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Appraisal of PLA Artillery Modernisation



Brig **Vivek Verma** is Former Deputy Director, Centre for Land Warfare Studies and Senior Research Fellow, USI of India, New Delhi.

Trigger for China's Artillery Modernisation

China has been closely monitoring American and Russian doctrinal and weapon modernisation programmes. It is looking to counter them through either asymmetric means or by building matching capabilities. Hu Jintao initiated the "New Historic Missions" in 2004 based on the lessons of foreign intervention during 1995-96 Taiwan-Strait crisis and 2003 Gulf War. The mission directed People's Liberation Army (PLA) to develop a range of systems to deter and deny foreign force projections. The 2019 white paper on "China's National Defence in New Era" talks about preparation for military struggle by elevating "capabilities for precise, multi-dimensional, trans-theatre, multi-functional and sustainable operations."¹ The effective use of artillery in 2014 Russo-Ukrainian conflict has reconfirmed Chinese belief in the artillery development plan in a hostile electronic environment as it realised that it can outgun the US military, its peer competitor, in this area. Despite priority being given to the PLA Rocket Force (PLARF), China is giving due impetus to artillery modernisation as it

Key Points

1. 2014 Russo-Ukrainian conflict demonstrated effectiveness of artillery in a hostile electronic environment.
2. It reaffirmed Chinese artillery development plan as it realised that it can outgun the US military, its peer competitor, in this area.
3. Taiwan and Tibet contingencies form the basis of PLA artillery modernisation drive.
4. Its artillery modernisation programme aims at developing operational and tactical in-depth strike system with an ability to carry out precision operations with integrated reconnaissance, control, strike and assessment capabilities.
5. New generation concepts of magnetised plasma artillery, electromagnetic rocket, anti-radar seeker sub-munitions for the rocket systems and smart loiter munitions are going to extend the range of PLA artillery and its lethality thus altering the deterrence correlation in the future.

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forms the backbone of the newly reformed Combined Arms Brigade.

PLA Artillery Overview

According to Military Balance 2019, PLA artillery holds almost 8,954 pieces² of artillery weapon systems with thrust on Self-Propelled (SP) systems and Multi-Barrel Rocket Launcher (MRL) systems (refer Figures 1 & 2). Given the PLA training priority for joint and trans-regional theatre training, since 2014, artillery and air defence brigades have undertaken training in transregional exercises as part of below-the-neck-reform.³ A total of 26 Artillery Brigade / AD Brigade training exercises have been conducted as part of Stride and Firepower Exercise.

Figure 1: PLA Artillery Systems

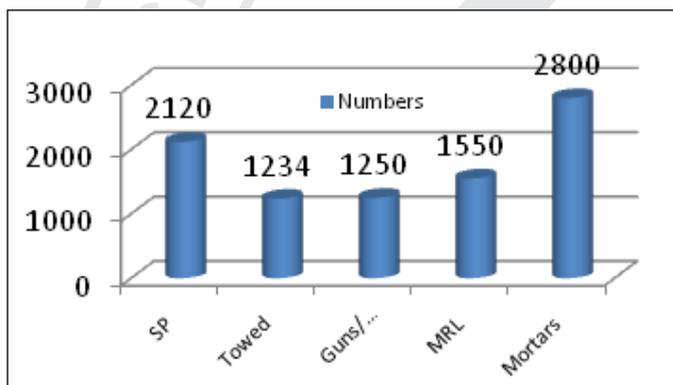


Figure 2: Details of PLA Artillery Holdings

Type	Calibre	Quantity	Remarks
SP Guns -2120			
PLZ-89	122 mm	500	in store 200 PLZ85/70
PLZ-07A	122 mm	350	
PLZ-07B	122 mm	150	Amphibious Role
PCL-09	122 mm	300	Truck Mounted Systems
PLL-09	122 mm	350	8x8 APC Wheeled
PLZ82/83	152 mm	150	in store 200
PLZ-05	155 mm	320	
Towed Guns-1234			
PL-96(D-30)	122 mm	500	in store 2,800 PL54-1
PL-59	130 mm	234	
PL-66(D-20)	152 mm	500	
MRL-1550			
PHL81/90	122 mm	550	in store 700 PHL-81
PHL-11	122 mm	350	
PHZ-89	122 mm	375	
PHZ-11	122 mm	100	
PHL-03	300 mm	175	

The majority of the weapon systems in PLA Artillery inventory are still of 122 mm calibre. However, the increasing thrust is towards indigenisation with 155mm calibre and development in the multi-barrel rocket launcher (MBRL) system. Towed guns are being replaced by SP gun systems or mounted gun systems. The 2010 China's white paper on National Defence sets the parameters for the PLA artillery modernisation – "working on new types of weapons, equipment, and ammunition with higher levels of informationisation, forming an operational and tactical in-depth strike system, and developing the capacity to carry out precision operations with integrated reconnaissance, control, strike and assessment capabilities." Taiwan and Tibet contingencies form the basis of their modernisation drive.

Examining the In-service Artillery Equipment

PLZ-07 Self-Propelled Howitzer. Unveiled during the 60th anniversary of the PRC on October 1, 2009, it was developed as land-based (PLZ07A) and amphibious (PLZ07B) model. It is set to replace the older Type 89 systems. PLZ-07 self-propelled artillery chassis is developed from ZBD-97 infantry fighting vehicles. The main armament remains 122 mm artillery which is from Chinese derivation of Soviet D-30 artillery and a 12.7 mm machine gun as a secondary armament. The gun has a maximum range of 18 km with normal ammunition, 22 km with base bleed and 27 km with rocket assisted rounds.

PCL-09 and PCL-181 (SH 15) Truck-Mounted Howitzers. Inspired by 1990s French CAESAR truck-mounted howitzer, PCL-09 or CS/SH1 (Chinese export name) is of 122 mm calibre launched in 2010. This howitzer uses Shaanxi 6x6 military trucks and was adopted alongside PLL-09 self-propelled howitzer, which is based on 8x8 armoured personnel carrier (APC). This gun system is fitted with a computerised fire control system, navigation, positioning and digital battlefield management system. The regiment consists of a couple of batteries with each battery comprising six truck-mounted howitzers, and also includes an artillery locating radar.⁴ It has a maximum range of 18 km with standard HE-FRAG projectile and 27 km with extended-range (ER) projectile. The PLL-09 is also

capable of firing 122 mm laser-guided projectiles based on Russian Kitolov projectile technology. China's PCL-181 155 mm truck-mounted howitzers, unveiled in 2017, uses latest 52-calibre barrel. The new technologies of electro-slag remelting (ESR) barrel smelting technology and gun barrel self-tightening process helps it in achieving 40-45 km range. The ESR projectile can reach a range of 50 km while it can also fire super-long-range projectiles such as the WS-35.

PLZ-05 / PLZ-52 Self-Propelled Howitzer. PLZ-05 is a 155 mm self-propelled howitzer developed to replace the Type 59-1 130 mm. Unveiled in July 2007, it has been upgraded to PLZ-52 which has a 52-calibre barrel. Its gross weight has increased to 43 tonnes from 35 tonnes due to turret modification. The howitzer has a maximum firing range of 53 km with extended range full-bore (ERFB), base-bleed (BB), rocket-assisted (RA) projectiles fire and is capable of firing the WS-35 shell of 100 km range.

PHL-03, AR 3 and PHL-16 MRL System. The PHL-03 MRL system is a Chinese version of the Soviet BM-30 Smerch. It was developed by NORINCO and reportedly entered service with the Chinese army in 2004-2005. The main role of this artillery rocket system is to engage remote strategic targets, such as airfields, command centres, support facilities, air defence batteries, and large concentrations of troops. Since 2010 China has developed longer range guided rockets for the export customers. The latest of these is the AR3 which can handle a number of different size rockets that are stored and fired from pods designed to operate from the same AR3 8x8 heavy truck. PHL-16 is a version of the AR3 that was first publicly revealed in 2019. The PHL-16 uses 370 mm guided rockets with a maximum range of 220 km. The system uses pods with missiles and can be configured to use rockets of different calibre. Some sources report that it is capable of launching tactical ballistic missiles and anti-ship missiles. The previous AR3 can also carry pods with 300 mm rockets, Fire Dragon 480 tactical ballistic missiles and TL-7B anti-ship missiles. The US M142 High Mobility Artillery Rocket System (HIMARS) has a maximum range of 85 km only.

Figure 3: PHL-16 Multi-barrel Rocket Launcher System



WS-35 Guided Munitions. This 155 mm guided projectile is of 1,620 mm length and weighs 18 kg. It uses Chinese GPS (BeiDou) and INS (for backup) and installs 'four tail stability wings' and 'four stability wings' on the warhead which is used to adjust the flight attitude. WS-35 is mainly intended for the PLZ-05 which is capable of firing rocket assisted shells. Its maximum range of 100 km and accuracy of 40 metres needs verification as the ammunition matches the US Excalibur GPS shell which weighs 45.5 kg with a range of 40-60 km⁵ planned to be replaced by VULCANO shells under development. These are full-calibre spin-stabilised projectiles up to the apogee. At the top of the trajectory, the front part, which integrates navigation sensors, a GNSS receiver, antenna, control devices and possibly a seeker, is roll-decoupled. Then the wings are unfolded that helps to gain additional range.

CM-501GA and CM-501XA Land-Based Mobile Missile System. The Chinese CM-501 system appeared after Israel revealed details of their Spike non-line-of-sight (NLOS) and Jumper missiles during the 2014 Israeli-Hamas War. Israeli artillery unit, Meitar, fired Tamuz guided missiles of 25 km range with radio link and a camera in the nose that enables operators of UAVs, helicopters, fixed wing aircraft and troops on the ground to "drive" the missile to a specific target. Chinese CM-501GA, a precision-guided missile, and CM-501XA, a loitering munition, were displayed in IDEX 2019 at UAE. The 2-metre-long CM-501GA is an NLOS missile capable of engaging both stationary and moving targets at a distance between 5 and 40 km. The missile, which has a diameter of 180 mm and weighs over 100 kg, carries a 20 kg blast fragmentation

warhead. Its propulsion system is believed to be based on a solid-propellant rocket motor. The missile uses a combined TV/imaging infrared (IIR) seeker for terminal guidance. It is presumed that some form of INS aided by the BeiDou Navigation Satellite System (BDS), is being used for the non-terminal guidance phases. The manufacturer claims the missile has a circular error of probability (CEP) of less than 1 metre when striking stationary targets, and a hit probability of more than 90 per cent when striking moving ones. The 2-metre-long CM-501GX loitering munition is more like a miniature cruise missile with pop-out wings and a small jet engine has both naval and land versions. The guidance options such as Satellite/Inertial Navigation System (INS), imaging infrared (IIR), semi-active laser (SAL) homing and in-flight updates for re-targeting coupled with a modular design makes it a versatile system. It is being introduced in two configurations: on a 6×6 APC, and on the CSK181 series of mine-resistant ambush protected vehicles. With an endurance of more than 30 minutes it is designed to engage targets at a range of 70 km.⁶

Figure 4: GM-501GA



Examining the Chinese Artillery New Generation System

Magnetised Plasma Artillery. The major challenge facing the artillery is extending the range. Optimisation of barrel and calibre length has thrown up challenges of looking at alternate means. The Chinese military published a notice in February 2019 inviting tenders to procure test systems for magnetised plasma artillery,⁷ a technology patented with the same name in 2015 by the PLA Academy of Armoured Forces Engineering. The weapon uses magnetism instead of gunpowder to fire shells. The system uses a magnetic field generator to create magnetic field inside the barrel. When the gun is fired, gas inside the barrel will be partly ionised into plasma by the high pressure and heat. The plasma having “stress anisotropic characteristic and has thermal insulation function”⁸ will then form about a millimetre sheath on the inner wall of the barrel due to the magnetic field. It greatly improves the driving force of the shell and the heat resistance thus prolonging barrel life. According to *Global Times*, the reduced friction extends the range of a conventional 155 mm self-propelled howitzer from 30-50 km to 100 km besides improving its accuracy. According to *The National Interest*, while the idea may be possible on paper, the main hurdle is the lifespan of the plasma and whether it is enough during launch time.⁹ In response to the Chinese development, the US’ Extended Range Cannon Artillery (ECRA) programme has claimed that its new 155 mm self-propelled howitzer (M1299) has achieved 62 km range. The gun uses 58-calibre barrel length firing XM1113 rocket-assisted artillery shell. However, it means upgrading the metallurgy, breach and hydraulics to sustain the additional pressure.¹⁰

Electromagnetic Rocket. For Tibetan contingency, China is developing the world’s first electromagnetic surface-to-surface rocket that offers greater fire range. While the conventional rockets rely on explosive powder for the initial push, the new electromagnetic rockets will be launched using additional electromagnetic force, like the catapult launchers that China and the US are developing for their rail guns. The lower air pressure over Tibetan plateau with less

air friction might assist in achieving longer range but the thinner air will affect the tail-fins control during the flight thus reducing its precision. Although the actual range of the electromagnetic rocket being developed is unknown, it is believed to be much longer than any of the existing types. China has spared no effort to catch up with the US' electromagnetic technology, to turn the new technology into an all-purpose propulsion system for a wider use – from ships to space.

WeiShi-2 (WS-2). This is a 400 mm rocket system with variants having a range of 200-350 km. It was fielded in 2007, but detailed information on the numbers produced is not available.¹¹ In 2008, it was revealed that submunitions are developed for WS-2, including a specialised anti-radar version, which is a rocket containing three UAVs. Once the rocket is fired to the target area, the UAVs are released the same way as other submunitions. The seekers then seek out target radar signals as UAVs begin to cruise, and once locked on to the radar, UAVs would home in and attack. Some have even compared it to Israeli Harpy anti-radar UAVs.

Laser Surveillance System. It combines the use of Lidar (a portmanteau of light and radar), Artificial Intelligence (AI) and 5G technology to synergise detection and dissemination of the images and intelligence. Lidar uses ultraviolet, visible, or near infrared light to image objects like non-metals, rocks, aerosols, clouds and even chemical compounds. However, it has atrophying effect in fog and murky water. China's new satellite 'Project Guanlan,' meaning "watching the big waves," launched in May 2019 at the

Pilot National Laboratory in Qingdao, uses lasers to spot objects deep under water up to 500 metres. According to researchers, this high-powered laser beam is capable of scanning an area of around 100 km on land and when used alongside microwave radar it can scan and identify surface movement besides penetrating through the foliage, thus blowing the camouflage cover. A narrow laser beam can be used to map physical features with very high resolution. This brings transparency both on land and sea and exposes weapon systems including submarines.¹² Riding on its 44 BeiDou Navigation Satellite System (BDS), AI and 5G technology increases the swathe of Chinese surveillance. The use of such features to fuse sensor-shooter integration using AI is a distinct possibility.

Conclusion

Longer term trends for artillery modernisation are well established. Guided artillery rounds will follow much the same path as aerial bombs – satellite/inertial guidance followed by enhanced derivatives of laser, millimetric wave radar and optical correlator seekers added to the core guidance package. Navigation and fire control systems will see increasing levels of integration and networking to accept sensor inputs based on satellite navigation, a digital moving map, and data link interfaces to accept targetting data from other sources. The new artillery systems are likely to alter the deterrence correlation in future. Choosing to employ a limited quantity of inferior artillery systems, and instead relying on the manoeuvre force to do the lion's share of the hard work of combat at close range is a recipe for disaster. Lessons for Indian Armed forces are ominous.

Notes

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CENTRE FOR LAND WARFARE STUDIES (CLAWS)

RPSO Complex, Parade Road, Delhi Cantt, New Delhi 110010

Tel.: +91-11-25691308, Fax: +91-11-25692347, Email: landwarfare@gmail.com

Website: www.claws.in

CLAWS Army No. 33098