DOI 10.70286/ISU-28.01.2026.019

POSSIBILITIES OF INCREASING THE MASS OF THE WAR UNIT AND THE RANGE OF STRIKE UAVS WITH DIFFERENT LAYOUTS

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Abstract
The problem of increasing the combat effectiveness of unmanned aerial vehicles (UAVs), i.e., increasing the mass of the warhead (m_{wh}) both in front-line combat zones and at a significant distance behind the front line (L_{UAVs}), is considered.

Keywords: Unmanned Aerial Vehicles (UAVs), Attack UAVs, UAV Range, UAV Layout.

Introduction

An unmanned aerial vehicle is an aircraft designed to fly without a pilot on board, the flight control and monitoring of which is carried out using a special control station located outside the aircraft.

Unmanned aerial vehicles or aircraft (UAVs) are among the three most important needs for Ukrainian security and defense forces.

The main role of UAVs is to provide reconnaissance, as well as the destruction of enemy manpower, their vehicles, armored vehicles, shelters and firing points. In addition, they have a variety of applications, including 24-hour patrols, delivery of cargo to hard-to-reach areas, protection of facilities, artillery fire correction, aerial reconnaissance, obtaining current spatial data, electronic reconnaissance and for communication signals. These UAVs are able to provide valuable information and support for the effective planning and execution of law enforcement operations [1-3].

Attack UAV (unmanned aerial vehicles) are drones designed to hit land, sea or air targets, carrying missiles, bombs or controlled munitions, working with a high degree of autonomy or remotely, revolutionizing military tactics, Replacing piloted aircraft and reducing the risks for crews, these include heavy reconnaissance-attack drones (Reaper type), armor-piercing munitions (Lancet type) and tactical attack systems such as «Orion» or «Bayraktar TB2».

They have a number of key advantages:

1. UAV versatility. They are capable of reconnaissance, surveillance, and target engagement.

2. UAV high accuracy. They use precision-guided munitions with various guidance systems, including laser, infrared, and television.

3. UAV autonomy (remote control). They are controlled by an external operator or operate with varying degrees of automation.

The payload weight of attack UAVs varies greatly: from tens of grams for mini-FPV drones carrying fragmentation munitions, to hundreds of kilograms for heavy attack drones (such as the MQ-9 Reaper), which can carry guided missiles and bombs, and sometimes up to several tons for converted light kamikaze aircraft (such as the Ukrainian A-22), turning them into "flying projectiles" with high lethality. The primary characteristic is not so much the weight of the UAV itself, but rather the payload it can deliver to its target, whether shaped-charge warheads, high-explosive fragmentation warheads, or other warheads, to destroy ground, naval, or air targets.

Thus, the payload weight is a key factor determining the type and power of destruction, and it directly depends on the class and purpose of the UAV itself.

The accuracy of destruction from an altitude of one kilometer is approximately ten meters, but this also depends on whether the munition is equipped with targeting and trajectory correction systems [4, 5].

Furthermore, improved engine efficiency is expected, increasing range and flight time. The integration of systems to suppress enemy electronic warfare is also a priority.

Research relevance

FIRE POINT has a monopoly on the market for the development of such UAVs, but constant changes in combat operations require prompt modifications to this type of aircraft, including increasing the warhead weight and extending the range of attack UAVs.

Solutions to this problem lie in the use of various attack UAV configurations (Fig. 1). Each of these configurations has its advantages and disadvantages:

1 – uses a propeller and fixed masses (Fig. 1a);

2 – uses jet engine thrust, tension rods, and a tail section (Fig. 1b);

a б

Figure 1. Forms of long-range UAV strikes

Flying wing attack UAVs have become widespread (Fig. 2).

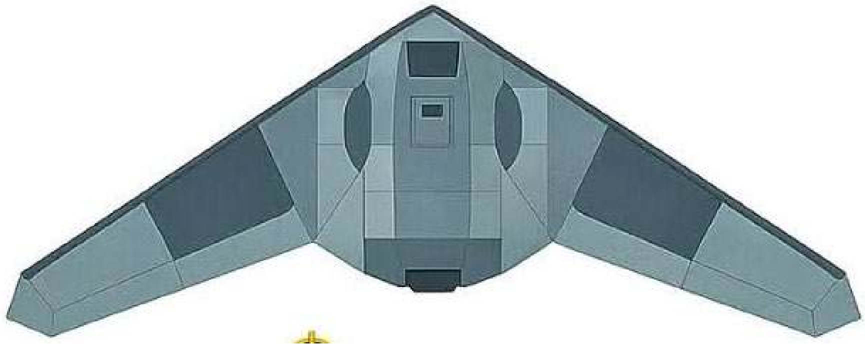

Figure 2. Attack UAV in the form of a flying wing

Its use is most effective when striking deep into enemy territory. However, the capabilities of this type of UAV, which is still underutilized, are still underutilized.

Additional modifications, such as the creation of a non-flat wing, open up new possibilities for increasing the warhead weight and extending the range of this type of attack UAV.

This approach requires a comprehensive computational model for assessing the impact of three engine thrust on increasing the UAV's range (L) while simultaneously increasing the warhead weight (m_{wh}).

Modeling the relationship $L = f(m_{wh})$.

The relationship is established based on the UAV weight balance equation:

$$m_{wh} = m_o - m_{a.w.} - m_f; \tag{1}$$

$$L = \frac{KV_{cr.s.}}{C_R} \ell n \frac{1}{1 - \overline{m}_f}, \tag{2}$$

where m_o – UAV launch weight;

$m_{a.w.}$ – UAV airframe weight;

m_f – mass of fuel on board the UAV;

К – aerodynamic quality of a wing;

$V_{kr.s}$ – cruising speed;

C_R – specific fuel consumption;

$\overline{m}_f$ – reduced mass of fuel.

The main focus of UAV modernization and further development is increasing their autonomy through the use of artificial intelligence and expanding their combat capabilities. In the future, such vehicles could become part of networked combat systems, where target data is received in real time from various sources, including satellites, reconnaissance UAVs, and ground stations.

Conclusions

A method for increasing the warhead weight and extending the range of various aerodynamic configurations for attack UAVs has been developed and tested.

The method is based on the effect of UAV geometry on its aerodynamic drag.

It has been shown that the use of a fixed-wing configuration (Fig. 1a) (for launching from small horizontal platforms) does not provide an increase in range, even when using a fuel-efficient propeller-driven propulsion system.

A jet-engine-based configuration (Fig. 1b) increases the weight and geometric dimensions of the tail section, which also fails to address the primary mission of an attack UAV.

A UAV configuration in the form of a flying, non-flat wing has been recognized as the most effective in terms of increasing warhead weight and extending range. By changing its leading and especially trailing edges, its inductive drag is reduced by 16 percent, which allows the warhead weight to be increased by almost 10 kg and its range to be increased by more than 300 km.

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ТЕХНОЛОГІЯ ОЦИФРОВУВАННЯ АВІАЦІЙНИХ ДЕТАЛЕЙ СКЛАДНОЇ ГЕОМЕТРІЇ

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Виробництво деталей авіаційної техніки (АТ) є сферою впровадження різноманітних сучасних конструкторсько-технологічних рішень з проєктування, виробництва, експлуатації та поточних ремонтних робіт з технічного