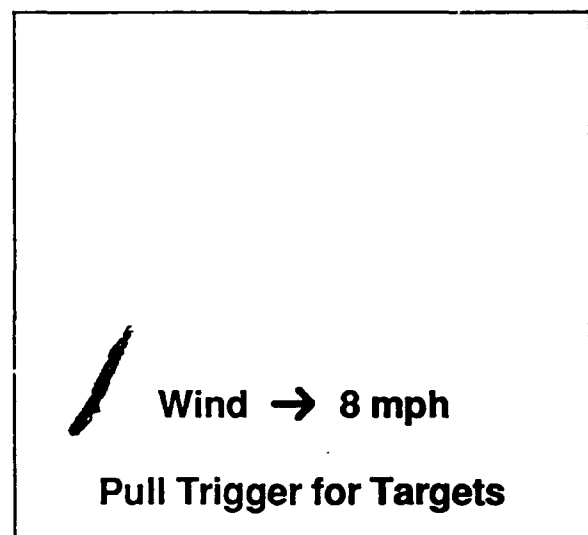


5-69

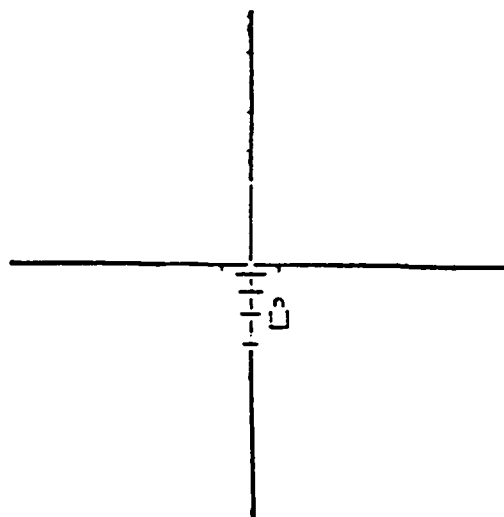
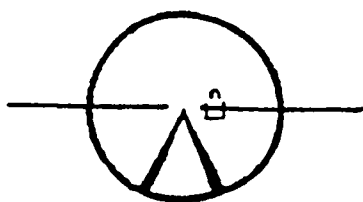


500 M target.

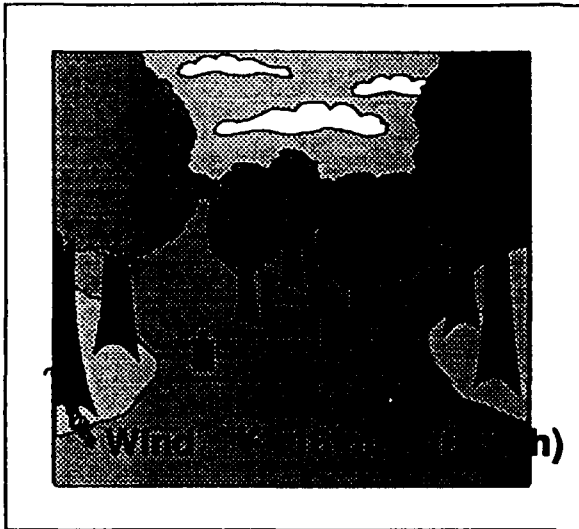
5-70



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

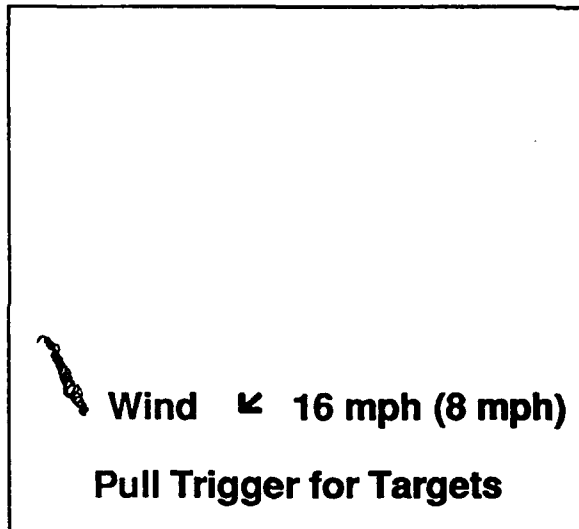


5-71



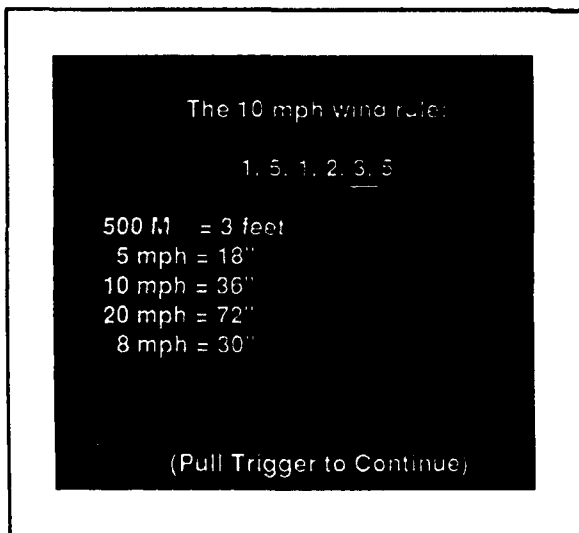
500 M target.

5-72

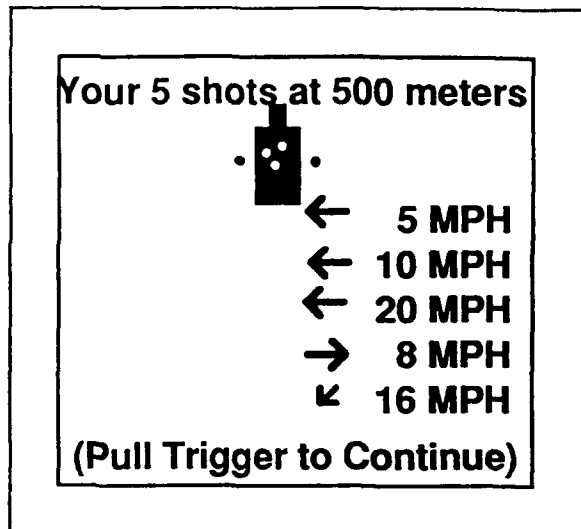


Playback. Reverse of 5-70.

5-60a



5-73



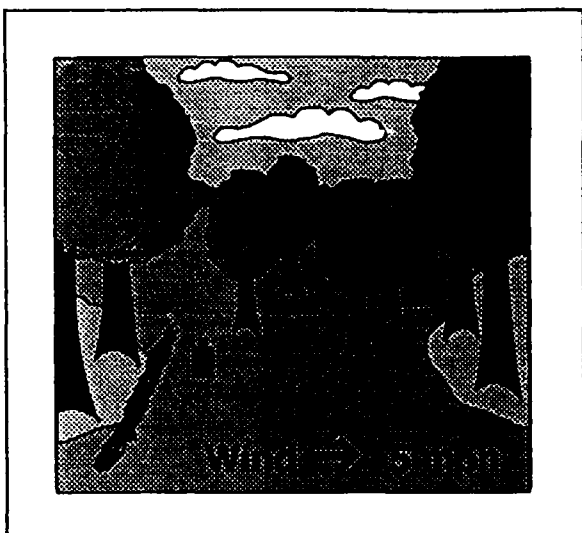
Target with 5 shot locations.

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

5-74

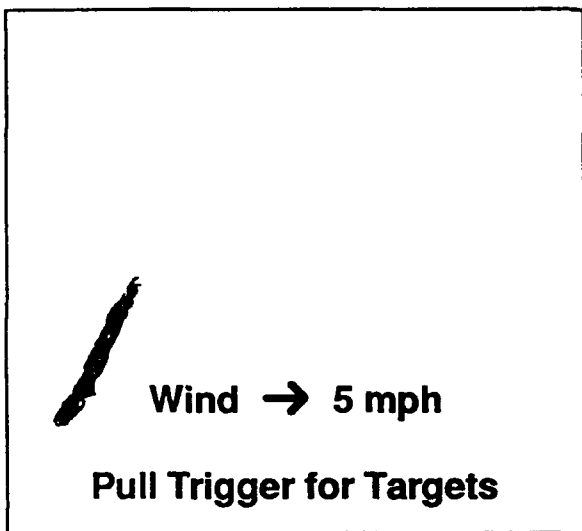


5-75

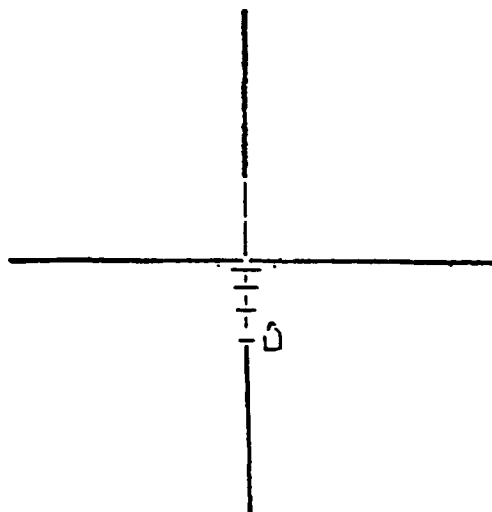
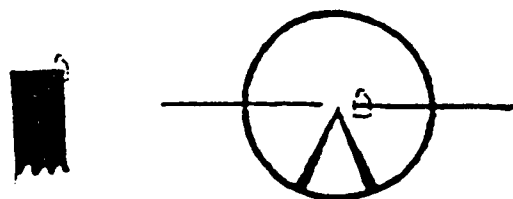


600 M target.

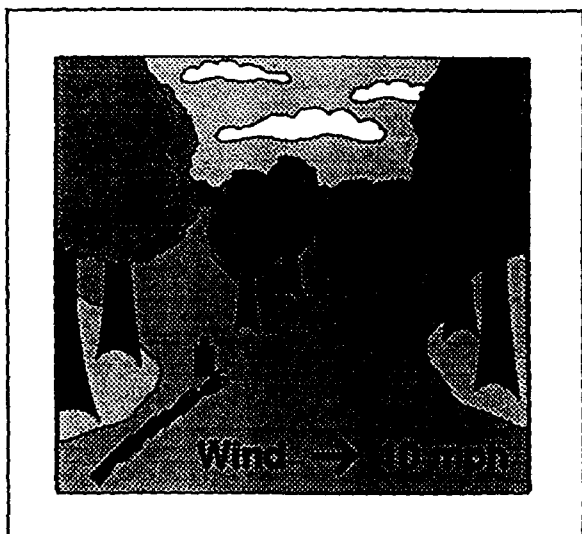
5-76



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

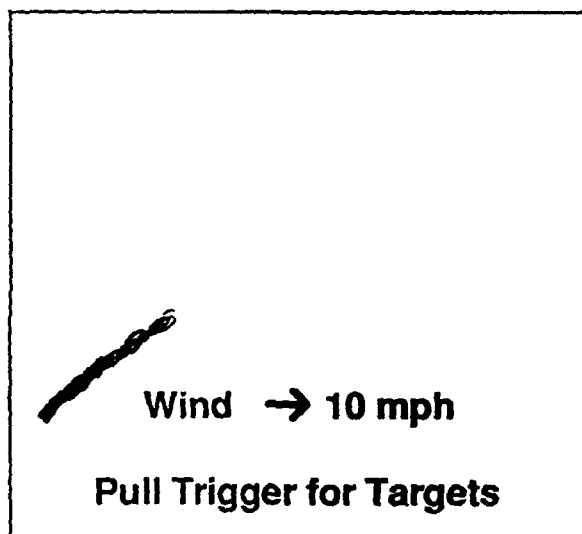


5-77

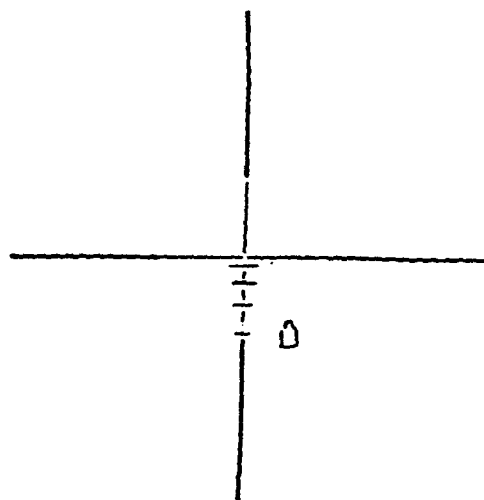
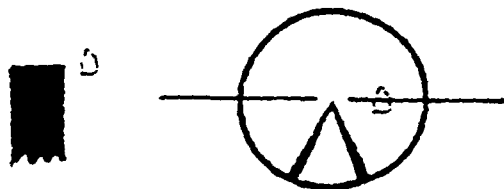


600 M target.

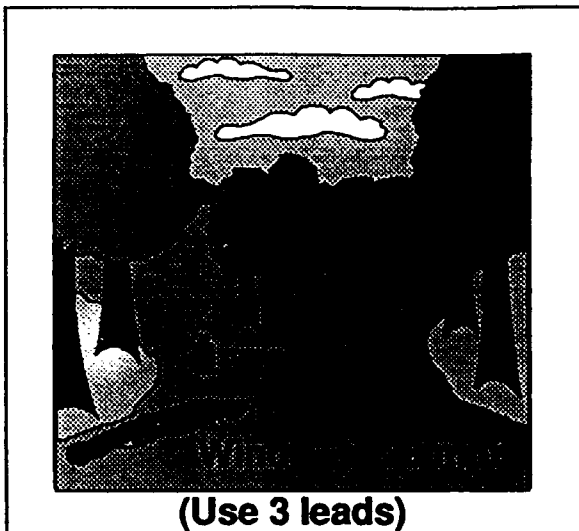
5-78



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

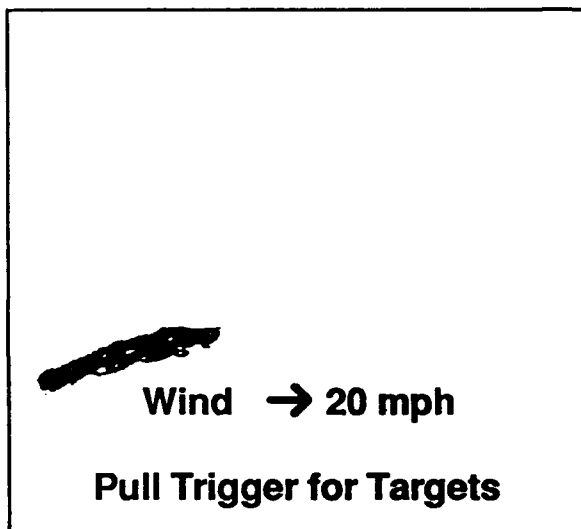


5-79

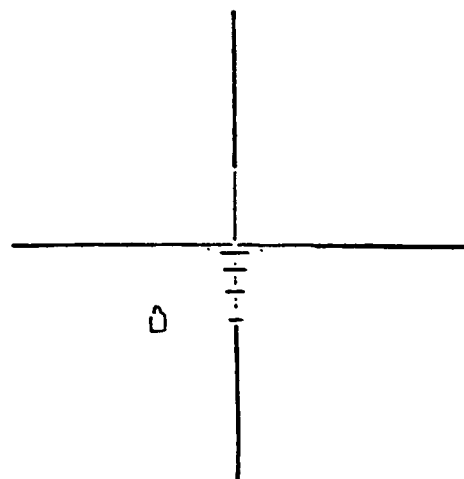
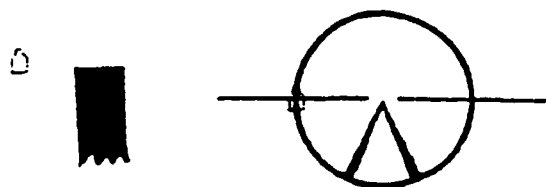


600 M target.

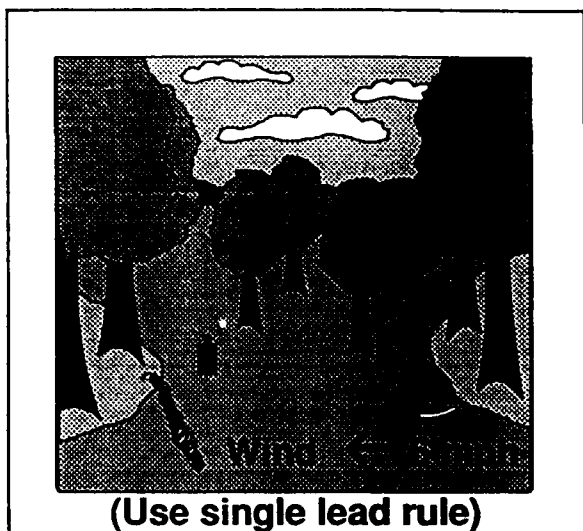
5-80



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

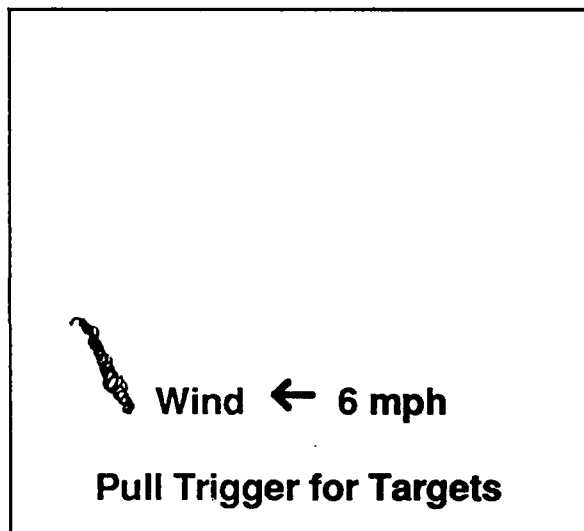


5-81

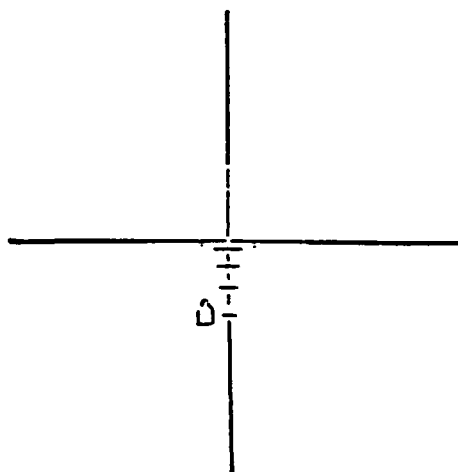
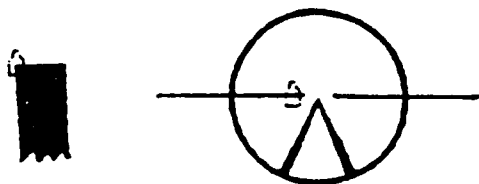


600 M target.

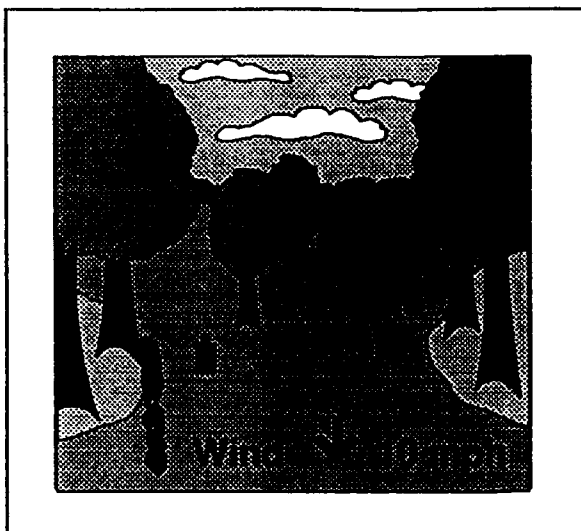
5-82



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

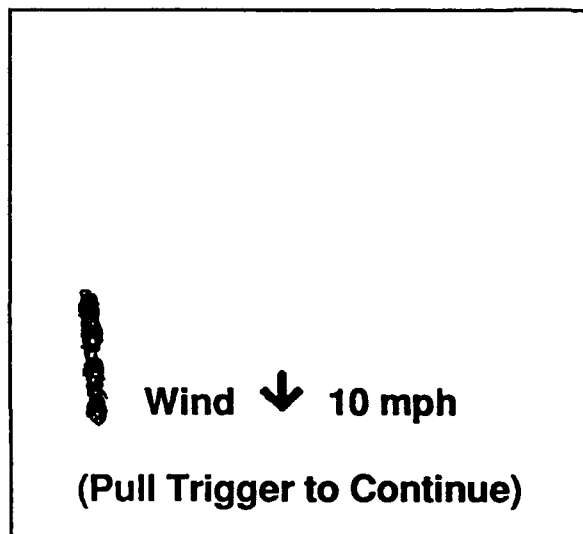


5-83

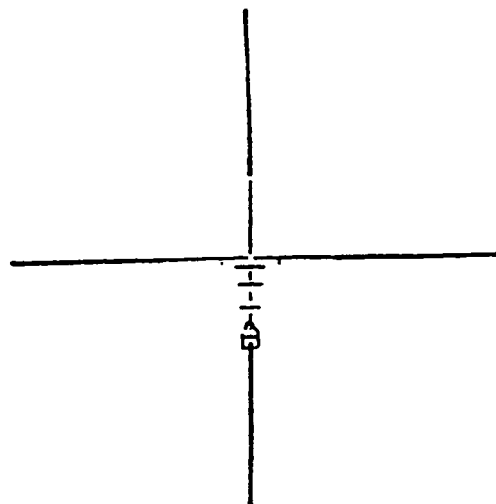
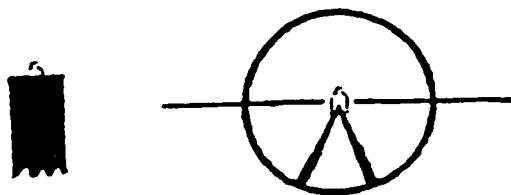


600 M target.

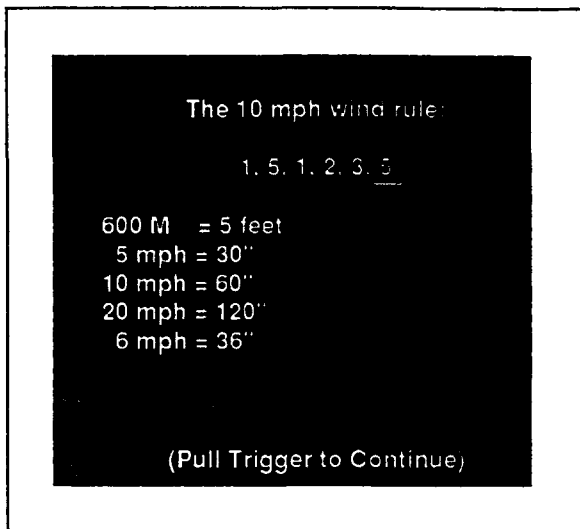
5-84



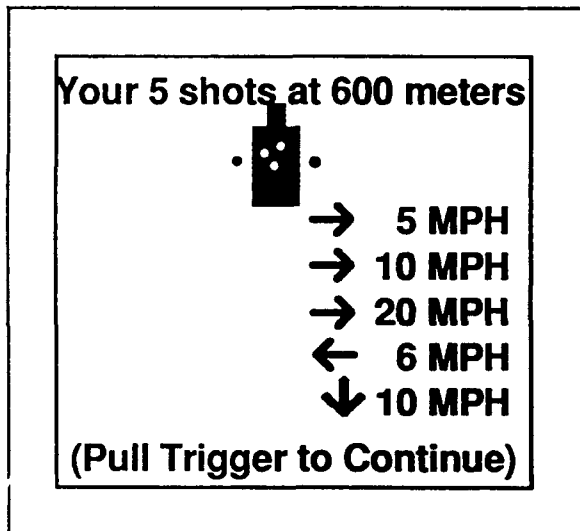
Playback. Center aim. Bullet hits aim point.



5-84a



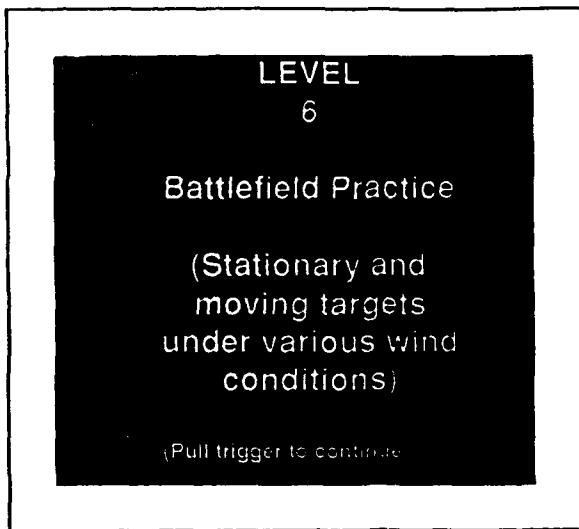
5-85



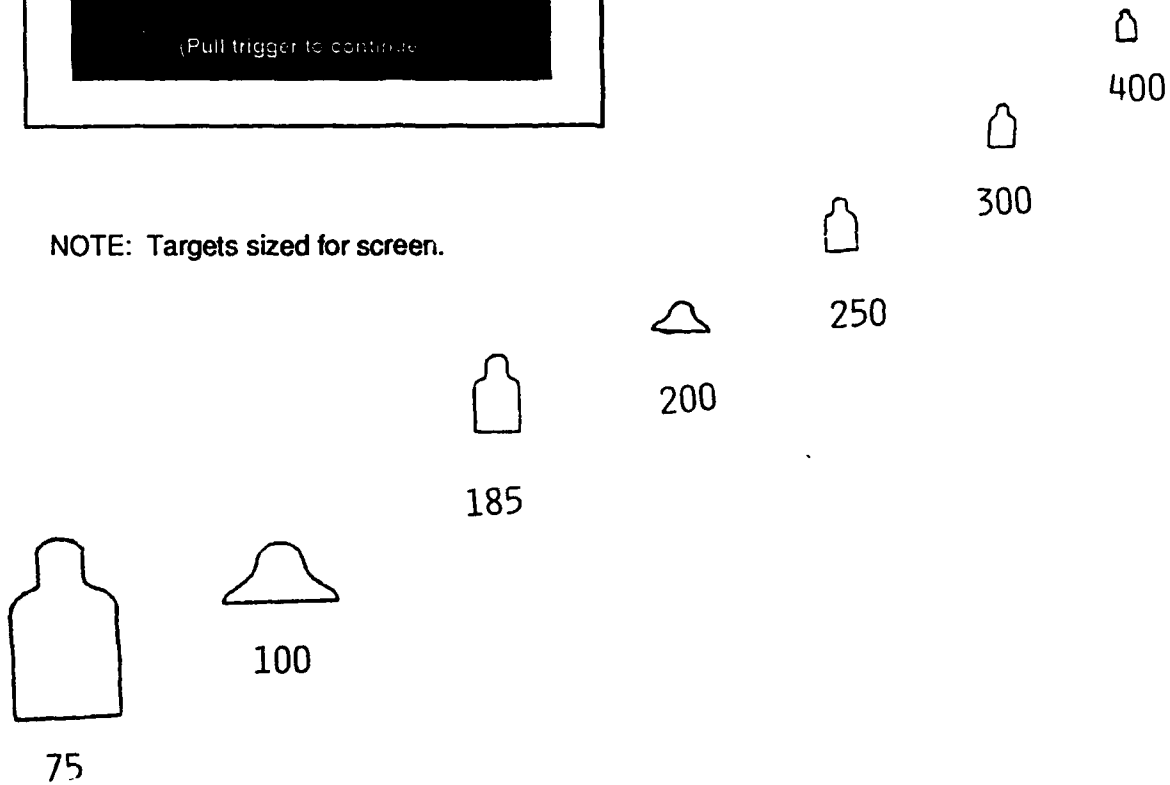
Target with 5 shot locations.

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

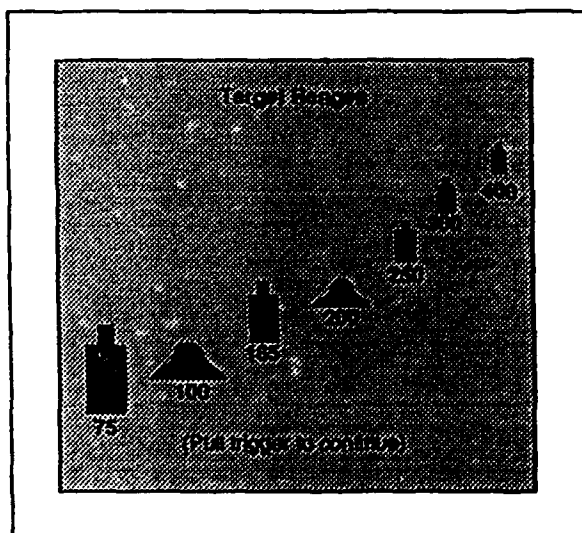
6-1



NOTE: Targets sized for screen.



6-2



MACS INFANTRY RIFLE MARKSMANSHIP (TELESCOPES)

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Page 103

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	+3
100	+4
185	+5
200	+6
250	+7
300	+8
400	+10

(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	3.4"
100	4.5"
185	5.7"
200	6.8"
250	8.0"
300	12" (1 foot)
400	24" (2 feet)

(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)

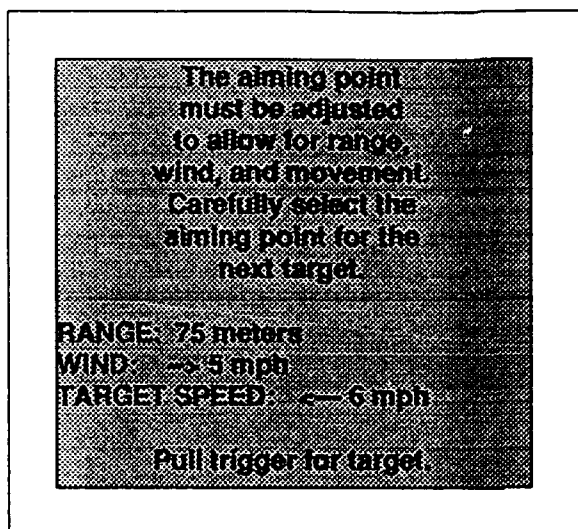
6-8

The amount of bullet
displacement which
results from leads:

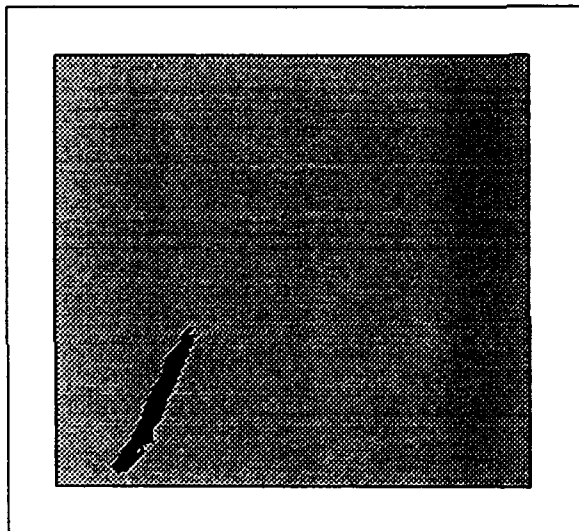
RANGE (ft)	LEADS		
	1	2	3
75	4"	8"	12"
100	6"	12"	18"
185	11"	22"	33"
200	12"	24"	36"
250	15"	30"	45"
300	18"	36"	54"
400	23"	46"	69"

(Pull trigger to continue)

6-9



6-10



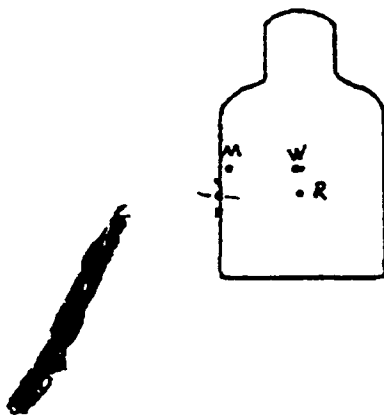
75M target moving Right to Left.

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

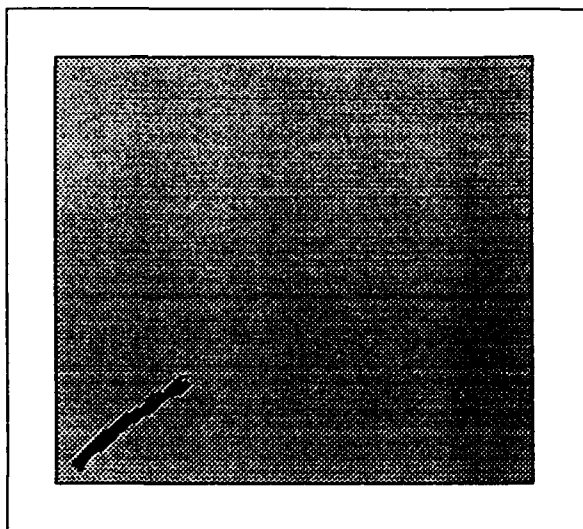
✚ CORRECT AIM POINT

✚ YOUR AIM POINT

(Pull trigger for target)

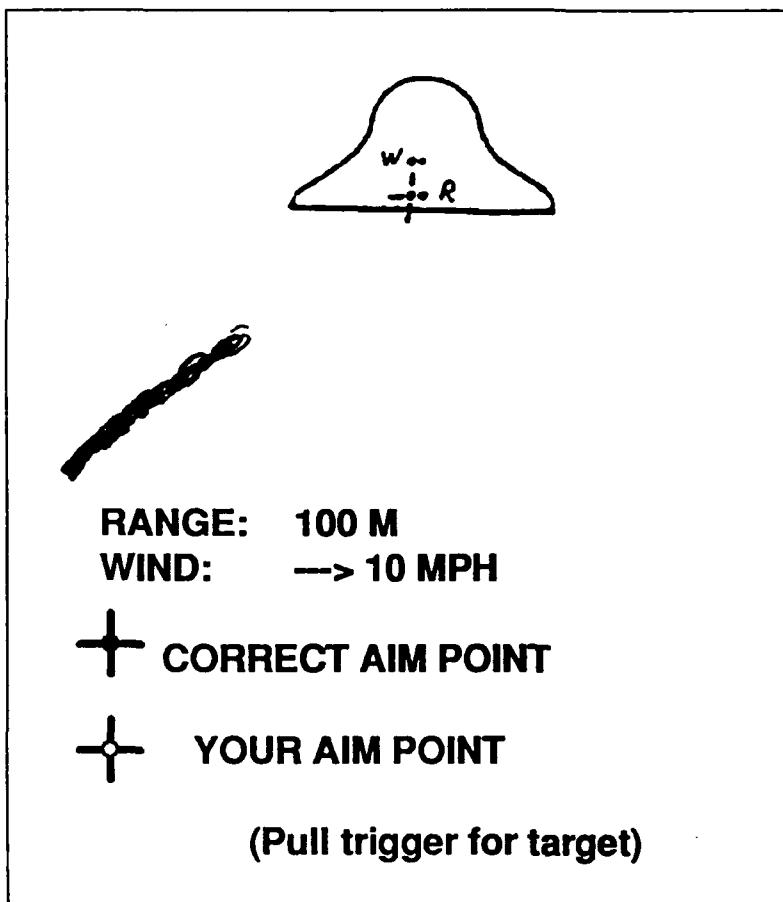
NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

6-13



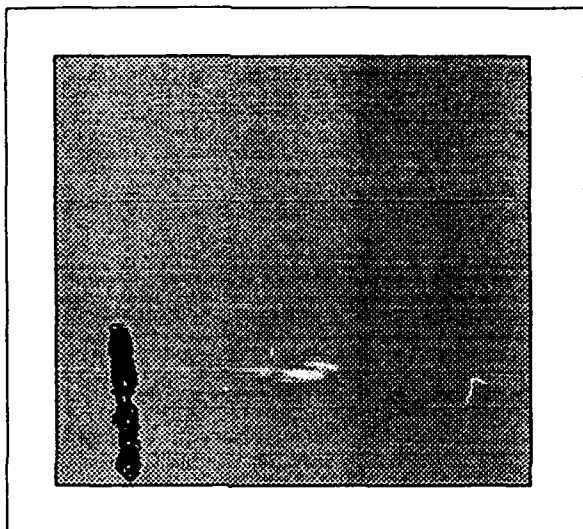
100 M target.

6-14



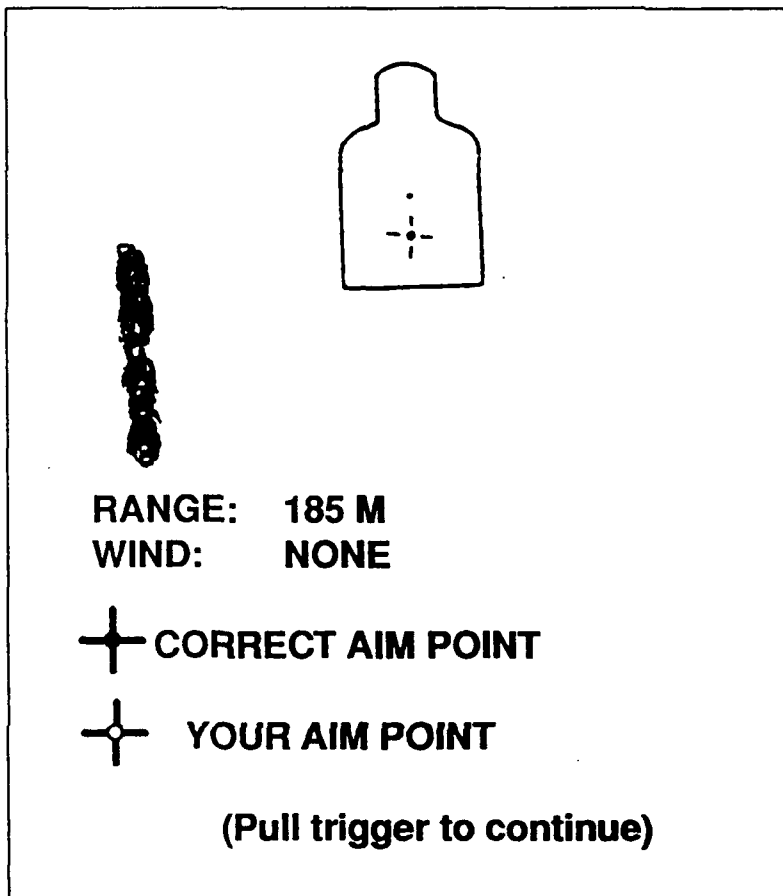
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-15



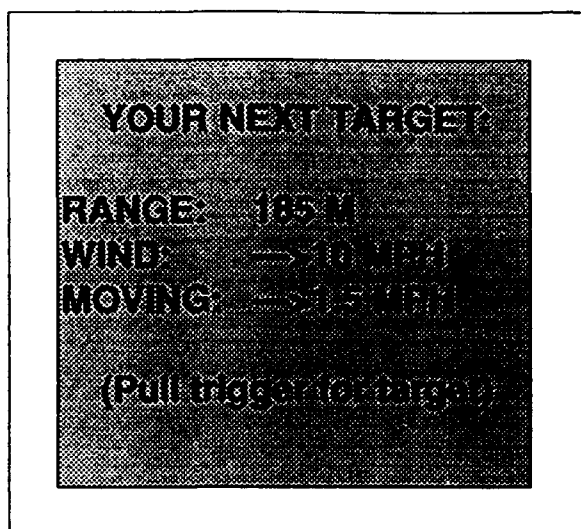
185 M target.

6-16

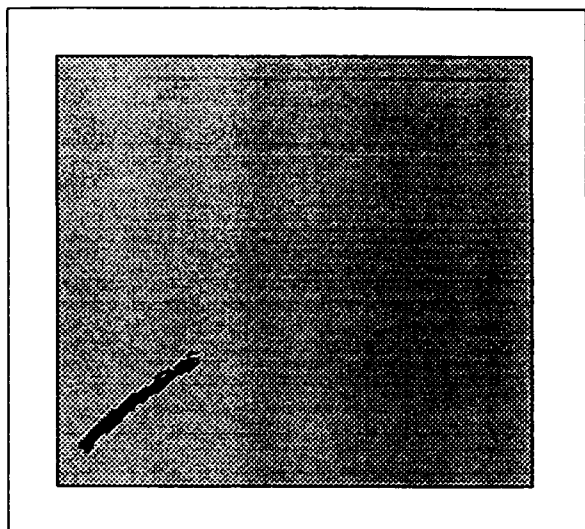


NOTE: In sequence,
flash range, wind,
and correct aim
with the
corresponding
aim point.

6-17

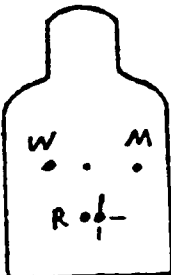


6-18



185 M target moving left to right at 1.5 mph.

6-19





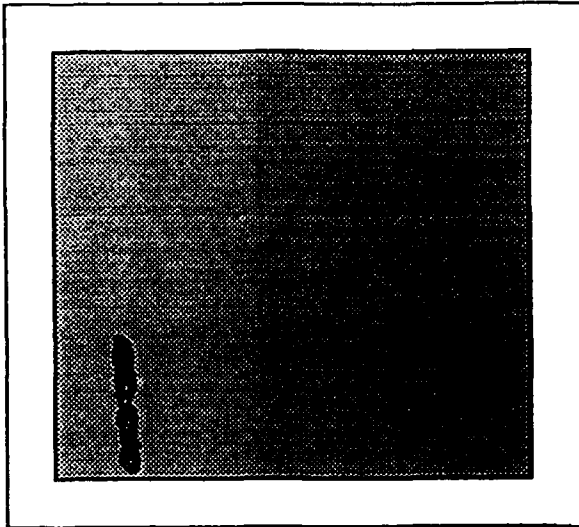
RANGE: 185 M
WIND: → 10 MPH
MOVING: → 1.5 MPH

✚ CORRECT AIM POINT
✚ YOUR AIM POINT

(Pull trigger for target)

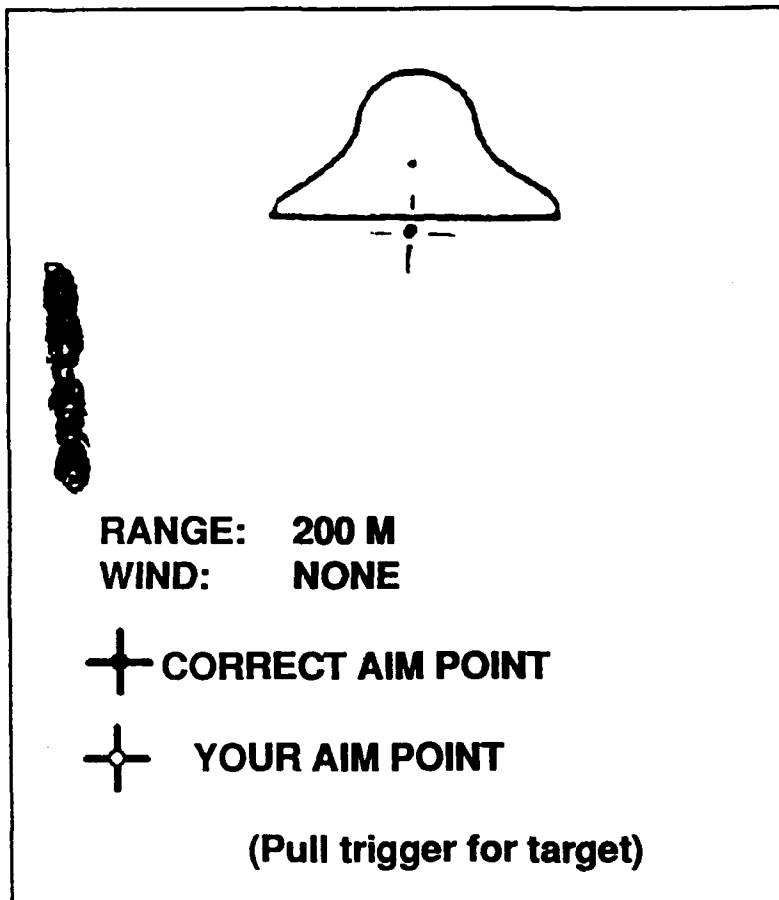
NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

6-20



200 M target.

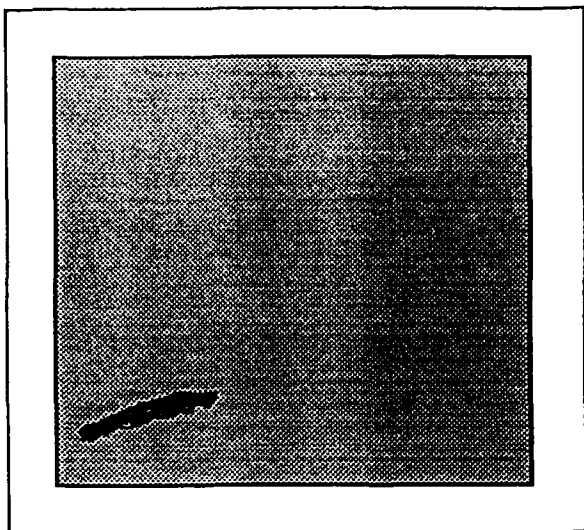
6-21



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

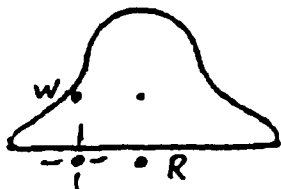
6-22

200 M target.



6-23

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



RANGE: 200 M

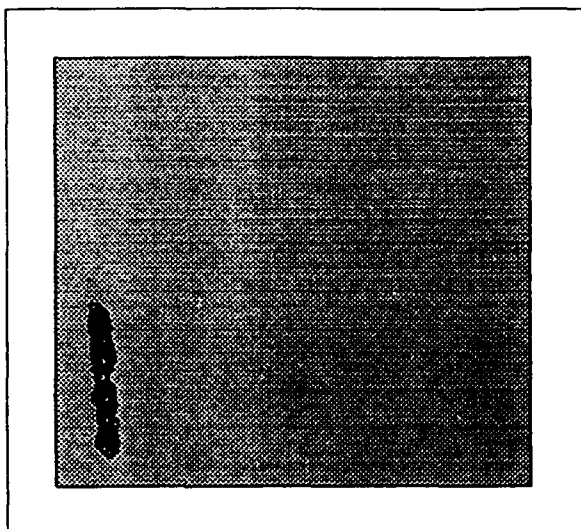
WIND: → 15 MPH

✚ CORRECT AIM POINT

✚ YOUR AIM POINT

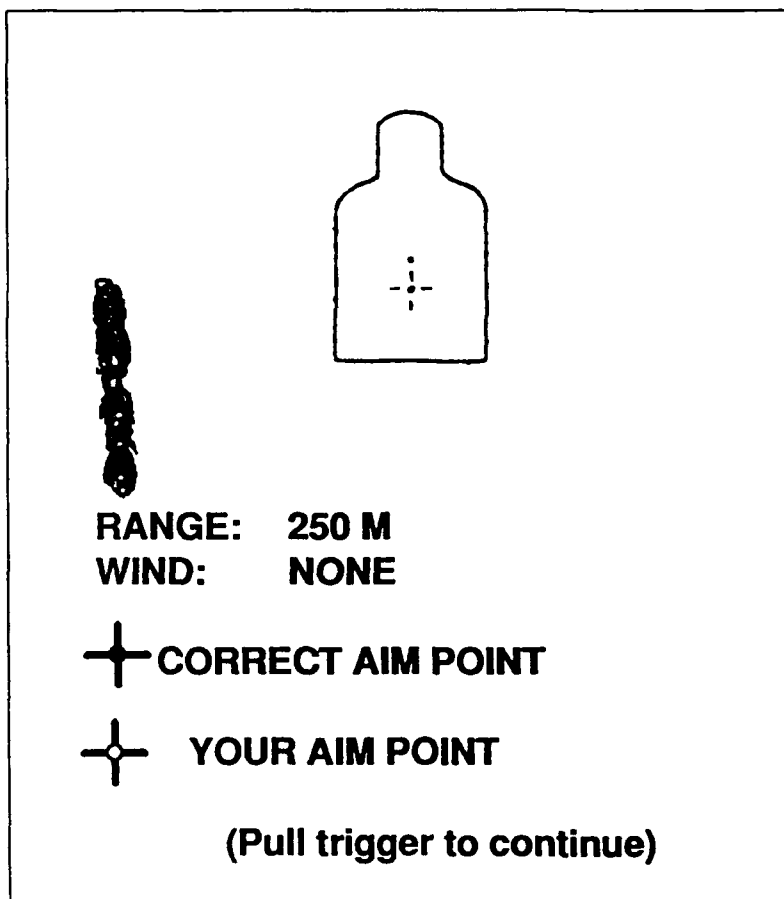
(Pull trigger for target)

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:

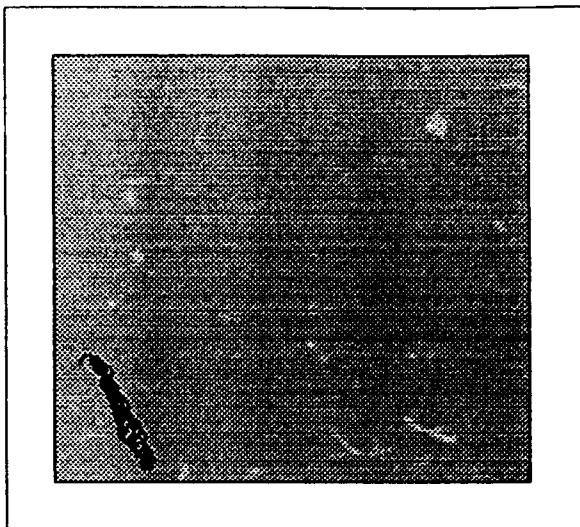
RANGE: 250 M

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

RANGE: 250 M
WIND: ← 5 MPH
MOVING: → 2.5 MPH

+ CORRECT AIM POINT
+ YOUR AIM POINT

(Pull trigger to continue)

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:

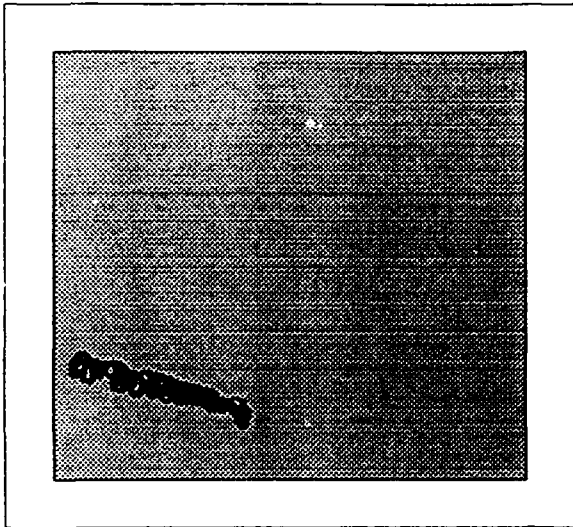
RANGE: 300 M

WIND: ← 15 MPH

MOVING: ← 3 MPH

(Pull trigger for target)

6-30



300 M target moving right to left at 3 mph.

6-31

RANGE: 300M
WIND: <— 15 MPH
MOVING: <— 3 MPH

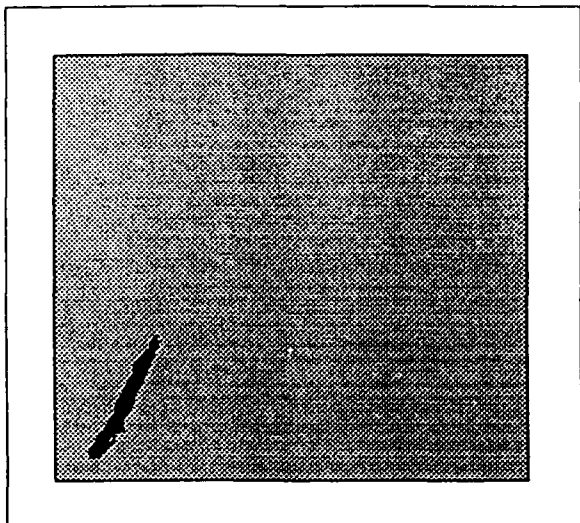
CORRECT AIM POINT

YOUR AIM POINT

(Pull trigger to continue)

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

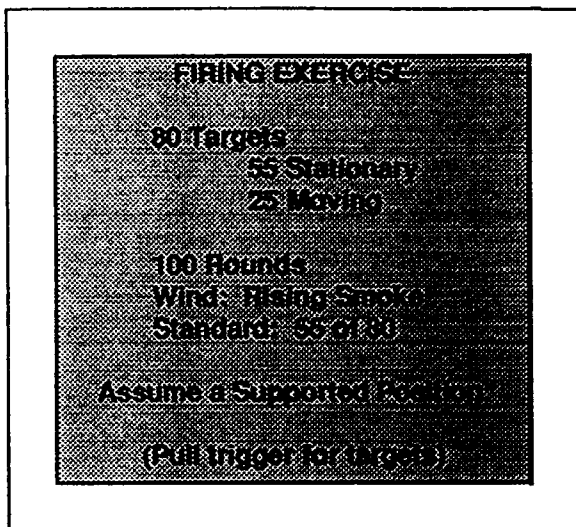
RANGE: 400M
WIND: ---> 5 MPH

+ CORRECT AIM POINT
+ YOUR AIM POINT

(Pull trigger to continue)

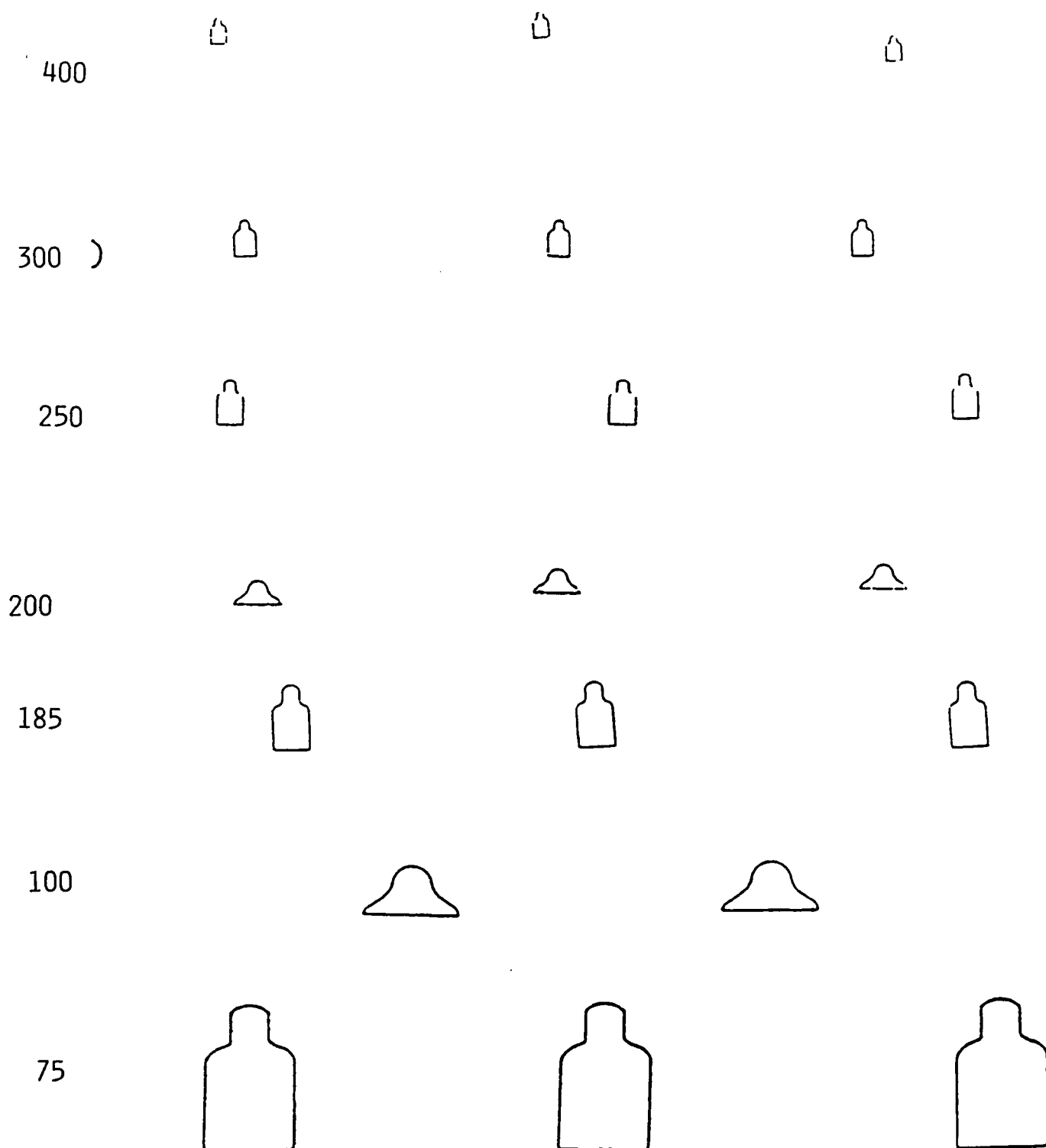
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-34



6-35 to 6-29

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



	<u>WIND</u>	<u>RANGE</u>	<u>LOC</u>	<u>TIME/MOVEMENT</u>	<u>SHOT DISPLACEMENT (cm)</u> <u>FROM AIMING POINT</u>
1.	5 --->	400	C	S 6 sec	40 cm low, 30 cm right
2.	5 --->	300 250	R	S 6 sec —> 4 mph	—, 15 cm right 10 cm high, 43 cm left
3.	5 --->	200 250	L	S 5 sec —> 4 mph	15 cm high, 6 cm right 10 cm high, 43 cm left
4.	5 --->	185 200	R	<— 6 mph S 5 sec	15 cm high, 60 cm right 15 cm high, 6 cm right
5.	10 -->	185 100 100	L L R	—> 6 mph 5 sec 5 sec	15 cm high, 56 cm left 10 cm high, 2 cm right 10 cm high, 2 cm right
6.	10 -->	400 300	L	S 8 sec —> 6 mph	40 cm low, 60 cm right —, 80 cm left
7.	10 -->	400 300	R	S 8 sec <— 6 mph	40 cm low, 60 cm right —, 132 cm right
8.	5 --->	400 185 185	C L R	S 8 sec S 5 sec S 5 sec	40 cm low, 30 cm right 15 cm low, 10 cm right 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	185 200 200 200	L C R	<— 3 mph 6 sec 6 sec 6 sec	15 cm low, 30 cm right 15 cm low, — 15 cm low, — 15 cm low, —
12.	0	75 100 100	L L R	—> 6 mph 4 sec 4 sec	8 cm low, 22 cm left 10 cm low, — 10 cm low, —

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

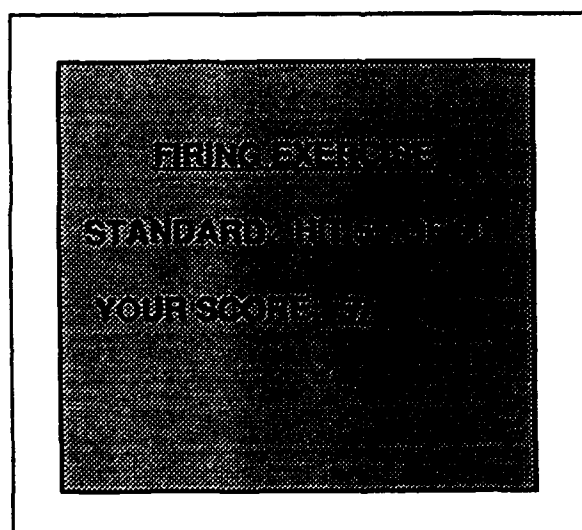
		<u>WIND</u>	<u>RANGE</u>	<u>LOC</u>	<u>TIME/MOVEMENT</u>	<u>SHOT DISPLACEMENT (cm)</u> <u>FROM AIMING POINT</u>
26.	0	400	L	S	7 sec	40 cm low, —
		400	R	S	10 sec	40 cm low, —
		300		—>	3 mph	—, 50 cm left
27.	0	400	L	S	9 sec	40 cm low, —
		300	C	S	7 sec	—, —
		250	R	S	5 sec	10 cm high, —
28.	0	300		<—	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

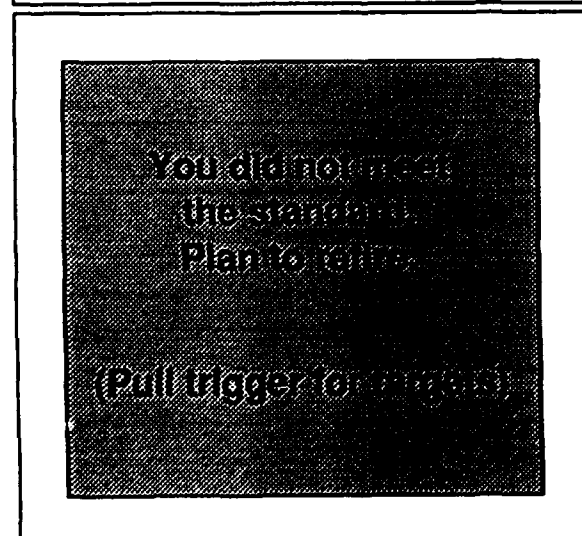
STATIONARY			MOVING	
<u>RANGE</u>	<u># TGT</u>	<u>HIT</u>	<u># TGT</u>	<u>HIT</u>
75	7	5	5	4
100	11	10	-	-
185	4	4	7	5
200	14	12	-	-
250	3	2	8	5
300	7	4	5	-
400	<u>9</u>	<u>3</u>	<u>-</u>	<u>-</u>
	55	40	25	17

(Pull trigger to continue)

6-71



6-71



NOTE: If standard is not met.

TOP GUN

A	B	C	D	E	F	G
H	I	J	K	L	M	N
O	P	Q	R	S	T	U
V	W	X	Y	Z		
Empty initials						

- 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.

HIGH SCORE	
1. JIMM	1. 20
2. MAC	2. 20
3. LGS	3. 20
4. JMB	4. 20
5. JEM	5. 20

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

CONGRATULATIONS	
You are finished with this program. Call instructor.	

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



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  ROTRG  :3209
JMP  BANG   :3212
JMP  WHISTL :3215
JMP  WAIT   :3218
JMP  SCENE  :3221
JMP  SEVAL  :3224
JMP  COLORS :3227
JMP  HITMIS :3230
JMP  MATH   :3233
JMP  ADJLOC :3236
JMP  TRKTRP :3239
JMP  SHTRGP :3242
JMP  BITPLT :3245
.OPT  NOL

```

```

EIPTR = 32792
SELSUB = 49162
SUBWO  = 49168
:
: CONVENTIONS USED
:PROCEDURE XXXX
: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
NSRT   = 825
HOLDA  = 826
HOLDX  = 827
NUMRD  = 828
NUMR20 = 829
HOLD   = 831
DELAY  = 832
CUR1   = 833
OPFX   = 834
OPFY   = 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
SRTIZE = 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
CURTAR = 882
CUR2   = 883
IRQ2   = 884
COPY   = 885
CODE3  = 886
CODE4  = 887
TARPRE = 888
NUMR50 = 889
HOLDAD = 891
HITSPT = 893
SUNX   = 894
NSIZE  = 896
TIMES  = 897
PSTAT  = 898
MAXSHT = 899
LASTSH = 900
HITS   = 910
NISSES = 911
PENAL  = 912
PINPO  = 913
MAXVAL = 928
WIND   = 929
WDRIPT = 930
SHOTRK = 932
KEYMSK = 933
CURNUM = 934
BORCOL = 936
LPCMPY = 937
LPCMPY = 938
METHEN = 939
X1      = 940
Y1      = 942
X2      = 944
Y2      = 946
:NEXT ONE AT 948
CENTX   = 15872
CENTY   = 15880
YARNUM  = 15888
SPECIL  = 15896
YDRIPT  = 15904
XDRIPT  = 15912
TLIN1   = 15920
TLIN2   = 15928
TIMPL1  = 15936
TIMPL2  = 15944
INSTX   = 15952
COLSTX  = 15960
DLSTK1  = 15968
DLSTK2  = 15976
:NEXT ONE AT 15984
:
LENSTR  = 16383
ADD     = $B86F
CHKIN   = $FFC6
CHKOUT  = $FFC9
CHRIW   = $FFCF
CLOSE   = $FFC3
CLRCNN  = $FFCC
CHROUT  = $FFD2
DIVIDE  = $BB12

```

```

FALISC = $BBC7
FALFA2 = $BC0F
FALMEN = $BBD4
FLOAT  = $B391
GETIN  = $FFFA
LOAD   = $FFD5
HMFPA1 = $BBA2
HMFPA2 = $BBA8
HMTPLY = $BBA2B
OPEN   = $FFC0
SETLFS = $FFB1
SETNAM = $FFB0
SQRT   = $B7F1
SUBRT  = $B853
UNFLOT = $B1BF
V       = $D000
SID     = $D400
TEMP    = 16192
XLPB20 = 40960 :UNDERNEATH ROM
YLPB20 = 41472 :UNDERNEATH ROM
XTGB20 = 41984 :UNDERNEATH ROM
YTG20  = 42496 :UNDERNEATH ROM
XLPB60 = 43008 :UNDERNEATH ROM
YLPB60 = 43264 :UNDERNEATH ROM
XTGB60 = 43520 :UNDERNEATH ROM
YTG60  = 43776 :UNDERNEATH ROM
XLP60  = 44032 :UNDERNEATH ROM
YLP60  = 44062 :UNDERNEATH ROM
XTG60  = 44092 :UNDERNEATH ROM
YTG60  = 44122 :UNDERNEATH ROM
INFO   = 44152 :UNDERNEATH ROM
INFO2  = 44496 :UNDERNEATH ROM
HLDDBY = 44840 :UNDERNEATH ROM
:NEXT ONE AT 44840
RANTAR = 52224
.HAC  BINC :DOUBLE
INC   ?1 :PRECISION
BNE   ?2 :INCREMENT
INC   ?1+1
?2 .HND
.HAC  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
.HND
.HAC  MOVE
LDA   ?2
STA   ?1
LDA   ?2+1
STA   ?1+1
.HND
.HAC  DISK :DISK
LDA   ?8 :OPERATIONS
YAX   :LOAD"?2".8
LDY   ?21 :?2 IS END OF
JSR   SETLFS :FILE NAME.
LDA   ?23-22 :THUS LENGTH
LDX   ?(2 :OF FILE NAME
LDY   ?(2 :IF ?3-22
JSR   SETNAM
LDA   ?0
.HND
.HAC  PRINT
LDA   ?(21
LDY   ?(21
JSR   SABC :PRINT
.HND
.HAC  PUTR

```

```

PHI
TTE
PHI
TTE
PHI
.HND
.HAC  GETR
PLA
TAT
PLA
TAT
PLA
.HND
.HAC  DADD
LDA   ?1
CLC
ADC   ?2
STA   ?1
LDA   ?1+1
ADC   ?2+1
STA   ?1+1
.HND
.HAC  DSUB
LDA   ?1
SEC
SBC   ?2
STA   ?1
LDA   ?1+1
SBC   ?2+1
STA   ?1+1
.HND
.HAC  PLOT
LDY   ?21
LDX   ?22
CLC
JSR   $FFFO
.HND
.HAC  DSPL
LDA   ?22-21
STA   LENSTR
LDA   ?(21
STA   S23
LDA   ?(21
STA   S24
JSR   LETNL
.HND
.OPT  LIST
.HND
.OPT  NOL
.LIB  IROSTUFF
:IROSTUFF FOR ARM PROGRAM
:PROCEDURE ENABLE
:PREPARES IRQ TO TAKE READINGS
:B:NONE
:C:SYS ENABLE
:A:NONE
ENABLE SRI
LDA   ?0
STA   55334
LDA   53265
AND   4127
STA   53265
LDA   4250
STA   53266
LDA   45
STA   53274
LDA   53273
STA   53273
ADDR  5314.START

```

C-2

```

STA V+29
IRQ200 LDA (SPB).Y :EXPAND Y?
AND #64
BEQ IRQ210
LDA V+23 :YES?
ORA H3IRQ
STA V+23
IRQ210 LDA (SPB).Y :RIGHT X?
AND #32
BEQ IRQ220
LDA V+16
ORA H3IRQ
STA V+16
IRQ220 LDA (SPB).Y :SPR COLOR
AND #15
STA V+39.X
INY
LDA (SPB).Y :TIME LIMIT
CMP #255 :NO LIMIT?
BEQ IRQ230
LSR A :TIME LIMIT
LSR A :2ND NVMT
AND #254
STA TLIM2.X
LDA (SPB).Y :TIME LIMIT
AND #15 :1ST NVMT
ASL A
IRQ230 STA TLIM1.X
INY
LDA (SPB).Y :DELAY FOR
STA DLSTK1.X :1ST NVMT
STA CDLSTK.X
INY
LDA (SPB).Y :INCREMENT
STA INSTK.X
INY
LDA (SPB).Y :FLIGHT TIME
LSR A :2ND NVMT
LSR A
LSR A
STA TINF12.X
LDA (SPB).Y :FLIGHT TIME
AND #15 :1ST NVMT
STA TINF11.X
INY
LDA (SPB).Y :X DRIFT
STA XDRIPT.X
INY
LDA (SPB).Y
STA YDRIPT.X
INY
LDA (SPB).Y :SPECIAL
STA SPECIL.X
AND #16 :COUNT AS
BNE IRQ240 :TARPRE?
INC TARPRE
TXA
JSR INCHUH
TAX
IRQ240 INY
LDA (SPB).Y :CEN X OFFST
STA CENX.X
INY
LDA (SPB).Y :CEN Y OFFST
STA CENY.X
INY
LDA (SPB).Y :DELAY FOR
STA DLSTK2.X :2ND NVMT
INT
LDA V+21 :TURN ON
ORA H3IRQ :SPRITE
STA V+21
IRQ250 LSR H3IRQ
DEX :NEXT SPRITE
BEQ IRQ260 :FINISHED?
JMP IRQ160
IRQ260 TXA :SET UP
CLC :TARORD
ADC SFB :FOR NEXT
STA TARORD :TIME
LDA SFC
ADC #0
STA TARORD+1
LDA IRQ2 :SHOW NUMBER
AND #2 :OF TARGTS?
BEQ IRQ270
JSR SHOWNH
IRQ270 LDA IRQ
BHI BEFORE
JMP AFTER
BEFORE AND #5 :READY TO
BEQ IRQ290 :PROCESS?
IRQ280 JMP IRQ360
IRQ290 JSR ONSCRN
ADDR SFB.XLPB20
LDA CUR2
AND #127
TAX
LDA SHOTS
AND #1
BEQ IRQ300
TXA
ORA #128
TAX
INC SFC
IRQ300 LDA H1IRQ
STA XLPB50.Y
LDA H2IRQ
STA YLPB60.Y
LDA V+16 :RIGHT X FOR
ASL A :SPRITE 7
LDA V+14 :XVAL: S7
ROR A : /2
STA XYGB50.Y
INY
STY CUR2
DINC NUMR60
DEC H7IRQ
BNE IRQ280
LDA #3
STA H7IRQ
LDY CUR1
LDA H1IRQ
STA (SPB).Y
INC SFC
INC SFC
LDA H2IRQ
STA (SPB).Y
INC SFC
INC SFC
LDA V+16 :RIGHT X FOR
ASL A :SPRITE 7
LDA V+14 :XVAL: S7
ROR A : /2
STA (SPB).Y
INY
STY CUR1
DINC NUMR20
LDY CURSRT
INC CURSRT
CPY #5
BCC IRQ310
LDY #0
STY CURSRT
IRQ310 LDA H1IRQ
STA SPTBUF.Y
CLC
ADC #5
TAX
LDA H2IRQ
STA SPTBUF.Y
AND #12 :HAS TRIGGER
BNE IRQ320 :RELEASED?
LDA 56321 :TRIGE PULL
CMP #247
BNE IRQ320
BIT BORCOL :LIGHTPEN
BPL SVPULL :ON SCREEN?
LDA #4
STA 53280
JMP IRQ360
IRQ320 SVPULL 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
CLC :THE CALL
ADC OFFX :TO GETXY
STA XVAL :IN CTRNOV
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 (SPB).Y
STA LASTSH.Y
INY
LDA NUMR20+1
STA (SPB).Y
STA LASTSH.Y
LDA NUMR60
STA LASTSH+7
LDA NUMR50+1
STA LASTSH+8
LDA #0
STA CUR1
STA CUR2
STA CURSRT
STA #1
STA H7IRQ
BIT IRQ2
BHI IRQ390
BVC IRQ400
LDA V+21
AND #254
BNE IRQ400
IRQ390 LDA IRQ
AND #63
STA IRQ
IRQ400 JMP IRQ360
ONSCRN LDA 53257 :X READINGS
STA H1IRQ :Y READINGS
LDY 53258
STY H2IRQ
CMP LPCHPX

```

C-4

```

STA (SFB).Y
INY
BPL ROTM20
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
VHISTL LDY #23
LDA #0
VHSL10 STA SID.Y
DEY
BPL VHSL10
LDA #18
STA DELAY
VHSL20 LDA #180
STA SID+1
LDA #46
STA SID
LDA #15
STA SID+5
STA SID+24
LDY #7
VHSL30 LDY #255
VHSL40 DEY
BNE VHSL40
DEY
BNE VHSL30
LDA #170
STA SID+1
LDA #6
STA SID
LDA #21
STA SID+4
LDY #30
VHSL50 LDY #255
VHSL60 DEY
BNE VHSL60
DEY
BNE VHSL50
DEC DELAY
BNE VHSL20
LDY #23
LDA #0
VHSL70 STA SID.Y
DEY
BPL VHSL70
RTS

:PROCEDURE WAIT
:CAUSES A DELAY
:B:LDY WITH AN APPROPRIATE DELAY
:C:JSR WAIT
:A:MOVE
WAIT LDY #255
WAIT1 DEY
BNE WAIT1
DEY

SCENE LDA SFB :CEIP #/BANK
STA SDFPF
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 #1024
BNE SCL010
LDA SA4
CMP #1024
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 SDFPF
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
PRA

LDA #54 :SELECT RAM
STA 1 : AT SA000
ADDR SFB.XLPB20
LDY #0
LDA SHOTS
AND #1
BNE SEE010
INC SFC
SEE010 LDA (SFB).Y :BULLET X
STA 12972.Y
INY
BNE SEE010
INC SFC
SEE020 LDA (SFB).Y
STA 12928.Y :BULLET Y
INY
BNE SEE020
INC SFC
SEE030 LDA (SFB).Y :TARGET X
STA 13184.Y : BEFORE
INY
BNE SEE030
LDY #128
SEE040 LDA XPG60.Y :TARGET X
STA 13440.Y : AFTER
DEY
BPL SEE040
LDY #32
SEE050 LDA XLP160.Y :BULLET X
STA 13568.Y : AFTER
LDA YLP160.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
DEY
BNE COL010
COL020 LDY HOLD2 :HOW MANY
COL030 LDY #39
COL040 LDA SFD :COLOR
STA (SFB).Y
DEY
BPL COL040
JSR ADD40
DEY
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 HITNIS
:RETURNS HITS IN TEMP+T22GET #
: MISSES IN TEMP+64+TARGET #
: EXPOSURES IN TEMP+128+TARGET #
HITNIS LDY #192
LDA #0
HML010 STA TEMP-1.Y
DEY
BNE HML010
LDA SHOTS
BEQ HML070
STA HOLD1
LDA 1
PRA
LDA #54
STA 1
ADDR SFB.INFO
LDY #0
HML020 LDA (SFB).Y
TAX
AND #127
CMP #7
BCC HML030
TAX
AND #248
TAX
HML030 TAX
BHI HML040
AND #63
TAX
INC TEMP.X
JMP HML050
HML040 CMP #255
BEQ HML060
AND #63
TAX
INC TEMP+64.X
HML050 INC TEMP+128.X
HML060 LDA SFB
CLC
ADC #8
STA SFB
LDA SFC
ADC #0
STA SFC
DEC HOLD1
BNE HML020
PLA
STA 1
HML070 RTS

:LIB MATHFUNCTIONS
:MATHFUNCTIONS FOR ARM PROGRAM
MATH JSR UNFLOT
LDA #47
STA SFB
LDA #48
STA SFC
DEC HOLD1
BNE HML020
PLA
STA 1
HML070 RTS
HML070 LDY MATHFUNCTIONS
: MATHFUNCTIONS FOR ARM PROGRAM
MATH JSR UNFLOT
LDA #47
STA SFB
LDA #48
STA SFC
HML010 LDY #0
LDA (SFB).Y
BNE HML020
RTS
HML020 CMP #1'S
BNE HML030
INY
LDA (SFB).Y
CMP #1'D
BEQ HML040
HML030 INY :ADD OFFSET
LDA (SFB).Y : TO HIT
CLC : ARRAY

```

C-6

C-7

```

JSR  FLOAT
JSR  PA1FA2
LDY  CODE3
LDA  CODE4
JSR  FLOAT
JSR  NLTPLY
JSR  PA1SC
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  PA1FA2
      LDY  CODE3
      LDA  CODE4
      JSR  FLOAT
      JSR  NLTPLY
      JSR  PA1FA2
      LDA  #COWSQ
      LDY  #COWSQ
      JSR  NEMPA1
      JSR  NLTPLY
      LDA  #SSC
      LDY  #0
      JSR  NEMPA2
      JSR  ADD
      LDA  102 ;PA1 SIGN
      AND  #127
      STA  102 ;ABS
      JSR  SQR7
      RTS
TRKTRP ADDR SPD.XLPB60
      LDY  #0
      LDA  SHOTS
      AND  #1
      BNE  TRK010
      LDA  SPD
      CLC
      ADC  #128
      STA  SPD
      LDY  #128
      LDA  #0
      STA  HOLD
      STY  TEMP+2
      JSR  UNFLOT
      LDA  100
      STA  SFB
      STA  NSIZE
      LDA  101
      STA  SPC
      STA  TIMES
      SEC
      SBC  SFB
      CLC
      ADC  #1
      CNP  #2
      BCS  TRK020
      LDY  #2
      JNP  TRK060
TRK020 PHA
      JSR  GETSTD
      STX  TEMP
      STA  TEMP+1
      LDA  SFB
      STA  NSIZE
      LDA  SPC
      STA  TIMES
      LDA  1
      PHA
      LDA  #54
      STA  1
      LDY  TEMP+2
      LDX  #0
      LDA  XLPB60.Y ;LPI=(LPI-
      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  SPD.XTGB60
      PLA
      JSR  GETSTD
      LDY  #1
      CPIX  TEMP
      BCC  TRK060
      BEQ  TRK040
      BCS  TRK050
      CNP  TEMP+1
      BCC  TRK060
      INY
      TRK050 STY  NETHEN
      TRK060 CPY  #1
      BNE  TRK070
      JSR  SETTRK
      LDY  #1
      TRK070 LDA  #0
      JSR  FLOAT
      RTS
      LDA  1
      PHA
      LDA  #54
      STA  1
      LDY  #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
      JSR  STDEV
      JSR  PA1FA2
      LDY  #10
      LDA  #0
      JSR  FLOAT
      JSR  NLTPLY
JSR  UNFLOT
LDX  100
LDZ  101
RTS
.END
.LIB  SHOTGROUPS
:PROCEDURE SHTCRP (SHOTGROUPS)
:POKE SFB WITH START ADDRESS.
:POKE XI.YI WITH TARGET CENTER
:POKE HOLD3.TARX
:POKE HOLD4.WITH # OF SHOTS.
:AT END: HITS. MISSES ARE SET.
:HOLD1 WILL HAVE # UNGRAPHABLES
:SHOTS. HOLD2 WILL HAVE TOTAL
:# SHOTS FIRED AT THIS TARGET
SHTCRP LDA  XI
      CNP  #160
      BCC  SHT010
      BEQ  SHT020
      LDA  #84
      LDZ  #156
      JNP  SHT030
      SHT010 LDA  #4
      LDZ  #76
      JNP  SHT030
      SHT020 LDA  #4
      LDZ  #156
      SHT030 STA  NSIZE
      STX  NSIZE+1
      LDA  #255
      STA  CHOICE
      LDA  #0
      STA  HITS
      STA  MISSES
      STA  HOLD1
      STA  HOLD2
      STA  HOLDY
      LDA  HOLD3
      AND  #127
      TAX
      CNP  #7
      BCC  SHT040
      LSR  A
      LSR  A
      LSR  A
      CLC
      ABC  #6
      SHT040 SEC
      SBC  #1
      ASL  A
      ASL  A
      ASL  A
      TAX
      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
      CNP  CODE1
      BEQ  SHT070
      JMF  SHT160
      INC  HOLD2
      LDA  (SFB).Y
      BNE  SHT080
      INC  HITS
      JNP  SHT090
      SHT080 INC  MISSES
      SHT090 LDY  #4
      SHT100 LDA  (SFB).Y
      STA  LASTSH.Y
      DEY
      BPL  SHT100
      LDZ  #0
      STA  XVAL
      STA  XVAL+1
      STA  YVAL
      STA  YVAL+1
      LDA  LASTSH+3 ;TARX
      LDZ  #0
      ASL  Z
      BCC  SHT110
      INY
      SHT110 STA  SFD
      STX  SFE
      LDZ  LASTSH+1 ;BULZ
      LDZ  #0
      ASL  A
      BCC  SHT120
      INY
      SHT120 SEC
      SBC  SFD
      STA  SFD
      TAX
      SBC  SFE
      STA  SFE
      LDZ  CODE2
      SHT130 LDA  XVAL
      CLC
      ADC  SFD
      STA  XVAL
      LDA  XVAL+1
      ADC  SFE
      STA  XVAL+1
      DEX
      BNE  SHT130
      LDZ  XVAL
      CLC
      ADC  X1
      STA  XVAL
      TAX
      LDZ  XVAL+1
      ADC  #0
      STA  XVAL+1
      LSR  A
      TAX
      ROR  A
      CNP  NSIZE
      BCC  SHT150
      CNP  NSIZE+1
      BCS  SHT150
      LDY  HOLDY
      STA  TEMP.Y
      LDZ  LASTSH+2 ;BULY
      SEC
      SBC  LASTSH+4 ;TARZ
      STA  SFD
      LDA  #0
      SBC  #0

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```

SHT140 STA SFE
      LDX CODE2
      LDA YVAL
      CLC
      ADC SFD
      STA YVAL
      LDA YVAL+1
      ADC SFE
      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 HOLDI
SHT160 LDA SFB
      CLC
      ADC #8
      STA SFB
      LDA SFC
      ADC #0
      STA SFC
      DEC HOLDA
      BEQ SHT170
      JNP SHT060
SHT170 PLA
      STA 1
      LDY #0
SHT180 LDX #0
      LDA TEMP.Y
      CMP #255
      BEQ SHT230
      STA SFB
      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 SFC
      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 SFB
      BNE SHT220
      LDA TEMP+1.X
      CMP
      BNE SHT220
      INC TEMP.X
      INC TEMP+1.X
SHT220 INX
      INX
      JNP SHT210
SHT230 LDA #EXPTAR
      STA SUBNO
      JSR SELSUB
      RTS
;
BITPLT STY HOLDY
      LDA #0
      STA SFD
      STA SFE
      STA SA4
      STA YVAL+1
      LDA YVAL
      AND #248 :INT(Y/8)*320
      LDX #3
      ASL A
      ROL SA4
      DEX
      BNE PL010
      STA SA3
      LDX #5
      LDA SFD
      CLC
      ADC SA3
      STA SFB
      LDA SFE
      ADC SA4
      STA SFE
      DEX
      BNE PL020
      LDA XVAL
      AND #248 :8*INT(X/8)
      CLC
      ADC SFD
      STA SFD
      LDA XVAL+1
      ADC SFE
      CLC
      ADC #8192 :+8192
      STA SFE

      LDA YVAL :Y AND 7
      AND #7
      TAY
      LDA XVAL :X AND 7
      AND #7
      STA SA3
      LDA #7
      SEC
      SBC SA3 :7-(X AND 7)
      TAX
      LDA #1
      CPX #0
      BEQ PL040
      ASL A :2*7-1X
      DEX :AND 7
      BNE PL030
      BIT CHOICE
      BPL PL050
      ORA (SFD).Y
      JNP PL060
      EOR (SFD).Y
      STA (SFD).Y
      LDY HOLDY
      RTS
EXPDAT .BYTE 39.48.33.2.1.11.0.0
:50 H (6)
      .BYTE 41.48.74.4.2.0.0.0
:100 H
      .BYTE 35.34.37.3.3.0.0.0
:150 H
      .BYTE 36.46.58.4.4.0.0.0
:200 H
      .BYTE 37.57.77.5.5.0.0.0
:250 H
      .BYTE 38.69.99.6.6.0.0.0
:300 H
      .BYTE 47.24.20.2.1.12.0.0
:60 H (8)
      .BYTE 46.24.25.2.1.0.0.0
:75 H
      .BYTE 45.48.66.4.2.0.0.0
:125 H
      .BYTE 44.46.54.4.4.0.0.0
:185 H
      .BYTE 40.0.33.2.1.0.0.0
:50 H (8)
      .BYTE 48.24.62.2.1.0.0.0
:60 H (7)
      .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 GETIX :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
PIGHUM =49161
.LIB CTRMOV
:PROCEDURE CTRMOV
:POKE KEYS 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.
: CONNODORE.Q.BREX
CTRMOV JSR ENABLE
LDA #0
STA HITSPL
STA NUMR20
STA NUMR20+1
STA NUMR60
STA NUMR60+1
STA FSTAT
JSR SBINP
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 GETIX :NO MORE SORT
JSR CLOSES
STA CURTAR
TAX
BNE CTR040
JMP CTR100
CTR040 LDA SPECIL.X
STA SPECIL
LDA #0
STA WDRIPT+1
LDA WIND
AND #96
BEQ CTR060
LDA WDRIPT.X
ASL A :RANGE*8
ASL A
ASL A
STA WDRIPT
LDA WIND :GET SPEED
AND #7
CLC :ADD TARGET
ADC WDRIPT :OFFSET
TAX
LDA WIND :FULL OR
AND #32 :HALF VALUE?
BNE CTR050
LDA VTABLE.Y
LSR A
LSR A
LSR A
JMP CTR050
CTR050 LDA VTABLE.Y
AND #15
CTR060 STA WDRIPT
BIT WIND :NEGATIVE
BPL CTR070 :DIRECTION?
DEC WDRIPT+1
EOR #255
STA WDRIPT
DINC WDRIPT
CTR070 LDA WDRIPT.X
STA TRAJ
LDA TIMPL.X
BEQ CTR100
STA CTR100
LDA DLSTK1.X
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 WDRIPT
STA XVAL
STA V
LDA XVAL+1
ADC WDRIPT+1
STA XVAL+1
LDA YVAL
CLC
ADC TRAJ
STA YVAL
STA V+1
LDA V+15
AND #254
BEX XVAL+1
BEQ CTR110
ORA #1
CTR110 STA V+15
LDA V+28 :TURN OFF
AND #254 :MULTICOLOR
STA V+28 :FOR SPR 0
LDA #34 :BULLET
STA 2040
LDA #12 :RED 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
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
ROL SFC
ADC #1:INFO
STA SPB
LDA SFC
ADC #1:INFO
STA SFC
LDA SSCOL
AND #254
TAX
LDA #2
STA CODE3 :2 (HIT SPR)
LDX #1 :HIT SPR
CTR150 TAX
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 (SPB).Y :TARGET ID
STA LASTSE.Y
INX
LDA XVAL+1
LSR A
LDA XVAL
ROR A
STA (SPB).Y :BULLET
STA LASTSE.Y
INX
LDA YVAL
STA (SPB).Y :BULY
STA LASTSE.Y
INX
LDA SPECIL.X
STA SPECIL
LDA CENZ.X
STA CENZ
LDA CENY.X
STA CENY
TAX
ASL A :FOR SPR IX
PHE
LDA V+16
CTR190 LSR A :PUT RISE?
DEX :1 IN
BPL CTR190 :CARRY
PLA
TAX
LDA V.X
ROR A :RIGHT X
CLC :ADD CENTER X
ADC CENZ :OFFSET
STA (SPB).Y :TRAJ/X
STA LASTSE.Y
INX
LDA V+1.X
CLC :ADD CENTER Y
ADC CENY :OFFSET
STA (SPB).Y :TRAJ
STA LASTSE.Y
LDA IRQ2 :IS THIS SHOT
AND #4 :A REPEAT?
BNE CTR210
LDA SPB :STORE IN
CLC :2ND INFO
ADC #344 :BUFFER
STA #344 :DISK
LDA SFC :RECORDS
ADC #344 :ONLY HAVE
STA SFC :ORIGINAL
LDA SHOTS :SHOT
CLC
ADC #1
STA SHOTX
LDY #7
CTR200 LDA LASTSE.Y
STA (SPB).Y
DEX
BPL CTR200
CTR210 LDA IRQ2 :NO CROSS?
AND #16
BNE CTR240
LDA IRQ2
AND #8
BEQ CTR220
LDA LASTSE
BPL CTR240

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CTR220 LDA XVAL :PUT UP CROSS
SEC
SBC #10
STA V
LDA XVAL+1
SBC #0
TAX
LDA V+16
AND #254
CPI #0
BEQ CTR230
ORA #1
CTR230 STA V+16
LDA TVAL
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
CPI #128
BCC CTR310
JMP CTR320
CTR300 LDA IRQ2 :SPECIAL
AND #8 :CROSS?
BEQ CTR330
CPI #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 MAXSH
BCC CTR420
LDA #0
ORA #1
STA IRQ
LDY #87
CTR400 LDA NOANNO.Y
STA 15776.Y
DEY
BPL CTR400
LDY #10
LDA #11
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 PSTAT :KEY FLAG
JMP CTR470
CTR430 LDA OFFSCR2
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
CTR450 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 SPB.TARORD
LDY #0
LDA (SPB).Y
CMP #254
BNE CTR480
DINC TARORD
CTR480 LDA #0
LDY PSTAT
JSR SB391
RTS
CKSPCL LDA IRQ2 :RETURN WHEN
BHI 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
NOV010 LDA V+21
AND HOLD
BEQ NOV050
LDA DLSTEL.X :STATIONARY?
BEQ NOV060
DEC CDLSTK.X :MOVE 100
BNE NOV060
LDA HOLD
AND OFFSCR
BNE NOV060
LDA DLSTEL.X
STA CDLSTK.X
LDA HOLD :CHECK
AND V+16 :RIGHT?
BEQ NOV020
LDA #1
NOV020 STA HOLD
LDA INSTK.X :ADD
STA HOLBY :INCREMENT
CLC
ADC V.Y
STA V.Y
LDA #0
BIT HOLBY :INCREMENT(0)?
BPL NOV030
LDA #255
NOV030 ADC HOLBY
BEQ NOV040
LDA HOLD
ORA V+16
STA V+16
LDA V.Y
CMP #80
BCS NOV050
JMP NOV060
NOV040 LDA HOLD
EOR #255
AND V+16
STA V+16
LDA V.Y
CMP #20
BCS NOV060
LDA HOLD
ORA OFFSCR
STA OFFSCR
NOV050 DEY
DEY
LSR HOLD
DEX
BNE NOV010
RTS
PAUSE LDA IRQ :TRIG PULS
AND #4
BEQ PAU010
SEC
RTS
PAU010 LDA #566
PAU020 SEC
SBC #1
BNE PAU020
CLC
RTS
CLOSES LDA #255
STA HOLD :LOW DISTANCE
LDA #128
STA CODE1 :SPRITE CODE
STA TARNUM :FOR MISS
LDA XVAL+1
LSR
LDA XVAL
ROR
STA HOLD :BULLET 1

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```

LDA #0                      .OPT NO
STA HOLD1                   .LIB DATITEMS
STA HOLD3                   :DATITEMS FOR ARM PROGRAM
LDX #14                     DODATA JSR WECDAT
CLO010 LDA V+21 :SPRITE ON? LDA #0 DITEMS
AND CODE1                   CLC
BEQ CLO050                  ADC STOP
LDI V+1.X                   STA STOP
SEC                          LDA #0 DITEMS
SBC VVAL                    ADC STOP+1
BCS CLO020                  STA STOP+1
EOR #255                    ADDR SFD.RANTAR
CLC                          LDI #0
ADC #1                      DOD010 LDA (SFD).Y
STA HOLDY :PART-BULY      STA (SFD).Y
LDA V+16                    DINC SFD
AND CODE1                   DINC SFD
CLC                          LDA SFD
BEQ CLO030                  CNP STOP
SEC                          BCC DOD010
LDA V.X                     LDA SFC
ROR A                       CNP STOP+1
SEC                          BCC DOD010
SBC HOLDX                   RTS
BCS CLO040                  :PROCEDURE RANDOM
EOR #255                    :POKE STOP WITH THE STARTING LOC
CLC                          : IN STACK (X=START-16325)
ADC #1                      : AND 16325-XXXX WITH THE DATA
CLO040 CLC                  : ITEMS. POKE HOLD1.HOLD2 WITH
ADC HOLDY :XDIF+YDIF        : ADDRESS OFFSET OF DATA TO BE
ROR A : (XDIF+YDIF)/2       : MOVED.
CNP HOLDA                   RANDOM LDX STOP
BCS CLO050                  ADDR SFD.RANTAR
STA HOLDA                   RAN010 JSR WECDAT
STX HOLD1                   LDA 16325.X
LDA CODE1                   BNE RAN020
STA HOLD3                   JSR SEARCH
CLO050 LSR CODE1            INX
DEX                          BNE RAN010
DEX                          LDI #0
BNE CLO010                  LDA #255
LDA HOLD1                   STA (SFD).Y
LSR A                       RTS
RTS                          SEARCH STA SA3
                               STX SA4
                               LDI #0
                               LDX #0
                               CNP #0
                               BEQ RAN060
                               RAN030 LDA (SFD).Y
                               DINC SFD
                               TAX
                               RAN040 LDA SFD
                               CLC
                               ADC #15
                               STA SFD
                               LDA SFC
                               ADC #0
                               STA SFC
                               DEX
                               BNE RAN040
                               LDA (SFD).Y
                               BPL RAN050
                               DINC SFD
                               RAN050 DEC SA3
                               BNE RAN030
                               RAN060 LDI (SFD).Y
                               STA SA3
                               STA (SFD).Y
                               INY
                               RAN070 LDX #15
                               RAN080 LDA (SFD).Y
                               STA (SFD).Y
                               INY
                               DEZ
                               BNE RAN080
                               DEC SA3
                               BNE RAN070
                               LDA (SFD).Y
                               BPL RAN090
                               STA (SFD).Y
                               INY
                               RAN090 TYA
                               CLC
                               ADC SFD
                               STA SFD
                               LDA SFE
                               ADC #0
                               STA SFE
                               LDX SA4
                               RTS
                               WECDAT LDA #0 DITEMS
                               CLC
                               ADC HOLD1
                               STA SFD
                               LDA #0 DITEMS
                               ADC HOLD1+1
                               STA SFC
                               RTS
                               :ZERO DATA (0-17)
                               DITEMS .BYTE
                               1.0.150.5.37.12.255.0.0.0.4.0.0.5.15.0
                               .254.255
                               :LEV 1-5 (10-515). 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. 36. 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. 1. 6.254. 32. 12. 19. 0
                               .BYTE 23.121. 11. 48.236. 5.
                               21.254. 1. 6.254. 48. 12. 61. 0.254
                               .BYTE 2. 23.163. 13. 47.236. 5.
                               10.254. 1. 6.254. 32. 12. 19. 0
                               .BYTE 23.121. 13. 48.236. 5.
                               10.254. 1. 6.254. 48. 12. 61. 0.254
                               .BYTE 1.179.159. 17. 45.204. 5.
                               52.254. 1. 7.254. 0. 12. 24. 0.254
                               .BYTE 1. 13.159. 19. 46.236. 5.
                               25.254. 1. 7.254. 0. 12. 24. 0.254
                               .BYTE 1. 13.159. 21. 45.236. 5.
                               13.254. 1. 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. 1. 8.254. 0. 12. 32. 0.254
                               .BYTE 1. 13.147. 29. 45.236. 5.
                               21.254. 1. 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. 1. 9.255. 0. 6. 13. 0.254
                               .BYTE 1. 13.155. 37. 44. 44. 5.
                               32.254. 1. 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. 35. 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. 5. 15. 0.254
                               .BYTE 1. 0.126. 6. 38. 12. 5. 0
                               0. 0. 5. 1. 0. 5. 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 11)
                               .BYTE 3.251.115. 6. 38. 12. 4. 0
                               0. 0. 5. 1. 0. 5. 16. 0
                               .BYTE 83.130. 5. 37. 12. 3. 0
                               0. 0. 5. 0. 0. 5. 15. 0
                               .BYTE 225.152. 35. 44. 12. 5.
                               54.254. 1. 10.255. 0. 6. 13. 0.140
                               .BYTE 135 (END 21)
                               .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. 6. 1. 0. 5. 16. 0.136
                               .BYTE 145 (END 31)
                               .BYTE 1. 79.160. 3. 35. 12. 4.
                               0. 0. 3.254. 0. 6. 13. 0.132

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C-13

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: .BYTE 2, 15, 161, 17, 45, 236, 6, STA LENSTR
52, 254, 1, 8, 254, 0, 12, 24, 0, JSR LETHL
: .BYTE 85, 154, 2, 41, 204, 4, LDA #1
0, 0, 0, 2, 254, 0, 12, 37, 0, 140, STA V+39
: .BYTE 2, 41, 170, 10, 47, 204, 4, STA V+28
21, 2, 3, 7, 254, 32, 12, 19, 0, LDA #42
: .BYTE 41, 128, 10, 48, 204, 4, STA 2040
21, 2, 3, 7, 254, 48, 12, 51, 0, 136, LDY #240
: .BYTE 1, 111, 161, 16, 45, 204, 4, LDA #13
52, 2, 1, 8, 254, 0, 12, 24, 0, 136, YSK010 STA 1583.Y
: .BYTE 2, 53, 146, 27, 45, 236, 5, DEY
43, 254, 3, 9, 254, 0, 12, 32, 0, BNE YSK010
: .BYTE 85, 154, 2, 41, 204, 7, LDY #200
0, 0, 0, 2, 254, 0, 12, 37, 0, 142, YSK020 STA 1823.Y
: (END 7) DEY
: .BYTE 2, 101, 169, 1, 39, 204, 3, BNE YSK020
0, 0, 0, 1, 255, 32, 24, 34, 0, YSK030 LDX #0
: .BYTE 149, 169, 1, 40, 204, 3, LDA 53267 :X READING
0, 0, 0, 1, 255, 48, 24, 34, 0, 134, SEC
: .BYTE 2, 199, 170, 8, 47, 204, 3, SBC #5
41, 2, 1, 7, 254, 32, 12, 19, 0, ASL A
: .BYTE 199, 128, 8, 48, 204, 3, BCC YSK040
41, 2, 1, 7, 254, 48, 12, 61, 0, 134, INX
: .BYTE 1, 71, 161, 19, 45, 236, 4, YSK040 CLC
25, 254, 3, 8, 254, 0, 12, 24, 0, 136, ADC OFFX
: .BYTE 135 (END 8) STA V
: .BYTE 2, 71, 170, 10, 47, 204, 3, TXA
21, 2, 3, 7, 254, 32, 12, 19, 0, ADC OFFX+1
: .BYTE 71, 128, 10, 48, 204, 3, TAX
21, 2, 3, 7, 254, 48, 12, 61, 0, 134, AND #1
: .BYTE 1, 55, 146, 29, 45, 236, 3, BEQ YSK050
21, 254, 5, 9, 254, 0, 12, 32, 0, 134, ORA V+16
: .BYTE 1, 161, 152, 34, 44, 12, 6, JMP YSK060
64, 2, 3, 10, 255, 0, 6, 13, 0, 142, YSK050 LDA V+16
: .BYTE 255 (END 9, END LEVEL 6) AND #254
: .END STA V+16
: .LIB REKEEP YSK060 LDA 53268 :Y READING
: REKEEP IN MLCHOBK1.TXT OF ARM SEC
REKEEP LDA #0 SBC #9
JSR SETNAM CLC
LDA #1 ADC OFFY
LDX #8 STA V+1
LDY #15 LDA #1
JSR SETLPS STA V+21
JSR OPEN CPX #0
BCS MODISK BNE YSK070
LDX #1 LDA V
JSR CHKOUT CNP #182
BCC DISKON BCS YSK070
MODISK LDA #1 LDA #13
JSR CLOSE JSR COLYES
JSR CLRCHN LDA #253
LDA #0 JSR COLNO
TAX LDY #255
JSR FLOAT JMP YSK080
DISKON JMP YSK080 YSK070 LDA #253
LDA #1 JSR COLYES
JSR CLOSE LDA #13
JSR CLRCHN JSR COLNO
ADDR SA3.S1 LDY #0
LDA #S2-S1 YSK080 LDA 56321
STA LENSTR CNP #247
JSR LETHL BEQ YSK090
YSK0 ADDR SA3.S2 LDY #100
LDA #S3-S2 JSR WAIT
STA LENSTR JSR GETIN
JSR LETHL CNP #0
ADDR SA3.S3 BEQ YSK030
LDA #S4-S3 LDY #255

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COLNO  STA 1794.X
CN1    DEI
      BPL C71
      RTS
      LDX #3
      STA 1770.X
      STA 1810.X
      DEI
      BPL CN1
      RTS
COLUP   LDX #1
CU1     STA 1300.X
      STA 1340.X
      DEI
      BPL CU1
      RTS
COLDN   LDX #1
CD1     STA 1780.X
      STA 1820.X
      DEI
      BPL CD1
      RTS
      .OPT HOL
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 HOL
      .LIB DESCRIPTIONS
;DESCRIPTIONS IN MLCHOBK1.TXT
; OF ARM CARTRIDGE
DESCRP  ADDR SPB.DESC
      LDX HOLD1
      BEQ DES050
      LDY #0
DES010  DEI
      BEQ DES020
      LDA (SPB).Y
      CLC
      ADC #1
      CLC
      ADC SPB
      STA SPB
      LDA SFC
      ADC #0
      STA SFC
      JMP DES010
DES020  LDA #40
      SEC
      SBC (SPB).Y
      LSR A
      TAY
      LDX #0
DES030  LDA #32
      STA TEMP.X
      INI
      DEY
      BNE DES030
      LDA (SPB).Y
      STA HOLD1
      INY
      DES040 LDA (SPB).Y
      STA TEMP.X
      INX
      INY
      DEC HOLD1
      BNE DES040
      STX LENSSTR
      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
      LDY #0 ;BLACK
      STX 646
      DES080 LDZ #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 #1
      STA TEMP+2
      LDY #0
      LDA (SPB).Y
      PHA
      TAY
      DES100 LDA (SPB).Y
      STA TEMP+3.Y
      DEY
      BNE DES100
      PLA
      TAY
      DINC SPB
      CLC
      ADC SPB
      PHA
      LDA SFC
      ADC #0
      PHA
      LDA SPD
      PHA
      LDA SPE
      PHA
      LDA #13
      STA TEMP+4.Y
      INY
      INY
      INY
      INY
      ADDR SA3.TEMP
      STX LENSSTR
      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,'ONBAT '.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
      TAY ; THE SRTBUF
      LDA SRTBUF.X
      ASL A ;*2
      STA XVAL ;SET UP FOR
      LDA #0 ; ADDITION OF
      BCC GXY10 ; OFFSET X
      LDA #1 ; BULLET RIGHT
      GXY10 STA XVAL+1
      DADD XVAL,OFFX
      LDA STSIZE ;FIND MEDIAN
      LSR A ; OF THE
      CLC ; Y HALF OF
      ADC STSIZE ; THE SRTBUF
      TAY
      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 I VALS
      LDA (SFD).Y
      DEY
      STA (SFD).Y
      INY
      TAX
      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
      TAX
      STA (SFD).Y
      TYA
      SEC
      SBC NSRT
      TAY
      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 PAL.
RNDIZE  JSR SBIBF
      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
      RND2010 STA 16324.Y
      DEY
      BNE RND2010
      LDY SA2 ;CLOCK
      LDA #0
      JSR SB391 ;FLOAT?
      JSR SE260 ;SINE
      JSR SBC0F ;PUT IN PAL

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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
RNZ030 LDA 16325.Y
CNP #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
CNP STOP+1
BCC RNZ020
RTS
.END
.LIB EXPTAR
;EXPTAR IN ARM.3200.TXT
;PROCEDURE EXPTAR
;POKE HOLD3,TARGET. 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
CNP #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 HOLDX
LDA Y1
SEC
SBC EXPDAT+2.Y
STA YVAL
LDA EXPDAT+3.Y
STA CODE2
LDA #0
STA SSD
LDA EXPDAT.Y
LDY #6
EXP020 ASL A
ROL SSD
DEY
BNE EXP020
STA SSC
EXP030 LDY #0
EXP040 LDA #3
STA HOLDA
EXP050 LDA #128
STA CODE1
EXP060 LDA (SSC).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
LDA XVAL+1
SBC #0
STA XVAL+1
LSR CODE1
BNE EXP060
INY
CPY #63
BCS EXP090
DEC HOLDA
BNE EXP050
LDA HOLDX
STA XVAL
LDA #0
STA XVAL+1
LDA YVAL
CLC
ADC CODE2
STA YVAL
JMP EXP040
EXP090 LDY HOLD3
LDA EXPDAT+5.Y
BEG EXP100
STA HOLD1
JMP EXP010
EXP100 RTS
;SPRITE PTR.STARTX.STARTY.TARGET
FACTOR.BULLET FACTOR.WEET
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 45.48.56.4.2.0.0.0
: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 CR1050
ADDR STD.CRDATA
LDY HOLD1
BEQ CR1020
CR1010 LDA SFD
CLC
ADC #20
STA SFD
LDA SFE
ADC #0
STA SFE
DEY
BNE CR1010
LDA HOLD2
ASL A
ASL A
TAY
LDX #5
LDA 101
CNP (SPD).Y
BCC CR1040
BEQ CR1040
DEY
INY
CPY #1
BNE CR1030
CR1040 TAY
TAY
CR1050 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

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.BYTE 3.8.14.19 :TRAP
.BYTE 5.11.18.24 :LIM
.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 :LIM
.BYTE 6.11.18.24 :TS
.BYTE 3.7.13.18 :SL
.END
.OPT LIST
.END
```

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* = 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
ENABLE = 3200
NOTTRG = 3209
ROTATE = 3206
WAIT = 3218
WHISTL = 3215
YESNO = 32783
YESNO2 = 32798
WETNL = 49185
PRGNUM = 49161
SELSUB = 49162
BANKSB = 49163
SUBNO = 49168
BANKRT = 49171
.LIB DEMONAIN
:DEMONAIN IN MLCH0BK2.TXT OF ARM
DEMO DSPL DDES03.DDES04
LDA #YESNO2
JSR BANK1
JSR UNFLOT
LDA 101
CMP #2
BNE DEM010
RTS
DEMO10 JSR DENSB4
DSPL DDES04.DDES05
LDA #3 :185 M
LDX #2 :6 MPH
JSR DENSB5
LDA #0
LDX #0
JSR DENSB1
CMP #255
BNE DEM020
RTS
DEMO20 JSR DENSB4
DSPL DDES05.DDES06
LDA #3 :185 M
LDX #2 :6 MPH
JSR DENSB5
LDA #1
LDX #1
JSR DENSB1
CMP #255
BNE DEM030
RTS
DEMO30 DSPL DDES06.DDES07
JSR DENSB3
BEQ DEM040
RTS
DEMO40 JSR DENSB4
LDA #0 :60 M
LDX #0 :1.5 MPH
JSR DENSB6
LDA #2
LDX #99
JSR DENSB1
CMP #255
BNE DEM050
RTS
DEMO50 JSR DENSB4
LDA #0 :50 M
LDX #1 :3 MPH
JSR DENSB6
LDA #3
LDX #99
JSR DENSB1
CMP #255
BNE DEM060
RTS
DEMO60 JSR DENSB4
LDA #0 :50 M
LDX #2 :6 MPH
JSR DENSB6
LDA #4
LDX #99
JSR DENSB1
CMP #255
BNE DEM070
RTS
DEMO70 JSR DENSB4
LDA #1 :75 M
LDX #0 :1.5 MPH
JSR DENSB6
LDA #5
LDX #99
JSR DENSB1
CMP #255
BNE DEM080
RTS
DEMO80 JSR DENSB4
LDA #1 :75 M
LDX #1 :3 MPH
JSR DENSB6
LDA #6
LDX #99
JSR DENSB1
CMP #255
BNE DEM090
RTS
DEMO90 JSR DENSB4
LDA #1 :75 M
LDX #2 :6 MPH
JSR DENSB6
LDA #7
LDX #99
JSR DENSB1
CMP #255
BNE DEM100
RTS
DEMO100 JSR DENSB4
LDA #2 :125 M
LDX #0 :1.5 MPH
JSR DENSB6
LDA #8
LDX #99
JSR DENSB1
CMP #255
BNE DEM110
RTS
DEMO110 JSR DENSB4
LDA #2 :125 M
LDX #1 :3 MPH
JSR DENSB6
LDA #9
LDX #99
JSR DENSB1
CMP #255
BNE DEM120
RTS
DEMO120 JSR DENSB4
LDA #2 :125 M
LDX #2 :6 MPH
JSR DENSB6
LDA #10
LDX #99
JSR DENSB1
CMP #255
BNE DEM130
RTS
DEMO130 JSR DENSB4
LDA #3 :185 M
LDX #0 :1.5 MPH
JSR DENSB6
LDA #11
LDX #99
JSR DENSB1
CMP #255
BNE DEM140
RTS
DEMO140 JSR DENSB4
LDA #3 :185 M
LDX #1 :3 MPH
JSR DENSB6
LDA #12
LDX #99
JSR DENSB1
CMP #255
BNE DEM150
RTS
DEMO150 JSR DENSB4
LDA #3 :185 M
LDX #2 :6 MPH
JSR DENSB6
LDA #13
LDX #99
JSR DENSB1
CMP #255
BNE DEM155
RTS
DEMO155 DSPL DDES15.DDES16
LDA #YESNO
JSR BANK1
JSR UNFLOT
LDA 101
BEQ DEM160
JMP DEM040
DEMO160 JSR DENSB4
LDA #1 :75 M
LDX #1 :3 MPH
JSR DENSB5
LDA #14
LDX #4
JSR DENSB1
CMP #255
BNE DEM170
RTS
DEMO170 JSR DENSB4
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
DEMO180 LDA DDATLY.X
STA V+2.X
BEI
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+45
LDA #126
STA V+23
STA V+29
LDA #254
STA V+21
DSPL DDES01.DDES02
JSR DENSB3
LDX #0
STA V+21
CMP #0
BEQ DEM190
RTS
DEMO190 DSPL DDES09.DDES10
JSR DENSB3
BEQ DEM200
RTS
DEMO200 JSR DENSB4
LDA #0 :50 M
LDX #0 :1.5 MPH
JSR DENSB6
LDA #15
LDX #101
JSR DENSB1
CMP #255
BNE DEM210
RTS
DEMO210 JSR DENSB4
LDA #0 :60 M
LDX #1 :3 MPH
JSR DENSB6
LDA #16
LDX #101
JSR DENSB1
CMP #255
BNE DEM220
RTS
DEMO220 JSR DENSB4
LDA #0 :50 M
LDX #2 :6 MPH
JSR DENSB6
LDA #17
LDX #101
JSR DENSB1
CMP #255
BNE DEM230
RTS
DEMO230 JSR DENSB4
LDA #1 :75 M
LDX #0 :1.5 MPH
JSR DENSB6

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LDA #18
LDX #101
JSR DENSB1
CMP #255
BNE DEN240
RTS
DEN240 JSR DENSB4
LDA #1 :75 M
LDX #1 :3 MPH
JSR DENSB6
LDA #19
LDX #101
JSR DENSB1
CMP #255
BNE DEN250
RTS
DEN250 JSR DENSB4
LDA #1 :75 M
LDX #2 :6 MPH
JSR DENSB6
LDA #20
LDX #101
JSR DENSB1
CMP #255
BNE DEN260
RTS
DEN260 JSR DENSB4
LDA #2 :125 M
LDX #0 :1.5 MPH
JSR DENSB6
LDA #21
LDX #101
JSR DENSB1
CMP #255
BNE DEN270
RTS
DEN270 JSR DENSB4
LDA #2 :125 M
LDX #1 :3 MPH
JSR DENSB6
LDA #22
LDX #101
JSR DENSB1
CMP #255
BNE DEN280
RTS
DEN280 JSR DENSB4
LDA #2 :125 M
LDX #2 :6 MPH
JSR DENSB6
LDA #23
LDX #101
JSR DENSB1
CMP #255
BNE DEN290
RTS
DEN290 JSR DENSB4
LDA #3 :185 M
LDX #0 :1.5 MPH
JSR DENSB6
LDA #24
LDX #101
JSR DENSB1
CMP #255
BNE DEN300
RTS
DEN300 JSR DENSB4
LDA #3 :185 M
LDX #1 :3 MPH

JSR DENSB6
LDA #25
LDX #101
JSR DENSB1
CMP #255
BNE DEN305
RTS
DEN305 DSPL DDES16.DDES17
LDA #YESNO
JSR BANK1
JSR UNPLOT
LDA 101
BEQ DEN310
JMP DEN200
DEN310 JSR DENSB4
DSPL DDES10.DDES11
LDA #3 :185 M
LDX #2 :6 MPH
JSR DENSB5
LDA #26
LDX #6
JSR DENSB1
CMP #255
BNE DEN320
RTS
DEN320 JSR DENSB4
DSPL DDES11.DDES12
LDA #3 :185 M
LDX #2 :6 MPH
JSR DENSB5
LDA #27
LDX #6
JSR DENSB1
CMP #255
BNE DEN330
RTS
DEN330 DSPL DDES12.DDES13
JSR DENSB3
RTS
SPCDEN JSR UNPLOT
LDA 101
BNE DSP010
JSR DENSB4
DSPL DDES13.DDES14
LDA #1 :75 M
LDX #1 :3 MPH
JSR DENSB5
LDA #28
LDX #7
JSR DENSB1
JMP DSP020
DSP010 JSR DENSB4
DSPL DDES14.DDES15
LDA #1 :75 M
LDX #1 :3 MPH
JSR DENSB5
LDA #29
LDX #8
JSR DENSB1
DSP020 TAY
JSR FLOAT
RTS
.END
.LIB DENOSUBS
;DENOSUBS FOR MLCHOBK2.TXT
DENSB1 STA HOLD1
STX HOLD2
LDA #48 :60M TOP
STA 2046

LDA #42 :CROSS
STA 2040
LDA #34 :BULLET
STA 2041
LDA #43 :SPOST
STA 2042
LDA #12 :RED GRAY
STA #45
STA #46
LDA #1 :WHITE
STA #39
STA #40
ADDR SA3.DDES26
LDY #0
LDA HOLD2
AND #31
TAX
BEQ SIL020
LDA (SA3).Y
CLC
ADC #1
CLC
ADC SA3
STA SA3
LDA SA4
ADC #0
STA SA4
DEX
BNE SIL010
LDA (SA3).Y
STA LEWSTY
DINC SA3
JSR LETHL
JSR DSABLE
LDA #59
STA #3265
BIT HOLD2
BVS SIL030
JSR HOLDIT
SIL030 LDA #0
STA CHOICE
SIL040 JSR DENSB2
LDY HOLD3
BMI SIL110
LDA HOLD2
AND #32
BNE SIL050
DSPL DDES01.DDES02
SIL050 LDA #255
STA CHOICE
LDA #2
STA HOLDY
SIL060 LDE #255
STA HOLDA
STA HOLDX
SIL070 LDA #6321
CMP #247
BNE SIL080
LDY #128
JMP SIL110
SIL080 CMP #127
BNE SIL090
LDY #255
JMP SIL110
SIL090 DEC HOLDA
BNE SIL070
DEC HOLDX
BNE SIL070
DEC HOLDY

BNE SIL100
LDY #0
LDA HOLD2
AND #32
BNE SIL110
JMP SIL040
LDA #0
STA #38
LDX #21
AND #249
STA #21
SIL100 JMP SIL060
SIL110 LDA #6321
CMP #255
BNE SIL110
LDA #0
STA #38
STA #21
LDA #12
STA #39
TYE
RTS
DENSB2 LDY #0
ADDR SFB.DDAT
LDX HOLD1
BEQ S2L020
S2L010 LDA SFB
CLC
RRC #15
STA SFB
LDA SFC
ADC #0
STA SFC
DEX
BNE S2L010
S2L020 LDA #0
STA #41 :BLACK
STA #16
STA #21
LDA #1
STA #28 :MULTICOLOR
STA #38 :WHITE
LDA #6
STA #23 :EXPAND Y
STA #29 :EXPAND X
LDA #78 :SET UP
STA #2 :BULLET FOR
LDA #185 :CH DEMO
STA #3
LDA (SFB).Y :X VALUE
STA #14
STA #12
INY
LDA (SFB).Y :Y VALUE
STA #15
SEC
SBC #42
STA #13
INY
LDA (SFB).Y :SPRITE PTR
STA 2047
INY
LDA (SFB).Y :EXPAND X?
BPL S2L030
LDA #29
ORA #192
STA #29
S2L030 LDA (SFB).Y :EXPAND Y?
AND #64

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BEQ S2L040
LDA V+23
ORA #192
STA V+23
S2L040 LDA (SPB).Y : RIGHT X?
AND #32
BEQ S2L050
LDA V+16
ORA #196
STA V+16
S2L050 INY
LDA (SPB).Y : # READINGS
STA TLIN1+7
STA TLIN1+6
INX
LDA (SPB).Y : DELAY
STA DLSTK1+7
STA DLSTK1+6
STA DLSTK1+2
STA DLSTK1+1
STA COLSTK+7
STA COLSTK+6
STA COLSTK+2
STA COLSTK+1
INX
LDA (SPB).Y : TARGET
STA INSTK+7 : INCREMENT
STA INSTK+6
STA INSTK+1
INX
LDA (SPB).Y : FLIGHT TIME
STA TIMFL1
INX
LDA (SPB).Y : SPOST
STA INSTK+2 : INCREMENT
INX
LDA (SPB).Y : SPOST
STA CODE1 : PAUSE
BEQ S2L060
LDA DLSTK1+2
STA CODE2
LDA #0
STA DLSTK1+2
S2L060 INY
LDA (SPB).Y : SPOST X OFF
CLC
ADC V+14
STA V+4
INX
LDA (SPB).Y : SPOST Y OFF
CLC
ADC V+15
STA V+5
INX
LDA (SPB).Y : CROSS X/2
ASL A
STA V
BCC S2L070
LDA V+16
ORA #1
STA V+16
S2L070 INY
LDA (SPB).Y : CROSS Y
STA V+1
INX
LDA (SPB).Y : WHICHSPRITES
STA V+21
INX
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 SPD
JSR COLORS
LDA #14
STA HOLD1
LDA #0
STA V+27
S2L080 LDA V+14
STA HOLD3
JSR MOVESP
JSR DENPAU
BCS S2L110
LDA V+14
CMP HOLD3
BEQ S2L080
LDA CODE1
BEQ S2L090
DEC CODE1
BNE S2L090
LDA CODE2
STA DLSTK1+2
S2L090 DEC TLIN1+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 DENPAU
BCS S2L110
LDA V+14
CMP HOLD3
BEQ S2L100
DEC TIMFL1
BNE S2L100
S2L100 LDA #0
STA HOLD3
S2L110 RTS
DENPAU LDX #255
LDA 56321
CMP #247
BEQ DNP010
LDX #127
BNE DENSB3
S3L010 LDA 56321
CMP #255
BNE S3L010
TXA
RTS
S3L010 : SUBROUTINE TO CLEAR SCREEN
: AND SET COLORS
DENSB4 DSPL DDES02.DDES03
LDA #12
STA HOLD1
STA HOLD2
LDA #221
STA SPD
JSR COLORS
RTS
S3L010 : 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)
DENSB5 ASL A
ASL A
STA HOLD3
TXA A
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
STA TEMP+3
TXA A
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
STA TEMP+3
CLC
ADC #6
TXA
LDA #0 : 'METERS'
S6L010 LDA TGTDS2.X
STA TEMP.Y
INX
INX
CPI #9
BNE S6L010
LDX HOLD4
LDA #137
STA TEMP.Y
INX
LDA TGTDS5.X
STA TEMP.Y
INX
LDA TGTDS5+1.X
STA TEMP.Y

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INV		BCS	NOV050	52.151.45.192.100.26.2.3.2.0.6.255.132	52.151.46.192.75.25.2.3.0.0.155.255.107
LDA	TGTDSS+2.I	JMP	NOV050	.174.132 :75H4PF	.174.132 :75H4PF
STA	TEMP.Y	LDA	HOLD	.BYTE	DDATZY .BYTE
INV		NOV040		16.161.46.224.100.13.254.5.254.0.246.2	57.154.156.154.244.154.60.160.60.118.15
LDA	TGTDSS+3.I	END	I255	55.42.174.132 :75H8PF	.147.250.165
STA	TEMP.Y	STA	V+16	.BYTE	DDSSH .BYTE 126.133.29.217.'OU MAY
INV		LDA	V.Y	165.145.45.192.50.86.2.1.2.0.2.7.139.1	'.28.'MISS'.154.' MOVING'.140
LDA	TGTDSS+16.X	CHP	I20	57.132 :125H2PF	.BYTE 'TARGETS BY AIMING ATCENT:
STA	TEMP.Y	BCS	NOV060	.BYTE	HASS. BECAUSE'
LDA	TGTDSS+17.X	NOV050	LDA	23.145.45.224.50.43.254.3.254.0.250.7.	.BYTE 'THE '.28.'TARGET
STA	TEMP+1.Y	ORA	OFFSCR	96.167.132 :125H4PF	CONTINUES'
LDA	TGTDSS+18.X	STA	OFFSCR	.BYTE	.BYTE 'MOVING'.154.' AS THE
STA	TEMP+2.Y	NOV060	DEY	61.145.45.192.50.21.2.5.2.0.10.7.87.15	BULLET TRAVELS DOWN RANGE.'
TYA		DEY		7.132 :125H8PF	.BYTE 125.133.212.'O HIT A TARG:
CLC		LSR	HOLD	.BYTE	THAT'
ADC	TGTDSS+19.X	DEX		147.152.44.0.25.128.254.1.254.0.242.24	.BYTE 29.'IS MOVING
TAY		BNE	NOV010	5.49.156.132 :185H3PF	LATERALLY'.140.'ACROSS YOUR FRONT'.14.
LDX	I0 :NPH....'	RTS		.BYTE	.BYTE ' YOU MUST '.28.'AIN
LDA	TGTDSS6.X	HOLDIT	LDA	141.152.44.0.25.64.2.3.2.0.250.245.96.	ABEAD'.154.140.' OF TARGET CENTER.'
STA	TEMP.Y	TAX		156.132 :185H4PF	.BYTE 140.212.'HIS IS CALLED
INV		LDY	I10	.BYTE	'.28.204.197.193.196.154.'.
INX		HOLD01	SEC	33.152.44.32.50.32.254.5.254.0.234.245	.BYTE 122.133.32.212.'BE AMOUNT
CPX	I22	SBC	I1	.95.156.132 :185H8PF	OF LEAD'.140.' NEEDED TO HIT NEAR'
BNE	S6L020	BNE	HOLD01	.BYTE	.BYTE 140.' THE CENTER
STY	LENSTR	DEX		55.161.46.192.100.26.2.3.2.20.45.255.1	CHANGES'.140
ADDR	SA3.TEMP	BNE	HOLD01	34.174.134 :75H4SLDH	.BYTE 'FOR DIFFERENT
JSR	LETHL	DEY		.BYTE	TARGET'.29.'RANGES. SPEEDS. AND'.140.2
LDA	I19 :NONE	BNE	HOLD01	41.170.47.192.100.41.2.1.2.0.6.250.129	.BYTE 'ANGLES OF MOVEMENT.'
JSR	SPFD2	RTS		.178.196 :60H2SL	.BYTE 1.32
LDA	I14 :LT BLUE	BANK1	STA	.BYTE	.BYTE 122.133.32.212.'O SIMPLIF
STA	646	LDA	I1	23.170.47.224.100.21.254.3.254.0.250.2	TARGET'.140
RTS		STA	BANKSB	50.46.178.196 :60H4SL	.BYTE 'LEADS PUT THE TRAIL-ING
NOVESP	LDY	LDA	BANKRT	.BYTE	TIP OF THE FRONT'
LDX	I7	PHA		41.170.47.192.100.10.2.5.2.0.6.250.125	.BYTE 'SIGHT POST AT CENTEROF
LDA	I128	LDA	I2	.178.196 :60H8SL	HASS. '.212.'HIS IS THE '.29
STA	HOLD	STA	BANKRT	.BYTE	.BYTE
NOV010	LDA	JSR	SELSUB	180.161.46.192.50.52.254.1.254.0.248.2	28.211.201.205.199.204.197.32.204.197.
AND	HOLD	PLA		55.43.174.132 :75H2SL	3.196.32
BEQ	NOV060	STA	BANKRT	.BYTE	.BYTE 210.213.204.197.154.'.
LDA	DLSTK1.X :STATIONARY?	RTS		52.161.46.192.100.26.2.3.2.0.6.255.132	.BYTE 1.32
BEQ	NOV060	TGTDSS1	.BYTE '60 '.2.'75	.174.132 :75H4SL	: .BYTE 125.32.133.32.212.'O USE
DEC	CDLSTK.X :MOVE IT?	'2.'125'.3.'185'.3.'1.5'.3.'3 '.1.'6		.BYTE	THE SINGLE'.140
BNE	NOV060	'1		16.161.46.224.100.13.254.5.254.0.248.2	: .BYTE 29.'LEAD RULE.
LDA	HOLD	TGTDSS2	.BYTE ' METERS'.140.32	55.43.174.132 :75H8SL	REMEMBER'.140
AND	OFFSCR	TGTDSS3	.BYTE ' MPH LATERAL SPEED'	.BYTE	: .BYTE 29.'TO PUT THE
BNE	NOV060	TGTDSS4	.BYTE	165.146.45.192.50.86.2.1.2.0.6.7.141.1	'.28.'TRAILING'.140.' TIP'.154
LDA	DLSTK1.X	'1102'. '1102'. '1002'. '1002'		67.132 :125H2SL	: .BYTE ' OF THE FRONT'.140.'SICE
STA	CDLSTK.X	TGTDSS5	.BYTE '1305'. '1505'. '1505'	.BYTE	POST AT '.28.'CENTER'.29
LDA	HOLD :CHECK	TGTDSS6	.BYTE ' MPH'.137.'0707LATERAL	23.146.45.224.50.43.254.3.254.0.250.7.	: .BYTE 'HASS'.154.' OF THE
AND	V+16 :RIGHT X	SPEED'		96.167.132 :125H4SL	TARGET.'
BEQ	NOV020	DDAT	.BYTE	.BYTE	.BYTE 125.133.212.'HE SINGLE LE
LDA	I1	51.152.44.0.100.32.2.5.2.0.244.245.121		51.146.45.192.50.21.2.5.2.0.6.7.85.167	RULEVILL HIT MOST COMBAT'
NOV020	STA	.156.132 :185H8SL		.132 :125H8SL	.BYTE 'TARGETS. '.212.'O HIT
LDA	HOLDX	.BYTE		.BYTE	'.28.'PAST'.154.' LATERAL TARGETS AT'
STA	INSTX.X :ADD	51.152.44.0.100.32.2.5.2.0.254.245.126		147.152.44.0.25.128.254.1.254.0.238.24	.BYTE 140.28.'MORE THAN 100
CLC	HOLDY :INCREMENT	.156.132 :185H8PF		5.47.156.132 :185H2SL	METERS'.154.29.'YOU NEED MORE LEAD.'
ADC	V.Y	.BYTE		.BYTE	.BYTE 104.133.29.32.212.'O
STA	V.Y	41.170.47.192.100.41.2.1.2.0.2.250.127		141.152.44.0.25.64.2.3.2.0.250.245.96.	'.28.'TRACE'.154.'. GET THE'.140
LDA	I0	.178.196 :60H2PF		156.132 :185H4SL	.BYTE ' CORRECT LEAD AND'.140
BIT	HOLDY :INCREMENT(0?	.BYTE		.BYTE	.BYTE 'MOVE YOUR RIFLE WITH'.29
BPL	NOV030	23.170.47.224.100.21.254.3.254.0.250.2		33.152.44.32.50.32.254.5.254.0.239.245	THE TARGH AS YOU'.140
LDA	I255	50.46.178.196 :60H4PF		.98.156.132 :185H8SL	.BYTE 28.'SQUEEZE'.154.' THE
NOV030	ADC	.BYTE		.BYTE	TRIGGER.'
BEQ	NOV040	41.170.47.192.100.10.2.5.2.0.10.250.12		33.152.44.32.50.32.254.5.254.0.234.245	.BYTE 126.133.212.'O
LDA	HOLD	7.178.196 :60H8PF		.95.156.132 :185H8PF	'.28.'TRAP'.154.'. ESTABLISH A'
ORA	V+16	.BYTE		.BYTE	.BYTE ' STEADY POSITION IN'.14.
STA	V+16	180.161.46.192.50.52.254.1.254.0.254.2		52.161.46.192.75.26.2.3.2.0.6.255.107.	.BYTE 29.'FRONT OF THE
LDA	V.Y	55.46.174.132 :75H2PF		174.132 :75H4TK	TARGET'.140.'AND '.28.'PULL'.154.' TE
CHP	I80	.BYTE		.BYTE	.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.'ENONSTRATION'.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 133.'0'.208.'ULL TRIGGER
FOR 12 EXAMPLES'.134.'04'
DDES07 .BYTE 144.137.'0219'.195.'ENTER
OF'.137.'0420NASS'
        .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
N'.137.'1719125 N'.137.'2819185 N'
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 THERE
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
        .LDB SPECINSTR
;SPECINSTR IN MLCHOBK2.TXT
SPECINS JSR UNFLOT
LDA 101
BNE SPC010
ADDR SA3.INST02
LDA #INST03-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 LEHSTR
JSR LETHL
ADDR SA3.INST06
LDA #INST07-INST06
SPC040 STA LEHSTR
JSR LETHL
DSPA INST01.INST02
LDY #0
LDA 56321
CMP #247
BEQ SPC060
DEY
CMP #127
BNE SPC050
SPC050 PPA
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.'ATIONARY'.30
        .BYTE 137.'0108'.133.'
'.133.211.'TEADY'.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'.208.'ULL'.133.153
INST05 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
'.0402'.28
        .BYTE 198.'UNDAMENTALS
OF'.137.'0805'.205.'ARKSHANSHIP'
        .BYTE
133.30.137.'0010'.211.'ATIONARY'
        .BYTE 205.'OVING ('.212.'RACK'
'.205.'OVING ('.212.'RACK'
        .BYTE
183.183.183.183.183.183.183.183.18
32.32
        .BYTE
183.183.183.183.183.183.183.183.18
183.183.183.183
        .BYTE
32.183.183.183.183.183.183.183.183
83.183.183.183
INST06 .BYTE 211.'TEADY'.208.'OS
'.211.'HOOTH'.212.'RACK'
        .BYTE 211.'TEADY
'.208.'OS'.140.193.'INING'
        .BYTE 294.'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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C-23

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INL080 LDA 15880.Y          LDA SFD                      BPL INL210                .BYTE
STA 15872.Y                CLC                          LDA SA3          24.24.24.0.0.0.124.102.96.96.96.0.0.0.
INX                          ADC #64                     CLC                          .5.52.102.52.0.0.24
BNE INL080                 STA SFD                      ADC #40                .BYTE
INL090 LDA 16136.Y          LDA SFE                      STA SA3          0.56.24.24.50.0.0.0.124.102.102.102.10
STA 16128.Y                ADC #1                      LDA SA4          0.0.24.0.56.24.24
INX                          STA SFE                      ADC #0                .BYTE
CPY #56                    DEC GUNDL                     STA SA4          50.0.0.0.124.102.102.102.101.0.0.0.52
BNE INL090                 BNE INL170                   DEX                      2.102.52.5.124
LDY #7                     LDA #10                      BNE INL200            .BYTE
INL100 LDA (SFB).Y          STA GUNDL                     INL220 LDA CTRREG      254.254.254.254.254.254.254.254
CHK #254                   LDA CTRREG                    AND #64                PTTB .BYTE
BEQ INL110                 EOR #24                      BEQ INL280            0.102.50.255.50.102.0.0.0.132.60.255.6
STA 16184.Y                STA CTRREG                    DEC SCRC1 ;DELAY FSB 102.0.0.0.102
DEY                          LDA CTRREG                    BNE INL280            .BYTE
BPL INL100                 AND #16                      DEC SCRC2            50.255.60.102.0.0.0.0.0.0.0.0.124
LDA SFB                    BEQ INL180                     BNE INL240            2.102.124.96
CLC                          JSR SPRUPD                   LDA CTRREG            .BYTE
ADC #8                      DEC GUNDL ;GUN DELAY          EOR #55              96.96.0.0.0.102.102.102.102.52.0.0.56
STA SFB                    LDA INL180                     STA CTRREG            24.24.24.50
LDA SFC                     LDA CTRREG                    ADDR SFB.FH16         .BYTE
ADC #0                      EOR #48                      LDY #40              0.0.56.24.24.24.24.50.0.0.0.0.0.0.0.0
STA SFC                     STA CTRREG                    STY SCRC1            0.24.125.24.24
INX                          LDA #5                      DEY                      .BYTE
JMP INL130                 STA GUNDL                     LDA #177             24.14.0.0.0.124.102.96.96.96.0.0.24.0
LDA #0                     LDA #13952                    INL230 STA 1984.Y      24.24.50.0.0
STA 16184.Y                STA SFD                      DEY                      .BYTE
DEY                          LDA #13960                    BPL INL230            0.52.102.102.62.6.124.0.0.52.102.102.6
BPL INL110                 STA SC3                      JMP INL260            6.124.0.0.50
DEC SCRC1                  LDA #13960                    INL240 LDA SCRC2      .BYTE
BNE INL130                 STA SFE                      AND #1                102.125.96.50.0.0.0.124.102.96.96.96.6
LDA #3                     STA SC4                      BEQ INL250            .0.0.0.0.0.0
STA SCRC2                  LDA CTRREG                    LDA CTRREG            .BYTE
EOR CTRREG                 AND #32                      EOR #66              0.0.24.126.24.24.24.14.0.0.0.50.102.1
STA CTRREG                 BEQ INL220                    STA CTRREG            102.50.0.0.0
LDY #39                    LDY #240 ;KICK RIGHT   JMP INL280            .BYTE
LDA #33                    JSR SPRUPD                    INL250 LDA #50        0.0.0.0.0.0.96.96.124.102.102.124.0
INL120 STA 1984.Y          INL190 LDA (SFB).Y      INL260 STA SCRC1      0.60.102.126
DEY                          STA (SC3).Y                    LDY #247             .BYTE
BPL INL120                 DEY                      LDA #0                96.60.0.0.0.62.102.102.62.5.124.0.24
INL130 LDA CTRREG          AND #2                      INL270 STA 15912.Y    5.24.24.60.0
LDA #2                      BNE INL190                    DEY                      .BYTE
BEQ INL150                 LDA SC3                      BNE INL270            0.0.124.102.102.102.102.0.0.0.0.0.0
LDY #232 ;BLINK            CLC                          JMP SEA31             0.0.102.60.255
INL140 LDA PTTB-1.Y        STA #64                      INL280 JMP INC        .BYTE
STA 15919.Y                STA SC3                      INC Y                 60.102.0.0.0.102.60.255.60.102.0.0.0
DEY                          LDA SC4                      INC Y                 .60.255.60.102.0.0.0
BNE INL140                 ADC #1                      RTS                      .END
LDA #180                   STA SC4                      FN15 .BYTE           FIN =*
STA SCRC1                  LDA SFD                      126.96.96.120.96.96.96.0.0.0.60.102.10
LDA CTRREG                 CLC                          2.102.60.0.0.0.124.102
EOR #66                    ADC #64                      .BYTE
STA CTRREG                 STA SFD                      96.96.96.0.0.0.0.0.0.0.0.99.119.127.
INL150 LDA CTRREG          LDA SFE                      107.99.99.99.0.0.0.50
AND #8                     ADC #1                      .BYTE
BEQ INL170                 STA SFE                      102.102.102.60.0.0.0.102.102.60.24
LDY #0 ;KICK LEFT         DEC GUNDL                     .0.0.24.0.56.24.24.60
JSR SPRUPD                 BNE INL220                    .BYTE
LDA (SC3).Y                LDA CTRREG                    0.0.0.124.102.102.102.102.0.0.0.62.102
STA (SFD).Y                AND #223                     .102.62.6.124.0.0.0
INX                          STA CTRREG                    .BYTE
CPY #240                   LDA #0                      0.0.0.0.0.126.24.24.24.24.24.24.0.0.0
BNE INL160                 STA V+21 ;SPRITE CTRRG 60.5.52.102.52.0.0.0
LDA SC3                    ADDR SA3.1334                .BYTE
CLC                          LDY #9                      124.102.96.96.96.0.0.0.62.102.102.62.5
ADC #64                    STA SC3                      124.0.0.60.102.126
STA SC3                    LDA #177                     .BYTE
LDA SC4                    INL210 STA (SA3).Y          96.60.0.0.24.125.24.24.24.14.0.0.0.0
ADC #1                      DEY                      0.0.0.0.125.24.24.24
STA SC4

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*=57344
.OPT NOC
: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
.NAC ADDR
LDA #C2
STA ?1
LDA #D2
STA ?1+1
.NND
.NAC DINC
INC ?1
BNE ?2
INC ?1+1
?2
.NND
JMP LETTERS
JMP LETHL
LETTERS LDA ?1
STA SFD
LDA ?2
STA SFE
LDY #0
LDA (SFD).Y ;LENGTH OF
BNE LETO10 ; STRING
RTS
LETO10 STA LENSTR
INY
LDA (SFD).Y ;ADDRESS OF
STA SA3 ; STRING NOW
INY ; IN SA3 AND
LDA (SFD).Y ; SA4
STA SA4 ; ---
LETHL LDY #0
STY FLAGS ;CLEAR FLAGS
LDA 53272 ;WHICH SET?
AND #2
BEQ LETO20 ;SET 1
LDA #4 ;SET 2
STA FLAGS
LETO20 LDA 1 ;SWITCH IN
AND #251 ; CHARACTER
STA 1 ; ROM
LETO30 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 LETO40
INC HOLDA
LETO40 ASL A ;LINE*32
BCC LETO50
INC HOLDA
LETO50 ASL A ;LINE*64
BCC LETO60
INC SFE
LETO60 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 LETO70
INC SFE
CLC
LETO70 ADC SFD ;L*320+C*8
STA SFD
LDA SFE ;+8192
ADC #32
STA SFE
LETO80 LDA (SA3).Y
STY HOLDY
CHP #142 ;SET 1
BNE LETO90
LDA FLAGS
AND #251
STA FLAGS
JMP LET690
LETO90 CHP #14 ;SET 2
BNE LET100
LDA FLAGS
ORA #4
STA FLAGS
JMP LET690
LETO100 CHP #133 ;F1-ENLARGE
BNE LET110 ;OR
LDA FLAGS ;NORMAL
EOR #1
STA FLAGS
JMP LET690
LETO110 CHP #137 ;F2-CURSOR
BNE LET120
JSR BYTE2
BCC LET130
JMP LET700
LETO120 JMP #40
LETO130 CHP #40
BCS LET140
STA 211 ;X
JSR BYTE2
BCS LET120
CHP #25
BCS LET150
STA 214
LDY #4
STY 210
ASL A
ASL A
ASL A
STA HOLDA
STA 209
STA HOLDA
MUL5 LDA HOLDA
CLC
ADC 209
STA 209
LDA 210
ADC #0
STA 210
DEY
BNE MUL5
JMP LET590
LETO150 JMP #134 ;F3-SPCINSTR
LETO160 CHP #134
BEQ LET170
JMP LET310
LETO170 JSR BYTE2
BCC LET180
JMP LET700
LETO180 LDA 1 ;VIC CHIP
ORA #4 ;BACK IN POR
STA 1 ;A SECOND
LDA HOLDA
AND #1
BEQ LET190
LDA 53265 ;BLANK SCR
AND #239
STA 53265 ;SCREEN
JMP LET200
LETO190 LDA 53265 ;UNBLANK
ORA #16 ;SCREEN
STA 53265
LETO200 LDA HOLDA
AND #2
BEQ LET210
LDA 53265 ;SET
AND #223 ;TEXT
STA 53265 ;MODE
LDA 53272
AND #247
STA 53272
JMP LET220
LETO210 LDA 53265 ;SET
ORA #32 ;BIT MAP
STA 53265 ;MODE
LDA 53272
ORA #8
STA 53272
LETO220 STA 53272
HOLDA
AND #4
BEQ LET230
LDA 53272 ;SET UPPER
AND #253 ;CASE
STA 53272
LDA FLAGS
AND #251
STA FLAGS
LETO230 LDA HOLDA
AND #8
BEQ LET240
LDA 53272 ;SET LOWER
ORA #2 ;CASE
STA 53272
LDA FLAGS
ORA #4
STA FLAGS
LETO240 LDA 1 ;VIC CHIP
AND #251 ;OUT AGAIN
STA 1
LDA HOLDA
AND #16 ;CLEAR PART
; OF SCREEN?
BEQ LET290
JSR BYTE2
BCS LET300
LDA HOLDA ;START LINE
JSR BYTE2 ;LAST LINE
BCS LET300
TXL
TAY
LDA #8192
STA SFD
LDA #8192
STA SFE
CPY #0
BEQ LET260
CPY #25
BCS LET290
LETO250 LDA SFD
CLC
ADC #320
STA SFD
LDA SFE
ADC #320
STA SFE
DEY
BNE LET250
LETO260 LDY #0
LDA #0
LETO270 STA (SFD).Y
INY
BNE LET270
INC SFE
LETO280 STA (SFD).Y
INY
CPY #64
BCC LET280
LDA SFD
CLC
ADC #64
STA SFD
LDA SFE
ADC #0
STA SFE
INY
CPY #25
BCS LET290
CPY HOLDA
BCC LET260
BEQ LET260
JMP LET690
LETO290 JMP LET700
LETO300 JMP LET690
LETO310 CHP #18 ;REVERSE
BNE LET320 ;ON
LDA FLAGS
ORA #2
STA FLAGS
JMP LET690
LETO320 CHP #146 ;REVERSE
BNE LET330 ;OFF
LDA FLAGS
AND #253
STA FLAGS
JMP LET690
LETO330 CHP #138 ;F4-ARROWS
BNE LET360
JSR BYTE2
BCC LET350
JMP LET700
LETO340 JMP LET700
LETO350 SEC
SBC #1
CHP #8

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BC      LET340
ASL     A
ASL     A
ASL     A
CLC
ADC     <<ARROWS
STA     SFB
LDA     >>ARROWS
ADC     #0
STA     SFC
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     $3280          ;BORDER
LDA     1              ;SWITCH OUT
AND     #251           ; VIC CHIP
STA     1              ; AGAIN
JMP     LET690
LET400  CMP     #147      ;CLEAR SCR#
BNE     LET430
LDA     #8192
STA     SPD
LDA     #8192
STA     SFE
LDY     #0
LET410  LDA     #0
STA     (SPD).Y
DINC     SPD
LDA     SPD
CMP     #16192
BNE     LET410
LDA     SFE
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     TLINE
JMP     LET690
LET450  CMP     #145      ;UP ARROW
BNE     LET460
LDA     FLAGS
AND     #1
BIG1    STA     SFF
LDA     214
BEQ     SKIP
DEC     214
LDA     209
SEC
SBC     #40
STA     209
LDA     210
SBC     #0
STA     210
DEC     SFF
BEQ     BIG1
JMP     LET690
LET460  CMP     #157      ;LEFT ARROW
BNE     LET480
LDA     FLAGS
AND     #1
STA     SFF
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
DEC     211
DEC     SFF
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             ;NONE
BNE     LET530
JMP     LET420
LET530  LDY     #0
LET540  LDA     SPECIAL.X
BEQ     LET560
CMP     (SA3).Y
BEQ     LET550
INX
JMP     LET540
LET550  INX
LDA     SPECIAL.X
STA     #45
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     SFB
LDA     #0
STA     SFC
LDA     #3             ;+8
ASL     SFB
ROL     SFC
DEX
BNE     LET600
LDA     SFC
CLC
ADC     #500
STA     SFC
LDA     FLAGS          ;WHICH SET?
AND     #4
BEQ     LET610          ;SET 1
LDA     SFC             ;SET 2
CLC
ADC     #8
STA     SFC
LDA     209
CLC
ADC     211
STA     SC3
LDA     210
ADC     #0
STA     SC4
LDX     #8
LDA     #646
ASL     A
ASL     A
ASL     A
ASL     A
STA     COLOR
LET620  LDY     #0
LDA     (SFB).Y         ;CEARS
STA     HOLDA
LDA     FLAGS
BEQ     LET640
AND     #1
BEQ     LET630
JSR     DOUBLE
JMP     LET690
LET630  LDA     FLAGS
AND     #2
BEQ     LET640
LDA     HOLDA
BEQ     #255
STA     HOLDA
LDA     HOLDA+1
EOR     #255
STA     HOLDA+1
LET640  LDA     HOLDA
STA     (SPD).Y         ;BIT MAP
LDA     (SC3).Y         ;COLOR
AND     #15
ORA     COLOR
STA     (SC3).Y
LDA     FLAGS
AND     #1
BEQ     LET560
LDA     214
CMP     #24
BEQ     LET560
INX
LDA     HOLDA
STA     (SPD).Y
LDA     214
CMP     #15
AND     COLOR
ORA     #15
STA     (SC3).Y
LDY     #40
STA     (SC3).Y
INX
STA     (SC3).Y
LDY     #8
LDA     HOLDA+1
STA     (SPD).Y
INX
STA     (SPD).Y
DINC     SFB
DINC     SPD
DINC     SPD
DEX
BNE     LET650
INC     211
DEC     SFE
LDA     SFB
SEC
SBC     #64
STA     SFB
LDA     SFE
SBC     #0
STA     SFE
JMP     LET680
LET650  CPX     #4
BNE     LET670
LDA     SPD
CLC
ADC     #56
STA     SPD
LDA     SFE
AND     #1
STA     SFE
JMP     LET620
LET660  DINC     SPD          ;BIT MAP
DINC     SFB              ;CHARS
DEX
BEQ     LET680
LET670  JMP     LET620
LET680  JSR     TLINE
LET690  LDY     HOLDY
INX
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  #14
      CMP  #24
      BEQ  LET730
      INC  #14
      LDA  #209
      CLC
      ADC  #40
      STA  #209
      LPA  #210
      ADC  #0
      STA  #210
      DEC  SFF
      BEQ  LET720
LET730 RTS
ADJSCR LDY  #(<1024
      STY  SFD
      LDY  #(>1024
      STY  SFE
ADJ01  LEW  #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
      LDY  #0
      STY  HOLDA
      STY  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
SPECIAL .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
0.32.96.255.255.96.32.0.0.24.30.22.22.
6.3.3
      .OPT  LIST
      .END

```

```

10 POKE 808,237:V=53248:POKE 53281,0:POKE V+21,0:POKE V+38,0:POKE 893,0
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$(10,5):DSS(2,4):CRS(5):CR$(3):LV$(11)
40 DEF FNH(X)=INT(X/256):DEF FNL(X)=X-INT(X/256)*256
50 DEF FNW(X)=PEEK(X)+PEEK(X+1)*256:DEF FNZ(X)=INT((ABS(X)>0)*X)+.5)
60 EN=3200:DS=3203:RT=3206:BAWG=3212:WH=3215:SC=3221:SV=3224
70 CO=3227:HM=3230:NA=3233:TK=3239:GP=3242
80 FOR I=0 TO 10:LV$(I)=I:NEXT I:LV$(11)=-1
90 IF PEEK(56321)=127 THEN SYS DS:GOSUB 3350:GOTO 140
100 IF PEEK(56321)=247 THEN POKE 53280,0:SYS DS:GOTO 140
110 GET AS:IF AS="" THEN 90
120 BS=RIGHT$(BS,1)+AS:Z=-(BS="lp"):IF Z=0 THEN 90
130 SYS DS:POKE 53265,27:POKE 53272,23:PRINT "CLR":POKE 49161,2:SYS 49179
140 AS="[F3]09[F6]00[F5]00[F7]00[CLR][LBLU][F2]0500[F1]The REDMACS Moving[F2]0102Target Program[LBLU] will"
150 AS=AS+"[F2]0004give instruction and[F2]0806practice on:[F8]"
160 AS=AS+"[GRN][F1].[F1]How to lead moving targets[F8][F1].[F1]A single lead rule[F8]"
170 AS=AS+"[F1].[F1]Tracking targets[F8][F1].[F1]Trapping targets[F8]"
180 AS=AS+"[F1].[F1]Engaging multiple[F8] targets[GRN][F3]00":GOSUB 3000:AS="
190 FOR I=1 TO 10:FOR J=0 TO 6:READ D1$(I,J):NEXT J,I
200 FOR I=0 TO 2:FOR J=0 TO 4:READ DSS(I,J):NEXT J,I
210 FOR I=1 TO 5:READ CRS(I):NEXT I:GOSUB 3170
212 AS="[F3]09[F1][CLR][LBLU][F2]0101This program may be[F2]0003fired with (Gun scope[LBLU][F2]0505"
213 AS=AS+"or [GRN]iron sights.[RED][F2]0708Are you using[F2]0610the [GRN]telescope?[F3]08"
214 GOSUB 3000:SB=15:GOSUB 5440:I=(PEEK(2774)=255):IF Z=I THEN 220
215 FOR I=2752 TO 2815:Z=PEEK(I+384):POKE I+384,PEEK(I):POKE I,2:NEXT I
220 AS="[F3]09[F5]00[F7]00[CLR][GRN][F2]0702[F1]MOVING TARGET[F2]0404TRAINING PROGRAM[LBLU][F8][F1][F8]. Zeroing[F8]"
230 AS=AS+". Instruction and Demonstration[F8][F8][F2]0199[GRN]Levels:[LBLU][F8]:GOSUB3000:AS="[GRN]"
240 POKE 253,1:POKE 254,10:POKE 823,0:SB=3:GOSUB 5430:GOSUB 3170
250 POKE 929,0:LS=0:CL=0:GOSUB 1000:LS=1:CL=LV$(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 AS="[F3]09[F6]05[CLR][F5]05[F7]05[BLK][F2]0502[F1]CONGRATULATIONS[F8][F8] You are finished[F8] with this "
300 AS=AS+"program.[F8][F8] Call instructor.[F1][F2]0823Pull trigger to continue[F3]00"
310 GOSUB 3000:LS=0:POKE 198,0:RESTORE:GOTO 90
1000 H$(0)=0:S1=32768:S2=3:TA=5:WE=0:POKE 940,160:POKE 942,100
1010 AS="[F3]09[F6]00[F5]13[F7]00[CLR][BLK][F1][F2]0701First 3 shots[F2]0503establish zero."
1020 AS=AS+"[F2]0105Aim center of mass.[F2]0517White dot shows[F2]1319center.":GOSUB3000
1030 POKE 880,3:SB=24:GOSUB 5430:FOR Z=12196 TO 12199:POKE Z,15:NEXT Z
1040 POKE 1524,1:AS="[F2]0723(Pull trigger to continue)[F3]00":GOSUB 3000
1050 IF PEEK(56321)=247 THEN 1080
1060 GET AS:IF AS="" THEN 1050
1070 TN=-1
1080 GOSUB 3200:IF WI=0 THEN 1110
1090 AS="[F3]09[F5]00[F7]00[F1][GRN][F2]0904There is no[F2]0607wind while you[F2]0410are establishing"
1100 AS=AS+"[F2]0913shot group.[GRN][F1]:GOSUB 3160
1110 BC=0:POKE 899,42:POKE 883,60:POKE 838,0:FOR Z=834 TO 837:POKE Z,0:NEXT Z
1120 OX=0:OY=0:POKE 838,0:POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180
1130 POKE 823,0:POKE 824,0:POKE 821,17:POKE 822,0:SB=9:GOSUB5430:GOSUB 3200:S=0
1140 IF (S<>0) AND (S<>3) THEN 1180
1150 FOR Z=0 TO 3:SD(Z,36)=0:NEXT Z:PS=INT(S/3)
1160 AS="[F3]09[CLR][F6]00[F5]00[F1][WHT][F2]1209ASSUME A[F2]1112SUPPORTED[F2]1215POSITION[F1]"
1170 GOSUB 3160:GOSUB 3010
1180 POKE 876,0:POKE 877,204:X=((INT(RND(1)*75))+2)+71:IF TN THEN X=165
1190 POKE 52225,X:GOSUB 3200:POKE 933,0
1200 Z=-20352:SB=0:GOSUB 5440:POKE V+21,0:IF Z=128 THEN 1180
1210 N=FNW(907):N=N+(N>128)*(N-128):GOSUB 3020
1220 IF S>2 THEN 1250
1230 X1=(X+11)-FNW(847):Y1=165-FNW(849):OX=OX+X1:OY=OY+Y1:SD(1,S)=Z
1240 IF (X1>-73) OR (X1<-148) OR (Y1>-17) OR (Y1<-47) THEN BC=1
1250 SD(0,36)=SD(0,36)+SD(0,S):SD(2,36)=SD(2,36)+SD(2,S)
1260 GOSUB 3200:IF S<2 THEN 1410
1270 BC=0:IF BC=0 THEN 1330
1280 AS="[F3]09[CLR][RED][F5]00[F7]00[F1][F2]0204Invalid shot group[F2]1107try again":IF H$(0)=0 THEN 1300
1290 AS=AS+"[F2]0310or check lightpen[F2]0513mount alignment[F2]0816(see manual)"
1300 AS=AS+"[F1][GRN]":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(1,2)
1370 SD(3,36)=SD(3,36)+SD(3,2):NEXT Z:Z=1:GOSUB 4740:IF CRS=CRS(5) THEN 1410
1380 AS="F3|05|CLR|F5|00|F7|00|F1|WHT|shot group"+CRS+"SWLC|LBU|F2|0304Would you like toF2|1107try for a"
1390 AS=AS+"F2|08|0better 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 AS="F3|09|CLR|F5|00|F7|00|F1|GRN|F2|0203Use the non-firing"
1470 AS=AS+"F2|0406hand as a pivot.F2|0209Smoothly track theF2|0412target by moving"
1480 AS=AS+"F2|0415your upper body.F1|LGRN|":GOSUB 3170:GOTO 1500
1490 Z=1:SB=3:GOSUB 5470:SB=6:Z=2:GOSUB 5470
1500 AS="F3|09|CLR|F1|GRN|F2|100110 targetsF2|0105Feedback after eachF2|1507shot.F2|1111Standard:"
1510 IF CL=2 THEN 1540
1520 AS=AS+"F2|0413Smooth track andF2|0615proper lead onF2|06173 of 5 targets"
1530 GOTO 1550
1540 AS=AS+"F2|0313Apply proper trapF2|0715lead for 3 ofF2|11175 targets"
1550 AS=AS+"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:NV=-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:AS="L="+STR$(CL)+"T="+STR$(S+1)+"R="+STR$(RP)
1640 GOSUB 5230:AD=FNW(876):PO=6:TP=PEEK(AD+9)*2
1650 IF PEEK(AD+8)>127 THEN TP=-TP:PO=-PO
1660 Y=PEEK(AD+2):TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:POKE 12+,:S+8,RP
1670 GOSUB 4020:POKE 933,128
1680 Z=IR:SB=0:GOSUB 5440:POKE 878,0:IF Z=128 THEN POKE V+21,0:GOTO 2060
1690 IF PEEK(900)=255 THEN SYS WH:GOTO 1810
1700 AS="miss":IF PEEK(900)<128 THEN AS="hit"
1710 AS="F2|0123|F1|BLK|"+AS:AS:GOSUB 3000
1720 GOSUB 4040:IF Z=128 THEN
1730 IF (CR$(0)>3) AND (ME=CL) THEN H=H+1
1740 IF (CR$(1)>3) AND (ME=CL) THEN H=H+16
1750 IF ME=CL THEN 1820
1760 BS="tracked":IF ME=2 THEN BS="trapped"
1770 AS="F3|09|CLR|F5|00|F7|00|F1|F2|0204|GRN|On the last targetF2|0007you {RED|"+BS+"|GRN|. Try toF2|0210{RED|"
1780 BS="IC|RT|trap":IF ME=2 THEN BS="track"
1790 AS=AS+BS+"|GRN| every targetF2|0013for the rest of this"
1800 AS=AS+"F2|0216practice exercise.F1|":GOSUB 3160
1810 POKE 838,S:Z=FNW(876)-17:POKE 876,FNL(Z):POKE 877,FNH(Z):GOTO 1620
1820 S=S+1:POKE 838,S:IF S/5<INT(S/5) THEN 1620
1830 N=5:Z=1+H*(1)*8:Z4=1:GOSUB 4500
1840 AS="F3|09|F6|00|F5|00|F7|00|CLR|LBU|SWLC|F1|F2|1303Summary"+GRN|F2|0306Standard: Good or"
1850 IF CL=2 THEN 1890
1860 AS=AS+"F2|0108Excellent Track andF2|0610lead on 3 of 5"
1870 AS=AS+"F2|1212targets.F2|0915Your Score:F2|0017Smooth Track:"
1880 AS=AS+STR$(H AND 15)+" of 5F2|0819Lead:"+STR$(INT(H/16))+" of 5F1|LGRN|":GOTO 1910
1890 AS=AS+"F2|0308Excellent lead onF2|05103 of 5 targets.F2|0913Your Score:F2|1215"
1900 AS=AS+STR$(INT(H/16))+" of 5F1|LGRN|"
1910 GOSUB 3170
1920 IF ((H AND 15)>2) OR (CL=2) AND (INT(H/16)>2) THEN 2050
1930 GOSUB 3090:AS="F3|09|F6|00|F5|00|F7|00|CLR|RED|SWLC|F1|F2|0407You did not meetF2|0710the standard."
1940 AS=AS+"F2|0213Prepare to refire.F1|LGRN|":GOSUB 3170:BC=2
1950 IR=-31616:RP=RP+1:AS="F3|09|F6|00|F5|00|F7|00|CLR|GRN|SWLC|F1|"
1960 IF CL<>1 THEN 2010
1970 AS=AS+"F2|0102For a smooth track,F2|0204move your rifle at"
1980 AS=AS+"F2|0306the same speed asF2|0208the target, trying"
1990 AS=AS+"F2|0010to keep the trailingF2|0412tip of the front"
2000 AS=AS+"F2|0014sight post at targetF2|0516center of mass.F1|":GOTO 2040
2010 AS=AS+"F2|0202To {RED|trap|GRN|, aim aheadF2|0105and wait for target"
2020 AS=AS+"F2|0008center mass to reachF2|0111the nearest edge of"

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2030 AS=AS+"|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:AS="|F3|09|CLR||F5|00|F7|00|F1||F8||GRN|You may either track"
2090 AS=AS+"or trap targets, but|C|RT|in harder exercises|F8|many shooters find a"
2100 AS=AS+"|C|RT|mixture of both|F8||C|RT|methods works best.|F1||LGRN|":GOSUB 3170
2110 AS="|F3|09|CLR||F5|00|F7|00|F1||LBU||F2|100118 targets|F2|0105Feedback after each|F2|1607shot"
2120 AS=AS+"|F2|1111Standard:|F2|0213Hit 2 of 3 targets|F2|0715at each speed"
2130 AS=AS+"|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:AS="L="+STR$(CL)+"T="+STR$(S+1)+"R="+STR$(RP)
2240 GOSUB 5230:AD=FNW(876)
2250 PO=6:TF=PEEK(AD+9)*2:IF TA>36 THEN PO=TF:REM 185M 6 MPH
2260 IF PEEK(AD+8)>127 THEN TF=-TF:PO=-PO
2270 Y=PEEK(AD+2):TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:POKE I2+7+S*8,RP
2280 GOSUB 4020:POKE 933,128
2290 Z=IR:SB=0:GOSUB 5440:POKE 878,0
2295 IF Z=128 THEN POKE V+21,0:GOSUB 4845:GOTO 2440
2300 IF PEEK(900)=255 THEN SYS WH:GOTO 2370
2310 AS="miss":IF PEEK(900)<128 THEN AS="hit"
2320 AS="|F2|0123|F1||BLK|"+CHR$(142)+AS: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 N=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:AS="|F3|09|CLR||F5|00|F7|00|F1||LBU||F2|040336 timed targets|F2|1007Replay for"
2460 AS=AS+"|F2|0909misses only|F2|1113Standard:|F2|0115Hit 8/12 stationary"
2470 AS=AS+"|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,21-6
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:AS="|F6|00|CLR||F5|00|F7|00|LBU||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 AS="|F3|09|CLR||F5|00|F7|00|F1||LBU||F2|100340 targets|F2|110740 rounds"
2650 AS=AS+"|F2|1111Standard:|F2|0013Hit 10/14 stationary|F2|0415Hit 20/26 moving|F1|"
2660 GOTO 2690
2670 AS="|F3|09|CLR||F5|00|F7|00|F1||LBU||F2|100330 targets|F2|0907"+STR$(RN)+" rounds"
2680 AS=AS+"|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:GOSUB 5370
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:AS="L="+RIGHTS(STRS(CL),2)+"]T="]R="+STRS(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 AS="{F6|00|CLR|F5|00|F7|00|LBLU|SWLC|F2|1201Summary: Level"+STRS(CL):GOSUB 5000
2820 IF A=0 THEN GOSUB 5210:RP=RP+1:GOTO 2700
2830 LS=LS+(A AND 1):RETURN
3000 AS=AS: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 CRS=CRS(Z):CR%(J)=Z:IF (CL<>0) OR (NU=0) THEN RETURN
3140 BS=STRS(39-LEN(STRS(SD(J,S)))):BS=RIGHTS(BS,2)
3150 CRS="{F1|F2|2499"+MIDS(CRS,6,10)+"{F8|F2|"+BS+"99"+STRS(SD(J,S))+"{F8|F1|":RETURN
3160 AS=AS+"{RED|F2|0723(Pull trigger for targets)|F3|00":GOSUB 3000:GOTO 3180
3170 AS=AS+"{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):AS="{F3|09|F6|00|CLR|F5|00|F7|00|F1|LBLU|F2|1505LEVEL|F2|1709":BS=STRS(CL):Z=CL+(CL=10)*10
3230 IF CL=10 THEN BS="{C|RT|10"
3240 AS=AS+BS+"{GRN|F2|0014":GOSUB 3000:POKE 823,CL:SB=3:GOSUB 5430
3250 IF CL<3 THEN AS="":GOTO 3300
3260 IF CL<7 THEN 3290
3270 AS="{F2|0117Moving & stationary targets presented"
3280 AS=AS+"{F2|0418at random from 50 to 300 meters":GOTO 3300
3290 AS="{F2|0617Slow, medium & fast targets|F2|1118from left & right"
3300 AS=AS+"{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:AS="{F6|00|F5|00|F7|00|CLR|GRN|Level order:"
3360 AS=AS+"{GRY1|F2|3299AR19112|GRN|F8|":FOR Z=1 TO 10:AS=AS+CHRS(30+(Z=LS)*2)
3370 BS="":IF LV%(Z)<>-1 THEN BS=STRS(LV%(Z))
3380 AS=AS+BS:NEXT Z
3390 REM AS=AS+"{F8|GRN|Wind speed: ":IF (WI AND 16) THEN AS=AS+" Variable":GOTO 3420
3400 REM AS=AS+STRS((WI AND 7)*5)+" MPH ":IF ((WI AND 7)=0) THEN 3420
3410 REM BS=STRS(INT(WI/32)+1):BS="0"+RIGHTS(BS,1):AS=AS+"{F4|"+BS
3420 AS=AS+"{BLK|F8|F8|":GOSUB 3000:POKE 253,1:POKE 254,10:POKE 823,0:SB=3:GOSUB 5430
3430 AS="{F8|LBLU|D: View Moving Target Demo|F8|L: Change Level Order|F8|"
3440 AS=AS+"N: New firer|F8|":REM W: Set Wind Speed|F8|"
3450 AS=AS+CHRS(158+(CH=3)*4):AS=AS+"C: Set Crosshair status for Levels 7-10|LBLU|"
3460 AS=AS+"LP: Light Pen Mount Adjustment|F8|F8|"
3470 IF NU THEN AS=AS+"{GRN|Pretest diagnostic scores are numeric)|F8|"
3480 BS="number or letter":IF LS=0 THEN BS="letter"
3490 AS=AS+"{F2|0023{RED|Select "+BS+" & press RETURN|LBLU|F8|F3|00":GOSUB 3000
3500 AS="":GOSUB 5270:Z=INT(VAL(AS))
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 AS="{F2|0010The level you choose must be in the|F8|current sequence.|F8|F8|"
3560 AS=AS+"Press RETURN to continue":GOSUB 5270:GOTO 3350

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3570 IF AS="D" THEN GOSUB 1420:RETURN
3580 IF AS="NU" THEN NU=NOT(NU):GOTO 3350
3590 IF AS="N" THEN LS=0:RETURN
3600 IF AS(">")="L" THEN 3760
3610 I=1:AS="{F3|09|CLR|GRN|Choose level order:{F8|F8|Type a number (1-10) for the desired{F8|
3620 AS=AS+"level, in the desired order of{F8|presentation. Type 0 and press{F8|
3630 AS=AS+"RETURN when done.{F8|F8|{F3|00|LBLU|
3640 FOR Z=1 TO 10:ZS=STR$(Z):IF Z<10 THEN ZS=" "+ZS
3650 AS=AS+ZS+"": "{F8|":NEXT Z:GOSUB 3000
3660 ZS=STR$(I+6):ZS=RIGHT$(ZS,LEN(ZS)-1):IF I<4 THEN ZS="0"+CHR$(I+54)
3670 AS="{BLUE|{F2|04"+ZS:GOSUB 5270:IF (Z<0) OR (Z>10) THEN 3660
3680 AS="{LBLU|{F2|04"+ZS+" {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$(I)=Z:I=I+1:IF I<11 THEN 3660
3730 AS="{GRN|{F2|00|Is everything correct (type Y or N and{F8|press RETURN!"
3740 GOSUB 5270:IF AS(">")="Y" THEN 3610
3750 LS=-(LS>0):GOTO 3350
3760 GOTO 3880:IF AS(">")="W" THEN 3880
3770 AS="{F3|09|CLR|Wind Effects:{F8|F8|Type a number (1-3) for wind speed:{F8|F8|
3780 AS=AS+" 1: 0 MPH{F8|F8| 2: 10 MPH{F8|F8| 3: 20 MPH{F8|F8|{F3|00":GOSUB 3000
3790 AS="":GOSUB 5270:IF (Z<1) OR (Z>3) THEN 3790
3800 WI=(Z-1)*2:IF WI=6 THEN WI=16:GOTO 3350
3810 IF WI=0 THEN 3350
3820 AS="{F3|09|CLR|Wind Effects:{F8|F8|Type a number (1-8) for wind direction:{F8|F8|
3830 AS=AS+" 1: {F4|01 (No value){F8|F8| 2: {F4|02 (Half value){F8|F8| 3: {F4|03 (Full value){F8|F8|
3840 AS=AS+" 4: {F4|04 (Half value){F8|F8| 5: {F4|05 (No value){F8|F8| 6: {F4|06 (Half value){F8|F8|
3850 AS=AS+" 7: {F4|07 (Full value){F8|F8| 8: {F4|08 (Half value){F8|F8|{F3|00":GOSUB 3000
3860 AS="":GOSUB 5270:IF (Z<1) OR (Z>8) THEN 3860
3870 WI=WI+((Z-1)*32):GOTO 3350
3880 IF AS(">")="C" THEN 3990
3890 AS="{F3|09|CLR|Set Crosshair status for Levels 7-10:{F8|F8|
3900 AS=AS+CHR$(158+(CH(">"))*4)+" 1: Crosshair appears after each shot.{F8|LBLU|
3910 AS=AS+CHR$(158+(CH(">"))*4)+" 2: Crosshair appears only when target{F8|
3920 AS=AS+" is missed.{F8|LBLU|
3930 AS=AS+CHR$(158+(CH(">"))*4)+" 3: No Crosshair on Levels 7-10.{F8|F8|:GOSUB 3000
3940 AS=CHR$(158+(CH(">"))*4)+" 4: Level 7: Crosshair after each shot."
3950 AS=AS+" Level 8: Crosshair for misses only."
3960 AS=AS+" Levels 9 & 10: No crosshair.{F8|F8|LBLU|{F3|00":GOSUB 3000
3970 AS="Type the number (1-4) of your choice":GOSUB 5270
3975 IF (Z<1) OR (Z>4) THEN 3970
3980 CH=Z-1:GOTO 3350
3990 Z=-(AS="LP"):IF Z>0 THEN 130
4000 GOTO 3500
4010 REM SETUP FOR REPLAY: CALL ONCE BEFORE ANY TARGETS PRESENTED
4020 POKE 2041,43:POKE 2042,43:POKE V+23,6:POKE V+29,6
4030 POKE V+40,1:POKE V+41,0:RETURN
4040 N=FNW(907):N=N+(N>128)*(N-128):Z=(N-30)*256+(N-1):IF N<30 THEN Z=N
4050 ME=0:IF TN>6 THEN POKE 785,FNL(TK):POKE 786,FNH(TK):ME=USR(Z)
4060 POKE 939,ME:IF PEEK(900)=255 THEN ME=-ME
4070 GOSUB 3020:HI=PEEK(900)<128
4080 J=0:GOSUB 3110:AS="{F3|05|CLR|{F5|00{F1|"+DSS(ME,0)+CRS:ZS=MIDS(CRS,6,1)
4090 J=1:GOSUB 3110:AS=AS+DSS(ME,1):Z1$=CRS
4100 CRS="{F2|3099"+ZS+"check":IF CR$(0)>2 THEN CRS="{F2|3699"+ZS+"ok"
4110 BS=DSS(ME,2)+CRS
4120 J=2:GOSUB 3110:BS=BS+DSS(ME,3)+CRS:GOSUB 3200
4130 J=3:GOSUB 3110:TG=TG+Z:IF HI=0 THEN CRS="{F2|3299|RED|miss":TG=TG-2
4140 IF (CR$(0)>3)AND(CR$(1)>3)AND(HI=0) THEN Z1$=CRS(3):CR$(1)=J
4150 CRS="{F3|160809{F1|{F2|0008"+DSS(ME,4)+CRS:AS=AS+Z1$+BS
4160 IF MB(">")>2 THEN 4200
4170 Z=6+(TA)=36)*(6-ABS(TP)):IF TP<0 THEN Z=-Z
4180 Z=PEEK(903)*2+Z-23-TP:POKE V+4,ABS(FNL(Z))
4190 POKE V+16,((PEEK(V+16)AND 251)OR ((Z>255)*-4)):GOTO 4210
4200 PO=PO+D1$(TN,0)-23:PO=PO-(PO<0)*65536:POKE 839,FNL(PO):POKE 840,FNH(PO)
4210 POKE 841,Y+D1$(TN,1):POKE V+5,Y+D1$(TN,1)-25-TJ
4220 IF TN<7 THEN Z=8:GOTO 4250
4230 BS="tracked.":IF ME=2 THEN BS="trapped."
4240 AS=AS+"{F3|170809|WHT|{F2|0908you "+BS:Z=10

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4250 GOSUB 3000:WS=128-(TN=1)*64-(TN=7)*64
4250 X=PEEK(V)+(PEEK(V+15) 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:F=-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="F81"+STRS(Z)
4310 AS=AS+" mph lateral speed":Z=-TN*7*60-(TN=8)*75-(TN=9)*125-(TN=10)*185
4320 AS="|BLK|F210023"+STRS(Z)+" meters"+AS:GOSUB 3000
4330 POKE V+21,WS OR 6:AS="|BLK|F212823|F1|RVON|replay|RVOF|F3100":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|F212823pull trigger|F212824to 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|F31160809|WHT|F210908you "+BS:GOSUB 3000:GOTO 4330
4490 GOSUB 3200:POKE V+21,0:RETURN
4500 AS="|F3109|F6100|CLR|F5113|F7100|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 24:POKE 251,FNL(Z):POKE 252,FNH(Z):POKE 880,Z1:POKE 881,N
4530 Z=USR(0):Z1=Z1+Z2:Z2=Z2+PEEK(824):Z3=Z3+PEEK(823):NEXT Z5:IF Z2=0 THEN RETURN
4540 AS="|F211302Your"+STRS(Z2)+" shot(s)"
4550 IF Z3>0 THEN AS=AS+"|F211003"+STRS(Z3)+" shot(s) missing"
4560 Z2=-TN*7*60-(TN=8)*75-(TN=9)*125-(TN=10)*185
4570 AS=AS+"|F211404"+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/LP|"+BS
4574 AS=AS+"|F211605"+BS:BS="|F211205|F4107":IF (TA AND 1)=0 THEN BS="|F212605|F4103"
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=11+S*8:POKE AD+7,1:POKE 900,255:POKE AD,255:GOSUB 4020
4670 AS="L="+STRS(CL)+"T="+STRS(I)+"R="+STRS(RP):GOSUB 5230:POKE 12+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="|F3105|F6100|F5100|F7100|CLR|F1|"+DSS(0,0)+CRS
4760 ZS=MIDS(CRS,6,1):J=1:GOSUB 3110:AS=AS+DSS(0,1)+"|F213499---"
4770 CRS="|F213099"+ZS+"check":IF CR*(0)>2 THEN CRS="|F213699"+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|F210921"+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="|F3109|CLR|F6100|F5100|F7100|LBLU|F210801Summary:"+STRS(Z)+"-meter targets|F81|F81"

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4880 AS=AS+"[GRN][F2]0599Number of targets tracked --"+STR$(D2%(4.01))+"[F8][F8]":GOSUB 3000
4890 AS="":ME=1:Z=0:GOSUB 4940:ZS=MIDS(CRS,6,1):Z=1:GOSUB 4940:GOSUB 4970
4900 Z=3:GOSUB 4940:Z=4:GOSUB 4940:GOSUB 3000
4910 AS="[F8][F8][GRN][SWLC][F2]0599Number of targets trapped --"+STR$(D2%(4.11))+"[F8][F8]":GOSUB 3000
4920 AS="":ME=2:Z=0:GOSUB 4940:ZS=MIDS(CRS,6,1):Z=1:GOSUB 4940:GOSUB 4970
4930 Z=3:GOSUB 4940:Z=4:GOSUB 4940:AS=AS+"[LGRN][SWLC]":GOSUB 3170:RETURN
4940 AS=AS+CHRS(142)+"[F2]0899"+DSS(ME,Z):Z1=D2%(4,ME-1):Z=Z+(Z>2)
4945 IF Z1=0 THEN AS=AS+"[F2]2999[WHT]---[F8]":RETURN
4950 Z1=INT(D2%(Z,ME-1)/Z1+.5):CRS=CRS(Z1):BS=RIGHTS(STR$(38-LEN(CRS)),2)
4960 AS=AS+"[F2]"+BS+"99"+RIGHTS(CRS,LEN(CRS)-5)+"[F8]":D2%(Z,ME-1)=Z1:RETURN
4970 AS=AS+"[F2]0899"+DSS(ME,Z):IF D2%(4,ME-1)=0 THEN AS=AS+"[F2]2999[WHT]---[F8]":RETURN
4980 CRS="[F2]2799"+ZS+"check":IF D2%(0,ME-1)>2 THEN CRS="[F2]3099"+ZS+"ok"
4990 AS=AS+CRS+"[F8]":RETURN
5000 AS=AS+"[F2]0203[LBLU]Range [BRN]Exposures [GRN]Hits [RED]Misses[YELO] No Fires[F8]:"
5010 AS=AS+"[LBLU][F2]1499(Stationary)[F8]":GOSUB 3000:HI=0
5020 FOR I=0 TO 5:HI(I)=0:NEXT I:SYS HM:FOR I=1 TO 10:Z=I:Z1=I*50
5030 IF I>6 THEN Z=(I-6)*8:Z1=-(I-7)*60-(I-8)*75-(I-9)*125-(I-10)*185
5040 Z2=PEEK(16192+Z):Z3=PEEK(16256+Z):Z4=PEEK(16320+Z):AS="[LBLU][F2]0299"+STR$(Z1)
5050 AS=AS+"[F2]1199[BRN]"+STR$(D1%(I,CL-5)):H%(HI)=H%(HI)+Z2:H%(HI+2)=H%(HI+2)+Z3
5060 Z4=D1%(I,CL-5)-Z4:Z4=Z4+(Z4<0)*24:H%(HI+4)=H%(HI+4)+Z4
5070 AS=AS+"[GRN][F2]1899"+STR$(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:AS="[SWLC][LBLU][F2]1699(Moving)[F8]":GOSUB 3000
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 AS="[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 AS="[SWLC][F2]1599[GRN]QUALIFIED":A=A+1
5180 AS=AS+"[F8][F8][LBLU]Stationary Target Standard:Hit"+STR$(Z1)+" of "+STR$(H%(7))+":[F8]"
5190 AS=AS+"Moving Target Standard:Hit"+STR$(Z2)+" of "+STR$(H%(8))+":[LGRN]"
5200 GOSUB 3170:RETURN
5210 AS="[F3]09[F6]00[F5]00[F7]00[CLR][RED][SWLC][F1][F2]0407You did not meet[F2]0710the standard."
5220 AS=AS+"[F2]0213Prepare to refire.[F1]":GOSUB 3160:BC=2:RETURN
5230 BS="":IF ((WI AND 7)*5)=0 THEN 5260
5240 BS=STR$(WI AND 224/32)+1)
5250 BS="[F2]3400W="+STR$(WI AND 7)*5)+"[F4]0"+RIGHTS(BS,1)
5260 AS="[HOME][BLK][RVON][SWLC]+AS+BS+[F6]0"+CHRS(BC+48)+"[BLUE]":GOSUB 3000:RETURN
5270 AS=AS+"? / [C/LP][C/LP][C/LP][C/LP]":GOSUB 3000:BS=""
5280 GET AS:IF AS="" THEN 5280
5290 IF (AS=CHRS(13)) OR (LEN(BS)>2) THEN PRINT"(C/UP)":AS=BS:Z=INT(VAL(AS)):RETURN
5300 IF AS<>CHRS(20) THEN 5330
5310 IF BS<>"" THEN BS=LEFT$(BS,LEN(BS)-1):AS="[C/LP][C/LP][C/LP][C/LP]":GOSUB 3000
5320 GOTO 5280
5330 AS=CHRS(ASC(AS) AND 127):IF (AS<"0") OR (AS>"z") THEN 5280
5340 IF (AS>"a") AND (AS<"z") THEN AS=CHRS(ASC(AS) OR 128)
5350 BS=BS+AS:AS=AS+"[C/LP]":GOSUB 3000:GOTO 5280
5360 FOR Z=11 TO 11+343 STEP 8:POKE 2,255:NEXT Z:RETURN
5370 FOR Z=12 TO 12+343 STEP 8:POKE 2,255:NEXT Z:RETURN
5380 AS="[F3]09[F6]00[CLR][F5]00[F7]00":GOSUB 3000
5390 POKE 823,12:POKE 824,12:POKE 253,221:SYS CO
5400 AS=BS+"[HOME][LBLU]":GOSUB 3000:Z=USR(Z1+Z2*256):RETURN
5410 AS="[SWLC][F2]0299[GRY]21TOTAL[F2]1199[BRN]"+STR$(Z1)+"[F2]1899[GRN]"+STR$(HI)+"[F2]2499[RED]"+STR$(MI)
5420 AS=AS+"[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"

```

ARM BASIC Program (December 1991)

Page 3

6070 DATA "F212299|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 AS 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 DSS array.
 Lines 6060-6070: The verbal scores read into the CRS 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 occurrence, 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 introductory 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 dl% 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.

MACS Basic and Assembler Program Notes

15 November 1991

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, 0
load "ARM.Z", 8
π 16384, 24575, 0, 230, 6
π 24576, 32767, 8192, 230, 6
π 32768, 40959, 16384, 230, 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, 0

;
; Now load the BASIC program.
;
load "ARM.AL",8

;
; PROMOS burn commands follow. (assuming 12.5 volt chips)
;
π 16384, 24575, 0, 230, 6
π 24576, 32767, 8192, 230, 6
π 32768, 40959, 16384, 230, 6
```

CHIP BANK MEMORY LOCATIONS:

(0)	0	start of BANK 0
(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 0 (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 5430 Call a specific assembly language routine via MLCHØBK1.
The SB variable denotes the desired routine:

SB	ASSEMBLY LANGUAGE ROUTINE
--	-----
0	ctrmov
3	descrip
6	random
9	dodata
12	rekeep
15	yesno
18	getxy
21	rndize
24	exptar
27	criter
30	yesno2