ISSN:2790-1688 DOI: 10.56028/aetr.1.1.277

Research on the application of airport ATC Communication Transmission Network

Can Liu

Navagational Matters Management Department of Chongqing Jiangbei International Airport Co., Ltd., Chongqing Airport Group, 401120.

763189732@qq.com

Abstract: During the work of the airport runway, the transmission network, as the technical support and basic guarantee of the overall system operation, will connect a number of geographically dispersed platforms together, and undertake the data transmission responsibilities of the airport safety operation, such as navigation, takeoff and landing. According to the analysis of the operation of the dual runways constructed at various airports in recent years, the transmission and communication network with higher safety performance and reliability should be selected as the support, so as to ensure the effective transmission of information data between production scheduling and administrative offices and avoid the impact of data errors on the safety of aircraft. In this article, therefore, to understand the airport runway and on the basis of current situation of the development of civil aviation air traffic control communication transmission network, according to the basic principle of optical transmission network and double track transport demand, deeply discusses the airport runway synchronization technology optical transmission network planning and design in the form of digital system, starting from the viewpoint of modern science and technology innovation, clear the development trend of the future airport atc communication transmission network.

Keywords: Airport runway; Air traffic control communication; Transmission network; Production scheduling; The administrative office

1. Introduction

As a basic part of the airport construction and operation, the runway has strict requirements for the construction and identification of the internal facilities of the runway. The reason is that the performance and infrastructure of the runway determine which class of aircraft can use the airport. The airport will be classified according to this capability, and the specific results are shown in Table 1 below:

Table 1 Classification of flight zones

Flight zone class	Examples of maximum takeoff and landing aircraft
4F	Airbus A380 and other four-engine long-range wide-body superjumbo jets
4E	Boeing 747, Airbus A340 and other long-range wide-body airliners
4D	Boeing 747, Airbus A300 and other twin-engine wide-body airliners
4C	Airbus A320, Boeing 737 and other twin-engine medium-range narrow-body airliners
3C	Boeing 737, ERJ,ARJ,CRJ and other short and medium route changers

Based on the analysis of the above table, it is found that the flight zone grade can be visually represented by the code composed of two parts. On the one hand, the number represents the runway performance and the restrictive conditions of obstacles corresponding to the aircraft performance. On the other hand the letters represent aircraft dimensions required for runway type and taxiway width. For runway design, the first number in the flight zone rating represents the required length of flight space, and the second letter represents the maximum wingspan and wheelbase width of the corresponding aircraft. The details are shown in Table 2 below:[1.2.3]

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Table 2 codes correspond to runway requirements

Flight area code	Length of runway (m)	Flight area code	Wingspan (m)	Main landing gear outer wheel spacing (m)
1	L<800	A	WS<15	T<4.5
2	800≤L<1200	B	15≤WS<24	4.5≤T<6
3	1200≤L<1800	C	24≤WS<36	6≤T<9
4	L≥1800	D	36≤WS<52	9≤T<14
		E	52≤WS<65	9≤T<14
		F	65≤WS<80	14≤T<16

Nowadays, most of China's open airport flight zones are rated above 4D. For example, Beijing Capital Airport,Hangzhou Xiaoshan Airport, Wuhan Tianhe Airpor have the highest flight zone rating of 4F. Shanghai Hongqiao Airport and Lhasa Gongga airport have the flight zone rating of 4E. The transmission network, as an important technical platform for the airport runway to obtain and transmit information, directly affects the practical operation effect. Among them, the communication and transmission network of civil aviation air traffic control system is the basic part of modern air traffic control system, which directly undertakes the implementation effect of information transmission and control in the field of modern air traffic control. In the 1980s, the theory of communication technology has attracted the attention of scholars all over the world. The application of computer in airborne equipment and air traffic control ground equipment has become more and more extensive, which provides an effective basis for the design and research of modern air traffic control system. From the Angle of practical application, the civil aviation communication network as the basis of the civil aviation safety and stable operation condition, the overall national civil aviation system refers to the civil aviation transport network data communications network communication network as the main content of the industry, the actual development has experienced three stages, the first is refers to the X 2.5 packet-switched networks, the second is refers to the frame relay network, finally is refers to the ATM network.[4.5] From the perspective of overall development, civil aviation X 2.5 packet-switched network was first built mainly in the late 1980s to the early 1990s, and smoothly transitioned from the traditional Morse mode to the digital transmission mode, effectively improving the security and reliability of forwarding information transmission. In the late 1990s, telecom circuits gradually realized digital transformation, digital data circuits gradually replaced analog circuits, and X 2.5 packet switching technology was replaced by frame relay technology. Starting in the late 1990s, frame relay networks are being built faster and faster, using their technological advantages to replace traditional packet-switched networks. With the steady development of Chinese aviation field, the development speed of air traffic control industry is growing faster and faster. Therefore, higher requirements are put forward for flight information data transmission, high frequency signal, radar signal, etc. From the perspective of practical application, due to the limited transmission capacity of frame relay network, the contradiction between supply and demand becomes more and more serious. In order to scientifically solve the problems caused by large-capacity broadband data transmission, ATM technology is regarded as the main direction to replace relay technology in the future. Since the establishment and construction of ATM data communication network in civil aviation in 2003, the ATM data communication network was fully constructed and applied in 2004. This network technology fully meets the basic service needs of air traffic control in such aspects as high-frequency signal transmission and radar information connection. With the continuous improvement of information technology of CAAC in our country, the number of air traffic control data information presents an explosive growth trend. Therefore, ATM data communication network of CAAC has been reformed into a comprehensive rectification and innovation after the 21st century, and provides an important guarantee for air traffic control operation. On the basis of understanding the current airport runway construction and operation, this paper mainly discusses the application of air traffic control communication and transmission network, in order to provide

ISSN:2790-1688 DOI: 10.56028/aetr.1.1.277
effective basis for the construction and application of airport air traffic control communication and transmission network.[6.7.8]

2. Method

2.1 Optical Transmission network

In essence, optical fiber communication is to use optical fiber to transmit the light wave carrying information, so as to achieve the basic goal of effective communication. In the development of modern science and technology innovation, the technical theory of optical fiber communication has become more and more mature, and has been widely used in the communication network construction projects. Combined with the optical fiber communication structure diagram shown in Figure 1 below, it can be seen that the transmission mode of optical fiber is divided into two types, one is single-mode optical fiber, the other is multi-mode optical fiber. From the perspective of practical application, the diameter of single-mode fiber is usually controlled between 9 or 10um, and can only transmit one mode of light. The transmission capacity is larger and the distance is longer, which is very suitable for long-distance transmission. The single-mode fiber, with a diameter of 50 or 62.5um, is mainly used to transmit multiple modes of light. The dispersion between modes is large, which effectively limits the frequency of data signal transmission. Moreover, the longer the distance, the more serious the actual impact will be, so it is more suitable for short-distance transmission. Compared with other existing communication methods, optical fiber communication technology is more stable and secure, and has become the core content of transmission network.[9.10.11]

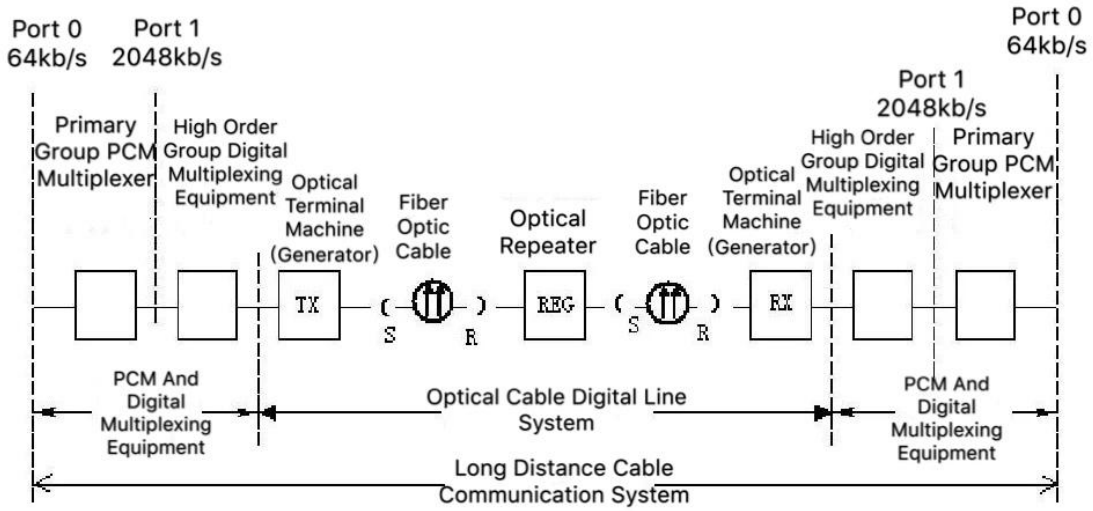

Figure 1 Structure of optical fiber communication

2.2 Synchronous Digital System (SDH)

This system is designed to use optical fiber to achieve synchronous information transmission, differential, cross, etc., on the basis of the construction of the transmission network, the use of the same transmission rate level, usually can reach 155.520Mbit/s, and different rate levels meet the application requirements under different circumstances, the highest transmission rate can reach 10Gbit/s. Compared with the traditional sense of the quasi synchronous digital system, the synchronous digital system design is more effective, can be in building a unified communications system, on the basis of using synchronous multiplexing and byte examination way to enhance the reliability, using rich overhead bits in structure, convenient network system maintenance and management, is applicable to various types of network topology, It has the advantage of forward and backward compatibility.

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2.3 Ring network protection

Compared with the topological structure analysis of other transmission networks, it can be seen that the ring network structure of optical transmission network has strong survivability, in other words, it has strong self-healing ability. In the case of a network fault, no human intervention is required. The network can automatically recover services from the fault in a short time, and users can hardly feel the network fault. The principle is to use the dissolving capacity of standby and existing equipment to replace routing. In case of failure, the network itself has the ability to find alternative routes and re-establish communication, so as to ensure the normal operation of the airport air traffic control communication transmission network.

2.4 Dual-runway communication transmission network planning and design

Nowadays, the dual-runway transmission and communication network of the airport has a layered structure and undertakes a variety of communication services. Therefore, the construction and promotion of the self-healing ring network with optical fiber transmission as the core can not only meet the performance requirements of the dual-runway transmission and communication network, but also meet the basic principle of economic applicability. Combination are shown in figure 2 below transmission structure analysis, on the basis of the optical fiber ring network, according to the request of double track communication transmission, using core level synchronization between regional digital system, create a backbone transmission of environmental protection, in accordance with user requirements online smooth upgrade to 2.5 G capacity, ran to their heart to build a 155 M transmission ring network, According to the needs of network users, the capacity is adjusted to form a transmission network system of business interconnection between stations.

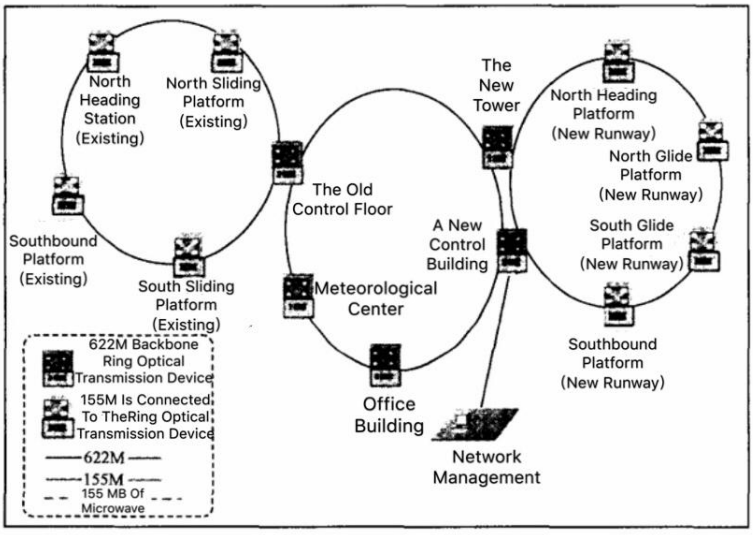

FIG. 2 Schematic diagram of the transmission network

According to the analysis of the figure above, five backbone ring j optical transmission nodes of 622 M and eight access ring optical transmission nodes of 155 M are built in the transmission network system. Because there are many types of air traffic control services at airports, the practice of air traffic control is independent. Therefore, nodes in different areas need to be separated by physical and VLAN to ensure the reliability and security of data transmission. At the same time, you need to provide redundancy backup for important components to ensure that a fault in any area of the system does not affect services. In the dual-runway fiber backbone ring network, the new ATC building will be used as the main station to centrally process services. In this case, the two-fiber unidirectional channel protection ring should be selected as the self-healing scheme, as shown in the following diagram:[12.13]

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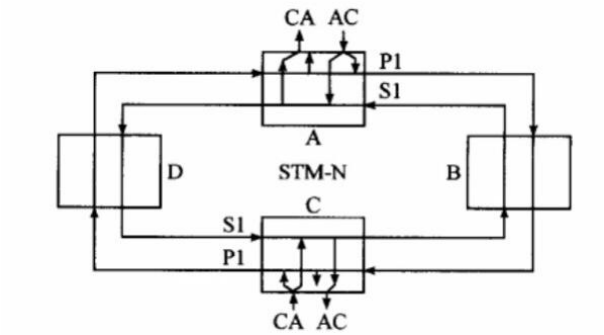

FIG. 3 Schematic diagram of two-fiber unidirectional channel protection ring

3. Result analysis

From the current our country the construction of the airport atc communication transmission network application perspective, the nationwide widely synchronous digital system construction technology, double continuously optimize the airport runway communication transmission network planning and design level, can provide technical basis for internal staff at the airport, and to protect the safety of aircraft operation performance in the practice exploration. In addition to the synchronous digital system proposed in this paper, scholars at home and abroad have also proposed other technical means, such as the application of digital communication technology in IPRAN network and the digital communication technology carried by the entire IPRAN network. Nowadays, network has become the basic content of communication operators, which is widely used in the construction and management of transmission network system. Because IPRAN network is based on IP network protocol and packet multiplexing as the core, it can dynamically control the practical data transmission process, while the traditional network operation has great complexity and ambiguity. However, the use of IPRAN network can provide users with sufficient high bandwidth resources and possess strong statistical reuse ability. Therefore, in the future technological innovation, Replacement of the new network network is only a matter of time, believe that with the improving of the scientific research and technology level, to enhance professional scholars research, airport atc communication transmission network in our country, the inevitable can build more quality management system in practice to explore, to fully demonstrate the application value of the theory of a new era of advanced technology in the new period, the social environment of construction development with Chinese characteristics.

4. Conclusion

To sum up, in the continuous improvement of Chinese airport air traffic control system information level, the special network of airport air traffic control communication has higher and higher requirements for intelligent and digital service functions. Due to the transmission network is the foundation of communication private network construction management content, the working efficiency of the transmission network directly affects the communication private network development level, so, in the face of the system requirements for more and more high, the airport atc communications staff want to combine the development of communication technology research, will mature synchronous digital system used in construction work. From the perspective of practical research, the construction and application of this technology can not only improve the capacity and rate of the airport air traffic control communication transmission network, but also ensure that the service transmission will not be interrupted according to its self-healing ability, providing basic guarantee for the safe and effective operation of the airport. At the same time, Chinese researchers should continue to strengthen the construction of airport air traffic control communication and transmission network system, focusing on the combination of existing science and technology to provide more perfect transmission system and service functions.[14.15]

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