Application of Aerometeorological Technology in Air Traffic Control—Taking Huatugou Airport as an Example

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Abstract
The development of modern aviation industry is inseparable from the support of aviation meteorological technology. In the process of air traffic control, aviation meteorological technology also plays a key role and becomes an important auxiliary technical means for air traffic control management. As an important participant in air traffic control, airports also have a huge demand for the use of aviation meteorological technology in traffic control. For this reason, the research of aviation meteorological technology is in. The application status and main practices of air traffic control will help promote the airport to further improve its air traffic control capability and enhance its own air traffic control efficiency. Taking Huatugou Airport as a case, this paper discusses and analyzes the application of aviation meteorological technology in air traffic control, studies its current situation and main practices, and gives optimization measures, hoping to promote the efficient application of aviation meteorological technology in air traffic control. Airports also play an important role in air traffic control. At present, with the gradual evolution of the integration trend of air traffic control management, more and more aviation meteorological technologies have become important technical support points for airports to apply to air traffic control.

Keywords
Aviation, meteorological technology, air traffic control

Haixi Huatugou Airport, located in Mangya City, Haixi Mongol and Tibetan Autonomous Prefecture, Qinghai Province, China, is a 4C domestic branch airport, which was officially put into operation in 2015. At present, the airport has four Class C aircraft slots, which can take off and land A319, MA700, ARG21 and other high-profile aircraft. In the air flight traffic management, Huatugou Airport also relies on aviation meteorological technology to promote its own route safety and ensure the stability of the airport operation.

1. Current situation of the application of aviation meteorological technology in air traffic control at Huatugou Airport

Huatugou Airport is located at the edge of the Qinghai-Tibet Plateau, belonging to the plateau airport, with an average altitude of more than 2900 meters. Therefore, the airport needs to use more aviation meteorological technology in the implementation of air traffic control. As Mangya City, Haixi Mongolian and Tibetan Autonomous Prefecture, is located in the high and cold zone, and the weather condition is bad, and the annual average number of windy days is more than 185 days, the meteorological monitoring of the airport plays a major role in the operation of the airport. In order to effectively deal with the geographical, meteorological and environmental conditions of Huatugou Airport, the aviation management department established a special aviation meteorological work class when implementing air traffic control.
control on the air route of the airport, and formed a unified aviation meteorological information interaction platform. On this interactive platform, the traffic control department can continuously monitor the weather and meteorological data such as gale and wind change level data, temperature change status data, hail, thunderstorm and other weather and meteorological data sent by the aviation meteorological monitoring department at any time, and output the information continuously for 24 hours. Based on this platform, the red line warning is set through the red line warning. When meteorological elements touch the meteorological red line in the traffic and air traffic control of Huatugou Airport, the meteorological monitoring interaction platform will automatically give early warning, timely send the aviation meteorological data to the airport and various management departments, and issue different levels of early warning signals [1].

In order to effectively deal with the geographical, meteorological and environmental conditions of Huatugou Airport, a series of measures have been taken when implementing air traffic control on the air route of the airport.

First, establish a special aviation weather class and build a unified aviation weather information interaction platform. On this interactive platform, the air traffic control specialty can continuously monitor the wind force change, temperature status, ice and snow thunderstorm and other meteorological data sent by the aviation meteorological specialty at any time, and output information continuously for 24 hours. Based on this platform, a red line warning is set. Through this red line warning, when meteorological elements touch the meteorological red line in the air traffic control of Huatugou Airport, the meteorological monitoring interactive platform will automatically give an early warning, timely send the mastered aviation meteorological data to all units of the airport and issue different levels of early warning signals [2].

Second, in the meteorological monitoring of Huatugou Airport, the air traffic control specialty also conducts integrated meteorological analysis through satellite cloud image monitoring and computer simulation computing monitoring technology to simulate the meteorological change trend over the region. Through data accumulation, model construction, parameter analysis, a series of different models such as gale weather trend early warning model, ice and snow storm weather early warning model, temperature weather monitoring and early warning model have been formed [3]. These models can be automatically analyzed based on the historical meteorological information data in the past, and provide meteorological monitoring parameters, suggestions and meteorological control reference for the air traffic control of Huatugou Airport [4].

Finally, the air traffic control department also carries out all-weather aviation meteorological technology monitoring for Huatugou Airport. The meteorological department directly realizes the real-time online presentation of the air meteorological early warning information through the automatic monitoring of the air traffic control department and the meteorological radar data collection and terminal interactive adjustment. In addition, it can carry out special information submission and information trend prediction on the temperature, pressure, wind speed, market and cloud distribution, future rainfall changes, thunderstorm conditions, etc. of the region. The supply of coping strategies, through these measures, effectively ensured the safety and stability of air traffic control at Huatugou Airport, and maintained the safe and smooth operation of long-term traffic control in the region. It can be said that aviation meteorological technology has played a major role in air traffic control in the region.

2. Main practices of applying aviation meteorological technology in air traffic control at Huatugou Airport

The accurate provision of meteorological parameters at Huatugou Airport is mainly due to the implementation of a series of effective aviation meteorological services by air traffic control, weather forecast and other disciplines, combined with the latest aviation meteorological technology.

First, provide accurate weather monitoring and early warning analysis. The meteorological specialty of Huatugou Airport provides a meteorological observation report for the air traffic control area every 15 minutes, and carries out detailed data collection and submission on the current air speed, cloud amount change, field visibility change, atmospheric pressure change, etc. From 3h before each flight starts to the end of flight activities, the aviation meteorological specialty in the region provides uninterrupted real-time weather online monitoring. In winter, Huatugou Airport is located in the cold and anoxic zone, with more wind and snow. At this time, the aviation meteorological specialty in Huatugou area will give a comprehensive warning of the existing severe convective weather conditions every 30min to 60min [5]. These meteorological data can automatically process the weather distribution of strong convection in the air, the change state of clouds and the change trend of clouds and rain within 300-50Km of Huatugou Airport. The final use of these meteorological data can effectively ensure the collection, monitoring and submission of relevant data such as rain and snow, cloud displacement direction, intensity, precipitation degree, cloud top distribution state, etc. in Huatugou area in cold winter season [6]. Finally, Huatugou aviation meteorological service also uses satellite cloud images to monitor the changes of satellite cloud images every 2 hours [7], and carries out detailed analysis of satellite cloud images on the characteristics of cloud and rain location movement, cloud thickness, rainfall size, cloud scale, strong convective weather changes, etc., and puts forward data analysis and meteorological reports, which are provided to air traf-
fic control to ensure that the airport air traffic operation is not affected by bad weather [8].

Second, provide meteorological pre-forecast. In the process of air traffic control, the aviation meteorology in Huatugou area also provides various kinds of aviation weather pre-forecast. Generally, this forecast can be shortened to 1h-24h. The local aviation meteorological service will normally send weather pre-forecast information data to the air traffic control every 30min to 60min, and realize the aviation meteorological data pre-warning broadcast through the meteorological database and the aviation fixed telecommunication network AFTN [9]. Huatugou Airport can receive the weather forecast of wind speed, visibility, clouds, air pressure, ice, rain and snow provided by the meteorological service between 9h and 24h in advance, and can make air traffic control arrangements.

In addition, Huatugou Airport also provides a series of route weather forecasts, and the local aviation meteorological service department will also carry out radar and meteorological pre-detection and early warning for the flight route of the aircraft, and will also provide information on the altitude, course and icing conditions of the aircraft. Carry out trend prediction of turbulence, temperature trend, strong convection weather change, etc., and form specific route weather information data forecast by combining its own meteorological database and data modeling that has been accumulated. And provide these data to the air traffic control department for their use in air traffic control. In addition, in the air traffic control of Huatugou Airport, the aviation meteorological department will also provide the aircraft that need to land in the future to forecast the meteorological technical information two hours in advance. Through the air satellite broadcasting system and the aircraft broadcasting system, the aviation landing weather pre-forecast and takeoff pre-forecast will be realized [10].

Third, Huatugou Airport also provides a series of important sudden meteorological technical forecasts and technical parameters through aviation meteorological services during the process of traffic air traffic control, for example, severe convective weather, severe hail, severe turbulence, significant sandstorm and topographic wave changes. The aviation meteorological department will timely carry out data monitoring, data early warning and meteorological analysis, and make the judgment of meteorological destructive force, and finally submit the report for the air traffic control management to make corresponding reference, so as to ensure the safety and reliability of the entire air traffic operation.

3. Measures to further optimize the application of aviation meteorological technology in air traffic control of Huatugou Airport

First is unified meteorological information data submission and data sharing technology. At present, some of the aviation meteorological service technologies used by Huatugou Airport in air traffic control come from local aviation meteorological services, and some are connected to higher level aviation meteorological data. The diversification of aviation meteorological data information sources and the extension of early warning transit time make the circulation time of aviation meteorological information in the region relatively long, and the management departments cannot effectively connect with the transmission of aviation meteorological information. For this reason, in the next step, it is necessary to further promote the integration and sharing of aviation meteorological technology in Huatugou area. For aviation meteorological information technology, the database should be opened to form a cooperative mechanism for communication and data sharing between all parties.

Secondly, we should further strengthen the construction of automatic decision-making mechanism for meteorological information. In the future air traffic control process of Huatugou Airport, the more convenient meteorological information control software system should be used as far as possible to integrate the forces of all departments into the air traffic control. Air traffic control can also achieve visual collection, evaluation and decision-making of air meteorological information through one-touch. For example, in the next step of aviation meteorological technology development, the five-dimensional visual meteorological service can be used, and the quantitative model development can be implemented in groups to realize the description modeling of route meteorological monitoring between time, meteorological variables and three-dimensional structures. Three-dimensional simulation and five-dimensional presentation of the wind field, temperature, rain and snow changes in the route and air traffic control area are carried out to find out the flight path of the route in time, monitor and forecast the meteorological status of the aircraft's location in real time, and avoid severe convective weather such as atmospheric storm in time, so as to promote the efficiency and safety of air traffic control.

Third, we should further strengthen the construction of automatic decision-making mechanism for meteorological information. In the future air traffic control process, more convenient meteorological information control software system should be used as much as possible to make it. The forces of all departments are integrated into the air traffic control department, and the air traffic control department can also realize the visual collection, visual evaluation and visual decision-making of air meteorological information through one-touch. The development of aviation visualization information technology can also improve the digital weather radar mosaic and the assessment of fuel consumption of air route meteorological conditions, thus promoting the auxiliary intelligent decision-making of air traffic control, and facilitating the timeliness and high automation of aviation meteorological services in air traffic control of Huatugou Airport.

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For example, in the next step of aviation meteorological technology development, the quantitative model development of five-dimensional visual meteorological service cluster can be used to realize the description modeling of route meteorological monitoring between time meteorological variables and three-dimensional structures. Three-dimensional simulation and five-dimensional presentation of the wind field, temperature, rain and snow changes in the route and air traffic control area are carried out to find out the flight path of the route in time and monitor and forecast the weather at the location of the aircraft in real time. Avoid severe convective weather such as atmospheric surge in time to promote the efficiency and safety of air traffic control.

To sum up, the application of aviation meteorological technology has played an important role in air traffic control. In the air traffic control of Huatugou Airport, aviation meteorological technology ensures the stability of the airport operation through a series of optimization practices. The next step is to promote the convenience of aviation meteorological services in air traffic control by unifying meteorological information, promoting intelligent decision-making, and realizing visual meteorological information monitoring and early warning.

References


