

"Almaz-Antey" Concern PJSC "Almaz R&P Corp." LEMZ DIVISION



## RADAR-OPTICAL COMPLEX FOR PERIMETER SECURITY PROVISION AND UAVs' COUNTERACTION "ROSC-1"



"ROSC-1" complex in the deployed state with an external system SEM, and SEC (you have the option of embedding SEM and SEC on one chassis with radar)

Radar-optical security complex "ROSC-1" is a system that includes several components:

- surveillance 3-coordinate solid-state X-band radar; - built-in ADS-B;

- optical-electronic system (OES);

- subsystem of electronic monitoring (SEM);

- subsystem of electronic control (SEC).

The complex is designed to provide a comprehensive control of the air situation for the detection and recognition of various types of air targets, including small and lowspeed UAVs.

It is possible to work simultaneously with several complexes to ensure the best control zone in the area of the protected object.

When choosing the main technical solutions for the design of the complex PJSC "ALMAZ R&P Corp." specialists analyzed the threats and ways to neutralize them, taking into account the prospects of their development, including the possibility of autonomous flight of UAVs.

The main radars of small and medium range have good capabilities to detect medium and large UAVs at altitudes of 1 km and above, but have limitations when working with mini and micro UAVs having low values of RCS (less than 0.05 m<sup>2</sup>).

Thus, it is suggested to use the complex against the following types of UAVs:

1) Small class UAV RQ-11B Raven;

2) Small class UAV RQ-7 Shadow;

3) Various modifications of commercial UAVs capable of carrying explosives (quadcopters such as the DJI Phantom, multirotor, UAV aircraft and helicopters);

4) Commercial UAV that allows concealed carry to shooting great heights (type DJI Mavic, DJI Spark).

The complex can be used, among other things, to ensure ornithological security in the aerodrome area. The principles of "ROSC-1" allow quick

The principles of "ROSC-1" allow quick reprogramming of operating modes for search and tracking of air targets without changing the composition and volume of the equipment. The complex can be a basic element for search, direction finding and counteraction of UAVs making unauthorized flights.

Equipment of "ROSC-1" is placed on the same truck chassis type KAMAZ, including radar, SEM, SEC, OES, auxiliary systems (Power Generator and system of providing thermal regimes). It is possible to place the equipment of the complex on stationary objects.

The composition of the "ROSC-1" comes with a set of equipment ADS-B for airspace monitoring and aircraft tracking.

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Main technical characteristics of the complex: The characteristics of the radar complex: -Wavelength range: 3 cm;

-Detection zone in azimuth: 360 degrees;

-Detection zone in elevation angle: from 0 to +30 degrees;

-Detection at ranges not less than 15 km and heights not less than 1,5 km of UAVs and small-sized objects with approximate RCS of  $0,2 \text{ m}^2$ ;

-Minimal range: not more than 300 m;

-Measurement of three coordinates of the targets from the RMSE: range - no more than 10 m; azimuth-no more than 0.2 degrees; elevation angle (in the zone of intersection of diagrams of the upper and lower rays) - no more than 1 degree;

-RPM in azimuth: 2,5 seconds;

-Radar with automated lift mechanism is built-in inside the container mounted on the KAMAZ-type chassis.

The characteristics of SEM and system SEC of the complex:

-Operating frequency range, MHZ: from 400 to 6 000;

-The method of direction finding is correlationinterferometric;

-Instrumental root mean square error of direction finding (RMSE): no more than 4 degrees;

-Radio influence range: not less than 2 km through control channels and not less than 2 km through radio navigation channels.

Characteristics of optic-electronic system (OES):

-Composition: TV camera, thermal imaging camera, rotary support device;

-Detection range in azimuth: 360 degree;

-Detection range in elevation angle: from - 3 to +45 degrees;

-The rate of update of information about the angular coordinate with the target information FO: at least 10 times per second;

-Optical axis unit OES allows to set the optical axis of the unit OES azimuth in the range from 0 to 360 degrees and the angle of the place from minus 3 to 45 degrees. The error of the unit OES does not exceed 0.3 degrees.

Built-in set of ADS-B equipment:

-Range of operation of the built-in ADS-B is at least 150 km (depending on ADS-B antenna type).

In "ROSC-1" there is a possibility of interfacing with additional external OES systems and SEM and SEC, control systems of UAVs.

## Short description of "ROSC-1"

Radar complex operates in the range of 3-cm and allows to perform the measurements of target's 3 coordinates.

Radar has high reliability, remote control, automatic

## monitoring and diagnostic.

The majority of operations on processing of a signal and the choice of operating modes is performed programmatically on a computer.

The main features of Radar complex are:

- two-polarization operation;
- high resolution in range;
- adaptive long-range targeting system.

## Composition of "ROSC-1"

The composition of the radar-optical complex:

-Radar on the support-rotary device under the Radome with cooling system, mounted on the lift in the front compartment of the body container;

-The body of the container on the chassis of KAMAZ (accommodation on an alternative chassis), including:

- Diesel-generator;
- Lifting mechanism of Radar;
- · Power supply and communication stand;
- OES, installed on a bracket of container;

 Equipment providing thermal modes (air conditioning, fan heaters);

• SEM and SEC systems (with the possibility of removal and remote operation of systems);

· Operator workstation of radar, SEM and SEC;

- Set of Operational software;

- Remote radar, SEM and SEC OWS(s);

-Spare equipment and instrumentation, remote equipment for external connection of the complex (cables, interface units, etc.).

Composite bipolar antenna is designed to emit microwave energy into the ether and receive echo signals on two polarizations.

Direct drive rotation device intended to rotate the antenna in azimuth according to a given from the control system speed.

Radar complex is installed under the Radome on a hydraulic lift. All radar equipment is mounted on the rotating part of the rear side of the antenna.

When lifting the radar, operator shifts the roof with a hoist and then raises the radar. Air conditioner is placed under the radar to ensure the appropriate thermal mode of the radar.

Equipment SEM and SEC can be mounted on KAMAZ chassis, and on the remote fast counters.

Inside the body container working stations for radar operators and electronic control are provided. Additionally, there is a possibility of remote operation of operators by means of remote OWS.

Information from the output of the complex can be broadcast to different users according to the agreed protocols.

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