



Russia's "Penitsillin" Artillery Reconnaissance System

OE Watch Commentary: Since the 1960s, Russia has pursued technologies to determine the location of active enemy artillery. Such artillery reconnaissance is necessary for counterbattery engagement, or in other words, the suppression of enemy guns (by fire). Typically, most of these systems are radar-based and mounted upon wheeled or tracked chassis, functioning by tracking the trajectory of projectiles. In recent years, due to high speed computing, it became possible to determine the trajectories of multiple projectiles, to include their point of impact. Today, the most popular counterbattery radars are the American AN/TPQ-36, AN/TPQ-48, and the Russian Zoopark-1M. These systems are equipped with high-speed computer processors and phased array radars capable of determining the originating point of large enemy artillery at distances of approximately 20 km. Although these systems are quite effective, they do present a significant problem. In order to function these systems emanate a large amount of electromagnetic energy, which makes counterbattery radars easy to find and target on modern battlefields, by either antiradar missiles or artillery systems.

In order to increase the resiliency of artillery reconnaissance capability, the Russians (then Soviets) chose to diversify their technology, to not only include electromagnetic-based systems, but also acoustic (non-electromagnetic-based) systems. In 1987, they fielded the AZK-7 automatic sound-ranging system, which was later upgraded to AZK-7M. The AZK-7M functions by placing three sound monitors certain distances from one another and then triangulating the location of a given (artillery) sound. Although acoustic systems have a shorter effective range, and are much more susceptible to environmental conditions, they are able to passively collect targeting data, a feature that significantly enhances their survivability on the modern battlefield.

The accompanying excerpted articles discuss Russia's most recent attempt to diversify artillery reconnaissance capabilities, the "Penitsillin" automated sonic-thermal artillery reconnaissance system. The Penitsillin is mounted on a Kamaz-6350 chassis, with a detection radius of up to 25 km. It consists of the 1B75 electro-optical module, which works in the infrared and visible spectrum using imaging cameras placed on a telescopic boom, and several ground-installed 1B76 sound and seismic receivers; the system receives and processes thermal, acoustic and seismic signals from enemy fire, calculating their location and transmitting the data to friendly artillery in reportedly less than five seconds.

Although the Russian Armed Forces are keen on the use of UAVs and SIGINT as means of determining locations for artillery targeting, systems such as the Penitsillin make it clear that these are not the only means they are pursuing. The diversification of artillery reconnaissance capabilities is a key feature of Russian military modernization, and one that significantly enhances the Reconnaissance-Fire System (ROS) [разведывательная-огневая система (РОС)]. **End OE Watch Commentary (Bartles)**

“But it (the Penitsillin) has another advantage that bears on operational reliability...it is not susceptible electronic countermeasures.”

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Continued: Russia's "Penitsillin" Artillery Reconnaissance System

Source: Rafael Fakhruddinov: "Революция в вооружении: в США испугались «Пенициллина» (An Arms Revolution: The United States is in Awe of 'Penitsillin')," *Gazeta.Ru*, 2 December 2018. <https://www.gazeta.ru/army/2018/12/02/12079747.shtml>

...The new Russian 1B75 Penitsillin sonothermal artillery reconnaissance complex could be a breakthrough "method for eliminating American heavy artillery" and, thereby, bring about an arms revolution, just as its namesake revolutionized the whole of medicine...

Experts point out that the system can find targets in just five seconds within a radius of up to 25 kilometers, and also determine in advance the places where enemy projectiles will fall. The Rostec Russian state corporation notes that the system's detectors are so precise that they can even detect a door slamming. Moreover, the Penitsillin is fully automated.

According to available data, the advantages include low probability of its detection by enemy artillery. This is due to the fact that the Penitsillin does not use electromagnetic waves, which are integral to radar. The system was first presented last year; it is now completing test trials and its serial production is expected in 2019...

Source: Vladimir Tuchkov, "Укол «Пенициллина» заставит пушки НАТО замолчать навсегда (A Shot of Penitsillin Will Silence NATO Guns Forever)," *Svobodnaya Pressa*, 5 December 2018. <https://svpressa.ru/war21/article/218137>

...In technical terms, the task turned out to be so difficult that the Penitsillin research and development which began in 2006 is coming to an end only now. Serial production of the systems can start at one of the plants of the Roselektronika holding company in 2019 or a year later. The system is ready for this because it has successfully passed tests...

The system includes a push-up telescopic mast with six television cameras and six thermal imaging receivers, four seismic sensors, and a control system with a high-performance computer. In the working position the mast is raised to the required height, which allows a survey of the terrain, while the seismic sensors are fixed in the ground and connected by cable to the processing and control system.

The visual part of the system records flashes from artillery guns and shell bursts. The seismic sensors convert ground tremors into an electrical signal. In the case of massed fire by the enemy, a superimposition of waves on each other is obtained. Very large computational processing power is required to decipher this picture of superimpositions, which at the same time also takes into account the picture of multiple shots and shell bursts obtained from observation cameras. In the event of massed fire the Penitsillin is able to get a bearing on 90 percent of enemy firing points. It takes no more than five seconds to get a fix on each firing point after its "illumination." This is a very important parameter because it makes it possible to hit a self-propelled artillery gun with return fire before it changes position after a shot. At the same time, the system operates in fully automatic mode, disseminating an electronic map of the fire situation to its batteries. This eliminates operator errors that are unavoidable in a high-intensity combat environment.

The Penitsillin monitors a much greater width of the frontline sector than systems using radar. It reaches 25 kilometers. In depth, a mortar can be recorded at a distance of 10 kilometers and a howitzer at about 20 kilometers. Meanwhile, the maximum azimuth error does not exceed 1.5 minutes of angle.

The developers claim that the equipment can record even a door slam. The high accuracy of direction-finding and sensitivity, the large monitoring area, and the ability to work at any time of the day or night all make it possible to assert that the Penitsillin significantly surpasses the combat capabilities of systems based on the use of radar. The Penitsillin can also be used to adjust the actions of its friendly artillery by transmitting data to batteries with the point-of-impact coordinates of projectiles.

We have already said that the system cannot be detected using radio-technical reconnaissance. But it has another advantage that bears on operational reliability...it is not susceptible electronic countermeasures. By the way, sometimes it is possible to encounter the opinion that in the era of drones the use of systems such as the Penitsillin or Zoopark is over. To which it can be replied that drones, under certain conditions, may be suppressed by enemy EW assets.

Reconnaissance-in-Force Russian Style

By Lester W. Grau

"Integrated fires, rapid detect-destroy systems and the controlled, merciless onslaught of smaller robot tanks and assault vehicles may rip through robust defenses to determine the true nature of the defense and prepare the main attack to totally dismantle it. To the Russian way of thinking, the reconnaissance-in-force remains a viable method of tactical intelligence. Learning how to employ it optimally is the current challenge."

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