

A hard look
at the new
National Match
ammunition
answers
the question...



Why Are Service Rifle

BY J. B. ROBERTS, JR.



Any test of ammunition must include firing, preferably in the specific arm in which it will be used. We fired the government's new match ammunition in a match M14, scoped for precise aiming and benchrested to give a steady hold.



Numbing cold increased group size until assessing accuracy became impossible. At that, the largest of our groups equated to "clean" scores at 200 yards.

WHEN the last shots in the 1980 Infantry Trophy match had gone downrange and that year's round of National Trophy matches was complete, the shooters noticed a trend. Scores were higher. Army Specialist Greg Strom upped the President's Hundred record to 297-10X. Marine "Gunner" Robert Busher pushed the National Trophy Individual mark to 493-20X. Virginians posted new civilian records in both the National Trophy Team and Infantry Trophy Team matches.

It took only a cursory examination of the factors involved to pinpoint the likely reason for the sudden improvement. The National Match M14s had not changed; neither had the shooters, really. Only the ammunition, Lake City experimental Special Match Lot LC-80F300S111, was radically different from that used in previous years.

National Match ammunition was first prepared for the 1921 National Matches. That year, and in the decades since, its use has enabled shooters to set some pretty impressive records. And the ammunition itself — fired in accuracy test fixtures — has set some records of its own. At the high point of pre-World War II development, accuracy assessments of Frankford Arsenal National Match ammunition yielded average group sizes of 7.23" and 7.36" at 600 yds.

Again, in the early 1960s, one lot of .30 cal. National Match gave an accuracy test

average of 6.72" at 600 yds., and two yearly lots of 7.62 mm National Match grouped in 6" or less at 600 yds. — and those averages are for 10-shot groups fired from three different accuracy test fixtures. Shooters in those years swore by National Match ammunition. It was the standard by which others were judged.

From 1968 on, however, some things changed, and some things did not. First, with the dropping of military support for the National Matches, the need for a separate production run of super-accurate National Match ammunition ceased to exist. The then-current M118 Match cartridge for the M14 was sufficient for military purposes (inter- and intraservice target shooting and sniping) without the application of special methods required by the Director of Civilian Marksmanship (DCM) and the National Board for the Promotion of Rifle Practice (NBPRP) for use in National Match ammunition production.

Too, the target used in National Match Course firing had changed from a five-point aiming bull to a 10-point target that initially had the same size aiming black, but two or more scoring or tie-breaking rings. Holding the black would no longer guarantee a clean score.

Finally, the accuracy requirements for M118 Match ammunition, accuracy requirements designed to give good results on military targets and five-point bulls-eyes, remained unchanged. The minimum

standard for M118 ammunition was, and is, 3.5" average mean radius at 600 yds. That performance means 11" groups center to center, without adding error induced by either the rifle or the shooter. That standard makes shooting a clean score on today's 600-yd. target very difficult for any but the best shooter.

Shooters, whether civilian or military, by 1979 had lost faith in "Match" ammunition and in its capacity to help them shoot good scores. That is why, when the money became available for 1980, the DCM and the NBPRP induced the Army's Armament Research and Development Command (ARRADCOM) and Lake City Ammunition Plant to manufacture a special lot of Match cartridges, the lot which, as noted, produced such a rash of broken records.

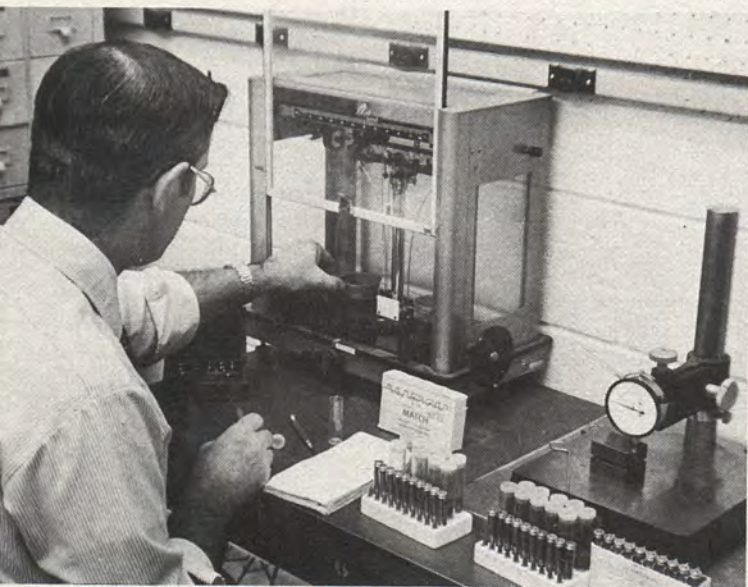
The major difference between M118 and Lake City Special Match ammunition was the bullet. Whereas M118 uses the same 173-gr., 9° boattail bullet that was developed in the 1920s, Special Match and its follow-on XM852 Match both use a Sierra 168-gr. International Hollowpoint bullet.

In that respect, the new ammunition resembled "Mexican Match" that had been used for competition other than the National Trophy and Excellence in Competition matches for some years. The resemblance, however, is only skin deep. Special Match was produced under conditions as controlled as conditions of

Scores Improving?

With most pre-1968 National Match ammunition a good shot could depend on 200-yd. rapid-fire groups like this one. With M852 he can expect to shoot them again.





Weighing charges and bullets on a .0001-gram lab balance and measuring bullet diameter and roundness with a .0001" dial indicator gave an assessment of dimensional uniformity of new and old match ammunition.



Examination of the new National Match ammunition began in 1981 at Camp Perry, where personnel and equipment from Rock Island Arsenal aided in recording the velocities of 25-shot samples.

Mexican Match ammo conversion are uncontrolled.

For example, in assembling the 200,000-round lot of LC80 Special Match, all the cases were drawn from cups made of the same lot of brass. All the primer cups and anvils were made from similarly selected lots of metal, and the primer mix was from a single batch. The propellant charges were measured from a single lot of DuPont IMR 4895 set aside for the purpose. And the bullets, Sierra 168-gr. International Hollowpoints, were made on dedicated machinery from dedicated lots of lead and virgin gilding metal. All Special Match ammunition was plated-loaded at Lake City by the most experienced personnel available, using the same machinery for the entire operation. No Mexican Match-maker can hope for that sort of control and uniformity.

There was, and is, a good reason for taking such care. Special Match ammunition was the opening phase of an ongoing experiment. As such, it was required to be as similar as possible to the M118 ammunition against which it would later be compared, with only one variable — the Sierra bullet. For that reason, interiors of the case necks in Special Match ammunition were coated with the same lacquer sealant that is used in M118.

Following the obvious success of the Sierra-bulleted Special Match, ARRADCOM, again at the behest of the NBPRP, undertook a thorough test of all reasonably available match-grade bullets, both domestic and foreign. These tests, in which ammunition using the several bullets was prepared as the Special Match had been and was then assessed both by ARRADCOM technicians and by military team shooters, produced the conclu-

sion that, while not suitable as a combat replacement for M118, the Sierra-bulleted round had been the correct choice for target use.

That's why, for 1981, the 1980 ammunition was type-classified XM852 and produced in essentially the same manner as the 1980 match lot. That's probably also why the winning score in the President's Match for 1981 equalled — in point total — the 1980 record of 297. And, that's why the higher scores that marked 1980's National Trophy Matches also marked the NBPRP phase of the 1981 High Power Rifle Championships.

Now, how good is the new XM852 ammunition? How does it stack up against its precursors, Lake City 80 and M118?

To learn, we turned to the DCM, who kindly provided testable quantities of Lake City 1977 M118 Match ammunition, Lot 60-24, and Lake City 1981 XM852 National Match ammunition, Lot LC 81 E300S152. He also provided a limited amount of Lake City Special Match (1980) Lot LC80F300S111, and an issue National Match M14 rifle, TRW serial 1454580.

The actual analysis began during the High Power Rifle Championships in 1981. Using the chronograph operated for competitors' convenience by personnel from the Army Armament Material Readiness Command and the issue M14, we fired 25-shot strings to measure average velocity, extreme spread and standard deviation of the LC 77 Match and 81 NM ammunition. Velocities were taken using an ECI Model 4013 chronograph and Oehler Model 55 screens spaced 10 ft. apart at 10- and 20-ft. downrange, to give velocities at 15 ft.

Of the two, the LC 81 was the more

uniform and gave the higher velocity: 2603 f.p.s. average, 65.1 f.p.s. extreme spread, and 15.4 f.p.s. standard deviation. LC 77 Match gave an average velocity of 2572 f.p.s. with an extreme spread of 75.2 f.p.s. and a standard deviation of 17.8 f.p.s. While both lots of ammunition yielded results that are extremely uniform, the XM852 was marginally better.

Following completion of the 1981 Championships, we did two things. We began by sending samples of both ammunition types to *American Rifleman* Contributing Editor William C. Davis, Jr., for his assessment of the uniformity of performance of each type. We also borrowed one of Creighton Audette's Universal Case Selection gauges to assess the uniformity of the components of each type of ammunition.

To do the latter, we selected one round from each of 10 boxes of LC 77 and LC 81 ammunition and 10 rounds from our limited supply of LC 80, setting them aside for disassembly and weighing and measuring of the various components.

Prior to disassembly, however, we spun each of the cartridges on a Wilson runout gauge to check the bullet/case neck concentricity of loaded rounds of each type. Of the three, the LC 81 was the most concentric, registering total runout between .001" and .010" and an average of .0045". The 1977 Match ammunition was next best, registering from .002" to .010" total runout, and an average of .00525". LC 80 ran from .003" to .010" total runout, and .00625" average.

Once disassembled, weighing and measuring the components almost completely gave the nod to the Sierra-bulleted ammunition. The 173-gr. bullets used in LC 77 M118 are a prime example,



To aid in our test, the Director of Civilian Marksmanship provided a National Match M14 and sufficient M118 and XM852 ammunition for a thorough wringing out. The M14 and an accurized M1A were fitted with scopes and mounts lent by Weaver and S&K. Accuracy tests were conducted by two shooters who shared in firing five 10-shot groups with each ammunition type from each of the test rifles.

inasmuch as they varied between 174.763 grs. and 175.778 grs., a total variation range of 1.015 grs., and a standard deviation from the mean weight of .261 grs. Sierras, by comparison, varied between 167.914 grs. and 168.382 grs. in LC 80, and 167.692 grs. and 168.192 grs. in LC 81, for total variation ranges of just .468 and .5 grs. respectively, and standard deviations of .136 and .141 grs.

Likewise, the Lake City Match bullets averaged .3087" dia., with .00022" runout, or out-of-round. Sierras, in the Special Match, averaged .3083" dia., and .00019" runout. In the sample of XM852, the figures were .3082" and .00017". Bullet diameter is thought by a number of knowledgeable shooters to be a prime cause of diminished accuracy in M118 ammunition. The effect of an oversize bullet (.3087" dia. in a nominal .3080" dia. barrel) is thought to be particularly harmful.

Charge weights were not meaningfully different in terms of uniformity. LC 77 charges weighed an average of 41.466 grs., with an extreme variation of .793 grs. and a standard deviation of .234 grs. Samples of Special Match and XM852 had essentially the same charge (adjusted at each loading to produce desired levels of velocity and pressure with different lots IMR 4895), but both were slightly more uniform. Special Match charges ran 42.556 grs., average, with an extreme variation of .666 grs., and a standard deviation of .217 grs. XM852 charges averaged 42.274 grs., with .575 grs. extreme variation and a standard deviation of .173 grs.

Having learned what we could concerning the uniformity of weight of the various components, we turned to the pressure

data supplied by William C. Davis, Jr. Firing 10-round samples of Lake City M118 and Lake City XM852 in the SAAMI-approved manner, Davis determined that average chamber pressures for the two types ran 55,100 c.u.p. and 53,900 c.u.p., respectively. Those pressures would seem to be meaningfully higher than the 50,000 p.s.i. called for in military specifications. They are, however, within maximum product averages recommended by SAAMI. A check of lot acceptance records showed that, when measured by military methods — methods that differ in terms of both equipment and technique — both cartridges gave average pressure

levels below the maximum specified for military ammunition.

In the matters of case concentricity and variations in case and neck wall thickness, all three samples gave good indications. Average variation in case wall thickness for Lake City 77 was .0029", and only one of the 10 cases measured exceeded the .004" variation described by Creighton Audette (*American Rifleman*, June, 1981, p. 27, and January, 1982, p. 30) as the maximum amount that can exist without diminishing accuracy.

In Special Match cases, the average wall variation was .0031", and only one case

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Comparison of Pressure and Accuracy: Lake City M118 vs. Lake City XM852

Test firings conducted by American Rifleman Contributing Editor William C. Davis, Jr., Jan. 7, 1982

	Lake City M118 Lot 60-24 (1977)	Lake City XM852 Lot LC81300S152 (1981)	Lake City Spl. Match Lot LC80F300S111 (1980)
Pressure Series:			
Average — C.U.P.	55,100	53,900	50,400
Extreme Variation	9,900	2,500	4,500
Std. Deviation	2,700	1,000	1,900

Pressure series are for 10 rounds each, fired in a 24" SAAMI pressure barrel with SAAMI chamber. Data corrected by SAAMI .308 Win. reference ammunition, lot 4WW.

Accuracy Series:

	Extreme Spread, inches		
Target 1 —	1.264	1.275	Not Fired
Target 2 —	1.935	1.482	
Target 3 —	1.552	1.327	
Target 4 —	1.675	1.693	
Target 5 —	1.742	1.420	

Average Extreme Spread 1.634 1.439

Accuracy firing conducted using an A.R. Goode 24" 1:12" twist .308 Win. barrel chambered to National Match specifications and fitted in a Modern Bond Universal Receiver. Series are 10 shots each, groups measured to report the extreme spread, center to center, of the two widest shots, at 100 yds. range.

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Nat'l Match Ammo

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varied as much as .004" or more. XM852 cases were essentially like those of the M118 sample, averaging .0029" variation in wall thickness, with a maximum of .0055" (one case) and a minimum of .001" or less (three cases). Runout on the case bases averaged .0022", .0015" and .0305" for the three ammunition types, respectively.

Having completed our dimensional analysis, we began to guess that the primary reason for the higher scores at Camp Perry in 1980 and '81 was the use of Sierra bullets in otherwise standard ammunition assembled from match-quality components.

To really ascertain the failing of the Lake City match bullet is beyond our capability. To isolate all the possible variables would require dozens of barrels and thousands of bullets — not to mention other components — each selected as displaying only one variable.

What we could and did learn, was how much improvement in accuracy could be expected by changing from M118 to XM852 in two fairly typical service rifles. For that test we used both the National Match M14 provided by the DCM and our own M1A, rebuilt by National Guard rifle team armorer S/Sgt. John Miller to duplicate the rifles used by the All-Guard team. Both rifles were fitted with telescopic sights, T-10s, loaned by W.R. Weaver Co., mounted on M14 Insta-Mounts provided by S&K Manufacturing Co. Because the Insta-Mount places a scope above the rear sight and slightly to the left of center (the S&K mount for the M14/M1A is a very effective adaption of the mount used on the M21 sniper rifle), we fitted each rifle with temporary cheek rests adapted from a pair originally used on British No. 4 Mk1 (T) sniper rifles.

Unfortunately, the day that was selected for actual range firing dawned clear and cold. The temperature hovered around 32° all day long, and an icy 15 mph wind blew steadily from 12 o'clock. It was no day to shoot groups. But we did it anyway.

Lt. Col. Gene Enterkin, USA-Ret., the Assistant Executive Officer, NBPRP, who lent his assistance and expertise to preparation of this piece, and I set up the first of our targets at 200 yds., and, while one shooter thawed out, the other began firing the first of five 10-shot groups with each rifle and each type of ammunition — LC M118 and LC XM852.

The groups we shot were not representative, in terms of average size, of the level of accuracy attainable with either rifle. It is, after all, difficult to shiver in precisely the same manner for 10 consecutive shots. What we did learn was the percent reduction in group size that a service rifle

shooter can reasonably expect when he switches from M118 Match to the new XM852. It's quite a reduction.

With the M1A, the overall reduction in average group size was 17%. With the M14, groups shrank by 27.96% when the switch from M118 to XM852 — that is, from the government match bullet to the Sierra — was made.

That's an odd coincidence, for, if X-count is considered, winning scores in the National Trophy matches were about 15% higher in 1980 and '81 than in 1979, the last year M118 ammunition was issued. Among less-skilled shooters, Marksmen, Sharpshooters and Experts, scores for 1980 and '81 were up about 25%. It follows, too, that the winners are more likely to be using specially refitted versions of the service rifle, whereas the lesser shooter tends to draw an issue M14NM from the National Match Support Detachment and use it for the National Trophy Matches.

The newest National Match (XM852 was permanently type-classified in late 1981 and is now M852) is a tremendous improvement over later M118, but it has a way to go. Despite the reduction in group size that Col. Enterkin and I noted, the '81 lot of National Match ammunition is not up to Lake City's cal. .30 National Match lot for 1962, nor will it equal lots of M118 produced in 1964 and '66 — lots that averaged right around 6" extreme spread for 10 or more 600-yd. groups. In its acceptance firing, LC 81 XM852 averaged 7.7" center-to-center extreme spread for 12, 14-shot groups at 600 yds. (though average group size is bound to increase when the number of shots in the group increases).

Even at that, it's a demonstrated improvement, one that leaves plenty of room for further progress. Lake City does not presently dedicate a case drawing line for use in making match cases. Only after headstamping are the cases segregated from other production. Lake City still puts, and will continue to put, the lacquer sealant inside the case mouth. They have test results that show it actually increases accuracy, even though the super-accurate lots of National Match ammunition apparently were left unsealed. And, beyond the ammunition, there are considerations affecting the dimensions and form of rifling and of chambers. The important thing is that a start has been made.

The meaning of all this, to the service rifle shooter, is twofold. First, he can expect to shoot scores that, if not better, are at least more like his own appreciation of what they should be. Second, he knows that the NBPRP and the DCM are back in the ammunition business, and that care in manufacture that produced some outstandingly accurate Match ammunition in the '20s, and again in the late '60s, may be expected to reappear. ■