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"Laboratory of system solutions for air security and robotics"

Counter-Unmanned Aircraft System (CUAS)

Mobile Air Defense Integrated System
with
Reconfigurable Integrated Weapons Platform (RIwP)
Possessing Modular, Automatic and Networked system for Targeting, Intercepting and Eliminating Targets (MANTIET)

The Counter-Unmanned Aircraft System (CUAS) is based on detecting radio frequency radiation characteristic of existing UAVs/Drones and further countering unauthorized flights by causing radio interference in certain frequency ranges and subsequent fire damage to the target.

Purpose of the Unmanned Aviation Countermeasures System.

The CUAS system is designed to create a low-altitude radar field with passive detection of the frequency spectrum of signals from low-flying objects at subsonic speeds and systems for suppression and fire destruction of UAVs.

Mobile Air Defense Integrated System CUAS consists of direction finding systems, 12/24 band jammer UAVs and PS 12/24 UAV HAD drones and a Reconfigurable Integrated Weapons Platform (RIwP) with a modular automatic network guidance system, interception and elimination of targets, including the use of kamikaze anti-drones as a destructive element.

The system is designed for electronic suppression of UAVs and drones at distances of 20 - 30 km, depending on the terrain and their fire damage up to 70 km.

Composition of the CUAS System:

UAV and drone detection system

1. Active / passive radars
2. Visual target identification system
3. Lifting mechanism mounted on a moving platform or stationary
4. Antenna direction mechanism
5. Directional antenna block

System for suppressing and countering navigation, telemetry and communications of UAVs and drones

1. Electronic jamming units
2. Precision shooting systems
3. Combat modules with a 30 mm cannon;
4. Jet drones

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Control System CUAS Systems

1. Remote Control
2. PSU
3. Autonomous power system

- **The detection system for CUAS can be equipped with various types of direction finders and radars and a multi-sensor video camera system for viewing and visually identifying targets depending on specific combat missions.**

- **Coherent pulse radar station (CPRS),** which ensures the creation of a continuous radar field from "0m" and above and identifies various threats at distances of up to 100 km depending on the terrain

- **Advanced Compact Radar ACHR** - ground-based multi-mission radar for Active Protection Systems (APS), Vehicle Protection Systems (VPS), Hostile Fire Detection (HFD), Counter-UAS and Hemispheric Surveillance.

- **Multi-Mission Radar MHR -** Multi-role radar for Counter-UAV, Very Short Range Air Defense (VSHORAD), Counter-Missile, Artillery and Mortar (C-RAM) and Hemispheric Surveillance.

- **The NMHR Multi-Mission Radar** is a ground-based multi-mission radar for Counter-UAV, Very Short Range Air Defense (VSHORAD), Counter-Missile, Artillery and Mortar (C-RAM) and Hemispheric Surveillance.

- **Hemispheric Multi-Mission Radar MMHR** - Ground-based multi-role radar for Counter-UAS, Very Short Range Air Defense (VSHORAD), Counter-Missile, Artillery and Mortar (C-RAM) and Hemispheric Surveillance.

- **Hemispheric Multi-Mission Radar MMHRe** - Ground-based multi-role radar for Counter-UAS, Very Short Range Air Defense (VSHORAD), Counter-Missile, Artillery and Mortar (C-RAM) and Hemispheric Surveillance**.**

Omega Compact - a modular and scalable passive sensor network for electronic warfare (EW).

- **Multi-sensor video camera system** for target identification and visual confirmation of targets.

These radars and the Multisensory video camera system can be installed both on mobile platforms and permanently, depending on the tasks performed.




➢ **The CUAS system for countering navigation, telemetry, communications, suppression and fire destruction is completed.**

❖ System for electronic suppression of countermeasures to navigation, telemetry, communications, suppression of UAVs in several ranges.



❖ The fire destruction system for UAVs and drones receives data from the surveillance radar.
The rifle radar includes:
- X-band solid-state radar with monopulse antenna;
- fire control module (MCS);
- power supply control device;
- software for providing target designation from radar.

Radar (fire control)

Antenna post

Interface device with gun mount

Power management device

Shooting control panel

Combat module with a 30 mm cannon mounted on a movable platform and stationary

❖ High-speed kamikaze drones - antidrones

Drone equipment:
- Wide-angle TV camera or video camera
- Damaging elements 100 pcs
- Mount for launching from a ground/vehicle launch system
- Mount for suspension on UAVs of the "BAYRAKTAR" type
- Launch platform
- Software for working with radar for target designation.

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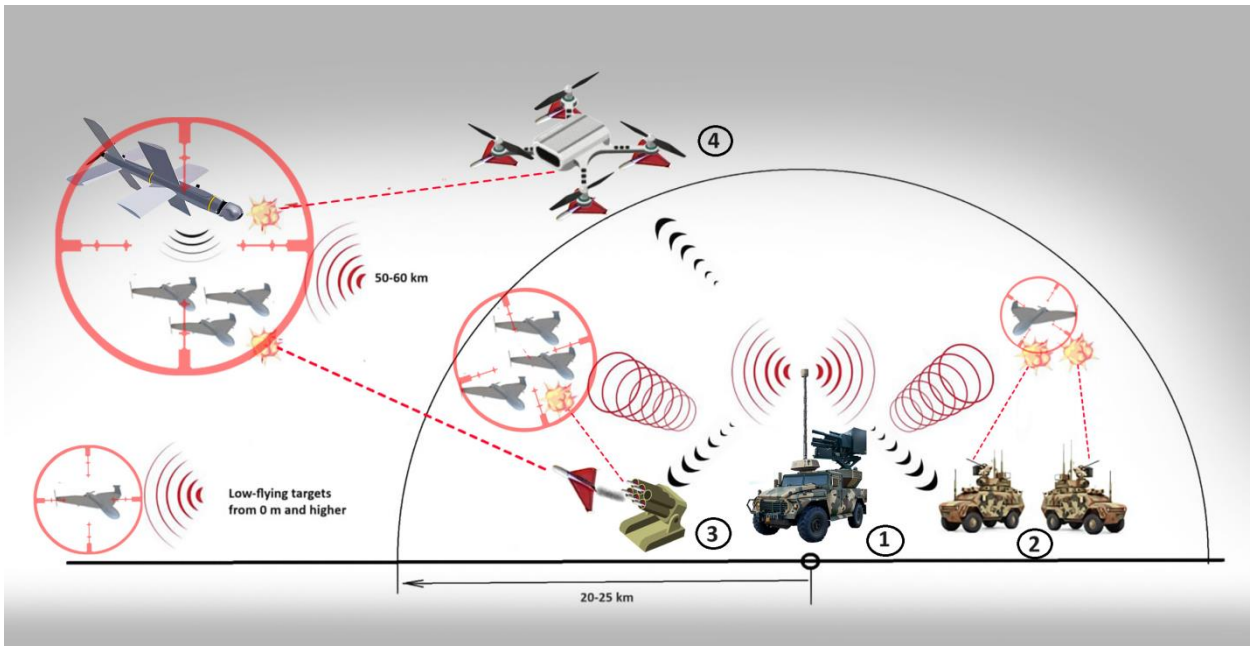
The extended-range CUAS anti-UAV system is controlled from the control center in a semi-automatic mode.
The direction to the target and the range selection are set automatically by the control center equipment. The operator decides to turn jamming on/off or activates the UAV destruction system.



Many **CUAS** Systems equipped with a **Mobile Integrated Air Defense System** with a Reconfigurable Integrated Weapons Platform components **MOBILE SYSTEMS OF COMPANY SHORT-RANGE AIR DEFENSE COMPLEXES FOR PROTECTING TROOPS AND STATIONARY OBJECTS FROM UAVS AND DRONES** form a self-organizing network on the battlefield to create a system for dividing areas of responsibility and conducting and transferring targets between systems.

In such systems, to increase “battlefield awareness”, information from several devices is processed by a built-in **artificial intelligence system** and commands are transmitted to operators for execution.

The key role of artificial intelligence and machine learning in the fight against small aircraft (UAVs and drones) in the CUAS system

1. Introduction to AI/ML in CUAS

In the rapidly evolving landscape of modern defense, Artificial Intelligence (AI) and Machine Learning (ML) have emerged as cornerstone technologies. Particularly in Counter-Unmanned Aircraft Systems (CUAS), AI/ML components not only enhance operational efficiency but also redefine the capabilities of these systems in identifying, tracking, and neutralizing aerial threats.

2. AI/ML Component Overview

At the heart of CUAS, the AI/ML component acts as the brain behind its operations. This subsystem seamlessly integrates with radar, cameras, and other sensory equipment, enabling a high level of situational awareness and real-time decision-making. It's the fusion center where data meets intelligence.

3. Targeting Functions

AI/ML significantly elevates the targeting process. By employing sophisticated algorithms, the system can distinguish between friendly, neutral, and hostile elements, ensuring precise targeting. The integration of machine learning allows the system to adaptively prioritize targets in complex environments, effectively dealing with multiple threats simultaneously.

4. Control and Decision-Making

In CUAS, control is not just about reaction but anticipation. AI/ML-driven control mechanisms allow for autonomous decision-making, offering rapid responses to threats even in the absence of direct human control. The system can assess potential threats and decide the best course of action, balancing effectiveness with safety.

5. Data Analysis and Processing

One of the most significant contributions of AI/ML in CUAS is its ability to handle vast datasets. The component analyzes data from diverse sources, identifying patterns and anomalies that might elude human operators. This capability is crucial in creating a comprehensive situational picture and enhancing decision-making processes.

6. Learning and Adaptation

A remarkable feature of AI/ML in CUAS is its ability to learn from experiences. The system continuously evolves, using data from past engagements and simulations to improve its algorithms. This ensures that the CUAS remains effective against ever-changing threats and tactics used by adversaries.

7. Challenges and Ethical Considerations

While AI/ML in CUAS offers numerous advantages, it also presents challenges. These include ensuring system reliability, addressing potential vulnerabilities to cyber-attacks, and managing the ethical implications of autonomous decision-making in defense scenarios. Maintaining a balance between automation and human oversight is essential.

8. Future Developments

The future of AI/ML in CUAS looks promising, with potential advancements including integration with emerging technologies like quantum computing and enhanced cognitive capabilities. These developments could further expand the operational scope and efficiency of CUAS, making them more adaptable and intelligent.

9. Conclusion

The integration of AI/ML in Counter-Unmanned Aircraft Systems represents a significant leap forward in defense technology. By enhancing targeting accuracy, decision-making speed, and overall system adaptability, AI/ML components not only increase the effectiveness of CUAS but also set a new standard for future defense systems. As this technology continues to evolve, it will undoubtedly play a crucial role in shaping modern warfare strategies..

Anti-drone and other equipment produced by the Laboratory:

1. Anti-drone five-band portable complex for dome and directional protection with a target engagement range of up to 6 km, equipped with an individual direction finding system.

Designed to identify and neutralize enemy UAVs and Drones by causing radio interference at signal frequencies used by UAVs and Drones.

2. A complex of dome protection for military equipment to prevent damage to FPV drones - electronic warfare "Armored Vehicles Dome 360" equipped with a direction finding system.

The electronic warfare complex "Armored Vehicles Dome 360" is designed to form a protective field for military equipment at 360^0.

3. Stationary "field" anti-drone complex of directed action

The stationary "field" directional electronic warfare complex is designed to detect and suppress hostile UAVs at distances of 1500-2500 m by causing radio interference at signal frequencies used by UAVs and Drones.

4. AIR JAMMER SUPPRESSION (Anti CRP)

The drone-mounted portable 2-channel jammer can be used to jam UAVs using CRP antennas. Provides reliable suppression of UAVs at long distances.
It can be used both separately and in combination with other UAV suppression systems.

5. Modular, scalable, passive sensor for surveillance challenges across all levels of tactical operations

Sensor operated as a stand-alone unit or as part of a network with several sensors. Through own platform movement or interfacing to multiple sensors, for instance a swarm of drones; it is possible to determine the exact position of a signal through triangulation. It can provide early warning capabilities, typically supporting Ground Based Air Defence (GBAD) with accurate target information.
Typical applications as complement to multi-sensor systems for Coastal/Border Surveillance, Ground Based Air Defence (GBAD)

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6. Stationary anti-drone complex of directed action

The stationary directional electronic warfare system is designed to protect stationary infrastructure facilities by detecting and suppressing hostile UAVs and drones at distances of 25-30 km by causing radio interference at signal frequencies used by UAVs and drones.

7. Mobile anti-drone complex of directed action

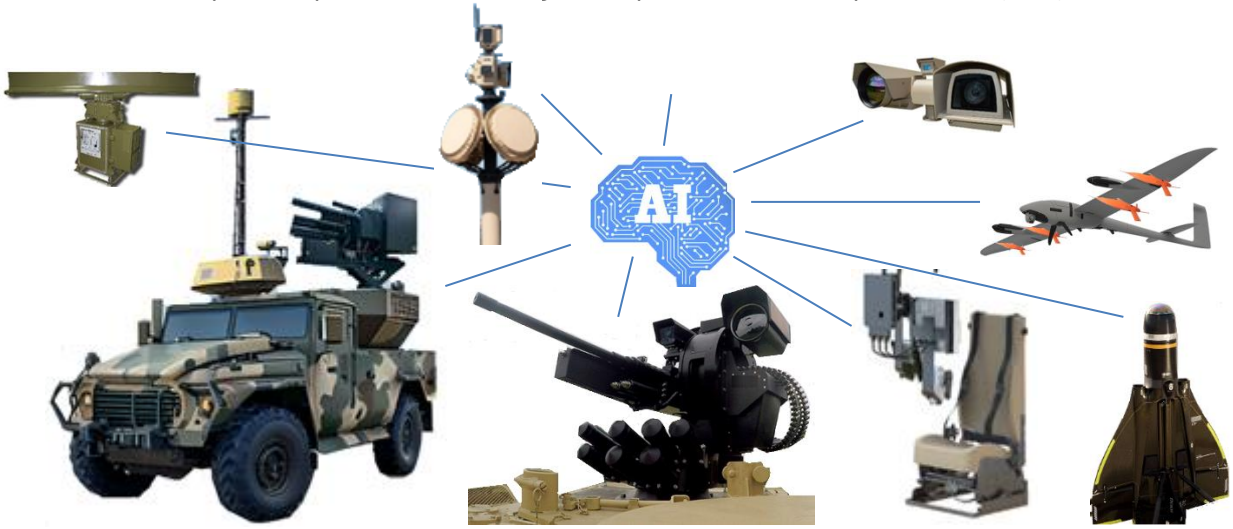
The mobile electronic warfare system is designed to detect and suppress hostile UAVs and drones at distances of 25-30 km by jamming the signal frequencies used by UAVs and drones.

These products will be produced as a small-scale production and the functions of the Laboratory will consist of constant modernization of manufactured products taking into account the emergence of new security threats from UAVs and drones.

4. Counter-Unmanned Aircraft System (CUAS)

Mobile Air Defense Integrated System with Reconfigurable Integrated Weapons Platform (RIwP) Possessing Modular, Automatic and Networked system for Targeting, Intercepting and Eliminating Targets (MANTIET).

❖ The CUAS system is produced according to a separate Technical Specification (TOR) of the Customer.



The **CUAS** system will be able to undergo modernization in terms of software and additional equipment for the complete process of automating the operation of the complex.
All specifications are subject to discussion and can be changed according to customer requirements.

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We will provide a revolutionary new class of autonomous drones with advanced capabilities to operate in denied environments and track/engage high-value targets. Our drones feature ruggedized airframes for all-weather operations, anti-jam networking, and onboard AI/computer vision modules to maintain target lock even when the target temporarily goes out of sensor range. This ensures persistent mission execution in GPS-denied areas or when control links are jammed or suppressed.

Technical Overview

The key innovations in our drone system include:

Autonomous Targeting - Leveraging advanced machine learning models for computer vision and pattern recognition, our drones can automatically acquire targets based on operator-specified parameters or data passed from off-board sensors/unmanned teammates. Targets can be tracked autonomously if the manual control link is lost.

Adaptive Mission Execution - Our drones have pre-programmed autonomous mission modes for reconnaissance (trail/monitor target and relay data when able) or attack (prosecute target when communications disrupted). Machine intelligence allows dynamic re-planning to prosecute moving/re-acquired targets.

All-Environment Operation - Ruggedized design enables operations in adverse weather. Anti-jam networking and sensor fusion allows functionality when GPS/RF communications are degraded or denied.

Note: *Some pictures and photographs used in this document are informative / representative for the customer to have a general impression of the system.*