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HIGH POWER MICROWAVE: CHINA'S PURSUIT OF FUTURE WEAPONS

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It is now known that China's microwave weapon system is on the top priority project list. In January 2017, the microwave anti-missile project won the first prize in the National Science and Technology Progress Award.¹ This is one of the future weapon technologies which almost all major weapon producing countries are working on including the United States, Russia, Britain, Germany, India and Israel.² This technology is still under research and development and it has the potential to revolutionise future warfare.

The Chinese system under development is claimed to have been tested on 18 November 2010 in a place in northwest China.³ The system is claimed to have (as a proof of concept) been completed in 2010 itself, but is being improved to increase the effective range to the required 1000 meters from the current 640 meters.⁴ In 2013, it was mentioned in the Ninth National High Power Microwave Symposium held by the University of Electronic Science and Technology that China has made a number of significant

advancements in the microwave Directed Energy Weapon (DEW) technology since the seventies when research was initiated in this area.⁵ The word 'significant advancement' is unquantifiable without credible data. Nevertheless, in this area it appears that China has been doing research on directed energy weapons since the sixties. In a recent (Feb 2017) testimony before the U.S China Economic and Security Review Commission hearing on China's advancements with DEW, it is mentioned, reportedly on informal Chinese sources, that research on HPM weapons were started in the eighties as part of the 863 program.⁶ Nevertheless, there is no authoritative source on the extent of advancement made in this area.

The Northwest Institute of Nuclear Technology is the actual institute developing this weapon, with Huang Wenhua as its deputy director. The areas of his research, as know from his research publications, are high power microwave (HPM), including high power microwave detection and high power microwave



anti-missile, air defence weapons and other fields. On the application part, the primary focus of his research is the use of HPM for anti-ship applications.⁷

A microwave weapon is a directed energy system where powerful high intensity microwave beam is directed on a target which will result in the burn up of the target's electronic circuitry rendering it useless. Going into the physics of it, when a high intensity microwave (Microwave frequencies fall between 1 meter and 1 mm) passes over a circuit (conducting elements), it generates a strong electromotive force. According to Lenz's Law, for every emf generation there is counter emf in a conducting element which results in resistance heat. As a result of such high emf generated by the powerful microwave, immense heat builds up in the circuit which, when it goes beyond the melting point of the element, results in the breakup of conducting lines.

This weapon does not destroy any biological matter; rather it just destroys the electronics of any equipment. The primary advantage of this system is that it does not require physical contact with the system but just needs to be within range of the target. This aspect makes it a sought after weapon for missile defence and numerous other military applications. There are two types under research in this area. One is the exploding type which creates a single high spike of high power

microwave, while the second type involves a varactor vacuum tube to produce the required particle oscillation.

The second type can be used multiple times. Both types have their advantages and disadvantages in applications. But at present, the vacuum tube method is found to be feasible and most researches are focused on it. It is not known what method the Chinese are following, though it is highly likely that they too are developing the vacuum tube model. There are also some Chinese language news reports discussing only the vacuum tube oscillator method and not the explosively generated HPM.⁸ However, there are several challenges in developing the weapon and some of them are miniaturisation (particularly if it is to be fitted to a missile), high power requirement, and effective range as the strength declines rapidly due to the high frequency as a result of scattering by atmospheric molecules, etc.⁹ It is not known how far the Chinese have progressed in these aspects.

Comments from the Chinese officials indicate that they primarily see the application of the weapon against aircraft carriers and in the area of ballistic missile defence. However, at present the focus is on anti-missile system because, as indicated by Huang Wenhua, a HPM anti-ship weapon would be too challenging at present and even if feasible would have to be integrated with other means to target a ship.¹⁰ Hence, the immediate focus of the HPM

weapon would be to demonstrate air defence and anti-missile capability. Nevertheless, Chinese media usually has quite a high element of exaggerations on Chinese military industrial lab capabilities and achievements. Hence, there would probably be a lot of challenges still to be overcome, particularly considering the complexity involved in this future technology.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Notes

¹ “Microwave weapon capable of burning cruise missile electronics won national award”, <http://mil.news.sina.com.cn/china/2017-01-23/doc-ifxzusws0087052.shtml>, 23 January 2017

² “Did China use high-power microwave to kill Air defence radar?”, <http://military.china.com/jszmt/02/11173748/20160901/23448449.html>, 09 January 2017.

³ No.1

⁴ “深度：中国微波武器研发已超美射程比美军远 50%”, <http://mil.news.sina.com.cn/jssd/2017-01-06/doc-ifxzkfuk2517832.shtml>, 06 January 2017

⁵ “微波武器会成为中国的杀手锏吗”, <http://world.worker.cn/84/201702/16/170216143041384.shtml>, 16 February 2017

⁶ Richard D. Fisher, Jr, “China’s Progress with Directed Energy Weapons”, Testimony before U.S-China Economic and Security Review Commission hearing, le at: https://www.uscc.gov/sites/default/files/Fisher_Combined.pdf, 23 February 2017

⁷ No.1

⁸ No.2

⁹ No.1

¹⁰ No.1