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Influence of Aviation Meteorological Service on Flight Operation and Improvement Measures

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Abstract: *Aviation meteorological services (AMS) are essential steps of civil aviation transportation, which play an important role in normal flight operations. In this study, the AMS are firstly briefly summarized. Then, the influence of AMS on normal flight operations is analyzed. Finally, some measures to improve AMS are proposed, so as to provide some reference for relevant departments.*

Keywords: *Aviation meteorological services; Flight operation; Influence; Measures*

1. Introduction

Aviation meteorological services (AMS) are a crucial guarantee to ensure the safe operation of civil aircraft. With the progress of the times and the improvement of science and technology, the means for monitoring the civil aviation weather continue to improve and develop. Furthermore, the combination with information technology makes it possible to monitor the atmosphere and weather changes in real-time, which can provide data support for the formulation of flight routes and the implementation of response measures. In addition, due to the continuous increase in the number of flights and the of aviation users for AMS, there is an urgent need for diversified and refined AMS to ensure normal flight operation. Therefore, how to do the AMS well under the new situation to provide strong decision support for aviation users is the main challenge in aviation meteorological development.

2. Overview of aviation meteorological services

2.1 Content of aviation meteorological services

Aviation meteorological services refer to meteorological services provided for aviation activities. basic tasks are to detect, collect, analyse and process meteorological data, produce and release aviation meteorological products, provide timely and accurate meteorological information needed for civil aviation activities, and provide services for flight safety, normality and efficiency.Actually, AMS consist of six parts[1]: the special consultation service, the surface observation service, the trend forecasting service, the meteorological announcement service, the dangerous weather warning service and the high-level forecasting service. These various parts of AMS can provide meteorological data references for flight centers and flight crews to ensure aircraft safety.

2.2 Aviation meteorological service type

Generally, AMS include three types of services[2]: the meteorological service during the flight, the network meteorological service and the face-to-face meteorological service. The meteorological service during the flight mainly relies on the meteorological office to pay close attention to and update the weather conditions in the aircraft flight area, so as to protect aviation flight safety. The network meteorological service mainly relies on the network, microblog, WeChat, mobile phone and other multimedia communication platforms to release meteorological information, so that the staffs can prepare in advance. The face-to-face meteorological service means the pilots directly communicate the staff in meteorological offices during the flight.

2.3 Characteristics of aviation weather service

Fine timeliness.As aviation flight is to transport passengers or cargo from one place to another,or to carry out some special tasks,such as emergency rescue, fire prevention, disaster relief, the flight time is

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often only a few minutes to a few hours, these characteristics determine that the AMS must be time-sensitive, so the meteorologists are required to produce weather forecasts in a timely, accurate and rapid exchange of information.Meteorological factors have a great influence.Aviation flight is closely related to weather factors such as temperature, pressure, wind and weather phenomena[3]. For example, temperature affects the load of aircraft , pressure affects the instrument altitude of aircraft, wind affects take-off and landing and flight speed of aircraft and so on..There are many severe weather phenomena affecting flight safety.Thunderstorm, downburst, severe icing in cloud, vertical wind shear are extremely harmful to aircraft. Precipitation affects visibility easily, overcooled raindrops or freezing rain cause aircraft icing easily and so on, that seriously endangering flight safety.High degree of concern, strong security, large impact.As air transport is fast and convenient,people always will be concerned about whether flights take off and arrive on time, passengers choose the aircraft as a means of travel is to convenience, punctuality and safety of the aircraft, so AMS should be timely and thoughtful.

2.4 Sources of aviation meteorological service information

The sources of aviation meteorological service information have diversification, including but not limited to airports, air traffic management system of civil aviation, meteorological service network and aircraft meteorological information feedback.

3. Current status of aviation weather services

3.1 The aviation meteorological observation data are few

According to the current situation, the meteorological observation data of civil aviation in our country are very few, for example, the observation data of high altitude wind and the observation data of aircraft are very limited, and the conventional Doppler radar is usually only suitable for observing strong convective echoes, unable to warn of low-level wind shear and turbulence conditions[4] .Without sufficient observation data, forecasting can not be carried out, affecting judgment of the forecaster.

3.2 The operational quality of Aviation Meteorological Service personnel needs to be improved

At present, the operational level of aviation weather forecasters is stagnant. Within forecasters, the level of forecasting varies widely. Many forecasters did not change the concept in time, the people engaged in aviation weather forecast because of long-established work habits: the main content of the work when the TAF. For a long time, it was the relevant departments concerned with flight activities that asked the meteorologists about the weather conditions, and they did not offer their services to the users, thus forming the habit of “Sitting and waiting”, this habit will also lead to the staff of the inertia of the heart of the formation.

3.3 The aviation weather service form is simple

Because of the monopoly status of aviation meteorology, most forecasters are only satisfied with the general guarantee service, but do not form a more active service consciousness. Service form is single, satisfied with TAF forecast or telephone consultation, and in the Service Strategy, publicity and fine management did not form a set, users do not very trust the weather warning.

4. Influence of aviation meteorological services on normal flight operation

4.1 Significant benefits of aviation weather monitoring

Although aviation weather monitoring has developed relatively slowly and its professional benefits are not outstanding compared with the sounding network, it can meet the basic requirements of normal flight operation. The function of aviation meteorology in the civil aviation industry is mainly reflected in the comprehensive monitoring of atmospheric conditions. These observation data are relatively targeted and accurate. By comprehensively analyzing these observation data, the law of weather change could be found, and then the possible weather conditions in the route area can be predicted. On this basis the flight route can be adjusted in time. If bad weather is monitored or predicted, the signing and dispatching strategy can be adjusted in time. In addition, the effectiveness of the aviation

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meteorological monitoring service is mainly reflected in the feedback of relevant information. Some monitoring equipment can effectively collect information in the flight route area, but it is not complete. Therefore, it is difficult to accurately analyze the atmospheric conditions, thereby increasing the risk of flight operation. With the rapid development of science and technology, various modern monitoring instruments and equipment have been widely used in aviation meteorological work. With the continuous improvement of the meteorological monitoring work of civil aviation, its economic benefits in the aviation industry are more and more significant.

4.2 Effective reflection of weather conditions

Although the meteorological monitoring work in the civil aviation industry does not develop as fast as the state-owned aviation industry, the overall meteorological monitoring technology in the civil aviation industry is continuously updated and improved, which can basically meet the needs of civil aviation. Human damage to the ecological environment, such as automotive exhaust emissions, industrial waste gas emissions, wastewater emissions and waste residue emissions, has worsened the atmospheric conditions. The severe pollution phenomena in large and medium-sized cities in China, including haze and dust, have appeared more frequently in recent years. The low visibility weather not only affects people's daily travel but also has a great impact on people's visual distance. The impact of low-visibility weather is the most significant on the aviation flight, especially on the take-off and landing stages. Moreover, due to the increasing global warming, various kinds of severe weather occur frequently, which could seriously affect the normal flight operation, thereby threatening the life and property safety of passengers and staff. The meteorological monitoring in the civil aviation industry requires the staffs to pay close attention to the weather conditions and determine future weather changes in the flight-route region. Then, the accurate fine forecast could effectively ensure the normal flight operations.

4.3 Multi-faceted reflection of weather conditions

The current civil aviation meteorological monitoring work monitors the basic weather conditions. Besides, it gradually covers all aspects of the meteorological conditions, such as the temperature, pressure and wind direction in a certain area. These monitoring data can effectively reflect the weather conditions and further improve flight safety. This has a great reference value for signing and dispatching strategy for aircraft travel. Besides, aviation meteorological monitoring has a high vertical resolution, and could provide high-precision data for civil aviation staffs and passengers. With the application of modern observation instruments and equipment, the credibility of the data is further enhanced, which can provide practical data support for aviation aircraft travel.

5. Measures to improve aviation meteorological services

5.1 Strengthening researches on the application of new technology

It is necessary to strengthen the researches on integrating multi-source data, such as meteorological satellite data, wind profile radar data and automatic observations, and actively develop the integration technology of multi-source detection data that are consistent with aviation meteorological operations. For example, to combine artificial intelligence technology with big data analysis techniques is hoped to efficiently improve the aviation weather forecast. By combining data collection, cleaning, and standardized processing techniques, we can obtain helpful information. Besides, by extracting meteorological observations and forecast information, we can develop new forecast techniques that are different from traditional numerical models to improve the quality of AMS.

5.2 Creation of a new meteorological service mode

In the Internet eraage, we should actively explore the corresponding meteorological service mode. Through integration development, meteorological information and meteorological services, the accuracy of which is to be continuously improved in future, are integrated into the operation system of professional users in the aviation industry. The Internet of Things, cloud computing, big data, artificial intelligence and other technologies are fully utilized to actively build the "Internet +" meteorological service mode. Besides, with the help of an open interface, users can obtain the corresponding meteorological data information according to their own needs. The service target should be accurate to

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each passenger, and the service cycle should be included in the entire aviation activities. Also, AMS should provide convenient and efficient service means and corresponding channels for users according to their habits.

5.3 Active construction of a high-resolution assimilation numerical forecast system

With the continuous development of numerical forecast technology, the aviation meteorological forecast service level has also been improved. However, due to the influence of the leading time and regionality, the occurrence time and duration time of thunderstorms and low-visibility weather, as well as precipitation intensity, are still the bottlenecks in the aviation weather forecast. Because it is difficult to make a breakthrough in weather forecast technology and numerical forecast in the short term, it is possible to combine the numerical forecast data with the real-time observation data to build a high-resolution assimilation numerical forecast system as soon as possible, thereby improving the objectivity and fining level of meteorological products. Thus, it can provide better aviation meteorological service support for normal flight operations and can enhance the forecast accuracy of aviation weather and the service level.

6. Conclusion

In summary, AMS can directly affect normal flight operations. Therefore, the civil aviation department should fully realize its importance in aviation flight, and improve the quality of AMS by strengthening the application research of new technology, creating the new meteorological service mode and actively building the high-resolution assimilation numerical forecast system, so as to enhance the economic operation efficiency of the civil aviation industry.

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