ISSUE BRIEF

INSTITUTE OF STRATEGIC STUDIES ISLAMABAD
Web: www.issi.org.pk
Phone: +92-51-9204423, 24
Fax: +92-51-9204658

GLOBAL COMPETITION FOR ANTI-DRONE TECHNOLOGIES

By
Aamna Rafiq
Research Associate
Arms Control & Disarmament Centre, ISSI

Edited by
Malik Qasim Mustafa

October 11, 2022

Recent reports predict that the value of the military drone market would reach US$17.0 billion in 2027 at a compound annual growth rate CAGR of 7.3 per cent from US$12.0 billion in 2022. On the other hand, exponential growth is observed in the market size of anti-drone technologies. Due to the COVID-19 pandemic, the global market for anti-drone technologies had to put up with a sharp decline and reached a total value of US$623.4 million in the year 2020. However, the post-pandemic projections about the market size made a huge comeback with a sharp increase in numbers as compared to pre-pandemic projections.[1]

According to 2021 estimates, the market size of anti-drone technologies is expected to reach US$3.1 billion by 2027 at an impressive CAGR of 25.9 per cent. However, the 2019 pre-COVID estimates predicted that the value of the global anti-drone market would reach US$3.5 billion by the end of 2030 at a CAGR of 21 per cent. If the conditions for business remain stable without any major disruption in global production and supply chains then it might be possible that global as well as national markets achieve their projected targets earlier by the year 2025. In 2020, the estimated

1 "Military Drone Market worth $17.0 billion by 2027," *Global News Wire*, last updated on September 26, 2022, https://www.globenewswire.com/news-release/2022/09/26/2522485/0/en/Military-Drone-Market-worth-17-0-billion-by-2027-Exclusive-Report-by-MarketsandMarkets.html; "Anti-Drone Technology - Global Market Trajectory & Analytics," Global Industry Analysts, Inc, last updated on April 2021, https://www.researchandmarkets.com/reports/4805109/anti-drone-technology-global-market-trajectory; "Anti-Drone Market Insights, 2020-2030," Transparency Market Research, last updated on July 2020, https://www.transparencymarketresearch.com/antidrone-market.html+.

value of the US anti-drone market was US$186.9 million. China's market value is projected to reach US$537.4 million by the year 2027 at a CAGR of 25.1 per cent. The anti-drone markets of Japan, Canada and Germany are projected to grow at a CAGR of 23.1 per cent, 22.1 per cent and 18.1 per cent respectively.[2]

In addition to unique and advanced military threats posed by drones, wide-scale commercialisation and increasing terrorist access to drones are the major drivers of rapid development in the realm of anti-drone technologies. Several defence and aerospace manufacturers across the globe are now focusing on enhancing the range and accuracy of drone technologies. In addition to improving the variety of sizes and other physical parameters, these manufacturers are offering a high level of mission/project-based customisations. These technological advancements and high customisation of drones would put further innovation and development pressures on manufacturers that could result in the variety and market expansion of anti-drone technologies. While states and militaries remained the top consumers of these anti-drone technologies, a surge has also been observed in the non-military consumers like industry, power generation, fuel storage, transportation and agriculture sectors. The global market of anti-drone technologies is largely dominated by giant companies like Dedrone (US), DroneShield Ltd (Australia), Lockheed Martin Corporation (US), Raytheon Co, Northrup Grumman Corporation (US), Rafael Advanced Defense Systems Ltd (Israel), Thales Group (US), Israel Aerospace Industries Ltd (Israel) and SAAB AB (Sweden).[3]

Anti-drone technologies refer to a wide range of technologies used for countermeasures to detect, identify, track, disable or destroy drones. There are various criteria to categorise anti-drone technologies. The first criterion is the nature of the platform used for the installation of anti-drone technologies. Whether the platform is stationary or mobile. Two other criteria are how an anti-drone system detects and what it does to an incoming drone threat.[4] Based on these three criteria, the anti-drone technologies are divided into the following categories:

1. Radars and Traditional Weaponry

Before deploying any anti-drone technology to destroy a drone, the first crucial step is detection. Traditional radar devices emit electromagnetic signals to detect aerial objects. Through echo, radars measure the range, velocity, direction and angle of an incoming aerial object. These systems were mainly developed for large aircraft and missiles. In this modern and new warfare, they are

2 Ibid.

3 Ibid.

4 Kelsey Atherton, "Anti-drone Tech's Tangled Regulatory Landscape," Brookings: Tech Stream, October 2, 2020, https://www.brookings.edu/techstream/anti-drone-techs-tangled-regulatory-landscape/.

ineffective as they cannot detect small drones and drone swarms. Furthermore, the upgradation of these radars is quite an expensive process. Therefore, states have developed modern radar systems to fight drone warfare. After detection, the first, common and readily available anti-drone technology is traditional ammunition ranging from small bullets to big missiles.

2. Dogfighting Drones

Air combat manoeuvring (ACM) or dogfighting is considered one of the greatest hallmarks of 20th-century aerial warfare. ACM refers to the complex tactical art of moving and turning the fighter jets to attain the best position to attack or destroy another fighter jet in mid-air. This air-to-air combat became famous during 1916-1917 when pilots used to engage the fighter jets of the enemy in various formations. Once engaged, the formation would break into different individual dog fights.[5] In 21st-century warfare, dogfighting is still very much relevant but this time it will happen without pilots in the cockpit. A single drone or drone swarms in innovative formations could be used to detect and destroy opponent's drones. A few weeks ago, the Chinese military released the first official footage of its dedicated drone squadron called "Seed Unit." The squadron consists of specialised reconnaissance and combat drones like AI and satellite-enabled GJ-2 or Wing Loong-2. China is also revising the operating procedures and training modules for the Seed Unit.[6]

3. High Energy Laser (HEL) Systems

A high-energy optical device generates a highly intense and focused beam of laser that destroys the drone system at the speed of light. High energy lasers (HEL) are the most effective and precise anti-drone technology. As compared to shooting a drone with a missile, HEL is a cost-effective system with minimum collateral damage. Major militaries across the globe are fast-tracking the development and operationalisation of their HEL systems. In June 2021, Israel became the first country to use its aerial laser weapon system against drones.[7] A few months ago, Deputy Prime Minister, Yury Boriso, revealed that Russia also possesses a HEL system named "Zadira" and already

5 Charlie Keitch and Josh Blair, "What Impact did the First World War have on Aircraft and Aerial Warfare?" IWM, last updated on December 7, 2017, https://www.iwm.org.uk/learning/resources/what-impact-did-the-first-world-war-have-on-aircraft-and-aerial-warfare.

6 Liu Zhen, "China's Military gives a Look at its First Dedicated Drone Squadron," *South China Morning Post*, last updated on September 24, 2022, https://www.scmp.com/news/china/military/article/3193598/chinas-military-gives-look-its-first-dedicated-drone-squadron.

7 Anupama Ghosh, "Israel Becomes the 'First Country' to Use Aerial Laser Weapons to Shoot Down Hostile Drones," *Eurasian Times*, last updated on June 22, 2021, https://eurasiantimes.com/watch-israel-becomes-the-first-country-to-use-laser-weapons-to-shoot-down-hostile-drones/.

using it against drones in Ukraine.[8] Under various signature programmes like IFPC-HEL, RCCTO, HELSI and DEMSRAD, the companies like Lockheed Martin and Boeing have developed a wide variety of HEL weapon systems against drones and missiles for the US ranging from tactical systems like Stryker-mounted (50 kilowatts) and Army Multi-Purpose High Energy Laser (20 kilowatts) to a latest 300-kilowatt HEL system.[9]

4. Radio Frequency (RF) Jammers

A radio frequency jammer is a non-kinetic device used to prevent the reception of radio signals by the receiver. It disrupts the incoming signals and floods the receiver with noise. Consequently, the drone could go back to its location of origin or any random coordinates. Without any physical damage, it can also safely land in its current location depending on its pre-flight programming.[10] Among all anti-drone technologies, RF jammers are the least effective option due to imprecision and huge collateral damage. To achieve precision, a jammer must be pointed directly towards a target. In addition to knowing the exact frequency band, the information about the altitude, speed, velocity, entry point and angle of an incoming drone are crucial to use RF jammers efficiently. Collecting such specific data about a flying drone is technically difficult. Furthermore, the new generation of drones are using Global Positioning System (GPS) instead of relying on traditional RF signals. With the integration of GPS, drones turn out to be silent and untraceable by radar systems, making RF jammers a useless and redundant technology.[11]

In the absence of precise and accurate data about the frequency band, the RF jammers use a general range of frequencies these drones normally use. The issue is that an extensive number of other technologies or systems might be operating under the same frequency range. In the case of an airport/airbase or military base, these jammers would jam the other friendly equipment and disrupt the communications among pilots, technicians and air traffic controllers. This could cause a major disaster or accident in the air. In the case of targeting a drone in urban warfare, an RF jammer

8 Dipanjan Roy Chaudhury, "New Military Tech: Russia uses New Anti-drone Laser Tool in Ukraine," *Economic Times: India Times*, last updated on May 19, 2022, https://economictimes.indiatimes.com/news/defence/new-military-tech-russia-uses-new-anti-drone-laser-tool-in-ukraine/articleshow/91659825.cms.

9 Andrew Eversden, "Lockheed Martin Delivers 300-kilowatt Laser to Defense Department," *Breaking Defense*, last updated on September 16, 2022, https://breakingdefense.com/2022/09/lockheed-martin-delivers-300-kilowatt-laser-to-defense-department/.

10 Atherton, "Anti-drone Tech's tangled regulatory landscape."

11 Jen Colton, "The Problems and Limitations of RF Jammers for Stopping Rogue Drones," Fortem Technologies, last updated on March 26, 2019, https://fortemtech.com/blog/discussions/2019/03/26/problems-and-limitations-of-rf-jammers.html.

would disrupt every internet device and cell phone transmission in its range, causing great collateral damage in the civilian domain.[12]

5. High Power Electromagnetic Pulse

The high-powered microwave is another non-kinetic device that generates an extremely strong electromagnetic pulse (EMP) that disrupts or destroys the electronics of targeted drones. In this category, the US, Japan, Canada and Europe alone contribute 24.4 per cent CAGR. In 2020, the total contribution of these regional markets was US$155.6 million and is expected to reach US$719.2 million by 2027. China is the fastest-growing market of all.[13] In August 2021, China conducted the first public and successful test of an electromagnetic pulse weapon (narrow beam) to destroy a drone flying at a height of 1,500 meters. However, the US possesses the most powerful EPM weapon known as the "Tactical Power Microwave Operational Reactor." First tested in 2019, it can shoot down 50 drones at once within the range of 10 kilometres which makes it highly effective against drone swarms.[14] Recently, Russia also claimed to use an EPM weapon named "Stupor Anti-drone System" for the first time on the battlefield against the combat as well as surveillance drones of Ukraine. Developed by the Main Robotics Research and Test Center, it can jam or block drone transmission in the range of 2 kilometres without causing damage to the drone hardware.[15]

To conclude, the military and commercial development and deployment of drones are growing exponentially. The easy access and high customisation make drones equally attractive to good and bad actors in this contemporary security landscape. One or multiple anti-drone technologies could be deployed to protect critical national infrastructure. Consequently, the rise of anti-drone technologies is inevitable and unstoppable.

12 Ibid.

13 "Anti-Drone Technology - Global Market Trajectory & Analytics," Global Industry Analysts, Inc, last updated on April 2021, https://www.researchandmarkets.com/reports/4805109/anti-drone-technology-global-market-trajectory.

14 "China used EMP Weapon to Destroy Large Drone at 1,500 meters," *China Arms*, last updated on September 2, 2021, https://www.china-arms.com/2021/09/china-emp-weapon-destroy-large-drone/.

15 Joe Saballa, "Russia Claims Use of Electromagnetic Weapon Against Ukrainian Drones," *The Defense Post*, last updated on July 7, 2022, https://www.thedefensepost.com/2022/07/07/russia-electromagnetic-weapon/.

