THE HIGH-PRECISION TULIP: DEVELOPMENT AND COMBAT EMPLOYMENT OF THE

SOVIET LASER-GUIDED MORTAR ROUND

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Lizards watched from under the sun-baked rocks of the Pandjshir valley as the huge metallic Leviathan crawled to a halt. Dusty soldiers crawled out from inside the metal monster and stood by as a hydraulic lift slowly eased a 240mm mortar tube over the end of the vehicle and into firing position on the stony ground. Eagles soared overhead in the hot Afghanistan sky as the soldiers busied themselves with the large ordnance. Then came a series of shouted commands and an ear-splitting roar. The mortar had spit death at a group of determined guerrillas dug-in high on a far-off canyon wall. But the shot was long, to the relief of the shaken guerrillas. The mortar roared again. The shot was short, however, a laser now painted the guerrilla position. The mortar roared a final time. A laser-guided mortar round arced into the sky and fell directly onto the guerrilla position. There was little left to indicate the number or even humanity of the former occupants.

A Mortar Named "Tulip"

Mortars of all sizes have always been part of Russian and Soviet artillery. Artillerymen are assigned to motorized rifle units and other non-artillery units that have small and medium-caliber mortars in their TO&E. During the Great Patriotic War (World War II), the Red Army fielded 160mm and 240mm large-caliber mortars. Their OB-29 240mm mortar weighed 3,500 kilograms (7,718 pounds) and fired a 125 kilogram (276 pound) round out to 7,000 meters. After the war, the Soviets developed the M-240 240mm mortar and fielded it in 1953. This breach-loading mortar fired a 100-kilogram (221 pound) high explosive round out to 9,650 meters.[1] At that time, its intended role was to smash through heavily-fortified regions and prepared defensive positions.

In 1960, the Soviets mounted the M-240 mortar on a tracked, self-propelled chassis. A hydraulic system raised and lowered the tube from the carrying position to the firing position. As was customary, the self-propelled artillery system was christened with an alpha-numeric designator (the 2S4) and the name of a flower (the tulip).[2] The tulip has a variety of rounds. The 130-kilogram (287 pound) fragmentation-blast round fires out to a range of 9650 meters. The 228-kilogram (503 pound) rocket-assisted projectile fires out to a range of 18,000 meters.[3] In addition, it has special munitions (concrete-piercing, chemical and nuclear).[4] Due to its nuclear capability, the 2S4 was assigned to the nuclear-capable High-Powered Artillery Brigades.[5] The High-Powered Artillery Brigades were used against high-priority targets that were operationally-significant.

Enter the Laser

Along with the *Krasnopol* laser-guided projectile that the Soviets designed for their 152mm family of guns and howitzers[6], the Soviets developed a laser-guided projectile for their 240mm mortar. They christened this precision-guided munition (PGM) the *Smel'chak* (daredevil). It weighs a hefty 125 kilograms (276 pounds)[7] and is breach-loaded like all other 240mm rounds. The round consists of the explosive warhead, an optical-electronic guidance head, a disposable nose cap, the control assembly, the detonator, the flight correction motor, and the fin stabilizers (see diagram 1) There are two settings on the detonator—fragmentation and blast.[8]

Report Documentation Page

Form Approved
OMB No. 0704-0188

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1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2006		**00-00-2006 to 00-00-2006**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The High-Precision Tulip: Development and Combat Employment of the Soviet Laser-Guided Mortar Round	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Army Training and Doctrine Command,Foreign Military Studies Office,Joint Reserve Intelligence Center,Fort Leavenworth,KS,66027**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

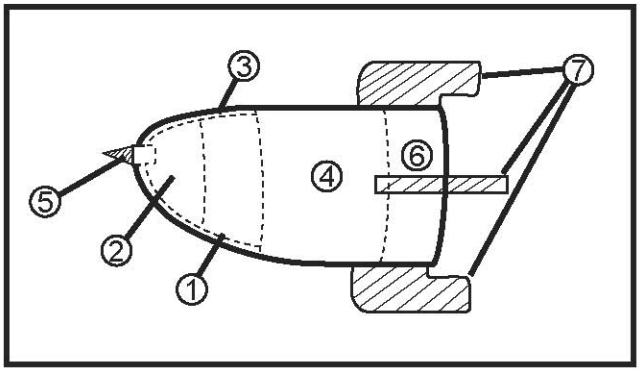
12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**		**4**	



① Explosive warhead

② Optical-electronic guidance head

③ Disposable nose cap

④ Control Assembly

⑤ Detonator

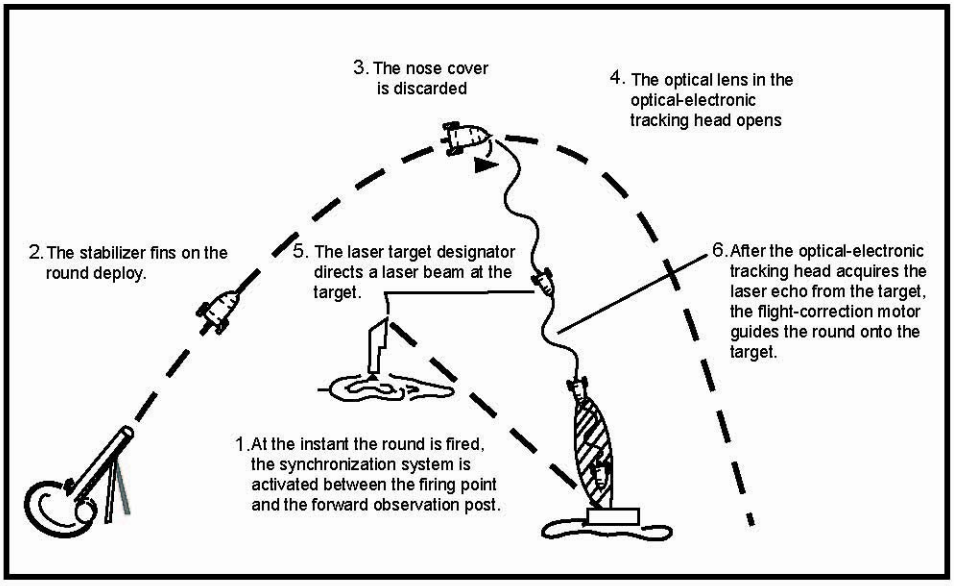
⑥ Flight correction motor

⑦ Fin stabilizers

The streamlined head of the round is painted red and houses the optical-electronic guidance head. It was said that due to all the electronics, the cost of one of these devices was equivalent to the price of a new "Zhiguli" automobile.[9] The round is terminally guided to the target by the 1D15 laser target designator (LTD) that is located at a forward observation post. The laser beam is laid on the target and the reflection from the target creates a petal-shaped electronic echo. The optical-electronic tracking head must acquire this petal-shaped electronic echo and, scanning it, direct the round to the target.[10] The "Daredevil" has a maximum range of 9,200 meters.[11]

When the 2S4 is ready to engage a target with the laser-guided round, the fire direction center computes the firing data and meteorological conditions. The 2S4 must first fire two or three conventional rounds to establish the PGM "footprint" and confirm that the rounds are landing near the target. The forward observation post with the laser target designator must be linked to the firing position by the 1A35 shot synchronization system—composed of the 1A35K command device (at the firing position) and the 1A35I observation post device. When the round is fired, this information is transmitted over the 1A35 system to the LTD that then paints the target with a laser beam.[12] The petal-shaped echo of this beam is what the optical-electronic tracking head must acquire.[13]

The firing sequence is as follows (See diagram 2-Viktor Litvinenko shows the round launched from a ground-mounted mortar, but the 2S4 is the system associated with the Daredevil.). At the instant the round is fired, the synchronization system is activated between the firing point and the forward observation post. The stabilizer fins on the round deploy. The nose cover is discarded. The optical lens in the optical-electronic tracking head opens. The laser target designator directs a laser beam at the target. After the optical-electronic tracking head acquires the laser echo from the target, the flight-correction motor starts to guide the round onto the target.[14] The flight correction system is activated when the projectile is within 400 to 800 meters of the target.[15]



The "Daredevil" Passes its Combat Testing

In April 1985, the Soviets shipped the 3F5 "Daredevil" round to the Division Artillery of the 108th Motorized Rifle Division located near Kabul, the capital of Afghanistan. The 108th gunners were to do the first combat tests of the round. An artillery instructor from the Artillery school in Leningrad came with the rounds to help with the test. On the day of the first test, the forward observation post personnel climbed a mountain to get into position. They triggered a mine in route severely wounding two of the party. Following their medical evacuation by helicopter, the remaining forward observation personnel conducted their test on a half-demolished fortress some 3250 meters away from the firing position. The forward observation team was some 5 mills off the gun-target line. The firing conditions were ideal. After firing two standard rounds to establish a PGM "footprint", they fired a "Daredevil" round which penetrated the roof of the fortress. The fortress disappeared in a cloud of smoke, dust and debris. The mission took 15 minutes.[16]

Following this successful test, the "Daredevil" was used in support of combat. In June 1985, Senior Lieutenant A. Beletskiy employed his 2S4 battery against a Mujahideen stronghold that artillery could not engage. The stronghold was located near the Pandjshir valley and garrisoned by Mujahideen of Ahmed Shah Masood. The laser range finder determined that the distance to the target was 2350 meters. A 2S4 fired a conventional round to establish the PGM footprint. The FDC adjusted the firing data and then fired the "Daredevil" round. It hit the target exactly. The 2S4 battery destroyed the Mujahideen stronghold with just twelve rounds.[17]

There were several restrictions on the use of the "Daredevil" in Afghanistan. The laser target designator could not be over 300 meters off the gun-target line.[18] It could not be used when the cloud cover was less than 600 meters from the ground or during sandstorms. Strong sunshine would overheat the LTD, ruining its effectiveness. These shortcomings were reported and corrected.[19]

Aftermath

The laser-guided heavy mortar round was clearly designed for other than guerrilla war, but in the mountainous terrain of Afghanistan, it destroyed targets that guns, howitzers and multiple rocket launchers could not reach. Precision-guided munitions are not always the best way to execute a mission and they require near-optimum conditions that are not always available on the battlefield. Further, laser beams can be detected and countered. However, when conditions are right, PGMs can significantly reduce the expenditure of time and ammunition while providing a high rate of target destruction. The Soviet use of the "Daredevil" round was against stationary targets. There is little indication that they used the 2S4 against targets of opportunity and no indication how they would differentiate LTDs on a laser-crowded battlefield to safeguard against a round being captured by the wrong LTD. As the PGM technology improves, PGMs should become cheaper and available for a wider range of weapons systems. Although the Daredevil round is not currently offered for sale, the *Krasnopol* is. Improved PGM rounds are being developed and these new PGM systems will be deployed globally and will dramatically effect the tactical deployment and formations of forces on the future battlefield.

ENDNOTES:

[1] A. Grigor'ev, "240-millimetrovyy 'tyl'pan'" [240-millimeter 'Tulip'], Voennye znaniya [Military knowledge], January 1994, 17.
[2] Ibid.
[3] Yuri Pirogov, "Nyet minometov moshchnee 'tyl'pana'" [There is no mortar mightier than the "Tulip"], Krasnaya zvezda [Red star], 21 May 1993, 2.
[4] Christopher Foss, Jane's Armour and Artillery 1996-97, Surrey: Jane's Information Group Limited, 1996, 590.
[5] Pirogov.
[6] For information on the *Krasnopol* system, see Walter Williams, "*Krasnopol*-A Laser Guided Projectile for Tube Artillery", Red Thrust Star, April 1997, 16-18 or http://leav-www.army.mil/fmso/fmso.htm.
[7] Viktor Litvinenko, " Pervye 'smel'chaki'" [The first 'daredevils'], Soldat udachi [Soldier of fortune], August 1996, 11. Foss, 591 states that the weight is 134.2 kilograms (296 pounds) of which 32 kilograms (71 pounds) are the warhead.
[8] Litvinenko, 11. Diagrams 1 and 2 are from this article and are Viktor Litvinenko's own drawings. Litvenko was chief of artillery for the 108th Motorized Rifle Division in Afghanistan and was involved in the initial combat testing.
[9] The "Zhiguli" is a medium-sized Russian automobile based on the Fiat of the mid-1970s. It has recently gone out of production.
[10] Litvinenko, 12.
[11] Foss, 591.
[12] The LTD has a ten power monocular sight and can designate targets from 200 to 10,000 meters within ten meters accuracy. Ibid.
[13] Litvinenko, 12.
[14] Ibid.
[15] Foss, 591.
[16] Litivenko, page 13.
[17] Of the 12 rounds fired, probably only two or three were PGMs. Incident from Viktor Litivenko, "Novo to, Chto Khorosho Zabyto" [What is Completely Forgotten is Brand New], Armeiskiy Sbornik [Army digest], September 1996, 46. This incident was also cited in Lester W. Grau, "Artillery and Counterinsurgency: The Soviet Experience in Afghanistan", FA Journal, May-June 1997, 40-45.
[18] The $\measuredangle$T, expressed in mills, is currently not available.
[19] Litivenko, "Pervye…", page 12.