CONTEMPORARY RUSSIAN 7.62 × 39 MM AMMUNITION

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ABSTRACT: Substantial quantities of ammunition in 7.62 × 39 mm have been, and continue to be, imported into the United States from a number of countries due to the large number of firearms chambered in this calibre. Some novel design and construction features have taken place over the last few years among former Soviet-Russian manufactures of military ammunition. Careful examination and disassembly of cartridges in 7.62 × 39 mm imported into the United States during this period has revealed features that set them apart from all other sources of ammunition in this caliber and even distinguish the factory or origin in the present day Russian Republic. The recognition of these features by the laboratory examiner stands to provide useful information to both the laboratory and investigators confronted with crimes involving such ammunition.

KEY WORDS: Russian ammunition; 7.62 mm bullets; 7.62 × 39 mm; M43; AK47; SKS; Hunting bullets; Steel jacketed hollow point bullets; Plastic base plug; Polyethylene, Barnaul; Tula; Ulyanovsk.

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INTRODUCTION – HISTORICAL INFORMATION

The 7.62 x 39 mm Russian cartridge (properly called the M43 but commonly referred to as the AK47 cartridge) was adopted by the Soviet Union shortly after the World War II. The first production rifle chambered for this new cartridge was the semi-automatic SKS45 carbine. This rifle was quickly superseded by the selective fire AK47. Other so-called East Block countries allied with- or armed by the Soviet Union adopted the same or similar rifles chambered for the M43 cartridge. Communist China and a number of Arabic countries also produced military guns in this caliber. The cartridge is now manufactured in a number of countries including the United States.

Large numbers of obsolete, surplus SKS carbines were imported into the U.S. from Communist China, Russia and a number of former communist block countries. Their low cost, robust nature, modest recoil and generally acceptable accuracy made them very popular with recreational shooters. Semi-automatic clones of the AK47 were also made for importation by these same countries. The relative low cost of foreign-made 7.62 × 39 mm ammuni-

tion coupled with the desire by many to own a piece of the "Evil Empire" has resulted in large numbers of semi-automatic rifles and carbines being imported and sold in the U.S. It should come as no surprise that some members of the criminal element in American society have also made these guns a popular choice.

DESIGN FEATURES AND BALLISTIC PROPERTIES

The M43 round is considerably less powerful that the standard battle cartridges of World War II. It is a cartridge of intermediate size- and power- more powerful than the 30 M1 Carbine cartridge but less powerful than the .30–30 Winchester cartridge developed near the end of the 19th Century. The standard bullet weight for the M43 cartridge was slightly less than 8 grams (122 gr). Muzzle velocities for this bullet fired from SKS carbines and AK47 assault rifles are typically 2300 f/s to 2400 f/s (~720 m/s). Although described as 30 caliber bullets, they typically measure .310 in to .311 in (7.87 mm – 7.90 mm) in diameter rather than .308 inches. This is in keeping with groove diameters of Soviet 7.62 mm rifles.

The overall length of the M43 bullet is about 1.045 in (26.5 mm). The center of gravity for the M43 Soviet ball round is about 9 mm forward of its base. The G_1 ballistic coefficient (G_1 BC) for this bullet is approximately 0.30.

In accordance with the military practices of virtually all countries in the 1940s and thereafter, the Soviet M43 bullet was of full metal jacketed design and possessed a spitzer point. A mild steel core (rather than a lead core) was employed in the M43 service round. This core is about 0.775 inches (19.7 mm) in length and 0.226 in (5.74 mm) in diameter with a flat point and is both centered and secured inside the mild steel bullet jacket by means of a lead sheath of about 0.020 in (0.5 mm) thickness. This core weighs about 55 gr (3.57 g).

This hard, non-deforming bullet is one of the most ballistically stable rifle bullets in existence and as a consequence, it often produces entrance and exit wounds in gunshot victims that look more like wounds from full metal jacketed pistol bullets than so-called high velocity wounds. This ballistic stability increases the likelihood of surviving a gunshot wound from one of these bullets as compared to a soft point .30 M1 Carbine bullet, a .30–30 Winchester bullet or even a hollow point pistol bullet fired into the same area of the torso. This is not necessarily undesirable from a military standpoint since the wounding of ones adversary rather than the outright killing of him will tie up more of the enemy due to the need to treat and remove the wounded soldier from the battlefield.

Much, if not all, of the Soviet service ammunition possesses a clear red lacquer sealant at the junction of the bullet and the cartridge case mouth. Vestiges of this lacquer often survives the discharge process and can be seen in the groove impressions of recovered bullets. Most other sources of military 7.62 × 39 mm ball ammunition do not possess this lacquer sealant.

POLITICAL-LEGISLATIVE EVENTS

The anti-firearms ownership political climate that arose in the U.S. following several tragic multiple shootings by deranged gunmen took a number irrational and emotional courses during the last decade and a half. Most imported 7.62 × 39 mm ammunition was built around the Soviet model and possessed bullets with steel cores. This ammunition was deemed armor-piercing ammunition by certain American politicians and policy makers. That this is untrue did not dissuade the federal government and BATF from banning the importation, sale or transfer of such ammunition in 1987. Ironically, this resulted in specific design changes in Russian-made 7.62 × 39 mm ammunition which produced more lethal (but legally importable) ammunition. This ammunition is the primary subject of this paper.

MANUFACTURING CHANGES

Following the collapse of the Soviet political system, the desire to obtain hard currency and the import ban on steel core bullets, Russian ammunition manufacturers replaced the steel core with lead so their products could once again be imported and sold to the substantial shooting fraternity in the U.S. Both the surplus military ammunition (with the steel cores) and the redesigned ammunition was significantly cheaper than ammunition manufactured in the U.S. so there was a ready market for the imported Russian ammunition.

The early version of the new Russian bullet simply involved replacing the entire interior of the same mild steel bullet jacket with lead. This produced bullets weighing 140 gr ± 2 gr rather than 122 gr bullets. The jackets of these bullets weigh 33 gr and the lead cores weigh 107 gr. The external shape and dimensions of the bullet remained the same as the M43 ball round although the faint impressed cannelure found in the military bullets was missing in the 140 gr projectiles. The author obtained a number of these redesigned FMJ-BT bullets as reloading components.

It is unclear if any of these bullets were ever loaded in Russian 7.62 × 39 mm cartridges and imported into the U.S. but their outstanding charac-

teristic is that they are much heavier than the standard M43 bullet or any of the subsequent replacements. The greater weight is, of course, due to the greater density of lead compared to steel. It should also be noted that the muzzle velocity of these bullets stands to be lower than the lighter 122 gr bullets if the peak pressures are to be kept within the normal limits of approximately 38 000 psi (2775 kg/cm^2). Tests in FSSI's 7.62 × 39 mm pressure/velocity system revealed that the loading of these 140 gr bullets with the same powder charge as for the standard service load used in the standard 122 gr. M43 bullet produced an average peak pressure of 52 000 psi (3800 kg/cm^2) and velocities on the order of 2400 ft/s (732 m/s). Pierced primers (due to excessive pressure) also occurred when these over-weight bullets were loaded with the same charge of powder as for the lighter 122 gr bullets. Some limited testing indicated that muzzle velocities on the order of 2100 to 2200 ft/s (ca. 650 m/s) would be produced by cartridges loaded within normal peak pressure limits.

This modification (the complete replacement of the steel core and centering sheath with lead) would logically simplify manufacturing procedures and cost of production but the overweight nature of these bullets must have caused the Russian manufacturers some concern because in the early 1990s a new bullet appeared in imported Russian 7.62 x 39 mm ammunition.

RUSSIAN "HUNTING" AMMUNITION AND BULLETS

In the mid-90s 20-round boxes of Russian 7.62 × 39 mm ammunition appeared labeled "for Hunting Purposes".

When these cartridges first appeared in gun stores, the headstamps were typical Russian military (arsenal code at 12 o'clock and year at 6 o'clock). More recently they have had symbols and English lettering such as TCW (Tula Cartridge Works) and WOLF after the American importer of 7.62 × 39 mm cartridges manufacturer at the Tula factory.

The hollow point "hunting" bullets were constructed with the same mild steel jacket with a gilding metal wash, nose profile and open boat tail base. It was clear that the Russians had simply cut off the tip of their military bullet. There was also some semantic confusion on their part because some of the early cartridge boxes included the word "ball" which denotes a military style full metal jacketed bullet. An example of this is shown in one of the photo-illustrations appended to this article.

The weight of these bullets was back to 122 to 123 gr (7.9–8.0 g). This was achieved in a most novel way. Lead core material weighing approximately 88 gr (5.7 g) had been inserted into the mild steel jacket followed by a plug of translucent polyethylene plastic weighing approximately 1.5 gr (0.1 g). This

plug can be seen at the open base of these bullets. Because of its translucent nature and the underlying lead core material, it looks like lead but closer inspection under the stereomicroscope and/or probing it with a needle will quickly reveal the plastic nature of this material.

To date (September 2000) this design is uniquely Russian and therefore of special forensic value.

TABLE I. RESULTS OF THE YPG* DOPPLER RADAR TRAJECTORY OBTAINED FOR 7.62 × 39 122 gr FMJ-BT (M43); MUZZLE ELEVATION: +5.00 deg

Data point	Time [ms]	Velocity [m/s]	Velocity [Mach]	X-distance [m]	Y-height [m]	Z-off [m]	Slant distance [m]
Muzzle	0.0	727.90	2.1204	0.00	0.00	0.000	0.00
50	313.7	551.86	1.6079	197.89	16.87	0.272	198.61
100	618.4	435.30	1.2685	346.84	28.75	0.469	348.03
150	923.1	352.66	1.0278	465.82	37.42	0.619	467.32
200	1227.9	308.29	0.8986	565.46	43.83	0.738	567.16
250	1532.6	285.16	0.8314	655.37	48.74	0.839	657.18
300	1837.4	270.08	0.7876	739.86	52.47	0.930	741.72
350	2142.1	256.44	0.7481	820.07	55.12	1.011	821.92
400	2446.8	244.22	0.7127	896.38	56.75	1.083	898.18
450	2751.6	233.20	0.6808	969.20	57.42	1.148	970.90
472	**2885.7**	**228.54**	**0.6674**	**1000.20**	**57.41**	**1.174**	**1001.85**
500	3056.3	222.58	0.6502	1038.77	57.16	1.206	1040.35
550	3361.1	212.55	0.6213	1105.21	56.03	1.256	1106.63
600	3665.8	202.90	0.5935	1168.67	54.05	1.300	1169.92
650	3970.5	193.90	0.5677	1229.32	51.27	1.338	1230.39
700	4275.3	184.97	0.5421	1287.25	47.72	1.370	1288.14
750	4580.0	176.37	0.5176	1342.51	43.45	1.397	1343.21
800	4884.8	167.83	0.4933	1395.18	38.49	1.418	1395.71
850	5189.5	160.30	0.4719	1445.33	32.89	1.435	1445.71
900	5494.2	153.31	0.4522	1493.23	26.67	1.446	1493.47
950	5799.0	146.85	0.4342	1539.07	19.82	1.454	1539.20
1000	6103.7	140.85	0.4176	1582.97	12.37	1.457	1583.02

Table I bullet had a muzzle velocity of 727.9 m/s (2388 ft/s) and was fired with a departure angle of +5 degrees.

The mean sea level elevation of the gun position was 182 meters (199 ft MSL). It was tracked out to 1602.9 meters where it was travelling 138.19 m/s (453 ft/s) after 6.25 seconds of flight and was still 8+ meters above the terrain. Its angle of fall at this distance was calculated to be –10.5°. This bullet became transonic at a distance of 481 meters (526 yards) after 0.966 seconds of flight.

At a distance of 1000 meters (the bold enter in the table) the bullet's velocity had dropped to 228.5 m/s after 2.886 seconds of flight.

The G_1 ballistic coefficient for this bullet based on the first 200 meters of flight was 0.29.

The maximum range for an M43 round fired at a departure angle of +37° was 2747 meters (3004 yards) after a 27.3 second flight.

*YPG – Yuma Proving Grounds, Yuma, Arizona.

The exterior ballistic performance of these bullets appears normal out to considerable distances based on multiple firings and trackings with Doppler radar carried out at the U.S. Army Proving Grounds in Yuma, Arizona. Table I provides a highly abbreviated printout of a Weibel Doppler radar track of an M43 bullet fired at a departure angle of +5° from an SKS carbine. The twenty-two rows of data out of the 1024 actually recorded should provide the reader some idea of the wealth of information available with this technology. A shot fired from the same carbine and at the same +5° departure angle with a round of the TCW (Tula Cartridge Works) 122 gr JHP-BT bullet gave the following results: muzzle velocity of 2411 ft/s (734 m/s); 2057 ft/s (627 m/s) at 100 meters; 1770 ft/s (540 m/s) at 200 meters; 1294 ft/s (394 m/s) at 400 meters; 539 ft/s (164 m/s) at 1869 meters (2044 yd) + ground impact with an angle of fall of –9.8°.

Note: the nominal G_1 BC for this bullet in the supersonic range (derived from the Doppler radar data) was calculated to be 0.28 which is essentially the same as the standard M43 bullet (0.29).

Somewhat more detailed exterior ballistic data for the Tula JHP-BT bullet is given in Table II.

TABLE II. 7.62 x 39 122 GR. JHP-BT (TULA MFG – PLASTIC BASE PLUG) ABBREVIATED EXTERIOR BALLISTIC RESULTS FROM YPG* DOPPLER RADAR TRACK #101 12/5/98; MUZZLE ELEVATION :+5.00 deg

Distance [m]	Velocity [m/s]	Velocity [ft/s]	Flight time [s]	Calculated G_1 BC
muzzle	710.6	2331	0.0000	–
100	606.9	1991	0.1530	0.257
200	520.5	1708	0.3318	0.281
300	444.0	1457	0.5403	0.280
400	378.0	1240	0.7830	0.264
500	330.3	1084	1.068	0.258
1000	242.7	796	2.858	0.305
				Overall average BC = 0.285

Gun position 1 – 99 ft. MSL, temperature – 60°F, relative humidity – 40%, barometric pressure – 998.5 mb.
*YPG – Yuma Proving Grounds, Yuma, Arizona.

The terminal ballistic performance of these hollow point bullets in tissue and tissue simulants is erratic. Because of the steel jacket and the small hollow point cavity, these bullets often fail to expand. In this situation they act like a full metal jacketed bullet. When they do expand, the frequently fragment rather than mushroom like a copper jacketed hollow- or soft point bullet. When they expand and fragment in a body, the plastic base plug may separate from the base of the jacket and be left in the wound track. It will

only be found through luck or special diligence on the part of the forensic pathologist since it is totally transparent to X-rays.

The recovery of one of these plastic base plugs means the bullet associated with the injury came from a 7.62 × 39 mm cartridge, it was of Russian manufacture and made during the 1990s.

The packaging of these "hunting" cartridges and others that have followed has undergone a number of interesting changes and refinements during the 1990s and has ultimately ended up with colorful 20 round boxes from at least four Russian manufacturers – the names of which are derived from the towns or districts in which they are located. These are the Tula factory about 50 miles south of Moscow, the Ulyanovsk factory about 550 miles east of Moscow and the Klimovsk factory (about 25 miles south of Moscow) and the Barnaul factory in Southern Siberia. The military code numbers for these and other Russian ammunition plants along with a description of actual bullets disassembled from individual cartridges are given in Table III. A more complete listing of Soviet and post-Soviet Russian ammunition factories is given in Table IV.

TABLE III. CONTEMPORARY RUSSIAN 7.62 × 39 mm BULLETS

Headstamp year of MFG	Source	Bullet description	Propellant
17 76	Barnaul Machine-Tool Factory	123 gr FMJ-BT, steel core, 1.05" OABL, red lacquer	Tubular
3 93	Ulyanovsk Machine-Tool Factory	125 gr JHP-BT, lead core, 1.00" OABL, plastic base plug, rolled heel, open base	Flattened ball
3 94	Ulyanovsk Machine-Tool Factory	124 gr JHP-BT, lead core, 1.01" OABL, plastic base plug, heel not rolled, open base	Tubular
3 96	Ulyanovsk Machine-Tool Factory	124 gr JHP-BT, lead core, 1.00" OABL, plastic base plug, rolled heel, open base	Tubular
711 93	Klimovsk – Moscow Region	125 gr JHP-BT, lead core, 1.01" OABL, plastic base plug, rolled heel, open base	Flattened ball
711 94	Klimovsk – Moscow Region	121 gr JHP-BT, lead core, 1.01" OABL, plastic base plug, rolled heel, open base	Flattened ball
7.62 × 39 ТП 3	Tula Cartridge Factory (Тула Патронний Завод)	123 gr JHP-BT, lead core, 1.02" OABL, deep HP cavity, very shallow cannelure at 0.33", heel not rolled, lead flush at open base	Flattened ball
7.62 × 39 TCW* *inverted	Tula Cartridge Works	122 gr FMJ-BT, lead core, 1.05" OABL, red sealant, heel not rolled, lead flush at open base	Tubular
7,62 × 39 WOLF* *inverted	Tula	122 gr JHP-BT, lead core, 1.02" OABL, deep HP cavity, very shallow cannelure at 0.33" with red sealant, heel not rolled, lead flush at open base	Tubular
7.62 × 39 98	Ulyanovsk Machinery Plant	126 gr JHP-FB, lead core, 0.876" OABL, open base with recessed lead core	Tubular
7.62 × 39 0 98	Barnaul Machine Tool Plant	125 gr JSP-Concave Base, lead core, 0.867" OABL, shallow square-cut cannelure at 0.16" above base, red sealant	Tubular

TABLE IV. SOVIET AND CONTEMPORARY FACTORY CODES ON RUSSIAN SMALL ARMS AMMUNITION (MILITARY PISTOL AND RIFLE CARTRIDGES)

Russian factory code	Name and location
3	Ulyanovsk Machine – Tool Factory
17	Barnaul Machine – Tool Factory (Southern Siberia)
29	Ulyanovsk Machine – Tool Factory
38	Youryouzan Mechanical Factory
46	Sverdlovsk (Ekaterinburg)
60	Frunze (Bishkek)
188	Novosibirsk
270	Lugansk* (Ukraine)
304	Moscow-Kuskovo
529	N. Lyalya (Sverdlovsk Region)
539	Tula Cartridge Factory (So. of Moscow)
541	Cheljabinsk
543	Kazan
545	Orenburg
710	Podolsk (Moscow Region)
711	Klimovsk (Moscow Region)
904	Lugansk* (Ukraine)
911	Lugansk* (Ukraine)

Pre-revolution codes for St. Petersburg are 09, 13, 14.
*The Ukrainian factory at Lugansk has gone out of business according to the author's contact in Russia.

A more recent design change in the Russian "hunting" bullets and full metal jacketed bullets has been discovered which I shall call New Millennium Russian 7.62 x 39 mm ammunition since it started appearing in January 2000.

The multi-step requirements to assemble the previously-described "hunting" bullets with the lead core and plastic base plug must have been troubling to the Russians because the new bullets represent a simplification. The author's first encounter with one of the new "hunting" bullets was immediately after New Year's Eve-2000 when a Phoenix homicide detective brought this writer a pristine 7.62 × 39 JHP bullet recovered from a person that had been struck and slightly injured shortly after midnight by a falling bullet (as determined from the nature of the wound, the path of the projectile and absence of any nearby gunshots). The recovered bullet possessed the expected 4-right rifling characteristics of the SKS/AK series of firearms and vestiges of clear red sealant about midway up the bullet and in the groove impressions. The astute detective had also noticed that the hollow point cavity was very deep and not like previous examples of Russian "hunting" bullets. Simple examination of the open base of this bullet under the

stereomicroscope also showed a lead core rather than the plastic base plug. These features were found to be in agreement with some WOLF brand ammunition (manufactured by the Tula factory) and recently purchased by the author. A lengthwise sectioning of one of the WOLF brand JHP bullets quickly revealed the reason for the deep hollow point cavity and the exposed lead base. The Russians had redesigned the hollow point "hunting" bullet to eliminate the plastic base plug yet keep the bullet weight at 122 gr (7.9 g). The overall bullet length was also unchanged as was the gilding metal coated mild steel jacket, the open, boat tail base and the ogive shape. The weight had been retained by forming an internal shelf or ledge inside the steel jacket against which an appropriately sized lead core was inserted through the open base of the bullet jacket. The weights of this new jacket and core arrangement were 33–34 gr (2.1 g) for the jacket and about 89 gr (5.8 g) for the soft lead core. The various features of this new bullet and other Russian 7.62 × 39 mm bullets are described in Table III along with the other *Novi Russ* bullets.

Pressure and velocity values (as measured with the Oehler PBL system) were approximately 2400 ft/s (732 m/s) and 39 000 psi (2847 kg/cm^2) respectively for the WOLF brand ammunition in both hollow point and full metal jacketed versions.

The exterior ballistic performance of these bullets with their aft center of gravity has yet to be examined by this writer. Doppler radar tracks are planned for December 2000. The reader is advised that a copper jacketed version of the WOLF product line has also been noted in some recent advertising literature but yet to be examined by this writer.

Several other Russian entries into the non-military style bullets appeared in sporting goods stores in the late 1990s. One of these was a jacketed hollow point with an open flat base with a rolled heel and manufactured by the factory in Ulyanovsk. The jacketing material was mild steel with a gilding metal coating. No cannelure or crimp groove was present nor were the bullets lacquer-sealed at the case mouth. The headstamp on these cartridges was "7,62 × 39 98" with a unique symbol denoting the Ulyanovsk factory. This symbol is also depicted on the blue and white, 20-round cartridge boxes which describe the contents as "hunting cartridges" loaded with 124 gr bullets. Additional details regarding these bullets can be found in Table III and the photo-illustrations appended to this article.

The second entry comes from the factory at Barnaul. These bullets, loaded in steel cases headstamped "7,62 × 39 0 98" including a unique symbol for the Barnaul plant, consisted of closed base, jacketed soft point bullets with exposed lead at the tips. The jacketing was, once again, mild steel with a gilding metal coating, no cannelure but a clear red lacquer sealant at the case mouth.

Fig. 1. Representative headstamps on Russian "hunting" cartridges: 1 – Soviet-style headstamp: 3 = Ulyanovsk, 94 = 1994 year of manufacture, bullet = 123 gr JHP-BT with plastic base plug; 2 – Barnaul 125 gr JSP, 1998 manufacture (note symbol at 12 o'clock); 3 – Ulyanovsk 124 gr JHP, 1998 manufacture (note symbol at 4 o'clock); 4 – "WOLF" Tula 122 g. JHP-BT, current (1999–2000) production.

Fig. 2. Representative cartridge boxes for Russian "hunting" ammunition. Top row: early development of hollow point loadings in 7.62 × 39 mm. Note description on the middle box-"HP L.C.B. 123 GR. BALL". All of these boxes contain 122–123 gr JHP-BT bullets with plastic base plugs. Bottom row: recent (1999–2000) entries from Ulyanovsk, Barnaul and Tula.

Fig. 3. Close up views of cartridge box end flaps showing factory logos that are included in the headstamps on the cartridges.

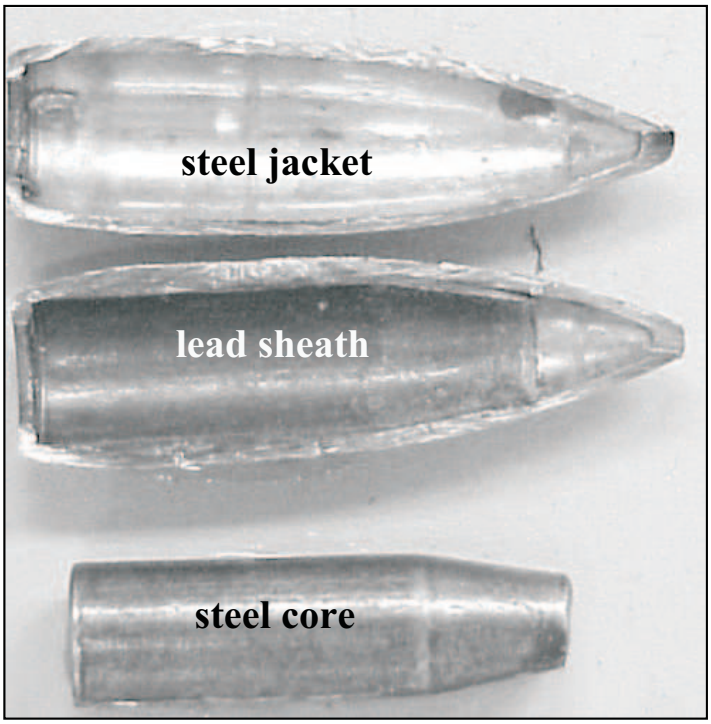

Fig. 4. Sectioned soviet M43 ball round.

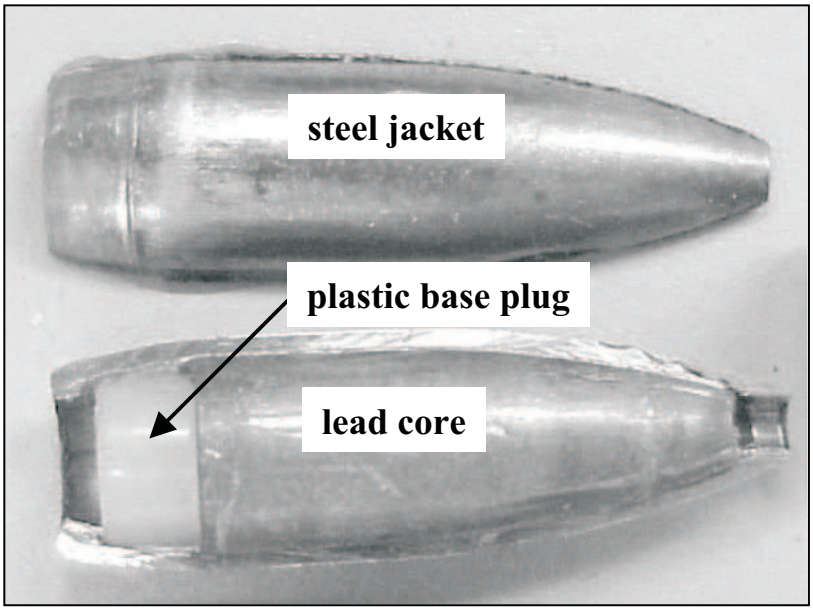

Fig. 5. First generation sectioned "hunting" bullet.

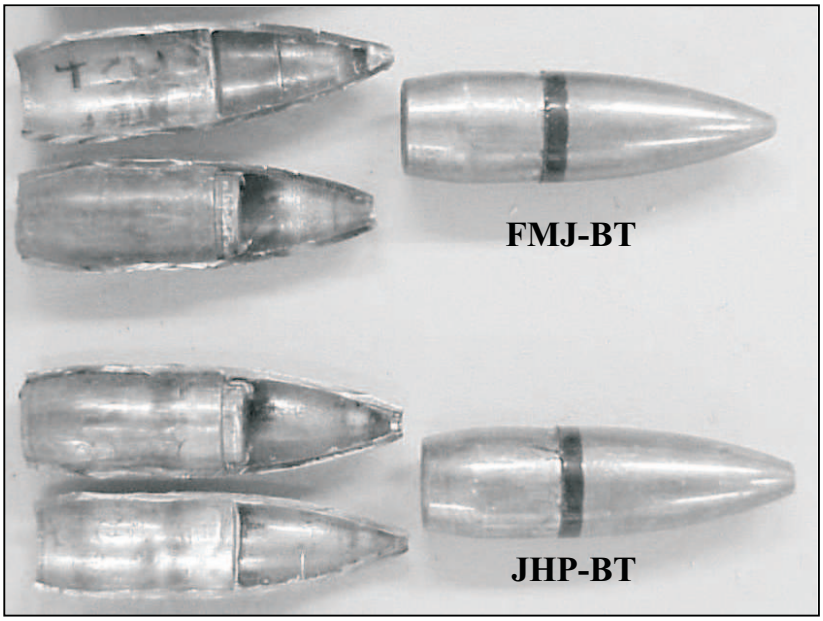

Fig. 6. Sectioned full metal jacketed bullet and "hunting" bullet manufactured at Tula and imported by WOLF ammunition.

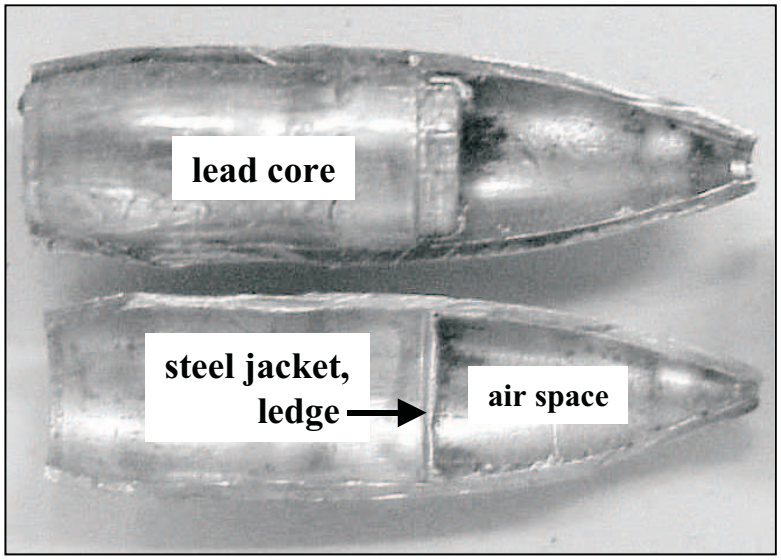

Fig. 7. Second generation sectioned bullet: close-up view.

Fig. 8. Jacketed hollow point bullet from Ulyanovsk (top); jacketed soft point bullet from Barnaul (bottom).

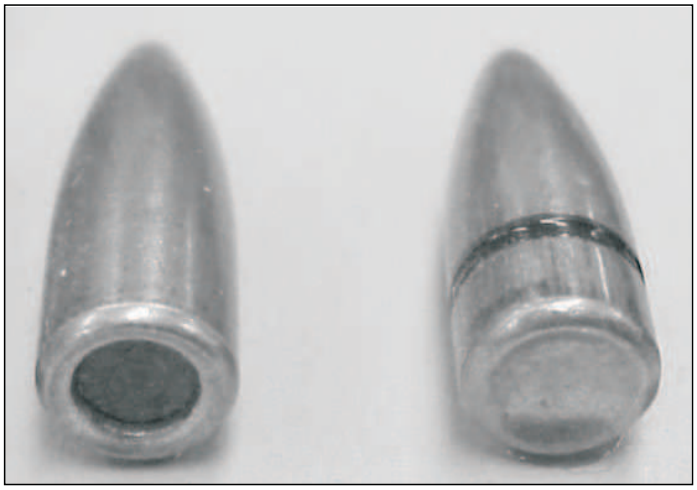

Fig. 9. Oblique base views of the h.p. bullet from Ulyanovsk (left); and the jacketed soft point bullet from Barnaul (right).

The closed, flat base was slightly concave. The 20-round red, white and blue cartridge boxes describe the contents as "Hunting Rifle Cartridges".

SUMMARY

A number of interesting and presently unique bullet designs loaded in 7.62 × 39 mm cartridges are coming out of factories in Russian. These are clearly for export and the design variations are an effort to comply with U.S. import requirements for small arms ammunition as well as to simplify earlier efforts to meet these import requirements.

The unique design features described and illustrated in this paper should alert the firearms examiner to the forensic value of such characteristics in instances where such ammunition is used for criminal purposes.

Photographs of these bullets and the cartridge boxes are appended to this article.

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