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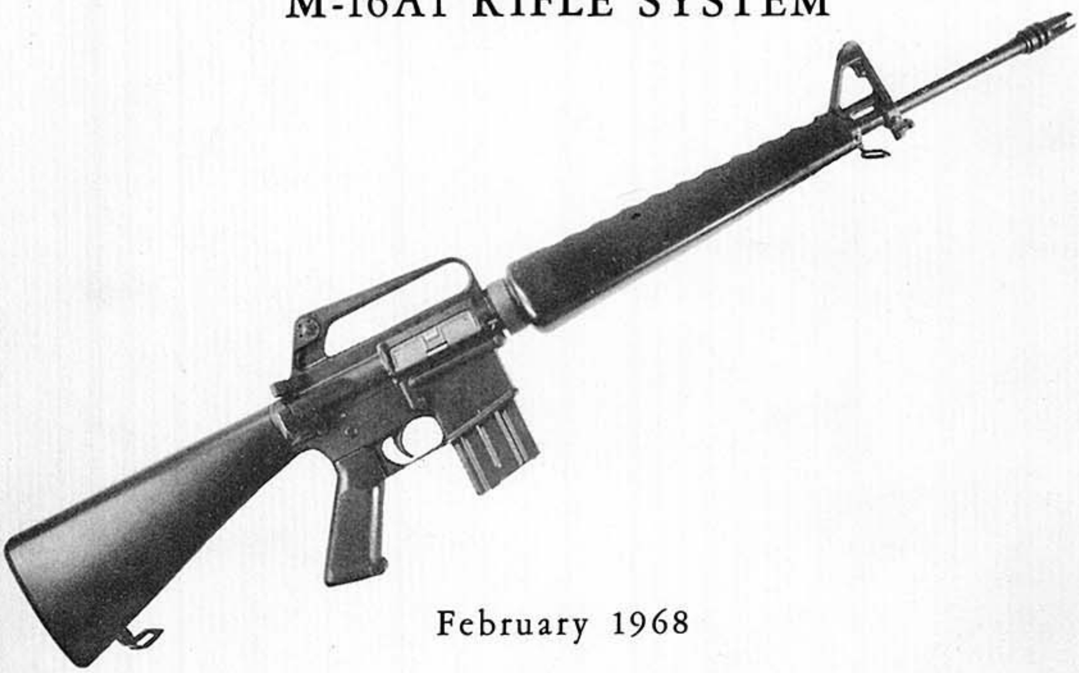
13-JB

WSEG REPORT 124

OPERATIONAL RELIABILITY TEST
M-16A1 RIFLE SYSTEM



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automatic firing mode and 2.41 per thousand in the semiautomatic mode. The corresponding rates for the M-14 rifle system were 1.67 per thousand in automatic and 1.11 per thousand in the semiautomatic mode. When firing ball propellant ammunition, the M-16 rifles exhibited a malfunction rate of 2.11 per thousand in the automatic mode and 1.79 per thousand in the semiautomatic mode. The corresponding rates when firing IMR propellant were 6.45 in automatic and 3.04 in the semiautomatic mode. Section III, Subsection G.

- During a pre-test rehearsal, new M-16 rifles firing IMR propellant exhibited unusually high malfunction rates, at least 18.7 per thousand rounds, during their first 240 rounds. After this time, this "new rifle" effect had practically disappeared. Neither the M-16 rifles firing ball propellant, nor the M-14 rifles, showed the effect. Section III, Subsection H.
- Over a third of all malfunctions occurred during the first two rounds in rifle magazines. This was many more than could be attributed to chance. Section III, Subsection J.
- For M-16 rifles firing IMR propellant ammunition, the most prevalent type of malfunction observed during the test was failure to feed (i.e., failure of the top round to be fed from the magazine) which accounted for 62.7 percent of the total malfunctions. It is believed that the high incidence of these failures results from insufficient rearward travel of the bolt, which in turn, might stem from a marginal impulse imparted to the bolt by the IMR propellant. Section III, Subsection I.
- For M-16 rifles firing ball propellant ammunition, the most prevalent type of malfunction observed during the test was failure to eject (i.e., failure to eject a spent cartridge from the rifle upper receiver) which accounted for 26.3 percent of all failures. It is believed that this high incidence of failures to eject is caused by the spent cartridge striking the edge of the ejection port and rebounding back into the upper receiver, where interference with the returning bolt may ensue. It further appears that this process could be initiated by excessive rearward velocity of the bolt at ejection, which, in turn, could result from a more than adequate gas-port impulse imparted to the bolt by the ball propellant. Section III, Subsection I. ?? Don't buy this
- The chrome-plated chamber modification of the R_1 M-16 rifle appeared to be effective in reducing the incidence of failures to extract in the test. Section III, Subsection I.

- Using ball propellant ammunition, the M-16 rifle with the chrome-plated chamber exhibited more failure-to-eject malfunctions than its unchromed counterpart. A possible explanation for this result might be that the reduced extraction friction of the chrome-chambered rifle may, in combination with an already ample gas-port impulse from the ball propellant, result in an even higher rearward velocity of the bolt at ejection. Section III, Subsection I.

Appendix A

METHODOLOGY USED IN THE EVALUATION AND COMPARISON OF MALFUNCTION RATES

APPENDIX A

The purpose of this enclosure is to describe the methodology used in the statistical interpretation of the data. In particular descriptions of the techniques used in the evaluation of the malfunction rates and associated confidence intervals of the various rifle systems are presented along with descriptions of the procedures used in the comparisons between these systems. Sample calculations are also given to illustrate these methods.

I. EVALUATION OF MALFUNCTION RATES

Malfunction rates, and associated confidence intervals, have been given in the main body of this report. Such rates are mean rates, averaged over specified conditions, and over all 24 firing periods of the M-16 Rifle Test. For example, M-16 rifles firing ball propellant had 1064 malfunctions of all types during the firing of 544,271 ball propellant rounds. Simple division furnishes the average rate, 1.95 malfunctions per thousand rounds.

The malfunctions in the separate firing periods are denoted by m_i; $i=1,2,\cdots 24$. The numbers of rounds fired in the separate periods, for any conditions, were substantially equal. Denote the total number of malfunctions $\sum m_i$ by M. Then an unbiased estimate of the population variance of the m_i's is

$$\frac{1}{23} \sum_i \left(m_i - \frac{M}{24}\right)^2$$

and thus

$$s = \sqrt{\frac{24}{23} \sum_i \left(m_i - \frac{M}{24}\right)^2}$$

is an estimate, based on 23 degrees of freedom, of the population standard deviation of the sum of 24 m_i's, i.e., of M. It is known that the variable t, defined as 1/s times the deviation of M from its population mean, is distributed in accordance with the Student t-distribution. Since the probability that $\underline{t}$ will exceed 2.07 for 23 degrees of freedom is 95 percent, it follows that the 95 percent confidence limits of the observed M, regarded as an estimate of the population mean of M, are $M \pm 2.07s$. These limits, divided by the number of thousands of rounds fired, furnish the 95 percent confidence limits of the malfunction rate.

In the example referred to, the m_i's are

44	33	42	61	30	42	
32	54	48	33	31	43	M = 1064
43	49	56	28	73	51	
33	44	47	47	53	47	

leading to a value s = 2.215 and to the confidence limits 1.95 ± 0.20 stated in the report.

II. THE COMPARISON OF MALFUNCTION RATES BY THE t-TEST

If two rates are to be compared to determine whether they differ by more than chance, denote the malfunctions in the ith firing period by a_i and b_i, respectively. For example, a_3 may be the malfunctions of M-16 rifles firing ball ammunition in the 3rd period, and b_3 the malfunction in the same period of M-14 rifles (both fired nearly equal numbers of rounds). One wishes to test the hypothesis, H, that both rates are inherently equal -- that is, that the two samples, of 24 a's and 24 b's, may be regarded as samples drawn at random from populations α and β having equal means. If the hypothesis is true, the quantities $c_i = a_i - b_i$ must form a random sample from a population γ having a zero mean, and some unknown variance. Because each a_i and b_i is the sum of contributions by many (96) rifles during firing period i, each of the original populations α and β must be nearly normal, and also the population γ of their differences. Thus the quantity

$$t = \frac{\overline{c}}{\left[\frac{1}{24} \cdot \frac{1}{23} \sum (c_i - \overline{c})^2\right]^{1/2}}$$

where

$$\overline{c} = \frac{1}{24} \sum c_i$$

should be distributed in the t-fashion with 23 degrees of freedom. The probability $P_n(t)$ that by chance a value of t will be obtained that exceeds the observed t is given by tables. A small value of P(t) suggests, with a degree of assurance depending upon its smallness, that hypothesis H is false, and that the population rates α and β really differ.

As an example, in comparing the M-16 ball malfunctions with M-14 malfunctions by the t-test, the a_i's are the m_i's given in the preceding example and the b_i's are

29	31	37	47	30	41
36	42	30	34	30	22
44	24	21	45	36	34
19	20	21	35	26	31

leading to the c's

15	2	5	14	0	1
-4	12	18	-1	1	21
-1	25	35	-17	37	17
14	24	26	12	27	16

whence

$$\bar{c} = 12.46$$

$$\left[\frac{1}{24} \cdot \frac{1}{23} \sum (c_i - \bar{c})^2\right]^{1/2} = 2.70$$

and

$t = 4.61$

$P < 0.0002$

very strongly suggesting that the M-16 ball rate inherently exceeds the M-14 rate.

III. THE COMPARISON OF MALFUNCTION RATES BY THE CHI-SQUARE TEST

A problem which arises in the comparison of the malfunction rates of two different rifle systems is illustrated by the following example: Suppose that it is desired to compare rifle types R_1 and R_2, and that the sample size is 100 rifles of each type. Suppose that the result of the rifle firings is that all 100 of the R_1 rifles have no malfunctions, 99 of the R_2's have no malfunctions, but the last R_2 has 100 malfunctions. The average number of malfunctions per rifle is 0 for the R_1's, and 1 for the R_2's; and indeed if each R_1 had 0 malfunctions, and each R_2 had 1, it would ordinarily be concluded from this that the R_1 rifle was better than R_2. In the hypothetical situation, however, the overwhelming majority of the R_2's - 99 percent - are every bit as good as the R_1's. It is just one "straggler" that makes all the difference, and indeed it may just be chance that one of the R_1's turned out to be "stragglers." One would thus be reluctant to conclude on the basis of such data that there was a significant difference between the R_1 and R_2 rifle types.

In the actual test this same problem arises, but its solution is not so clear. It is desired to take account of the "stragglers" without letting them totally dominate the results. In the following procedure for comparing rifle systems this aim is achieved by taking as the basic unit the number of malfunctions suffered by a given rifle in a given firing period (called "the number of malfunctions per rifle-firing-period). For example, rifleman 01 in squad 1 of platoon 1 had 0 malfunctions in firing period #1, 1 in period #2, 0 in periods

#3 and #4, 1 in period #5, and 0 in period #6. Hence, for the first six firing periods he had 4 rifle-firing-periods with 0 malfunctions, and 2 with 1 malfunction.

The comparison of two rifle systems was carried out by tabulating for each rifle system the distribution of the number of rifle-firing-periods with 0,1,2,3,··· malfunctions. These two distributions were then compared by the chi-square test (see the next section) which gives the probability of their differing by chance (assuming they both were samples from the same parent population) by an amount at least as great as that observed. If this probability was too low, the hypothesis that both samples were from the same parent population -- i.e., that the two rifle systems were equivalent -- was rejected.

To illustrate this method let us compare the M-16 rifle system using ammunition with ball propellant with that having IMR propellant. Each platoon contained 24 men using each system, and since there were 4 platoons and 24 firing periods, there was a grand total of 2304 rifle-firing-periods for each rifle system. The distributions of these rifle-firing-periods according to numbers of malfunctions are given in Table 1. Thus, there were 1721 rifle-firing-periods with no malfunctions for the ball system, and 1338 for the IMR; 368 rifle-firing-periods with one malfunction for the ball system, and 400 for the IMR; etc.

To use the chi-square test to test the hypothesis that both distributions are from the same parent population, we arrange the distributions into classes, each class corresponding to a given range of malfunctions per rifle-firing-period. The size of these classes is determined by the constraint that each class must contain at least 20 occurrences, so that the expected number of occurrences in the class for each rifle system is at least 10. (Since the total number of rifle-firing-periods is the same for each rifle system, the expected number

Table 1. COMPARISON OF BALL AND IMR PROPELLANTS

No. of Malfunctions	Occurrences		Classes		Chi-square Contribution
	Ball	IMR	Ball	IMR	
0	1721	1338	1721	1338	48.0
1	368	400	368	400	1.3
2	111	229	111	229	41.0
3	48	121	48	121	31.5
4	24	74	24	74	25.5
5	10	47	10	47	24.0
6	8	28	8	28	11.1
7	5	16	6	29	15.1
8	1	13			
9	4	10			
10	2	6	6	19	6.8
11	0	3			
12	0	7			
13	0	2			
14	0	3			
15	1	1			
16	0	1	2	19	13.8
19	0	1			
20	0	1			
22	1	1			
23	0	1			
31	0	1			
	2304 pds 1064 malf.	2304 pds 2617 malf.			Chi-square = 218 P = 5.10^{-42}

2-3-68-7

of occurrences in the class for each system is just one half of the total number of occurrences observed.) This constraint insures the validity of the chi-square approximation (see the derivation in the next section), which assumes that the expected number of occurrences is not too small - usually at least five in practice. As shown in the table there are 10 distinct classes: 0 malfunctions per rifle-firing-period; 1 malfunction;

2;3;4;5;6;7 or 8;9 to 11; and 12 or more. The contribution of each class to the total value of chi-square is also shown. This is found by taking for each rifle system the square of the difference between the observed number of occurrences and the expected number of occurrences, and dividing this quantity by the expected number of occurrences. For example, in the class corresponding to zero malfunctions per firing period the expected number of occurrences for each system is 0.5 (1721 + 1338) = 1529.5, thus the contribution of each system to the value of chi-square is $(191.5)^2/1529.5 = 24$, and the total contribution for the class is 48. Summing up the contributions from all ten classes we find that the value of chi-square is 218, which for a distribution with 9 degrees of freedom corresponds to a probability of 5.10^{-42}. Thus, either the distributions do not come from the same parent population, or else we have observed an extremely improbable event. Accordingly, we reject the hypothesis that the two distributions came from the same parent population. Note that the test does not say which rifle system is better; it merely suggests that they are different. A quick glance at the actual distribution is sufficient in this particular case, however, to determine which system has the better performance.

THE CHI-SQUARE TEST

Suppose that the members of some group of N individuals (which might be, for instance, attempted shots) are classified into s mutually exclusive and exhaustive classes $A_1, A_2 \cdots A_s$ on the basis of some attribute A. This attribute might be, for instance, rifle-type, and there might be three such classes corresponding to shots attempted from rifles of types M-16A1 fully modified, M-16A1 with new buffers but no chrome, and M-14. Suppose that these same individuals are also classified into t mutually exclusive and exhaustive classes $B_1, B_2 \ldots B_t$ on the basis of some attribute B. In the example, B_1 might denote malfunctions of Category I, B_2 malfunctions of Category II, B_3 malfunctions of Category III, and B_4 correct functionings. Then there will be <u>st</u> classes of the type A_mB_n. Let the frequency (number) of individuals A_m be denoted by (A_m), of individuals A_mB_n by (A_mB_n), etc. Then the data can be exhibited in the form of a contingency table having <u>t</u> rows and <u>s</u> columns as shown in Table 2. The frequency of the class A_mB_n is entered in the cell common to the <u>m</u>th column and <u>n</u>th row; the totals at the ends of the rows and at the feet of the columns are the first-order frequencies (A_m) and (B_n); and the grand total of individuals N appears at the bottom right-hand corner.

Even when there is no real dependence of the relative frequency of the B_n's upon the A_m's, a contingency table like Table 2 representing the observed results obtained from a finite number N of attempted shots may nevertheless exhibit differences among the proportions of B_n's in the various columns, from fluctuations of sampling. Suppose, for example, that there were a very large or infinite population of individuals classified according to attributes A_m and B_n, but with

Table 2. CONTINGENCY TABLE

Attribute	A_1	A_2	...	A_s	Totals
B_1	(A_1B_1)	(A_2B_1)	...	(A_sB_1)	(B_1)
B_2	(A_1B_2)	(A_2B_2)	...	(A_sB_2)	(B_2)
.	.	.	...	.	.
B_t	(A_1B_t)	(A_2B_t)	...	(A_sB_t)	(B_t)
Totals	(A_1)	(A_2)	...	(A_s)	N

no differences at all between the proportions p_n of the various B_n's in the different classes A_m. That is, in the population, the attributes A and B are independent. If s different samples consisting of (A_1), (A_2),....(A_s) individuals, respectively, were drawn independently and at random from the population and placed in the columns of Table 2 that are labeled A_1, A_2,...A_s respectively, then the probability that the cell frequencies corresponding to the classes B_n would be exactly those of Table 2 would be, by the fundamental principles of probability,

$$\prod_j p_j^{(B_j)} \frac{\prod_m (A_m)!}{\prod_{m,n} (A_m B_n)!} .$$

The probability that the total row-frequencies (B_n) would be exactly those of Table 2 would be by the same principles

$$\prod_j p_j^{(B_j)} \frac{N!}{\prod_n (B_n)!}$$

Hence the probability of finding, among such sets of samples that exhibited the same total row-frequencies as Table 2, precisely the cell-frequencies of the table would be

$$p = \frac{\prod_m (A_m)! \ \prod_n (B_n)!}{N! \ \prod_{m,n} (A_m B_n)!}$$

It can be shown[1] that p is approximately equal to a constant (that depends on the row and column totals) multiplied by exp $(-\chi^2/2)$ where χ^2 is the sum taken over all cells

$$\chi^2 = \sum [(A_m B_n) - (A_m B_n)_o]^2/(A_m B_n)_o$$

[1]By using Stirling's approximations for the logarithms of the factorials, and expanding log p about its maximum in a Taylor series (in the residuals), whose first term is found to be $-\chi^2/2$.

where the "independence frequencies" $(A_mB_n)_o$ are defined by

$$(A_mB_n)_o = (A_m)\ (B_n)/N.$$

The differences $(A_mB_n) - (A_mB_n)_o$ are called "residuals." The probability p is a decreasing function of χ^2. Hence it can further be shown[1] that the probability P of obtaining, by such random drawings from a population in which the attributes A and B are independent, a contingency table that has a value of p equal to or less than the p of the observed table is given by

$$P(\chi^2) = \text{const} \int_{\chi}^{\infty} y^{r-1}\, e^{-y^2/2}\, dy$$

where the constant is such that P(0) is unity. Here r (called the number of "degrees of freedom") is equal to (s-1)(t-1).

For any particular contingency table a small value of P suggests, with a degree of assurance depending upon its smallness, that the A_m columns of the table cannot be considered to constitute random samples from a population in which the proportions of B_n's are independent of the A_m's. A small value of P thus suggests that an association indicated by the table is present in the parent population; i.e., that the association is real, and that it is not merely an accident of sampling. Values of 0.05 and 0.01 for P are often chosen as criteria of "suggested" and of "strongly suggested" significance, respectively.

The preceding test is of great generality. Although the manner of its derivation, in the form that has been just given that is applicable to contingency tables, shows that the test is really an approximation that approaches perfect accuracy

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[1] By considering the extension, in the multi-dimensional space of the residuals, that corresponds to an increment $d\chi$ in χ.

only in the limit as the "independence frequencies" approach infinity, analysis and experience both show that the χ^2 test is adequately accurate for practical purposes when the independence frequencies are at least five, or even perhaps at least two.[1] Should doubt be felt in any particular case concerning the accuracy of the χ^2 approximation, P may be accurately calculated from the exact expression that has been given for p.

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[1] Statistics and Experimental Design, Volume 1, N.L. Johnson and F.C. Leone, p 239, Wiley & Sons, New York, 1964. See also Biometrika Tables for Statisticians, Volume 1, E.S. Pearson and H.O. Hartley, p 10, Cambridge University Press, 1958.

Appendix B

HUMAN FACTORS ASPECTS OF THE M-16 RIFLE SYSTEM RELIABILITY TEST

APPENDIX B

NOTE: This section was prepared by Dr. J. S. Kidd, IDA Consultant. The author is grateful for the cooperation of the Marine Corps personnel, particularly Major Charles Emmons, Commander of Troops. He is also appreciative of the valuable help given by Mr. Adrian Dubusant, Chief Behavioral Scientist of the U.S. Army Tropical Test Center in Panama.

I. INTRODUCTION

The reason for including human factors considerations in the Operational Reliability Test of the M-16A1 Rifle System was to provide a means to understand and control, either operationally or statistically, influences on test results which could be derived from human participation in the test.

In contrast with laboratory tests and bench tests of weapons, the M-16 reliability test was conducted in a field setting under simulated combat conditions. The procedures for the test were established in such a manner as to statistically balance and thus control all sources of variability of test outcome. In this sense, the test was a controlled experiment; comparable in rigor to tests in a laboratory.

The potential influence of opinion, attitude, and the abilities of test participants on test outcomes had been a matter for serious attention in the deliberations of the Ichord Committee with reference to previous tests of the M-16. Concern for these issues was apparent in the committee report. Consequently, it was deemed essential that these issues be handled in an objective way in the present test.

It was also recognized that the technical analysis of the basic data could be strengthened if information were available on specific attributes of the test participants. For example, if it were found that a reliable correlation existed between entering the military service and how often his weapon malfunctioned in the test, this fact could be used to increase the precision of the comparison between the M-14 and M-16 weapons.

In summary, the goals of the human factors portion of the test were to obtain information about test participants so that any potential biasing effects could be minimized and so that the precision of the statistical analyses of the resultant test data could be enhanced. In particular, the following factors were to be considered:

- Training of the riflemen with respect to the different weapons under test.
- Attitudes of riflemen regarding test site, test conditions, and complete operational setting.
- Attitudes of platoon officers and noncommissioned officers toward test, procedures, and weapons.

In addition, human factors support was provided on matters involving such issues as the morale of the personnel participating in the tests, learning effects, fatigue effects, safety hazards, identification and neutralization, realism, and the articulation and development of incidental observations such as might relate, for example, to training of troops in infantry tactics.

II. APPROACH

A. GENERAL METHODS

One of the problems involved in any human factors inquiry is the sensitization of the participants. It was determined early in the planning stages that any formal data collection having a human-factors emphasis should take place at the end of or near the end of the operational tests. Thus, we would avoid suggesting attitudes or biases that did not, in fact, exist.

Consequently, the following schedule was developed for the human-factors inquiry:

- Background and technical familiarization -- review of reports of weapon-test activities related to M-16 evaluation; review of doctrine on care and cleaning of weapons, all usage aspects of weapons (refs.)
- Review of personal history data on test participants.
- Informal interviews of key test participants; particularly platoon and squad NCOs.
- Test site familiarization -- assessment of exposure courses regarding matters of safety, realism, and level of stress imposed on men and weapons.
- Direct observation of operations at the exposure sites with emphasis on the maintenance of tactical realism, morale and interest-level of troops, inter-unit competition, hazards, fatigue, etc.
- Development and administration of a formal questionnaire to all test participants -- using separate forms for rank and file and leadership components.
- Analysis of data and preparation of report.

III. GENERAL OBSERVATIONS

As indicated above, systematic, formal observations covering the attitudes and opinions of test participants were not undertaken until the last day of operational testing. However, informal observations were made intermittently prior to and during the full duration of the test.

A. ATTITUDES OF MARINE CORPS LEADERSHIP COMPONENT

Informal interviews with available junior officers and noncommissioned officers were held at Camp Lejeune, North Carolina, and later at the test site. As anticipated, most of the junior officers and non-commissioned officers who participated in the test already had developed strongly-held attitudes toward the weapons being tested. In general, these attitudes were negative toward the M-16. However, any group of five or six men would usually contain at least one who would argue in favor of the M-16. Expressed attitudes appeared to be closely tied to personal experience (as opposed to hearsay or second-hand evidence). Those men whose experience with the M-16 was limited to use in training as opposed to use in combat appeared to have relatively weaker attitudes.

The presence of a broad spectrum of attitudes toward the M-16 among the leadership component of the test participants was a matter for careful deliberation because of the potential implications regarding biasing influences.

The option of utilizing leadership elements who could be considered completely neutral toward the weapon was not available. Consequently, it was arranged that the four platoon leaders would be junior officers who had not had combat exposure and therefore could be expected to be less strong in their attitudes than the other junior officers who were available.

Control of the potential influences exertable by noncommissioned personnel was undertaken by means of instruction. That is, these latter personnel were instructed not to discuss the relative merits of the weapons with the riflemen nor were they to comment in any way on any of the controversial aspects of the test.

Direct observation in the field confirmed that the Marine noncommissioned officers adhered closely to this instruction. Follow-up confirmation based on the comparison of expressed attitudes of leaders with actual malfunction rates by squad and platoon elements was undertaken and is reported in a subsequent section.

B. FIELD OBSERVATIONS

Field observations were conducted over the total period of the test in three segments: pre-test, mid-test, and end-test phases.[1]

In the pre-test observation period, the primary areas of interest were the functions of the support personnel provided by the U.S. Marine Corps and the development of the exposure sites. In particular, the Mojinga Swamp Site (E_2) was a source of concern because the firing range had to be carved out of the jungle whereas in the other exposure sites, firing ranges were already in existance prior to the test.

In the pre-test phase, the Marines performed admirably under conditions which were not ideal. For example, ammunition loading was kept on schedule despite the reliance on

[1] Additional supplementary observations were made independently during the mid-test and end-test phases by Mr. Adrian Dubusant.

hand methods and the limited space. Likewise, initial preparation of the Swamp Site firing range and bivouac area which was undertaken with hand tools, proceeded rapidly. Additional personnel resources, equipment and demolition material were provided by U.S. Army South (USARSO) when it appeared that range clearance at the Swamp Site might delay the test. The Marines and Army, working together, had the range ready for safety evaluation on 7 January. All facilities were in place and all marginal hazards removed by 10 January when the test-practice operation was conducted.

Observations in the field were conducted during the mid-test period by means of accompanying the Marine tactical units through all exposure courses and observing the firing exercises proper at all sites.

In the main, weapon exposure occurred simply by the movement of the troops through the various terrains (rain forest, swamp, beach, and upland jungle, alternatively). However, tactical exercises (simulated enemy action) took place during each exposure period which were intended to expose the weapons to acute stresses such as immersion, contact with hard obstructions, contact with dirt and sand, etc.

The intensity of the exposure was controlled and sustained by the squad leaders who insisted that the men move and take cover in accordance with infantry tactical doctrine.

During the end-test phase (last three firing days), observations were again made by accompanying the Marine tactical units through the exposure courses. The particular concern was the possibility of flagging interest or excessive fatigue which would result in either greater or diminished intensity of exposure of weapons.

Insofar as participant observation can yield valid judgments in such matters, the behavior of the Marines was highly consistent from the first to the last day of the test with respect to enthusiasm, tactical realism, and weapon exposure.

C. OTHER GENERAL OBSERVATIONS

Several potential sources of problems were anticipated and general monitoring was maintained on these aspects during the test. For example, there was general concern that inter-unit rivalry would develop which would impair the rigor or realism of the test.

In this regard, unit spirit contributed to the maintenance of motivation and morale to the completion of the test. The most persuasive type of observation to verify this assertion were the statements by riflemen that they wished the units could be held together for employment in Vietnam or elsewhere.

Likewise, there were no indications that any personnel perceived any particular connection between the occurrance or lack of occurrance of malfunctions during firing and their personal status in the unit, unit proficiency, or leadership abilities. In other words, the criterion measure used for the test was not particularly relatable to any personal values held by the Marines as individuals or units.

The pre-test level of training of the riflemen was another concern. Since men were drawn from different sources and several different occupational specialities were represented, it was possible that this factor could distract the findings. Likewise, if the men were "under trained," their performance could vary radically over the course of the test and if the Marines were trained more adequately on one weapon rather than another, weapon performance would be differentially affected.

Potential differences between individuals and sub-groups of riflemen were controlled by balanced assignment of men to units and within units. No evidence of undertraining appeared.

Detailed information concerning the rifle instruction given the men is presented in the complete WSEG test report. Quantitative evidence bearing on learning effects during this test is presented in a subsequent section of this enclosure.

There can be little doubt that some important learning effects occurred during the test. All Marine officers and noncommissioned officers who were interviewed asserted that the experience of going through tactical exercises in the tropical environment was excellent training for combat in theaters such as Vietnam. However, they related this to the execution of infantry tactics (individual and unit) and to confidence in self and weapon rather than to the technical care of the weapon which could effect the occurrance of malfunctions. This proposition appears to be verified by the quantitative findings to be reported below.

Finally, questions were raised concerning the possible reactions of the Marines to the experience of being intensely observed by non-Marine military and civilian personnel. It is probably not possible to make an objective assessment of the impact of such a factor but the Marines appeared to take the presence of "outside" observers as a matter of course and evidenced little curiosity concerning the presence of non-military personnel.

In summary, there were no observable indications that substantial biasing influences, stemming from any personal attributes of participants, were operating during the test. It was, to all appearances, a remarkably "clean" test in this respect.

IV. QUANTITATIVE FINDINGS

As indicated above, the principal source of quantitative data concerning the participants was the questionnaire which was administered during the last day of the test. Two forms were used: one form was circulated to all riflemen and a different form was used to obtain information from platoon leaders and non-commissioned officers who directly supervised the men. Examples of both forms of questionnaire are appended to this section.

The principal analytic procedure was to relate personal-attribute data obtained from the questionnaire with frequency of malfunction for each man-rifle combination. They key issue was the discovery of biasing effects if such were present.

The basic test findings were, of course, available at the commencement of tne analysis of the human-factors data. Consequently, it was possible to refine the latter process by taking into account the most potent of the test variables. It was possible in several instances to avoid confounding of effects due to rifle type and ammunition, for example, while retaining workable sample sizes. In each case, not all possible analyses were conducted but rather attention has been focused on those comparisons which were judged to be most relevant to the basic purpose of the test.

A. TRAINING OF RIFLEMEN

Information on the formal training of the riflemen and their distribution throughout the test units was obtained by interview during the last phase of test.

The U.S. Marine Corps provided a total of 328 riflemen for the test. Within this total were 203 men from Camp Lejeune who were awaiting assignment to schools for aviation technicians and mechanics. These 203 men had had the Marine boot training course, two weeks of Infantry Combat Training (ICT) in an Infantry Training Regiment (ITR), and 26 hours of special training on the M-16 rifle.

The remaining 125 men came from Camp Pendelton, California. These men had had boot training, two weeks of ICT and two weeks of Special Combat Training in an ITR, plus the 26-hour course on the M-16. Moreover, 102 of these men had served long enough in a regular unit to have been qualified in an infantry or artillery specialty. The 23 not having infantry or artillery specialty codes were either qualified or ready to begin training in utility specialties (e.g., engineers, trade specialties, vehicle drivers and mechanics, etc.).

At the beginning of the test, 304 men were selected for operations and 24 were held in reserve for use as replacements. The following table shows the initial assignments by platoon and squad.

Table 1. INITIAL ASSIGNMENTS OF RIFLEMEN

Platoon	Squad	Aviation Technicians	Infantry and Artillery	Utility	Total
1	1	12	6	1	19
	2	12	6	1	19
	3	11	6	2	19
	4	12	5	2	19
2	1	12	6	1	19
	2	12	6	1	19
	3	12	6	1	19
	4	12	5	2	19
3	1	12	6	1	19
	2	12	6	1	19
	3	11	6	2	19
	4	12	5	2	19
4	1	12	6	1	19
	2	12	6	1	19
	3	12	5	2	19
	4	12	5	2	19
TOTALS		190	91	23	304

2-10-68-21

The principal difference between assignees is the experience of two weeks formal training and some on-the-job training which those with an infantry or artillery specialty had which the others did not.

Also, it was determined that while intensive training was given to all participants on the M-16 rifle, total hours of formal exposure to the M-14 substantially exceeded those available and used for specific M-16 training. For example, the M-14 was the weapon used in boot training and the M-1 and M-14 are generally used in ITR.

Several questions then become salient. First, how much actual variation in practice of both firing and cleaning is represented by the differential in formal hours of instruction between the two weapons? Second, is the differential in amount of practice, if present, representative of a real difference in proficiency? Third, are differences, if any, in proficiency such to contribute to the differences observed between types of weapon (or the effect of other variables) with respect to the occurrence of malfunctions?

In partial answer to the first question, the men did indicate that they had had more actual practice in both firing and cleaning the M-14 compared to the M-16. For example, 35% of the men reported having fired 20 or fewer magazines with the M-16 while only 14% of the men reported this level of firing practice on the M-14. Similarly, over half (55%) of the men reported having field-stripped and cleaned an M-14 at least 50 times while only 4% of the men had that level of practice in the care and cleaning of the M-16. The complete picture is given in Tables 2 and 3.

To answer the second question, an assumption had to be made to establish an index of proficiency. The only datum which can be so used is the malfunction frequency proper. The

Table 2. COMPARISON OF PRETEST EXPERIENCE FIRING TEST WEAPONS

(300 Riflemen Reporting)

		Approximate Number of Magazines Fired				
		0-10	11-20	21-50	51-100	>100
Weapon	M-14	9	35	122	69	65
	M-16	26	82	134	28	30

most direct approach, then, was to look for a correlation between level of training on the rifle actually used and the frequency of malfunction for the particular man-rifle combination. Because of the impact of the rifle and ammunition factors, separate correlation matrices were established for three subgroups: M-16 plus ball propellant ammunition; M-16 plus IMR ammunition; and M-14. The findings are summarized in Tables 4 through 7. The malfunction frequencies, which were distributed differently for the three categories of rifle ammunition combination, were cast into a five-fold set for each combination. Natural breaks in the raw-score distributions were used to establish interval boundaries. Frequencies within intervals were chosen so that the resulting distribution would be approximately Gaussian.

Table 3. COMPARISON OF PRETEST EXPERIENCE IN CLEANING TEST WEAPONS

(300 Riflemen Reporting)

		Approximate Number of Times Weapon Was Cleaned					
		0-1	2-5	6-10	11-20	21-50	>50
Weapon	M-14	4	2	7	21	102	164
	M-16	14	62	104	72	34	13

Table 4. RELATIONSHIP BETWEEN LEVEL OF TRAINING AND GROSS MALFUNCTION FREQUENCY

(M-16 Plus Ball Ammunition)

Gross Malfunction Frequency	Rifle Training Score[a]				
	2-5	6-7	8-9	10-11	12-13
High	2	5	8	3	0
Med-High	3	6	5	3	1
Med	0	3	11	4	3
Med-Low	0	6	13	2	1
Low	2	7	5	3	0

[a] A score of 13 indicates a maximum level of training in both firing and cleaning.

Because of the truncated distribution of the M-14 training score, a chi-squared test was used to determine whether a reliable dependency existed between training and malfunction

Table 5. RELATIONSHIP BETWEEN LEVEL OF TRAINING AND GROSS MALFUNCTION FREQUENCY

(M-16 Plus IMR Ammunition)

Gross Malfunction Frequency	Rifle Training Score				
	2-5	6-7	8-9	10-11	12-13
High	0	5	9	2	0
Med-High	2	3	6	4	4
Med	2	7	3	6	3
Med-Low	0	5	7	4	3
Low	1	5	7	3	0

Table 6. RELATIONSHIP BETWEEN TRAINING AND GROSS MALFUNCTION FREQUENCY (M-14)

Gross Malfunction Frequency	Rifle Training Score[a]		
	8-9	10-11	12-13
High	2	2	6
Med-High	5	13	7
Med	5	10	7
Med-Low	3	13	10
Low	1	4	5

[a]Training on the M-14 was such that no men fell into the two lowest categories.

frequency for the composite data. This test indicated that a systematic relationship cannot be demonstrated (the χ^2 was 19.01).

It was possible to use the more powerful Pearson correlation test on the composite of the two subsets of M-16 data. This is the crucial determination of a possible training bias. The value obtained from the test was -0.074 which while in the predicted direction, accounts for only 0.55 percent of the

Table 7. RELATIONSHIP BETWEEN TRAINING AND GROSS MALFUNCTION FREQUENCY (COMPOSITE)

Gross Malfunction Frequency	Rifle Training Score				
	2-5	6-7	8-9	10-11	12-13
High	2	10	19	7	6
Med-High	5	9	16	20	12
Med	2	10	19	20	13
Med-Low	0	11	23	19	14
Low	3	12	13	10	5

Table 8. RELATIONSHIP BETWEEN PRESERVICE EXPERIENCE WITH RIFLES AND GROSS MALFUNCTION FREQUENCY

(M-16 Plus Ball Ammunition)

Gross Malfunction Frequency	Level of Preservice Experience[a]			
	1	2	3	4
High	4	4	2	8
Med-High	3	4	3	8
Med	2	2	5	12
Med-Low	3	5	1	12
Low	4	4	3	6

[a]Note: A score of 4 indicates a high level of preservice experience.

variability in gross malfunction frequency and is not statistically significant.

To make doubly sure that no real influence was present, one additional analyses was undertaken. A check on the possible influence of hand-gun experience prior to service training was made. It had been noted early that all riflemen were relatively novice regarding weapon utilization in combat and

Table 9. RELATIONSHIP BETWEEN PRESERVICE EXPERIENCE WITH RIFLES AND GROSS MALFUNCTION FREQUENCY

(M-16 Plus IMR Ammunition)

Gross Malfunction Frequency	Level of Preservice Experience			
	1	2	3	4
High	6	0	4	6
Med-High	4	6	2	8
Med	5	4	3	9
Med-Low	3	3	0	13
Low	1	3	2	10

Table 10. RELATIONSHIP BETWEEN PRESERVICE EXPERIENCE WITH RIFLES AND GROSS MALFUNCTION FREQUENCY (M-14)

Gross Malfunction Frequency	Level of Preservice Experience			
	1	2	3	4
High	1	0	3	6
Med-High	4	7	5	9
Med	1	8	4	9
Med-Low	8	2	3	13
Low	0	1	1	9

consequently, those with extensive preservice experience in weapon use might have a substantial advantage in proficiency. Tables 8 through 11 summarize these findings.

A weak inverse correlation is apparent in these data. Chi-squared test on the composite findings yields a value of 21.31 which is considered significant at the 5 percent confidence level (would occur in only 1 out of 20 instances by chance). However, while this factor of preservice experience appears to have a slight effect on the incidence of

Table 11. RELATIONSHIP BETWEEN PRESERVICE EXPERIENCE WITH RIFLES AND GROSS MALFUNCTION FREQUENCY (COMPOSITE)

Gross Malfunction Frequency	Level of Preservice Experience			
	1	2	3	4
High	11	4	9	20
Med-High	11	17	10	25
Med	8	14	12	30
Med-Low	14	10	4	38
Low	5	8	6	25

malfunction, the distribution of this training factor between rifle-types is almost exactly equivalent. The average pre-service experience scores are 2.9, 2.9, and 3.0, respectively. This small difference in preservice experience between assignees combined with the relatively weak dependency relationship suggest that no impact on basic test results derives from this factor.

The training issue was further pursued by considering the differential performance between squads. Concern was directed at the po-sibility of variations between squads on total training and the effect such differences might have on frequency of malfunction. Again, despite the equilibration of personnel assignment based on formal training, some variation in specific weapon experience for the whole group and composite weapon experience for the whole group was noted between squads.

The first specific question to be pursued was the possibility that there was a differential in training between squads firing the M-16 with ball propellant ammunition and those squads firing the M-16 with IMR ammunition.

The average specific-weapon training score per squad for M-16 assignees was determined. The range was from 7.09 to 11.45. The sixteen squads were arranged in rank-order and an average rank for the two sub-sets of squads was computed. The average rank for the squads assigned the M-16 plus ball propellant ammunition was 7.75 and the average rank for the squads assigned the M-16 plus IMR ammunition was 9.25. The difference was not statistically reliable. Under any circumstances, the advantage lay with the squads which had the higher gross malfunction rate. Consequently, no bias could be adduced. As an attempt to further confirm this assertion, rank order correlation matrices were prepared to determine whether there was, within each subset of eight squads, any relationship between training and performance as measured by gross malfunction.

Table 12. RANK-ORDER MATRICES RELATING GROUP TRAINING TO GROSS MALFUNCTION FREQUENCY BY SQUAD

Rank Order of Level of Training of Squad	Squad Assignment[a]	
	M-16 Plus Ball Propellant Ammunition	M-16 Plus IMR) Ammunition
	Rank for Malfunction Frequency	Rank for Malfunction Frequency
1	3	2
2	7	1
3	6	3
4	8	7
5	5	4
6	2	8
7	4	6
8	1	5

[a]Note: Squads having low rank had low total frequency of malfunction. The relationship indicating a bias effect would be an inverse correlation.

The numerical correlation (-0.48 for ball ammunition and +0.31 for IMR ammunition) computed from the matrices were not high enough to demonstrate any reliable connection between squad training and squad performances as measured by gross malfunction frequency.

B. ATTITUDES OF RIFLEMEN

Two approaches were used to organize the attitude findings. First, a coarse-grain analysis was made to determine the overall climate of attitude toward the M-16 on the part of the riflemen and to ascertain whether the experience of the test itself had any impact on expressions of attitude. Three gradations of attitude were noted in this first approach: positive, neutral or uncertain, and negative. Three hundred ten questionnaires were compiled and differentiated only by whether the man had been assigned the M-14 or the M-16 for the test.

This first analysis revealed that 82 percent of the men were negatively disposed toward the M-16 at the outset of the test. However, by the end of the test, 59 percent of the men preferred the M-16 and 4 percent were undecided. Of the men queried who actually used the M-16 in the test, 75 percent clearly preferred the M-16 by the time the test was completed. Even among those who were assigned the M-14 during the test, there was a shift in attitude such that 23 percent clearly preferred the M-16 at the end. In all, 51 percent of the men shifted from a negative attitude toward the M-16 to a positive attitude after the test experience. The remainder either had a positive attitude at the outset or retained a relatively negative attitude or were still undecided at the end of the test.

A finer grain analysis was conducted to determine whether initial attitude toward the M-16 affected the gross malfunction rate experienced on this rifle. Again, a breakdown was made between whether the man was in a squad using ball propellant ammunition or IMR ammunition. The results are presented in Tables 13 through 15.

Table 13. RELATIONSHIP BETWEEN ATTITUDE TOWARD THE M-16 AND GROSS MALFUNCTION FREQUENCY

(M-16 Plus Ball Propellant Ammunition)

Gross Malfunction Frequency	Attitude Toward M-16				
	Negative	Qualified Negative	Neutral	Qualified Positive	Positive
High	10	1	5	1	1
Med-High	7	2	9	1	1
Med	13	1	5	0	2
Med-Low	12	3	3	2	0
Low	9	2	2	2	2

Table 14. RELATIONSHIP BETWEEN ATTITUDE TOWARD THE M-16 AND GROSS MALFUNCTION FREQUENCY

(M-16 Plus IMR Ammunition)

Gross Malfunction Frequency	Attitude Toward M-16				
	Negative	Qualified Negative	Neutral	Qualified Positive	Positive
High	6	0	2	5	0
High-Med	8	8	4	0	0
Med	21	2	6	2	0
Med-Low	8	3	3	1	0
Low	7	2	2	2	0

It will be noted that a very weak contingency relationship appears to exist between attitude and malfunction frequency such that negative attitudes are associated with high malfunction rates and positive attitudes with low malfunction rates. A Pearson correlation test of the degree of this contingency relationship results in a **r** of 0.187 which is statistically

Table 15. SUMMARY RELATIONSHIP OF ATTITUDE TOWARD THE M-16 AND GROSS MALFUNCTION SCORES ON THE M-16

Gross Malfunction Frequency	Attitude Toward M-16				
	Negative	Qualified Negative	Neutral	Qualified Positive	Positive
High	16	1	7	6	1
Med-High	15	10	13	1	1
Med	34	3	11	2	2
Med-Low	20	6	6	3	0
Low	16	4	4	4	2

significant (would occur less often than one in twenty by chance) but accounts for only slightly more than 3 percent of the variability in the outcome.

C. LEADERSHIP ELEMENT

The leadership element consisted of four platoon leaders (two first lieutenants, two second lieutenants), four platoon sergeants, and sixteen squad leaders for a total of twenty-four men. Completed questionnaires were obtained from twenty-two respondents.

As indicated above, the four platoon leaders were officers who had not yet seen combat duty. They were selected on this basis to minimize the intensity of opinion they might bring to the test toward the weapons under test.

The basis for assignment was validated by the questionnaire responses. One respondent reported a favorable attitude toward the M-16 prior to the test, one stated he had no opinion but had heard of some problems with the M-16 and the other two indicated qualified negative attitudes (e.g., a good weapon for a limited set of conditions).

The test experience tended to polarize attitudes. One man shifted from a favorable attitude toward the M-16 to an unqualified preference for the M-14. Two others ended up favoring the M-14 because of the problems of "keeping the M-16 clean." The fourth man shifted from a qualified negative attitude to a qualified positive attitude toward the M-16.

The noncommissioned officers all expressed more intense attitudes. All but two of the eighteen respondents indicated extensive combat experience in Vietnam. However, only three had actually used the M-16 in combat.

Seven of the men indicated qualified favorable attidudes toward the M-16. Five of the men were strongly negative toward the M-16 and two had qualified negative opinions. Four indicated that they had formed no opinion prior to the test. In narrative comments, all but these latter four expressed some pretest reservations or skepticism about the combat qualities of the M-16 rifle.

Again, the experience of the test tended to polarize attitudes such that four of the men ended up favoring the M-16 for regular combat use and sixteen favoring the M-14. The four who were strongly positive toward the M-16 at the end of the test all had had qualified positive responses toward the weapon prior to the test.

The narrative comments of those expressing preference for the M-14 at the end of the test referred to the degree of attention to care and cleaning of the M-16 which could not always be readily given under combat conditions and a lack of "confidence" in the weapon.

Evidence regarding possible influences on test results deriving from attitudes of leaders was sought at both the platoon and squad levels.

Total M-16 malfunctions per platoon ranged from 702 to 992 over the complete test. The rank-order of malfunction frequency is compared to the rank and order of the combined attitudes of the platoon leader and platoon sergeant in Table 16 below.

Table 16. RELATIONSHIP OF PLATOON LEADERSHIP ATTITUDES TO PLATOON PERFORMANCE

Rank of Platoon on Frequency of Malfunction	Rank of Platoon on Attitudes of Platoon Leadership
1	1
2	4
3	2
4	3

No indication of influence is revealed in this comparison.

At the squad level, the sample size and sensitivity increases. Again, in order to avoid confounding effects, squads firing ball propellant ammunition are analyzed separately from squads firing IMR ammunition.

Table 17. RELATIONSHIP BETWEEN ATTITUDES OF SQUAD LEADERS AND GROSS MALFUNCTION FREQUENCY (M-16 Plus Ball Propellant Ammunition)

Rank of Squad	Attitude of Squad Leader
1	2
2	2
3	5
4	5
5	X[a]
6	4
7	3
8	3

[a]X indicates that a completed questionnaire was not available for analysis.

The squad ranked #1 had the fewest malfunctions with the M-16. An attitude score of #2 indicates a qualified positive attitude and a score of #5 indicates a strong negative attitude. (No unqualified positive attitudes were reported.)

Table 18. RELATIONSHIP BETWEEN ATTITUDES OF SQUAD LEADERS AND GROSS MALFUNCTION FREQUENCY (M-16 Plus IMR Ammunition)

Rank of Squad	Attitude of Squad Leader
1	2
2	3
3	5
4	5
5	X[a]
6	3
7	2
8	5

[a]X indicates that a completed questionnaire was not available for analysis.

A slight suggestion of a contingency effect is revealed in Table 17 but it is not strong enough to be supported by statistical test. Table 18 does not even reveal the suggestion of any dependency between squad leaders' attitudes and the frequency of occurrence of malfunctions in the squad.

D. INCIDENTAL FINDINGS

Fatigue

A modest degree of fatigue was reported by 27 of the 281 riflemen completing questionnaires on this factor. Of the 93 M-14 assignees, 13 or 14 percent reported some fatigue. Of the 188 M-16 assignees 14 or 7.4 percent reported like amounts of fatigue. Average malfunction scores were calculated for those reporting fatigue and those not reporting fatigue for the three crucial rifle-ammunition combinations. The results are summarized in Table 19.

Table 19. AVERAGE MALFUNCTION FREQUENCIES FOR MEN REPORTING FATIGUE AND NOT REPORTING FATIGUE

	Rifle Category		
	M-16 Plus Ball Propellant Ammo	M-16 Plus IMR Ammo	M-14
Reporting Fatigue	11.9	18.7	5.9
Reporting No Fatigue	10.9	27.5	8.0

In two out of the three comparisons, those not reporting fatique experienced more malfunctions than those reporting fatigue. Thus, fatigue could not be a serious factor in contributing to malfunction occurrence.

Injuries and Illnesses

During the test approximately 20 men were incapacitated for a day or more by injury or sickness. Fifty-nine men reported minor cuts, bruises, and burns. Thirty more reported minor twists, strains, and sprains.

Ten men reported intestinal upsets, 8 reported headaches and 10 reported colds and fevers.

The only effect which these disorders had on the test results was the forced replacement of temporarily disabled personnel by spare riflemen. These transient differences in the men did not exert a detectable effect on malfunction frequencies.

IV. CONCLUSIONS

The basic conclusion from the preceding evidence must be that no detectable biasing effects occurred.

The M-14 rifle enjoyed several advantages at the onset of the test. The men had had more exposure to the weapon with respect both to firing and cleaning. Likewise, both riflemen and their leaders had generally negative attitudes toward the M-16.

Considering the total mass of the data, it still seems conceivable that the M-14 benefited slightly from its initial favored status. However, such an effect, if present, is only marginally detectable by the techniques used in the present analysis.

No revision in the main analysis nor in the basic conclusions of the test can be instigated based on the analysis of the human factors.

M-16 EVALUATION POST-TEST QUESTIONNAIRE

ATTN: Shooters

As you know, the purpose of this test was to evaluate the reliability of the M-16 rifle under different conditions of exposure similar to conditions in Vietnam. A comparison standard was provided by the M-14 rifle being exposed to identical conditions. Your job has been to make the exposure conditions realistic. You have done this job very well.

As part of the final phase of the test, there is another job that only you can do. That is, to report your personal experience of the test.

The following questionnaire is a means for you to provide your own report.

1. Instructions

Your answers to the questions below will help us get a more complete understanding of the test results. Please answer all questions even if you are not sure of the answer. It is important that each answer is what you believe, not what others might believe or want you to believe. Your answers will be kept confidential and will be used only for data analysis purposes.

2. Personal History

a. Name________________________

b. Age__________________(years)

c. Last year of civilian school completed (circle one)
6, 7, 8, 9, 10, 11, 12, 12+

e. How long in Marine Corps? ____________(months)

3. Experience and Training

a. Before entering the Marine Corps, I (circle the best answer)

1. went deer hunting every year.
2. often hunted small game.
3. both #1 and #2
4. had been taught how to use a gun and practiced often with targets.
5. had been taught how to use a gun but did not shoot often.
6. had never been taught how to use a gun.

b. Before coming to Panama, approximately how many magazines had you fired from each of the listed weapons? (Check one box for each weapon)

	M-1	M-14	M-16
None	___	___	___
10 or less	___	___	___
20 or less	___	___	___
50 or less	___	___	___
100 or less	___	___	___
more than 100	___	___	___

c. Before coming to Panama, approximately how many times had you field-stripped and cleaned the listed weapons? (Check one box for each weapon)

	M-1	M-14	M-16
Never	___	___	___
Once	___	___	___
2-5 times	___	___	___
6-10 times	___	___	___

(Item C Continued)

	M-1	M-14	M-16
11-20 times	___	___	___
21-50 times			
Over 50 times			

d. Complete the following sentence: "Before coming to Panama, I had heard that the M-14 was________________

(If you heard nothing, so state!)

e. Complete the following sentence: "Before coming to Panama, I had heard that the M-16 was________________

(If you heard nothing, so state!_

4. Test Conditions

a. What rifle were you issued for the test?

M-14 ___ M-16 ___ (check one)

b. What problems other than malfunctions, if any, did you have with the rifle?

c. Were any of the men ever too tired to handle their weapons? (yes or no) _____

d. If yes, how often? (check one)

1. Almost always _____
2. Most of the time _____
3. A few times _____
4. Almost never _____

e. Did you have any injuries or accidents, major or minor, during the test? (yes or no) _______

f. If yes, please describe.

g. Were you ever sick during the test? (yes or no)

h. If yes, describe and tell how long you were sick.

5. Present Opinion

a. If you were going into actual combat next week, what rifle would you want to be carrying?

b. Why?

c. Any other comments?

M-16 EVALUATION POST-TEST QUESTIONNAIRE

ATTN: Platoon Leaders and Squad Leaders

1. Instructions

Below is a set of questions designed to yield a summary of your personal experience, prior to and during the M-16 test, which will help in the interpretation of the test results. Please answer each question as fully and frankly as possible in the space provided. Your answers will be kept confidential and used only in the interpretation of test data.

2. Personal History

a. Name ______________________

b. Rank ______________________

c. How long have you been in the Marine Corps?

_________________________(months)

d. How long have you held your present rank?

_________________________(months)

e. Have you led troops in combat? (yes or no)

____

f. How many months have you been in combat?

(In Vietnam) _________________

In other theaters of operation?

____

g. What hand-held weapons have you used in combat?

h. Have you led troops in combat who were equipped with the M-16? ____________________________

i. For what period of time? ________________(weeks)

3. Weapons Assessments

a. Prior to this test, what was your own general evaluation of the M-16? (check one)

1. The best rifle available__________
2. The best rifle available, but issued too soon to the troops___________
3. A very good weapon___________
4. A very good weapon for a limited set of conditions____________
5. A weapon with serious limitations________
6. Not a suitable weapon for regular combat use __________________
7. Other____________

Explain

b. Prior to this test, what was your own general evaluation of the M-14? (check one)

1. The best rifle available____________
2. The best rifle available, but issued too soon to the troops_____________
3. A very good weapon_____________
4. A very good weapon for a limited set of conditions__________________

(Item b Continued)

5. A weapon with serious limitations____________
6. Not a suitable weapon for regular combat use______________
7. Other____________

Explain

c. If you were going into a combat next week, what rifle would you want to carry personally?______________

d. What rifle would you prefer to be issued to troops under your command?_______________

e. Did your experience, in the present test, change your opinion of either the M-14 or M-16?_____________

f. If so, in what way?

4. <u>Test Experiences</u>

a. What problems other than malfunctions, if any, did your people have with the M-14 during the test?

b. What problems other than malfunctions, if any, did your people have with the M-16 during the test?

c. Was anything done or did anything happen during the test which would tend to favor one of the rifle types more than another? (yes or no)____________

d. If yes, what?

5. <u>Suggestions</u>

a. What changes, if any, would you like to see made in the M-14?

b. What changes, if any, would you like to see made in the M-16?

c. Please summarize in your own words your general reaction to the test (including, possibly,) such factors as facilities, exposure conditions, schedules, personnel, data-taking procedures, weapons, ammo, or any other such factors.

d. Please summarize in your own words your present opinion of the M-16 rifle.

e. In light of your experience in the test, what suggestions regarding troop training, if any, do you have?

ENCLOSURE D

Enclosure D

CHOICE OF RIFLES AND AMMUNITION

CHOICE OF RIFLES AND AMMUNITION

A. RIFLE SELECTION

The M-16 Test was conducted utilizing the following type and configuration of weapons:

- The M-16A1 rifle, new production, with all modifications, i.e., new buffer and chromed chamber (Test Symbol R_1).
- The M-16A1 rifle, new condition, produced between December 1966 and September 1967. This weapon had the new buffer but no chromed chamber (Test Symbol R_2).
- The M-16A1 rifle, new condition, produced prior to December 1966. This rifle had the old buffer, without the chromed chamber. New buffers were installed at the test site (Test Symbol R_3).
- The reconditioned M-14 rifle with selectors[1] (Test Symbol R_4).

The Numbers of each type weapon selected and source were as follows:

- M-16A1, new production, 150: These weapons were shipped from the manufacturer in boxes of 30 rifles each. The rifles were not packed in rifle serial number sequence.

    From October 1967 production, 90: 4500 rifles were shipped to the Marine Corps Supply Activity, Barstow, California. The shipment consisted of 150 boxes, numbered 1 through 150. Boxes 47, 110 and 134 were selected for the test.

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[1]Reconditioned M-14 Rifle: Any defective part, with exception of the receiver, is replaced, and the weapon is reblued. It must then pass acceptance testing to meet the same military specifications as a new weapon. Since the weapon serial number is on the receiver, the replacement of this part would destroy the weapon as an identifiable unit. There have been no firing tests to directly compare the new M-14 rifle with the reconditioned M-14 rifle.

From November 1967 production, 60: 4530 rifles were shipped to the Army Supply Depot, Letterkenny, Pennsylvania. The shipment consisted of 151 boxes. Boxes 46 and 124 were designated for the test.

- The M-16A1 produced with new buffer, without chrome, between December 1966 and September 1967; 90: From a total number of 4095 weapons at the Marine Corps Supply Activity at Barstow, California, boxes 28, 32 and 314 were selected.
- M-16A1, prior December 1966 production, new condition, old buffer, without chrome; 67: The weapons were from Marine Corps stocks at Camp Pendelton, California. Only 67 were available therefore no random selection was required.
- M-14 rifle with selector, 140: Reconditioned M-14 rifles were used for the test. The Marine Corps located 5900 rifles at the Marine Supply Center at Albany, Georgia. The weapons were packed 10 to a box without regard to manufacturer or serial number. Boxes selected were 6, 50, 75, 106, 134, 223, 269, 302, 397, 385, 402, 480 and 521.
- All rifles tested were randomly selected by the Weapons Systems Evaluation Group. The weapons were selected by box number and these numbers were determined by throwing dice.
- Rifle serial numbers and corresponding test numbers are shown below:

R_1		R_1		R_1	
TEST NO.	SER. NO.	TEST NO.	SER. NO.	TEST NO.	SER. NO.
101	855886	125	859047	162	859290
102	883840	126	854517	163	876896
103	885549	139	874306	164	884831
104	854128	141	856987	165	885155
105	884130	142	856552	166	885334
106	880985	143	858945	179	886835
119	885651	144	846169	201	873540
121	884476	145	857328	202	882691
122	846783	146	848500	203	884742
123	883353	159	875150	204	883173
124	857034	161	856277	205	883864

R_1	
TEST NO.	SER. NO.
206	885252
219	874415
221	885103
222	885225
223	874198
224	875388
225	885036
226	884958
239	888470
241	885430
242	884059
243	884978
244	884205
245	885360
246	884278
259	875154
261	875839
262	884361
263	861133
264	858548
265	857203
266	857594
279	885948
301	856603
302	857107
303	852871
304	857414
305	852611
306	857359
321	852876
322	857353
323	834226

R_1	
TEST NO.	SER. NO.
324	852874
325	787952
326	858810
341	856609
342	857527
343	857417
344	848747
345	856728
346	858426
361	857557
362	857803
363	854856
364	854705
365	854689
366	856441
401	851160
402	851156
403	888439
404	875184
405	875601
406	874987
421	888074
422	875481
423	888465
424	885882
425	885695
426	876268
441	876162
442	874540
443	876212
444	874733
445	889213

R_1	
TEST NO.	SER. NO.
446	887521
461	886051
462	875695
463	875837
464	875465
465	887510
466	888839

R_1 SPARES	
501	857761
502	858203
503	854969
504	850657
505	857764
506	851433
507	858222
508	851090
509	853257
510	851241
511	857117
512	857772
513	855455
514	857777
515	849835
516	855173
517	843853
518	849350
519	857418
520	858497
521	855735
522	850914
523	851526

TEST NO.	R_1 SER. NO.
SPARES (Cont'd)	
524	854402
525	853551
526	819762
527	857039
528	849197
529	855309
530	858727
531	853398
532	831385
533	857543
534	855997
535	855868
536	856954
537	854923
538	852888
539	857280
540	852414
541	852066
542	844784
543	855489
544	854237
545	848562
546	857688

R_2		R_2		R_2	
TEST NO.	SER. NO.	TEST NO.	SER. NO.	TEST NO.	SER. NO.
107	767427	307	770604	467	772577
109	770997	309	775451	469	771355
110	767105	310	776051	470	771489
112	762857	312	773310	472	770613
127	767195	319	777913	R_2	
129	766620	327	772739	SPARES	
130	768198	329	774566	601	776795
132	771321	330	774300	602	768323
147	766301	332	778895	603	766577
149	770900	339	773271	604	770903
150	771108	347	773054	605	772567
152	769180	349	773526	606	775166
167	769466	350	774071	607	772524
169	768097	352	772815	608	772205
170	767174	359	774537	609	767587
172	765361	367	769155	610	768567
207	769606	369	770632	611	767046
209	777869	370	776206	612	770647
210	775807	372	765311	613	763187
212	777025	379	769996	614	769431
227	771730	407	768043	615	774760
229	768111	409	767954	616	766732
230	772726	410	767607	617	768464
232	772586	412	772052	618	764704
247	776311	427	768755	619	768124
249	777828	429	777369	620	767974
250	770101	430	771958	621	765174
252	771185	432	771676	622	768816
267	773966	447	764458		
269	774349	449	771622		
270	766850	450	772884		
272	775307	452	770504		

R_3	
TEST NO.	SER. NO.
108	534748
111	534183
128	551966
131	553744
148	544446
151	546766
168	550456
171	531614
208	549804
211	534612
228	534668
231	530408
248	534037
251	530020
268	533571
271	547759
308	552634
311	532994
328	533402
331	553437
348	553319
351	533223
368	530397
371	547837
408	534939
411	550321
419	551584
428	552436
431	551011
439	531949
448	530322
451	550408
459	553195

R_3	
TEST NO.	SER. NO.
468	550388
471	532653
479	552430

R_3 SPARES	
701	530689
702	532499
703	535103
704	533720
705	532216
706	531925
707	533505
708	531062
709	534669
710	553037
711	530115
712	530030
713	552421
714	530746
715	533046
716	534060
717	531071
718	532390
719	531995
720	530153
721	531831
722	533681
723	533221
724	552448
725	532912
726	532748
727	531395
728	534847

R_3	
TEST NO.	SER. NO.
729	552044
730	531027
731	530894

R_4		R_4		R_4	
TEST NO.	SER. NO.	TEST NO.	SER. NO.	TEST NO.	SER. NO.
113	1018360	233	999513	353	1214122
114	953019	234	1022402	354	1020317
115	992472	235	1024888	355	593807
116	996020	236	995484	356	593893
117	969184	237	1211962	357	978202
118	970834	238	998217	358	1020864
133	991368	253	988835	373	1221673
134	985372	254	991395	374	1215938
135	944843	255	996795	375	1176777
136	1016221	256	995479	376	1216663
137	1016716	257	1009701	377	995945
138	991159	258	978879	378	1217419
153	999648	273	1021704	413	1183794
154	971946	274	978790	414	995507
155	927273	275	1024670	415	966406
156	1024782	276	960930	416	997093
157	1022948	277	1026172	417	1072201
158	989411	278	1025815	418	47668
173	995189	313	1024521	433	43796
174	993808	314	1024919	434	1080354
175	942356	315	1013088	435	41471
176	1001631	316	1019042	436	1081356
177	997882	317	969262	437	42372
178	966600	318	1024918	438	1078577
213	996593	333	964322	453	46965
214	996032	334	976593	454	47234
215	1002956	335	1005833	455	1071471
216	997313	336	597007	456	1082768
217	995080	337	102402	457	1084854
218	971652	338	998402	458	1022499

R_4 TEST NO.	R_4 SER. NO.	R_4 TEST NO.	R_4 SER. NO.
473	1022480	823	1220629
474	1016544	824	997361
475	961003	825	997470
476	964630	826	995376
477	1215095	827	980877
478	1022298	828	1081306
R_4 SPARES		829	1069333
		830	996955
801	1018357	831	1081802
802	1023925	832	1079546
803	997733	833	1076725
804	992667	834	999247
805	969487	835	1082820
806	998781	836	1082310
807	1219545	837	1024904
808	589661	838	993932
809	1025710	839	997910
810	1196930	840	1082836
811	1019970	841	1025364
812	992749	842	995466
813	1016074	843	968602
814	1015633	844	971822
815	1003198		
816	1010574		
817	994425		
818	1017216		
819	966446		
820	1024247		
821	1223825		
822	1083691		

B. AMMUNITION SELECTION

Six categories of M-16 ammunition were needed: ball projectiles with ball propellant from each of two manufacturers; ball projectiles with IMR propellant from each of two; tracer projectiles with ball propellant from a single manufacturer; tracer projectiles with IMR propellant from a single manufacturer.

The period 1 November 1966 through 1 November 1967 was chosen to limit the production within which the selection was to be made; later production might be non-representative; older, not readily available in adequate quantities. For statistical control, each type tested was from a single manufacturing lot. The creation of "grand lots" within manufacturers, by mixing lots, was rejected on grounds of realism and practicality. Two or more lots from each manufacturer could have been used if kept separate in the test, but this multiplication of the types to be tested was rejected because of the resulting complexity of the test.

Remington Arms (RA), the largest private producer and Lake City (LC), the largest Government producer were chosen for the ball projectiles, with ball propellant. Twin Cities (TW) and LC were chosen as the only two manufacturers of ball projectiles with IMR propellant. For tracer projectiles, with ball propellant, only Olin Mathieson (OL) was available; with IMR propellant, only LC. From each of the six preceding types of ammunition, therefore, a single lot had to be selected in a random manner from lots with acceptance dates lying within the designated timespan.

During a visit to the Frankford Arsenal, Philadelphia, on 5 December 1967, detailed information was obtained as to the number of lots of each type with acceptance dates within the timespan 1 November 1966 - 1 November 1967.

The Remington Arms (RA) production ball cartridges with ball propellant did not stop on 28 July 1967, but lot numbers were not available beyond this time. Based on previous production, about 90 lots were estimated produced for the year. Table D1 shows the ammunition considered for use in the test, and Table D2 indicates those lots actually selected and utilized for the test.

All lots of ammunition used in the test were randomly selected by the throwing of dice.

Table D1. AMMUNITION

Ammo	Propel-lant	Mfr	Acceptance Dates	Lot Numbers	No. Lots
Ball	Ball	TW	4 Jan 67-31 Oct 67	18050-18148 18154-18155 18209-18262	145
Ball	Ball	LC	12 Dec 66-16 Oct 67	12100-12211 12238-12283	158
Ball	Ball	OL	1 Nov 66-25 Oct 67	6124-6157	34
Ball	Ball	RA	1 Nov 66-28 Jul 67	5239-5306	68
Ball	IMR	TW	25 Apr 67-11 Jul 67	18149-18153 18156-18208	58
Ball	IMR	LC	11 Jul 67-16 Aug 67	12212-12237	26
Tracer	Ball	OL	15 Nov 66-18 Oct 67	6064-6102	39
Tracer	IMR	LC	10 Nov 66-18 Sep 67	12013-12111	99

2-10-68-1

Table D2. RANDOMLY SELECTED AMMUNITION

Rifle	Ammo	Propel-lant	Rounds Required	Lot No. in Decreasing Order of Preference (Lots actually chosen are underscored)
M-16A1	Ball	Ball	273,000	RA 5241, 5269, 5287, 5305
M-16A1	Ball	Ball	273,000	LC 12140, 12279, 12195, 12245
M-16A1	Ball	IMR	273,000	TW 18156, 18199, 18159, 18179[a]
M-16A1	Ball	IMR	273,000	LC 12217, 12215, 12229, 12235
M-16A1	Tracer	Ball	144,000	WCC[b] 6100, 6077, 6099, 6081, 6066, 6083, 6090, 6101
M-16A1	Tracer	IMR	144,000	LC 12021, 12092, 12082, 12073, 12016, 12056, 12083, 12109
M-14	Ball	Ball	534,000	TW 18103, 18102, 18100, 18101
M-14	Tracer	Ball	141,000	LC 12644, 12648, 12647, 12645

[a] The number originally selected had been 18173. An error in data transmission changed this to 18179, and the latter lot was located and found to contain an adequate number of rounds. The error was later discovered and left uncorrected, since it neither changed the random character of the selection, nor placed it outside the permissible timespan.

[b] WCC (Western Cartridge Company) is the East Alton Plant of Olin Mathieson.

2-10-68-2

After the ammunition was selected, acceptance data for each lot utilized in the test were obtained from Frankford Arsenal for inclusion in this report. Extracts from these data sheets, shown below, graphically compare IMR and ball propellant with respect to chamber pressure (Figure D1), port pressure (Figure D2), and velocity (Figures D3a and D3b).

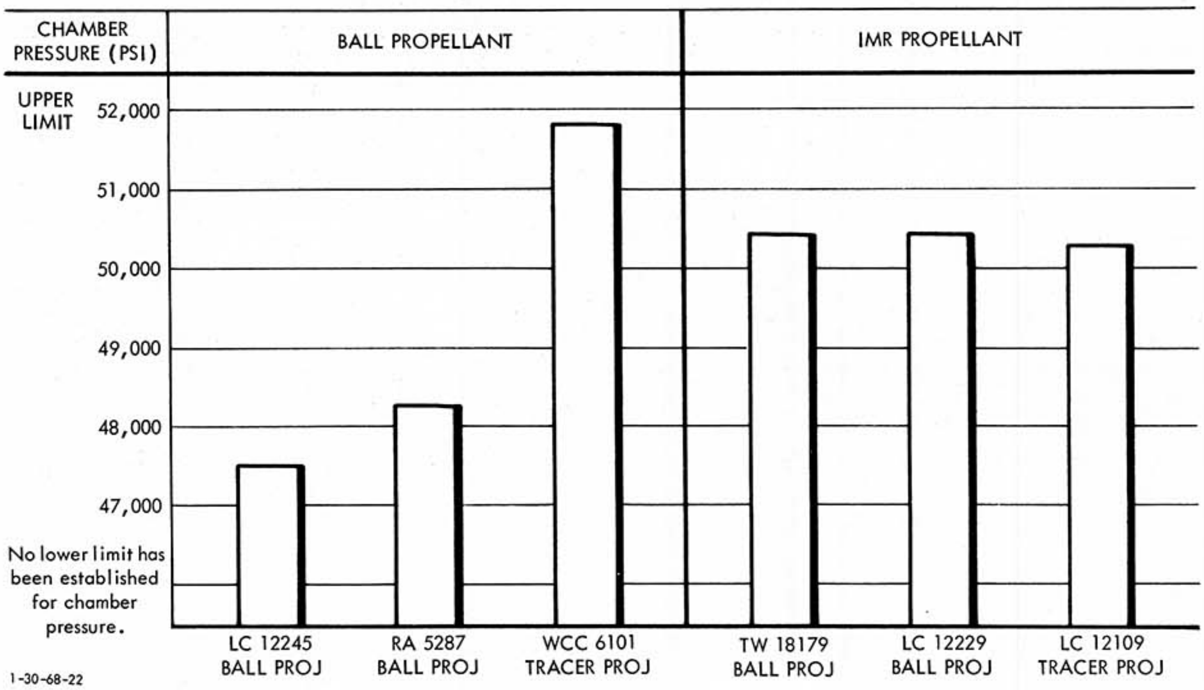

FIGURE D1. Chamber Pressure

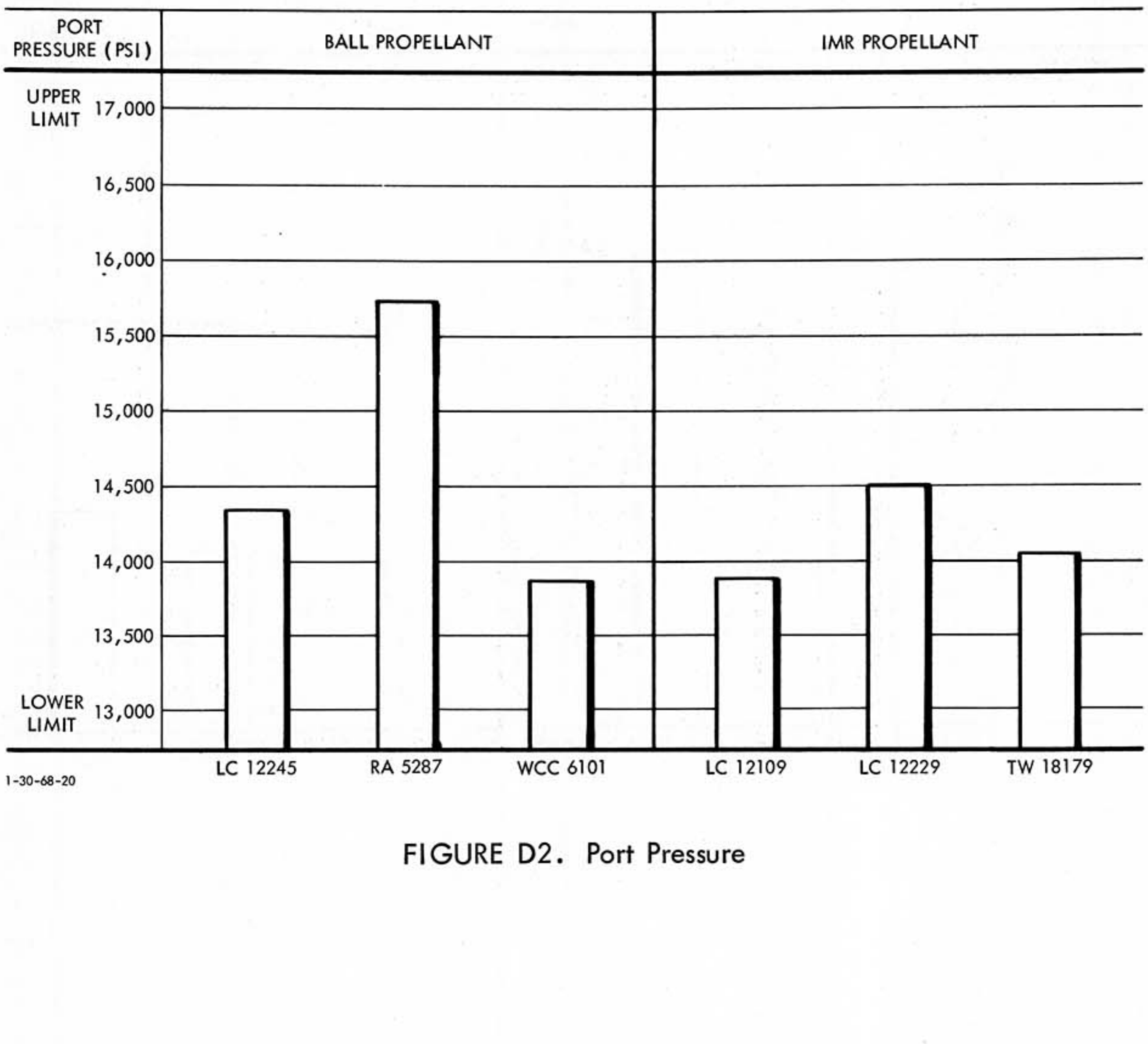

FIGURE D2. Port Pressure

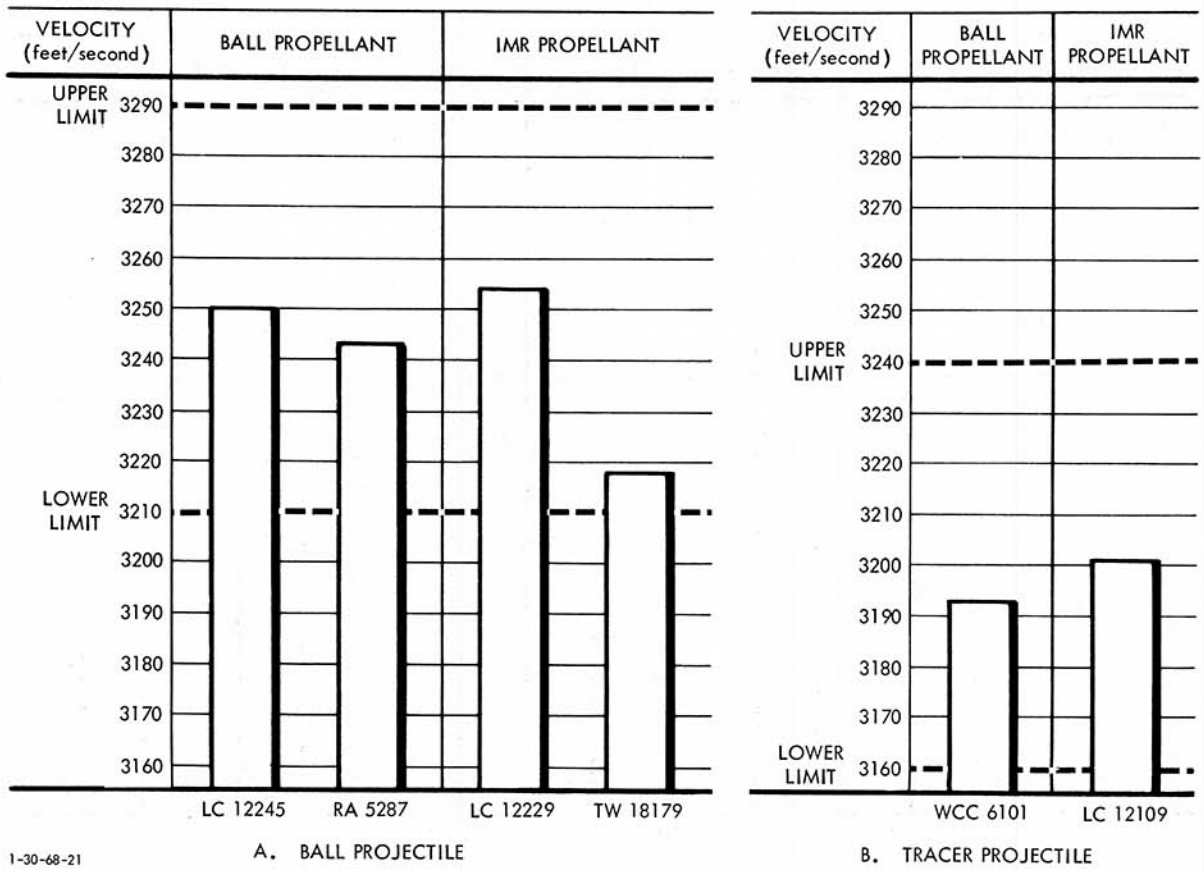

FIGURE D3. Velocity

All test ammunition was segregated by test symbol and placed in four separate loading rooms marked with both the color code for the magazines to be loaded and the test symbol numbers as shown in Table D3.

Table D3. 5.56mm AMMUNITION

Fired By	Propel-lant	Test Symbol	Lot Numbers	Color Code
1st Squad each Platoon	Ball	$A_1 = M_1 + M_5$	M_1 = RA 5287 (Ball Proj) M_5 = WCC 6101 (Tracer Proj)	Green
2nd Squad each Platoon	Ball	$A_2 = M_2 + M_5$	M_2 = LC 12245 (Ball Proj) M_5 = WCC 6101 (Tracer Proj)	Red
3rd Squad each Platoon	IMR	$A_3 = M_3 + M_6$	M_3 = TW 18179 (Ball Proj) M_6 = LC 12109 (Tracer Proj)	Blue
4th Squad each Platoon	IMR	$A_4 = M_4 + M_6$	M_4 = LC 12229 (Ball Proj) M_6 = LC 12109 (Tracer Proj)	Yellow

After the magazines were loaded with the proper ammunition, they were packed in boxes marked with the magazine color coding and then delivered to each environmental site. The ammunition was then distributed to the individual rifleman on a color code exchange basis, i.e., twelve empty <u>green</u> magazines for twelve full <u>green</u> magazines. The empty magazines were placed back in boxes corresponding to their respective color codes and returned to the loading area for reloading. This system of ammunition loading, control, and distribution was utilized throughout the test.

WSEG Test Site Monitors and USMC personnel spot checked each platoon on a daily basis to insure that each squad was utilizing the ammunition designated for that squad. A WSEG representative checked the loading of ammunition every other day to insure that magazines were being properly loaded. No deviations were noted throughout the test.

The acceptance data sheets for all lots of ammunition utilized in the test follow.

OLIN MATHIESON CHEMICAL CORPORATION
WINCHESTER-WESTERN DIVISION

FINAL ACCEPTANCE REPORT Part 1

Cartridge, 5.56mm Tracer
Lot No. WCC 6101 Date 10/5/67

Accepted X Rejected lst Test X Retest Waiver

. Date Accepted 10/5/67	9. Primer Mix No. 257W
. Quantity Packed 1,175,040	10. Propellant WC846 Lot 1018
. Stock Number 1305-965-0832-A068	11. Army Lot No. A. 44766 B.
. Contract No. DAAA-25-67-C-0510	12. Type Ball, Class
. Spec.-MIL-C-60111 MU Amend #6 Date 5/5/66	13. Ave. Chg.(Gr.) A. 27.0 B.
. Dwg. C10534193 Rev. Date	14. Case Brass Headstamp 67
. Primer Type - Styphnate	15. Bullet Jacket FMCBT
. Primer - 116D	16. Bullet Weight 53.0 Grains

TESTS	NO. RDS.	RECORDS		LIMIT	
A. Accuracy					
1. Mean Radius @200 Yds.	90	2.12		5.0 inches	
B. Action Time	50	1.10		4 ms	
C. Bullet Extraction	25	100		35 LBS. Min.	
D* Chamber Pressure(psi)		Ave.	Ave.+3S.D.	Ave.	Ave.+3SD
2. Normal Temp.	20	51,800	55,100	52,000	58,000
3. +125°F	10	+1200		+5,000	
4. +160°F	10	+1600		+5,000	
5. -65°F.	20	- 200		+5,000	
6. -80°F.				+5,000	
D* Port Pressure(psi)		Average		Average	
7. Normal Temp.	X	13,882		15,000 ±2,000	
8. +125°F	X	+325		±2,000	
9. +160°F.	X	+325		±2,000	
10. -65°F	X	-740		±2,000	
11. -80°F	X			±2,000	
E. FUNCTION & CASUALTY					
12. Ambient Temp.	240	OK		Table III in	
13. +125°F.	120	OK		MIL-C-60111, Amend.	
14. +160°F.	120	OK		2, 9/28/64	
15. -65°F.	240	OK			
16. -80°F.					
F. Mercurous Nitrate	50	0		No Failures	
G. Primer Sens.(Each 1") **	50	H+3S=10.52	H-3S=4.44	H+3S=12", H-3S=3"	
H. Trace	100	2		20 defects	
J. Waterproof	50	0		3 failures	
K. Velocity(FS)					
17. Corr. Inst.Mean@15 ft.	20	3192		3200 ±40 ft./sec.	
18. Standard Deviation		27		40 ft/sec.	
Vari.Corr.Ins.@15 ft.					
19. +125°F.	10	+49		-200 ft./sec.	
20. +160°F.	10	-27		-200 ft./sec.	
21. -65°F.	20	-102		-200 ft./sec.	
22. -80°F.				-200 ft./sec.	
L. Airtightness, Base Closure	X	0		6 failures	

*Chamber and Port Pressure Tests are conducted simultaneously.

** Composite of 14 lots.

2-10-68-3

OLIN MATHIESON CHEMICAL CORPORATION
Winchester-Western Division
FINAL ACCEPTANCE REPORT Part 2
Cartridge, 5.56mm Tracer
Lot No. WCC 6101 Date 10/5/67
Accepted X Rejected ____ 1st Test X Retest ____ Waiver ____

M.	Cartridge Inspection	Number Inspected	Date Completed
	1st	7,560	9/22/67
	2nd		

N.	Defects	Critical	Major	Minor
1.	Classification	Critical	Major	Minor
2.	Acceptable Quality Level %	0	0.25	1.50
3.	Percent Defective		0.13	0.15
4.	No identification paint on bullets			6
5.	Bad identification paint on bullets			2
6.	Scratch (9)			1
7.	Fold (14)			1
8.	Total Length (39)		3	
9.	Cartridge profile failure (40)		4	
10.	DEFECTS CONTINUED ON NEXT PAGE			

Packing Inspection

Defect Classification	Major % Def.	Major AQL %	Minor % Def.	Minor AQL %
1. Container Contents		1.00		2.50
2. Container		1.00		2.50
3. Leak Test		1.00		-
4. Overpack		1.00		2.50

TOTAL AUTHORIZED ROUNDS USED IN TESTS

This lot has been inspected in accordance with contract requirements (except as otherwise authorized and noted below.)

Remarks:

CONTRACTOR REPRESENTATIVE

GOVERNMENT REPRESENTATIVE

2-10-68-4

OLIN MATHIESON CHEMICAL CORPORATION
Winchester-Western Division
FINAL ACCEPTANCE REPORT Part 2
Cartridge, 5.56mm Tracer
Lot No. WCC 6101 Date 10/5/67

Accepted X Rejected ____ 1st Test X Retest ____ Waiver ____

DEFECTS CONTINUED FROM PAGE 2

M. Cartridge Inspection	Number Inspected	Date Completed
1st		
2nd		

N. Defects			
1. Classification	Critical	Major	Minor
2. Acceptable Quality Level %	0	0.25	1.50
3. Percent Defective			
4. Diameter of extractor groove, Max. (41)		1	
5. Diameter of extractor groove, Min. (42)			1
6. Diameter of head (43)		1	
7. Thickness of head (44)		1	
8.			
9.			
10. Total		10	11

Packing Inspection

Defect Classification	Major		Minor	
	% Def.	AQL %	% Def.	AQL %
1. Container Contents	0	1.00	0	2.50
2. Container	0	1.00	0	2.50
3. Leak Test	0	1.00	-	-
4. Overpack	0	1.00	0	2.50

TOTAL AUTHORIZED ROUNDS USED IN TESTS 1205

This lot has been inspected in accordance with contract requirements (except as otherwise authorized and noted below.)

Remarks:

CONTRACTOR REPRESENTATIVE F. R. [signature]

GOVERNMENT REPRESENTATIVE [signature]

2-10-68-5

Sheet 1 of 2 Sheets

RD 1598 Rev. 4 — REMINGTON ARMS COMPANY, INC. — Item #0002 - 850,000

BRIDGEPORT, CONNECTICUT

Quantity Packed: 1,414,480 * — AMMUNITION LOT INSPECTION REPORT — LOT NO.: RA-5247

ITEM: CARTRIDGE, BALL, 5.56 MM M193 — CONTRACT NO.: DAAA-25-67-C0511

Spec. No.: MIL-C-9963D Date: 1 June 1964 Amend No.: 3 Date: 2 November 1966

Drawing No.: D-10523632 Date: 26 June 1963 Rev. No.: C Date: 23 October 1964

Case: Steel ☐ Brass ☒ Head Stamp: (Year) 1967 Fed. Stock No.: None

Primer: 924 Mix: 5067 Primer Lot Nos.: RA2-1084-1038 thru 1094,1096,1098,1099

Propellant: Western Ball WC-846 LOT NO.: 952 & 955 Charge: See below

Loading Dates: Lot 952-27.60 grs.-April 27 Bull.Jkt. GM ☒ GMCS ☐

Lot 955-27.50 grs.-May 1 thru 6, 1967

*Composed of Item 1-Clip Pack - 564,480 rounds (See Sheet #2 of 2 Sheets)
Item 2-Carton Pack - 850,000 rds.

BALLISTIC TESTS

	ROUNDS	RECORD	LIMIT
VELOCITY (fps)			
Normal - Temp. 70° ± 2°F.	20		
Corr. Mean @ 15 ft.		3243	3250±40
Standard Deviation		26'	40'Max.
High Temperature			
125°F. - 4 hrs.	10	-9	-250
160°F-4 hrs.then 70°-6 hrs.	10	-12	-250
Low Temperature			
-65° - 6 hrs.	20	-186	-250
PRESSURE (CHAMBER)(psi)			
Normal-Temp. 70°±2°F.	20		
Max. Ave.		48,200	52,000 Max.
Max. Ave. + 3s		50,591	58,000 Max.
High Temperature			
125° - 4 hrs.	10	-200	+5,000
160°F-4hrs.then 70°F.-6 hrs.	10	-1100	+5,000
Low Temperature			
-65°F. - 6 hrs.	20	-5200	+5,000
PRESSURE PORT (psi)	20	15,760	15,000 ±2,000
ACTION TIME (milliseconds)	50	1.36	4 max.
ACCURACY - (M.R. @ 200 yds.)	20	1.19"	2.00" max.
FUNCTION & CASUALTY			
AR 15 Rifle Ambient	240	OK	
" " " -High	240	OK	
" " " -Low	240	OK	
CASUALTIES - None			

OTHER TESTS

	ROUNDS	RECORD	LIMIT
BULLET EXTRACTION	25	55	35min
MERCURY CRACK	50	0	0
WATERPROOF	50	0	3

VISUAL, GAGE & WEIGH INSPECTION

Sample Size 20,750	Crit.	MAJOR	MINOR
Accept.Qual.Level	0.0	0.25	1.50
% Defective	0.0	0.0	0.0
DEFECTS			
TOTAL			

Item #0002 - Carton Pack

PACKING INSPECTION

850 cases (850,000)	MAJOR %Def.	MAJOR AQL	MINOR % Def.	MINOR AQL
Container Contents	0.0	1.0	0.0	2.5
Packed Container	---	1.0	---	2.5
Leak Test	---	1.0		
Overpack	0.0	1.0	0.0	2.5
Overpack-telescope	---	4.0	---	10.0

Port Pressure Variation

125°F. + 560

160°F. + 170

-65°F. - 240

Packed: 20 rounds/carton
50 cartons/fiber container

Primer Sensitivity

H + 3s - 10.52-10.78-10.87-11.15-10.68-10.88-11.21-11.69-11.05-11.41-10.36

H - 3s - 3.92-4.54-3.43-4.13-3.54-[illegible]-3.56-4.19-3.95-4.63-4.27-3.[illegible]4

This Lot of Ammunition Has Met All Requirements For Acceptance.

J. E. Williamson — Contractor Representative — 5/17/67 Date — Joseph [illegible] QAR — Ordnance Representative — 18 May '67 Date

2-10-68-6

Sheet 2 of 2 Sheets

RD 1598 Rev. 4

REMINGTON ARMS COMPANY, INC.
BRIDGEPORT, CONNECTICUT
AMMUNITION LOT INSPECTION REPORT

Item - #0001 - 564,480

Quantity Packed: 1,414,480 *

LOT NO. RA-5287

ITEM: CARTRIDGE, BALL, 5.56 MM M193 — CONTRACT NO.: DAAA-25-67-C-0511
Spec. No.: MIL-C-9963D — Date: 1 June 1964 — Amend No.: 3 — Date: 2 November 1966
Drawing No.: D-10523632 — Date: 26 June 1963 — Rev. No.: C — Date: 23 October 1964
Case: Steel [ ] Brass [X] Head Stamp: (Year) 1967 — Fed. Stock No.: 1305-926-3930-A071
Primer: 92M — Mix: 5067 — Primer Lot Nos.:
Propellant: Western Ball WC-846 — LOT NO.: — Charge:
Loading Dates: — Bull.Jkt. GM [X] GMCS [ ]

* Composed of Item #2 - Carton Pack -850,000 rds (See sheet #1 of 2 sheets)

BALLISTIC TESTS Item #1-Clip Pack 654,480 rds.

	ROUNDS	RECORD	LIMIT
VELOCITY (fps)			
Normal - Temp. 70° ± 2°F.			
Corr. Mean @ 15 ft.			3250±40
Standard Deviation			40' Max.
High Temperature			
125°F. - 4 hrs.			-250
160°F-4 hrs.then 70°-6 hrs.			-250
Low Temperature			
-65° - 6 hrs.			-250
PRESSURE (CHAMBER)(psi)			
Normal-Temp. 70°±2°F.			
Max. Ave.			52,000 Max.
Max. Ave. + 3s			58,000 Max.
High Temperature			
125° - 4 hrs.			+5,000
160°F-4hrs.then 70°F.-6 hrs.			+5,000
Low Temperature			
-65°F. - 6 hrs.			+5,000
PRESSURE PORT (psi)			15,000 ±2,000
ACTION TIME (milliseconds)			4 max.
ACCURACY - (M.R. @ 200 yds.)			2.00" max.
FUNCTION & CASUALTY			
AR 15 Rifle Ambient			
" " " -High			
" " " -Low			
CASUALTIES			

OTHER TESTS

	ROUNDS	RECORD	LIMIT
BULLET EXTRACTION			
MERCURY CRACK			
WATERPROOF			

VISUAL, GAGE & WEIGH INSPECTION

Sample Size

	Crit.	MAJOR	MINOR
Accept.Qual.Level	0.0	0.25	1.50
% Defective			
DEFECTS			
TOTAL			

Item #0001 - Clip Pack

PACKING INSPECTION

336 crates
564,480

	MAJOR %Def.	MAJOR AQL	MINOR % Def.	MINOR AQL
Container Contents	0.0	1.0	0.0	2.5
Packed Container	0.0	1.0	0.0	2.5
Leak Test	0.0	1.0		
Overpack	0.0	1.0	0.0	2.5
Overpack-telescope	---	4.0	---	10.0

Port Pressure Variation
125°F.
160°F.
-65°F.

Packed:
10 rds/clip
14 clips/XM3 bandoleer
6 bandoleers/M2A1 box
2 M2A1 boxes/wirebound crate
30 crates/pallet

Primer Sensitivity
$\bar{H} + 3s$ -
$\bar{H} - 3s$ -

This Lot of Ammunition Has Met All Requirements For Acceptance.

J. E. Wilhamson [signature] — 5/17/67 — Joseph J. [signature] QAR — 18 May 67

Contractor Representative — Date — Ordnance Representative — Date

2-10-68-7

Date Presented 24 May 1967	**TWIN CITIES ARMY AMMUNITION PLANT**	Contractor: Federal Cartridge Corp.
Quantity Packed 2,427,200 Rds.	**INSPECTION REPORT - 5.56MM**	Contract # DA-36-038-AMC-1099(A)
FSN 1305-926-3970-A066*	ITEM Ctgs. 5.56mm Ball M193	Primer No. 195
	Lot No. TW- 18179	Primer Lot Nos. 200A, B-201A, B-202A
Functional Lot Nos.	Accepted [×] 1st Test [×]	Tracer Mix
AMCMS Code 4810.16.0217.2.49*	Rejected [ ] Retest [ ]	Igniter Mix
	Waiver [ ]	Propellant Type I.M.R. 8208
		A.L. No. 44939-44938
Spec. No. MIL-C-9963-D Rev. Amend. 2		Chg. (Grs) 25.5, 25.7, 25.8, 25.9
ECO Date		Case - Steel [ ] Brass [×]
Dwg. No. D10523632		Headstamp (Yr) 1967
Rev. D Date 2-17-65	Acceptance Date 26 May 1967	Bullet Jacket Gilding Metal

FIRING TESTS

CHAMBER PRESSURE (PSI)	AMB	125°	160°	-65°
RDS FIRED	20	10	10	20
RECORD	50,400	-200	-1600	-3900
LIMIT MAX	52,000	+ 5,000	+ 5,000	+ 5,000
AVG + 3 SD	57,300			
LIMIT MAX	58,000			
PORT PRESSURE (PSI)				
RDS FIRED				
RECORD	14,060	-590	-190	-1170
LIMIT	15,000 ±2,000	±2,000	±2,000	±2,000
VELOCITY @ 15 FT. (FS)				
RDS FIRED	20	10	10	20
RECORD	3218	+58	-7	-127
LIMIT	3250 ± 40	-250	-250	-250
STD DEV	26.2			
LIMIT	40			

	RDS FIRED	RECORD	LIMIT
ACCURACY (INCHES) MEAN RADII @ 200 YDS	90	1.23	2.0
ACTION TIME (MS)	50	1.03	4.0
FUNCTION & CASUALTY RIFLE, 5.56MM, XM16E1	720		
CASUALTIES		None	

TRACE	NO. RDS.	RECORD	LIMIT
NO. TRACING @ 500 YDS			
NO. BULLET BURSTS			
NO. ERRATIC FLIGHTS			
NO. MUZZLE FLASHES			

WATERPROOF TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	3

DESCRIPTION OF DEFECTS

BULLET EXTRACTION TEST (Lbs.)

No. Tested	SPEC. MIN.	NO. FAILED	MAX.	MIN.	MEAN
25	35	0	96	48	67

MERCUROUS NITRATE TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	0

BASE CLOSURE SEAL TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
		3

VISUAL GAGE & WEIGH INSPECTION

1st SAMPLE 2400 DATE 5-24-67
2nd SAMPLE

	CRITICAL	MAJOR	MINOR
AQL %	.04	.25	1.50
% DEFECTIVE		.04	.13
DEFECT NO. & DESCRIPTION		1/46	2/19
TOTAL		1	2

PACKING INSPECTION - CONTAINER CONTENT

MAJOR % DEFECTIVE	MAJOR AQL %	MINOR % DEFECTIVE	MINOR AQL %
0	1.0	0	2.5

TOTAL AUTHORIZED RDS EXPENDED IN TESTS: 1030

REMARKS: *This carton packed lot charged against PRON: F6-7-A2037-01-FO-FN, (10-rd clip), authority per SMUAP Form 1018, May 1967.

PAGE ______ OF ______

CHIEF BALLISTICIAN TCAAP

May 1967
Acting-CHIEF, GOVERNMENT QA DIVISION

2-10-68-8

Date Presented	5 May 1967
Quantity Packed	2,380,560 Rds.
FSN	1305-914-4675-A130
Functional Lot No.	
Contractor:	Fed. Ctg. Corp.
Contract No.	DA-36-038-AMC-1099(A)
Spec. No.	MIL-C-46931B(MU) A/4
EO No. / Date	
Dwg. No.	C10521998
Rev.	F Date 10/5/64
AMCMS Code:	4810.16.9987.2.L3

TWIN CITIES ARMY AMMUNITION PLANT
INSPECTION REPORT - 7.62MM

ITEM: Ctgs. 7.62mm NATO Ball M80
Lot No. - TW- 18103

Accepted [X] Rejected [ ]
1st Test [X] Retest [ ] Waiver [ ]

Acceptance Date 12 May 1967

Primer No.	34
Mix No.	LC 12092
Tracer Mix	
Igniter Mix	
Propellant	WC 846
A. L. No.	44693 - 44699
Chg. (Grs)	45.0 - 45.2 - 45.5
Case:	Brass [X] Steel [ ]
Headstamp (YR)	1967
Bullet Jacket	Gilding Metal

	Fired		LIMITS F/S
VELOCITY @ 78 FT (F/S)			
CORRECTED MEAN	20	2738	2750 ± 30
STANDARD DEVIATION		18.8	32
125° (F) VAR. FROM 68° TO 72°	10	-19	+150 -250
160° (F) VAR. FROM 68° TO 72°	10	-1	+150 -250
-65° (F) VAR. FROM 68° TO 72°	20	-70	+150 -250
CHAMBER PRESSURE (PSI)			NOT MORE THAN PSI
68° TO 72° (F)	20		
CORRECTED MEAN		45,800	50,000
MAX. READING		48,600	55,000
MEAN + 3 STD. DEV.		50,400	55,000
125° (F) VAR. FROM 68° TO 72°	10	-2200	+5,000 -15,000
160° (F) VAR. FROM 68° TO 72°	10	-1000	+5,000 -15,000
-65 (F) VAR. FROM 68° TO 72°	20	-3200	+5,000 -15,000
PORT PRESSURE (PSI) MEAN	20	10,850	12,000 ± 2,000
ACCURACY (Inches)			5.0 Ctn or Clip 7.5" Link
AVG. MEAN RADII @ 600 YDS.	90	4.0	
EXTREME SPREAD		18.2	
VERTICAL SPREAD		17.2	
ACTION TIME (MS) MAX. READING	50	1.36	4.0 M/S

NO. TRACING @ 850 YDS		
NO. BULLET BURSTS		
NO. ERRATIC FLIGHTS		
NO. MUZZLE FLASHES		

WATERPROOF TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	3

DESCRIPTION OF DEFECTS

BULLET EXTRACTION TEST (Lbs.)

NO. TESTED	SPEC. MIN.	NO. FAILED	MAX.	MIN.	MEAN
25	60	0	236	100	165

MERCUROUS NITRATE TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	0

BASE CLOSURE SEAL TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT

HARDNESS EXTERIOR SURFACE OF CASE

SAMPLE SIZE	NO. FAILED	SPEC. LIMIT
10	0	0

HARDNESS HEAD AXIAL SECTION OF CASE

SAMPLE SIZE	NO. FAILED	SPEC. LIMIT
10	0	0

GRAIN STRUCTURE OF CASE

SAMPLE SIZE	NO. FAILED	SPEC. LIMIT
10	0	0

Description of Defects

FUNCTION

GUN, MACH.	AMB	125° F	160° F	-65° F	RECORD	LIMIT
M60	300	50	50	100		
M73						INFO
MLE 1952	300	50	50	100		
RIFLES						
M14	120	40	40	80		
FN (LAR)	120	40	40	80		
G3	120	40	40	80		
L1A1	120	40	40	80		

CASUALTIES	RECORD	LIMIT
Perforated Primer	1	2
Small Primer Leaks	5	45

VISUAL GAGE & WEIGH INSPECTION

1st SAMPLE 2400 DATE 5/5/67
2nd SAMPLE

	CRITICAL	MAJOR	MINOR
AQL %		.25	1.50
% DEFECTIVE		.08	.27
DEFECT NO. & DESCRIPTION			
		1/8	3/19
		1/40	1/12
TOTAL		2	4

PACKING INSPECTION—CONTAINER CONTENT

MAJOR % DEFECTIVE	MAJOR AQL %	MINOR % DEFECTIVE	MINOR AQL %
1	1.0	3	2.5

TOTAL AUTHORIZED RDS EXPENDED IN TESTS: 2460

REMARKS:
This lot marked with NATO Symbol of Interchangeability.

PAGE ______ OF ______

A. Anderson
Chief Ballistician, TGAAP

Acting CHIEF, Q. A. DIVISION 12 May 67

2-10-68-9

LAKE CITY ARMY AMMUNITION PLANT
INSPECTION REPORT - 5.56MM

DATE PRESENTED 9-8-67
QUANTITY PACKED 1,602,280
FSN 1305-914-4719-(A068) R#
FUNCTIONAL LOT NOS.
AMCMS CODE 4810.16.0185.2.03.FY68
SPEC. NO. MIL-C-60111 (MU) REV. A/6
ECO DATE 5-5-66
DWG. NO. D-10534193
REV C DATE 8-16-66

ITEM Ctg., Tracer, M196
LOT NO. LC 12109
ACCEPTED [X] 1ST TEST [X]
REJECTED [ ] RETEST [ ]
WAIVER [ ]
ACCEPTANCE DATE 18 Sept, 1967

CONTRACTOR: REM ARMS CO, INC.
CONTRACT NO. DA-49-010-AMC-3(A)
PRIMER NO. 41 MIX FA956
PRIMER LOT NOS. 10-206, 207, 208
TRACER MIX R-284
IGNITER MIX R-20C
PROPELLANT TYPE IMR 8208M
A.L. NO. 44343
CHG (GRS) 24.3
CASE- STEEL [ ] BRASS [XXX]
HEADSTAMP (YR) LC 67
BULLET JACKET Gilding Metal

FIRING TESTS

CHAMBER PRESSURE (PSI)	AMB	125°	160°	-65°
RDS FIRED	20	10	10	20
RECORD	50200	+1415	-315	-1490
LIMIT - MAX	52,000	+5,000	+5,000	+5,000
AVG + 3 SD	53800			
LIMIT - MAX	58,000			
PORT PRESSURE (PSI)				
RDS FIRED	20	10	10	20
RECORD	13900	+290	+200	-260
LIMIT	15,000 ±2,000	±2,000	±2,000	±2,000
VELOCITY @ 15 FT (FS)				
RDS FIRED	20	10	10	20
RECORD	3201	+32	-16	-91
LIMIT	3200±40	-250	-250	-250
STD DEV	21.0			
LIMIT	40			

ACCURACY (INCHES)	RDS FIRED	RECORD	LIMIT
MEAN RADII @ 200 YDS	90	3.17	5.0
ACTION TIME (MS)	50	1.61	4.0

FUNCTION & CASUALTY	RDS FIRED	RECORD	LIMIT
RIFLE, 5.56MM, XM16E1	720	OK	
CASUALTIES			
None			

TRACE	NO. RDS.	RECORD	LIMIT
NO. TRACING @ 500 YDS	100	93	79
NO. BULLET BURSTS		0	
NO. ERRATIC FLIGHTS		0	
NO. MUZZLE FLASHES		0	

WATERPROOF TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	1	3

DESCRIPTION OF DEFECTS
1 ctg. w/2 or more mouth bubbles @ 7½ PSI for 30 sec.

BULLET EXTRACTION TEST (LBS)

NO. TESTED	SPEC. MIN.	NO. FAILED	MAX.	MIN.	MEAN
25	35	0	118	60	92

MERCUROUS NITRATE TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	1

BASE CLOSURE SEAL TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
25	0	3

VISUAL, GAGE & WEIGH INSPECTION

1ST SAMPLE DATE
2ND SAMPLE

	CRITICAL	MAJOR	MINOR
AQL %	.04	.25	1.50
% DEFECTIVE			
DEFECT NO. & DESCRIPTION			
TOTAL			

PACKING INSPECTION - CONTAINER CONTENT

MAJOR		MINOR	
% DEFECTIVE	AQL %	% DEFECTIVE	AQL %
	1.0		2.5

TOTAL AUTHORIZED RDS EXPENDED IN TESTS: 1205

REMARKS:

PAGE 1 OF 1

for QUALITY ASSURANCE REPRESENTATIVE

2-10-68-10

DATE PRESENTED 7-31-67	LAKE CITY ARMY AMMUNITION PLANT INSPECTION REPORT - 5.56MM	CONTRACTOR: REM ARMS CO. INC.
QUANTITY PACKED 1,370,880	ITEM Ctg., Ball, M193	CONTRACT NO. DA-49-010-AMC-3(A)
FSN 1305-926-3930(A071) R	LOT NO. LC 12229	PRIMER NO. 41 MIX FA956
FUNCTIONAL LOT NOS.	ACCEPTED [X] 1ST TEST [ ]	PRIMER LOT NOS. 10-180, 10-181, 10-182
AMCMS CODE 4810.16.0217.2.FA.FY 67	REJECTED [ ] RETEST [X]	TRACER MIX
SPEC. NO MIL-C-9963D REV. A/2	WAIVER [ ]	IGNITER MIX
ECO DATE 5-5-66	ACCEPTED, RETEST	PROPELLANT TYPE IMR 8208M
DWG. NO. D10523632	REJECTED DATE 31 July 1967	A.L. NO. 44940
REV D DATE 2-17-65	ACCEPTANCE DATE 4 August 1967	CHG (GRS) 251
		CASE- STEEL [ ] BRASS [X]
		HEADSTAMP (YR) lc 67
		BULLET JACKET Gilding Metal

FIRING TESTS

CHAMBER PRESSURE (PSI)	AMB	125°	160°	-65°
RDS FIRED	20	10	10	20
RECORD	50400	-300	-2120	-1135
LIMIT - MAX	52,000	+5,000	+5,000	+5,000
AVG + 3 SD	56000			
LIMIT - MAX	58,000			
PORT PRESSURE (PSI)				
RDS FIRED	20	10	10	20
RECORD	14500	+320	+10	-205
LIMIT	15,000 ±2,000	±2,000	±2,000	±2,000
VELOCITY @ 15 FT (FS)				
RDS FIRED	20	10	10	20
RECORD	3254	+23	-18	-59
LIMIT	3250±40	-250	-250	-250
STD DEV	16.0			
LIMIT	40			

ACCURACY (INCHES)	RDS FIRED	RECORD	LIMIT
MEAN RADII @ 200 YDS	90	2.19*	2.0
ACTION TIME (MS)	50	1.07	4.0

FUNCTION & CASUALTY	RDS FIRED	RECORD	LIMIT
RIFLE, 5.56MM, XM16E1	720	OK	

CASUALTIES

None

TRACE

	NO. RDS.	RECORD	LIMIT
NO. TRACING @ 500 YDS			
NO. BULLET BURSTS			
NO. ERRATIC FLIGHTS			
NO. MUZZLE FLASHES			

WATERPROOF TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	3

DESCRIPTION OF DEFECTS

None

BULLET EXTRACTION TEST (LBS)

NO. TESTED	SPEC. MIN.	NO. FAILED	MAX.	MIN.	MEAN
25	35	0	95	49	70

MERCUROUS NITRATE TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	1

BASE CLOSURE SEAL TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
		3

VISUAL, GAGE & WEIGH INSPECTION

1ST SAMPLE DATE

2ND SAMPLE

	CRITICAL	MAJOR	MINOR
AQL %	.04	.25	1.50
% DEFECTIVE			
DEFECT NO. & DESCRIPTION			
TOTAL			

PACKING INSPECTION - CONTAINER CONTENT

MAJOR % DEFECTIVE	MAJOR AQL %	MINOR % DEFECTIVE	MINOR AQL %
	1.0		2.5

TOTAL AUTHORIZED RDS EXPENDED IN TESTS: 1105

REMARKS: *Rejected 1st test for accuracy. Accepted on retest with 180 additional rounds, Results: 1.61.

ACCEPTED, RETEST

PAGE 1 OF 1

Carl Kay for H. McEwen
QUALITY ASSURANCE REPRESENTATIVE

2-10-68-11

DATE PRESENTED 8-17-67 QUANTITY PACKED 2,036,160 FSN 1305-926-3930-(A071) FUNCTIONAL LOT NOS. RH AMCMS CODE 4810.16.0217.2.80.FY66 SPEC. NO. MIL-C-9963D REV. A/2 ECO DATE 5-5-66 DWG. NO. D-10523632 REV D DATE 2-17-65	LAKE CITY ARMY AMMUNITION PLANT INSPECTION REPORT - 5.56MM ITEM Ctg., 5.56mm, Ball, M193 LOT NO. LC 12245 ACCEPTED [XX] 1ST TEST [ ] REJECTED [ ] RETEST [XX] WAIVER [ ] ACCEPTANCE DATE 25 August 1967	CONTRACTOR: Rem Arms Co. Inc. CONTRACT NO. DA-49-010-AMC-3(A) PRIMER NO. 41 MIX FA956 PRIMER LOT NOS. 10-196, 10-197 TRACER MIX IGNITER MIX PROPELLANT TYPE WC 846 A.L. NO. 44960, 44942 CHG (GRS) 28.0, 27.3, 27.4 CASE- STEEL [ ] BRASS [XX] HEADSTAMP (YR) LC 67 BULLET JACKET Gilding Metal

FIRING TESTS

	AMB	125°	160°	-65°
CHAMBER PRESSURE (PSI)				
RDS FIRED	20	10	10	20
RECORD	47500	+1445	+75	-1180
LIMIT - MAX	52,000	+5,000	+5,000	+5,000
AVG + 3 SD	52700			
LIMIT - MAX	58,000			
PORT PRESSURE (PSI)				
RDS FIRED	20	10	10	20
RECORD	14300	+125	-125	-400
LIMIT	15,000 ±2,000	±2,000	±2,000	±2,000
VELOCITY @ 15 FT (FS)				
RDS FIRED	20	10	10	20
RECORD	3250	+14	-14	-88
LIMIT	3250±40	-250	-250	-250
STD DEV	25.0			
LIMIT	40			

ACCURACY (INCHES)	RDS FIRED	RECORD	LIMIT
MEAN RADII @ 200 YDS	90	2.09*	2.0
ACTION TIME (MS)	50	1.14	4.0

FUNCTION & CASUALTY	RDS FIRED	RECORD	LIMIT
RIFLE, 5.56MM, XM16E1	720	O.K.	
CASUALTIES None			

TRACE	NO. RDS.	RECORD	LIMIT
NO. TRACING @ 500 YDS			
NO. BULLET BURSTS			
NO. ERRATIC FLIGHTS			
NO. MUZZLE FLASHES			

WATERPROOF TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	3

DESCRIPTION OF DEFECTS: None

BULLET EXTRACTION TEST (LBS)

NO. TESTED	SPEC. MIN.	NO. FAILED	MAX.	MIN.	MEAN
25	35	0	81	52	66

MERCUROUS NITRATE TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	1

BASE CLOSURE SEAL TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
		3

VISUAL, GAGE & WEIGH INSPECTION

1ST SAMPLE DATE
2ND SAMPLE

	CRITICAL	MAJOR	MINOR
AQL %	.04	.25	1.50
% DEFECTIVE			
DEFECT NO. & DESCRIPTION			
TOTAL			

PACKING INSPECTION - CONTAINER CONTENT

MAJOR % DEFECTIVE	MAJOR AQL %	MINOR % DEFECTIVE	MINOR AQL %
	1.0		2.5

TOTAL AUTHORIZED RDS EXPENDED IN TESTS: 1105

REMARKS: * Accepted on retest with MR of 1.42, [illegible]

PAGE 1 OF 1

Carl Hoge for N. McEnery
QUALITY ASSURANCE REPRESENTATIVE

2-10-68-12

DATE PRESENTED	4-13-67
QUANTITY PACKED	1,036,840
FSN	1305-882-5678-(A124) R
FUNCTIONAL LOT NO.	
CONTRACTOR:	REM ARMS CO. INC.
CONTRACT NO.	DA-49-010-AMC-3(A)
SPEC. NO.	MIL-C-46281B (MU) A/2
EO NO.	S-40111 6-48162; DATE 6-18-64
DWG NO.	C-10522000
REV.	D; DATE 2-10-65

LAKE CITY ARMY AMMUNITION PLANT
INSPECTION REPORT - 7.62MM

ITEM: Ctg., NATO, Tracer, M62
LOT NO. - LC 12644

ACCEPTED [X] 1ST TEST [X]
REJECTED [ ] RETEST [ ]
WAIVER [ ]

ACCEPTANCE DATE 24 Apr 67 & 9 May 67 ✓

PRIMER NO.	#34; MIX NO. FA 956
PRIMER LOT NO:	4-1450, 1451
TRACER MIX	R-284
IGNITER MIX	I-136 I-280
PROPELLANT	WC 846
A. L. NO.	44586, 44694
CHG. (GRS)	43.5, 44.3
CASE:	BRASS [X] STEEL [ ]
HEADSTAMP (YR)	LC 67
BULLET JACKET	Gilding Metal

AMCMS Code: 4810.16.9987.2.BL.FY66

FIRING TESTS	RDS FIRED	RECORD	LIMIT
VELOCITY @ 78 FT (F/S)			
CORRECTED MEAN	20	2664	2680±30
STANDARD DEVIATION		11	32
125° (F) VAR. FROM 68° TO 72°	10	+39	+150 / -250
160° (F) VAR. FROM 68° TO 72°	10	-2	+150 / -250
-65° (F) VAR. FROM 68° TO 72°	20	-56	+150 / -250
CHAMBER PRESSURE (PSI) 68° TO 72° (F)	20		Max
CORRECTED MEAN		45700	50000
MAX READING		48000	Info
MEAN + 3 STD. DEV.		49900	Info
125° (F) VAR. FROM 68° TO 72°	10	+2185	+5000 / -15000
160° (F) VAR. FROM 68° TO 72°	10	+275	+5000 / -15000
-65° (F) VAR. FROM 68° TO 72°	20	-2025	+5000 / -15000
PORT PRESSURE (PSI) MEAN	20	10800	12500 +2000
ACCURACY (INCHES) AVG. MEAN RADII @ 600YDS	90	6.4	15.0
EXTREME SPREAD			
VERTICAL SPREAD			
ACTION TIME (MS) MAX. READING	50	1.42	4.0

FUNCTION

GUN, MACH.	AMB	125° F	160°F	-65°F	RECORD	LIMIT
M60	300	50	50	100	OK	
M73	1000				OK	INFO
MLE 1952	300	50	50	100	OK	
RIFLES						
M14	120	40	40	80	OK	
FN (LAR)	120	40	40	80	OK	
G3	120	40	40	80	OK	
L1A1	120	40	40	80	OK	

CASUALTIES	RECORD	LIMIT
None		

TRACE	NO. RDS	RECORD	LIMIT
NO. TRACING @ 850 YDS	200	196	160
NO. BULLET BURSTS		0	0
NO. ERRATIC FLIGHTS		0	0
NO. MUZZLE FLASHES		25	Info

WATERPROOF TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
*50	**1	3

DESCRIPTION OF DEFECTS
**1 ctg w/2 or more mouth bubbles @ 7 1/2 PSI for 30 seconds.

BULLET EXTRACTION TEST (LBS)

NO. TESTED	SPEC. MIN.	NO. FAILED	MAX.	MIN.	MEAN
25	60	0	279	201	234

MERCUROUS NITRATE TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
50	0	0

BASE CLOSURE SEAL TEST

NO. TESTED	NO. FAILED	SPEC. LIMIT
25	0	3

HARDNESS EXTERIOR SURFACE OF CASE

SAMPLE SIZE	NO. FAILED	SPEC. LIMIT
10	0	0

HARDNESS HEAD AXIAL SECTION OF CASE

SAMPLE SIZE	NO. FAILED	SPEC. LIMIT
10	0	0

GRAIN STRUCTURE OF CASE

SAMPLE SIZE	NO. FAILED	SPEC. LIMIT
10	0	0

DESCRIPTION OF DEFECTS

VISUAL GAGE & WEIGH INSPECTION

1ST SAMPLE ________ DATE ________
2ND SAMPLE ________

	CRITICAL	MAJOR	MINOR
[illegible]			
[illegible]			
[illegible]			
SYSTEM EVALUATION			
Contractor Sample 1500		0	0
Government Sample 100		0	0
TOTAL			

PACKING INSPECTION - CONTAINER CONTENT

MAJOR % DEFECTIVE	MAJOR AQL %	MINOR % DEFECTIVE	MINOR AQL %
0	1.0	0	2.5

TOTAL AUTHORIZED RDS EXPENDED IN TESTS: 3755

REMARKS:

NATO interchangeability symbol applied.

*50 additional rounds tested for waterproof vacuum, acceptance not based on waiver as authorized in TT ROB-283-64 dtd 28 Mar 64.

PAGE 1 OF 1

James H McTinkle for
CHIEF INSPECTOR

2-10-68-13

ENCLOSURE E

Enclosure E

DATA COLLECTION

I. GENERAL

The methods, forms and procedures for utilization of personnel employed in the data collection process were developed to satisfy the requirement to obtain valid statistical data regarding rifle malfunctions and the conditions under which those malfunctions occurred. It was necessary to identify the category, nature and -- where possible -- the cause of each rifle malfunction and to record, not only these technical data, but also all the other pertinent facts regarding the controlled test conditions existing at the time of malfunction.

Data collection required qualified small arms technicians who could observe and diagnose rifle malfunctions and competent data collectors who could record data accurately and handle those data in the prescribed manner. In addition, it was necessary to develop a data collection system that would both facilitate the data collection process and provide an organizational structure and and procedures for those engaged in the process.

II. ARMORERS AND DATA COLLECTORS

The test required 40 armorers (10 per platoon). Of these, the USMC furnished 26 and USARSO furnished 14. A total of 64 data collectors (16 per platoon) in NCO grades were furnished by the Marine Corps.

The Marine armorers and data collectors reported into Camp Lejeune between 18 and 20 December 1967. On 19 December two officers from the WSEG staff, two civilians from the IDA staff, and a Marine gunnery sergeant from Quantico thoroughly briefed the officers and NCOs of the Marine test group on the data collection procedures. Data collection forms were furnished and the detailed instructions were given for their use. This enabled the officers and NCOs to conduct a course of instruction for the armorers and data collectors.

On 20 December, two courses of instruction were initiated, one for the armorers and one for the data collectors. Following these courses of instruction, actual firings were conducted at Camp Lejeune and data were collected by the armorers and data collectors from both real and simulated firing malfunctions.

Another purpose of the data collection exercise at Camp Lejeune was to determine if the data collection forms were satisfactory. Although comments were solicited from all of the participants, no changes were proposed.

The Marine armorers and data collectors were deployed to Panama on 29 December 1967. After arrival at Fort Sherman, both armorers and data collectors were given additional training on the data collection forms and the data collection process. A majority of the armorers provided by the USARSO reported at Fort Sherman on 4 January 1968, and, along with Marine armorers, received a two-day course of instruction on 5 and 6 January 1968. The remainder reported on 7 January 1968 and received similar instruction on 8 January 1968.

All armorers, both Marine and Army, and all data collectors participated in a live firing dress rehearsal of the data collection process on 9 and 10 January 1968. Malfunction reports were completed as malfunctions occurred, and recapitulation forms were accomplished after the completion of the rehearsal. Squad and platoon data packages were assembled, and forwarded to the data collection office to complete the check-out of the data collection system procedures.

In order to improve the proficiency of the data collectors, a final period of instruction was conducted on 10 January 1968. A Marine officer, assisted by two officers from the WSEG staff, conducted a review of the data collection forms and procedures. Practice in the correct completion of malfunction reports and recapitulation forms was accomplished using simulated malfunction data.

III. DATA COLLECTION FORMS

The forms used in the data collection process together with instructions for their use are shown in the Appendix.

IV. DATA COLLECTION PROCEDURES

A. GENERAL

Each rifle malfunction was recorded on a Rifle Malfunction Report -- Form #3.

The Rifle Malfunction Report was filled out by the Squad Data Collector for those riflemen and rifles for which he had data recording responsibility.

The procedure followed in handling a rifle malfunction was as follows:

- When a rifle for any reason failed to function, the rifleman signaled that his rifle had malfunctioned by raising his arm to attract the attention of the Armorer and Data Collector.
- The Armorer and Data Collector proceeded to the rifleman who signaled the malfunction.
- The rifle was inspected by the Armorer who identified the category of malfunction, the nature of the malfunction, and -- when possible -- the cause of the malfunction, and gave this information to the Data Collector who recorded it on the Rifle Malfunction Report.
- The Armorer then instructed the rifleman to "clear the malfunction."
- The Data Collector identified the time required for the rifleman to clear the malfunction.

- In some instances the Armorer, in the process of ascertaining the category and nature of the malfunction, was not able to avoid clearing the malfunction. In those cases the Armorer and Data Collector estimated the time required to clear the malfunction.

B. SQUAD DATA COLLECTION PROCEDURES

Four (4) Data Collectors were assigned to each squad of 19 riflemen. Three Data Collectors handled five riflemen each; the fourth handled four. The fourth Data Collector was designated the Squad Senior Data Collector. At the conclusion of each firing period, each Data Collector immediately prepared a Firing Period Recap Form -- Form #4 -- for each rifle for which he had data collection responsibility. When these Form #4s were prepared they were turned in to the Squad Senior Data Collector. The Rifle Malfunction Reports -- Form #3 -- were attached to the appropriate Form #4. The Squad Senior Data Collector was instructed to assure that the Squad Data Package was complete and "in order" before submitting the data package to the Platoon OIC Data Collection.

Ten (10) Armorers were assigned to each platoon of 76 riflemen. At Pina Beach, where the four squads of a platoon fired simultaneously, each of six Armorers monitored eight riflemen and each of four Armorers monitored seven riflemen. In all other firing locations, where only two squads of a platoon fired simultaneously, each of eight Armorers monitored four riflemen and each of two Armorers monitored three riflemen. Each Armorer had the responsibility of identifying to the appropriate Data Collector the category and nature of each rifle malfunction and, whenever he could, the cause.

In most instances the individual Armorers and Data Collectors monitored a particular group of riflemen. There were, however, instances where there were more malfunctions occurring in a particular group of riflemen than there were Armorers and

Data Collectors assigned to that group. In these circumstances, other Armorers and Data Collectors who did not have malfunctions to service were used to help out. The Platoon OIC Data Collection directed these assignments as appropriate.

When a Category III malfunction occurred the Armorer prepared a Category III Failure Data Tag -- Form #6. If a replacement part was needed to restore the rifle to a serviceable condition, the Armorer making the repair was responsible for the preparation of the Replacement Parts Report -- Form #5.

Ammunition Associated with a Malfunction

Each Armorer was also responsible for retrieving the cartridge or cartridge case associated with a rifle malfunction. He placed this cartridge or cartridge case in an "ammunition envelope" provided for this purpose and gave it to the appropriate Data Collector who entered the information required on the face of the envelope. These envelopes were then collected daily and brought to a collection point at Fort Sherman. This ammunition currently is in the custody of WSEG.

Collection of Replaced Rifle Parts

Armorers involved in repairing a rifle of <u>any</u> type saved each part of the rifle which was replaced. The unserviceable part was accompanied by a copy of the Replacement Parts Report -- Form #5.

These replaced parts are also in the custody of WSEG.

C. PLATOON DATA COLLECTION PROCEDURES

One officer from each platoon was assigned as OIC Data Collection. He was responsible for the supply and issue of all necessary forms to the squads, and for the completeness and accuracy of all data collected within his platoon. He also had the responsibility of assuring that the Platoon Data Package was dispatched to the Data Assembly Point at Fort Sherman at the completion of each firing period.

When each platoon completed its Platoon Data Package, the OIC Data Collection notified the Data Assembly Point that the Platoon Data Package was ready for pickup.

D. DATA ASSEMBLY POINT, FORT SHERMAN

The OIC Data Assembly Point (a WSEG officer) was responsible for:

- Collection procedures for the platoon data, the replacement parts and the ammunition associated with a malfunction.
- Review of the Data Packages for accuracy and completeness.
- Dispatch of the Firing Period Data Package to the Data Collection Center at Albrook Air Force Base.

E. DATA COLLECTION CENTER, ALBROOK AFB

The Data Collection/Processing Center was responsible for the collection, reduction and analysis of the test data. This center was operated by personnel from IDA/WSEG, Washington, D. C.

V. SUBSTITUTE RIFLES

All test rifles were given test numbers and assigned to individual riflemen in compliance with the Rifle Numbering Plan. The Rifle Numbering Plan also assigned blocks of numbers to the spare rifles. These Test Rifle Numbers and the corresponding factory serial numbers are shown in Enclosure D.

The initial instructions for the use of spare rifles specified that once a substitute rifle was introduced during a firing period, the substitute rifle would be fired for the remainder of that firing period. In the early stages of the test it became apparent that there were occasions when a rifle could be pulled out of the test, put in serviceable condition, and returned for firing with loss of only a few rounds or, in some instances, no rounds. Accordingly, the initial instructions were modified to permit the original rifle to be returned for firing as soon as repaired.

Whenever a spare rifle was introduced, care was taken to assure that it was of the same test configuration as the rifle it was replacing. For example, when an R_1 rifle experienced a Category III malfunction and was withdrawn, the spare rifle was from the 500 rifle test number series. When an R_2 rifle was replaced, the replacement was from the 600 series.

Appendix

DATA COLLECTION FORMS AND INSTRUCTIONS

TEST FIRING INFORMATION FORM (# 1)

PLATOON 1 SQUAD 1

MAN NO.	NAME	RIFLE TYPE	RIFLE TEST NO.	AMMO TYPE	MAG LOAD	CLEAN CYCLE	ENVIRONMENT FIRING DAY 1 2 3	7 8 9	4 5 6	10 11 12
01		1	101	1	2	1	1	2	3	4
02		1	102	1	2	1	1	2	3	4
03		1	103	1	2	1	1	2	3	4
04		1	104	1	2	2	1	2	3	4
05		1	105	1	2	2	1	2	3	4
06		1	106	1	2	2	1	2	3	4
07		2	107	1	2	1	1	2	3	4
08		3	108	1	2	1	1	2	3	4
09		2	109	1	2	1	1	2	3	4
10		2	110	1	2	2	1	2	3	4
11		3	111	1	2	2	1	2	3	4
12		2	112	1	2	2	1	2	3	4
13		4	113	5	2	1	1	2	3	4
14		4	114	5	2	1	1	2	3	4
15		4	115	5	2	1	1	2	3	4
16		4	116	5	2	2	1	2	3	4
17		4	117	5	2	2	1	2	3	4
18		4	118	5	2	2	1	2	3	4
19		1	119	1	1	3	1	2	3	4
	SUBSTITUTE RIFLEMEN (IF ANY)									

INFORMATION ON THIS FORM APPLICABLE ONLY TO SQUAD 1 OF PLATOON 1

2-10-68-14

INSTRUCTIONS FOR COMPLETING TEST FIRING INFORMATION FORM (#1)

The purpose of the Test Firing Information Form (#1) is to provide to data collectors the information required to complete the Rifle Malfunction Report (#3). The Form #1 will be completed each day by Senior Squad Data Collectors who will then provide copies to data collectors in their squads. Only the Senior Squad Data Collector's copy will be turned in with other data at the completion of each firing period.

SPECIFIC INSTRUCTIONS

Enter the name of each rifleman in the "Name" column on the form, opposite the correct number of the man's position in the squad.

If, at any time during a firing period, a rifleman is replaced, his name should be lined out, and the name of the substitute rifleman inserted in the lower section of the Form. On the same line, the substitute's position number in the squad, rifle type, rifle test number, ammo type, magazine load, cleaning cycle, and environmental sequence should be inserted. These entries are to be identical to the corresponding numbers opposite the name of the man replaced.

If a substitute rifle is introduced at any time, the rifle test number should be changed to agree with the substitute rifle test number.

SQUAD LOG FORM (#2)

SQUAD NO. ________ PLATOON NO. ________

SQUAD LEADER ____________ DATE________

	ARMORER	DATA COLLECTOR	RIFLEMEN NO.
TEAM NO. 1	____________	____________	1,2,3,4,5,
TEAM NO. 2	____________	____________	6,7,8,9,10,
TEAM NO. 3	____________	____________	11,12,13,14,15
TEAM NO. 4	____________	____________	* 16,17,18,19

FIRING DAY ____________ EXPOSURE COURSE: ____________
(Environment)

MORNING FIRE AND MANEUVER TIMES

**START FIRE ____________ FINISH FIRE ____________

START MANEUVER ____________ FINISH MANEUVER ____________

START FIRE ____________ FINISH FIRE ____________

AFTERNOON (OR NIGHT) FIRE AND MANEUVER TIMES

START FIRE ____________ FINISH FIRE ____________

START MANEUVER ____________ FINISH MANEUVER ____________

START FIRE ____________ FINISH FIRE ____________

REMARKS ____

____

____

*Designated as senior squad data collector.
**Omit for those days where morning exercise begins with maneuver.

2-10-68-15

INSTRUCTIONS FOR COMPLETING SQUAD LOG FORM (#2)

The Squad Log Form (#2) will be completed by the Senior Squad Data Collector of each squad prior to start of the day's firning. A copy will be provided to each Data Collector for his use, but only one copy is required to be turned in to the Platoon Data Collection NCO after each day's firing.

The Senior Squad Data Collector will assign individual Data Collectors and Armorers to Teams, as shown on the Form, and ensure that each Team understands from which riflemen, by number, they are to obtain data. Some armorers will be required to serve on more than one team.

The correct firing day number will be entered in the appropriate space. Firing periods will be numbered sequentially from 1 through 24 as follows:

Period 1	Morning period of first firing day
Period 2	Afternoon period of first firing day
Period 3	Morning period of second firing day
--------	------------------------------------
--------	------------------------------------
Period 24	Afternoon period of twelfth firing day

There are four exposure or environmental courses, numbered E_1 through E_4. The correct number to be entered on Form #2 can be obtained from the Test Firing Information Form (#1), using the correct firing day. Each exposure course will be used for three successive days.

RIFLE MALFUNCTION REPORT
(Form #3)

PLATOON ☐ SQUAD ☐ MAN ☐☐ FIRING PERIOD ☐☐

RIFLEMAN'S NAME ______________ LAST ______________ FIRST RIFLE TEST NO. ☐☐☐

RIFLE TYPE ☐ FIRING MODE AT MALFUNCTION (CIRCLE ONE) A SA

CATEGORY OF MALFUNCTION (CHECK ONE) ☐

I. CORRECTABLE IMMEDIATELY BY SHOOTER WITHOUT TOOLS

II. NOT CORRECTABLE IMMEDIATELY, BUT REQUIRES CLEANING, FIELD STRIPPING. LUBRICATION, OR MINOR ADJUSTMENT BY SHOOTER

III. NOT CORRECTABLE BY SHOOTER

NATURE OF MALFUNCTION (CIRCLE ONE) ☐☐

01. FAILURE TO FEED
02. FAILURE TO CHAMBER
03. FAILURE TO LOCK
04. FAILURE TO FIRE
05. FAILURE TO UNLOCK
06. FAILURE TO EXTRACT
07. FAILURE TO EJECT
08. FAILURE TO COCK
09. FAILURE TO LOAD BY HAND CHARGING
10. FIRING WITHOUT TRIGGER BEING PULLED
11. FAILURE TO MAINTAIN CYCLIC RATE
12. DOUBLE-FEED, TWO ROUNDS FED FROM MAGAZINE AT ONCE
13. FIRES WITH SELECTOR ON SAFE
14. BOLT CATCH ENGAGED BOLT CARRIER INSTEAD OF BOLT AFTER FIRING THE LAST ROUND IN THE MAGAZINE
15. FIRED ON CLOSURE OF BOLT
16. FAILURE OF MAGAZINE TO LOCK IN RIFLE
17. FAILURE OF TRIGGER TO RETURN TO FORWARD POSITION
18. FAILURE OF BOLT TO REMAIN AT REAR AFTER LAST ROUND
19. FAILURE OF BOLT TO GO FORWARD
20. FIRED TWO OR MORE ROUNDS WITH 1 TRIGGER PULL (SEMI-AUTOMATIC MODE)
21. SINGLE SHOT (IN AUTOMATIC MODE)
22. CARTRIDGE RIM SHEAR
23. SELECTOR LEVER INOPERATIVE
24. OTHER (EXPLAIN IN REMARKS SPACE)

MAGAZINE NUMBER AT MALFUNCTION ☐☐ MAGAZINE LOAD (CIRCLE ONE) 18 20

WAS IT FIRST CARTRIDGE IN MAGAZINE? ◯ SECOND CARTRIDGE? ◯

BEST ESTIMATE OF MAGAZINE ROUND NO. WHERE MALFUNCTION OCCURRED ☐☐

TIME TO CLEAR MALFUNCTION: MINUTES ☐☐ SECONDS ☐☐

CAUSE OF MALFUNCTION (IF KNOWN) ☐☐

ROUND AT WHICH UNSCHEDULED COMPLETE CLEANING OCCURRED ☐☐☐

TEST NUMBER OF SUBSTITUTE RIFLE (IF ANY) ☐☐☐

ROUND AT WHICH SUBSTITUTE RIFLE INTRODUCED (THIS FIRING PERIOD) ☐☐☐

REMARKS ____

____

____

NAMES OF ARMORER ______________ DATA COLLECTOR ______________

2-10-68-16

INSTRUCTIONS FOR COMPLETING THE RIFLE MALFUNCTION REPORT (FORM #3)

A. GENERAL

The Rifle Malfunction Report will be used for recording each rifle malfunction, irrespective of its category, nature or cause.

The Rifle Malfunction Report will be filled out by the Squad Data Collector for those riflemen and rifles for which he has been assigned data recording responsibility. (See Squad Log Form #2.)

The procedure to be followed in handling a rifle malfunction is as follows:

1. When a rifle, for any reason, fails to function, the rifleman will signal that his rifle has malfunctioned. This will be by blowing a whistle and making a hand or flag signal to attract the attention of the Armorer and Data Collector.

2. The Armorer and Data Collector will proceed to the rifleman who has signalled the malfunction.

3. The rifleman will hand his rifle to the Armorer who will identify the category of malfunction, the nature of the malfunction and -- when possible -- the cause.

4. The Armorer will then return the rifle to the rifleman with instruction to "clear the malfunction."

5. The Data Collector will identify the time required for the rifleman to clear the malfunction and will obtain from the Armorer and record the category, nature and, if possible, the cause and other information related to the malfunction.

6. In some instances the Armorer, in the process of ascertaining the category and nature of the malfunction, will not be able to avoid

clearing the malfunction. In these cases the Armorer will be able to estimate the time required to clear the malfunction.

7. The Armorer and the Data Collector will not leave the rifleman until all data for the Rifle Malfunction Report requiring the rifleman's cooperation has been entered on the form.

8. The Data Collector will complete all entries on a given Rifle Malfunction Report before starting the preparation of another Rifle Malfunction Report.

B. SPECIFIC INSTRUCTIONS FOR COMPLETING THE FORM

1. PLATOON [ ]

   Enter Platoon number ... 1,2,3, or 4

2. SQUAD [ ]

   Enter Squad number ... 1,2,3, or 4

3. MAN [ ] [ ]

   Enter appropriate man number ... 01 thru 19

4. FIRING PERIOD [ ] [ ]

   Enter appropriate firing period ... 01 thru 24 (i.e. 2 per day for 12 days, numbered consecutively)

For example, the afternoon firing period of the third day would be [0] [6]

The morning firing period of the ninth day will be [1] [7]

5. RIFLEMANS NAME ______________________________

   Last First

   Enter name of the rifleman firing the malfunction rifle.

6. RIFLE TEST NO. [ ] [ ] [ ]

   Enter three digit test number stenciled on stock of rifle.

7. RIFLE TYPE [ ]

   Enter Rifle Type from Form #1.

8. FIRING MODE AT MALFUNCTION A SA

The rifle will be firing in either the automatic mode (A) or semi automatic mode (SA). Circle the appropriate symbol.

9. CATEGORY OF MALFUNCTION

The Armorer will identify the Category of Malfunction, as Category I, Category II or Category III. The Data Collector will (✓) the appropriate item.

If Category I is checked enter [1] in square

If Category II is checked enter [2] in square

If Category III is checked enter [3] in square

10. NATURE OF MALFUNCTION [ ][ ]

The Armorer will identify the Nature of Malfunction from the list (01 thru 24) of items on the Rifle Malfunction Report. The Data Collector will circle the appropriate number, for example (07).

Whatever number is circled is then enetered in the squares ... for example, if 07 is circled then enter [0] [7] in the squares.

11. MAGAZINE NUMBER AT MALFUNCTION [ ][ ]

Enter the number of the magazine that is in the rifle at the time the malfunction occurs. For example, Magazine #3 enter [0] [3] or if Magazine #11 enter [1] [1].

12. MAGAZINE LOAD (Circle One) 18 20

Platoons 1 and 3 will have 20 rounds loaded in magazines.

Platoons 2 and 4 will have 18 rounds loaded in magazines.

The 19th man in each squad will always have an 18 round magazine load. Circle appropriate number.

13. WAS IT FIRST CARTRIDGE IN MAGAZINE ◯ SECOND CARTRIDGE ◯

If the malfunction occurred with the first cartridge, place a check (✓) in the first circle.

If the malfunction occurred with the second cartridge, place a check (✓) in the second circle.

If neither, leave both circles blank.

14. BEST ESTIMATE OF MAGAZINE ROUND NUMBER WHERE MALFUNCTION OCCURRED. ☐☐

When the rifle is firing in the automatic mode it may be difficult to identify the exact round (without, of course, taking out the magazine and counting the rounds remaining). However, the rifleman, in most cases, should be able to estimate fairly accurately where he is in the magazine. If not, then the alternative is to fire out the magazine and count the rounds fired after the malfunction.

For example:

18 round magazine load and firing in automatic mode.

Malfunction occurs.

Rifleman not able to make a good estimate.

After malfunction has been cleared, the rifleman fires out remaining rounds in short bursts and makes a close estimate of rounds fired (i.e. 7 to 9). Subtract 8 from 18 and estimate that malfunction occurred at around 10.

Enter [1] [0] in squares

When firing in the semi-automatic mode, if the rifleman can not make an estimate, then -- after the malfunction has been cleared -- fire out the remaining rounds and get an exact count of rounds fired. Then make the necessary subtraction.

15. TIME TO CLEAR MALFUNCTION: MINUTES ☐☐ SECONDS ☐☐

When the armorer returns the rifle to the rifleman with the instruction to "clear the malfunction" the Data Collector starts to time. (Starts the stop watch.) When the malfunction has been cleared the Data Collector stops the stop watch and notes the elapsed time.

Enter the seconds, if less than 10, as 01 thru 09.
Enter the minutes, if less than 10, as 01 thru 09.

16. CAUSE OF MALFUNCTION (IF KNOWN) ☐☐

The Armorer will refer to his "Cause of Malfunction" card and, if possible for him to identify the cause of malfunction, he will give the Data Collector the appropriate two digit number (i.e. a number from 31 thru 71). This number will be entered in the squares.

17. ROUND AT WHICH UNSCHEDULED COMPLETE CLEANING OCCURRED ☐☐☐

The emphasis here is on unscheduled and complete cleaning. Scheduled complete cleanings are not to be reported. The unscheduled ones are to be reported. Generally, these cleanings will occur in connection with a malfunction. Nevertheless, whenever it is necessary for the rifleman to give his rifle a complete cleaning outside of the regular cleaning cycle it is important that the round be reported at which this complete cleaning occurred.

The procedure for computing this would be (a) to record the magazine number in the rifle -- for example, magazine #8 -- (b) to estimate the number of rounds fired from #8 -- for example, 13 -- (c) to note the magazine loading, -- i.e. either 18 or 20.

If the magazine loading was 18, the computation would be:

7 x 18 = 126 + 13 = 139

In this case the numbers to be entered in the squares would be [1] [3] [9].

If the magazine loading was 20, the computation would be:

7 x 20 = 140 + 13 = 153

In this case the numbers to be entered in the squares would be [1] [5] [3].

18. TEST NUMBER OF SUBSTITUTE RIFLE (If any) ☐☐☐

Whenever a substitute rifle is introduced the three digit number stenciled on the rifle stock is to be entered in these squares.

19. ROUND AT WHICH SUBSTITUTE RIFLE INTRODUCED (This Firing Period) ☐☐☐

The procedure for computing the numbers to be entered is the same procedure as used for computing the ROUND AT WHICH UNSCHEDULED

COMPLETE CLEANING OCCURRED (See Paragraph 17 above).

20. NAMES OF ARMORER ________________ DATA COLLECTOR __________

Enter the name of the Armorer who provided the required data for this malfunction and the name of the Data Collector.

FIRING PERIOD RECAP FORM (#4)

Item No.		CARD COLUMN NUMBER
1	PLATOON NUMBER ______	2
2	SQUAD NUMBER ______	3
3	MAN NUMBER ______	4,5
4	FIRING PERIOD ______	6,7
5	RIFLE TYPE ______	8
6	RIFLE TEST NUMBER ______	9,10,11
7	AMMO TYPE ______	12
8	MAGAZINE LOADING ______	13
9	CLEANING CYCLE ______	14
10	ENVIRONMENT ______	15
11	ROUNDS FIRED THIS PERIOD ______	16, 17, 18
12	NUMBER CAT I MALFUNCTIONS ______	19,20
13	NUMBER CAT II MALFUNCTIONS ______	21
14	NUMBER CAT III MALFUNCTIONS ______	22
15	TOTAL NUMBER MALFUNCTIONS ______	23,24
16	TEST NUMBER SUBSTITUTE RIFLE (IF ANY)	25,26,27
17	CATEGORY OF 1ST MALFUNCTION ______	28
18	NATURE OF MALFUNCTION ______	29,30
19	FIRING MODE WHEN MALFUNCTION OCCURRED ______	31
20	ROUNDS FROM BEGINNING OF FIRING PERIOD ______	32, 33, 34
21	FIRST OR SECOND CARTRIDGE OF MAGAZINE ______	35
22	TIME TO CLEAR MALFUNCTION (IN SECONDS)	36,37,38

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Item No.			
23	CATEGORY OF 2ND MALFUNCTION	☐	39
24	NATURE OF MALFUNCTION	☐☐	40,41
25	FIRING MODE WHEN MALFUNCTION OCCURRED	☐	42
26	ROUNDS FROM PRECEDING MALFUNCTION	☐☐☐	43, 44, 45
27	FIRST OR SECOND CARTRIDGE IN MAGAZINE	☐	46
28	TIME TO CLEAR MALFUNCTION (IN SECONDS)	☐☐☐	47,48,49
29	CATEGORY OF 3RD MALFUNCTION	☐	50
30	NATURE OF MALFUNCTION	☐☐	51,52
31	FIRING MODE WHEN MALFUNCTION OCCURRED	☐	53
32	ROUNDS FROM PRECEDING MALFUNCTION	☐☐☐	54, 55, 56
33	FIRST OR SECOND CARTRIDGE IN MAGAZINE	☐	57
34	TIME TO CLEAR MALFUNCTION IN SECONDS	☐☐☐	58,59,60
35	CATEGORY OF 4TH MALFUNCTION	☐	61
36	NATURE OF MALFUNCTION	☐☐	62,63
37	FIRING MODE WHEN MALFUNCTION OCCURRED	☐	64
38	ROUNDS FROM PRECEDING MALFUNCTION	☐☐☐	65, 66 67
39	FIRST OR SECOND CARTRIDGE IN MAGAZINE	☐	68
40	TIME TO CLEAR MALFUNCTION IN SECONDS	☐☐☐	69,70,71
41	ROUNDS FROM LAST MALFUNCTION TO END OF FIRING PERIOD	☐☐☐	72, 73, 74

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INSTRUCTIONS FOR COMPLETING FIRING PERIOD RECAP FORM (#4)

The Firing Period Recap Form (#4) will be completed by Squad Data Collectors for each rifleman after each firing period. Data required for completion will be found on the Squad Log Form (#2), Test Firing Information Form (#1), and the Malfunction Report Form (#3). When fully completed and checked for completeness, Form #4 will be turned in to the Senior Squad Data Collector.

Specific instructions for completing the form are as follows:

A. IF NO MALFUNCTIONS

Items 1, 2, 3.	Enter Platoon number, Squad number and riflemen number from Form #1. For numbers less than 10 enter 01, 02, 03, etc.
Item 4.	From Form #2. For period numbers less than 10 enter 01, 02, etc.
Items 5, 6, 7, 8, 9, 10.	Enter numbers shown opposite corresponding man number on Form #1.
Item 11.	Leave blank. (To be filled in at Data Collection Center.)
Item 12, 13, 14, 15	Enter zeros in all boxes.

B. IF ONE OR MORE MALFUNCTIONS

Items 1 thru 11.	Same as above.
Item 12.	Enter total number of Cat. I malfunctions from Rifle Malfunction Report Forms

(#3). If number is less than 10, enter 01, 02, 03, etc., as appropriate.

Items 13, 14. Same as above except for Cat. II and Cat. III malfunctions. Enter zero if appropriate.

Item 15. Enter total of entries in Items 12, 13, and 14. If number is less than 10, enter 01, 02, 03, etc., as appropriate.

Item 16. Enter Test Number of Substitute rifle from Form #3 (if any). Otherwise leave blank. Refer to paragraph 3 below for special instructions when substitute rifle is used.

Item 17,18. Enter appropriate numbers from Rifle Malfunction Report Form (#3) for first malfunction.

Item 19. Enter 1 if Firing Mode circled on Form E3 is A. Enter 2 if SA is circled.

Item 20. Leave blank. (To be filled in at Data Collection Center.)

Item 21. Enter 1 if Form #3 indicates malfunction occurred on first round of magazine. Enter 2 if malfunction occurred on second round. Otherwise enter zero.

Item 22. From Form #3. Enter total time in seconds.

Item 23, 24. Enter appropriate numbers from Rifle Malfunction Report (#3) for second malfunction.

Item 25.	Enter 1 if Firing Mode circled on second Form #3 is A. Enter 2 if SA is circled.
Item 26.	Leave blank. (To be filled in at Data Collection Center).
Item 27.	Enter 1 if Form #3 indicates second malfunction occurred on first round of magazine. Enter 2 if malfunction occurred on second round. Otherwise enter zero.
Item 28.	From Form #3 for second malfunction. Enter total time in seconds.
Items 29, 30.	Enter appropriate numbers from Rifle Malfunction Report (#3) for third malfunction.
Item 31.	Enter 1 if Firing Mode circled on third Form #3 is A. Enter 2 if SA is circled.
Item 32.	Leave blank. (To be filled in at Data Collection Center).
Item 33.	Enter 1 if Form #3 indicates third malfunction occurred on first round of magazine. Enter 2 if malfunction occurred on second round. Otherwise enter zero.
Item 34.	From Form #3 for third malfunction. Enter total time in seconds.
Items 35, 36.	Enter appropriate numbers from Rifle Malfunction Report (#3) for fourth malfunction.

Item 37. Enter 1 if Firing Mode circled on fourth Form #3 is A. Enter 2 if SA is circled.

Item 38. Leave blank. (To be filled in at Data Collection Center.)

Item 39. Enter 1 if Form #3 indicates fourth malfunction occurred on first round of magazine. Enter 2 if malfunction occurred on second round. Otherwise zero.

Item 40. From Form #3 for fourth malfunction. Enter total time in seconds.

Item 41. Leave blank. (To be filled in at Data Collection Center.)

A substitute rifle will be used only when a Cat. III malfunction occurs which cannot be quickly repaired by the armorer. When this occurs, the Form #4 for the original rifle will be terminated as of the round number at the time of the malfunction. An additional Form #4 will be prepared for the period during which the substitute rifle is used. Once a substitute rifle is introduced, it will continue in use at least through the remainder of that firing period.[1] Form #4 for the substitute rifle will be prepared in the same manner as for the original rifle.

If five or more malfunctions occur in any one firing period on any one weapon, an additional Form #4 must be used, since that form has space to report a maximum of four malfunctions. In this event, the reverse side (page 2) of the Form #4 will be used as follows:

1. Item 23. Change to read "Category of 5th Malfunction". Items 23, 24, 25, 27 and 28. Complete using information from Malfunction Report (#3) for fifth malfunction, in the same manner as for the previous malfunction. Leave Item #26 blank.

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[1]As explained earlier, this instruction was revised early in the test to permit the original rifle to be returned for firing as soon as repaired.

2. Item 29. Change to read "Category of 6th Malfunction". Items 29, 30, 31, 33 and 34. Complete using information from Malfunction Report (#3) for 6th malfunction. Leave Item #32 blank.

3. Item 35. Change to read "Category of 7th Malfunction". Items 35, 36, 37, 39 and 40. Complete using information from Malfunction Report (#3) for 7th malfunction. Leave Item #38 blank.

REPLACEMENT PARTS REPORT
(FORM #5)

RIFLE TEST NUMBER __________ RIFLE SERIAL NUMBER __________

PLATOON NUMBER _____ SQUAD NUMBER _____ RIFLEMAN NUMBER _____

RIFLE TYPE ______________

FIRING DAY ____________ FIRING PERIOD ___________

MAGAZINE NUMBER AT MALFUNCTION __________________

ESTIMATED ROUND NUMBER IN MAGAZINE AT MALFUNCTION ___________

ARMORER'S NAME ____

ITEM REPLACED ____

REASON FOR REPLACEMENT (Broken, Worn, Damaged, Weak, etc.)

____

CAUSE OF DAMAGE (If Known) __________________________________

____

REMARKS ____

____

____

INSTRUCTIONS FOR COMPLETING REPLACEMENT PARTS REPORTS (#5)

The purpose of the Replacement Parts Report (#5) is to collect data on worn, broken, or otherwise damaged rifle parts which are replaced during the test.

When a CAT. III malfunction occurs, the Squad Data Collector will prepare a Rifle Malfunction Report Form (#3). At the same time the armorer will fill in a CAT. III Failure Data (Form #6) tag and fasten it securely to the test rifle before the rifle is removed from the firing line. The Form #6 will provide information from the Malfunction Report necessary for completing the Replacement Parts Report (#5).

If it is necessary to replace a part in order to repair a rifle which has suffered a CAT. III malfunction, the armorer making such replacement will complete the Replacement Parts Report (Form #5) IN DUPLICATE. One copy will be placed, along with the part replaced and the Form #6, in an envelope, bag, or other appropriate container, and retained at or forwarded to the rifle repair shop at Fort Sherman. The second copy will be forwarded to the Data Collection Center at Albrook Field.

Information will be transcribed from the Form #6 to the Replacement Parts Report (Form #5). Additional information required are the Rifle Serial Number, the name of the part replaced, and the reason for such replacement. The armorer will attempt to determine the most probable cause of the breakage or damage, and will enter such information on the Form #5 if determined.

CAT III FAILURE DATA (FORM #6)

PLATOON # _______ SQUAD # _______ MAN # _______

RIFLE TEST NUMBER _______

FIRING DAY ______________ FIRING PERIOD _______

NATURE OF MALFUNCTION _________________________

MAGAZINE NUMBER AT MALFUNCTION _________________

ESTIMATED ROUND NUMBER IN MAGAZINE WHEN MALFUNCTION OCCURRED ____________________________

THE ABOVE INFORMATION SHOULD AGREE WITH INFORMATION ON THE CORRESPONDING RIFLE MALFUNCTION REPORT (#3)

CAUSE OF MALFUNCTION

31 Caked carbon in receiver

32 Magazine bent or deformed

33 Bolt carrier failure

34 Bolt catch stopped forward movement of bolt before last round was fired from magazine

35 Bolt lacked energy to force round from magazine

36 Bolt overrode base of round in feeding from magazine

37 Defective ammunition (bent, damaged, etc.)

38 Bolt failure

39 Bolt carrier key failure

40 Bolt fails to seat

41 Cam pin failure

42 Firing pin broken or damaged

43 Firing pin retaining pin failure

44 Firing pin improperly assembled

45 Hammer spring broken

46 Disconnector broken

47 Disconnector spring broken

48 Sear broken

49 Sear worn

50 Charging handle failure

51 Gas pressure insufficient

52 Binding bolt and bolt carrier in locked position

53 Dirt in chamber

54 Rust in chamber

55 Extractor worn or fails to function

56 Extractor broken

57 Extractor spring broken

58 Dirty chamber

59 Ejector frozen, damaged, or fails to function

60 Ejector spring damaged or broken

61 Selector lever detent spring rusted

62 Selected lever detent burred or rusted

63 Buffer assembly failure

64 Gas piston rings damaged

65 Lubrication inadequate

66 Improper cleaning

67 Caked carbon in gas cylinder (M14)

68 Gas cylinder plug loose (M14)

69 Operating rod spring weak or damaged (M14)

70 Operating rod bent or damaged (M14)

71 Spindle valve closed (M14)

72 Firing pin struck primer too lightly

73 Weak magazine spring

74 Rounds not positioned properly in mag

75 Shooter did not lock magazine properly

76 Binding bolt rings

77 Foreign matter in lower receiver extension

78 Foreign matter in magazine

79 Dust cover failed to open when bolt went forward

80 Bolt improperly assembled

CAUSE OF MALFUNCTION LIST (FORM #7)

This list initially contained 41 causes of malfunction from which the Armorer -- when possible -- attempted to identify one as the most probable cause. This information was given to the Data Collector for inclusion on the Rifle Malfunction Report. The initial list was printed on a laminated card, and each Armorer had one of these in his possession.

During the 12 days of test firing 9 additional causes of malfunction -- compiled from the remarks section of the Rifle Malfunction Report -- were identified and added to the list. The Cause of Malfunction List shown here contains the initial list (numbers 31 through 71) plus the additions (numbers 72 through 80).

RIFLE CONDITION REPORT (Form #8)

GENERAL CONDITION OF RUSTY OR DAMAGED RIFLES AT END OF EACH 3 DAY PHASE. (Record only rusty or damaged rifles)

Platoon ________________ Phase ________________ Site __________

Rifle Test Number	General Description and specific location of rust or damage.

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RIFLE CONDITION REPORT (FORM #8)

This report was introduced after test firing had begun and was applicable only to those rifles that were visibly rusty or damaged.

INSTRUCTIONS FOR COMPLETING AND COLLECTING RIFLE CONDITION REPORT (FORM 8)

Each WSEG Test Site Monitor assisted by Marine Corps personnel will, at the end of each 3-day phase record the general condition of each visibly rusty or damaged rifle. The Rifle Condition Report (Form 8) will be used for this purpose. Only rusty and/or damaged rifles need be recorded.

Briefly describe the type of damage, extent of damage or rust, and specific location on the rifle of damage or rust.

This report will be furnished to Data Collection by each WSEG Site Monitor no later than noon on the day following the last day of the 3-day phase.