Research on UAV Application in Mountain Anti-terrorism Combat

Wenxin Wang\textsuperscript{1,a,1st}, Bin Jiang\textsuperscript{1,b,2nd}, Jian Yang\textsuperscript{1,c,3rd}, Chao Li\textsuperscript{1,d,4th}

\textsuperscript{1}College of Information and Communication, National University of Defense Technology, Wuhan, China
\textsuperscript{a}wwx18627225925@163.com; \textsuperscript{b}Jiangb11365284@163.com
\textsuperscript{c}Corresponding author: 215632783@qq.com
\textsuperscript{d}313624393@qq.com

Abstract—Mountain anti-terrorism operations are an important anti-terrorism battlefield in our country. However, the complex terrain environment and harsh weather conditions in the mountainous areas cause difficulty in battlefield reconnaissance, poor communication guarantees, and difficulty in using the advantages of anti-terrorism forces in equipment, which brings great difficulties to mountain anti-terrorism. UAVs have become a sharp weapon in mountain anti-terrorism operations because of their flexibility and ability to adapt to the environment, and can effectively avoid casualties. Through approach reconnaissance, aerial firepower strike support, and relay communication guarantees, UAVs will show their talents in mountain anti-terrorism operations.

1. Introduction
In 2011, the U.S. military used "Predator" drones in the mountains of Afghanistan to successfully hunt down Al Qaeda's No. 2 figure, Atif\textsuperscript{[1]}, and let the world see the huge potential of drones in mountain counter-terrorism operations. At present, the "three forces" in Xinjiang have shrunk their fronts under the severe blows of the Chinese government, and a large number of terrorists are hiding in the mountainous border areas in order to make a comeback. At the same time, some international terrorists often enter my country through the border mountainous areas. Therefore, the mountains will be an important battlefield for our country’s future anti-terrorism operations. The complex terrain and harsh natural environment in the mountains have brought great difficulties to counter-terrorism operations, and UAVs will certainly play an important role in mountain counter-terrorism operations due to their flexible mobility, strong environmental adaptability, and suitability for performing dangerous tasks.

2. MAJOR DIFFICULTIES FACED BY MOUNTAINOUS ANTI-TERRORISM OPERATIONS
The difficulties faced by mountainous anti-terrorism operations are mainly the adverse effects brought about by the complex terrain and harsh climatic environment in the mountains, which are mainly manifested in:
2.1. *Terrorists hide deep in the mountains, and it is difficult to find their whereabouts with conventional reconnaissance methods*

The primary prerequisite for counter-terrorism operations in mountain areas is to lock the whereabouts of terrorists. The complex terrain environment in mountainous areas provides a natural barrier for terrorists to hide whereabouts, which brings difficulties to reconnaissance work. The terrorists of the "Al-Qaeda" organization can survive tenaciously under the suppression of the world's most well-equipped U.S. military because most of them are hidden in the mountains, and it is difficult for the U.S. military to find their tracks. Traditional reconnaissance methods such as satellite camera reconnaissance are often difficult to obtain high-definition photos due to the high mountains and dense forests and the high altitude of the satellites. Infrared imaging reconnaissance, electronic reconnaissance and other methods are also not effective due to the obstacles of mountain terrain. These conventional reconnaissance methods are often difficult to detect the whereabouts of terrorists in mountain environments.

2.2. *The terrain environment is harsh, and the equipment advantages are difficult to use*

In order to reduce casualties, a large number of advanced equipment such as anti-terrorist armored vehicles and helicopters have been put into use in recent years. However, in mountain anti-terrorism operations, subject to terrain, these advanced equipment are often useless. For example, in order to ensure safety, in mountain operations, helicopters cannot fly too low, especially in mountainous areas that are prone to severe weather such as dense fog, and the use of helicopters is even more restricted. The advantages of anti-terrorism equipment are difficult to take advantage of, and often they can only rely on officers and soldiers to carry light weapons through search and round up.

2.3. *Communication is easily affected and command coordination is difficult*

Anti-terrorism operations require strict organization and command and close coordination, which requires reliable communication means to guarantee. Wireless communication is the main means of communication in mountainous anti-terrorism operations, and mountainous terrain will seriously hinder the transmission of wireless signals, and severe weather will also cause severe attenuation of wireless signals, which may cause communication obstruction or even interruption, which will seriously affect the organization, command and coordination of anti-terrorism operations.

2.4. *The terrain is intricate and complicated, and it is easy to be ambushed for hunting, encircling and suppressing*

The mountainous terrain is often full of ravines and high mountains and dense forests, which is conducive to the hiding of terrorists, but it is not conducive to the search and suppression of anti-terrorist forces\(^2\). Even if careful reconnaissance is carried out before the war, it is difficult to fully understand the detailed terrain of the terrorist hiding place. Terrorists have been hiding in the mountains for a long time and are familiar with the environment. They can easily set up various obstacles and traps, ambush snipers and set mines to ambush during the encirclement and suppression of anti-terrorism forces.

3. **THE ADVANTAGES OF DRONES IN COUNTER-TERRORISM OPERATIONS**

In recent years, unmanned aerial vehicle technology has developed rapidly. With its superior performance, unmanned aerial vehicle has become the new favorite of modern warfare, and it has also become an anti-terrorist weapon. The main advantages of UAVs in counter-terrorism operations include:

3.1. *It is flexible and can be deployed and used quickly*

The UAV is small and flexible, and has low requirements on the terrain environment when taking off, so it can be deployed quickly. As shown in Figure 1, the reconnaissance drones commonly used in counter-terrorism operations are often carried by individual soldiers and operate for takeoff, which is very flexible and convenient. Some attack drones can also take off quickly after receiving intelligence
to carry out targeted attacks on terrorists to achieve a killing effect. In the fleeting anti-terrorist
operations of fighters, UAVs can just give full play to their flexibility and mobility.

3.2. **With strong environmental adaptability, it can be used in various combat environments**
Since the UAV has no driver, there is no need to worry about casualties. Therefore, the UAV can
perform tasks in various complex environments and has a strong ability to adapt to the environment.
For example, in urban anti-terrorism operations, in the face of row upon row of buildings, micro drones
can come and go freely, which is unmatched by traditional helicopters.

3.3. **Operators stay away from the battlefield, which can effectively avoid casualties**
In the recent Armenia-Azerbaijan conflict, drones have shown their talents, but there is no agreement
on the source of drones. Mainly because the drone can be controlled remotely, and the "pilot" can be
completely out of the battlefield. With the emergence of surveillance–strike drones, a new anti-
terrorism method has also emerged. As shown in Figure 2, drone operators are far away from the
battlefield and use drones to obtain accurate information. The plane directly attacked the terrorists. This
kind of anti-terrorism model that allows its own personnel to completely "outside the incident" and
achieve zero casualties has been realized in the anti-terrorist battlefield in Afghanistan, demonstrating
the huge advantages of drones in anti-terrorism operations.

3.4. **Concealed whereabouts, able to achieve surprising results**
UAVs are small in size and have low noise during flight. They are often not easily detected by terrorists
in anti-terrorism operations, so they can achieve surprising results. Especially with the proliferation of
micro drones, they will show their talents in the anti-terrorist battlefield. For example, for terrorists
hidden indoors, micro drones can detect the indoor environment without alerting the terrorists, and
provide accurate intelligence to the anti-terrorist forces.

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**Figure 1** A drone that can take off quickly

**Figure 2** Remote control drone
4. HOW UAVS ARE USED IN MOUNTAIN ANTI-TERRORISM OPERATIONS

The advantages of drones can overcome various difficulties faced by mountain counter-terrorism operations, and will play an important role in future mountain counter-terrorism operations. The main application methods are:

4.1. Reconnaissance approach, provide accurate intelligence for pre-war preparations
Anti-terrorism operations are inseparable from accurate intelligence support. In mountain anti-terrorism operations, drones can be used to carry out close reconnaissance of terrorists\(^3\). Before the war, large-scale reconnaissance drones were first used to carry out scanning reconnaissance on the mountainous area where terrorists were hiding, drawing out an intelligence map of the entire combat area, and locking key areas at the same time. Then use small UAVs to conduct close and precise reconnaissance in key areas. Without alarming terrorists, you can even use multi-rotor micro UAVs to hover over the terrorist activity area to carry out real-time reconnaissance and monitoring to ensure accurate intelligence. Provide support for follow-up operations.

**TABLE 1. TYPES AND FUNCTIONS OF RECONNAISSANCE DRONES IN ANTI-TERRORISM OPERATION**

| Type of drone | Large drone | Small drone | Multi-rotor drone |
|---------------|-------------|-------------|------------------|
| Scouting method | A wide range of scanning and reconnaissance | Close surveillance | Real-time reconnaissance monitoring |
| Role | Discover the scope of terrorist activities and lock key areas to lay the foundation for follow-up accurate reconnaissance | Find out the precise situation of terrorists and provide a basis for the formulation of combat operations plans | Monitor the movement of terrorists and provide intelligence support to counter-terrorism forces at any time |

4.2. Air strikes provide fire support for search and suppression
In the movie "Wolf Warriors", the helicopter hunting for foreign mercenaries in the border mountainous area is difficult to achieve due to the terrain and climate in the actual mountainous anti-terrorism operations. However, with the development of attack drones, in the future mountainous anti-terrorism operations, it will become the norm for drones to provide fire support from the air for search and capture troops\(^3\). On the one hand, UAVs are flexible and highly adaptable in the battlefield. They can move freely in mountain environments and track terrorists. On the other hand, UAVs equipped with tactical missiles and small aerial guns are very useful in mountain operations. For encirclement and suppression forces that are difficult to carry heavy weapons, it can be regarded as a powerful fire support, and it can also form a powerful deterrent to terrorists. Figure 3 shows the "Reaper" drone that can provide fire support to the ground.
4.3. Relay communication provides information support for command coordination

Relay communication is an important application field of UAVs. UAVs can be used as relay stations in mountain counter-terrorism operations to provide information and communication support for counter-terrorism forces to ensure smooth command and close coordination\[3\]. As shown in Figure 4, Before the war, the blind area of communication was found through reconnaissance, and the relay drone was arranged in advance as a communication relay station. In the process of searching for and suppressing terrorists, as the troops act, the position of the drones must be adjusted in time to keep up with the combat area of the troops to ensure the uninterrupted command of the encirclement and suppression forces and the uninterrupted coordination between neighboring forces.

![Figure 4 UAV relay communication model](image)

The complex terrain and harsh climate in the mountainous area provide convenience for terrorists to hide, and are a natural obstacle to counter-terrorism operations. However, UAVs make full use of their technical advantages to provide strong support for mountain anti-terrorism operations.

5. Conclusion

UAVs are rapidly developing towards stealth, long endurance, and intelligence\[6\], and the UAV family includes various types of UAVs from micro to large. UAV functions will become more and more perfect, will be more conducive to overcome the shortcomings of mountain anti-terrorism operations, and become a sharp weapon for future mountain anti-terrorism operations.

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