



CENJOWS

CHINESE MAGNETIZED PLASMA ARTILLERY

1. **China to Test Magnetized Plasma Artillery.** The Chinese military (People's Liberation Army (PLA) weapon and equipment procurement website weain.mil.cn in Feb 2019) recently published a notice inviting researchers to devise a weapon that sounds like a sort of electromagnetic rail gun—which uses magnetism instead of gunpowder to fire shells—that several nations are developing. But actually deploying railguns has been hampered by the size of the weapon and especially the vast amount of electrical energy needed to propel a shell to speeds of greater than Mach 7. For example, despite years of research and vast sums of money, *the U.S. Navy* appears less than optimistic about fitting railguns *on its warships*. But Chinese scientists believe that magnetized plasma artillery will be so light and energy-efficient that it can be mounted on tanks.
2. Although the weapon sounds as if it comes from a sci-fi movie, it will probably not shoot high-energy plasma but ultra-high velocity cannon shells. The notice did not elaborate on the nature of magnetized plasma artillery. However, the PLA Academy of Armored Forces Engineering filed a patent with the same name in 2015 to the National Intellectual Property Administration. The notice invites tenders for a theory-testing and a launch system for magnetized plasma artillery.
3. **Principle.** According to the specification of the patent, the cannon will have magnetic material covering the gun barrel and a magnetic field generator to create a certain magnetic field inside the barrel. When artillery is fired, gas inside the barrel will be partly ionized into plasma by the high pressure and heat. The plasma will then form about a millimeter sheath on the inner wall of the barrel due to the magnetic field, the patent specification said.
4. The magnetized plasma layer can greatly reduce the radial force the barrel takes and boost thrust of the cannon shell, making it possible for the initial velocity of shells to exceed Mach 6, the limit for conventional artillery.

5. By comparison, an electromagnetic railgun can in theory accelerate its munitions to Mach 7, US-based media outlet the National Interest reported. But a railgun and its power system are so large that they are not mobile unless installed on large warships, the report said. The patented Chinese technology, however, can be installed on tanks and self-propelled guns, the specification said.

6. Wei Dongxu, a Beijing-based military analyst, told that due to the increased thrust, the range of the artillery can also be extended. Wei predicts the new technology would extend the range of a conventional 155-millimeter self-propelled howitzer from 30-50 kilometers to 100 kilometers. He added that the plasma layer might also reduce friction between the barrel and rounds, making the weapon more accurate. The layer can also provide heat resistance to the barrel, which will prolong its service life.

7. Dennis Killinger, a professor emeritus of physics at the University of South Florida, called the idea “intriguing.” “The idea seems possible,” he told the *National Interest*. “My main question is what is the lifetime of the plasma and is it sufficient during the launch time inside the barrel.”

8. It is also a different approach than a railgun. “I don’t think that you can think of it as an offshoot of the classic railgun technique since the railgun is more a linear motor (moving mag field) approach using a fixed stator (i.e., bullet) similar to the linear accelerators used for the newer roller coasters. This new, patented technique uses a plasma which interacts with the magnetic field and serves as a liner for the barrel.”

<http://www.globaltimes.cn/content/1139224.shtml>

<https://nationalinterest.org/blog/buzz/report-china-developing-deadly-magnetized-plasma-artillery-worried-89941>

CHINESE AUTONOMOUS CARGO SHIP

9. **China's Autonomous Cargo Ship 'Jindouyun' Conducts Maiden Cargo Sortie.** The prototype autonomous vessel named as 'Jindouyun 0 Hao' carried out its maiden trial cargo delivery sailing from Wanshan test range off Zhuhai coast in southern China on 15 December 2019. It's networked and distributed control systems and cyber-physical algorithms, enable the Cargo USV to carry out autonomous navigation, track management, obstacle avoidance, and controlled berthing, sailing and other decision-making functions. The digitised control technology and electric propulsion allow the onboard operating system to make decisions and implement courses of actions without human in the chain, while the shore-based center is able to exercise real-time ship supervision and direction. The fully battery-powered vessel will be able to sail 500 NM with single charge.



'Jindouyun' Autonomous cargo ship on maiden sea Sortie

10. **Comments.** The joint design and development project of World's first unmanned cargo ship, 'Jindouyun' (magical cloud) by Zhuhai Municipal Government, China Classification Society (CCS), Wuhan University of Technology, and Yunzhou Tech (Oceanalpha), also commenced at the Zhuhai test range in 2017. The 'Jindouyun' project team plans to carry out multi-ship collision avoidance and autonomous berthing experiments, followed by demonstration of inland river autonomous navigation, in the next phase. The team eventually wants to make the ship compliant with 'fourth degree of autonomy' under a scoping methodology for autonomous shipping being prepared by the International Maritime Organisation (IMO).¹ Chinese maritime administrators will thereafter explore the feasibility of commercial operation of autonomous ships in the transport, supply and marine sectors in due consultation with the IMO.

Source: <http://www.ecns.cn/hd/2019-12-16/detail-ifzrtayn1412739.shtml#1>;
http://www.cityofzhuhai.com/2019-12/17/c_432497.htm

RADARS: ADVANCEMENTS IN CHINA

11. **Air Defence Radars Advancements in China.** Airspace defence of China against stealth aircraft such as F22 Raptor, have been the main concern of China for many years. Several research and development projects were launched to address this concern. These efforts have started to deliver desired results. Dave Makichuk² in his article "Nowhere to hide: Has China won the stealth war?" has brought out some of the measures shortlisted by China to detect stealth aircraft.

12. According to the Global Times, China's "meter wave radar can be deployed on vehicles, on land and warships, creating a dense web that gives hostile stealth aircraft nowhere to hide." In addition, it also functions as a fire control radar that can guide missiles toward stealth aircraft like the F-35 Joint Strike Fighter.

13. Chinese scientists have mastered the art of making best use of the different frequency band radars, all into one unit. Higher frequency band radars are good for guiding weapons to a target, whereas Lower frequency band radars, good for search role, aren't precise enough for fire control. Thus usually separate high- and low frequency bands radars tend to be paired for search and fire control. Stealth aircraft are shaped to avoid detection by high frequency band beams. Meter wave radars can detect stealth aircraft because modern stealth aircraft are mainly designed to avoid detection by microwave radar, and are less stealthy to meter wave radar.

14. Wu Jianqi, a senior scientist at the state-owned China Electronics Technology Group Corporation has reportedly solved the issue by designing the world's first practical meter wave sparse array synthetic impulse and aperture radar as this radar has multiple transmitting and receiving antennas tens of meters high, scattered in a range of tens to hundreds of meters. This arrangement significantly enhances the

¹ ***'Fourth degree of autonomy' as per guidelines for autonomous shipping being prepared by IMO, refers to fully autonomous ship, wherein its onboard operating system is able to make decisions and determine actions by itself. For details, see***
<http://www.imo.org/en/MediaCentre/HotTopics/Pages/Autonomous-shipping.aspx>.

² ***Dave Makichuk, Nowhere to hide: Has China won the stealth war?***
<https://www.asiatimes.com/2019/11/article/nowhere-to-hide-has-china-won-the-stealth-war/>

radar's ability to track an aerial target, pinpointing the stealth aircraft's exact coordinates by synthesizing parameters and data gathered by the radar under the support of advanced algorithms. Since the radar can now see stealth aircraft clearly and track them continuously and accurately, it could become capable of guiding long-range anti-aircraft missiles precision strikes on them.

15. These claims by Chinese scientists may not entirely be true. The vulnerability of stealth aircraft to low-frequency beams has not escaped the notice of military researchers around the world. The Chinese designed multi band radar can be easily spoofed or jammed. Huge radar size could make it vulnerable to easy detection and destruction.

16. China also displayed two state-of-the-art radars recently, the JY-27A 3-D long range surveillance and guidance radar that is the Chinese military's first active phased array radar, and the JY-26 Skywatcher-U. This radar works in a broader bandwidth, in VHF and Ultra-High Frequency (UHF) bands. It also has a range of 500km and can track up to 500 targets at once. Reportedly, the Chinese government claimed that while under development in Shandong it was able to track American F-22 Raptors flying over South Korea³.



(China displays some of its early warning radar equipment at Airshow. Credit: Defenseworld.net.)

17. China claims it has a radical new 'quantum' radar capable of detecting stealth fighters at great distances⁴. Presently, reported range is 100 km. This radar sends out a beam of photons as radio waves, quantum radar uses entangled photons. Entangled photons are two separate photons that share a deep quantum link. These photons mirror each other's behaviour when one of them is influenced in some way.

³ibid

⁴ ***Jamie Seidel, China's claim it has 'quantum' radar may leave \$17 billion F-35 naked; <https://www.news.com.au/technology/innovation/inventions/chinas-claim-it-has-quantum-radar-may-leave-17-billion-f35-naked/news-story/207ac01ff3107d21a9f36e54b6f0fbab>***

Quantum radar would send out bursts of photons while retaining their 'pairs'. The changes in behaviour of the retained photon would then reveal what's happening to the photon in the beam. The entangled photons bounce back to a sensor which can then compute course, speed and size. The use of entangled photons has a second major benefit over radio waves. It's not likely to be jammed.

18. Only a few of the photons sent out will be reflected back if they hit a stealth aircraft. A conventional radar wouldn't be able to distinguish these returning photons from the mass of other incoming ones created by natural phenomena—or by radar-jamming devices. But a quantum radar can check for evidence that incoming photons are entangled with the ones held back. This enables it to detect even the faintest of return signals in a mass of background noise⁵. The developments will force sixth generation fighter aircraft designers to think afresh for incorporating stealth features in futuristic aircraft.

⁵*Martin Giles, The US and China are in a quantum arms race that will transform warfare;*
<https://www.technologyreview.com/s/612421/us-china-quantum-arms-race/>