E-2978

AD 627219

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND
TECHNICAL INFORMATION

Hardcopy	Microfiche		
$ 1.00	$ 0.50	16	as

ARCHIVE COPY

Code 1

PROCESSING COPY

HumRRO

DDC
FEB 7 1966
TISIA E

Human Research Unit Nr 3, CONARC

Fort Benning, Georgia

Under the Technical Supervision of

The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
operating under contract with
THE DEPARTMENT OF THE ARMY

ACCESSION for
CFSTI WHITE SECTION
DDC BUFF SECTION
UNANNOUNCED
JUSTIFICATION
BY
DISTRIBUTION/AVAILABILITY CODES
DIST. AVAIL. and/or SPECIAL

Human Research Unit Nr 3, CONARC, is established under the command of the Commanding General, Continental Army Command. The Human Resources Research Office, the George Washington University, operating under contract with the Department of the Army, employs the Director of Research and other civilian staff members who are assigned to the Unit with the approval of Headquarters, Continental Army Command. The Human Resources Research Office provides the Unit with technical supervision in the planning and analysis of the research projects.

Conclusions stated herein do not necessarily represent the official opinion or policy of Headquarters, Continental Army Command, or the Department of the Army.

Report on One Phase of Task MOONLIGHT:

Experimental Development of Improved
Methodology for Training the Infantry
Soldier in Night Fighting

CLEARED
FOR OPEN PUBLICATION
28 JAN 1957
DIRECTORATE OF SECURITY REVIEW (OASD-PA)
DEPARTMENT OF DEFENSE

STAFF MEMORANDUM
on Sub-Task MOONLIGHT XI:

AN INVESTIGATION OF INDIVIDUAL NIGHT RIFLE FIRING UNDER ILLUMINATION RANGING FROM NO MOON THROUGH FULL MOON

By

John Sivy and John E. Taylor

August 1956

Approved:

Francis E. Jones
FRANCIS E. JONES
Director of Research
Human Research Unit Nr 3, CONARC
Fort Benning, Georgia

Edgar S. Sanders
EDGAR S. SANDERS
Lt Col, Inf, Chief
Human Research Unit Nr 3, CONARC
Fort Benning, Georgia

Research under the Technical Supervision of
The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
operating under contract with
THE DEPARTMENT OF THE ARMY

Copy 98

BRIEF

Objective: To examine the data collected during the implementation of Training Circular 23-1 by the Weapons Department of The Infantry School, Fort Benning, Georgia, to determine the applicability of the prescribed individual night rifle firing procedure under low levels of illumination ranging from no moon through full moon.

Conclusions: A general confirmation of the individual night firing procedures prescribed by TC 23-1 is indicated. An interaction was observed between firing technique (pointing or aiming) and low levels of natural illumination. At some point between half and full moon the pointing technique becomes less effective than the aiming technique.

Recommendation: In view of the findings of this report, it is recommended that HRU Nr 3 coordinate with TIS to gather additional individual night firing data at low levels of natural illumination above half-moon in order to accomplish the following objectives:

a. Determine the level of illumination at which the aiming technique becomes more effective than the pointing technique.

b. Establish a criterion or rule of thumb whereby riflemen can determine which method to employ depending upon the level of illumination present.

CONTENTS

Page

Brief ii

A. The Research Problem 1

1. Objective 1

2. Background 1

B. Method 3

1. Implementation of TC 23-1 3

a. Subjects 4

b. Identification of Aimed and Pointing Scores 4

2. Collection and Treatment of Data 5

3. Findings and Discussion 6

4. Conclusions 8

5. Recommendations 8

Figures

1. Individual Night Firing. Per Cent Hits by Illumination for 50 Yard Range 9

2. Individual Night Firing. Per Cent Hits by Illumination for 25 Yard Range 10

3. Individual Night Firing. Per Cent Hits by Illumination for 75 Yard Range 10

Table

1. Number of Classes and Number of Firers by Range for Each Level of Illumination 11

Acknowledgments 12

AN INVESTIGATION OF INDIVIDUAL NIGHT RIFLE FIRING UNDER ILLUMINATION RANGING FROM NO MOON THROUGH FULL MOON

A. The Research Problem

1. Objective. To examine the data collected during the implementation of Training Circular 23-1[1] by the Weapons Department of The Infantry School, Fort Benning, Georgia, in an attempt to determine the applicability of the prescribed individual night rifle firing procedure under low levels of natural illumination ranging from no moon through full moon.

2. Background. The findings of Sub-Tasks MOONLIGHT I[2] and MOONLIGHT II[3] were used by the Weapons Department of TIS for preparation of TC 23-1. The implementation of TC 23-1 has been carried out by TIS and the firing records for all classes have been retained as standardization data.

1/ Department of the Army Training Circular 23-1, 24 February 1955, "Technique of Rifle Fire at Night Without Artificial Illumination."

2/ HumRRO Technical Report to be published.

3/ Jones, Francis E., and Odom, William F., CWO. "MOONLIGHT II: Training the Infantry Soldier to Fire the M1 Rifle at Night," Technical Report 15, Human Research Unit Nr 3, CONARC, Fort Benning, Georgia, 1954.

The Training Circular prescribes that the "pointing technique"[1] of MOONLIGHT II be employed for firing the M1 rifle under low levels of natural illumination ranging from no moon starless to half-moon. The Training Circular further states, "The methods described (i.e., the pointing technique) should not be used and the training should not be conducted in high levels of illumination, such as artificial illumination or when more than half of the moon's surface is visible." The data collected by TIS in their standardization of the program provide a basis for verifying the effectiveness of the two techniques, aiming and pointing, under illumination ranging from no moon through full moon.[2]

Data from the original MOONLIGHT II research had indicated that somewhere in the moonlight zone the two techniques were equally effective. MOONLIGHT II was neither undertaken to determine this exact point, nor whether aiming would be superior to pointing at higher levels of moonlight.

A first step toward this end involved a pilot study conducted by HRU Nr 3. This pilot study was undertaken to determine

---

[1] The firer in the prone position places the butt of the rifle to his shoulder, holds his head high, keeps both eyes open, and points the rifle at the target. He then deliberately depresses the muzzle to compensate for a known tendency to fire high.

[2] The schedule for training classes required that some be instructed under illumination greater than half-moon.

if there is an interaction between firing technique (pointing or aiming) and level of illumination.

The pilot study was conducted using four subjects who were proficient in the use of both the pointing and aiming techniques. The subjects fired a total of 64 rounds each (half ball, half tracer) at "E" type silhouettes under three illuminations: no moon, half-moon and full moon. Under each level of illumination the order of firing was broken into four blocks of 16 rounds each. From block to block the subjects alternated between the pointing and aiming techniques. Order of firing was controlled by having two subjects fire with the pointing technique first and the other two with the aiming technique first. The scores for the four subjects indicated that, as outlined in TC 23-1, the pointing technique was superior to aiming under no moon; they were equally effective under half-moon; but aiming was superior to the pointing technique under full moon. These results were consistent for ball and tracer ammunition.

The night firing data gathered by TIS provided an opportunity to check a larger number of subjects for this observed interaction between firing technique and level of illumination.

B. Method

1. Implementation of TC 23-1. The publication of TC 23-1 formally initiated its implementation. During the implementation at TIS, scores were obtained for all personnel who took the prescribed

individual night firing training designated as TIS problems 1220N (Orientation Firing) and 1226N (Application Firing) between April 1955 and May 1956.

The Training Circular points out that individual night firing classes should be conducted under levels of illumination from no moon through one-half moon. However, this was not always administratively possible during the implementation. In a few instances a backlog of classes made it necessary to conduct the course under a higher level of illumination. Thus, scores for illuminations up to and including full moon were available.

a. Subjects. The personnel trained consisted of the following officer classes: Associate Advanced, Associate Company, Allied Associate Advanced,[1] Allied Advanced, Officer Candidate and Basic Infantry Officer; and of the following enlisted classes: Advanced Non-Commissioned Officers, Rifle Marksmanship Instructor, and Special Purpose classes such as National Guard.

The aimed and pointing scores were obtained from the same students on successive nights. Therefore, at each level of illumination the same subjects contributed both scores.

Data from classes which had received previous night firing instruction were not included.

b. Identification of Aimed and Pointing Scores. Three phases of instruction are prescribed by the training circular:

---

[1] Foreign personnel received instruction in their native tongue.

(1) Orientation Firing, (2) Corrective Firing and Night Vision Training, and (3) Application Firing. Since the students knew only the existing (aiming) technique at the time of Orientation Firing, it is logical that the results obtained were based on that technique during Orientation Firing. Therefore, in interpreting the data from TIS in terms of the relative effectiveness of the aiming and pointing techniques, it has been assumed that Orientation Firing scores reflect the effectiveness of the aimed technique. Application Firing scores have been assumed to reflect the effectiveness of the newly learned pointing technique.

2. Collection and Treatment of Data. The records for all classes instructed in Individual Night Firing during a fourteen month period were transcribed from the files of the Technique of Rifle Fire Committee, Weapons Department, TIS. The information collected included: firing scores, level of illumination, number of students, kind of class, and descriptive statements pertaining to conditions which arose during the conduct of firing (e.g., fog, ground haze, overcast sky, etc.). Data affected by such unforeseeable conditions were judged to be of questionable value and were not utilized in the analysis.

For some classes conducted during the fourteen month period, discrepancies were found between the illumination designated on the score sheet and that recorded in the Air Almanac. In addition, some classes experienced a change from no moon to full moon during the course of firing (starting a class under no moon and

having the moon rise during the instruction). In some classes, orientation firing and application firing did not occur under substantially the same illumination. In instances such as these, the data were deleted.

The remaining data were posted and plotted in curves to show per cent hits for four levels of illumination. The plotting of curves was carried out for four levels of illumination rather than five since the data for three-quarter moon fell within one of the questionable categories outlined above.

The curves were examined to determine the relative effectiveness of the pointing and aiming techniques under the various illuminations.

3. Findings and Discussion. Curves showing the relative effectiveness of the aimed and pointing techniques under levels of illumination ranging from starlight through full moon are presented in Figures 1, 2, and 3.

The curves plotted for the 50 yard range (Fig. 1) indicate that the pointing technique produced a higher percentage of hits than did the aiming technique up to an unknown and, to date, undetermined point between half-moon and full moon. At full moon the aiming technique produced a higher percentage of hits than did pointing.

The curves plotted for the 25 yard range (Fig. 2) indicate that through one-quarter moon the pointing technique was superior, but that the extent of this superiority seemed to decrease as

illumination increased.

The curves plotted for the 75 yard range (Fig. 3) indicate, as do the curves of Fig. 1, that the pointing technique was superior to aiming up to some point between half-moon and full moon, and that at full moon the aiming technique was superior to pointing.

Though these data were not treated statistically,[1] consideration of the large sample involved constitutes sufficient evidence to conclude there is an interaction between firing technique and level of illumination.

The most probable explanation of this phenomenon is that at higher levels of illumination the firer is able to capitalize on the light reflected from the barrel of the rifle and see his sights clearly enough to align them on the target. Thus, he can fire accurately by aiming. Under the same high levels of illumination, the pointing technique utilizes little or none of the light reflected from the rifle because the firer's head is held high. Thus, at high levels of illumination the firer will be more accurate if he takes advantage of the opportunity to use his sights than if he ignores his sights and continues to use the coarser method

---

[1] While the number of subjects contributing to each per cent is large, the data are available in terms of class scores only. The number of identifiable scores available for statistical analysis ranges between seven and two. The number of classes, total number of subjects participating, and other information are presented in Table 1.

of the pointing technique.

4. Conclusions

a. A general confirmation of the individual night firing procedures prescribed by TC 23-1 is indicated.

b. An interaction effect exists between firing technique (pointing or aiming) and low levels of natural illumination. At some point between half and full moon the pointing technique becomes less effective than the aiming technique.

5. Recommendations. In view of the findings of this report, it is recommended that HRU Nr 3 coordinate with TIS to gather additional individual night firing data at low levels of natural illumination above half-moon in order to accomplish the following objectives:

a. To determine the level of illumination at which the aiming technique becomes more effective than the pointing technique.

b. To establish an individual criterion or rule of thumb whereby riflemen can determine which method to employ depending upon the level of illumination present.

It is proposed that the new collection of data include photometric readings for more exact information on illumination.

Figure 1

MOONLIGHT III - TIS DATA

Individual Night Firing - Weapons Department

Per Cent Hits by Illumination

50 Yard Range

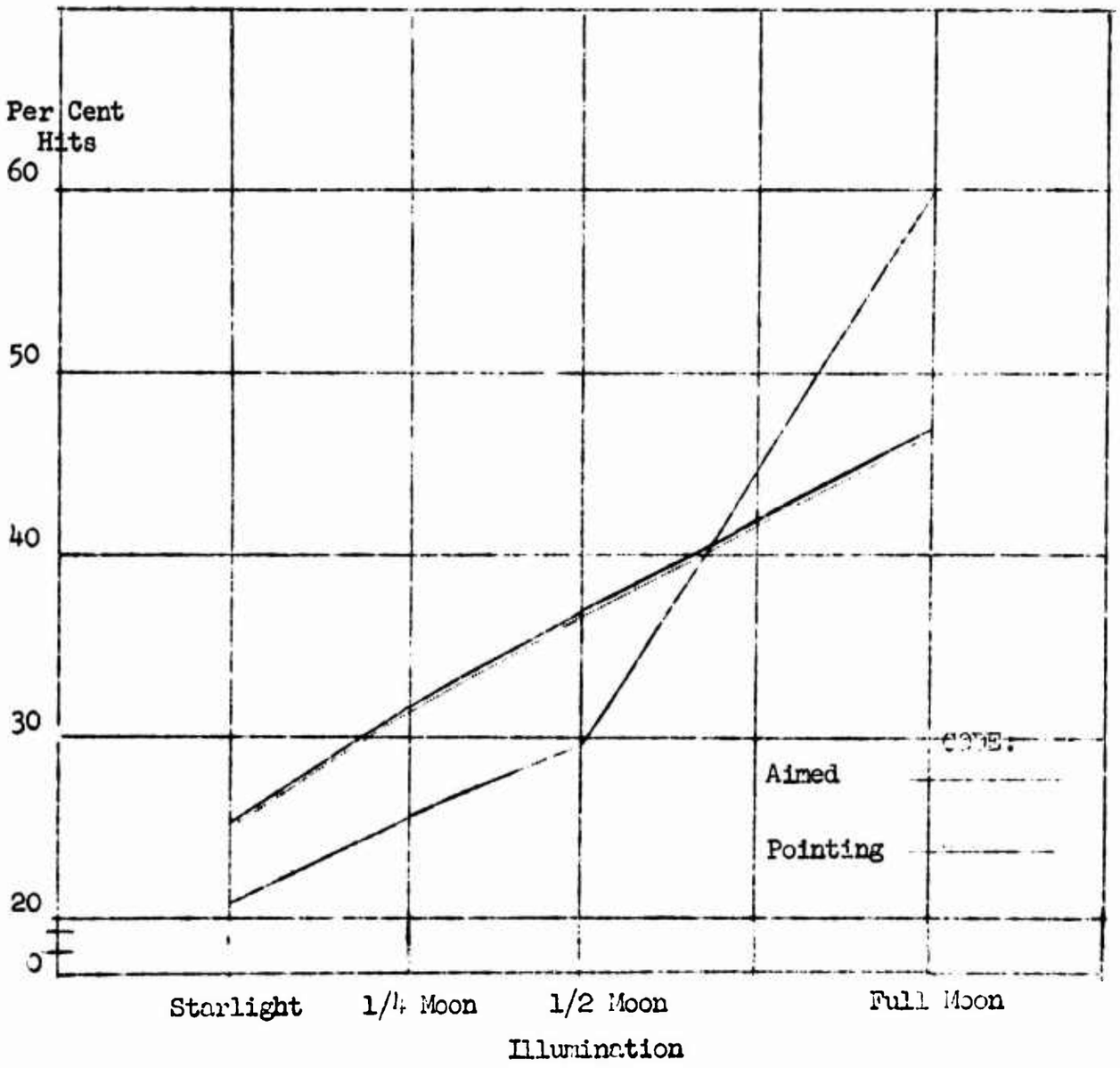

Figure 2

MOONLIGHT III - TIS DATA
Individual Firing - Weapons Department
Per Cent Hits by Illumination
25 Yard Range

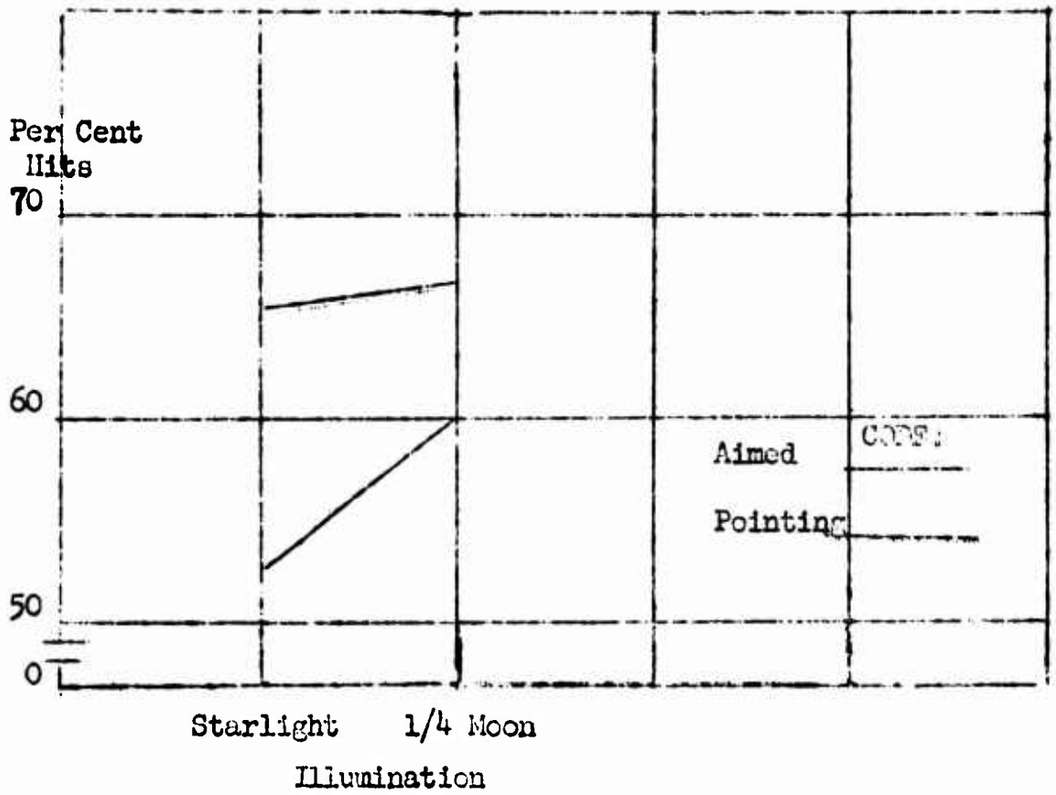

Figure 3

MOONLIGHT III - TIS DATA
Individual Firing - Weapons Department
Per Cent Hits by Illumination
75 Yard Range

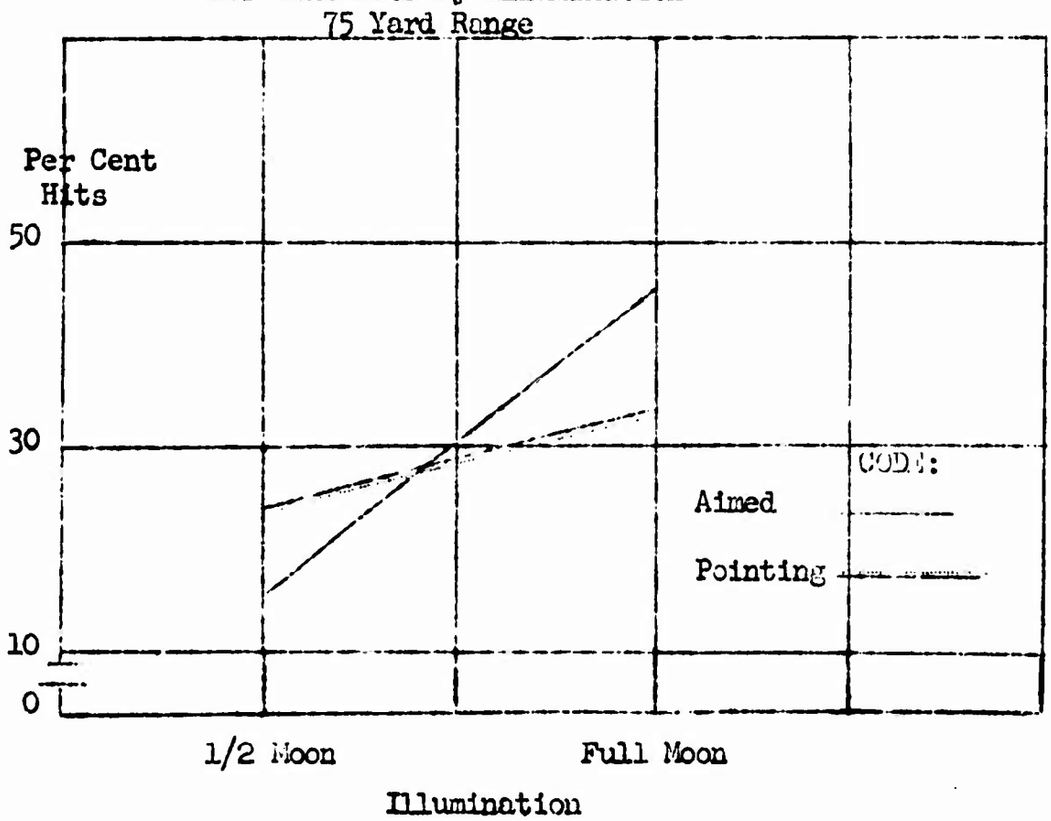

Table 1

Number of Classes and Number of Firers by Range for Each Level of Illumination

	Illumination			
	Starlight	1/4 Moon	1/2 Moon	Full Moon
25 Yard Range[a]				
Number of Classes	7	2	-	-
Total Number of Firers				
Aimed	863	284	-	-
Pointing	861	287	-	-
50 Yard Range[b]				
Number of Classes	7	2	4	2
Total Number of Firers				
Aimed	863	284	600	384
Pointing	861	287	598	392
75 Yard Range[c]				
Number of Classes	-	-	4	2
Total Number of Firers				
Aimed	-	-	600	384
Pointing	-	-	598	392

[a] The 25 yard range is prescribed for firing under moonless conditions.

[b] The 50 yard range is prescribed for firing under both moonlight and moonless conditions.

[c] The 75 yard range is prescribed for firing under moonlight conditions.

ACKNOWLEDGMENTS

Appreciation is extended to the Technique of Rifle Fire Committee of the Weapons Department, The Infantry School for the use of their data.