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THE USE OF ELECTRO-OPTICAL SYSTEMS IN COUNTERING DRONES

In recent years, drones (unmanned aerial vehicles, UAVs) have become more accessible and technologically advanced, bringing not only new opportunities but also numerous threats. These threats affect both military and civilian spheres and can have serious consequences.

In military applications, drones can carry out targeted attacks on military objects or infrastructure, making them potentially dangerous weapons. Swarm attacks, where multiple drones coordinate an assault, can overwhelm defence systems and increase the effectiveness of an attack. Additionally, drones can be used for reconnaissance, espionage, or electronic surveillance, tracking troop movements or monitoring communication signals. In some cases, drones may even be used for cyberattacks, such as jamming GPS signals.

In the civilian sector, drones pose a threat to privacy, as they can be used for unauthorized surveillance or industrial espionage. They also present a risk to air traffic, especially when flying near airports or flight paths. Furthermore, they can pose a threat to critical infrastructure, such as power grids, water plants, or pipelines, potentially leading to severe economic consequences. In smuggling operations, drones are utilized for the illegal transport of drugs and weapons, as well as for sabotaging supply chains, which can slow down or disrupt commercial processes.

Given these numerous threats, it is essential to implement a multi-layered defence strategy that includes detection, jamming, and various weapon systems to ensure maximum protection against drones. How can electro-optical systems contribute to such a solution?

In the Czech Republic, EVPÚ Defence a.s. specializes in the development, production, and servicing of electro-optical systems for security and defence applications. The company focuses on creating modular solutions that can be customized to meet specific customer requirements and the particular tasks the system is designed to perform.

In the fight against drones, electro-optical systems (EOS) play a crucial role. These systems consist of pan tilt positioners, day cameras, thermal imaging cameras, laser rangefinders, and radars. They are essential for detecting, tracking, and identifying various types of drones, though their effectiveness depends on specific conditions and their integration with other technologies. While not weapon systems themselves, they form a vital part of anti-drone defence mechanisms.

Thanks to different types of sensors, electro-optical systems can detect flying drones both in daylight and good visibility conditions as well as in reduced visibility scenarios, such as at night, in fog, or in smoke. A standard small civilian drone measuring 36 x 13 cm can be detected by EVPÚ Defence's electro-optical systems from a distance of up to 6.5 km, with drone type identification possible at up to 1 km.

However, some drones, such as battery-powered or plastic models, have a lower thermal signature, making detection through thermal imaging alone more challenging. To address this, EVPÚ Defence offers the MIZAR series of electro-optical systems, which integrate radar to ensure early detection of smaller drones at greater distances. In such a system, cameras serve as a secondary step for visual confirmation and tracking of the target. They also significantly reduce false alarms, as they can distinguish drones from other objects, such as birds.

The goal of a defence system incorporating EOS may be either the physical elimination of the drone or neutralizing the threat without physical intervention - such as disrupting the drone's communication link with its operators or manipulating its navigation system. Positioning devices, which form the foundation of all EVPÚ Defence electro-optical systems, can be equipped with jamming devices for this purpose.

To physically neutralize a drone, an electro-optical system integrated with a weapon system can be used - for example, a remotely operated weapon station equipped with an electro-optical sight and radar. The GLADIUS series of weapon stations, fitted with machine guns or cannons using programmable ammunition, provide an effective tool in the fight against drones. In addition to early threat detection, they offer high firing accuracy, thanks to their multi-axis design, which allows independent movement of the sight. A key advantage of remote-controlled weapon stations is their versatile deployment. The compact modular design, low weight, and reliable stabilization of the GLADIUS series make them suitable for installation on both stationary platforms (such as buildings and critical infrastructure sites) and mobile platforms (such as armoured vehicles and various types of naval vessels). Remote operation minimizes risks for personnel.

Thanks to their flexibility and adaptability for custom solutions, EVPÚ Defence's electro-optical systems and weapon stations have significant potential for broad application as part of counter-drone defence and security solutions capable of addressing evolving and complex airborne threats.