

## On the development of the aircraft electrical fault diagnosis system

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**Abstract:** aircraft electrical fault diagnosis system has always been a very important and widely used engineering technology in China. In recent years, electrical automation has attracted more and more attention. In fact, the integration of electrical automation technology is conducive to the further optimization of aircraft electrical fault diagnosis system and the further improvement of fault diagnosis efficiency. Therefore, in the development of aircraft electrical fault diagnosis system, the extensive promotion and application of electrical automation fusion technology is an important development direction in the future. Now, electrical automation fusion technology has been applied to a great extent in the field of aircraft electrical fault diagnosis in China, and its application effect is not what it used to be. However, there are still some deficiencies in the application, which need to be improved in the future. Here, we will analyze and discuss how to effectively use electrical automation fusion technology in aircraft electrical fault diagnosis, and put forward some feasible application methods. I hope to provide some constructive suggestions for this subject.

### 1. An shallow analysis of the overall engineering design concept

In recent years, the aircraft structure has become more complex and the difficulty of aircraft electrical troubleshooting is increasingly [1]. Aircraft electrical fault diagnosis system has always been a very important and widely used engineering technology in China. In recent years, electrical automation has begun to receive more and more attention. In fact, the application of electrical automation fusion technology in the aircraft electrical troubleshooting system can help to further optimize and further improve the aircraft electrical troubleshooting efficiency.

From the perspective of the overall aircraft electrical troubleshooting system design concept, the following elements:

#### 1.1 Effective remote control of the equipment of the aircraft fault diagnosis system through electrical automation

The essence of this technology is to achieve remote control of the aircraft troubleshooting system in the form of computer terminal. This is effective for reducing the economic cost of electrical troubleshooting. At the same time, it can also effectively overcome some difficulties and defects caused by the spatial distance in the fault diagnosis. However, the deficiency of this method is that its fault diagnosis effect is prone to the change of communication volume or communication signal, which causes some errors in fault diagnosis. Therefore, this method is generally only used for the relatively simple fault diagnosis, but it is unrealistic for the more difficult fault diagnosis.

Where is the idea of combining the specific electrical automation with the aircraft troubleshooting system? Above the structural arrangement, we adopt a hierarchical and distributed structure, which consists of several units and networks. Below we introduce these units and networks, respectively.

Process control: it is directly and specifically applied in each link of production, to effectively achieve the monitoring of the relevant equipment within the system, such as the operating status. Then through effective monitoring, to achieve the most fine control for the whole production process.

Workstation: This is mainly manual and computer interface set for staff. Its value is that: if we conduct the maintenance operation, we can receive the information and instructions from the

process control unit from the workstation, and the engineers can also use the operation of the workstation to conduct various settings and maintenance of the troubleshooting system.

Thus, the effective combination of process control and the workstation functions as well as possible.

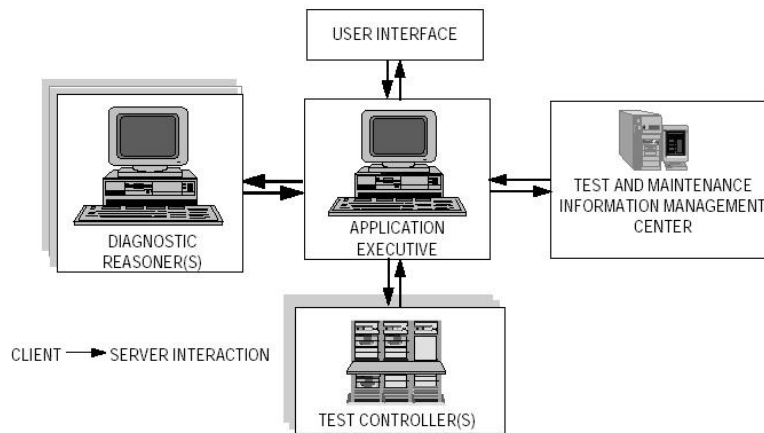


Fig.1 Typical diagram of the aircraft troubleshooting system

## 1.2 Centralized monitoring achieved effectively through electrical automation

The essence of this technology is to achieve the monitoring work of all the project technology through the same set of monitoring equipment. When we realize this technology, we can not only simplify the operation steps, but also make the routine management, maintenance and other links easier, and the requirements for the operating environment are significantly lower than other means. Therefore, according to our current national conditions, its use in electrical engineering can be said to be of considerable use value. Also, it also avoids too much processing equipment, which has also compressed the materials needed in the project. In this way, the economic cost and labor cost of the whole project can be effectively compressed, and also significantly improve the quality of the project.

## 1.3 Effectively monitoring the site bus through electrical automation

In the monitoring of this perspective, through this technology, we can provide the necessary technical tools for the maintenance site, so it is very targeted, so that the maintenance quality has also been optimized. Generally speaking, this plays its advantage in the site overhaul. And the optimized measures can be selected according to the needs of the project to reduce the maintenance cost, coupled with the technology has better flexibility, so the safety of the project to a large extent.

## 2. Brief analysis of the specific application advantages

The application characteristics of electrical automation in aircraft fault diagnosis, or the application advantages are mainly manifested in three aspects: automation, cost and efficiency. First, in automation, this is also the most distinctive and advantageous aspect of the application of the technology. In fact, this technology is not unfamiliar with most people, not only in the aircraft fault diagnosis, people are also somewhat exposed to automation related technology, and in the aircraft fault diagnosis, its automation advantages can be more obvious. Through the automatic operation of this machinery, it integrates a lot of technological components. Secondly, in terms of cost, it is through the integrated application of this technology that the labor cost of human resources can be greatly reduced. In addition, the technology has been developing in China for decades, and the cost of integrating the technology is also gradually decreasing. In a word, through the operation of the technology, enterprises on the one hand can through its greatly save the cost of manpower, the overall pay has been reduced, on the other hand, the cost of the enterprise investment will also gradually from human investment in science and technology, which is also conducive to the

transformation of the enterprise itself, is fit the policy, from this hand, electrical automation for aircraft fault diagnosis, and more a far-reaching significance. Finally, in terms of efficiency, it can undoubtedly greatly improve the efficiency. On the one hand, some originally need to invest a lot of manpower to complete a lot of computing, large digital calculation and some mechanical repetitive work and some very tedious detection work can be solved through this technology, and the technology application can also greatly improve the data calculation processing time, the same tedious workload, through automation technology can be far beyond the human calculation time, so has been greatly improved in speed. On the other hand, the automation technology is through the set program, so that, as long as the program is accurate, the error rate will be greatly reduced, even near zero, and without some very low mistakes, and the reduction of the error rate, will greatly save the time to eliminate and correct. The increase of speed and the reduction of error rate, both together promote the rapid growth of their efficiency.

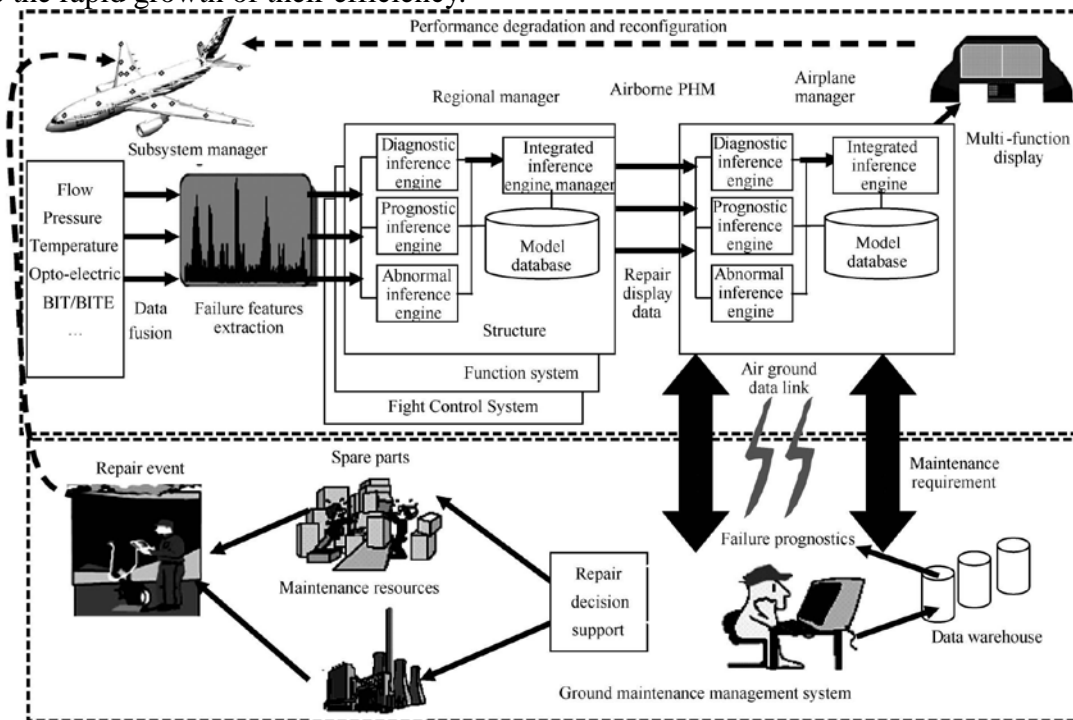


Fig.2 Figure of the troubleshooting flow

### 3. Brief analysis of the application means of aircraft fault diagnosis

#### 3.1 Overview of the troubleshooting system

Aircraft electrical failure refers to the loss of function or error in a link of the aircraft electrical system, which may be potential logic design defects, component damage, or occasional failure. There are two main classification methods for aircraft electrical faults. (1) partial and complete faults according to incapacity. The local fault is that the aircraft has lost some working capacity, but is still able to provide part of the electrical support for the aircraft system, only reducing the use performance. A complete failure means that the aircraft is completely disabled. (2) The consequences are divided into general faults, serious faults and fatal faults. General faults refers to local faults that can be timely or impossible in the operation of the aircraft. A serious fault is a complete fault that cannot be resolved during aircraft operation. Deadatal failure is a failure that causes significant damage or heavy casualties to the aircraft.

#### 3.2 Brief analysis on the application in electrical engineering management

Electrical automation technology is widely used in the management process of aircraft fault diagnosis, data collection and management in electrical engineering can be effectively realized through system programming and debugging, data analysis and system monitoring can effectively

reduce the possibility of system failure, and effectively control the cost of equipment maintenance while improving the reliability of electrical engineering maintenance. Electrical automation technology is widely used in electrical engineering management. Through automatic programming, it can effectively collect, manage, analyze and monitor the data in electrical engineering, and timely prevent and alarm the system failure, so the possibility of system failure is greatly reduced. At the same time, it also reduces the cost of manual maintenance and maintenance of the system.

#### **4. Brief analysis of the specific application methods**

##### **4.1 Integration of electrical automation and relay protection devices**

From the perspective of view of the main role of relay protection, we can see that when the electrical system produces some bad conditions, like faults, short circuits, etc., the alarm can be quickly generated, so that those connecting equipment are cut off in the shortest time, so that the relay protection can be performed.

For the relay protection devices we have used in the past, the past failure rate is always high. For example, misoperation, rejection, etc. and so on, and the use of electrical automation, different equipment operation parameters in the aircraft electrical system can be included into the scope of control. Long time live work can also be performed through remote monitoring to detect possible faults or abnormalities in the device. At the same time, the effective application of this technology can also realize the real-time monitoring of some corresponding electrical equipment or lines within some specific range in the electrical system. If an abnormal or fault is detected, a continuous rescue response can be issued in the first time.

##### **4.2 Application of power grid dispatching in the maintenance link**

In the specific maintenance operation, a variety of internal equipment should be coordinated for effective operation, so as to ensure the need of power supply in the maintenance. patching of the grid is needed here. Therefore, the realization of grid dispatching automation technology is not only conducive to the real-time dynamic monitoring of the electrical system during operation, to ensure the safe and stable operation of the electrical system, but also to analyze the detailed data comprehensively on relevant data, making the operation of the maintenance system be clear, and then improve the reliability and safety of the power system as a whole. Thus to meet the technical needs of the operation.

##### **4.3 Fusion application in the decentralized measurement and control system of the power plant**

In the aircraft maintenance activities, the effective integration and application of electrical automation technology is basically carried out by hierarchical distribution, including multiple subunits such as ethernet, process control and data high-speed communication network. We will introduce this separately.

Process control unit: its main function is to apply directly in the production process to realize the real-time dynamic monitoring of the relevant equipment in the system, and finally realize the effective control of the whole production process.

Workstation: Set up the interface for our operation, including manual and computer types. Through the workstation, the information, instructions, etc. issued from the process control unit can be effectively received. In the receiving link, the maintenance of the system is achieved at the same time. These two are operating in conjunction to make the workstation functional.

#### **5. Strengthen the management and application of distributed photovoltaic power supply information**

##### **5.1 Key points**

For the distributed power point information foundation, we must improve its management

strength, the power point must be distributed. Other things to be done are implementing distributed power point information annotation in the production PMS 2.0, in the line Maintenance and emergency repair as a safety risk point control, and included in the category of work ticket management.

## **5.2 Key safety control points**

1) Shall strictly check the commissioning and acceptance of the parallel grid inverter of the above power supply. The commissioning and acceptance of the grid-connected inverter must be implemented by the company or unit qualified to meet the national requirements, control and standardize the function of the parallel connection interface, standardize the function test process and check the function test of the grid-connected connection interface to prevent the occurrence of reverse power transmission.

2) Strict control and relevant safety protection and isolation should be implemented for the disconnection equipment of the parallel outlets. For example, if the working environment is high pressure, it is necessary to check the network to find out whether it has a disconnection point. That side of the grid requires a smooth ground; but if the working environment is low pressure, the distributed power supply will be checked, especially the network disconnection. It is also required for a protection function on low voltage, and other safety protection technical measures should be selected in reference to standards and experience.

3) Install the anti-isolated island protection device. In some specific cases, distributed power supplies sometimes appear in the island operation state, for which case, technicians should install the anti-island protection devices in advance. The protection equipment is usually used in the 220V/380V grid, usually at the low voltage bus in the power generation system, usually in the photovoltaic power system and maintenance circuit and related equipment; between the main switch and anti-island device, for example, when the bus is connected, the circuit breaker will also lock with the anti-island device.

## **6. Analysis of the future development direction**

According to some of our current trends in the aviation industry, and combined with the further development and promotion of aircraft troubleshooting technology, the application of electrical automation will only be more and more widely used in the future. For the improvements in the aircraft, it is unmatched in the past, which makes the use of the aircraft safer than in the past. But now we should also realize that the integration of electrical automation and aircraft troubleshooting is still But we should also be aware that as these problems improve step by step, the troubleshooting level of the aircraft will get a leap that can not be achieved in the past. In general, the future development direction and level will inevitably be optimistic.

## **7. Conclusion**

No matter in China or the world, in electrical engineering, electrical automation integration technology has been more and more attention and more, and more and more widely used. In fact, the electrical automation integration technology facilitates the further optimization of aircraft fault diagnosis and the further improvement of electrical engineering efficiency. Its application effect is not today than before. However, there are still some deficiencies in the application, which we need to improve in the future use. It is of great significance to promote the overall economic benefits of the country, or to promote the improvement of people's daily quality of life. Promoting the modernization of electrical engineering is a crucial topic in China. Because the modernization of electrical engineering is related to the engineering quality and engineering efficiency of electrical engineering. This is more true for the aircraft. We need to constantly achieve more centralized breakthroughs.

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