UDC 656.71:656.08(043.2)

A. F. Barna
Student of Faculty of Transport, Management and Logistics,
National Aviation University
D. V. Medynskyi
Assistant of Faculty of Transport, Management and Logistics,
National Aviation University

JUSTIFICATION OF THE INFORMATION BASE OF THE OPTIMIZATION MODEL OF FAILURE OPERATIONS AT THE AIRPORT

Manufacturing process control is impossible without information about the state of the control object and changes in the external environment. The composition and content of information, the routes of its movement can significantly affect the choice of management decisions, the response of the management system. The production of an airline is characterized by a large volume and constant direction of transmitted messages, which form information flows. These streams are based on operational information. In fig. 1. shows a diagram of the main information flows of the airline. A disruptive situation, especially in case of massive accumulations of aircraft, is characterized by a surge in the amount of information processed at the enterprise. This is caused by additional instructions, messages, approvals, regulations. Note that the elimination of the investigated production failure at the airport belongs to the operational control zone [1].

Analysis of the decision-making system inherent in aviation enterprises, allowing to highlight the following distinctive features of operational management:

- maximum detail of situations;
- the smallest, in comparison with other types of management, the duration of exposure and the lifetime of the decisions made;
-maximum requirements for response time and timeliness of decisions.

These features determine the basic requirements for the initial information used in operational management: completeness, accuracy, timeliness [2]. All ground services of the airport are involved in preparing the aircraft for the flight, as a result, even the elementary information of a separate service can be very significant and affect the entire further course of production [3].

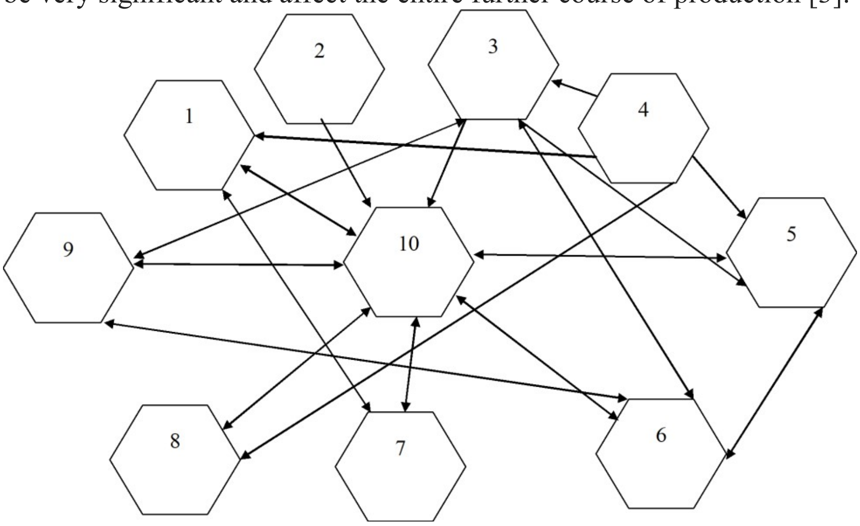

Figure 1. Scheme of the main information flows at an operating airline:
1 - airfield control point; 2 - metrorological service; aviation technical base; 4 - service for organizing passenger transportation; 5 postal - freight transport organization service; b - special motor transport service; 7 - communication center; 8 - daily flight plan; 9 - service for the provision of fuels and lubricants; 10 - production dispatching service [4].

The methods for constructing an optimization model and an optimization experiment developed in this chapter also demonstrate the high informational significance of each individual element of an enterprise [5].The interdependence of all airport subsystems determines the multiple use of data in the production process, necessitates the creation of a single information base. Accuracy and timeliness requirements predetermine the need to maintain an information base in real time, which allows you to respond promptly to deviations during production [6]. The same requirements determine different discreteness of updating the taken into account parameters.

The creation of a system in which the processes of processing information and maintaining arrays are functionally and organizationally separated from each other, determines the organization of data in the form of files oriented not to specific tasks and characterized by the static and rigid binding to specific programs, but to the description of the physical processes taking place in the corresponding services [7].

At the same time, multiple duplication of data is eliminated and a dynamic information model of the airline is organized, providing collective access to the stored data. For the automated solution of production management problems in failure situations, not only operational information is needed that characterizes the current state of the production process, but also regulatory information. This determines the storage in the Infobase along with operational and regulatory and reference data.

Taking into account the above, in order to solve the assigned tasks, it is possible to develop an information base that includes operational and normative data that characterize the work of each service at any time necessary for making decisions in failure situations time. Such an information base will ensure better coordination of airport services in a failure situation, and reduce the number of requests and approvals [8].

Development of a methodology for determining the economic efficiency of the optimization system

To analyze the functioning of the model, a methodology for assessing the expected economic effect from its implementation has been developed. Was taken the assumption that the source of savings is a decrease in losses in a failure situation.

When calculating the damage, the losses of the enterprise from ticket refunds, downtime of aircraft, losses caused to the enterprise by the delay of subsequent flights operated by base aircraft, and losses from the inactivity of air passengers as labor resources were taken into account.

The determination of the possible savings Ep for each i-th malfunctioning situation can be made if the values of losses for each priority for each 1-st type of aircraft are known after the opening of the airport:

$$E = \sum_{l=1}^{Mi} (\text{U}_{pl} - \text{U}_{ml}) \quad (1)$$

where *Up* is the damage caused during the implementation of the priority of servicing determined by the head; *Um* - damage from the priority of servicing obtained using the mathematical model; *Mi* is the number of types of detained aircraft in the i-th malfunctioning situation, The annual savings can be determined by summing the prevented damage for all L malfunctioning situations for the year:

$$E = \sum_{i=1}^{L} \sum_{l=1}^{Mi} (\text{U}_{pl} - \text{U}_{ml}) \quad (2)$$

The calculation using this method is very laborious, therefore, a statistical approach can be used. Since the parameters of failure situations are very different from each other, it is advisable to average the savings per type 1 aircraft.

The average savings per Type 1 aircraft can be obtained by considering five typical failures for the facility where the model is implemented. When considering the production situation, it is necessary to take into account the specific schedule, data on the status of alternate destination airports, and crew working hours. The average savings for one failure situation of the 1st type of aircraft was determined by the formula:

$$E = \frac{\sum_{i=1}^{K} (\text{U}_{pl} - \text{U}_{ml}) \times N_{li}}{\sum_{i=1}^{K} N_{li}}, \quad (3)$$

where N_{li} - the number of aircraft of the 1st type, detained in the i-th situation, K the number of failure situations per year.

Annual savings E, is determined after counting the number of failures recorded *during the year:*

$$E_y = \sum_{i=1}^{L} \sum_{l=1}^{Mi} E_{pl} \times N_{il} \quad (4)$$

The indicator of the annual economic effect was determined by the formula:

$$E_y = E_y - E_s W, \quad (5)$$

where W - one-time costs for the design and implementation of the mathematical model; Es- standard coefficient of economic efficiency.

Conclusions. The conducted research allows formulating the following scientific conclusions:

The analysis of the disruption of the aircraft movement according to the schedule to the airport was carried out, which made it possible to classify the failure situations arising at the airport due to the violation of the flight schedule.

It is proved that the elimination of emerging failure situations requires the solution (individually or jointly) of the following tasks:

- optimization of the sequence of servicing and release of delayed aircraft;
- optimization of the destination of expected aircraft on flights with late arrival;
- maximizing the readiness of delayed flights for departure when the airport is closed.

A systematic analysis of the production management process at the airport in a failure situation has been carried out, which made it possible to determine the main factors that must be taken into account when optimizing the process of restoring traffic according to the schedule. It is proved that the influence of a number of factors depends on the time interval for the restoration of the movement according to the schedule.

The methodology and criterion for optimizing the process of restoring the movement according to the schedule are substantiated. The optimization technique consists in developing a special optimization model and conducting optimization experiments. As an optimization criterion, the use of the total costs of the airline associated with the elimination of the consequences of flight delays is justified.

A list of general and specific requirements in the optimization model has been formed. Distinctive requirements for the model are the ability to take into account the dynamics of factors influencing the optimization, the calculation of the optimization criterion in real time and adaptation to computer implementation.

The structure of the information base and the methodology for constructing an optimization model have been developed, the distinctive features of which are the allocation of the controlled and control parts, the block for simulating external influences, the presence of feedback between the output and the control part of the model. The use of this technique can significantly simplify the process of creating an optimization model.

A technique for constructing an optimization experiment plan has been developed, the distinctive features of which is the use of an experiment plan close to the hyper - Greek - Latin square. The plan provides for determining the economic efficiency of the optimization model.

References:

1. Road transport of Ukraine: state, problems, prospects of development. K: State Enterprise "DerzhavtotransNDIproekt", 2005. 400p.

2. Aksenov I. M. Improving the efficiency of passenger traffic, taking into account foreign experience. *Railway transport of Ukraine.* 2005. №2. P.82-86.

3. Aksenov I. M., Janowski P. O. Organization of passenger suburban transportation. K.: QUETT, 2002. 69 p.

4. Al-Maya Ahmad Khalifa. Research of normative-legal base in systems of separate types of transport. *Bulletin of the Engineering Academy of Ukraine.* 2010. №3-4. S.151-155.

5. Al-Maya Ahmad Khalifa. Perspectives of Ukraine in the programs of the European community. *Problems of transport: Collection of scientific works.* 2010. №7. P.255-259.

6. Al-Maya Ahmad Khalifa. The results of the Eurasian transport initiative. *Problems of a systematic approach in economics: Collection of scientific works.* 2010. №35. P.75-80.

7. Artynov A.P., Kondrat'ev G.A. System analysis of the processes of transport interaction in the region and in transport hubs. *Automation of processes of interaction of transport systems in Vladivostok: Far East Scientific Center of the Academy of Sciences of the USSR*, 1983. pp. 25-38

8. Artynov A. P., Skaletsky V. V. Automation of planning processes in the management of transport systems. M .: Transport, 1981. 208 p.