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FAMILIARITY WITH THE TIMING METHOD OF RADIO BEACON SIGNALS FOR UAV CONTROLLING

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The introduction of new tactics in recent combat operations, increasing the ability to destroy long-range targets with high precision, the use of intelligence and armed UAVs integrated with computer modeling, and new control and coordination systems, have significantly reduced the loss of manpower, as well as both power and also created a spiritual and psychological advantage [1-3].

Lately, the outcome of military operations, the degree of readiness of the army for combat, and the ability to perform the assigned tasks have begun to depend significantly on the degree and scale of the use of UAVs. UAVs have become a powerful auxiliary factor for commanders in making decisions about the initiation of combat operations; they are constantly developing and improving, and are widely used in modern wars as both reconnaissance and strike tools. In recent times various types of UAVs have been increasingly used on the battlefield and in operations. They have evolved from being seldom utilized weapons to becoming a means of large-scale armed struggle. This evolution necessitates careful and detailed analysis of all aspects of their application [4].

In particular, the 44-day Second Karabakh War and the Russia-Ukraine conflict, during which UAVs were extensively utilized, have etched themselves into world military history as new-generation warfare. UAVs, employed not only for reconnaissance but also for executing mass fire strikes, have assumed symbolic significance in these conflicts. Since it is not advantageous for any country to expend expensive missiles to destroy inexpensive yet high-quality UAVs, the most optimal strategy is considered to be disabling their navigation systems using radio-electronic warfare (REW). Currently, the foremost research endeavor focuses on disrupting the navigation systems of UAVs, thus thwarting their operational deployment. Consequently, new research is underway to detect, identify, and neutralize UAVs, with the development of anti-GPS signal jamming systems and the implementation of false spatial deviation tactics. Considering these methods, new stable navigation systems should be created for UAVs to successfully perform reconnaissance tasks in radio-electronic warfare conditions and without satellite signals [5]. As advancements in science and technology progress, efforts are being made to reduce UAVs' dependency on satellite navigation, as the signals received from satellites are limited to a single frequency range. This dependency can potentially be circumvented by installing radio beacons at strategic locations on the ground and transmitting varied, encrypted frequencies as substitutes for satellite signals. As the integration of beacon technology into UAVs advances, their capabilities will be expanded even further.

In the article, to provide a stable navigation system, use the time method, to ensure its stable flight and the ability to determine the exact coordinates of targets, depending on satellite signals, to successfully perform tasks in difficult weather conditions, in closed space, and when applying radio-electronic warfare systems a mathematical solution to the problem of determining the location of the UAV by beacon signals is given.

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