AD

RDT&E PROJECT NO. OR FSN NOT AVAILABLE
USATECOM PROJECT NO. 8-WE-613-016-001
REPORT NO. APG-MT-3493
TEST SPONSOR PROJECT NO. NOT AVAILABLE
USACDC AC NO. NOT AVAILABLE

PRODUCT IMPROVEMENT TEST OF MODIFIED BUTTSTOCK ASSEMBLY FOR M16 AND M16A1 RIFLES

FINAL REPORT

BY

MICHAEL TROST

MARCH 1970

ABERDEEN PROVING GROUND

ABERDEEN PROVING GROUND, MARYLAND

DDC AVAILABILITY NOTICE

This document may be further distributed by any holder only with specific prior approval of US Army Weapons Command, ATTN: Project Manager, Rifles.

REPRODUCTION LIMITATIONS

Reproduction of this document in whole or in part is prohibited except with the permission of USAWECOM, ATTN: Proj. Mgr., Rifles.

DDC is authorized to reproduce this document for United States Government purposes.

DISPOSITION INSTRUCTIONS

Destroy this report in accordance with AR 380-5 when no longer needed. Do not return it to the originator.

DISCLAIMER

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents issued and approved by the Department of the Army.

RDT&E PROJECT NO. OR FSN NOT AVAILABLE

USATECOM PROJECT NO. 8-WE-613-016-001

REPORT NO. APG-MT-3493

TEST SPONSOR PROJECT NO. NOT AVAILABLE

USACDC AC NO. NOT AVAILABLE

PRODUCT IMPROVEMENT TEST OF MODIFIED BUTTSTOCK ASSEMBLY FOR M16 AND M16A1 RIFLES

FINAL REPORT

BY

MICHAEL TROST

MARCH 1970

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND
21005

(Following Page Blank)

TABLE OF CONTENTS

ABSTRACT

Product improvement testing of a redesigned buttstock for the M16 and M16A1 rifles was performed at Aberdeen Proving Ground from 26 August 1969 to 12 January 1970. The durability and usability of the stock in extreme temperatures (-65°F and +155 °F), adverse conditions environments of mud, dust, salt water, high temperature, and humidity and chemical compatibility, and weapon performance at various attitudes were evaluated. The new design was found to provide a compact stowage area, on the weapon, for all necessary cleaning equipment for the rifle. Comparative test results, using the standard buttstock for control, showed that durability of the test item equalled or surpassed that of the standard item. The shortcomings which occurred during testing of the redesigned buttstock, while detracting from its over-all performance, did not prevent usage of the item in any environment. It was recommended that the test buttstock be considered as an acceptable replacement and improvement over the standard item.

FOREWORD

The Materiel Testing Directorate was responsible for preparation of the test plan outline, conduct of the test, and preparation of the test report.

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND 21005

USATECOM PROJECT NO. 8-WE-613-016-001

FINAL REPORT ON PRODUCT IMPROVEMENT TEST OF MODIFIED BUTTSTOCK ASSEMBLY FOR M16 AND M16A1 RIFLES

26 AUGUST 1969 TO 12 JANUARY 1970

SECTION 1. SUMMARY

1.1 BACKGROUND

The buttstocks of the two previous US service rifles (M1 and M14) were constructed with storage space for maintenance equipment which included a combination tool, cleaning rod, bore brush, and oiler. Access to this equipment was gained through a trap door in the butt plate. The currently produced M16 and M16A1 rifle has no provision for a storage compartment; however, a redesigned stock has been fabricated that will meet this requirement.

1.2 DESCRIPTION OF MATERIEL

The test buttstock is a modified version of the standard M16A1 buttstock (control). A storage compartment and a trap-door assembly have been provided. The cavity which is formed in the foam stock filler is lined with a hard reinforcing coating which prevents damage and deterioration to the pliable foam. The cleaning kit which is stored in the buttstock is shown in Figure 1.2-1. The modified butt plate assembly, consisting of a reinforced butt plate and trap-door assembly, is attached to the buttstock by a lower retaining screw which is threaded into a modified lower sling swivel. The buttstock is attached to the rifle in the normal manner (i.e., with the standard butt-cap screw). Figures 1.2-2 through 1.2-4 depict various views of the test item. Figure 1.2-5 shows the control buttstock for comparison.

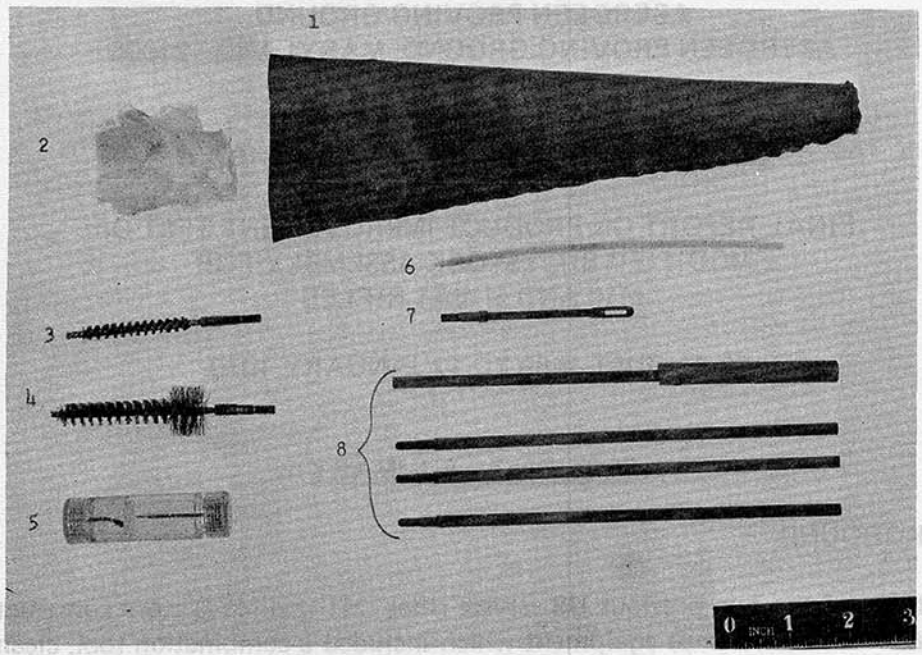

Figure 1.2-1: Cleaning Package and Cleaning Equipment Used in Tests. 1. Envelope. 2. Cleaning Patches. 3. Bore Brush. 4. Chamber Brush. 5. Oiler. 6. Pipe Cleaners. 7. Cleaning Rod Tip. 8. Cleaning Rod.

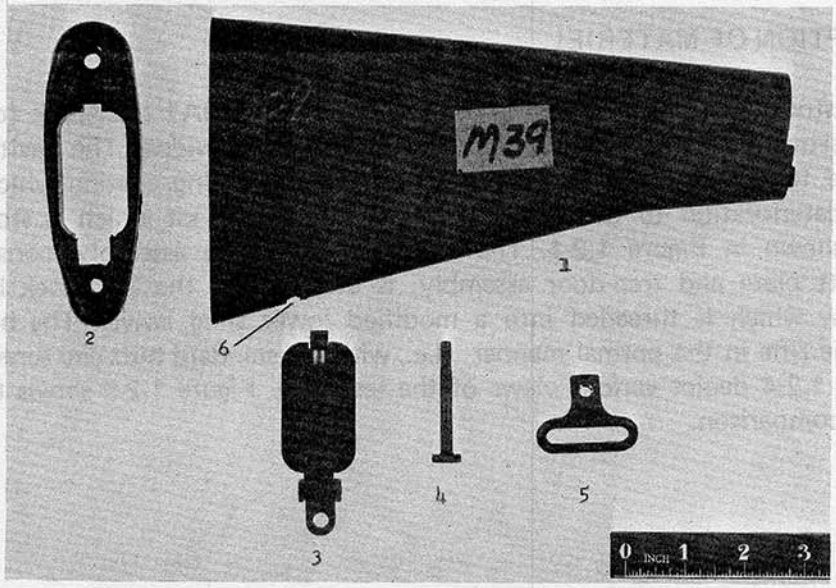

Figure 1.2-2: Disassembled View of Test Buttstock Major Components. 1. Plastic Stock. 2. Rubber Butt Plate. 3. Trap Door Assembly. 4. Butt Plate Retaining Screw (LOWER). 5. Rear Sling Swivel. 6. Slot for Rear Sling Swivel. (Standard Butt Plate Retaining Screw, UPPER, Not Shown).

Figure 1.2-3: Rear View of Modified Buttstock with Trap Door Assembly. LEFT: Closed Position. RIGHT: Open Position with Cleaning Package Kit in Place.

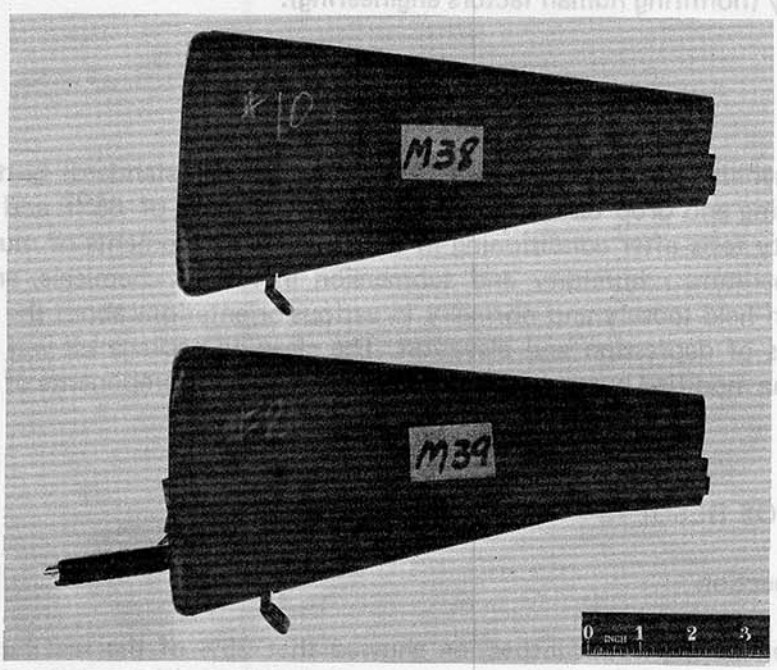

Figure 1.2-4: Side View of Modified Buttstock with Trap Door Assembly. TOP: Closed. BOTTOM: Open.

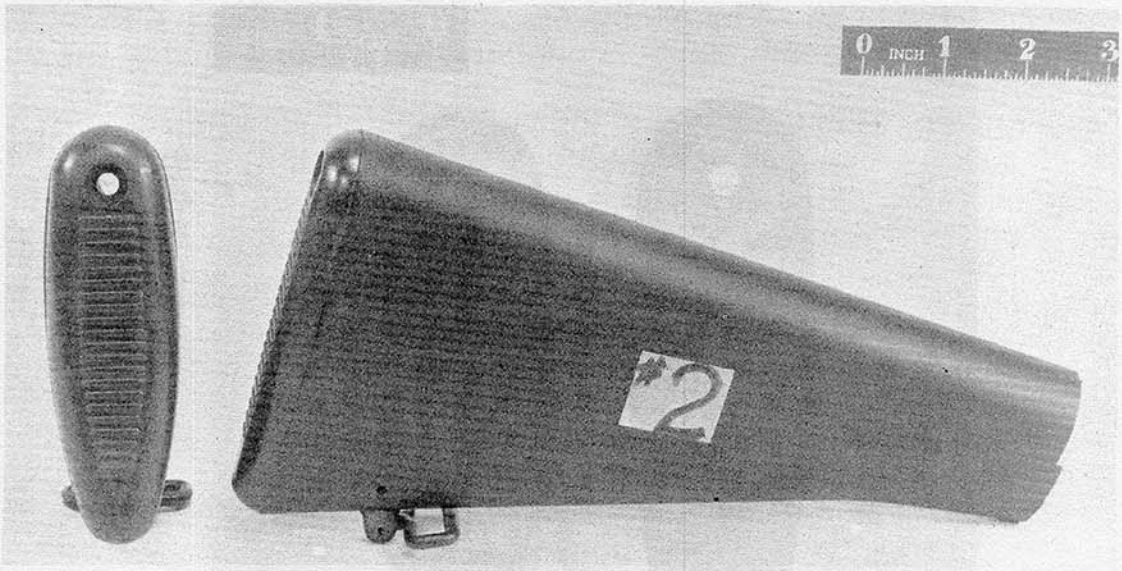

Figure 1.2-5: Rear and Side Views of a Standard (Control) Buttstock.

1.3 TEST OBJECTIVES

The objectives of this test were to comparatively evaluate the standard (control) and modified (test) M16 and M16A1 rifle buttstock for durability (rough handling and firing tests) and usability (nonfiring human factors engineering).

1.4 SCOPE

Durability and usability of the modified and control (test and standard) buttstocks were determined by firing and drop tests at the temperature extremes of -65°F and +155°F; by firing and usability tests after conditioning in the adverse environments of mud, dust, salt water, high temperature - humidity and submersion in various chemicals; and by firing performance when held loosely and normally in various orientations about the longitudinal axis and extremes of depression and elevation. The cleaning package kit was tested as an integral part of the modified buttstock. However, the individual components of the kit were not evaluated.

1.5 SUMMARY OF RESULTS

1.5.1 Initial Inspection

Radiographs taken during initial inspection showed that 25% of the test buttstocks had voids in the foam filler. In one of these stocks an air bubble was formed that intruded into the storage compartment.

The external dimensions of the test and control buttstocks were the same, but the modified buttstocks (with the cleaning equipment inside) weighed 0.75 pound more than the standard buttstock.

It was necessary to use a cartridge or pointed tool to open and close the trap door assembly.

1.5.2 High-Temperature Environment (+155°F).

The rifle and M203 grenade launcher firings had no adverse effects on either the test or control buttstocks. The rifle-grenade firing and 5-foot drop test caused damage to both types of buttstocks. This damage was in the form of chips and gouges in the rubber butt plate and cracks in the plastic stocks. The shock-type force encountered in the rifle grenade firing and drop tests caused the cleaning rod sections to puncture holes in the cleaning kit packages of the test buttstocks (Shortcoming).

1.5.3 Low-Temperature Environment (-65°F)

During the cold test, the trap door assemblies became harder to open and the cleaning packages were frozen in a closed position (Shortcoming). The rifle and M203 grenade launcher firings did not have any adverse effects on either the test or control buttstocks.

The butt plates of the two control buttstocks used in the rifle grenade phase completely shattered before completion of the firing. One of the two test buttstocks used was undamaged and the butt plate of the other was cracked but serviceable.

In the 5-foot drop test the control buttstocks were rendered unusable after the first drops. The test stocks were rendered unusable after four drops (Shortcoming).

The cleaning rods punctured holes in the cleaning kit packages during the rifle grenade firing and the drop tests (Shortcoming).

1.5.4 High-Temperature - Humidity Environment

The environment had no adverse effect on the test buttstocks.

1.5.5 Salt Water Immersion Test

The test buttstocks were evaluated with and without lubrication of the metallic components. The lubricated buttstocks performed satisfactorily. Without lubrication, the metallic components were subject to the corrosive action of the salt. In one instance a 50-pound force applied to the trap door latch was not sufficient to cause its release.

1.5.6 Dust Test

The dust test had no adverse effect on operation of the trap door on the test buttstocks.

1.5.7 Mud Test

Positive latching of the trap door on the test buttstocks was impaired by mud deposits in the locking recess of the butt plate. After unlatching the butt plate, mud seepage filled the locking recess and, after drying, had to be scraped out before the trap door could be securely relatched.

1.5.8 Attitudes Test

The attitudes firing had no adverse effect on either type buttstocks. No malfunctions attributable to either type buttstock occurred during the firing.

1.5.9 Chemical Compatibility Test

Use of various chemicals (specified in par. 2.10.2) had no detrimental effect on the test buttstocks.

1.6 CONCLUSIONS

It is concluded that:

a. Material durability of the test buttstock is considered equal to that of the control buttstock when subjected to firing the rifle with and without the M203 grenade launcher; and equal or superior when firing rifle launched grenades, or when the weapon is dropped onto a concrete surface from a height of 5 feet (ref pars. 2.3.5, 2.4.5, and 2.9.5).

b. Material durability is not adversely affected by nonstandard solvents, lubricants, or insect repellant (ref par. 2.10.5).

c. Operation of the buttstock is not adversely affected in a dusty or high-temperature - humidity environment, but operation is impeded by mud, and in a salt-water environment satisfactory operation is contingent on adequate protection with a rust inhibiting lubricant (ref pars. 2.5.5, 2.6.5, 2.7.5, and 2.8.5).

d. Over-all performance of the test buttstock is equal to that of the control buttstock (ref par. 1.5).

1.7 RECOMMENDATIONS

It is recommended that:

a. The test buttstock be considered satisfactory with respect to material durability and usability for purposes of cleaning equipment storage.

b. The cleaning kit package be redesigned to allow flexibility of the material at low temperature and the ends be reinforced to prevent perforation by the cleaning rod reactions.

c. The trap door latch and the locking recess in the butt plate be redesigned to ensure positive operation of the trap door when subjected to operation under adverse environments.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

The support material (weapons) consisted of standard issue M16A1 rifles and 40-mm, M203, grenade launchers. Maintenance of these weapons was performed in accordance with applicable TM's prior to each subtest where the weapons were fired. The trap door assemblies of the test buttstocks were always lubricated, except during the salt-water immersion test three of the samples were left dry. The lubricant used was MIL-L-14107 for low temperature and MIL-L-46000 semi-fluid oil for all other environments. Throughout the various subtests, inspection of the test buttstocks was performed in accordance with the procedures established in par. 2.2.2 (Initial Inspection). By using this procedure, the effects of adverse conditions could be determined.

Weapon function data which were not included in this report are maintained in the test agency files.

2.2 INITIAL INSPECTION

2.2.1 Objectives

The objectives were:

a. To determine the physical and operational characteristics of the test buttstock.

b. To determine the suitability of all test and control material for evaluation.

2.2.2 Criterion

The before-test condition of all material must be such that no defect or deviation from normal production would adversely influence test results.

2.2.3 Method

Radiographically determine the structural characteristics of all test and control buttstock assemblies. Weigh and measure each buttstock. Assemble the test buttstocks to the M16A1 rifles and determine the following:

a. The ease of opening and closing the trap door assembly noting:

   1) The force, time, and tool required.

   2) Any difficulties encountered.

b. The ease of insertion and removal of the cleaning kit package from the buttstock cavity noting:

   1) Force and time required.

   2) Any difficulties experienced.

c. The ease of removing the cleaning equipment from the cleaning kit.

d. The necessity of any special tools required to assemble and disassemble the trap door assembly.

e. The secureness of the trap door assembly in the latched and unlatched position.

f. The interference or fit of the trap door assembly to the rubber butt plate.

g. The looseness or restriction in the trap door hinge from continued use.

h. The tendency of the butt plate to split due to over tightening of the butt plate retaining screw (two stocks - after all subtests are completed).

i. The maximum force that the lower swivel assembly can withstand before failure of the buttstock, swivel, or retaining screw (two stocks - after all subtests are completed). (Secure the buttstock in the normal horizontal position, apply a steadily increasing, vertical (downward) force to the sling swivel, and note the force at which the failure occurs.)

2.2.4 Results

The radiographs of the test buttstocks revealed several structural variances. One of the stocks was transversely cracked. This stock had been previously tested by USAWECOM and was therefore not used in the APG evaluation (Figure 2.2-1). Other material variances, in the form of voids in the foam filler, were present in 25% of the test buttstocks. Representative samples are shown in Figures 2.2-2 and 2.2-3. Inspection of the control buttstocks revealed no variation in material composition.

The average weight of the test buttstocks, including the cleaning kit, was found to be 0.75 pound heavier than the control buttstock. The exterior dimensions of test and control stocks were essentially identical. The outer edge profile of the test butt plate used a smaller radius in order to accommodate the trap door assembly. Figure 2.2-4 shows the two stock types attached to the M16A1 rifle. Table 2.2-I summarizes the physical characteristics of the stocks and Table 2.2-II lists the test- and control-item usage in the various subtests.

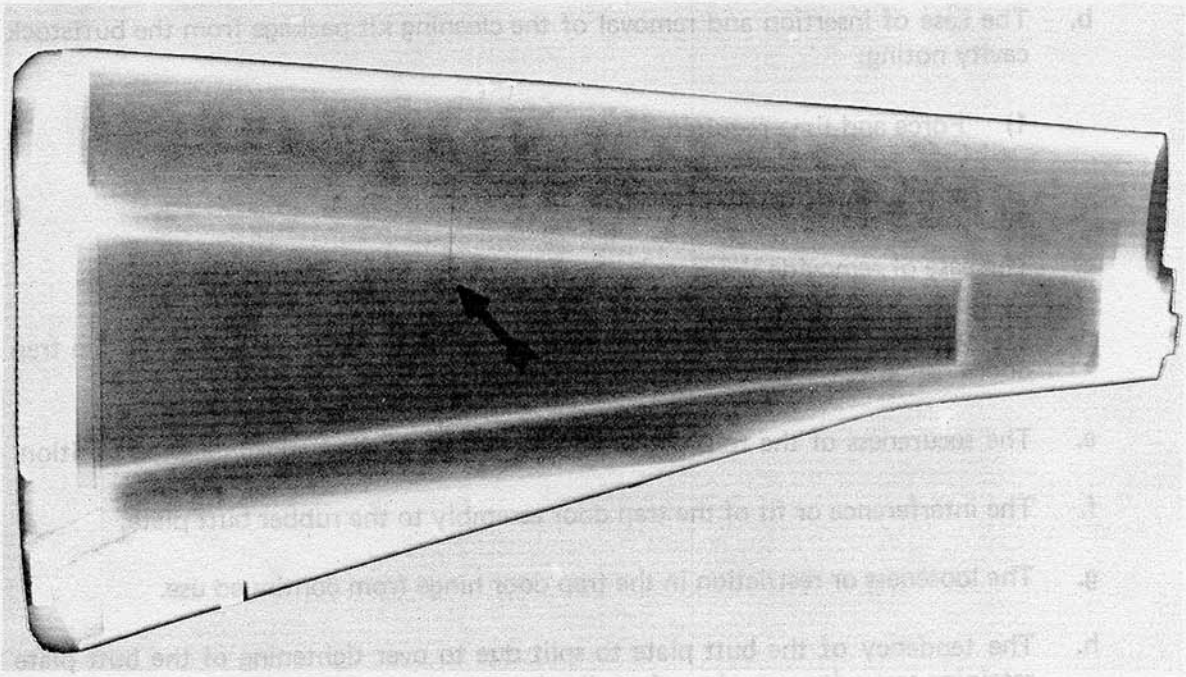

Figure 2.2-1: Radiograph of Test Buttstock No. 36M Showing the Crack Which Was Caused by Testing before Receipt of the Item at APG.

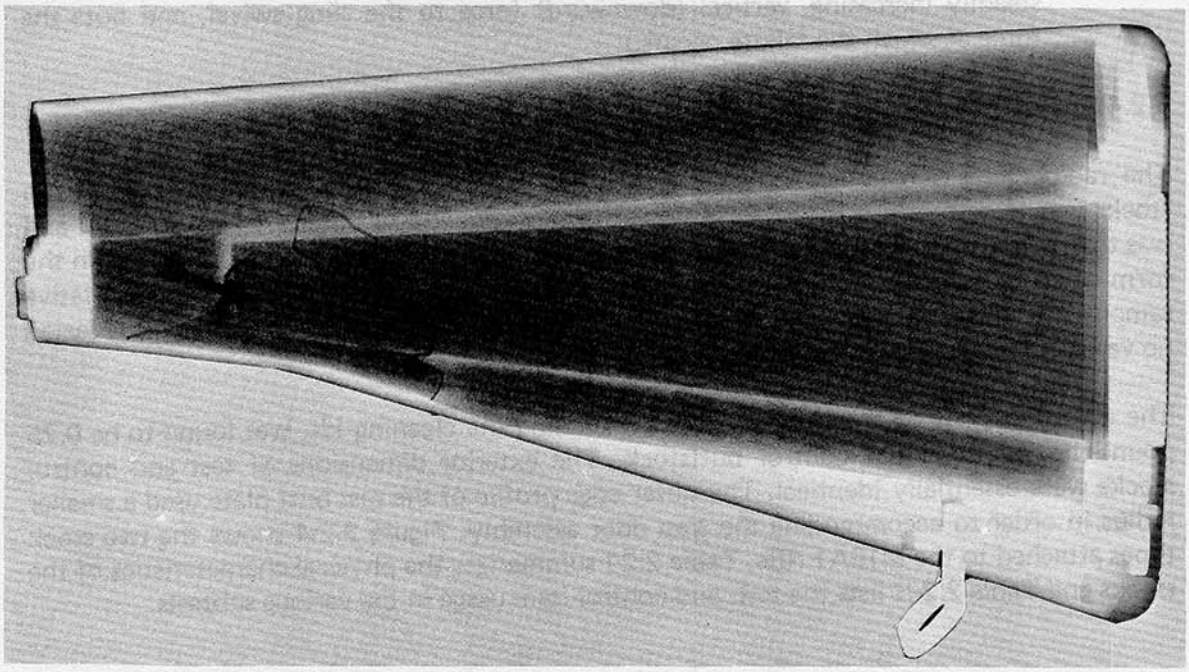

Figure 2.2-2: Radiograph of Test Buttstock No. 21M Showing Void in Foam Filler (See Arrow).

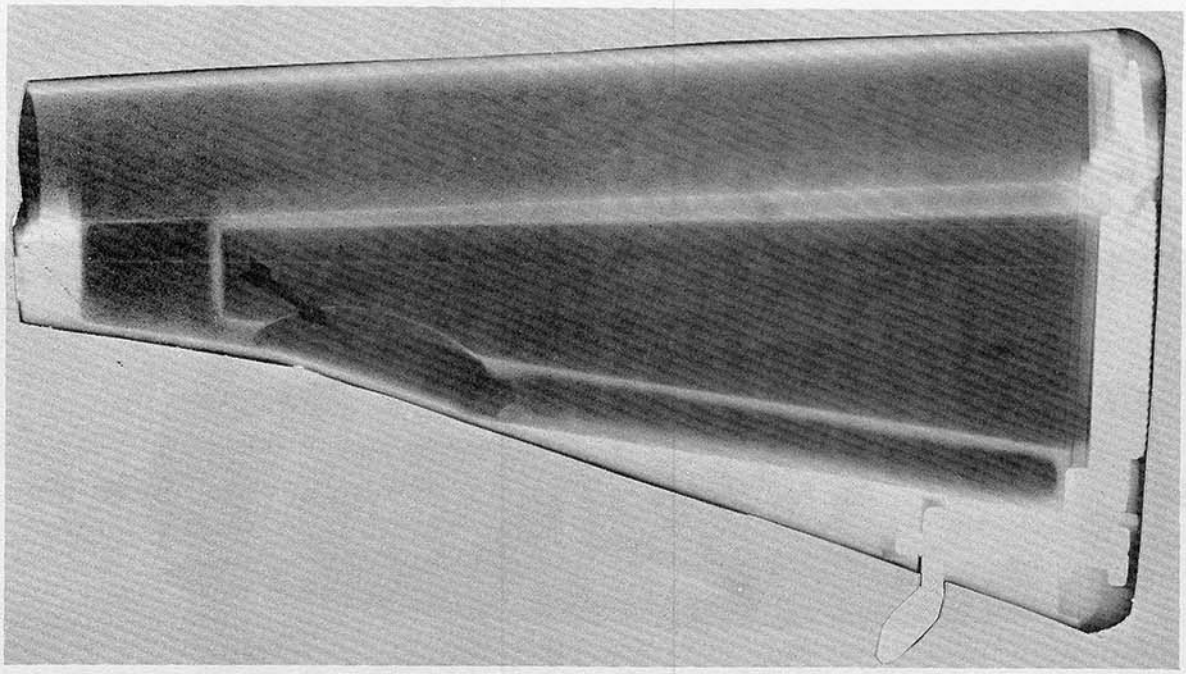

Figure 2.2-3: Radiograph of Test Buttstock No. 27M Showing Air Bubble (See Arrow) Intruding into Storage Space.

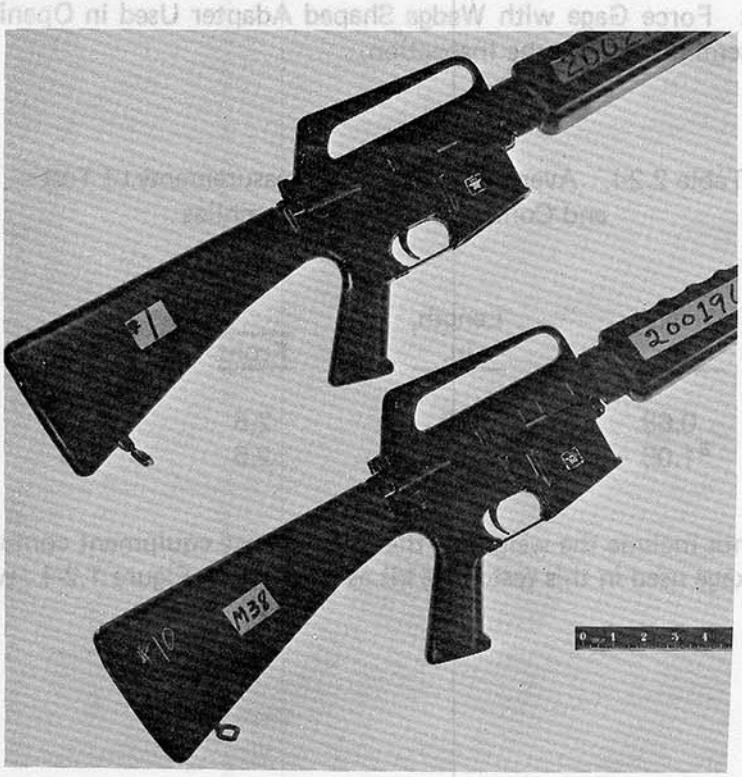

Figure 2.2-4: Test Buttstock (BELOW) and Control Buttstock (ABOVE) Installed on the M16A1 Rifle.

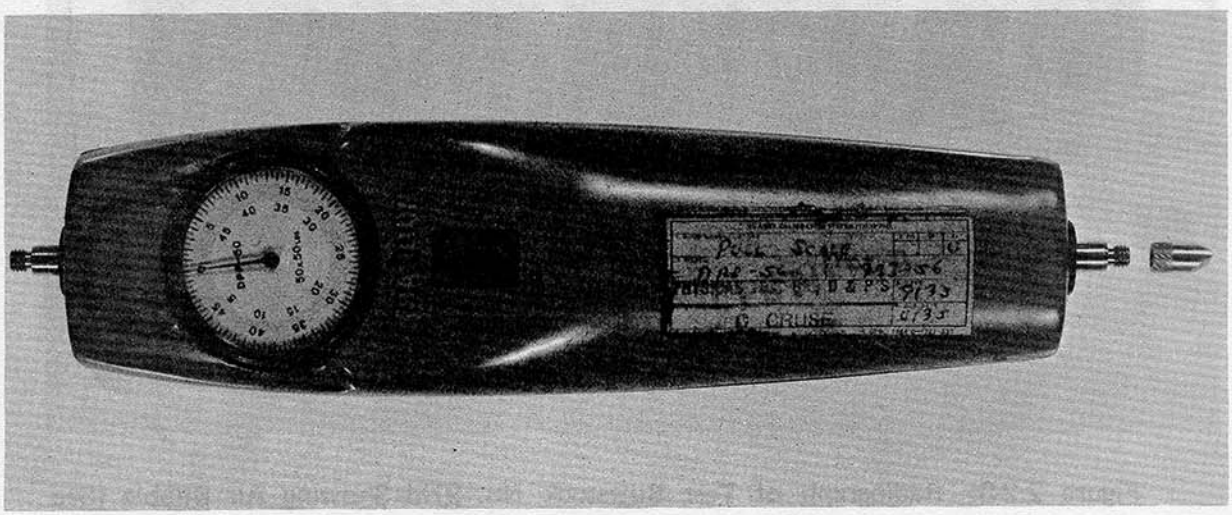

Figure 2.2-5: Force Gage with Wedge Shaped Adapter Used in Opening and Closing the Trap Door Assemblies during the Inspection.

Table 2.2-I. Average Weights and Measurements of Test and Control Buttstock Assemblies

Buttstock Type	Weight, lb	Length, in.	Height, in.		Width, in.
			Front	Rear	
Control	0.68	10	2.5	5	1.56
Test	[a]1.05	10	2.5	5	1.56

[a]This figure does not include the weight of the maintenance equipment contained in the cleaning kit package used in this test. This kit as depicted in Figure 1.2-1 weighs 0.38 pound.

Table 2.2-II. Schedule of Weapon and Buttstock Usage

Subtest			Materiel Numbers Assigned			
			Test		Control	
Par. No.	Description	Test Phase	Stock	Weapon	Stock	Weapon
2.2	Initial inspection		1M to 39M	1 to 15	1 to 15	Same
2.3	High-temp (+155°F)	1	1M to 5M	1 to 5	11 to 15	6 to 10
		2	5M	5	15	10
		3	3M, 5M	3, 4	13, 15	8, 9
		4	1M, 2M, 4M	1	11, 12, 14	6
2.4	Low-temp (-65°F)	1	6M to 10M	6 to 10	6 to 10	11 to 15
		2	10M	10	10	15
		3	8M, 10M	8, 9	8, 10	13, 14
		4	6M, 7M, 9M	6, 7	6, 7, 9	11, 12
2.5	High temp - humidity		21M to 25M	6 to 10	-	-
2.6	Salt-water immersion		26M to 30M	11 to 15	-	-
2.7	Dust		11M to 15M	11 to 15	-	-
2.8	Mud		16M to 20M	11 to 15	-	-
2.9	Attitudes		31M, 32M	2, 3	3, 4	5, 6
2.10	Chemical compatibility		11M to 19M	-	-	-

Inspection of the test buttstocks in accordance with par. 2.2.3a through f, h, and i revealed the following:

a. A force of 6 pounds was required to depress the trap door latch. Figure 2.2-5 shows the gage used to determine this force. Approximately 2 seconds were required to latch and unlatch the trap door.

b. The cleaning kit was easily removed and reinserted. Approximately 2 seconds were required to remove and replace the maintenance package in the buttstock.

c. The cleaning equipment was easily removed from the cleaning kit package.

d. A cartridge was used to latch and unlatch the trap door. Disassembly of the butt plate and floor plate assembly was accomplished with a screwdriver (for extraction of butt plate screws), 4-ounce hammer, and 1/16-inch drive-pin punch (for disassembly of the trap door latch pin and spring).

e. The trap door was securely latched when in a closed position. When opened, the trap door had 1/8-inch lateral movement at the hinge pin. There was no movement of the hinge assembly in the butt plate.

f. The mating surfaces of the trap door and butt plate were a close fit.

g. Not applicable.

h. The butt plate screws could not be hand tightened to the point of cracking the buttstock. Localized deformation of the butt plate was caused by over tightening the lower screw.

i. A force of 350 pounds was applied to the lower sling swivel before the buttstock started to crack. Complete separation of the sling swivel and its retaining screw occurred at 450-pounds applied force.

2.2.5 Analysis

The test and control buttstocks were considered satisfactory.

2.3 HIGH-TEMPERATURE ENVIRONMENT (+155°F)

2.3.1 Objective

The objective was to determine usability and material durability of the test and control buttstocks in a high-temperature environment (+155°F).

2.3.2 Criteria

The criteria are:

a. The durability of the test buttstock must equal or surpass that of the control buttstock.

b. Operation of the trap door in the test buttstock and removal of the maintenance equipment contained therein must not be impaired by high temperature.

2.3.3 Method

2.3.3.1 General. Five test and five control buttstocks were assembled onto ten M16A1 rifles. A 40-mm, M203, grenade launcher was attached to one M16A1 rifle in each 5-rifle group. The weapons and sufficient ammunition for the various subtests were temperature conditioned in accordance with par. 3.3.1a of Reference 1. After this conditioning period and after each of the four phases, the test buttstocks were inspected in accordance with pars. 2.2.3a through c and e through g.

2.3.3.2 Phase I - Rifle Firing. The rifles and buttstocks assigned in Table 2.2-II were used to fire 500 rounds, in 100-round cycles, from each weapon. The modes of fire were altered after each 20 rounds fired, from semiautomatic to full automatic. The weapons were cooled after each 100-round cycle.

2.3.3.3 Phase 2 - M203 Grenade Launcher Firing. This phase was conducted using the weapons and buttstocks assigned in Table 2.2-II. Twenty-five rounds of 40-mm, M407A1 ammunition (inert-loaded projectile) were shoulder fired from each launcher at two elevations (+6° and +45°).

2.3.3.4 Phase 3 - Rifle Grenade Firing. The rifles and buttstocks assigned in Table 2.2-II were used to fire 25 M11A4 inert-loaded rifle grenades (weight simulation of M31 HEAT grenade) from each rifle at an elevation of 45° in two conditions:

a. With butt of stock completely supported by a sandbag.

b. With only the toe of the stock resting on a flat, reinforced 3/8-inch sheet of plywood (firing platform).

2.3.3.5 Phase 4 - Five-Foot Drop Test. The rifles and buttstocks assigned in Table 2.2-II were used. The weapons were elevated so that the butt plates were 5 feet above a flat concrete floor. Each weapon was dropped in the following attitudes:

a. Butt plate impacted flat on the floor.

b. Toe of butt plate impacted on floor, rifle at 45° angle.

c. Heel of butt plate impacted on floor, rifle at 45° angle.

d. Left-hand edge of butt plate impacted on floor, rifle at 45° angle.

e. Right-hand edge of butt plate impacted on floor, rifle at 45° angle.

2.3.4 Results

2.3.4.1 Inspection of Buttstocks after Conditioning. In general, the rubber butt plates were extremely pliable, especially at the thinner sections surrounding the trap door assemblies and the screw holes. The trap door assemblies performed the same as in initial inspection with no problems encountered. Six pounds force was required to open and close the trap door. Buttstock No. 1M required a slightly greater force (8 pounds) to open or close. No difficulties were encountered in either the removal of the cleaning package or in the removal of the cleaning equipment from the package. The fit of the trap door assemblies to the rubber butt plates was not as snug as in the initial inspection due to the pliability of the butt plate material at increased temperatures.

2.3.4.2 Phase 1 - Rifle Firing. The rifle firing had no adverse effect on either type of buttstock. No weapon malfunctions could be attributed to the test buttstock. Inspection of the test buttstocks after firing showed no change in usability from the prefiring inspection (par. 2.3.3.1).

2.3.4.3 Phase 2 - Grenade Launcher Firing. The grenade launcher firing had no adverse effect on either the test or control buttstock. Inspection of the test buttstock after firing showed no change in operational characteristics.

2.3.4.4 Phase 3 - Rifle Grenade Firing. The firing of 25 rounds from each rifle, with test buttstocks (3M and 5M) and control buttstocks (13 and 15) fully supported by a sandbag had no adverse effect on the stocks. During the 25-round firings with only the toe of the butt plates contacting a flat, reinforced 3/8-inch plywood surface, buttstocks 3M and 13 had a piece from the toe of each butt plate torn loose from the rest of the butt plate after six rounds. The butt plates were not seriously damaged and were continued in test. No further damage was experienced through the remaining 25 rounds. These two stocks are shown in Figure 2.3-1. The remaining two buttstocks, 5M and 15, suffered no damage during this 25-round firing. Inspection of the test buttstocks after firing showed that the cleaning rods were starting to puncture holes in the cleaning package. This was caused by the shock-type action imparted to the package and cleaning equipment by the rifle grenade firing. Otherwise, the inspection results were the same as previously described in the before-firing inspection (par. 2.3.3.1).

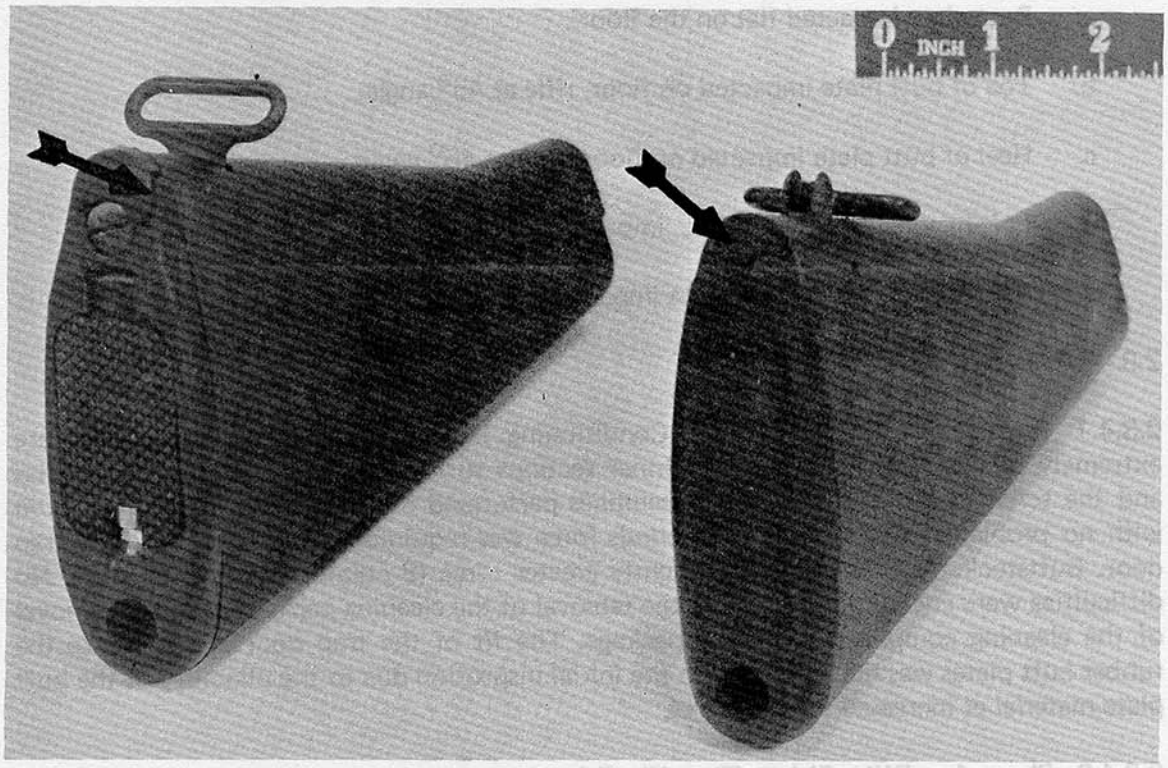

Figure 2.3-1: Butt Plate Damage After Rifle Grenade Firing in Hot Test (+155°F). LEFT: Modified Buttstock 3M. RIGHT: Control Buttstock 13.

2.3.4.5 Phase 4 - 5-Foot Drop Test. The results of the 5-foot drop test are listed in Table 2.3-I.

Table 2.3-I. Damage to Buttstocks during 5-Foot Drop Test (+155°F)

Butt-stock No.	Butt-stock Type	Drop Orientation[a]	Type and Area of Damage				
			Butt Plate		Stock		
			Chipped Heel	Chipped Toe	Crack at Heel	Crack at Toe	Crack on Side
11	Control	a					
		b		X			X
		c	X				
		d					X
		e					
12 (See Fig. 2.3-2)	Control	a					X
		b		X		X	
		c			XX		
		d					X
		e					
14 (See Fig. 2.3-2)	Control	a					
		b		X			
		c	X		X		
		d					
		e					X
1M (See Fig. 2.3-3)	Test	a					
		b		X		X	
		c			X		
		d					
		e					
2M	Test	a					
		b		X			
		c	X		X		
		d					
		e					
4M (See Fig. 2.3-3)	Test	a					
		b					
		c			XX		
		d					
		e					

[a]The 5-foot drop orientation attitudes are described in par. 2.3.3.5.

Representative samples of the buttstocks damaged in the drop test are shown in Figures 2.3-2 and 2.3-3.

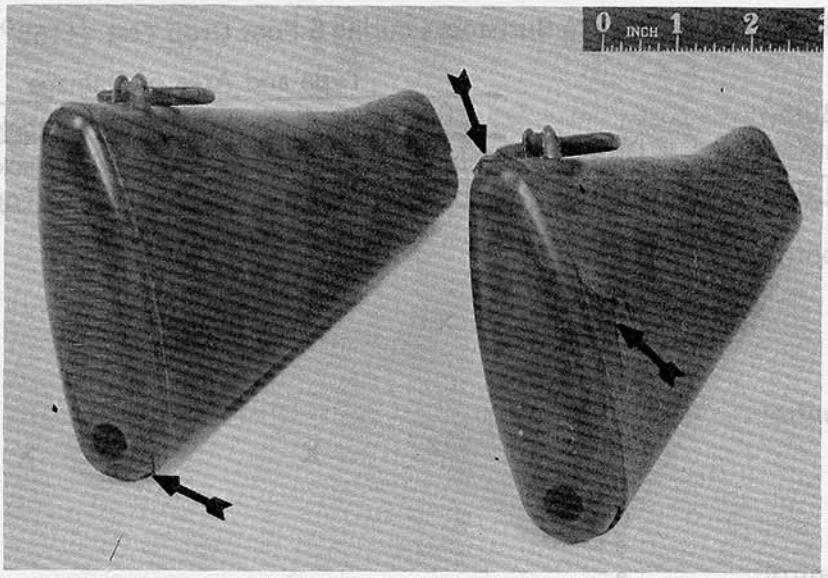

Figure 2.3-2: Control Buttstocks after the 5-Foot Drop Test at +155°F. LEFT: No. 14. RIGHT: No. 11.

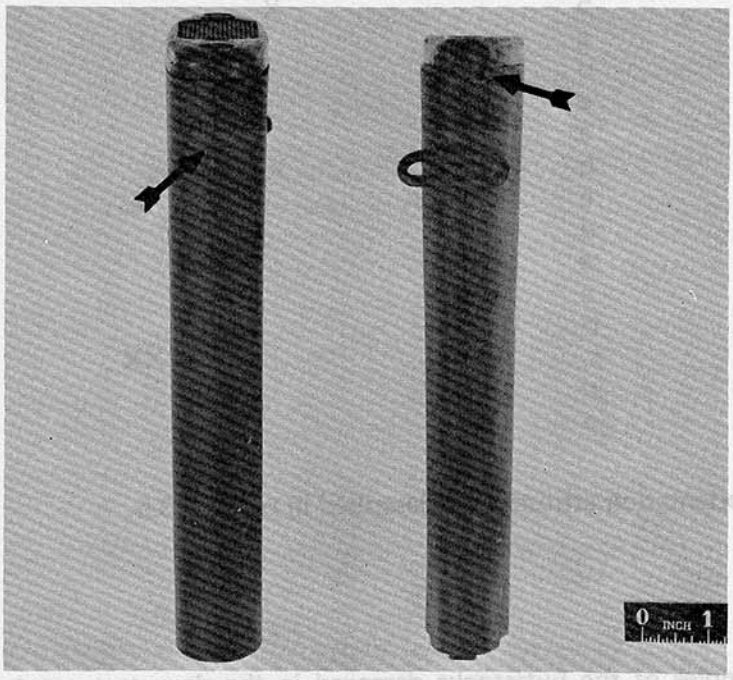

Figure 2.3-3: Damage to Modified Buttstocks after the 5-Foot Drop Test at +155°F. LEFT: Top View, No. 4M. RIGHT: Bottom View No. 1M.

Inspection of the test buttstocks after firing showed that the trap doors were slightly harder to open, requiring 8 pounds force to release the trap door latch. The cleaning package in buttstock 2M was punctured by the cleaning rod sections in the package. There was no difficulty in removing the cleaning packages or in removing the cleaning equipment from the cleaning kit.

2.3.5 Analysis

The durability of the test buttstocks was at least equal to that of the control buttstocks in all phases of the hot test. Puncturing of the cleaning kit by the cleaning rod sections did not interfere with the operation and use of the buttstock and cleaning kit.

2.4 LOW-TEMPERATURE ENVIRONMENT (-65°F)

2.4.1 Objectives

The objectives were:

a. To determine the material durability of the buttstock and cleaning package at low temperature (-65°F).

b. To determine the operational characteristics of the buttstock and cleaning packages at low temperature (-65°F).

2.4.2 Criteria

The criteria are:

a. The durability of the test buttstock must equal or surpass that of the control buttstocks.

b. Operation of the trap door in the test buttstock and removal of the maintenance equipment contained therein must not be impaired by low temperature.

2.4.3 Method

This subtest was conducted using weapons and buttstocks specified in Table 2.2-II. All material was temperature conditioned in accordance with par. 3.3.1b of Reference 1. The test was conducted using procedures outlined in pars. 2.3.3.1 through 2.3.3.5.

2.4.4 Results

2.4.4.1 Inspection of Buttstocks after Conditioning. The average force required to depress the trap door latch increased from 6 to 8 pounds, as a result of the temperature conditioning. Test buttstock 10M required a 14-pound force to accomplish the same function. Pliability of the cleaning kit material decreased at this temperature, but did not

cause the cleaning kit to adhere to the inside of the stowage cavity of the buttstock. After removal of the kit from the buttstock, the folded-over end flap (see Figure 1.2-3 for stowed position) had to be worked back and forth to loosen the package sufficiently for removal of the maintenance equipment. The close fit between trap door and butt plate remained unchanged from the initial inspection.

2.4.4.2 Phase 1 - Rifle Firing. Durability of the test and control buttstocks was not adversely affected by the rifle firing. The test buttstocks did not contribute to the presence of any weapon malfunctions. The force required to unlatch the trap door was measured after firing. An average of 10 pounds force was required. The force required for the latch on buttstock 10M increased from 14 pounds to 20 pounds. Test personnel experienced minor difficulties in opening the trap door when wearing arctic mittens. This difficulty was partly due to the latch design which required a combined pushing and prying action to effect unlatching and opening of the trap door.

2.4.4.3 Phase 2 - Grenade Launcher Firing. Shoulder firing of the 40-mm, M203 grenade launcher attached to the M16A1 rifle did not adversely affect buttstock durability. The average force to unlatch and relatch the trap doors of the test buttstocks was 12 pounds. There was no change in force for buttstock 10M (20 pounds).

2.4.4.4 Phase 3 - Rifle Grenade Firing. Material durability of the test buttstock was not adversely affected by firing rifle grenades when there was complete support (sandbag) for the butt plate of the stock. One of the two control buttstocks (No. 8) was damaged to the point of nonusability after 25 rounds firing. The butt plate was broken at the heel, which prevented the retainer screw from holding the buttstock to the lower receiver extension. This stock (Figure 2.4-1) was removed from test.

The test was continued with the remaining buttstocks (two test and one control) being subjected to an additional 25-round firing with only the toe of the stock contacting a firm, flat surface (3/8-inch plywood).

One test buttstock (10M) was not adversely affected by this firing while No. 8M developed a crack in the heel of the butt plate when the first round was fired. A small piece of the butt plate toe was broken off after 12 rounds of firing and after 25 rounds there was severe cracking of the entire butt plate. The trap door caused the fractured butt plate to remain intact until the trap door was opened (Figure 2.4-2).

A small piece from the butt plate toe of control stock 10 was broken off when round one was fired. Complete breakage of the butt plate occurred when round 12 was fired. This stock was thereby rendered unserviceable and was withdrawn from test (Figure 2.4-1).

After-firing inspection of the two test buttstocks (8M and 10M) revealed that the cleaning rod sections had perforated the cleaning kit packages. The average forces required to depress the trap door latches were 8 pounds and 14 pounds, respectively.

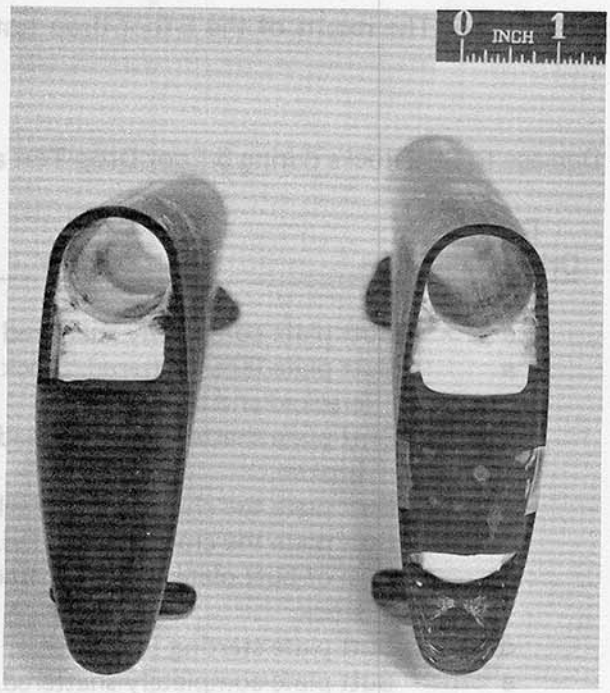

Figure 2.4-1: LEFT: Control Buttstock No. 8 after 25 Rifle Grenade Firings. RIGHT: Control Buttstock No. 10 after 37 Rifle Grenade Firings Made in the Low-Temperature Test (-65°F).

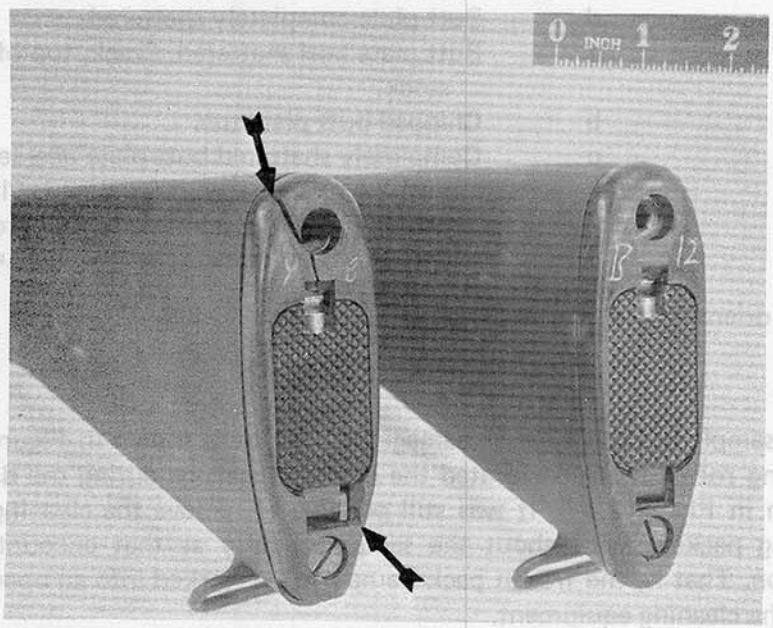

Figure 2.4-2: RIGHT: Modified Buttstock No. 10M (No Damage). LEFT: Buttstock No. 8M (Crack from Arrow to Arrow). Shown after Completion of 50-Round Rifle Grenade Firing in Low-Temperature Test (-65°F). Top Screws Have Been Removed for Photographic Purposes.

2.4.4.5 Phase 4 - 5-Foot Drop Test. The results of the 5-foot drop test are listed in Table 2.4-I.

Table 2.4-I. Damage to Buttstocks during 5-Foot Drop Test at -65°F

Buttstock No.	Buttstock Type	Drop Orientation	Damage
6	Control	a	Butt plate completely shattered (Figure 2.4-3).
7	Control	a	Butt plate 90% shattered. Stocks badly cracked and broken.
9	Control	a	Butt plate shattered. Stocks badly cracked and broken.
6M (See Figure 2.4-4)	Test	a	Butt plate toe chipped and cracked.
		b	Butt plate toe crack propagated.
		c	Heel of butt plate shattered. Bad crack top of stock.
		d	Butt plate starting to shatter.
		e	Butt plate completely shattered. Entire top of stock cracked.
7M	Test	a	Shattered butt plate toe.
		b	Shattering of butt plate toe propagated.
		c	Shattered butt plate heel. Bad crack top of stock.
		d	Butt plate completely shattered.
9M	Test	a	Butt plate heel shattered. Crack, top of stock.
		b	Chipped butt plate toe.
		c	Completely shattered butt plate heel leaving nothing to keep trap door closed. Cleaning kit fell out and cleaning rods had broken through cleaning package (Figure 2.4-5).

[a]The 5-foot drop orientation attitudes are described in par. 2.3.3.5.

A representative sample of each type of damaged buttstock is shown in Figures 2.4.3 and 2.4.4. The cleaning rod sections perforated the cleaning package during the drop test. An example is shown in Figure 2.4-5. It was still possible to remove the cleaning equipment from the cleaning package with about the same difficulty as that encountered in the prefiring inspection. That is, the frozen package had to be worked into an open position in order to remove the cleaning equipment.

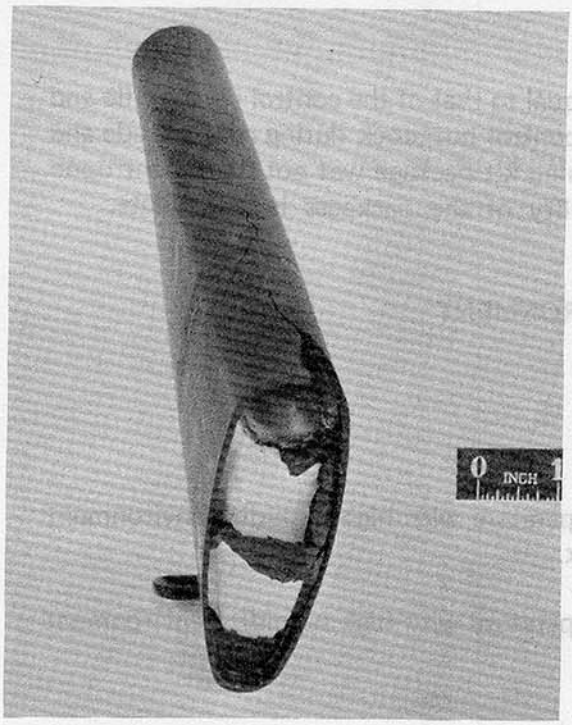

Figure 2.4-3: Control Buttstock No. 6 after One 5-Foot Drop (a) at -65°F.

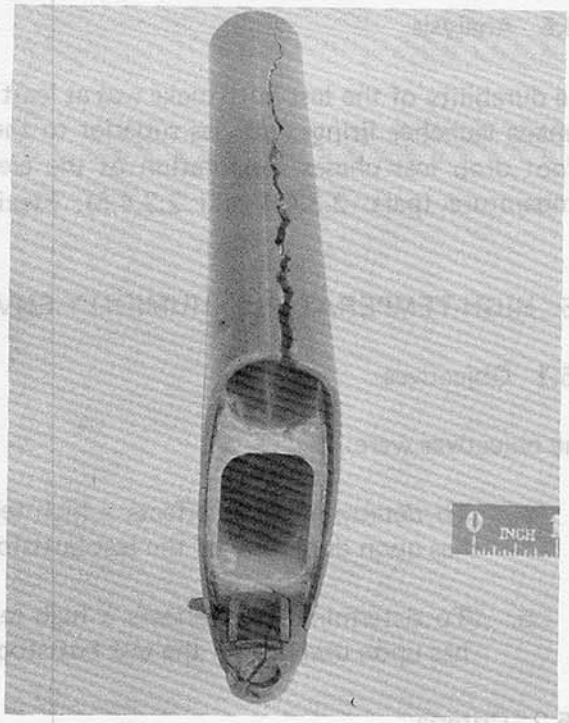

Figure 2.4-4: Modified Buttstock No. 6M after Five 5-Foot Drops (a, b, c, d, and e) at -65°F.

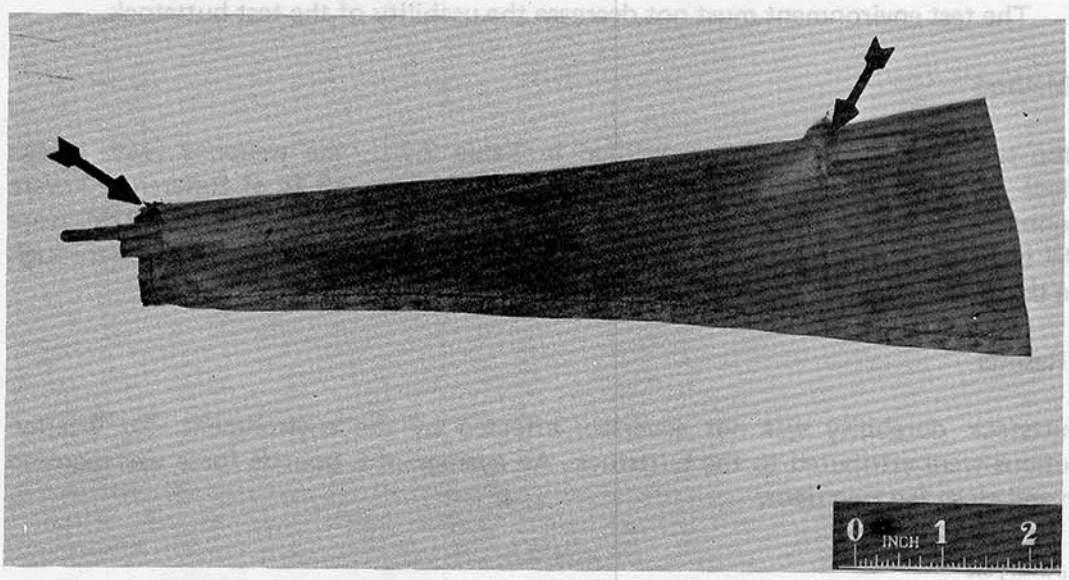

Figure 2.4-5: Perforation of the Cleaning Package Envelope by Cleaning Rods during 5-Foot Drop Test at -65°F.

2.4.5 Analysis

The durability of the test buttstocks was at least equal to that of the control during rifle and grenade launcher firings and was superior to the control buttstock during rifle grenade and 5-foot drop test phases. Perforation of the cleaning kit package was not dependent upon temperature (pars. 2.3.4.4 and 2.3.4.5). Flexibility of the packages is inadequate.

2.5 HIGH-TEMPERATURE - HUMIDITY ENVIRONMENT

2.5.1 Objectives

The objectives were:

a. To determine what effects a high temperature with high humidity environment has upon durability of the test buttstock.

b. To determine what effects a high temperature with high humidity environment has upon usability of the test buttstock.

2.5.2 Criteria

The criteria are:

a. The test environment must not cause a degradation of material durability.

b. The test environment must not decrease the usability of the test buttstock.

2.5.3 Method

Using the weapons and buttstocks specified in Table 2.2-II, the weapons (with stocks assembled) and ammunition required in accordance with par. 3.3.1c of Reference 1 were conditioned. Only two of the weapons (equipped with buttstocks No. 21M and 22M) were fired. All buttstocks were inspected in accordance with pars. 2.2.3a through c and e through g on the third, fifth, eighth, and tenth test days.

2.5.4 Results

Test buttstock durability was not adversely affected by the environment. No weapon malfunctions were attributed to the buttstock. An average of 8 pounds force was required to open and close the trap door.

2.5.5 Analysis

The test buttstocks performed satisfactorily in the high temperature and humidity environment.

2.6 SALT-WATER IMMERSION TEST

2.6.1 Objectives

The objectives were:

a. To determine the effects of salt water on the durability of the test buttstocks.

b. To determine the effects of salt water on the usability of the test buttstocks.

2.6.2 Criteria

The criteria are:

a. The durability of the test buttstocks must not be degraded by contact with salt water.

b. The usability of the test buttstocks must not be degraded by contact with salt water.

2.6.3 Method

The metallic components of buttstocks No. 29 and 30 were lubricated with MIL-L-46000 semi-fluid oil. Using the test buttstocks and weapons specified in Table 2.2-II, all buttstocks (not entire weapon) were immersed in a solution of 20% salt water for one minute. The weapons and buttstocks were stored in the high temperature - humidity environment (par. 2.5) for ten days. New cleaning kit packages were used in buttstocks 26M and 30M and used (perforated) packages were used in the remainder. Two weapons (26M and 27M) were test fired 60 rounds each (30 rounds semiautomatically and 30 rounds automatically) on the first, third, fifth, eighth, and tenth test days. Maintenance was not performed on weapons or buttstocks. The five buttstocks were inspected in accordance with paragraphs 2.2.3a through e, f, and g at the start of each test-firing day.

2.6.4 Results

No weapon firing malfunctions were attributable to the test buttstocks. The results of the prefiring inspections are shown in Table 2.6-I.

The trap door assembly which could not be opened on buttstock 26M was disassembled. Salt deposits were evident along the entire length of the metal latch. This condition caused seizure of the latch and prevented opening of the trap door (Figure 2.6-1).

Table 2.6-1. Inspection of Test Buttstocks during 10-Day Salt-Water Immersion Test

Test Buttstock No.	Test Day	Force to Open, lb		Force to Close, lb	Remarks
		Initial	Subsequent		
26M	3	10	10	7	Salt deposits on metal latch. Inside of cleaning package dry.
	5	18	10	7	Same as third day above.
	[a] 8	-	-	-	Only way to remove cleaning package was to unscrew butt plate.
	[a]10	-	-	-	Same as eighth day above (Figure 2.6-1).
27M	3	13	10	7	Rust on metal latch. Due to holes in cleaning package, rust on cleaning equipment.
	5	8	8	8	Same as third day above.
	8	40	10	10	Salt and rust on metal latch. Rust on sling swivel, screws, and cleaning equipment.
	10	10	10	10	Same as eighth day above.
28M	3	8	8	8	Rust on metal latch, cleaning rods, and rear sling swivel.
	5	8	8	8	Salt deposit on latch. Rust on screws, cleaning rods, and sling swivel.
	8	10	7	7	Same as fifth day above.
	10	10	7	7	Same as fifth day above.
[b]29M	3	9	9	6	Small amount of rust on cleaning rods. Metal latch satisfactory.
	5	6	6	6	Small amount of rust on sling swivel and cleaning equipment. Latch satisfactory.
	8	7	7	7	Same as fifth day above.
	10	7	7	7	Same as fifth day above.
[b]30M	3	8	8	6	Everything satisfactory.
	5	6	6	6	Small amount of rust on sling swivel. Latch satisfactory.
	8	7	7	7	Rust on screws and sling swivel. Small amount rust on cleaning rods. Latch satisfactory.
	10	7	7	7	Same as eighth day above.

[a]A force of 50 pounds was applied (maximum gage limit) to the trap door latch. This force was insufficient to cause release of the latch.

[b]The metallic components of these buttstocks were protected with lubricant (MIL-L-46000). The other stocks were left dry.

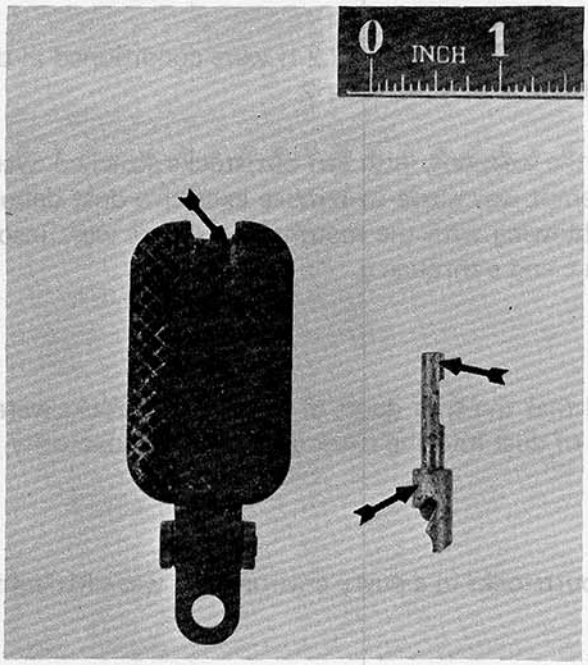

Figure 2.6-1: Trap Door Assembly from Buttstock 26M Showing Salt Deposits and Corrosion on the Door Latch (See Arrows) Which Prevented the Trap Door from Opening.

2.6.5 Analysis

The trap door and latch mechanism operates satisfactorily, provided the metallic components are adequately protected with a corrosion resisting lubricant. Rusting of the cleaning equipment can be minimized by lubrication and proper closing of an undamaged cleaning kit package.

2.7 DUST TEST

2.7.1 Objective

The objective was to determine the effects of blowing dust on buttstock usability.

2.7.2 Criteria

The criteria are:

a. The test butt plate and trap door assembly must inhibit free access of the dust into the storage cavity.

b. Operation of the trap door must not be degraded.

2.7.3 Method

The buttstocks and rifles specified in Table 2.2-II were conditioned in the dust environment in accordance with par. 6.2.1.7 of Reference 2.

After dust-conditioning, the weapons, with test buttstocks attached, were removed from the environment and an attempt was made to remove excessive dust deposits by hand-wiping, vigorously shaking, and blowing with the mouth. The stocks were inspected in accordance with pars. 2.2.3a through c and e through g.

2.7.4 Results

The inspection indicated that the trap doors of the test buttstocks were readily opened and closed and that intrusion of dust into the stock cavity was satisfactorily prevented.

2.7.5 Analysis

Performance of the test buttstocks in a dusty environment was satisfactory.

2.8 MUD TEST

2.8.1 Objective

The objective was to determine the effects of mud on test buttstock usability.

2.8.2 Criteria

The criteria are:

a. The test butt plate and trap door assembly must inhibit free access of the mud into the storage cavity.

b. Operation of the trap door must not be degraded.

2.8.3 Method

The buttstock portion of buttstocks and rifles specified in Table 2.2-II were immersed for 1 minute in a mud solution compounded in accordance with par. 3.3.8 of Reference 1 An attempt was made to remove excess mud deposits on the stock exterior by hand-wiping and shaking. The stocks were immediately inspected in accordance with pars. 2.2.3a through c, e through g. The inspection was repeated after 4 hours had elapsed.

2.8.4 Results

The force required to open the trap doors (7 pounds) was increased by only 1 pound from the original pretest inspection. Proper placement and closure of the cleaning kit packages prevented seepage of mud into the storage cavity.

Mud did seep into the trap door latch locking recess in the butt plate when the doors were open. After 4-hours drying time, the reinspection showed that this mud seepage prevented complete latching of the trap door. Ten pounds force was required to unlatch the trap doors after the mud dried.

2.8.5 Analysis

The trap door does inhibit free access of mud into the storage area. Design of the trap door latch surfaces should be improved to overcome the effects of mud fouling and ensure positive latching.

2.9 ATTITUDES TEST

2.9.1 Objectives

The objectives were:

a. To determine usability of the test buttstock.

b. To determine the influence of the test buttstock upon weapon function performance when fired in various attitudes.

2.9.2 Criteria

The criteria are:

a. Function performance of the weapons must not be adversely affected by attachment of the test buttstock.

b. Usability of the buttstock must not be impaired as a result of the attitudes firing.

2.9.3 Method

Four M16A1 rifles were used, two with new test buttstocks and two with control buttstocks. Two thousand rounds were fired from each weapon in 100-round cycles. The weapons were cooled after each 100-round cycle and cleaned after each 1000 rounds. The following firing schedule was used and cycles a through f and o through t were fired horizontally:

a. Semiautomatically with the rifle held loosely in the hands.

b. Automatically with the rifle held loosely in the hands.

c. Semiautomatically with the rifle held right side up.

d. Automatically with the rifle held right side up.

e. Semiautomatically with the rifle held left side up.

f. Automatically with the rifle held right side up.

g. Semiautomatically with the rifle held normally at an elevation of 80°.

h. Automatically with the rifle held normally at an elevation of 80°.

i. Semiautomatically with the rifle held loosely in the hands at an elevation of 80°.

j. Automatically with the rifle held loosely in the hands at an elevation of 80°.

k. Semiautomatically with the rifle held normally at an elevation of minus 80°.

l. Automatically with the rifle held normally at an elevation of minus 80°.

m. Semiautomatically with the rifle held loosely in the hands at an elevation of minus 80°.

n. Automatically with the rifle held loosely in the hands at an elevation of minus 80°.

o. Semiautomatically with the rifle held normally and with an M7 bayonet attached.

p. Automatically with the rifle held normally and with an M7 bayonet attached.

q. Semiautomatically with the rifle held normally and with an M7 bayonet attached.

r. Automatically with the rifle held normally and with an M7 bayonet attached.

s. Semiautomatically with the rifle held normally and with an M7 bayonet attached.

t. Automatically with the rifle held normally and with an M7 bayonet attached.

In semiautomatic fire, the rate was at least 15 rounds per minute. At the end of the test, the buttstocks were inspected in accordance with pars. 2.2.3a through c and e through g.

2.9.4 Results

No gun malfunctions, attributable to either type of buttstock, occurred during the firing of the four weapons. The firing had no adverse affect on test buttstock durability.

2.9.5 Analysis

The test buttstocks were at least equal to that of the control buttstocks in all phases of the attitudes test.

2.10 CHEMICAL COMPATIBILITY TEST

2.10.1 Objective

The objective was to determine the chemical compatibility of the test buttstocks with various chemical compounds used as cleaners, lubricants, and insect repellants.

2.10.2 Criterion

The test buttstock material must not be degraded by chemical reaction to various compounds specified in pars. 2.10.3a through g.

2.10.3 Method

Test buttstocks numbers M11 through M19 (total of 9) were paired with the 9 chemicals listed below. Each buttstock was subjected to a liberal hand application of the chemical assigned.

a. Insect repellant (FSN-6840-55-8-0918).

b. Bore cleaner (MIL-L-372B).

c. Gasoline.

d. Kerosene.

e. Diesel fuel.

f. Dry cleaning solvent (PS-661-B).

g. Lubricant (VV-L-800).

h. Lubricant (MIL-L-14107).

i. Lubricant (MIL-L-46000A).

After application of the chemicals the buttstocks were allowed a conditioning period of 24 hours. Inspection of the buttstocks were in accordancy with pars. 2.2.3a through c and e through g.

2.10.4 Results

None of the chemicals applied to the test buttstocks had any adverse effects.

2.10.5 Analysis

The performance of the test buttstocks was satisfactory. All of the chemicals applied to the buttstocks can be considered to be compatible.

SECTION 3. APPENDICES

APPENDIX I - DEFICIENCIES AND SHORTCOMINGS

1. Deficiencies

None

2. Shortcomings

Shortcoming	Suggested Corrective Action	Remarks
2.1 Perforation of cleaning kit package by cleaning rod sections (pars. 2.3 and 2.4).	Reinforce ends of cleaning kit package or provide a protective cap for the cleaning rod sections.	Condition occurs only in rifle grenade firing and with a 5-foot drop.
2.2 Cleaning kit package material becomes stiff at low temperature (par. 2.4).	Use a cloth material (for the opening) that remains flexible at low temperatures.	Repeated flexing of the package end may result in breakage.
2.3 Breakage of the test and control butt-stock and butt plates when firing rifle grenades or when dropped on concrete (pars. 2.3 and 2.4).	Determine if reinforcing fiber distribution in the stock is optimized.	The test item is more durable than the control, but neither is totally satisfactory.

(Following Page Blank)

COPY/bg

RTTUZYUW RUCIRRA1021 1191816-UUUU--RUEBEAA.

ZNR UUUUU

R 291615Z APR 69

4-1244
30 Apr 69
ACTION: INF
INFO: POD
CMD GP

FM PROJ MGR RIFLES USAMC ROCK ISLAND ILL

TO RUEBEAA/CGUSATECOM ABERDEEN MD

INFO RUEBBNA/CGUSAMC

BT

UNCLAS RI 11021 FROM AMCPM-RS, COL ISAACS FOR AMSTE-BC, MR. C. CRIDER. INFO TO AMCPMSO-RS, LTC SEMMLER

SUBJ: PRODUCT IMPROVEMENT TEST (PIT) OF MODIFIED BUTTSTOCK ASSEMBLY FOR M16/M16A1 RIFLE, USATECOM PROJECT NO. 8-9-0200-26

REF: A. AMSTE-BC LTR DTD 24 DEC 68, SUBJECT AS ABOVE.

B. AMCPM-RS MSG NO. RI4476 DTD 192045Z FEB 69, SUBJ: MODIFIED BUTTSTOCK ASSEMBLY FOR M16A1 RIFLES.

C. AMSTE-BC LTR DTD 28 FEB 69, SUBJECT AS ABOVE.

D. AMCPM-RS LTR DTD 4 APR 69, SUBJECT AS ABOVE.

1. THE TEST PLAN OUTLINED PROVIDED BY REFERENCE A INCLUDES ASPECTS WHICH CANNOT BE ACCOMPLISHED AT HQ, USAWECOM DUE TO LACK OF PROPER EQUIPMENT AND FACILITIES. THOSE ASPECTS OF REFERENCED TEST PLAN OUTLINED ARE AS FOLLOWS:

A. PARAGRAPH 3.3 HIGH TEMPERATURE ENVIRONMENT (PLUS 155 DEGREE F)

B. PARAGRAPH 3.4 LOW-TEMPERATURE ENVIRONMENT (-65 DEGREE F)

COPY/bg

PAGE 2 RUCIRRA1021 UNCLAS

C. PARAGRAPH 3.5 CONCURRENT HIGH-TEMPERATURE/HUMIDITY ENVIRONMENT AND SALT WATER IMMERSION TEST.

2. REQUEST THESE ASPECTS BE CONDUCTED BY USATECOM CONCURRENTLY WITH OTHER M16A1 RIFLE TESTS ON A NOT-TO-INTERFERE BASIS. AMCPM-RS WILL FURNISH MODIFIED BUTTSTOCKS.

3. REQUEST THIS OFFICE BE PROVIDED A TEST SCHEDULE AS OUTLINED IN PARAGRAPH 2. COMPLETION OF TESTS BY 1 JULY 1969 IS HIGHLY DESIRABLE.

BT

1021

NNNN

P90913

COPY/bg

Mr. IMichelson/der/234-3350-3136

STEAP-MT-TI

13 May 1969

SUBJECT: Product Improvement Test of Modified Buttstock Assembly for M16/M16A1 Rifle, USATECOM Project No. 8-9-0200-26

THRU: Commanding General
U. S. Army Test and Evaluation Command
ATTN: AMSTE-BC

TO: Commanding General
U.S. Army Weapons Command
ATTN: AMCPM-RS
Rock Island, Illinois 61201

1. References:

a. Letter, AMSTE-BC, 24 Dec 68, Subject: Same as above.

b. Message No. RI 11021, AMCPM-RS, 29 Apr 69, Subject: Same as above.

c. Project Transcript Sheet (Directive), AMSTE-BC, 1 May 69, Subject: Same as above.

2. By direction of reference 1c and in conformance with the specified paragraphs of references 1a and 1b above, the following information is transmitted:

a. It is estimated that funds in the amount of $25,000 and 43 working days will be required to test and report the subtests requested.

b. Materiel requirements are:

1) M16A1 Rifles - 10

2) XM203 Grenade Launcher - 2

COPY/bg

STEAP-MT-TI 13 May 1969
SUBJECT: Product Improvement Test of Modificd Buttstock Assembly for M16/M16A1 Rifle, USATECOM Project No. 8-9-0200-16

3) Modified Buttstock (M16A1 Rifle) - 10

4) Cartridge, Ball, 5.56-mm, M193 - 14000

5) Cartridge, Grenade, 5.56-mm, XM195 - 400

6) Grenade, Rifle, M29, inert - 400

7) Cartridge, Grenade, 40-mm, M407A1 - 200

3. It is not known at this time whether the test results can be furnished by 1 July 1969. Conduct of this test is subject to limitations imposed by test workload, test priorities, and available manpower at the time of arrival of the test materiel.

FOR THE COMMANDER:

/t/ R. P. WITT
Associate Director
Materiel Test Directorate

COPY/bg

NNNN

7-812
23 Jul 69
ACTION: INF
INFO: POD
CMD GP

RTTUZYUW RUCIRRA9773 2032153-UUUU--RUEBEAA.

ZNR UUUUU

R 222155Z JUL 69

FM PROJ MGR RIFLES USAMC ROCK ISLAND ILL

TO RUEBEAA/CGUSATECOM ABERDEEN MD

INFO RUEBBNA/CGUSAMC

RUCIRRA/CGUSAWECOM ROCK ISLAND ILL

BT

UNCLAS

AMCPM-RS

SGD COL ISAACS

FOR AMSTE-BC MR. CRIDER; INFO FOR AMCPMSO-RS LTC SEMMLER; WECOM FOR AMSWE-RES-R MR. PACKARD.

SUBJ: PRODUCT IMPROVEMENT TEST FOR MODIFIED BUTTSTOCK ASSEMBLY FOR M16 RIFLE

1. REFERENCE FONECON BETWEEN MR. CRIDER AND LTC WEST ON 18 JUL 69, AND AMSTE-BC LTR DTD 28 FEB 69, SUBJECT AS ABOVE.

2. THIS OFFICE DESIRES THAT TECOM PROVIDE RECOMMENDATIONS ON THE ACCEPTABILITY FOR ADOPTION OF THE MODIFIED BUTTSTOCK.

COPY/bg

PAGE 2 RUCIRRA9773 UNCLAS

3. CURRENT PROGRAMMING PROVIDES FOR TECOM TO PERFORM THE ENVIRONMENTAL PORTIONS OF THE PRODUCT IMPROVEMENT TEST AND REMAINING ENGINEERING PORTIONS TO BE PERFORMED BY WECOM. TECOM HAS AGREED TO COMMENT ON THE SAFETY, FUNCTIONAL PERFORMANCE, AND DURABILITY ASPECTS.

4. IN ORDER TO PROVIDE A BASIS FOR A RECOMMENDATION BY YOUR OFFICE ON SUITABILITY, REQUEST YOUR COMMENTS BY 25 JUL 69, ON THE MOST DESIRABLE COURSE OF ACTION FOR COMPLETION OF THE PRODUCT IMPROVEMENT TEST. THREE COURSES OF ACTION ARE PROPOSED:

A. CONDUCT ENTIRE PIT AT TECOM.

B. CONTRACT WITH TO CONDUCT ENTIRE PIT AND SUBSEQUENT REVIEW BY TECOM.

C. CONTINUE WITH CURRENT PROGRAMMING.

BT

9773

JOINT MESSAGEFORM

SECURITY CLASSIFICATION: UNCLASSIFIED

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY DATE - TIME	MONTH	YR
1 OF 2	28-2005Z	RR			UU		282005Z	Jul	69

BOOK NO

MESSAGE HANDLING INSTRUCTIONS

FROM: CGUSATECOM APG MD

TO: CGUSAWECOM RI ILL

INFO : CGUSAMC WASH DC
CGUSAWECOM RI ILL

UNCLAS

AMSTE-BC

FOR: AMCPM-RS; AMCPMSO-RS; AMSWE-RES

Subj: PI Test of Modified Buttstock for M16A1 Rifle

A. Your 222155Z Jul 69 (U)

1. It is desired that the entire test program be conducted by TECOM. Tests can be initiated with materiel on hand subject to immediate delivery of item 2g below.

2. In addition to the materiel on hand, request the following be provided:

a. M16A1 Rifles - 5 each 12 Aug 69

b. Modified Stocks - 40 each 29 (21 new, 8 used)

c. Ball Cartridge, 5.56mm, M193 - 11200 each 12 Aug

d. Grenade Cartridge, 5.56mm, XM195 - 200 each 12 Aug

e. Rifle Grenade, inert, M29 - 200 each

DISTR:

DRAFTER TYPED NAMED, TITLE, OFFICE SYMBOL AND PHONE
CHARLES L. CRIDER, PO, AMSTE-BC, 3608

RELEASER

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE
C.J. MOLLOY, Jr. COL, Dir, AMSTE-BC, 4476

SIGNATURE

SPECIAL INSTRUCTIONS

SECURITY CLASSIFICATION

DD FORM 1 JUL 68 173 REPLACES DD FORM 173, 1 NOV 63 AND DD FORM 173-1, 1 NOV 63, WHICH ARE OBSOLETE.

GPO : 1969—648—16—80375-1 325-398

JOINT MESSAGEFORM							SECURITY CLASSIFICATION: UNCLASSIFIED		
PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY DATE – TIME	MONTH	YR
2 OF 2		RR			UU			Jul	69
BOOK NO	MESSAGE HANDLING INSTRUCTIONS								

f. Grenade Cartridge 40mm, M407A1 - 100 each
FROM:

g. Rubberized Envelope with cleaning materials mix - 10 each
TO:

3. Additional funds in the amount of $5000 is requested. Send to: Commanding Officer, Aberdeen Proving Ground, ATTN: STEAP-CO-P, Aberdeen Proving Ground, Md. 21005.

4. For materiel in paragraph 2 above, ship to: Transportation Officer, Bldg 714, Account No. A - 23080, Aberdeen Proving Ground, Md. 21005, M/F USATECOM Project No. 8-WE-613-016-001 (Formerly 8-9-0200-26)

6 5 4 3 2 1 0

DISTR:

0

DRAFTER TYPED NAMED, TITLE, OFFICE SYMBOL AND PHONE	SPECIAL INSTRUCTIONS
CHARLES L. CRIDER, PO, AMSTE-BC, 3608	
RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE: C.J. MOLLOY, Jr. COL, Dir, AMSTE-BC, 4476	
RELEASER: SIGNATURE: CJM	SECURITY CLASSIFICATION

DD FORM 1 JUL 68 173 REPLACES DD FORM 173, 1 NOV 63 AND DD FORM 173-1, 1 NOV 63, WHICH ARE OBSOLETE.

GPO : 1969—o43—16—80378-1 335-398

APPENDIX III - REFERENCES

1. Test Directive, USATECOM Project Transcript Sheet, 1 May 1969, Evaluation of Modified Buttstock Assembly for M16A1 Rifle, Project No. 8-9-0200-26.

2. MTP 3-2-513.

(Following Page Blank)

APPENDIX IV - ABBREVIATIONS

APG	=	Aberdeen Proving Ground.
MTP	=	Materiel Test Procedure.
TM	=	Technical Manual.
USATECOM	=	US Army Test and Evaluation Command.
USAWECOM	=	US Army Weapons Command.

(Following Page Blank)

APPENDIX V - DISTRIBUTION LIST

USATECOM Project No. 8-WE-613-016-001

Addressee	Final Report
Commanding General US Army Test and Evaluation Command Aberdeen Proving Ground, Maryland 21005	
ATTN: AMSTE-BC	38
AMSTE-ST	1*
Commanding General US Army Materiel Command Washington, D. C. 20315	
ATTN: AMCRD-WI	2*
AMCRD-ET	1*
AMCRD-R	1
AMCMA-R	1
AMCSF	1
AMCQA-E	1
AMCMR-CP	2*
Commanding General US Army Weapons Command Rock Island, Illinois 61201	
ATTN: AMSWE-RES	3
Commanding General US Continental Army Command Fort Monroe, Virginia 23351	
ATTN: ATIT-RD-MD	4
Commanding General US Army Combat Developments Command Aberdeen Proving Ground, Maryland 21005	
ATTN: USACDC LO, USATECOM	23*
Commanding General US Army Munitions Comand Dover, New Jersey 07801	
ATTN: AMSMU-RE-M	1

*Distribution denoted by an asterisk (*) will be furnished from those copies forwarded to Headquarters, USATECOM.

Addressee	Final Report
Chief of Research and Development Department of the Army Washington, D. C. 20310 ATTN: CRDME-1 CRDPES	 7 1
Assistant Chief of Staff for Force Development Department of the Army Systems Staff Officers Washington, D. C. 20310	 1
Project Manager, Rifles US Army Weapons Command Rock Island, Illinois 61201	 5*
Commandant US Army Infantry School Fort Benning, Georgia 31905 ATTN: AJIIS	 1
Commanding Officer US Army Logistics Doctrine Systems and Readiness Agency New Cumberland Depot, PO Box 2947 Harrisburg, Pennsylvania 17105 ATTN: LDSRA-ME	 1
Commanding Officer US Army Frankford Arsenal Philadelphia, Pennsylvania 19137 ATTN: SMUFA-J1000 SMUFA-C2500 SMUFA-B2000 SMUFA-Q1000	 1 1 2 1
Commanding Officer Rock Island Arsenal Rock Island, Illinois 61201	 1
Commanding Officer US Army Arctic Test Center APO Seattle, Washington 98733	 1

*Distribution denoted by an asterisk (*) will be furnished from those copies forwarded to Headquarters, USATECOM.

Addressee	Final Report
Commanding Officer Crane Naval Ammunition Depot Crane, Indiana 47522 ATTN: WPECNAD	2
Commanding Officer Yuma Proving Ground Yuma, Arizona 85364	1
Commanding Officer Eglin Air Force Base Eglin, Florida 32542 ATTN: AFATL-ATAWG	1
Commanding Officer US Army Small Arms Systems Agency Aberdeen Proving Ground, Maryland 21005 ATTN: AMXAA-A	1
President US Army Maintenance Board Fort Knox, Kentucky 40121	1
President US Army Infantry Board Fort Benning, Georgia 31905	1
US Marine Corps Liaison Officer Aberdeen Proving Ground, Maryland 21005	1
Commanding Officer Aberdeen Proving Ground Aberdeen Proving Ground, Maryland 21005 ATTN: STEAP-TL	2
Commander, Hq, Defense Documentation Center for Scientific and Technical Information Cameron Station Alexandria, Virginia 22314 ATTN: Document Service Center	20

Secondary distribution is controlled by US Army Weapons Command, ATTN: Project Manager, Rifles.

(Following Page Blank)

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*
Materiel Testing Directorate
Aberdeen Proving Ground, Maryland 21005

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3. REPORT TITLE
PRODUCT IMPROVEMENT TEST OF MODIFIED BUTTSTOCK ASSEMBLY FOR M16 AND M16A1 RIFLES

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
Final Report 26 August 1969 to 12 January 1970

5. AUTHOR(S) *(First name, middle initial, last name)*
Michael Trost

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
March 1970	51	2

8a. CONTRACT OR GRANT NO.
Not Applicable

b. PROJECT NO.
USATECOM Project No. 8-WE-613-016-001

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
APG-MT-3493

9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*

10. DISTRIBUTION STATEMENT
This document may be further distributed by any holder only with specific prior approval of US Army Weapons Command, ATTN: Project Manager, Rifles.

11. SUPPLEMENTARY NOTES
None

12. SPONSORING MILITARY ACTIVITY
USAWECOM

13. ABSTRACT

Product improvement testing of a redesigned buttstock for the M16 and M16A1 rifles was performed at Aberdeen Proving Ground from 26 August 1969 to 12 January 1970. The durability and usability of the stock in extreme temperatures (-65°F and +155 °F), adverse conditions environments of mud, dust, salt water, high temperature, and humidity and chemical compatibility, and weapon performance at various attitudes were evaluated. The new design was found to provide a compact stowage area, on the weapon, for all necessary cleaning equipment for the rifle. Comparative test results, using the standard buttstock for control, showed that durability of the test item equalled or surpassed that of the standard item. The shortcomings which occurred during testing of the redesigned buttstock, while detracting from its over-all performance, did not prevent usage of the item in any environment. It was recommended that the test buttstock be considered as an acceptable replacement and improvement over the standard item.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Buttstock, Modified, M16/M16A1 Rifles						
High-Temperature (+155°F)						
Low-Temperature (-65°F)						
High Temperature - Humidity						
Salt-Water Immersion						
Dust						
Mud						
Attitudes						
Chemical Compatibility						

DEPARTMENT OF THE ARMY
HEADQUARTERS, U. S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005

AMSTE-BC

4 MAY 1970

SUBJECT: Reports of Product Improvement Tests of Modified Buttstock Assembly for M16 and M16A1 Rifles, USATECOM Project Nos. 8-WE-613-016-001/002

Product Manager, Rifles
US Army Weapons Command
Rock Island, Illinois 61201

1. References.

a. Letter, AMSWE-RES-R, HQ USAWECOM, 8 Oct 68, subject: M16/M16A1 Modified Buttstock Assembly.

b. Message 28929, PM Rifles, 111630Z Dec 68, subject: On Weapon Stowage-M16 Rifle.

c. Message 1853, PM Rifles, 221930Z Jan 69, subject: Modified Buttstock Assembly for M16 Rifle.

d. Message 4476, PM Rifles, 192045Z Feb 69, subject: Modified Buttstock Assembly for M16A1 Rifle.

e. Message 11021, PM Rifles, 291615Z Apr 69, subject: Product Improvement Test of Modified Buttstock Assembly for M16A1 Rifle.

f. Message, PM Rifles, 222155Z July 69, subject: Product Improvement Test of Modified Buttstock Assembly for M16 Rifle.

2. Approval Statement. Subject reports are approved except as stated herein.

3. Background of Test.

AMSTE-BC 4 MAY 1970

SUBJECT: Reports of Product Improvement Tests of Modified Buttstock Assembly for M16 and M16A1 Rifles, USATECOM Project Nos. 8-WE-613-016-001/002

a. Reference 1a forwarded a request for an engineer design (ED) test of a modified buttstock assembly which consisted of a butt plate with trapdoor and a cleaning kit cavity. Reference 1b requested addition of a service type test. Reference 1c suggested that the ED test be at US Army Weapons Command (USAWECOM). Reference 1d revised the test effort to final product improvement tests by USAWECOM. After initiation of tests by US Army Infantry Board (USAIB), reference 1e advised that technical tests included areas which could not be accommodated by USAWECOM. Reference 1f provided the basis for conducting all the tests by US Army Test and Evaluation Command (USATECOM) as being more cost-effective and as best fulfilling the requirement for a suitability statement from USATECOM. The difference in the dates of the inclosed reports is due to this chronology.

b. Engineering type tests were conducted by Aberdeen Proving Ground (APG). Major subtests involved exposure to temperature extremes (-65°F and 155°F), and adverse conditions (dust, mud, oil and solvent compatibility, salt water immersion, temperature-humidity). In addition, service type tests by the USAIB addressed training aspects, and exposure to normal and adverse conditions during field exercises, effect on accuracy and firing rate including use of a 40mm Grenade Launcher Attachment, durability, transportability and human factors, with special emphasis on operation of the trapdoor, and use of the cleaning kit.

c. In the absence of specific criteria, the performance of the modified stock was compared on a direct basis as being either equal to or better than the standard stock.

d. The storable cleaning kit consisted of a rubberized envelope, cleaning rod and tip, chamber and bore brush, oiler, patches and pipe cleaners. Except for the rubberized envelope and oiler, the kit items are standard. The rubberized envelope prevents rattling of components as well as minimizing contamination.

4. Results of Test.

a. There are no reported deficiencies. APG reported three shortcomings. USAIB reported one shortcoming. They are:

(1) Perforation of the rubberized envelope by the cleaning rod sections during rifle grenade firing and five-foot drop tests. (ET)

(2) The rubberized envelope was difficult to open at cold temperatures due to its inflexibility. (ET)

(3) During engineering drop tests and rifle grenade firing tests both the test and control stocks developed cracks, but the test stock was less vulnerable and more durable. (Service tests did not reveal any structural differences between stocks when executing butt strokes, when breaking a fall while assuming the prone position, or during bayonet exercises.) (ET)

(4) Opening of the hinged trapdoor requires the use of a cartridge or another pointed field expedient tool. (ST)

b. Service tests revealed the need to add an oiler and an all-purpose cleaning brush to the cleaning kit. Standard field lubrication in 2 ounce squeeze bottles will not fit in the cavity.

c. The modified buttstock introduces no additional requirements for maintainability and does not degrade reliability. As prescribed for the external parts of the rifle, a light coat of oil on the buttstock assembly is adequate. The top buttstock screw is not rust resistant and requires more maintenance than normally required for other external surfaces of the rifle.

d. Comparability between test and control buttstock was achieved in all other subtests.

5. Comments.

a. The modified stock, less cleaning equipment, is 0.37 pounds heavier than the standard stock. With cleaning equipment it is 0.75 pounds heavier, but the extra weight was not stated as operationally objectionable; test subjects stated that the extra weight seemed to provide better balance to the weapon during handling exercises.

b. When completely submerged, water will enter the stock cavity. Nevertheless, the cleaning equipment remained dry when encased in an intact folded over rubberized envelope.

c. With the trapdoor closed, mud did seep into the storage cavity but the rubberized envelope provided adequate protection to its contents. Mud seepage into the trapdoor latch recess affected the ease of opening and closing the door. It was not clearly determined as seriously objectionable but warrants review.

d. The USAIB report states that manual opening rather than use of a field expedient to open the trapdoor is desirable and recommends modification. This command does not concur in the recommended modification for the following reasons:

(1) A cartridge is specified as the basic tool for disassembly of the M16A1 Rifle and will also serve as a suitable tool for opening of the trapdoor as confirmed by USAIB message, Inclosure 3.

(2) After repeated use of a single cartridge for 100 trapdoor openings it could still be fired without difficulty and this is also confirmed by Inclosure 3.

(3) It is noted that not one incident of inadvertent opening of the trapdoor occurred during testing. Reduction of opening forces to achieve manual opening can not only compromise this integrity but could make for a more complex and weaker assembly.

e. Currently, the oil and the bore cleaner for the M16A1 Rifle are packaged in separate 2 ounce containers which will not fit into the buttstock cavity. The USAIB report concludes that an oiler and cleaning brush is needed. The oiler previously used for the M14 Rifle was included in the test kit and it provided sufficient oil and bore cleaner for one cleaning of the M16A1 Rifle. An all-purpose cleaning brush to be accommodated in the cavity is under development which is intended to fulfill the need stated in the USAIB report.

f. Instructions were not issued with respect to procedures for opening and closing the trapdoor. Test subjects were permitted to use a field expedient tool of their own choice, including a cartridge. Although not reported, the cartridge is the intended and the most appropriate device for opening the trapdoor; manuals must state this together with specific instructions on maintenance and use of the modified buttstock assembly.

g. Voids in the foam filler were evident in 10 of the 40 test stocks. Although degradation of stock performance was not apparent, quality control to minimize or control size and locations of voids should be implemented.

6. Conclusion. It is concluded that the modified buttstock assembly is suitable to release for field use.

7. Recommendations. It is recommended that:

a. The top buttstock screw be made corrosion resistant.

b. Manuals be updated to include maintenance and use of the modified buttstock assembly.

c. A suitable container for oil and bore cleaner be included in the cleaning kit.

d. The rubberized envelope for the cleaning kit be improved to remain intact and flexible.

FOR THE COMMANDER:

Michael Paulick

MICHAEL PAULICK
Brigadier General, USA
DCG/CofS

3 Incls (5 cys ea)
1. APG Report, Mar 70
subj as above
2. USAIB Report, Apr 69
subj as above, w/Addendum, 5 May 69
3. USAIB message

AMSTE-BC 4 MAY 1973

SUBJECT: Reports of Product Improvement Tests of Modified Buttstock Assembly for M16 and M16A1 Rifles, USATECOM Project Nos. 8-WE-613-016-001/002

Copies furnished:
CG USAMC ATTN: AMCRD-WI (2 cys ea)
AMCRD-ET (1 cy ea)
AMCMR-CP (2 cys ea)
CG USACDC ATTN: USACDC LO USATECOM (23 cys ea)
CO APG ATTN: STEAP-MT (w/o incl)
Pres USAIB (w/o incl)