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Research on the improvement of aircraft load and balance

Lin Yan[1], Lin Miao[2]
[1](School of Air Transportation, Shanghai University of Engineering Science, China)
[2](Department of Mathematics, Minjiang University, China)
Corresponding Author; Lin Yan

Abstract: *Aircraft load and balance is the key role of the airline's ground business operation. Improper load and balance of the aircraft will lead to overloading and deviation of the center of gravity of the aircraft from the normal range, which will directly affect the flight safety. Therefore, it is necessary to explore the countermeasures and methods to improve the load and balance of aircraft from various angles and aspects.*
Keywords *–aircraft, load and balance, flight safety*

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I. INTRODUCTION

Aircraft load and balance is the key role of airline ground business operation, which directly affects flight safety. The National Institute of Aeronautics and Astronautics of the Netherlands recently studied the unsafe events related to aircraft load and balance in the world from 1970 to 2018, and found that there were 85 flight accidents with complete records related to load and balance in these years. The worldwide accident rate related to load and balance is still rising slowly, and the global flight accident rate has decreased by nearly 50% in these years. Therefore, in order to ensure flight safety, it is necessary to pay attention to aircraft load and balance.

II. TASK OF AIRCRAFT LOAD AND BALANCE

Aircraft load and balance is to accurately calculate the carrying capacity of each flight according to the relevant performance data and fuel weight of the aircraft. On this basis, according to the passenger and cargo compartment layout of the aircraft, reasonably load the cargo, luggage, mail and arrange the passenger's seat so that the center of gravity of the aircraft can meet the requirements under the conditions of taking off, landing and no fuel, and maintain a good balance. On the one hand, the work of aircraft load and balance can ensure the "optimization" of aircraft load, avoid the waste caused by "no-load", and improve the operational efficiency of civil aviation transportation enterprises; on the other hand, make the center of gravity of the aircraft in an appropriate range, which is not only convenient for pilots to control the aircraft, but also ensure the flight safety.

III. IMPACT OF AIRCRAFT LOAD AND BALANCE ON FLIGHT SAFETY

If the aircraft load and balance work is improper, including: load and balance calculation error, inaccurate original data used, no load and balance calculation, defects in the company's internal control system, weight calculation error, distorted information transmission, poor loading supervision, improper load and balance arrangement, wrong telegram sending, etc., it will directly lead to flight safety problems. The specific hazards of improper load and balance of aircraft can be classified into two categories: overload flight and deviation of aircraft center of gravity from normal range.

3.1 Harm of overloading flight

The only benefit of overloading an aircraft is that it increases the rate of descent (it drops faster). In addition, the following side effects will be caused, as follows:
larger take-off speed, longer take-off run distance, smaller climb rate, smaller climb gradient (climb angle), smaller lift limit, shorter range, smaller cruise speed, greater stall speed, greater landing speed, greater landing run distance.In the critical stage of take-off or landing, the above effects will seriously endanger flight safety in some cases.

3.2 Harm of aircraft center of gravity deviation from normal range

When the center of gravity deviates from the normal range, the aircraft in flight will lose stability and operability.

The stability of aircraft refers to the characteristic that when the aircraft is slightly disturbed and deviates from the original state in flight, and after the disturbance disappears, the aircraft can automatically restore the original balance state without the pilot's control. Here small disturbance refers to: the fluctuation of air flow, the imbalance of engine operation, the accidental touch of rod and rudder by the pilot, etc.

The maneuverability of an aircraft is the characteristic that the aircraft changes its flight state following the action of the pilot's joystick and pedals. In order to change the original balance state and realize the change of takeoff, landing, turning and other flight states, the aircraft must have maneuverability.

Because the aircraft must have both operability and stability, the center of gravity of the aircraft after load and balance must be within the front and rear limits.

IV. MEASURES TO IMPROVE AIRCRAFT LOAD AND BALANCE

4.1 Study on human factors affecting aircraft load and balance

Aircraft load and balance work needs to be completed by employees. There are many factors that lead to aircraft load and balance errors, and the psychological state of employees is often the main or direct factors, such as fluke psychology, blind self-confidence and paralysis psychology, flaunting psychology, shortcut psychology, boredom of work, bad mood and excitement, psychological tension, etc. It is necessary for airlines to analyze the human factors that affect the safety of aircraft load and balance, and to seek countermeasures from multiple perspectives.

4.2 Strengthen the training of load and balance

Load and balance related training includes aircraft performance engineering, aircraft balance principle, load and balance calculation method, load and balance of common aircraft types, computer load and balance principle, hazards caused by overloading or exceeding the center of gravity of aircraft, load and balance case analysis, etc. The training of foreign airlines on load and balance of an aircraft generally takes 4-7 days. The qualified person shall be issued with a certificate of authorization, which is generally valid for one year and shall be retrained upon expiration. However, domestic airlines are generally not so strict, and the CAAC does not explicitly require the load and balance personnel to be certified. Therefore, it will bring great potential safety hazards. In view of this situation, both the management and airlines should be aware of the importance of load and balance training. It is necessary to list a type of work in civil aviation vocational skill appraisal, require to work with certificate, and regularly assess their qualifications.

4.3 Establish and improve the load and balance control system

In view of the improper performance of aircraft load and balance, airlines should strive to establish and improve the load and balance control system. Including: aircraft load and balance scheduling system, aircraft load and balance manual management system, aircraft load and balance document management system, aircraft load and balance checklist control system, computer load and balance system control system, aircraft load and balance audit review system, aircraft load and balance information control system, cargo and board weight control system, load and balance Balanced telegram receiving and sending system, aircraft loading inspection and supervision system, aircraft load and balance emergency plan, etc. Through these rules and regulations, the improper prevention, control and emergency disposal of load and balance work can be achieved.

4.4 Research and development of computer freight loading system

At present, the computer system used by domestic airlines for load and balance is mainly used to calculate the center of gravity of the aircraft, which is powerless for cargo selection and distribution in the cargo compartment. The distribution of cargo load is still mainly by hand, which to a certain extent inhibits the realization of the requirements of fast, accurate and safe aircraft load and balance. Therefore, it is necessary for the industry to concentrate resources to develop the corresponding computer freight loading system.

4.5Strengthen the emergency training of crew members

When using simulator training for flight crew, airlines should include training in special situations such as unexpected load and Balance errors. At the same time, it should be stipulated that the crew must review the aircraft load and center of gravity data submitted by the load and balance personnel.

V. CONCLUSION

In a word, aircraft load and balance is a more complex system. Airlines need to comprehensively use a variety of management methods to improve the ability of civil aviation system to resist unsafe load and balance behaviors and conditions and ensure flight safety.

REFERENCES

[1]. Han Mingliang, Zhao Guihong. Production organization of civil aviation transportation. Tianjin: Tianjin Science and Technology Press, 2001

[2]. Xu Gang, Analysis on the safety of cargo aircraft load and balance [J]. Air transport business, 2007 (12).

[3]. Zhao Tingyu. Pilot aviation theory course. Chengdu: Southwest Jiaotong University Press, 2004.