Analysis and Research on Aviation Power Operation Mode

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Abstract. Aviation power operation can effectively improve the efficiency and safety of power grid operation and maintenance. It has become the trend of the world's power operation field. Its operation modes are mainly divided into helicopter power operation and drone power operation. Helicopter power operation modes include helicopter power inspection operations, helicopter charged water flushing operations, helicopter live maintenance operations, helicopter infrastructure construction operations, and helicopter laser scanning operations. The drone power operation mode includes drone inspection work, drone clearing operation, and drone construction work. With the development of technology, the coordinated inspection mode based on helicopters and auxiliary aircraft will become the future development trend.

1. Introduction
The safe and stable operation of power systems is related to social stability and economic development. Governments and power companies all pay close attention to the operation and maintenance of power grids, improve the quality of power grid inspections, minimize potential risks, and ensure safe and stable operation of power grids. With the development of social economy, the labor cost continues to rise, and the operation and maintenance mode of the power grid has been transformed from traditional manual inspection to aviation power operation. Nowadays, aviation power operation has become the trend of world power operation.

The aviation power operation mode has experienced three stages: helicopter inspection, helicopter power operation and drone power operation. Reviewing the development of aeronautical power operations, aircraft performance and grid operation technology are important drivers of the transformation of aerospace power operations. With the gradual maturity of information processing technology and UAV application technology, the coordinated inspection mode based on helicopters and auxiliary aircraft will become the future development trend.

2. Helicopter power operation mode

2.1. Helicopter power inspection
Helicopter power inspection refers to the advantage of using helicopters with strong maneuverability, coupled with advanced photoelectric detection equipment, and professional technicians carry out inspections on the transmission line body and corridor environment. Helicopter inspection lines have strong ability to detect hidden defects, and they have strong advantages in detecting harmful defects, and they have obvious advantages in the inspection of defects above the bottle mouth.
2.2. Helicopter charged water washing operation
Helicopter charged water flushing refers to the use of a helicopter as a platform to install a high-pressure water gun to clean the heavily polluted areas and insulators of the transmission line, which can effectively reduce the degree of contamination of the insulator and reduce the chance of flashover trips.

2.3. Helicopter live maintenance
Helicopter live maintenance refers to the method by which the operator uses the helicopter to directly enter the equipotential to complete the maintenance work. It has the characteristics of high efficiency, quick operation and flexible operation, and overcomes the shortcomings of traditional manual work subject to terrain factors, which can effectively improve the line operation and maintenance efficiency.

2.4. Helicopter infrastructure construction operation
Helicopter infrastructure construction refers to the use of helicopters to carry out operations such as hoisting towers, lifting materials, and guiding ropes. The construction of helicopter infrastructure construction in China is relatively late, but with the construction of domestic super- and ultra-high-voltage power grids, the development of helicopter infrastructure construction is in great demand, and great progress has been made in material transportation, guide rope display, tower assembly and so on.

2.5. Helicopter laser scanning operation
Helicopter laser scanning refers to a laser scanning system equipped with a helicopter as a platform to acquire 3D laser point cloud data of the measured area, and generate relevant data and analysis reports through data processing and analysis to realize intelligent and visual channel operation and maintenance. Laser scanning technology has high measurement accuracy and can avoid the influence of high-altitude terrain and dense vegetation on data acquisition, which can significantly improve the overall level and capability of power grid survey and design.

3. UAV power operation mode

3.1. UAV inspection
The drone inspection mainly refers to the precise inspection of the multi-rotor UAV tower and the inspection of the fixed-wing UAV. The multi-rotor UAV is mainly flying at ultra-low altitude, hovering at each level of the tower, and taking 360° accurate photographs of the level insulators, fittings, wires, and ancillary facilities; the fixed-wing UAV patrols the line channel environment. Collect hidden danger information outside the channel protection area, master the relevant data of trees, buildings and cross-overs in the protected area.

At present, the application of the UAV inspection technology on the transmission line is mainly for the detailed inspection of each equipment body. First, the inspection of the failure of the transmission line. Transmission line failures are often accompanied by harsh weather conditions and complex on-site conditions. UAVs can effectively and quickly perform fault finding and accurately locate faults. The second is the acceptance of transmission line engineering. Utilizing the characteristics of maneuvering and flexible, close-range detection of line equipment, the application of UAV to the acceptance of transmission lines can improve the acceptance efficiency and reduce the labor and accident probability. The third is the maintenance of the transmission line. UAVs use their unique visual and high-altitude advantages to complete line equipment inspections, and important patrols of trees, houses, rivers, etc. in the passages to provide reliable imagery for maintenance operations.

The drone inspection technology greatly improves the efficiency of line operation and maintenance while making up for the lack of manual inspection. With the development of accurate, efficient and diversified airborne equipment, and the development of patrol operations in the direction of individualization, and then to the long-distance transmission line three-dimensional modeling,
inspection image data independent analysis, drone inspection Transmission line operation and maintenance bring about essential changes.

3.2. UAV clearing operation
In recent years, accidents caused by foreign matter floating outside the transmission line have increased, which affects the safe and economic operation of the power grid. In order to prevent line accidents caused by hidden dangers, in addition to increasing patrols and propaganda efforts, in the case of hidden dangers, in accordance with the traditional methods of clearing the barriers, it is necessary to urgently apply for line power outages and manual aerial work to remove the towers and remove them. Time and manpower, material resources, financial resources, as well as large personal safety risks and grid security risks. The use of drones to eliminate the safety hazards caused by foreign objects floating outside, the efficiency is higher, and the safety is better.

At present, there are generally three methods for applying a drone to remove foreign objects within a power company. First, the drone fires. The use of drones equipped with fire-breathing equipment, close contact with the flutter, shortening the original hours of clearing time to a few minutes, not only improves work efficiency, but also reduces human risk. The second is the removal of unmanned electromechanical hot wire. Install the heating wire on the drone and control the temperature of the heating wire by adjusting the voltage to change the current. The high temperature electric heating wire is used to blow foreign matter such as a streamer or a kite line that surrounds the power line. The third is the drone robot to clear the barrier. The robot uses a folding mechanism and a fish thread transmission mechanism, and the cutter uses ceramic materials to effectively prevent arcing and reduce overall weight, and to ensure the normal operation of the drone and the control system.

3.3. UAV construction work
Helicopters have certain safety risks in the construction of complex transmission lines such as “three-span”. The use of drones to guide the ropes can effectively solve such problems, which can not only greatly reduce the labor intensity, but also maximize the degree of labor. Reduce damage to the environment.

Due to the limited amount of unmanned aircraft, the main application in electric power construction is the application of guiding ropes and construction process control. One is to apply the guiding rope. The use of unmanned aerial vehicle traction lines can cope with various complicated deployment environments such as crossing and crossing, and directly send the traction line to the tower, which greatly improves the work efficiency. The second is the construction process control. Using fixed-wing UAVs with long battery life, fast response speed and accurate route, all parts of the construction process are patrolled and photographed, and a large amount of construction data is obtained to realize the whole process control in the construction of the transmission line.

4. Conclusion
China's aviation power operations started late, and there is a certain gap with advanced foreign countries. In recent years, domestic power companies have actively carried out research on aeronautical power operation technology through introduction and self-research, but limited by factors such as weak aviation foundation, aviation control and insufficient aviation personnel reserves, domestic aviation power operations are still only in the power inspection stage, with electricity Techniques such as operations and infrastructure construction have not been promoted and applied. With the development of domestic UAVs and emerging technologies such as “Dayun Wuzhi”, domestic power companies should actively explore helicopter and UAV collaborative inspection modes and intelligent inspection modes.

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