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ANALYSIS OF THE STATE OF AUTONOMOUS SYSTEMS (SAMPLES) OF WEAPONS AND MILITARY EQUIPMENT IN THE AIR FORCES OF THE ARMED FORCES OF UKRAINE USING THE EXAMPLE OF UNMANNED AVIATION

Local wars and military conflicts of our time, the experience of using the Armed Forces of Ukraine during large-scale aggression by the Russian Federation, provide a reasonable basis to note the decisive role of unmanned aircraft systems (UAS) units, armed with unmanned aircraft complexes (UACs), in solving combat missions to detect and destroy weapons and military equipment, manpower and critical infrastructure of the enemy.

UAVs can be classified as semi-autonomous weapons systems, and are capable of independently performing tasks for a given time at individual stages of application.

Usually this is takeoff, en route flight and landing, at these individual stages the operation of unmanned aerial vehicles (UAVs) after activation is predetermined and does not require intervention from an external crew, i.e. autonomous [1].

A significant amount of combat missions in the interests of the types and individual branches of the Armed Forces of Ukraine are performed by the UAV units of the Armed Forces of Ukraine, which have UAVs of classes I and II in their composition. Currently, the Armed Forces of Ukraine are equipped with UAVs of the operational-tactical level “BAYRAKTAR TB2” and the tactical level of application “ACS-3” [2]. In the future, it is planned to equip UAVs of the operational and strategic level of application.

The BAYRAKTAR TB2 UAV is intended for:

- conducting specific optical-electronic aerial reconnaissance (visible and infrared radiation range);
- detecting groups, combat formations, the nature of enemy troops’ actions, targets (objects) in operational-tactical depth;
- determining the coordinates of objects;
- transmitting intelligence information to control points in real time;
- engaging enemy manpower and equipment with high-precision ammunition of the “MAM-L”, “MAM-S” type;
- adjusting artillery fire;
- determining the results of fire engagement of targets (objects).

The automatic mode of operation of the UAV “BAYRAKTAR TB2” is the main one. It is used during taxiing, takeoff, flight, approach and landing. The flight in automatic mode is carried out according to the flight plan programmed during pre-flight settings. The operator’s task is to control and adjust the progress of the task. If it is necessary to change the flight plan or mode, the operator has the ability to intervene quickly. The control of the UAV in automatic mode has several options for implementing the planned action. In case of a discrepancy between the specified flight mode indicators and the actual flight, the flight is automatically interrupted [3].

The ACS-3 UAV is designed for:

- conducting specific optical-electronic aerial reconnaissance (visible and infrared radiation range);
- detecting groups, combat formations, the nature of enemy troops' actions, targets (objects) in tactical depth;
- determining the coordinates of objects;
- transmitting reconnaissance information to control points in real time;
- adjusting artillery fire;
- determining the results of fire destruction of targets (objects).

The UAV is automatically controlled in the modes of takeoff, climb, horizontal flight, descent, landing and maneuvering. The UAV takes off in automatic mode using a launcher. After the UAV reaches a given altitude, the UAV begins to work out the flight route in accordance with the flight task program. Long-term climb and climb in conditions of high outside air temperatures are carried out automatically with a transition to “platforms” every 500 m and are programmed in the autopilot, with the number of rotations in a circle ranging from 2 to 5. The UAV's horizontal flight is carried out in accordance with the flight task program in automatic mode, with the flight controller independently setting the engine speed and stabilizing the flight: deviations from the given course, altitude, and speed are automatically compensated. To avoid the UAV falling onto the wing and disrupting the air flow, the roll angle must not exceed the permissible values (programmed in the autopilot and performed automatically). Descent and approach are carried out in automatic mode according to the flight task program. In automatic control mode, the algorithm for gradual descent to the “platforms” is programmed in the autopilot and is carried out every (200–250) m, with the number of rotations in a circle being from two to five. The landing of the UAV under normal conditions is carried out in automatic mode. The flight controller independently builds the approach trajectory, taking into account the wind direction. After determining the desired trajectory, the device turns off the engine at the specified point, opens the parachute compartment and inflates the air bag [4].

Currently, UAVs in service with the Ukrainian Armed Forces can independently perform tasks for a given time only at certain stages of use and under the control of an

external crew. There are no models that can operate autonomously throughout the entire operational cycle.

The Ukrainian Armed Forces are working on developing navigation components that will expand the capabilities of autonomous UAV operation [5].

Thus, at present, the Ukrainian Air Force is equipped with the operational-tactical level UAVs “BAYRAKTAR TB2” and the tactical level “ACS-3”, which are automatically controlled only in the modes of takeoff, climb, flight, descent, landing and execution of individual maneuvers.

The UAVs in service with the Ukrainian Air Force can independently perform tasks for a given time only at certain stages of use and under the control of an external crew. There are currently no samples that can function autonomously throughout the entire operational cycle.

References:

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