Massed Fires to Precision: Is the Balance Shifting?

PK Chakravorty

"I do not have to tell you who won the war. You know the Artillery did."

—General George S Patton[1]

Abstract

The need for precision was felt during the Vietnam War. This led to the development of a variety of Precision Guided Munitions (PGMs) which led to these being selectively used in the interregnum. The current war in Ukraine has seen an increasing quantum of Massed Fire as well as Precision Fire. In many phases, Russia has been firing 20,000 rounds per day while Ukraine is firing 4000 rounds. Artillery is the principal arm being used for operations. There is a need to see how our environment has been impacted. In our context, the Kargil operation in 1999 was the harbinger for the introduction of PGMs. Gradually we have introduced them and the high point was the usage of Spice 2000 bombs in the strike on Balakot in 2019. Precision weapons are costly and use of these on prioritised targets would be the answer.

Major General (Dr.) **PK Chakravorty,** VSM (Retd) is a former Defence Attaché to Vietnam and Additional Director General Artillery at Army Headquarters. Views expressed are personal.

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Target Acquisition and Engagement

It is an indisputable fact that Firepower and Manoeuvre have been two components on which battles were won. Classical use of these was observed during the Gulf War in 1990. It is interesting to note that Western nations Fire to Manoeuvre whereas Russians Manoeuvre to Fire.[2] In our context, we are more flexible and adopt either method based on the situation.

Firepower essentially comes down to bringing effective fire on selected targets. The Cambridge Dictionary defines a target as "an object shot at during shooting practice, often a circle with a pattern of rings or any object or place at which bullets, bombs, etc., are aimed".[3] Armed Forces, be it any Service, aim at targets. They can be engaged by Direct Fire or Indirect Fire. To enable engaging by Direct Fire it is mandatory that the target must be visible to the sights of the gun to enable the cross wire to be laid on the target. Artillery Guns, Rockets, Missiles and Mortars are normally fired in an indirect mode. Tanks are normally fired in a direct firing mode. Fighter jets and helicopters as well as drones are used in a combination of direct and indirect firing modes.

Precise engagements are possible by two methods. The first is to undertake a procedure of engagement known as precision shoot. This is by using conventional ammunition which is adjusted on to the target by a precision procedure which is time-consuming and cumbersome. The other is to have PGMs. The United States Armed Forces, define a PGM as "a guided weapon intended to destroy a point target and minimise collateral damage".[4] This comprises artillery shells, missiles, rockets and

guided bombs. PGMs typically use the Global Positioning System (GPS), laser guidance or inertial navigation systems to improve a weapon's accuracy to less than 3 metres. The US sees the increasing use of Anti-Access/Area Denial (A2/AD) systems by China and Russia. As a result, they need PGMs to engage these targets.

The PGM concept started evolving from the Vietnam War onwards, progressed during the 1982 Lebanon conflict and was finally in the global eye during the Gulf War of 1990 where PGMs were used extensively against a variety of targets. Post the Gulf War, discussions revealed that the US was aiming for at least 30 per cent of PGMs in their inventory. The current military operations in Ukraine have further vindicated PGMs. However, it is more economical using conventional High Explosive (HE) Ammunition in comparison to PGMs. A look at US expenditure on the number of precision munitions for the past five years would highlight this aspect. The year 2019 witnessed a procurement of 65,800 munitions for US$ 4.6 billion, 2020 saw a reduced amount of US$ 4.8 billion, and 2021 had a further reduction to 39,600 munitions procured for US$ 4.3 billion. In 2022, US$ 3.8 billion were appropriated for 15,000 munitions and in 2023 the request was for 16,600 munitions for US$ 4.4 billion.[5]

Few varieties of PGM

It is important to consider a few varieties of PGMs with the US Armed Forces. These are as elucidated below:[6]

- **Air-Launched PGMs**
    - **Paveway Laser Guided Bomb**. This is a family of guidance kits that attach to unguided bombs. The assembly includes a seeker that fits on the nose of the bomb and a tail kit with fins to steer the bomb. When a laser is used to designate a target the seeker locks on to it and provides signals to the tail fins, enabling the bomb to be guided onto the target. These were developed during

the Vietnam War to enable tactical aircraft to deliver PGMs. The Paveway-III is the latest upgrade.

- **Joint Direct Attack Munition**. (JDAM). This is a tail kit that modifies unguided bombs. The tail kit is a GPS which provides accurate guidance. This was used in Kosovo by a B-2 Spirit bomber. JDAMs are used by all fixed-wing strike aircraft.
- **Hellfire Missile**. This is a Fire and Forget missile introduced into service in 1982 on the US Army's AH-64 Apache, using laser guidance to target tanks, bunkers, structures and leaders. They were used on the Unmanned Combat Aerial Vehicle (UCAV) Predator and later on the MQ-9 Reaper.
- **Joint Air-to-Ground Missile (JAGM).** This has been made as an advancement of the Hellfire Missile and would replace Hellfire, TOW and Maverick missiles. The missile has a new warhead and seeker which is paired with the existing AGM-114 R rocket motor to provide better target acquisition and comprehension. It started testing in 2010 and was declared to have initial operating capability (minimum acceptable capability), about four years ago. They can operate from the Apache and Super Cobra attack helicopters.
- **Joint Air to Surface Strike Munition (JASSM).** This is a 14 ft long, 2,250-pound missile that can operate on multiple aircraft. It is operational with B-1B Lancer, B-52 Stratofortress, F-16 Falcon, F-15 E Strike Eagle, F/A 18 Hornet and F-35 Lightning-II. An improved version was developed in 2004 with an improved IR seeker, a two-way data link and an enhanced anti-jam GPS receiver. The extended range version can cover from 926 km to 1,920 km.
- **Long Range Anti-Ship Missile (LRASM).** This has been used to replace the Harpoon missile. This is the AGM-158C Missile which has an operational range of 926 km. It can be operated

by stealth bombers as well as fighter jets operating from aircraft carriers.

- **Ground-Launched Precision Munitions**
  - **M 982 Excalibur.** This is an extended-range artillery shell with a calibre of 155 mm. It is developed and manufactured by Raytheon and BAE Systems. It is a GPS and inertial navigation-based system. It can be fired in a variety of weapon systems with 155 mm calibre guns. It has a stated accuracy of 2 metres[7] but the final result would depend on the accuracy obtained of the target location. Since in many cases a pinpoint location is difficult to obtain it would be pragmatic to presume that the CEP would be 5 metres. The shell is extremely expensive and each shell costs US$ 68,000 as compared to a conventional HE round costing US$ 800. It is widely used by many countries.
  - **Army Tactical Missile System (ATACMS).** The Missile is a 610 mm rocket that can be launched from M 270 MLRS or the M 142 High Mobility Artillery Rocket System (HIMARS). Developed in the 1980s, GPS guidance was added later. The latest version achieves ranges up to 300 km. They are currently based upon a combination of an Inertial Navigation system with GPS in the loop. The accuracy is good and varies as per open sources between 10-50-metre CEP.[8]
  - **Guided Multiple Rocket Launch System. (GMLRS).** A GPS-guided 227 mm rocket which is capable of being fired from M270 and HIMARS. These rockets achieve range from 15 to 70 km. The rocket has a Median Miss distance of 2.1 metres.[9]
  - **Precision Strike Missile (PrSM).** PrSM is a new development of a weapon with the intent to replace ATACMS. It would enable two missiles to be launched simultaneously in a launcher compared to one of ATACMS. It would have a range over

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400 km and have an anti-jam GPS antenna. The weapon is expected to be operationalised shortly.

- **Loitering Munitions.** Loitering Munitions are a new generation of Unmanned Aerial Vehicles that are designed to provide unprecedented levels of flexibility and precision in modern warfare. They are meant to attack targets directly, making them a game changer in modern warfare.[10]

- **Naval Precision Munitions**
  - **Tomahawk Cruise Missile.** Developed in 1970; currently, the Block IV variant is the latest. It has a range of about 2,500 km with a speed marginally less than the speed of sound. It uses an Inertial Navigation System and GPS and the CEP is 10 metres.[11] The missiles are extremely effective.
  - **RIM-174 Standard Extended Range Active Missile (ERAM).** This is also called the Standard Missile-6. Designed in 2004 it receives information from a Radar and Advance Early Warning Aircraft. The information is received in flight. The published range varies between 240 and 460 km. It has an Inertial Guidance System and the terminal guidance is active and semi-active radar homing. The latest version has GPS inserted. There is no open-source information on its accuracy.

Massed Fires vs Precision: The Ukraine War

As is evident, precision weapons being accurate are expensive. They are effective if the target data is accurate and there is a mode of undertaking Post Strike Damage Assessment (PSDA). Often in environments where target description is not accurate and to cover large areas, massed

fire using conventional ammunition is needed and proves to be extremely effective.

It would be interesting to study the Ukraine War which continues unabated, where Artillery has played a predominant role. Russia's weakness during the current war was the performance of its ground forces. Their ability to undertake tasks was mediocre. This has been considerably offset by their leveraging of massed artillery fires to facilitate a slow and deliberate advance. Massed Fires applied in a sustained manner have resulted in displacing the local population and destroyed their residential shelters and infrastructure. This devastation has compelled the Ukrainian military to withdraw.[12] It was estimated in 2022 that Russia was firing 20,000 rounds per day and Ukraine probably 5,000 rounds per day.[13]

The point at issue is that precision, particularly long range, does provide advantages but Massed Fires help to sustain the effort in a long-drawn battle.

The War also provides some insight into the question regarding the appropriate balance between Massed and Precision Fires. Both countries have used large quantities of unguided projectiles and precision ammunition. Massed artillery has covered numerous weaknesses of the Russian Army. It is pertinent to note that precision ammunition was used extensively by the Russians. They are using a combination of air, ground and sea-launched long-range precision missiles for strategic purposes engaging targets in depth including civilian infrastructure. Ukraine has countered Russian artillery by using a mix of domestic and Western-origin artillery to bring on Massed Fires. It has also used long-range drones and the HIMARS system to strike deep into Russian territory targeting logistics centres. In addition, it has used US-manufactured precision guided artillery shells. The point at issue is that precision, particularly long range, does provide advantages but Massed Fires help to sustain the effort in a long-drawn battle.

It is pertinent to describe the Russian doctrine of combat. Firepower is most important for the Russian Forces. Artillery is Russia's primary arm. Firepower enables assaulting forces to position themselves in a manner so that artillery can deliver fire that destroys targets thereby paving the way for success. For static operations, Russians execute centralised control over their artillery thereby optimising its effects.[14]

Another cruise missile used during the operations is the Ukranian-designed Neptune missile which is an improvement of the Russian Kh 35 Cruise Missile. The Russian cruiser Moskava was sunk by two of these missiles on 13 April 2022. Further a land attack variant destroyed a S-400 missile system radar in Crimea on 23 August 2023. These were two precision attacks by the Ukrainians resulting in severe damage to Russian equipment.

It would be appropriate to state that Precision is gradually assuming greater importance, particularly where target locations are known or can be constantly monitored. The high cost makes its use prohibitive against targets whose data is not specific but appreciated, and where massed fire can decimate the target. It would be logical to discuss how this would impact our environment.

Applicability to our Armed Forces

The terms 'Massed Fire' and 'Precision' entered our lexicon during the Kargil Conflict in 1999. Firepower was a major component of the conflict. It was during this period that precision engagement became a must. Targets were on mountain tops like Tiger Hill and Tololing. The 155 mm Bofors Gun was used in a Direct Firing role in a procedure known as Direct In Direct Fire (DIDF). In this procedure, the cross wires of the Dial Sight were laid on the target, whereas the range was measured by a Laser Range Finder and converted to elevation for the charge to be fired from the Range Table. In most cases, the first round was a target round. Often adjustments for range had to be undertaken. It was during this period that the Krasnopol Russian PGM was imported. This is a Russian

laser-guided artillery shell and possibly 3,000 rounds were imported between 1999 and 2002.[15] The ammunition was successful in plains and low hills but in high altitudes was not giving the desired results.

Post the Kargil conflict, the three Services realised the importance of having greater quantities of precision ammunition in conjunction with conventional ammunition.

It is learnt that over 2.5 lakh rounds were fired by India during the conflict. There were about 300 Artillery pieces which were used. It is estimated that 5,000 rounds were fired on an average every day. It is interesting to note that 9,000 rounds were fired on the day Tiger Hill was captured. When compared to the relatively smaller area within which the Kargil War took place, this exceeded the rates of artillery fire during the Second World War. It is also important to note that on July 3, 1999, direct firing on Tiger Hill began and continued till the attacking troops of 18 Grenadiers, asked the guns to stop firing as they had reached the top. The fire was devastating and Tiger Hill was captured.[16]

The Indian Air Force also actively participated in the operations. The use of airpower commenced on May 26, 1999. The primary munition used was mainly 57 mm Rockets which were used by three variants of Russian fighters. Two fighter jets and one helicopter were lost by the Indian Air Force. They were casualties to shoulder-fired missiles. It was then that a need was felt for precision ammunition. ASTE Bangalore quickly modified Mirage fighter jets to carry US-made PGM Paveway II with the help of Israeli Litening pods. Seven modified Mirage 2000 were used on June 17 to decimate the enemy's administrative base at Muntho Dhalo. A week later on June 24, 1999, the Mirages struck the Northern Light Infantry's bunkers at Tiger Hill. The target was acquired at about 12 nautical miles, and the weapon was released at 5 nautical miles.[17]

Post the Kargil conflict, the three Services realised the importance of having greater quantities of precision ammunition in conjunction with

conventional ammunition. They followed the US pattern but numbers were extremely small due to exceedingly high cost. A few of these are elucidated:

- **BrahMos Supersonic Cruise Missile System.** An indigenous two-stage missile system with a range of more than 400 km. It has pinpoint accuracy with a very low CEP. The missile operates with the Army, Navy and the Air Force.[18] Accurate targeting data is extremely important for its optimum usage.
- **Drones.** The Indian Army was the first to receive a Searcher Mark 1 UAV. In a short time, the Air Force, followed by the Navy, caught up and graduated to the level of UCAV. Currently, we are manufacturing drones indigenously and also procuring 31 MQ-9 B Reaper Drones from the US which would cost US$ 3.5 billion. These will be used for multiple purposes including the firing of missiles. All Services are procuring swarm drones for engagement of targets with accuracy.
- **Naval Missile Systems.** The Indian Navy has undertaken the development of a number of missile systems which are capable of precision capabilities in surface-to-surface, surface-to-air and underwater-to-surface missiles. Barak Missile system is an eco-development project between DRDO and IAI System Israel.
- **Excalibur.** The Indian Army had procured the 155 mm Excalibur extended range guided rounds and test-fired them from M777 Ultra-Light Howitzer (ULH) in 2019. The initial batch of 1200 Excaliburs were procured in October 2019. This guided munition has a CEP of 5 meters and currently can be fired from M 777 ULH and K 9 Vajra.[19] This is a force multiplier with the Indian artillery.
- **SPICE-2000 Used by Air Force at Balakot in February 2019.** The Spice 2000 bombs that were used in Balakot air strike to avenge the Pulwama attack were made in Hyderabad at Kalyani Rafael Advanced System (KRAS) facility.[20] The Spice 2000 were dropped from Mirage 2000 and could glide for a distance of 60

Km before engaging the target with a CEP of 3 metres. The strikes were effective.

- **Loitering Munition.** This is being procured and would be used at all levels.

Efforts are being made by the three Services to enhance the precision content despite its prohibitive cost. In discussions, it has been stated that at least 10 per cent of our ammunition should be precision and the rest conventional. Thus, Massed Fire would continue to be our mainstay with Precision selectively used against prioritised targets.

On October 7, 2023, Hamas fired 5,000 rockets and intruded into Israel by land, sea and air causing heavy casualties. This was the use of Massed Fire and resulted in deaths and casualties on both sides. Hamas has also captured Israeli hostages who in the past also have been used as a bargaining shield.[21] Israel has declared war against Hamas and is currently using Massed Fire and Precision fire on selected targets. Ground offensive on the Gaza Strip is currently underway. Whatever be the case it would involve Massed Fire with selective Precision Fire.

Conclusion

In our context, we would gradually enhance our Precision Fire content while using Massed Fire as the main component till our Intelligence, Surveillance and Reconnaissance capabilities are state of the art and we can use Precision Fire without wastage of this exponentially expensive resource. An optimum mix would balance cost with success in operations.

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