

Brief Analysis of Main Safety Hazards for Unmanned Aerial System in Low Altitude Airspace

ISSN: 2640-9690



Feng Dengchao^{1*} and Tao Weiwen²

¹Police Unmanned Aircraft Combat Training Research Center, Shandong Police College, China

²Unmanned Systems Research Center, People's Police University of China (Guangzhou), China

Abstract

In low altitude airspace, Unmanned Aerial Vehicles (UAVs) often face many security threats, which pose enormous challenges to the development of low altitude industries and the construction of low altitude economies. This paper analyzes the main security risk factors from the perspectives of UAVs flight physical failures, low altitude early warning detection network, UAVs communication link defects and information security threats, among which the related threat issues are briefly discussed, such as poor flexibility of UAVs flying on fixed routes, vulnerability to attack during approach reconnaissance, electromagnetic interference emitted by low altitude defense systems and the change of flight control right of Wi-Fi link signals and onboard flight control systems. The results of this paper are helpful for the safety risk assessment of UAVs.

Keywords: Safety hazard; Unmanned aerial system; Threat factor

Introduction

With the development of the low altitude industry, the application of unmanned aerial system has become increasingly widespread, playing a significant role in areas such as national defense and security, emergency disaster relief, logistics and transportation, agricultural plant protection, traffic guidance, electric power line patrol, and combating illegal and criminal activities. However, UAVs often face various threats in practical applications, which pose serious challenges to ensuring the security of low altitude airspace. UAVs countermeasures, adverse climate impact, geographical environment, and unprofessional operations are important factors that directly threaten the flight safety of UAVs. This paper focus on analyzing the main technical threat factors faced by UAVs in low altitude airspace and briefly discuss the corresponding countermeasures, which will promote the construction of a safe operating environment for UAVs, improve the safety quality of aviation flight, and ensure the safety of people's lives and property in low altitude airspace.

Analysis of safety hazards

Threat factors caused by UAVs flight failures: The security threats caused by sudden failures of UAVs during low altitude flight are analyzed [1]. UAVs have no onboard pilots, making it difficult to directly carry out airborne troubleshooting when faults occur. The advanced UAVs have the automatic homing function in the event of a malfunction and may crash during the return journey due to a malfunction. When the electronic equipment of UAVs is disturbed by harsh natural environments, such as heavy fog and airflow, it can easily affect the completion of air missions [2]. The flight path of UAVs used for cruise missions is relatively fixed, making it difficult to change the route in advance and make flexible maneuvering responses when encountering air threats. When approaching for reconnaissance, UAVs can easily expose the positions and be shot down by ground defense equipment due to noise and low flying altitude.

***Corresponding author:** Feng Dengchao, Police Unmanned Aircraft Combat Training Research Center, Shandong Police College, China

Submission:  March 23, 2023

Published:  June 16, 2023

Volume 4 - Issue 4

How to cite this article: Feng Dengchao* and Tao Weiwen. Brief Analysis of Main Safety Hazards for Unmanned Aerial System in Low Altitude Airspace. *Evolutions Mech Eng.* 4(4). EME.000593. 2023. DOI: [10.31031/EME.2023.04.000593](https://doi.org/10.31031/EME.2023.04.000593)

Copyright@ Feng Dengchao, This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

Threat factors brought by low altitude early warning and detection system: UAVs detection network is an important task in UAVs countermeasures technology [1] and it is also an important threat factor for UAVs. In the ground UAVs defense area, UAVs detection equipment is usually installed around the special important targets, combining different altitudes and depth distances to form the low altitude detection network with different detection ranges [3]. Currently, some kinds of low altitude detection equipment can monitor the entire flight process of UAVs, master the flight situation in real time, and even detect the radio communication signal strength and content of UAVs and ground stations, which will directly expose the hidden position of UAVs.

Information security threat factors of unmanned aerial vehicles: UAVs mainly rely on air-ground links for control in low altitude airspace. Currently, many civil UAVs have transparent communication links [4], open frequency points and lack confidentiality measures. Interference, eavesdropping, interception, and tampering with communication links usually pose a significant threat to UAVs. Many civil UAVs use Wi-Fi to communicate with mobile terminals such as mobile phones. To attack the Wi-Fi communication link, information intruders can disconnect the WIFI link between the UAVs and the mobile device and take over the UAVs. Some UAVs are equipped with ADS-B equipment. The ground terminal UAVs defense system can obtain the UAVs position in real-time through ADS-B information, and attack the UAVs based on the detected position. In addition, some specific computer viruses can record data interactions and instructions through vulnerabilities in UAVs flight control software, posing a significant threat to UAVs security.

Conclusion

The security guarantee of UAVs is the key task to the healthy development of the low altitude industry. This paper briefly analyzes the main threat factors of UAVs from the physical failures, low altitude detection networks threat and information security hazards, which has a positive guiding role in formulating safe flight support strategies for UAVs in low altitude airspace.

Acknowledgment

This paper was funded by the open fund of the national defense key laboratory of the Chinese Academy of Sciences (No.092919251261) and the scientific research and training fund of Shandong Police College (No.YKYPYZX202201).

References

1. Wang H, Feng DC, Wang Y, Du Z (2022) Development and discussion of low altitude skynet project. *Computer measurement and control* 30(6): 1-10.
2. Tao W, Feng DC, Wu Y, Ding Y (2022) Preliminary study on safety management of civil unmanned aerial vehicles under the background of low altitude airspace management reform. *Dual Use Technologies & Products* 1: 28-33.
3. Feng D, Du P, Shen H, Liu Z (2020) UAS traffic management in low-altitude airspace based on three-dimensional digital aerial corridor system. In: Yuan X, Elhoseny M (Eds.), *Urban Intelligence and Applications*, Springer Cham, Switzerland, pp. 179-188.
4. Wen J, Feng DC, Ding Z, Wang Y (2022) Mobile robot communication fault diagnosis method based on swarm intelligence algorithm. *Journal of Physics* 2310: 1-7.