Chapter 12
Model of Calculating the Weight and Centering of the Airship With Measurement Errors

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ABSTRACT

In this chapter, the authors present an imitation model for calculating the weight and centering of the airship, taking into account the errors that arise in the process of determining these parameters. Also in this chapter there is the analysis of existing means, methods, and methods for determining the weight and alignment of the airship in domestic airlines and air companies. The authors made the research of the sources of errors and identified their types. This chapter provides a new model of the takeoff weight and balance of the aircraft determining process, as well as the weight distribution of passengers law. These materials allow simulating one of the main operations in the preparation for departure process.

INTRODUCTION

Flight safety is a complex character that reflects both air transport and aviation operations safety; it determines the ability to operate flights without a threat to health and life of people (Flight Manual).

The important task of providing safety of air transportation is the correct calculation weight and balance of the aircraft. While loading the airplane it is necessary to take into account two factors:

- Operational weight of aircraft;
- The position of its center-of-mass.

Structure of some lightweight aircraft provides centering in possible limits placing the load at different locations, however, the majority of aircraft have the strict load charts.

The incorrect distribution of load can cause:

1. Decrease flight performance when overloaded;
2. Decrease aircraft controllability at the displacement of the center of gravity;
3. Overloading leads to increasing the sluggishness and decreasing rate of climb and also to the stalling speed increase.

Performance of climb would get worse if an increase in the rate of climb is ignored. Ignoring other characteristics would even cause the catastrophic results.

BACKGROUND

For in order to determine what characteristics must satisfy the model we are developing, we have conducted an investigation of existing automated systems used in aviation. In works Shmelova (2005), Artemenko (2010) is presented the model of the choice of a spare aerodrome, as well as the importance of the question of the correct calculation of all parameters of the flight for safe flight performance. The issue of decision-making by the operator of the air navigation system is considered in the works Harchenko et al. (2011, 2012), Sikirda (2004), the authors of these works built the model of decision making by the operator of complex systems. The intellectual decision-making systems are considered in the works Gerasimov (2007), Gluhih (2000), Moskvichov (1998), Nedelko (2002). The main task of these works is in order to increase the safety of flights, the intelligent modules - decision support systems, in which the information support of the aviation operator is realized, should be included in the composition of the automated air traffic control systems (ATC).

Analysis of the Causes of air accidents for forty-three years, given in Kasak (2010) shows that the culprit of disasters in the 50% of cases is the aircraft crew. Overload of the aircraft occurs in the 0,8% of such cases.

Analyzing aviation events according to the site Aviation Safety Network Database that is related to the wrong loading and centering of aircraft (AC) over, we set next reasons that led to it, we illustrated it in Figure 1.

In spite of different repetition of reasons for passenger and freight transportations, they have an approximately identical influence on the safety of flights. Unsupported loads are more often observed at freight transportations. The conditions of origin of these events are that all standard sizes (weight of passengers, the weight of members of a crew, weight, and density of fuel and oil and others like that) undertake for a calculation. If there are the errors during a calculation related to an inexact determination of these sizes.

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