

# Analysis on the Demand and Countermeasures of Air Ground Coordination in China's Aviation Medical Rescue

### Jun Gao, Shuwen Chen

Shanghai Civil Aviation College, Shanghai, China Email: gaojun@shcac.edu.cn

How to cite this paper: Gao, J. and Chen, S.W. (2022) Analysis on the Demand and Countermeasures of Air Ground Coordination in China's Aviation Medical Rescue. *World Journal of Engineering and Technology*, **10**, 790-797. https://doi.org/10.4236/wjet.2022.104051

Received: September 20, 2022 Accepted: October 25, 2022 Published: October 28, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

http://creativecommons.org/licenses/by/4.0/

 $\bigcirc \bigcirc \bigcirc$ 

Open Access

# Abstract

Compared with ground first aid, aviation medical rescue has better advantages in mountain disaster relief, remote transfer and rapid medical rescue response, which is an effective supplement to ground medical first aid. China's aviation medical rescue is in its infancy, compared with the level of developed countries there is a big gap. Based on the development and characteristics of aviation medical rescue in China, this paper combs the process of air-ground cooperative rescue, analyzes the demand and current situation of air-ground cooperative rescue in aviation medical rescue in China, and puts forward some countermeasures to improve the ability of aviation medical rescue in China.

# **Keywords**

Aviation Medical Rescue, Rescue System, Three-Dimensional Coordination

# **1. Introduction**

With economic development, the demand for aviation medical rescue is growing and becoming more and more diversified. The limitations of the traditional single ground emergency service system have been highlighted. Aviation medical rescue has the characteristics of rapid and efficient, and the geographical environment, traffic conditions and other factors have little influence. It is a great expansion and supplement to the ground medical emergency system in space [1] [2] [3]. Foreign civil aviation powers have established a complete aviation medical rescue system, and have played a huge role in national health, emergency rescue and disaster relief, and humanitarian relief.

Compared with traditional rescue methods, aviation medical rescue is more

professional, which requires hospitals, emergency, airports and other departments to cooperate with rescue. The command and dispatch relationship is complex, and it also involves flight safety and security issues. At the same time, due to the late start of China's aviation medical rescue, aviation medical rescue capacity and other developed countries have a large gap, China's aviation medical rescue has great development and promotion space [4] [5] [6]. Based on the demand of air-ground collaboration in aviation medical rescue in China, this paper combs the process of air-ground collaborative rescue, analyzes the demand and current situation of air-ground collaboration in aviation medical rescue in China, and puts forward improvement countermeasures, so as to provide reference for the improvement of aviation medical rescue ability in China.

#### 2. Air-Ground Collaborative Rescue Process

Aviation medical rescue is divided into two types. The first type refers to the use of fixed-wing aircrafts or helicopters to deliver rescue forces, drugs and equipment needed for rescue to the rescue site and implement real-time and effective rescue. The second category is to transport critically ill patients from rescue sites to medical institutions, or between medical institutions under medical care, for further treatment. Helicopter is the main way of aviation medical rescue [7].

In order to accurately analyze the problems existing in the air-ground coordination of aviation medical rescue, the air-ground coordination rescue process is summarized and analyzed. Air-ground coordination of aviation medical rescue process includes air and ground coordination. The two-part rescue process includes:

1) To the rescue site stage

After receiving the first aid mission, according to the condition, location, helicopter flight conditions, determine whether the helicopter rescue conditions meet. If the conditions are satisfied, the helicopter is scheduled, and the unit is prepared to fly to the rescue site, if not satisfied, dispatch ambulance rescue.

Before the helicopter arrives at the medical rescue site or the predetermined landing site (accident point), the on-site personnel shall inform the flight personnel of the on-site real-time situation to assess whether the predetermined landing site is still suitable for take-off and landing and determine the on-site rescue mode. To minimize mission risks, helicopter operators need to provide information support to drivers, including in preflight planning, risk analysis and route flights, to help them make effective decisions. Small-scale operation can realize the above responsibilities through direct communication between drivers and ground operators, while large-scale operators can consider establishing command centers. Medical rescue operations to and from airports or approved helicopters are not different from normal operations, but helicopter movements to and from complex or unprepared rescue objects require careful planning and take into account multiple risk factors. 2) The stage of going to medical and health facilities

During the rescue process, the helicopter transported the patient's discovery site to the medical and health sites that were approved and qualified or had been checked in advance by the operator (accident acceptance point). According to the situation of the scene and patients, if the need for air-ground joint rescue, dispatch ambulance to. Pre-hospital disposal is carried out by airborne equipment and drugs during flight. Through the location information judgment of helicopters and ambulances, hospital resources are arranged in advance and patients are transferred quickly.

Before carrying the rescued personnel to the medical and health facilities or the pre-determined landing site (medical receiving point), they should inform the receiving medical personnel of the wounded situation, so as to prepare for the reception in advance. If the take-off and landing point is a non-medical and health place, it needs to be transported by ground vehicles. The necessary medical equipment and personnel should be prepared on the transport vehicle, and wait in advance at the medical contact point.

Specific air-ground collaborative rescue process is shown in **Figure 1**.

#### 3. Demand and Status Analysis

Combined with the air-ground collaborative rescue process, the demand of air-ground collaborative rescue is analyzed, including the following aspects:

1) Air-ground collaborative command

Air-ground collaborative rescue is an effective supplement to the ground rescue capability, which is fast, efficient and flexible. However, in the process of aviation medical rescue, it needs the cooperation of flight crew, random medical staff, ground support personnel, dispatchers and so on, involving more and complex personnel, more and more complex collaborative personnel, and involving flight safety and security issues. In the rescue of some major accidents, multiple helicopters and ground rescue forces may cooperate to complete the rescue, and the importance of air-ground cooperative command is more prominent [8]. Now China's aviation rescue forces scattered and weak, air-ground collaborative rescue mechanism has not formed. Therefore, it is necessary to establish specialized agencies or study the air-ground collaborative command technology to carry out the management of various departments and the air-ground collaborative command of aviation medical rescue.

2) Air-ground information transmission

In the process of air-ground collaborative rescue, in addition to communication and coordination between rescue personnel and ground departments through equipped wireless communication equipment, much real-time information involved in the rescue process also needs to be shared. Through information transmission, we can real-time understand the progress of rescue implementation, hospital emergency resources, the operation of helicopters and ambulances and other information. Using 5G network, Internet of Things, wireless



Figure 1. Flow chart of air-ground collaborative rescue.

communication and other technologies, we can establish an air-ground integrated and information-interoperability air-ground collaborative rescue communication network resources to meet the communication needs of various departments and provide communication, scheduling, decision-making and early warning support services for air-ground collaborative rescue [4].

3) Airfield rescue team

Air rescuers are more demanding than ground rescuers. Medical personnel engaged in air medical rescue should not only have professional first aid experience, but also have helicopter-related knowledge in order to cooperate with the division of labor between units to complete the rescue task, such as the use of radio and air rescue safety protection [6]. Previously, China's medical personnel involved in aviation medical rescue are usually selected in emergency centers or large hospitals, medical experience is rich, but lack of aviation medical knowledge, air emergency experience, etc [9]. Therefore, it is necessary to carry out the whole process, multi-role and multi-task collaborative training for all kinds of personnel involved in the rescue, and cultivate the team to meet the requirements of aviation medical rescue.

#### 4. Improvement Measures

### 4.1. Construction of a Sound Air-Ground Collaborative Command and Dispatch Center

Command and dispatch play a central role in the aviation medical rescue mission, the rescue mission, personnel, equipment, related units unified scheduling and coordination. China's aviation medical rescue started late, did not establish a complete set of aviation medical rescue system, command and dispatch system is also corresponding lack. Air-ground collaborative rescue involves the collaboration of multiple departments and industries. Each department needs to understand the progress of the overall rescue task, the dynamic allocation of resources, and obtain the information needed by each department in the implementation of the task.

Developed countries such as the United States have established an air rescue system based on major regions and unified central dispatching, which is conducive to unified management and enhances the pertinence and effectiveness of rescue [7]. China can refer to the establishment of a regional aviation medical rescue network, which is led by the government, participated by the society and organized uniformly. Air rescue stations can be built in hospitals that meet the aviation standards and emergency center command and dispatch information on the ground can be integrated to realize the sharing of rescue information and unified dispatch. The management methods can be further improved to construct the standards of aviation medical rescue system, including scheduling process, transport process, rescue site construction standards, medical equipment standards, etc., to guide the integration of air and ground medical rescue forces and to build a regional aviation medical rescue network system. Taking Bayannur city hospital as the center to construct the integrated medical rescue system of air and land in Mongolia [10]. As the dispatching system of the city's air-ground integrated command center, Bayannaoer hospital emergency command and management platform realizes the resource sharing of the city's hospital air-ground emergency power and the city's emergency power, and has the ability of disease assessment, emergency plan formulation and air-ground emergency coordinated command and dispatch.

# 4.2. Construction of Air-Ground Interconnection Communication Network

Aviation medical rescue mission execution has high real-time and security requirements, but the aviation medical rescue mission environment is complex, such as in mountainous areas, there will be unable to see and contact the rescue helicopter. Among the current communication methods, a single one cannot meet the requirements of air-ground interconnection communication, and the aviation emergency rescue mission area cannot achieve full coverage, which cannot meet the needs of voice and communication of the whole voyage. The sources, types and collection methods of data needed in aviation medical rescue missions are different. To meet the requirements of various rescue missions, various data collection, aggregation and rescue data interconnection are needed. Therefore, it is necessary to comprehensively utilize a variety of communication methods to realize the construction of air-ground interconnected communication network.

Based on Beidou, GPS positioning, Beidou satellite communication and 4G/5G mobile communication technology, the air-ground interconnection communication network can be constructed to realize the full coverage of aviation emergency rescue information data. At the same time, the aircraft, ground rescue station and dispatching center are connected to open up the communication links of voice, video and data in the whole rescue task, realize the transmission, storage, sharing and unified management of all data, and provide all-round data guarantee for the rescue task. In addition, the intelligent rescue equipment can be realized by using the Internet of Things technology, and the equipment operation data can be uploaded to the database to facilitate the command and dispatch of the equipment. At the same time, the data can also be used for equipment monitoring and task state control.

#### 4.3. Improve the Professional Training Mechanism of Air Medical Rescue

Medical personnel in aviation medical rescue are usually selected in emergency centers or large hospitals. Because of the characteristics of the environment in the rescue mission, medical staff should not only have medical ability, but also have aviation-related knowledge to adapt to the psychological and physical quality of special environment. In addition to medical personnel, to participate in aviation medical rescue management personnel, dispatchers, commanders, security personnel have new requirements. In order to improve the joint treatment ability of aviation medical rescue, it is necessary to strengthen the construction of aviation medical rescue personnel.

Training is a routine work of the team and a basic practical activity to improve the ability of aviation rescue support when dealing with emergencies. It is necessary to develop aviation rescue training plans, carry out targeted training, distinguish training contents, innovate training methods and improve training quality in combination with the health emergency tasks undertaken. The access system of aviation medical rescue personnel can be established, the professional training mechanism of aviation medical rescue can be improved, and the training of comprehensive ability, stress ability and team cooperation ability can be carried out. At the same time, according to the mission characteristics of aviation medical rescue, the whole process, multi-role and multi-task collaborative training is carried out for all kinds of personnel in the rescue. Through the team cooperation training, the simulation of each process and activity in the rescue task is realized, the cooperation rescue ability between various departments is trained, and the team meeting the aviation medical rescue is trained.

# **5.** Conclusion

Based on the development status of aviation medical rescue in China, this paper combs the process of aviation medical rescue, and analyzes the needs of air-ground coordination in aviation medical rescue in China, including air-ground coordination command, air-ground information transmission and air-ground professional rescue teams. According to the air-ground collaborative demand information, three improvement measures are put forward to build a perfect air-ground collaborative command and dispatch center, build air-ground interconnection communication network and improve the professional training mechanism of air medical rescue, so as to provide ideas and reference for the improvement of aviation medical rescue ability.

### Funding

Supported by Chenguang Program of Shanghai Education Development Foundation and Shanghai Municipal Education Commission.

# **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

#### References

- [1] Li, H. (2019) Current Situation and Development Strategy of Aviation Emergency Rescue in China. *Technological Innovation and Application*, **2019**, 2.
- [2] Ma, Y.F., He, X.J., Pan, S.D., *et al.* (2018) Current Situation and Development Trend of Aviation Medical Rescue in China. *Chinese Journal of Emergency Medicine*, 27, 4.
- [3] Li, Y.H. and Li, R. (2019) Research on the Construction of Aviation Emergency Rescue Standard System in China. *China Safety Science*, **29**, 7.
- [4] Guo, A., Liu, B., Fu, L., *et al.* (2022) Research on Key Technologies of Air Emergency Rescue Stereoscopic Coordination. *Journal of Natural Disasters*, **31**, 11.
- [5] Zhong, B. and Tian, J.Q. (2019) Development Status and Strategy of Aviation Medical Rescue in China. *Chinese Disaster Rescue Medicine*, 7, 531-535.
- [6] Hao, M., Tang, J.H., Xiong, L., *et al.* (2017) Problems and Countermeasures of Air Medical Rescue Construction in China. *Medicine and Society*, **30**, 3.
- [7] Zhang, L.D., Feng, T.N., Wang, C.X., *et al.* (2015) Development Status of Air Medical Rescue at Home and Abroad. *China Health Emergency Electronic Journal*, **000**, 234-236.
- [8] Zhang, Q.S., Jin, Y.J. and Qin, S.X. (2019) Research on Optimization of Helicopter

Collaborative Rescue Scheduling. China Safety Science, 2019, 7.

- [9] Zhang, X.L. and Song, J. (2015) Implementation of Team Cooperation Rescue Mode Training to Improve the Timeliness of Cardiopulmonary Resuscitation in Air Rescue. *General Nursing*, 13, 3.
- [10] Guo, A.B., Gao, W., Liu, B., et al. (2021) Research on the Construction Practice and Operation Mode of Air-Ground Integrated Medical Rescue System. *Chinese Journal* of Critical Care Medicine, 41, 6.