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Discussion on the Application of Unmanned Aerial Vehicles in Land Border Areas

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Abstract: Our country has vast territory and long land borders. In the face of increasingly severe border control challenges in the new era, applying police unmanned aerial vehicles that integrate technology, informatization, and intelligence to land border control is a significant trend and necessity. Given the realities of land border areas, the advantages of police unmanned aerial vehicles are self-evident, especially in border patrols and law enforcement cases, where they can fully leverage technological efficiency. However, their development and application on land borders still face numerous challenges. Exploring solutions to the issues in the application of police unmanned aerial vehicles in land border regions can provide valuable references for immigration management departments to better conduct border control work.

1. Introduction

Former Deputy Minister of the Ministry of Public Security, Xu Ganlu, once gave instructions on police aviation work: to fully recognize the significant role of police aircraft in the future police revolution, to conscientiously carry out research, scientifically formulate development plans, manage and use existing equipment well, and promote the healthy development of police aviation. The Party Committee of the Ministry of Public Security has always regarded technology-driven policing as the wings for the rapid development of the public security force. For immigration management departments, these wings are rapidly growing and becoming increasingly robust.

Currently, the application of police unmanned aerial vehicles in immigration management is still in its infancy, with relatively weak practical capabilities and an immature system structure. There are significant gaps compared to local public security organs in team building, personnel management, system composition, and joint operations. For immigration management departments, the application of police unmanned aerial vehicles is a completely new field that requires exploring distinctive models tailored to border regions, taking into account the unique realities of these areas.

2. Advantages of the application of police unmanned aerial vehicles in land border areas

Our country shares land borders with 14 countries, including Russia, Mongolia, Kazakhstan, Kyrgyzstan, and Tajikistan, spanning a total of 22,800 kilometers. This makes us one of the countries with the most neighboring countries and the longest land borders in the world. The terrain

along our land borders is relatively complex [1], with some areas featuring undulating mountains and dense forests; others are covered in ice caps and snow peaks, rarely visited by humans; still others are vast grasslands and boundless deserts. The geographical environment varies greatly from east to west, making it impossible for police officers to reach certain sections by vehicle or on foot. Additionally, the use of police equipment is severely restricted due to limited manpower in immigration management departments and the extensive jurisdiction over border areas. This results in blind spots in border patrols, posing significant challenges to effectively maintaining national security in border regions. The application of unmanned aerial vehicles in land border control can both free up human resources and save financial and material costs, while also enabling efficient supervision of blind areas [2].

2.1 Flexible and flexible, with little restriction on the site

The takeoff and landing of police unmanned aerial vehicles are less constrained by site conditions. Currently, there are two types of aircraft on the market: multi-rotor and vertical takeoff and landing fixed-wing. The multi-rotor model can complete takeoffs and landings with an open space about the size of its fuselage, while the vertical takeoff and landing fixed-wing model combines the advantages of both multi-rotors and fixed wings. It ensures flexible takeoffs and landings in extremely complex border environments and meets the requirements for long-duration endurance and high-altitude flight missions. Additionally, police unmanned aerial vehicles are not restricted by ground conditions, allowing them to freely navigate over mountains, forests, and rivers, significantly enhancing the mobility and flexibility of mission execution.

2.2 Reduce safety risks and reduce the physical and mental pressure of police officers

In actual border law enforcement and reconnaissance operations, the personal safety of police officers is easily affected by various factors such as criminals and weather conditions, leading to a significant increase in mental and physical stress. Using police unmanned aerial vehicles can effectively reduce the safety risks for police officers. Replacing human labor with technology means that even if danger arises, the cost of machine damage is much lower than that of personal injury. Especially in today's post-pandemic era, using police unmanned aerial vehicles in certain tasks avoids direct contact between police officers and others, reducing epidemic-related risks and effectively alleviating the mental and physical pressure on police officers, allowing them to better focus on various border control tasks.

2.3 Strong functional expansion, adapt to a variety of task requirements

The police unmanned aerial vehicle is equipped with a gimbal system. During flight missions, it can be configured with modules such as high-definition cameras, infrared thermal imagers, and loudspeakers based on the actual needs of border control tasks. This effectively addresses adverse factors like nighttime missions and complex terrains, enabling target tracking and positioning as well as high-definition image transmission during border control operations. It flexibly handles various cases and incidents, significantly extending its functional capabilities.

3. Problems existing in the application of unmanned aerial vehicles for police in land border areas

Although the application of police unmanned aerial vehicles in land border areas has great advantages, its application and development are restricted by the particularity of the border

environment and the limitations of the immigration administration itself.

3.1 Weak infrastructure and inadequate guarantee system

From the perspective of team building, currently only a few units in immigration management have established professional police aviation teams, and their operations are still in the exploratory stage. Regulations and standards for personnel management, aircraft management, team building, and daily support have yet to be established. Most units have only selected one or a few drone enthusiasts to handle routine flight tasks, lacking sufficient professional capabilities. In terms of equipment support, due to the lack of established professional standards in the police aviation field, units within immigration management institutions have no reference guidelines when purchasing drone equipment. This results in functional uses, technical specifications, and task adaptability being aligned with civilian drones. Consequently, drones that do not meet practical combat conditions are widely used in police applications, posing potential risks to the unified management and deep application of police unmanned aerial vehicles. Additionally, the market is flooded with a mix of drones from various manufacturers, each producing their own models. Technical support, component production, and supporting services are not universally compatible, making it difficult to promptly address issues in equipment management and maintenance. From the perspective of equipment functions, most drones primarily serve civilian purposes. However, immigration management institutions bear the responsibility of maintaining national (border) security, often in harsh environments. Especially in land border areas, extreme terrains and weather conditions are common. Whether drone equipment can meet task requirements and successfully complete missions under conditions such as low temperatures, storms, and snow or rain still needs practical verification.

3.2 The application is not standardized enough and the connection with the supporting data system is not close enough

In the practical application of police unmanned aerial vehicles, to actively respond to the strategy of revitalizing policing through technology, immigration management departments have taken the lead in equipping themselves with police unmanned aerial vehicles. The selection of models often prioritizes price as a measure of advanced technology. Some units even "mindlessly" emphasize high prices to demonstrate their commitment to business, leading to a situation where there is an overemphasis on demonstrations and underemphasis on actual combat, as well as a focus on publicity and neglect of practical results. Daily applications are limited to multi-angle video recording and photography within visual range, without other advanced operations. Some units, for the sake of publicity, remain at the level of "flying around casually" or "taking simple photos," merely for show and attention, failing to effectively leverage the role of police drone pilots. In terms of integration with supporting data systems, most units use police unmanned aerial vehicles primarily as shooting tools, with low integration with accompanying information systems. Under the current trend of multi-police force collaboration, this makes it difficult to form efficient coordination with command departments, directly affecting the efficiency of emergency task execution. Additionally, border areas differ from inland regions; most civilian map software only accurately maps data from inland areas, while border regions have complex terrain, mostly consisting of mountains, forests, and water sources, with few reference points. The basic mapping data is often vague or even missing, significantly impacting the effectiveness of police unmanned aerial vehicles in border missions. Therefore, integrating professional data into police unmanned aerial vehicles and linking them to corresponding supporting information systems is an urgent issue that immigration management departments need to address.

3.3 There is a shortage of professional talents and the tactics are not deep enough

From the perspective of professional competence, most police officers currently working in police aviation across various immigration management departments hold multiple positions or have been temporarily reassigned from other roles. Some have had personal exposure to drones due to personal reasons, relying solely on their interest to support their work. Most drone pilots and maintenance personnel lack sufficient professionalism, being unfamiliar with flight principles, equipment structure, communication links, and the integration of multifunctional modules. Even fewer police officers are certified for these roles, leading to a situation where they "buy but cannot use, want to use but dare not." As a result, it is difficult to form a well-matched reserve force for police aviation. From a practical standpoint, in numerous videos and texts, reports often highlight the use of police unmanned aerial vehicles for target monitoring, reconnaissance, positioning, and emergency rescue missions. However, these operations are mostly conducted by a single operator, with few examples of coordinated multi-vehicle operations or human-machine interaction. Additionally, training courses for police unmanned aerial vehicles tend to be monotonous, focusing heavily on exam preparation and license acquisition, lacking specific instruction aimed at real combat scenarios, making it challenging to achieve integrated operations.

3.4 The rules and regulations are not perfect, and the cooperation mechanism between military police and neighboring countries is not perfect

At the institutional level, the Police Aviation Office of the Ministry of Public Security has currently issued three series of documents, including the "Management Measures for Registration of Police Drones," but these documents still have a rather limited scope and cannot provide comprehensive guidance for the practical application of police unmanned aerial vehicles. From the perspective of military-police-local cooperation mechanisms, due to the high time sensitivity required for tasks conducted by police unmanned aerial vehicles in land border areas [3], they often need to be deployed promptly. The "Provisional Regulations on the Management of Police Unmanned Aerial Vehicles" stipulates that drones with a maximum take-off weight of less than 7 kilograms (inclusive) must be approved by the head of the user unit to operate within visual range; if using drones with a maximum take-off weight greater than 7 kilograms or operating outside visual range, an application must be submitted to the local air traffic control department (civil aviation and air force), which can only be implemented after approval, and at least 24 hours in advance. This conflicts with the need for emergency response tasks. How to achieve seamless integration with air traffic control departments, improve flight approval procedures and channels, is also a major challenge faced by immigration management departments in applying police unmanned aerial vehicles in land border areas. From the perspective of international cooperation, according to bilateral agreements, flights within a restricted area 25 kilometers from the border must be mission-specific. Conducting flight missions in this sensitive zone poses certain safety risks, making it highly susceptible to accidents due to operational errors, which can lead to international disputes. Therefore, communication between countries regarding border flight missions is an urgent issue that needs to be addressed. The reality of China having numerous land neighbors undoubtedly adds to the difficulty of resolving this problem[4].

4. Countermeasures and paths to promote the application of unmanned aerial vehicles for police in land border areas

The application of police unmanned aerial vehicles in border areas is an inevitable requirement and an objective trend in the development of modern policing. In line with Deputy Minister Xu

Ganlu's specific instructions on the use of police aviation by immigration management departments, which state that "it is necessary to conduct research and argumentation on the needs, performance areas, and environmental conditions for police aircraft used by immigration management agencies, and planning should be carried out from top to bottom, pursuing a path of connotative development," the following countermeasures and approaches are proposed to address the issues existing in the application of police unmanned aerial vehicles by immigration management departments.

4.1 Optimize the top-level design and improve the guarantee mechanism

To improve the overall infrastructure level of police unmanned aerial vehicle teams, it is necessary to coordinate from the top-level design perspective and continuously enhance their practical combat effectiveness. First, strengthen communication with the competent authorities. The Police Aviation Office of the Ministry of Public Security and the Police Aviation Offices of various provincial public security departments serve as business guidance departments for police aviation work. They have access to the latest developments and policies in police aviation. Immigration management agencies should enhance communication and coordination with the Police Aviation Office of the Ministry and the Police Aviation Offices of their respective provinces (municipalities, autonomous regions), actively seek support for construction guidance, and gain support in organizational structure, task implementation, policy support, and action deployment. While maintaining the characteristics of immigration management work, they must strictly follow the deployment of the provincial police aviation office in team building. Second, standardize team building in line with higher-level guidance. We need to standardize daily usage, management, supervision, maintenance, support, and accountability across various aspects, including compliance with laws and regulations, adherence to no-fly zones, flight safety, prevention of accident risks, and oversight of driver responsibilities. Specific work guidelines and implementation plans should be issued. Third, adapt production processes to meet border mission requirements[3]. The complex environment of land borders not only imposes higher demands on the payload weight, module support, and endurance capabilities of police unmanned aerial vehicles but also requires them to meet more complex "personalized" needs based on the nature of tasks. Therefore, the immigration administration should enhance communication with manufacturers to customize police unmanned aerial vehicle equipment suitable for border operations. They should also strengthen cooperation in service and maintenance, establishing a well-structured, standardized, and efficient work mechanism. This ensures that parameters, functions, technical support, and safety stability can overcome limitations imposed by climate and terrain, thereby ensuring high-quality service for police unmanned aerial vehicles in performing various border law enforcement tasks.

4.2 Highlight practical efficiency and strengthen infrastructure construction

First, establish the right application philosophy. As a new type of technological combat equipment under the current situation, police unmanned aerial vehicles have gradually become an indispensable force in informationized policing. To standardize their use, it is essential to firmly grasp the trend of technological development, uphold the idea that technology is the core combat power, and resolutely eliminate all forms of formalism. We must oppose purely showy actions aimed at attracting attention, focusing only on the "surface" while neglecting the "substance." Immigration management departments should combine practical border control realities, treating the performance of police unmanned aerial vehicles as a key issue to continuously enhance practical effectiveness. Second, promote data integration. It is necessary to broaden command channels, improve command system construction, and reasonably apply police unmanned aerial vehicles as

command and dispatch units in actual operations, continuously advancing synthetic operational capabilities. Third, improve basic data construction. Immigration management agencies should collaborate with professional surveying institutions to strengthen the collection of three-dimensional geographic coordinate data in border areas, recording detailed and visible coordinate information for landmarks such as buildings, boundary markers, mountains, and water sources. This will provide precise coordinate data support for police unmanned aerial vehicles conducting border patrols, case investigations, emergency rescue, and crisis response tasks[5].

4.3 Improve the professional level and deepen the study of tactics

Although the operation of police unmanned aerial vehicles is easier than that of manned police aircraft, officers involved in this work must undergo professional training and pass specialized assessments to obtain qualifications issued by the competent authority. "Professional" is at the core of their role; only with professionalism can they provide solid support for safety, efficiency, flexibility, and compliance during flight missions. To enhance the professionalism of the team, it is necessary to break the current situation where personnel hold multiple roles, transitioning from "specialization" to "professionalism." Immigration management departments should actively coordinate with local public security organs to conduct basic training for crew members, strictly implement systematic training and practical exercises, regularly assess and evaluate performance, maintain the crew's operational proficiency, ensure that pilots have solid skills and excellent teamwork, and achieve the goal of being "ready when called, capable upon arrival, and victorious in battle." In practical work, we need ot focus on three key elements: personnel, equipment, and tasks." We need to develop targeted strategies for growth, coordinate the capabilities of various police units and departments, delve into technical and tactical expertise, and devise effective plans based on the realities of border areas.

4.4 Accelerate the establishment of rules and regulations and improve the cooperation mechanism

To strengthen the construction of basic legal and regulatory systems for drones, providing a legal foundation and guarantee for public security departments to formulate regulations on police unmanned aerial vehicles. It is necessary to coordinate with air force and civil aviation authorities to further promote the improvement of mechanisms for military, police, and civilian flights, eliminating departmental barriers, simplifying the cumbersome procedures for reporting daily flight tasks, exploring the simplest methods for approving flight missions in emergencies, breaking through time constraints for approval, and making the use of police unmanned aerial vehicles more adaptable to practical combat requirements. At the national level, international cooperation with neighboring countries should be strengthened, formulating and issuing agreements on managing flight operations within 25 kilometers of border areas, improving emergency response plans for potential safety risks such as landing in other countries' territories or disrupting border order, ensuring the maximum protection of interests and friendly relations between neighboring countries, so that police unmanned aerial vehicles can safely perform border flight missions under the protection of improved rules and mechanisms.

5. Conclusion

The application of police unmanned aerial vehicles in land border areas is a concentrated manifestation of the immigration management department's commitment to technology leadership, information support, and integrating technology with law enforcement. In the face of increasingly

complex border stability situations and exceptionally arduous border control tasks, the immigration management department must fully leverage the significant advantages of police unmanned aerial vehicles in border regions and continuously expand their superiority to meet the comprehensive needs of border control, enhance overall operational efficiency, and strive to build a new pattern of "prevention, control, governance, and construction" with distinctive features of immigration management.

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