Artillery Rockets:
Should Means of Interception be Developed?

Yiftah Shapir

The use of artillery rockets against civilian targets in Israel is the most prominent feature of the current war. Hizbollah has fired thousands of rockets at northern Israeli towns. Hamas uses a similar though much more primitive weapon, which it launches from the Gaza Strip into nearby towns. This article examines the characteristics of artillery rockets, the way they are operated, the implications stemming from their use, and the chances of developing a means to intercept them.

Pluses and Minuses of Artillery Rockets

Artillery rockets are used by regular armies for special needs only. In no army do they constitute the backbone of artillery fire support. Armies continue to rely on towed or self-propelled artillery, as they did half a century ago. There are several reasons, however, why Hizbollah nonetheless prefers to use artillery rockets.

First, rocket launchers are very simple to produce and operate. A rocket is fired from a thin barrel or a rail, which is not heavy or rifled like a cannon barrel. Unlike an artillery shell, there is no recoil, and therefore it does not require the complex recoil absorption mechanism of cannons. Many launching barrels can be mounted on a light truck, and a single launching barrel can be carried on the back of an animal or even a soldier. Second, artillery rockets provide coverage of longer ranges than standard artillery: unguided rockets are usually effective up to about 100 km, and some boast even longer ranges. For example, the Russian Smerch has a range of 70 km and the Chinese WS-1B is advertised as having a range of 180 km. Third, artillery rockets are used for quick and dense coverage: the Russian BM21 launcher, for example, is capable of firing 40 122-mm rockets in less than a minute. A battalion of twelve launchers can, therefore, fire 480 rockets on one target in less than a minute. Fourth, artillery rockets are used for special needs. For example, very heavy rockets with short firing ranges (1-4 km) are used for clearing mine fields.

At the same time, artillery rockets have some serious disadvantages, besides being of lower accuracy than artillery shells. Special expertise is required for the manufacture of rockets that have a reasonable degree of accuracy. For longer range rockets, the manufacturing process is highly complex. In addition, and this is probably the greatest disadvantage, rocket firing generates a great deal of fire and smoke, which immediately exposes the launchers to the enemy. Therefore, launcher operators must withdraw from their firing positions as soon as they finish shooting. In the case of guerilla forces operating a single barrel, several launchers can be placed in the field, aimed at the target, and operated by remote control or by a delayed-action fuse, thereby preventing the operators from being exposed to counter-fire. In this manner, the attacking force can move quickly, hide, shoot, and flee to other hiding places. This is an advantage that does not exist in the case of regular artillery batteries, whose movement is more difficult to hide.

Is it Worthwhile to Develop Means of Interception?

Since artillery rockets are less than accurate (a reasonable degree of accuracy is a dispersion of about 1-1.5% of the range), they can be operated against point targets at short ranges only. At longer ranges, they are

Rocket Weaponry in the Battle Zone - Main Characteristics

Rocket Name	Caliber	Length	Weight	Warhead Weight	Range Minimum – Maximum	Warhead Type	Remarks
Chinese Rockets					12-barrel launcher, towed, or on a jeep, or a single launcher, portable		
Type 63 (Fadjr-1)	107 mm	0.84 – 0.92 m	18.8 kg	Approx. 5 kg (estimated)	8,500 m	Explosive, fragmentation	Chinese rocket
Grad Type					BM-21 40-barrel launcher, as well as 12, 36 barrels, and also portable single barrels		
9M22U	122 mm	3.226 m	66.2 kg	19.4 kg	1,500 m – 20,389 m	Fragmentation, smoke, ignition	This is the basic, original rocket
9M22M	122 mm	2.870 m	66.0 kg	18.4 kg	1,500 m – 20,000 m		
9M2B	122 mm	1.905 m	45.8 kg	19.4 kg	2,500 m – 10,800 m		Used by special forces
9M217	122 mm		70 kg	25 kg	30,000 m		New models
9M218	122 mm		70 kg	25 kg	40,000 m		
9M521	122 mm		70 kg	21 kg	37,500 m		
Uragan BM 9P140					Launcher - ZIL 135 truck, portable,16 barrels		
9M27F	220 mm	4.8 – 5.1 m depending on the type	280 kg	100 kg	10,000 –35,000 m	Explosive, fragmentation, various cluster munitions	There is a range of rocket types
Various Iranian Launchers							
Fadjr-3	240 mm	5.2 m	407 kg	90 kg	17,000 – 43,000 m		12 barrels, on truck
Fadjr-5	333 mm	6.485 m	915 kg	175 kg	75,000 m		4 barrels, on truck
Falaq-1	240 mm		111 kg	50 kg	10,000 m		4 barrels, on jeep
Falaq-2	333 mm		255 kg	120 kg	10,800 m		1 barrel, on jeep
Zelzal-2	610 mm	8.46 m	3,400 kg	600 kg	210,000 m		Track on jeep
Possible weaponry in the arena							
WS-1	302 mm	4.737 m	524 kg	150 kg	40,000 – 100,000 m		Chinese-made, maybe sold to Iran
WS-1B	302 mm	6.375 m	725 kg	150 kg	60,000 – 180,000 m		Chinese-made
BM 9A52 Smerch	300 mm	7.6 m	800 kg	120-130 kg	20,000 –70,000 m (there is also 90,000 m)	Explosive, fuel-air, various cluster munitions	12-barrel launcher

aimed at targets like neighborhoods or towns. Thus, their main function in the current war is to serve as a weapon of terror against population centers.

Although Hizbollah leader Nasrallah attempted in one of his statements to claim that he was deliberately refraining from firing rockets at the chemical plants in the Haifa bay in order to prevent large-scale contamination, it is clear that Hizbollah is mainly shooting at population centers. In the south too, Hamas is firing Qassam rockets at population centers for similar reasons. This use is what has turned artillery rockets into a grave strategic threat that no government can ignore.

In recent years, consideration has been given to the possibility of intercepting rockets, mainly as a byproduct of the idea of intercepting ballistic missiles, like Israel's Arrow System and the anti-ballistic missile defense systems currently being developed in the US.

However, intercepting artillery rocket is an exceedingly complicated matter. First, the flight duration of the rockets is relatively short – about a minute or two, for ranges of 20-40 km. Second, their signature is low. In terms of a radar cross-section, they constitute extremely small targets. True, the propellant has a significant signature while burning, but it operates for a few seconds only, and for most of their flight time, the rockets fly in a ballistic trajectory, without propulsion. Third, they are usually launched in large salvos. A successful interception would be one that hits a very high percentage of the salvo, but the attacker will always be able to saturate the defender's defense system with more rockets.

In addition, a careful financial analysis shows that the rockets do not cause a great deal of damage. Their large dispersal around targets on the one hand, and the dispersal of the elements that are likely to be hit in the target area on the other, causes

most of the rockets to land in open areas without causing any damage, and only a small fraction of them succeed in causing death and injuries. This fact has been demonstrated throughout the current war in the north. However, a cold calculation is of no value when a country's leadership faces a situation in which its citizens are hit in their homes by enemy weapons.

We must make such a calculation when we consider the cost of developing an anti-rocket system, and use it to derive the cost of intercepting a single rocket. It is precisely such calculations that have negated the idea of developing a system for intercepting artillery shells, for example. No one thought it worthwhile to invest hundreds of millions of dollars in developing such a system. However, when the rockets land on cities and political pressure is exerted on the country's leadership, this consideration takes on a different nature. The cold calculation of the average damage from a single rocket disappears when the population is hit. From the political leaders' point of view, the very existence of a technological option to intercept rockets, weak as it may be, is a weighty factor, since they feel they cannot withstand the claim voiced against them: "You could have done something and you didn't."

Thus, once again rocket fire is affecting weighty and costly political and military decisions since it was precisely these considerations that led Israel to begin developing a system like the Nautilus – a chemical laser system whose declared objective was to intercept the Grad rockets that were fired on Israel's northern towns during the late 1980s and the 1990s. The Nautilus system was not developed beyond a very heavy experimental system, and the development of its lighter, mobile version was discontinued due to financial considerations.

It seems that the fighting in the north has increased the chances that money will be invested in developing this system or another that is intended to achieve the same purpose. The purely technical consideration does not justify such investments, but when other considerations are taken into account, mainly the political one, such investments are legitimate.