

# Application of UAV aerial photography and remote sensing aerial survey technology in emergency rescue

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## Abstract

**Based on the introduction of the application characteristics and management norms of civil UNMANNED aerial vehicles, the remote control, image transmission and cloud platform technologies applied in remote sensing aerial survey of unmanned aerial vehicles are studied and analyzed. Then, it is proposed that the application of UAV and aerial photography system in emergency rescue and disaster relief can improve the rapid emergency response ability, the operation ability under emergency and bad environment, the acquisition ability of image information, and the ability to quickly set up temporary wireless network to provide communication and information transmission services.**

## Keywords

**UAV; Remote Sensing; Aerial; Emergency Rescue; Wireless Figure Pass.**

## 1. Characteristics and management specifications of civil UAV

UAVs, as the name suggests, are unmanned aircraft, usually operated remotely by people on the ground, so there is no need to worry about the safety and physical limitations of pilots. After decades of development, unmanned aerial vehicles (UAVs) have become relatively mature from a technical point of view. Compared with the "tall and tall" military UAVs, civil UAVs are relatively low in flight altitude, precision, duration and other aspects. However, they are low in cost, easy to operate, and highly flexible. They can also carry some important equipment to complete special tasks in low air. For example, it can be used in aerial photography, surveying and mapping, delivery, film entertainment and many other fields. When performing special tasks, it has the advantages of strong survivability, good maneuvering performance, and easy to use. It can play an important role in dealing with natural disasters, accidents, disasters and social security incidents. UAVs can perform a variety of dangerous missions in bad weather, in environments or in areas that are difficult for humans to reach. The worst that can happen is to lose the aircraft itself, so they are well suited for rescue and relief work.

From the perspective of security, all countries have some regulations on the management of civilian UAV use. For example, there are a large number of private planes flying in low-altitude airspace in the United States. According to the regulations of the Federal Aviation Administration (FAA), commercial unmanned aerial vehicles (UAVs) need to apply, and the permitted application fields cover agriculture, pipeline detection, aerial survey, film and television production, etc. Applications for civilian UAV flights will also have to comply with a number of regulations on flight location, height, weight and operational safety.

There are also relevant regulations on UAV management in China. The General Aviation Flight Control Regulations of 2003 explicitly stipulated that UAVs should be treated as general aviation aircraft when they are used for civil business flights. The Measures for Air Traffic Management of Civil UAV solves the problem of airspace management of UAV; The Interim Provisions on The Management of Pilots of Civil Unmanned Aerial Vehicle (UAV) System

address the management of UAV pilots' qualifications; According to the Interim Regulations on Pilot Management of Civil UNMANNED Aircraft System (UAVs), micro UAVs weighing less than or equal to 7 kilograms are not required to be licensed but should avoid remotely piloted aircraft entering excessively high airspace as far as possible. For UAVs whose weight is higher than the above standards and those flying into complex airspace, the pilots shall be subject to the supervision of the industry association and even the Civil Aviation Administration; In 2017, the Civil Aviation Administration of China issued the Provisions on the Administration of Real-name Registration of Unmanned Aerial Vehicles (UAVs), which provides real-name registration for UAVs with a quality of more than 250 grams, including how to declare flight plans of UAVs, the conditions required for such declaration, and the airspace in which they can fly.<sup>[1]</sup>

## 2. UAV aerial photography and picture transmission technology

UAV aerial photography simply looks as if the UAV is loaded with a camera flying in the air. In a deep sense, it is a high-tech product based on multiple technologies such as single-chip microcomputer control technology, aerial photography sensor technology, GPS navigation aerial photography technology, wireless communication service technology, flight control technology and programming control technology, and relies on a variety of hardware equipment.

From the perspective of hardware, as an aerial photography aircraft, it is equipped with advanced computer flight control, attitude sensing, radio data transmission, positioning self-service driving, image transmission and remote control servo system of camera and cradle head. It is a well-equipped "flight computer". From control perspective, UAV aerial photography in addition to use pick up camera, video camera, video camera equipment for aerial record hd video, at the same time control on the ground of the flight crew or the remote control camera crews use remote control flying platform, combined with wireless signal transmission equipment delivered back images in real time adjustment, control of flying and shooting process.

Unmanned aerial vehicle (UAV) provides a remote sensing platform with easy operation and field transfer for aerial photography. The take-off and landing is limited by the space is small, in the playground, highway or other more open ground can take off and land, its stability, safety, transfer field is very easy; Small and light, low noise, energy saving, efficient maneuver, clear image, light, miniaturization, intelligence is the outstanding characteristics of UAV aerial photography.

Onboard HD cameras can achieve professional-grade 4K high-definition images, which, of course, depends on the stability of the cradle head. In the air, multi-angle photos and videos can also be taken in the "first-person master perspective" mode. The clear video of wireless beyond visual range is transmitted back through the image transmission module to preview the aerial picture in real time. There are also real-time flight data transmission, control of longitude and latitude, attitude, altitude, speed, mode, return point information, error type and other flight control information transmission, to obtain all kinds of real-time data. Combined with the enhanced wireless WIFI image transmission repeater (WIFI can be used for near distance wireless transmission, enhanced WIFI can reach the range of nearly kilometers, and other remote wireless transmission modes should be selected for farther distance), we can obtain a further beyond-visual-range flight experience (the flight altitude and distance should be within the relevant regulations of low-altitude control). It includes a repeater Wi-Fi password setting and a complete SDK activation authentication mechanism to prevent the UAV from being interfered with or captured by others.

### 3. The application

UAV has a wide range of uses, including film and television shooting, surveying and mapping, and line inspection. Compared with real aircraft cruise or aerial photography, UAV has the advantages of low cost, less control, simple operation and easy promotion and application. And the UAV is equipped with high-definition equipment that flies near the ground to capture sharper images and monitor updates in real time. The advantages of UAV system in the application of emergency rescue and disaster relief are also reflected in the rapid emergency response ability, rapid travel to areas that cannot be reached by ordinary people, overcoming bad weather and environment, low altitude and near ground flight observation, no flight personnel safety risk, low image acquisition cost, saving labor cost and many other aspects. For example, the National Earthquake Disaster Emergency Rescue team uses unmanned aerial vehicle (UAV). Its search and rescue detection accuracy reaches 0.1 meters, and it can continuously fly for 100 kilometers at a low altitude of 200 meters [2]. Therefore, UAV and aerial photography technology in emergency rescue and disaster relief is worth studying and promoting.

#### Quick emergency response capability

UAV aerial remote sensing system is small in size, light in weight and easy to carry. It can reach the target monitoring area quickly after disaster occurs. Simple operation, short preparation time and system, can be quickly, quickly, quickly fly, fast imaging, with high precision equipment can get monitoring results in a short period of time, to realize the remote unknown data rapid acquisition, emergency maneuverability is strong, can be implemented according to the fixed route search, patrols, also can temporarily change flight path in the air. It can also take pictures of the scene of disasters and accidents to obtain information, carry out aerial monitoring of forest fire hazards, harmful gases and poison diffusion, etc. It can also complete aerial surveillance, airborne communication, airborne propaganda, and transmit emergency relief supplies and information, etc.

#### Ability to operate under harsh emergency conditions

UAVs can be in the traffic inconvenience, complex landform, even it is hard to reach areas, such as forest hills or divide large ground and the scene of the fire, flood in the danger zone and bad environment disaster investigation and assessment, rescue command and staff are often not arrive or can not directly to the target area, then UAVs and aerial technology can display its unique advantages, can obtain high resolution aerial images, can obtain first-hand information as soon as possible, provide real-time data support for the emergency command and decision-making.

#### The ability to get data under the clouds

Aerial photography of UAV can fly in low altitude under clouds, making up for the defect that satellite optical remote sensing and ordinary manned aerial remote sensing cannot acquire images due to cloud cover. Moreover, the inspection coverage area is large and the inspection accuracy is high, and it can also carry out remote assessment and verification through over-the-horizon automatic pilot. This can greatly reduce the workload of the field, save manpower, material resources.

#### Strong ability to guarantee safe operation

UAV remote sensing system adopts autonomous and ground remote control operation to carry out aviation remote sensing tasks, avoiding the safety risks of flight personnel. Over-the-horizon automatic driving can send back images in real time, realize feedback on dangerous situations and improve dynamic monitoring ability. When necessary, it can even carry explosives for remote blasting to clear roadblocks and cofferdams, so as to ensure safety.

#### Set up wireless network to provide network communication services

At the scene of the accident disaster, the traditional telecommunications and the Internet are often caused by the network infrastructure has been destroyed network paralysis, makes the scene personnel cannot use mobile phones or networks to distress, alarm, at this time of UAVs network relay device can be used to build a temporary network, providing network services, to help rescue workers, propaganda announcement, convey information in a news release.

Aerial photography forensics and mounted police equipment for law enforcement management Traffic jams often occur on highways because of accidents. Many people violate traffic rules and seize the emergency lane, resulting in law enforcement police cars and rescue ambulances unable to arrive at the scene. At this time, police equipment such as loudspeakers and floodlights mounted on the UAV can be used for broadcasting and guiding during flight, so as to open a path for rescue ambulance vehicles. UAVs can also be used to help police and other law enforcement personnel to conduct scene investigation, collect evidence and fix evidence remotely in combination with the function of hovering and shooting, and to remotely command the handling and removal of accident scenes, so as to quickly guide vehicles.

Application of remote sensing and telemetry

UAV carries out aerial survey through remote sensing and telemetry, providing high-resolution image data for departments that need to measure. Its wide shooting coverage greatly improves the efficiency of measurement and mapping. Combined with digital imaging technology, rapid production of three-dimensional electronic map, rescue and relief command to provide decision-making support.

Electronic detection and signal interference

Combined with sensors and high-precision electronic signal detection equipment, wireless electronic detection and signal interference. Signal jamming and signal coverage can also be used to counter and capture UAV.

#### 4. Summary and Prospect

UAVs were originally used for military purposes, but with the development of the information technology industry, the civilian UAVs market will grow. At present, the lack of endurance capability of civilian UAV is still a problem. Meanwhile, it needs to be improved in flight altitude, accuracy, long distance communication network, flight noise and other aspects. Wide-angle camera or multi-azimuth camera can also be modified if there is special need. UAV aerial photography application is far from aerial photography, photography, but also used for law enforcement supervision, on-site investigation and forensics. It is believed that with the emergence of more and more cost-effective unmanned aerial vehicles (UAVs) that can meet the requirements of the civil market, UAVs will be more developed and popularized in rescue and relief as well as other fields.

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