Exploration and Research on Maintenance Support Mode of UAV System

Tan Yifang

Aviation engineering institute, Civil Aviation Flight University of China, Guanghan, Sichuan, 618307,China

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Abstract: UAVs currently play an important role in military operations. They can achieve remote control, which can effectively reduce costs and reduce casualties. Therefore, the application of drones is more and more extensive, and the corresponding technology is more mature. Based on this, this paper focuses on the analysis of the system maintenance and security details of the drone, and hopes to provide some reference for the related research on the maintenance of the UAV system.

1. Introduction

UAVs can realize unmanned driving by means of radio remote control equipment. Its main uses are divided into military and civilian applications. Civilian use is mainly used for aerial photography, agriculture, remote sensing, news reporting, infectious disease surveillance, etc. It is to achieve various functions such as intelligence detection and bombing. In the continuous development, the scope of UAV applications has been continuously expanded, and now it is possible to achieve highly intelligent control. This paper will focus on the system maintenance and support mode of military drones, and explore the mode of maintenance support for drone systems.

2. Features of drone maintenance support

From the current actual situation, the characteristics of UAV system maintenance support are mainly reflected in the following points:

1) The failure mode and the change of the interactive interface increase the difficulty of maintenance work. In the traditional drone maintenance, warning systems and instruments can be used to reduce the difficulty of the whole work, but the modern UAV flight system cancels the cockpit, so the information feedback of the drone is not so intuitive, so the overall inspection system needs Complementary ground equipment to complete. In addition, the corresponding operation methods and operation interfaces have also undergone major changes, and various types of faults are more complicated, which further increases the difficulty of maintenance maintenance of the drone system. In the current UAV system, the dependence on maintenance is large. This is because the lack of pilot participation makes the drone no longer focus on personnel safety components in the design, and more importantly, it starts with economy and practicality. Although this reduces the cost of the drone to a certain extent, it also increases the risk of damage to the drone, so the entire drone system is more dependent on maintenance and fault diagnosis.

2) The design of the flight platform increases the difficulty of overhauling the drone. Today's UAV systems do not have a cockpit, so the overall inspection and maintenance space is greatly reduced, making the corresponding troubleshooting and routine maintenance more difficult. Moreover, since the UAV system relies on the aircraft platform for control, there are a large number of analog signals to control the servo action, which makes it more prone to various complicated faults, and the maintenance time is further extended.

3) Complex UAV systems place higher demands on the level of maintenance personnel. The modern UAV system needs to rely on ground control to realize the whole flight process. Therefore, more computers are installed on the aircraft to realize functions such as information control and information collection. This requires drone maintenance personnel to have information technology. More skilled, able to effectively find problems through computer serialization and upgrade. Of course, this also brings about an increased risk of the operation of the drone system, and the technical state

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control difficulty of the entire maintenance guarantee is greater than that of the manned machine. Moreover, most of the current drones use advanced body structure design, and maintenance support personnel are required to comprehensively inspect the entire state of the drone, and at the same time effectively analyze whether the composite material is damaged or not.

4) The intelligent management requirements increase the difficulty of maintenance maintenance of the drone system. Although the cost of small drones is relatively low, and most of them are seen as consumables. However, from the current development trend, UAVs are moving towards intelligent and modular directions. Therefore, it is necessary to build a system that guarantees maintenance so that UAVs can effectively achieve their strategic goals. Especially for the group operation of the drone, the operator must pre-judicate in advance whether the drone can complete the task, and at the same time effectively carry out the assignment of the maintenance support task, so that the drone system can be better. Serving people.

3. UAV maintenance support mode

3.1 maintenance system

The maintenance of the drone is mainly divided into the maintenance of the base level and the maintenance of the base level. It belongs to the repair and maintenance of the drone at different levels. The maintenance at the grassroots level is that the logistics support department provides the in-situ maintenance service for the drone according to the relevant requirements. At this time, it is judged according to the ability of each team to provide. The entire level of maintenance at the grassroots level includes electronic equipment, environmental system failures, data links, sensors and other aspects, of course, including maintenance and approval. Generally speaking, in the maintenance of the base level, it is mainly to check the specific working conditions of the detachable system on the drone, and to repair the lines and components of the aircraft, as well as the timing replacement parts of the aircraft and the compliance of various technical instructions. Judgment [1].

Depot-level maintenance is primarily concerned with failures that cannot be addressed at the base level, such as SRU (Workshop Replaceable Unit) and LRU (Operating System Algorithm) fault detection. In the maintenance of the base level, it is necessary to isolate and repair the problem parts, and send the repaired parts to the warehouse for safekeeping. In general, depot-level maintenance has a fixed location and is a higher level in the maintenance mechanism.

3.2 Storage system

The storage and maintenance support system of the UAV system also has a large relationship. When the mission is not performed, the UAV system will be stored, which can reduce the impact of the environment on the UAV system and prolong its service life. At the same time reduce the cost of daily maintenance support. In the daily training, you can use the analog form, or you can increase the small number of drones appropriately, so you can reduce the demand for human resources.

During the storage period, the UAV system must be repaired and maintained in a targeted manner. At present, the electronic technology is relatively mature, so it is possible to know the status of the UAV in real time according to the status monitoring, and ensure that the storage requirements are met. In general, the storage of the drone system should be as low as possible, while also meeting the usual training needs. From the actual situation in other countries, when the drone is not applicable, it will be stored in a closed container, so that the humidity and temperature can be effectively adjusted, and the status of the drone can be learned through various monitoring. [3]. At present, the United States, Sweden and Germany have great success in the UAV storage technology, and their dehumidification system can effectively protect the weapons and equipment on the UAV.

3.3 Base airport system

Base airport is the key to ensure the smooth take-off and landing of drones. Different UAV systems have different needs for the construction of base airports, which are mainly divided into the following aspects:

(1) Runway. The take-off of the drone has high requirements on the runway and requires reasonable design. For example, the length of the runway, the grade of the road and the obstacles of communication must be considered within the scope. If the requirements are not met, it may cause the take-off or landing failure. Directly affect the normal operation of the drone system.

(2) Maintenance support system. The normal operation of the drone is also inseparable from the maintenance support system, which needs to provide logistical support for the flight of the drone, such as fuel refueling and emergency power generation.

Specifically, the base airport system of the UAV system provides logistic support for the flight of the UAV, and it needs to be designed according to the various parameters of the UAV to ensure that the actual needs are met. For the military bases that have been prepared, the base airport of the UAV system is fixed, with specific personnel configuration, and the design of the entire base airport is also regulated, so that the normal use of the UAV system can be effectively ensured.

3.4 status monitoring

Compared with ordinary aircraft, the biggest feature of the drone is that there is no driver, but it has to face complex environment, so it must have the ability of self-detection and self-diagnosis, so as to improve the safety of flight. Especially when repairing a drone, if the fault cannot be located, the workload will be greatly increased. Therefore, state monitoring is essential in the maintenance and protection of drone systems. Condition monitoring monitors the flight parameters of the drone based on past flight experience and the operating specifications of the entire UAV system, and covers the entire phase from start to finish, thus effectively enhancing UAV status monitoring. Effectiveness. Combined with the current situation, the state monitoring of military drones should meet the following functions:

(1) Unsafe marking function. The state monitoring system should effectively monitor the operating state of the drone, and judge whether there is a fault according to the feedback of the parameters. Once the fault occurs, it must be effectively marked to make an alarm for the potentially unsafe or unsafe part to facilitate subsequent maintenance.

(2) Task system identification. Status monitoring also effectively identifies whether each system can perform tasks and marks them at the same time, which facilitates remote control.

In the state monitoring of the UAV system, BIT is very commonly used. It can also be divided into maintenance BIT, startup BIT and continuous BIT. They are used to monitor the software and hardware failure of the drone, and can also be timely after the problem occurs. Isolation, which can effectively improve the safety of the operation of the UAV system. In addition, BIT technology can also prevent virtual alarms. It can collect and store fault data according to the data's own analysis, so that it can form a diagnostic expert system and lay the foundation for scientific independent judgment. From the perspective of the more developed UAV system, the forecasting and condition monitoring system has been formed, which can fully evaluate the overall status of the UAV system, and even includes the power unit and electronic equipment. These are the UAV systems. The key to self-diagnosis [5].

4. Development trend of drone systems

The drone system was mostly used for military purposes at the beginning, and it can be used for multiple purposes such as investigation and strategic offense. In the subsequent development, the UAV system is more perfect, and the price is also greatly reduced. Therefore, it is no longer limited to military use, and has been widely used in geological mapping and aerial photography. Compared with the traditional, the UAV has a longer range, and some countries have realized the technology of drone refueling, which can effectively increase the range of the drone. Secondly, the maximum flying height of the drone has also been significantly improved. In this respect, the US military's drone is relatively advanced, and its navigation altitude is far higher than other countries, so it has a great advantage in ensuring combat missions. In addition, the modern UAV system has also significantly improved in terms of flight speed, and can effectively break through the defense line and achieve strategic strikes. From the specific data of 2018, the output value of the global UAV system has

reached 15 billion US dollars, which is nearly 30 times higher than that of 20 years ago, which has driven the development of supporting industries [6].

Because the modern UAV system has higher technology, he is also more convenient in terms of maintenance support. On the one hand, the UAV can feedback the fault point itself, and then the maintenance and repair and replacement of parts by professional maintenance personnel. On the other hand, the modern UAV system is more modular. In order to achieve efficient operation, its various parts can be effectively independent. This can continue to run even if it is partially damaged during the execution of the task. A major breakthrough in drone technology. In the future development, the UAV system will be more advanced, can effectively achieve various combat tasks, and at the same time, it will further broaden the field in civilian use. Correspondingly, the maintenance support of the UAV system will be more perfect, laying a solid foundation for the normal operation of the UAV.

5. Conclusion

UAVs currently have more important military uses, and have formed a complete system in the continuous development. For developed countries, the technology of the UAV system is very mature, can provide strong support for actual combat, and the corresponding maintenance support mode is also more advanced. Therefore, China should also speed up the research on the maintenance and repair of the UAV system. Based on the experience of other countries, we should improve it as soon as possible to create a maintenance system for the UAV system that is suitable for our military.

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