DEPARTMENT OF THE ARMY
UNITED STATES ARMY MATERIEL COMMAND
PROJECT MANAGER — RIFLES
ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61201

JR
25-6

IN REPLY REFER TO:
AMCPM-RS

31 March 1967

SUBJECT: Minutes of M16/M16A1 Rifle Technical Coordinating Committee Meeting on 2 March 1967

TO: SEE DISTRIBUTION

1. Attached hereto for your retention and necessary action are the minutes of the 2 March 1967 meeting of the M16/M16A1 Rifle Technical Coordinating Committee.

2. The action agencies designated after each paragraph are requested to take aggressive follow-up action to complete assigned tasks. Any delay in completion of the assigned tasks should be reported telephonically to the Project Manager, Rifles.

3. Sufficient copies have been included for each addressee for distribution to personnel listed in inclosure 1 (of the minutes), as well as other interested agencies.

Harold W. Yount

HAROLD W. YOUNT
Colonel, GS
Project Manager, Rifles

1 Incl
as

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Encl 2

AMCPM-RS 31 March 1967
SUBJECT: Minutes of M16/M16A1 Rifle Technical Coordinating Committee Meeting on 2 March 1967

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MINUTES
M16/M16A1 RIFLE TECHNICAL COORDINATING COMMITTEE MEETING
ROCK ISLAND ARSENAL, ILLINOIS
2 MARCH 1967

1. The 18th meeting of the M16/M16A1 Rifle Technical Coordinating Committee was held on 2 March 1967 at Rock Island Arsenal, Illinois. Major William T. Barrett of the Office of the Project Manager, Rifles, chaired the meeting. The list of attendees is shown as inclosure 1.

2. Major Barrett opened the meeting with the following announcements:

a. The XM16E1 Rifle has been type classified Standard A and is designated the M16A1 Rifle.

b. The CAR 15 Submachine Gun has been designated as Submachine Gun, 5.56mm, XM177/XM177E1.

c. The XM3 Bipod for the M16A1 Rifle has been type classified Standard A and is designated the M3 Bipod.

3. A synopsis of each discussion follows with the action agency responsible for follow-up listed at the end of each paragraph.

a. Chrome-plated Chamber

Maj Barrett summarized the findings of a team from the Project Manager's Office who recently visited Vietnam to investigate maintenance problems on the M16A1 (XM16E1). One malfunction which occurred too frequently was a failure to extract. Proper cleaning procedures alleviated this problem, but it was found that some chambers were actually pitted, owing to lack of thorough cleaning, and the very rigorous environment. Pitted chambers cannot be restored to serviceability by any feasible method, and thus require that the barrel be replaced. To avoid pitting of chambers, Colt's has experimentally chrome-plated the chambers of some barrels. Sixteen of these barrels were sent to Vietnam, for evaluation under control of Army Concept Team in Vietnam (ACTIV). A report from ACTIV is scheduled for April 1967. The chrome-plated chamber was also included in five SMG's (XM177E1) which will be furnished to TECOM for product-improvement tests, and thirty additional SMG barrels with chrome-plated chambers are being sent to Vietnam for fitting to weapons already in country. Six M16 barrels with chrome-plated chambers were furnished to USAF for testing.

Mr. Aumen, USAF, reported verbally that tests had been conducted by the USAF using six M16 Rifles with chrome-plated chambers. The weapons were exposed at 70° for 24 hours, and for 48 hours at 130°, at 100% humidity. The rifles were fired 15,000 rounds each, and were cleaned only at intervals of 2,000 rounds during testing. There were 3.4 failures to extract per 1,000 rounds with the chrome-plated chambers, and 16.2 failures to extract per 1,000 rounds with the standard chambers. It was concluded by these tests that the chrome-plated chambers showed less corrosion, better extraction, and were more easily cleaned. The report will contain further details, and is being prepared for publication.

Considerable discussion followed concerning the process of chrome-plating and the tolerances involved. Mr. Fremont, Colt's Inc., stated that the chrome-plating could be applied with the chambers reamed to current specifications and usually still meet the final inspection gage requirements. However, he indicated that the chambers might occasionally be undersize by as much as .0006", unless a change was made in the process so as to allow for the thickness of the plating applied. Colt's Inc. advised the committee that an estimated cost of chrome-plating a chamber would be $1.25 per weapon.

The committee agreed that the chamber, after chrome-plating, would have to conform to all of the present dimensional requirements for finished chambers. No "undersized" chambers could be allowed even as a temporary measure.

The committee agreed to the adoption of a chrome-plated chamber for the rifle and SMG, provided that the tests conducted by the USAF and the Army proved that the chrome-plated chamber was significantly better than the present chamber and that a reasonable cost could be confirmed.

Action: USAF & PM

b. Twist of Rifling

Mr. Carn of BRL explained that a review had been made of the data which were developed in preparation for the decision on barrel twist which was made in 1963. Some additional attention has been given to the round-to-round variation in stability factor for M193 bullets fired in the 14-inch twist. This analysis is consistent with the reported variation in accuracy from barrel to barrel, and from lot to lot of ammunition when the 14-inch twist was employed with the M193 bullet. It, thus, appears that a reduction in average stability should be approached with caution, considering that round-to-round variations about the average may yield some unstable bullets, and thus cause poor accuracy, even in normal temperature-zone use.

Mr. Carn reviewed again the consideration which led to the BRL recommendation of the 12-inch twist in 1963, and indicated that for the same specified environmental range (-65°F to +125°F), that recommendation is confirmed, in light of all the data available now as well as then. He indicated, however, that for more limited temperature ranges, some other solutions might be acceptable.

It was pointed out that the really significant variable in the argument of rifling twist is the stability factor of the bullet. There are well established means of changing the stability factor, by design changes in bullet configuration, while holding constant the twist of rifling. There are many technical advantages in approaching the question from the more general standpoint of bullet stability factor (instead of restricting the discussion to the question of barrel twist) and BRL is studying the question in that broader context.

After considerable discussion it was agreed by all service representatives on the committee that the decision made in 1963 on the twist rate of the AR15/M16/XM16E1 barrel is reaffirmed, and that barrels having a twist rate of 12 inches per turn should be continued in production and use. However, additional studies will be conducted by BRL on means of optimizing the stability factor for various ranges of temperature environment.

ACTION: BRL

c. Exterior finish on the M16/M16A1 Rifle

Maj Barrett advised the committee that exfoliation and inter-granular corrosion was taking place on the upper and lower receivers of the M16A1 Rifle. As part of the corrective action being taken, the USAF and the Army will conduct tests to determine the suitability of shot-peening the receivers in lieu of sand blasting.

Mr. Fremont indicated that shot-peening would provide a more durable finish and aid in the prevention of exfoliation and inter-granular corrosion. Colt's Inc. has been taking other corrective actions to improve the finish on the receivers. These actions include improved controls on the chemical processes by which the protective finishes are applied. The contractor indicated that a substantial improvement had been made toward corrosion-resistant receivers.

Mr. Powers, Colt's Inc., stated that the estimated cost of shot-peening the lower receiver would be eight (8) cents and for the upper receiver it would be five (5) cents. The costs quoted were based on 200,000 to 300,000 each upper and lower receivers, and were estimates only.

The committee agreed that shot-peening of the upper and lower receivers was desirable providing that the cost quotes were correct and that the USAF and Army test proved that the shot-peening was superior to the present method of sand blasting.

ACTION: USAF & PM

d. XM195 Rifle Grenade Cartridge

Representatives from the Department of Army and the Combat Developments Command were asked if there was any forecast on future requirements for the XM195 Rifle Grenade Cartridge, as a small quantity was presently being produced to satisfy a Vietnam requirement.

The DA and CDC representatives indicated that the present Vietnam requirement was a limited one, based on the use of some rifle-launched pyrotechnic flares and signals as temporary expedients. The Army's eventual requirement for the XM195 grenade cartridges depends upon the outcome of some tests being done by USAMUCOM to evaluate both 40mm and rifle-launched pyrotechnic munitions. No forecast is available at this time.

The DA and CDC representatives agreed that there is no need to further develop the XM195 Cartridge with a view toward standardization at this time.

e. XM177/XM177E1 Submachine Gun

Maj Barrett advised the committee that some product improvements were currently being evaluated for the XM177/XM177E1 SMG. The most important of these was a provision for mounting the XM148 Grenade Launcher on the SMG. This necessitates an increase of about 1½ inches in the length of the barrel, to give mounting space for the launcher attaching brackets. The increase in overall weapon length is disadvantageous, but there are also some incidental advantages to be gained with the longer barrel. A significant increase in velocity should be achieved, and there may be significant reductions in sound and flash. Concurrently with the tests of the longer barrel, certain other product improvements will be evaluated, including a nylon-coated buttstock, and a plastic (Delrin) charging-handle latch which greatly reduces wear on the upper receiver. These weapons will also have chrome-plated chambers, in order to evaluate this feature concurrently. Further details on product-improvements of the XM177/XM177E1 are given in inclosure 6.

Mr. Aumen, USAF, advised the committee that the longer barrel could possibly be detrimental to the USAF usage of the SMG. The longer barrel could cause problems in the packaging of the SMG in their survival kits. He stated that this was the only objection that the USAF had toward the longer barrel, and that an investigation into this matter would be conducted.

Col Yount, WECOM, indicated that there is no officially stated requirement for the XM148 Grenade Launcher to be mounted to the SMG. However, he indicated that unofficial interest in SMG/launcher combination would most probably generate a formal requirement, and he stated that the tests would be conducted to prove out the feasibility of this combination.

ACTION: USAF & PM

f. XM148 Grenade Launcher

Maj Podurgal, WECOM, advised the committee that all the weapons for the Army have been shipped to Vietnam, have been distributed to the divisions and brigades, and have now been in use in Vietnam for about five (5) weeks.

As the team chief of a New Equipment Training Team on the XM148 Grenade Launcher in Vietnam, he visited every major Army unit. The team trained about 500 key personnel in the maintenance, care and cleaning and operation of the weapon.

Upon completion of their mission, the team had an opportunity to interview twenty (20) grenadiers from the 1st Bn, 173d Abn Bde, who had used the launcher on operations during the three (3) previous weeks. Their opinion of the weapon, compared to the M79 Grenade Launcher, was highly favorable.

The committee was advised that the Army Concept Team, Vietnam (ACTIV) is conducting a battalion-size test of the launcher in the 199th Infantry Brigade operating in the Rung Sat Special Zone. The results of this evaluation are expected in April of this year.

g. Field Commanders Reports

The committee was advised that forms for a Field Commanders Report on the XM148 Grenade Launcher will be sent to the field during the month of March 1967. Four quarterly reports will be prepared by battalion commanders, company commanders and commanders of direct support maintenance units. The first of these reports should be submitted in April 1967.

ACTION: PM

h. New Sight for the XM148 Grenade Launcher

Maj Podurgal advised the committee that the present major effort in the XM148 program is the development of an improved sight. The existing sight, although extremely accurate, is a little cumbersome and is one which could pose problems in the Vietnam environment. The new sight will nest into the carrying handle of the M16A1 Rifle, is more compact and has fewer moving parts than the present sight. The new sight was tested by the USAIB and is presently being tested by D&PS. The tests at D&PS should be completed in March 1967.

ACTION: PM

The USAF and the U. S. Marine Corps indicated that they would prefer to test the new sight prior to establishing any service requirements for the item.

ACTION: USAF & USMC

i. IMR 8208M Propellant Production

At the April 1966 Technical Committee Meeting, Frankford Arsenal was requested to take action to procure 8208M Propellant. Attached as inclosure 2 is a detailed summary of the IMR 8208M Propellant production to date. The summary indicates that contracts were awarded to Dupont for a total quantity of 1.25 million pounds of IMR 8208M. To date approximately 29 million M196 Tracer Cartridges have been produced at LCAAP with IMR 8208M. Loading of M193 Ball Cartridges with IMR 8208M will begin at LCAAP and TCAAP during March 1967.

Further, in connection with the subject of propellants, Dr. Payne requested that a quotation be entered in the record from a Springfield Armory document, as follows: "The performance when using the proposed buffers and ball (WC846) propellant is not as good as the past performance of the M16 Rifle using standard buffers and IMR (CR8136) propellant". This statement appears in a Springfield Armory "Intradivision Work Request Reply", from the Chief, Test Branch to the Chief, Program and Control Office, No. P&CO-G-109-66, pertaining to "Item:

Buffer for 5.56mm, XM16E1 Rifle". In discussion on this point, the consensus was that the Springfield Armory tests were neither designed nor executed with the object of comparing types of propellant per se, and that the context from which the aforementioned quotation is taken indicates that this Springfield Armory document is not a suitable basis on which to judge the overall suitability of propellant types. The ammunition lots involved were made by different manufacturers, and may well have differed in other respects than just the propellant. There were, for example obvious anomolies in the data for firing at -65°F with tracer and ball cartridges, involving IMR and ball propellants, which cannot reasonably be explained by propellant attributes alone; this indicates the effect of uncontrolled variables which contraindicate use of the data for a definitive comparison of propellant types.

j. Monthly Fouling Tests

During the April 1966 Technical Committee Meeting, Frankford Arsenal was requested to investigate fouling and recommend necessary changes to specifications of testing and control in the acceptance of ammunition. Attached as inclosure 3 is a summary of tests to be conducted and the results of fouling tests conducted during February 1967.

The results of the February fouling tests indicate that the weapon malfunctions caused by fouling in tracer ammunition are probably attributable to pyrotechnic fouling deposits in the mechanism from the burning tracer igniter element, in addition to propellant fouling.

ACTION: FA

k. Standard 5.56mm Cartridge Case

During the January 1966 Technical Committee Meeting, Frankford Arsenal was requested to recommend to the Project Manager, Rifles whether or not justification exists for a change to military specifications which would place further restrictions on the manufacturing of cartridge cases. Attached as inclosure 4 is a summary of the Frankford Arsenal efforts to-date. The results to-date indicate that the ammunition producers appear to have their hardness and grain size patterns under control. Frankford Arsenal indicates that their recommendations concerning hardness and grain size requirements will be available in June 1967.

ACTION: FA

l. Bullet-in-bore Problem

All current producers of 5.56mm ammunition have been advised of a potential problem which has caused, under some circumstances, three types of cartridge malfunction; namely, (1) bullets remaining in the bore at the forcing cone location of M16/M16A1 Rifles, (2) cartridge misfires, and (3) hangfires. These three types of malfunctions appear to be interrelated and caused by a common problem, differing only by degree of severity. The problem relates to ignition characteristics of the small-size primer employed in the design of the 5.56mm cartridge. Details are given in inclosure 5, which is a report by Frankford Arsenal.

ACTION: FA

m. Range Standardization

A ballistic range standardization program was undertaken among Dupont, Frankford Arsenal, LCAAP and TCAAP in order to assure accurate and uniform ballistic results in the acceptance of IMR 8208M propellant and 5.56mm Ball and Tracer Cartridges loaded with this propellant. Ballistic agreement among these facilities was readily attained during the testing of the M193 Ball Cartridge. However, instrumentation problems were encountered and are yet to be resolved with regard to recording velocity of the M196 tracer cartridge. It appears that the M196 tracer bullet prematurely actuates the first velocity screen located 5 feet in front of the gun and thereby records an erroneously low velocity value. This problem is unique to the 5.56mm tracer in view of the fact that the velocity requirement for 5.56mm ammunition is stipulated for 15 feet from the muzzle, whereas the velocity requirement for other calibers of small arms ammunition is stipulated at 78 feet from the muzzle of the weapon. It is anticipated that resolution of the problem will be accomplished by making electronic modifications to the velocity screens. Testing of the modification will be accomplished early in March 1967.

ACTION: MUCOM

n. Telescope Requirement for the M16/M16A1 Rifle

Representatives of DA and CDC were asked if there was a future requirement for telescopes for the M16/M16A1 Rifle as a small quantity of Colt "Realist" telescopes had been sent to Vietnam. The representatives advised the committee that CDC is presently studying Army Requirements for telescopes. A representative of ACSFOR indicated that the question of a telescope will not come under the purview of the Technical Committee until such time as an SDR is prepared.

Both the U. S. Marine Corps and the USAF indicated that there is no requirement for a telescope for the M16/M16A1 Rifle at this time.

ACTION: ACSFOR & CDC

o. M3 Bipod

LTC Hogan, ACSFOR, advised the committee that the Army was reviewing the current basis of issue (BOI) for the M3 Bipod. He indicated that CDC will request that the bipod be issued on a two (2) per squad basis. He requested that consideration be given to determining another method by which to carry the cleaning rod, as it is now carried in the bipod case.

Col Yount advised the committee that he had anticipated the possibility of the change in BOI and that some preliminary work had been done to resolve carrying the cleaning rod. An experimental handguard, incorporating clips for carrying the cleaning rod, was passed around for examination. The committee was advised that other means were also being considered.

ACTION: PM

LIST OF ATTENDEES

NAME	ORGANIZATION	ADDRESS	TELEPHONE NO.
Dr. W. B. Payne	Office of Under Secretary of the Army	Wash., D.C.	OX 50083
Mr. F. J. Vee	OSD(I&L)(WI)	Wash., D.C.	OX 79223
Col H. W. Yount	AMCPM-RS	RIA	794-5546
Mr. S. R. Wildman	AMCPM-RS	RIA	794-6423
Mr. W. C. Davis	AMCPM-RS	RIA	794-6731
Mr. C. J. Rhoades	AMCPM-RS	RIA	794-6731
LTC H. P. Underwood	AMCPM-RS	RIA	794-6843
Maj E. Podurgal	AMCPM-RS	RIA	794-6756
Maj W. T. Barrett	AMCPM-RS	RIA	794-6882
Mr. C. E. Freeman	AMCPM-RS	RIA	794-6441
Mr. C. R. Fagg	AMCPM-RS	RIA	794-6636
LTC E. S. Andolina	AMCPMSO-RS	Wash., D.C.	OX 71695
LTC J. D. A. Hogan	OACSFOR	Wash., D.C.	OX 76676
LTC R. M. Hall	OCRD	Wash., D.C.	OX 54585
LTC D. F. Schnoor	DCSLOG	Wash., D.C.	OX 50714
Mr. L. A. Smith	AMC	Wash., D.C.	OX 52161
Mr. C. C. Crider	USATECOM	APG, Md.	278-3608
Mr. R. E. Carn	BRL	APG, Md.	278-3785
Maj T. G. Westerman	CDC	Ft. Belvoir, Va.	43337
Maj M. S. Edmunds	USMC	Wash., D.C.	OX 41341
Mr. James F. Weller	NAD CRANE	Crane, Ind.	854-2511
Mr. Wm S. Aumen, Jr.	USAF (AFATL-ATWG)	Eglin AFB	882-2488
Mr. W. E. Struve	USAF	Wash., D.C.	OX 75414

Incl 1

LIST OF ATTENDEES (CONT)

NAME	ORGANIZATION	ADDRESS	TELEPHONE NO.
Mr. H. P. Carr	USAF (WRNQTCA)	Warner-Robbins	5156/4373
Mr. Scott Spaulding	USAMUCOM	Dover, N.J.	3232/2269
Mr. George H. Cowan	USAMUCOM	Dover, N.J.	2283
Mr. Charles E. Shindler	Frankford Arsenal	Phila., Pa.	6112
Mr. Joseph R. Cranks	Frankford Arsenal	Phila., Pa.	22223
Mr. Wright H. Scidmore	Frankford Arsenal	Phila., Pa.	5163
Mr. S. M. Adelizzi	Frankford Arsenal	Phila., Pa.	7250
Mr. James Powers	Colt's Inc.	Hartford, Conn.	527-4101
Mr. Robert D. Fremont	Colt's Inc.	Hartford, Conn.	527-4101
Mr. Robert E. Roy	Colt's Inc.	Hartford, Conn.	527-4101
Mr. Charles Anderson	SWERI-QAE	RIA	5331/6872
Mr. Philip E. Heberle	SWERI-RDE	RIA	5065

IMR 8208M Propellant Production

Concurrence of the joint services for the use of IMR 8208M propellant in 5.56mm Ball and Tracer ammunition was obtained in June 1966.

Contracts were placed with Dupont for a total quantity of 1.25 million pounds of IMR 8208M for loading both Ball and Tracer 5.56mm cartridges at Lake City and Twin Cities Army Ammunition Plants. This total quantity of propellant will be utilized in the loading of approximately 200 million M193 Ball cartridges and 105 million M196 Tracer cartridges.

To date approximately 3/4 million pounds of IMR 8208M propellant has been produced and delivered to LCAAP and TCAAP. Approximately 29 million M196 Tracer cartridges have been produced at LCAAP with IMR 8208M propellant. Loading of M193 Ball cartridges with IMR 8208M propellant at LCAAP will begin during March 1967.

Ballistic acceptance test results at Dupont for all lots of IMR 8208M produced to date have complied with requirements. However, the velocity-pressure relationship of lots produced to date has not been as good as that of the three pilot lots originally tested (the results of which lead to the approval and adoption of IMR 8208M for loading 5.56mm ammunition). Dupont ballistic acceptance data for the first 14 production lots indicate an average chamber pressure level of approximately 47,000 to 49,000 psi as compared with pressure levels of approximately 43,000 to 46,000 psi for the first three pilot lots. Because of additional variables inherent to production loading of cartridges, pressure levels approaching 52,000 psi (the maximum permitted by Technical Data) have been encountered at the cartridge loading plants. Note: A waiver allowing a 50 ft/sec reduction in velocity was given LCAAP in loading four lots of IMR 8208M propellant

to preclude loading M196 Tracer cartridges to a chamber pressure exceeding 52,000 psi.

Dupont has made some improvement with regard to the pressure levels of more recent lots of IMR 8208M and will continue efforts to improve this parameter to afford cartridge loading plants the greatest margin of safety possible. A margin of approximately 5,000 psi is anticipated.

Monthly Fouling Tests

A 1000 round monthly fouling test will be conducted on each type cartridge (Ball and Tracer) containing each type propellant (Ball and IMR) produced by each manufacturer. Testing will begin with February 1967 production. Test results of February and March production should be available during March 1967. These tests will be run at Frankford Arsenal and will comprise testing parameters beyond the scope of current fouling test requirements; i.e., will include climatic conditions, analysis of fouling deposits, etc.

Data obtained from these tests will be used in establishment of a more comprehensive and objective fouling test for future implementation into Technical Data.

Recent Fouling Tests Conducted (1000 rds each) Feb 1967

Producer	Cartridge Type	Propellant Type	Stoppage Round No.	Remarks
Olin	Ball	WC846-Ball	None	
Olin	Tracer	WC846-Ball	801	Bolt failed to close - fouling
Remington	Ball	WC846-Ball	921	Misfire due to fouling
Remington	Tracer	CR8136	903	Bolt failed to close - fouling
Remington	Tracer	IMR 8208M	901	Bolt failed to close - fouling
Federal	Ball	WC846-Ball	None	
LCAAP	Ball	WC846-Ball	None	
LCAAP	Tracer	WC846-Ball	None	
LCAAP	Tracer	IMR 8208M	None	
TCAAP	Ball	WC846-Ball	None	
LCAAP/FA	Tracer	IMR 8208M (Radford)	901	Bolt failed to close - fouling

Observation:

(1) Failures due to fouling in Tracer ammunition are probably attributable to pyrotechnic fouling deposits on the bolt from the burning tracer bullets, in addition to propellant fouling.

(2) Failures due to fouling in Ball ammunition result in primer misfires caused by fouling inside bolt restricting movement of firing pin.

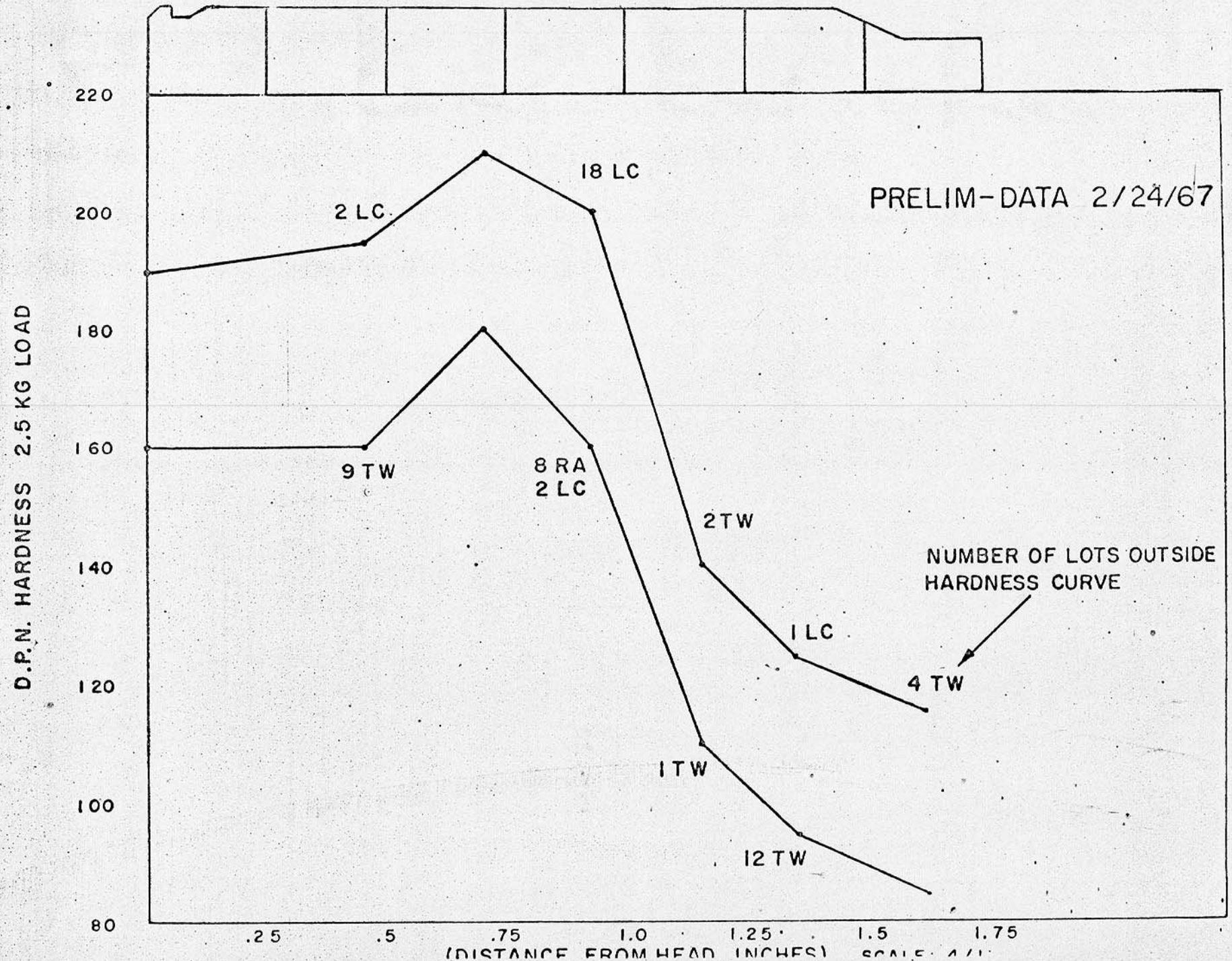
Study to Establish Hardness and Grain Size Requirements for 5.56mm Cartridge Case

Hardness and grain size data have been submitted for approximately 170 lots of 5.56mm cartridge cases by the various producers. These data is correlated with Function and Casualty test results. To date, one cartridge case casualty has been encountered in 122,000 rounds fired. All producers appear to have their hardness and grain size patterns under control. With few exceptions, all producers are manufacturing cartridge cases within the limits of a hardness pattern thought to be realistic for 5.56mm ammunition.

All data will be complete in June 1967, at which time recommendations can be made to establish hardness and grain size requirements.

Incl 4

5.56MM CTG CASE HARDNESS



Agenda Item

5.56mm Bullet Remaining in Bore Problem

All current producers of 5.56mm ammunition have been advised of a potential problem which has caused, under some circumstances, three types of cartridge malfunctions; namely, (1) bullets remaining in the bore at the forcing cone location of M16 Rifles, (2) cartridge misfires, and (3) hangfires. These three types of malfunctions appear to be interrelated and caused by a common problem, differing only by degree of severity. NOTE: Under normal production conditions (compliance with normal cartridge loading and primer production controls), this problem is not likely to be encountered.

The problem can be described as the failure or near-failure of the primer to ignite the propellant charge. Although testing to date has been somewhat limited, it has been observed that the problem is aggravated by the following conditions:

a. Increased airspace within the cartridge

b. Cold temperature

c. Low primer pellet weights

d. In M16 Rifles as opposed to bolt action test weapons

Malfunctioning cartridges which have caused bullets to remain in the bore have exhibited similar characteristics; namely, the primer fires, fails to ignite the propellant charge and the bullet moves out of the cartridge case into the forcing cone of the rifle bore. Examination of cartridge misfire specimens has revealed these same characteristics except that bullets do not move out of the cartridge case. In addition, these malfunction cartridges exhibit movement of the propellant against the base of the bullet as well as some fusion of the propellant charge but no evidence of ignition of any of the propellant. It is believed that hangfires which have been observed merely reflect the above conditions to a lesser degree.

Results of limited tests to date indicate but do not verify that these type malfunctions could possibly be induced under certain conditions with any combination of primer and propellant currently being used in production of 5.56mm ammunition. However, primers such as the FA 41 and Federal 215 containing metallic fuels appear to have greater potential in ignition of propellants under the conditions cited above (a thru d). For this reason, it was requested that each 5.56mm ammunition producer take cognizance of the potential problem and possibly investigate the likelihood of occurrence of these malfunctions with the primer-propellant combinations employed in their production. It was suggested the following be considered:

a. Using all combinations of primer and propellant types employed by the producer, design test to interrelate the following:

(1) Effect of primer pellet weight variation (minimum vs. maximum pellet weight permitted by process control).

(2) Effect of increased internal airspace (normal propellant charge vs. reduced propellant charge producing an airspace of 0.300 inches minimum).

b. Fire test cartridges at -65°F in a M16 rifle in accordance with the schedule prescribed for Function and Casualty testing.

M16/M16A1 Rifle

1.

PRODUCT IMPROVEMENT	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Ejection port cover - Substituted swaged latch for brazed latch.	6 Nov 64	Reduction	X	X
Gas Tube - Provided for stainless steel tube.	11 Dec 64	No Change	X	X
Upper & Lower Receiver - Reduced stress concentration, strengthened trigger guard, & eliminated possible interference.	8 Jan 65	No Change		X
Safety Lever - Revised to increase strength.	19 Jan 65	No Change		X
Cam Pin Hole - Established control on depth of staking.	21 Jan 65	No Change		X
Key Bolt Carrier - Strengthened and improved staking of screws.	24 Feb 65	No Change		X
Ejector Spring - Revised to improve reliability.	9 Mar 65	No Change		X
Extractor - Revised to improve reliability.	29 Mar 65	No Change		X
Handguard - Provided for stronger materiel (8130)	19 Mar 65	No Change	X	X
Bolt - Revised finish requirements from "Electrolize" to "Parco-Lubrite" exterior and to "Electrolize" interior.	15 Sep 65	Reduction	X	X

2.

PRODUCT IMPROVEMENT	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Handguard Liner - Revised materiel requirements to improve corrosion resistance.	10 Jun 65	No Change		X
Bolt - Revised hardness specification to improve life.	16 Jun 65	No Change		X
Key, Bolt Carrier - Revised finish requirements from "Electrolize" to "Parco-Lubrite" exterior and to "Electrolize" interior.	2 Sep 65	Reduction	X	X
Extractor - Revised finish requirements from "Electrolize" to "Parco-Lubrite".	2 Sep 65	Reduction	X	X
Ejector - Revised finish requirements from "Electrolize" to "Parco-Lubrite".	2 Sep 65	Reduction	X	X
Firing Pin Retaining Pin - Revised configuration to improve service life (cotter pin type).	2 Sep 65	Reduction	X	X
Pin, Extractor - Revised finish requirements from "Electrolize" to "Parco-Lubrite".	2 Sep 65	Reduction	X	X
Bolt Carrier - Revised finish requirements from "Electrolize" exterior to "Parco-Lubrite" and to "Electrolize" interior.	2 Sep 65	Reduction		X
Firing Pin - Revised materiel requirements to improve life.	3 Sep 65	No Change		X
Bolt Catch - Revised configuration to improve life.	3 Sep 65	No Change		X

3.

PRODUCT IMPROVEMENT	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Disconnect - Revised configuration to improve strength.	15 Sep 65	No Change		X
Pin, Takedown - Provided alternate materiel and improved case quality.	20 Jan 66	No Change		X
Pin, Receiver Pivot - Revised materiel and heat treat specifications to improve core & case qualities.	20 Jan 66	No Change		X
Firing Pin Retaining Pin - Revised materiel and heat treat specifications to improve service life.	20 Jan 66	No Change		X
Lower, Receiver - Provide protective boss around magazine catch button.	16 May 66	Increase		X
Screw, Buttcap - Revised to provide buttstock drainage.	23 Jun 66	Increase		X
Action Spring Guide Assembly (Buffer) - Improve reliability by reducing cyclic rate and eliminating possible carrier bounce.	16 Jul 66	Reduction	X	X
Spring Latch - Insure more positive locking of charging handle.	21 Jul 66	No Change		X
Spring, Latch (Charging Handle) - Revised to improve locking.	21 Jul 66	No Change		X
Bipod - Revised to provide riveted assembly.	1 Aug 66	Reduction		X

M16/M16A1 Rifle

4.

PRODUCT IMPROVEMENT	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Lower Receiver & Receiver Extension Assembly - Torque receiver extension in lieu of drilling & pinning.	1 Aug 66	Reduction		X
Charging Handle - Changed dimension to insure more positive locking of charging handle.	9 Aug 66	No Change		X
Bolt Catch Spring - To improve bolt catch action by increasing load at assembled length.	17 Aug 66	No Change		X
Flash Suppressor - Replaced open-end flash suppressor.	30 Sep 66	Increase	X	X
Bolt - Shot peening to increase fatigue life.	6 Feb 67	Increase	X	X
Front Sight Post & Selector Lever - Added lubra-plate to front sight post & selector lever.	6 Feb 67	Increase		X

M16/M16A1 Rifle

PRODUCT IMPROVEMENT CHANGES UNDER CONSIDERATION	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Handguard - Change in material & configuration.	(Future)	(Increase)	X	X
Buttstock - Change in material.	(Future)	(Increase)	X	X

5.

PRODUCT IMPROVEMENT CHANGES UNDER CONSIDERATION	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Magazine, 30 Round - Change in configuration to provide 30 round capacity.	(Future)	(Reduction)	X	X
Rear Sight - Provision for center index "o".	(Future)	(Unknown)		(X)
Chamber - Chrome plating chamber to prevent corrosion and improve extraction.	(Future)	(Unknown)	(X)	(X)
Front Sight - Drill tap hole through so that entire depth of hole will coat w/Parco-lubrite.	(Future)	(Unknown)		(X)
Charging Handle - Redimension angle cut to insure positive fit of handle w/receiver.	(Future)	(Unknown)		(X)
Charging Handle Latch - Put "Delvin" on charging handle latch to prevent wear of upper receiver.	(Future)	(Unknown)	(X)	(X)
Upper and Lower Receivers - Shot peening to provide a more durable finish and aid in the prevention of exfoliation and inter-granular corrosion.	(Future)	(Unknown)	(X)	(X)
Handguard Slip Ring - Redesign to allow for ease of handguard removal.	(Future)	(Unknown)	(X)	(X)
Handguard Slip Ring Spring - Cadmium coat slip ring spring.	(Future)	(Unknown)	(X)	(X)

6.

PRODUCT IMPROVEMENT CHANGES UNDER CONSIDERATION	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Extractor Spring (Nested Springs) - To provide longer life spring.	(Future)	(Unknown)		(X)
Bipod Assembly - Nylon Coating - To prevent rust and corrosion.	(Future)	(Unknown)		(X)
Lower Receiver - Add drain hole in front of pivot pin detent hole to allow entry of coating solution and allow water to drain.	(Future)	(Unknown)		(X)
Ejection Port Cover & Pin - Stainless Steel - To prevent rusting.	(Future)	(Unknown)		(X)
Magazine Spring - Stainless Steel - To prevent rusting.	(Future)	(Unknown)		(X)

XM177/XM177E1 Submachine Gun

PRODUCT IMPROVEMENT	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Noise and Flash Suppressor - Changed design to improve noise and flash suppression.	5 Oct 66	Increase	X	X
Stock - Changed design to improve locking of sliding stock and to provide longer life stock.	5 Oct 66	Increase	X	X

XM177/XM177E1 Submachine Gun

PRODUCT IMPROVEMENT CHANGES UNDER CONSIDERATION	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Magazine, 30 Round - Change in configuration to provide 30 round capacity.	(Future)	(Reduction)	X	X
Rear Sight - Provision for center index "o".	(Future)	(Unknown)		(X)
Chamber - Chrome plating chamber to prevent corrosion and improve extraction.	(Future)	(Unknown)	(X)	(X)
Front Sight - Drill tap hole so that entire depth of hole will cost w/Parco-lubrite.	(Future)	(Unknown)		(X)
Charging Handle - Redimension angle cut to insure positive fit of handle w/receiver.	(Future)	(Unknown)		(X)
Charging Handle - Put "Delvin" on charging handle latch to prevent wear of upper receiver.	(Future)	(Unknown)	(X)	(X)

XM177/XM177E1 Submachine Gun

PRODUCT IMPROVEMENT CHANGES UNDER CONSIDERATION	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Upper and Lower Receivers - Shotpeening to provide a more durable finish and aid in the prevention of exfoliation and inter-granular corrosion.	(Future)	(Unknown)	(X)	(X)
Handguard Slip Ring - Redesign to allow for ease of handguard removal.	(Future)	(Unknown)	(X)	(X)
Handguard Slip Ring Spring - Cadmium coat spring to prevent rust and corrosion.	(Future)	(Unknown)	(X)	(X)
Extractor Spring - (Nested Springs) - To provide longer life spring.	(Future)	(Unknown)		(X)
Lower Receiver - Add drain hole in front pivot pin detent hole to allow entry of Parco-lubrite and to allow water to drain.	(Future)	(Unknown)		(X)
Ejection Port Cover and Pin - Add stainless steel to prevent rusting.	(Future)	(Unknown)		(X)
Magazine Spring - Change to stainless steel to prevent rusting.	(Future)	(Unknown)		(X)

XM148 GRENADE LAUNCHER

PRODUCT IMPROVEMENT	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Grenade Launcher - Change maximum cocking force from 25 pounds to 30 pounds.	20 Oct 66	No Change	X	X
Firing Pin - Increase firing pin energy so that it would be compatible w/the all-fire energy of the 40mm ammo family.	4 Nov 66	No Change	X	X

XM148 GRENADE LAUNCHER

PRODUCT IMPROVEMENT CHANGES UNDER CONSIDERATION	DATE	COST EFFECT	TESTING AGENCY	
			GOVERNMENT	CONTRACTOR
Sight - Improve design of sight	(FUTURE)		X	X
Combination Tool - Improve combination tool	(FUTURE)	(UNKNOWN)	(X)	(X)