

EFFECTIVENESS INDICATORS OF MODELING THE AIR SITUATION

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I. INTRODUCTION

Simulation of the air situation is aimed at ensuring the most accurate reproduction of the real situation at various levels of radar information processing. Reproduction of the air situation with high accuracy in aviation training complexes is necessary for the high-quality conduct of training for the flight management group and combat control officers.

Therefore, when modeling the air situation, it is important to achieve the required values of effectiveness indicators of its modeling, which is determined by the ability to simulate the situation of the required complexity with a high degree of accuracy and reliability. To assess the effectiveness of modeling, first of all, it is required to substantiate the indicators for which this assessment will be made.

The purpose of the work is to substantiate the effectiveness indicators of modeling the air situation, characterizing its accuracy and reliability.

II. THE SOLUTION OF THE PROBLEM

Effectiveness indicators of modeling the air situation at the level of primary processing of radar information. At the output of the subsystem for the primary processing of radar information, data on the primary radar measurements (radar marks) are generated, containing the measured values of the observed parameters of the detected air targets.

The main observable parameters of the detected air targets include: the coordinates of the air target (slant range to the target, azimuth and elevation of the target relative to the radar station) and the radial speed of the air target relative to the radar station.

Measurements of the observed parameters are random variables with corresponding probability distribution laws. Consequently, the simulated situation at the level of primary processing of radar information should ensure that the distribution laws of the probabilities of measurements of the observed parameters coincide with those distribution laws that correspond to the tactical and technical characteristics of the radar station.

When simulating an air target of a given type, it is also necessary to form the law of the distribution of the amplitude of the echo-signal received by the radar station, which provides with a high probability the detection, measurement of parameters and identification of the air target.

The main characteristics of a radar station that affect primary measurements are: viewing area; review period; range and angular resolution; the accuracy of determining the coordinates of air targets [1].

To make a decision on the accuracy and reliability of modeling the air situation at the level of primary processing of radar information, a statistical decision criterion can be used with a given confidence level and a given confidence interval on the correspondence of the signal parameters of simulated air targets to the parameters of echo-signals of real air targets, taking into account the characteristics of the radar station.

Effectiveness indicators of modeling the air situation at the levels of secondary and tertiary processing of radar information. At the levels of secondary and tertiary processing of radar information, the same data composition is formed – time-related trajectory information about single and group air targets. The difference lies in the scale and completeness of the data on the air situation. Evaluation of the effectiveness of the simulation of the air situation can be carried out on the basis of particular indicators of the information capabilities of the radar station, the spatial and accuracy characteristics of the trajectory information, the characteristics of the continuity of the trajectory information, as well as the characteristics of the reliability and completeness of the trajectory information [2].

As well as for the level of primary processing, to make a decision on the accuracy and reliability of modeling the air situation at the levels of secondary and tertiary processing of radar information, a statistical decision criterion can be used with a given confidence level and a given confidence interval on the correspondence of the simulated air situation indicators to the considered indicators real air situation.

The effectiveness generalized indicator of modeling the air situation is a numerical measure of the correspondence of the real result obtained during the simulation to the required result. In this case, the real result is a random variable. This indicator has the physical meaning of the probability of meeting the requirements for modeling the air situation, in general, taking into account the requirements for the

performance indicators of modeling the air situation at the levels of primary, secondary and tertiary processing of radar information.

Figure 1 illustrates the proposed system of effectiveness indicators of modeling the air situation.

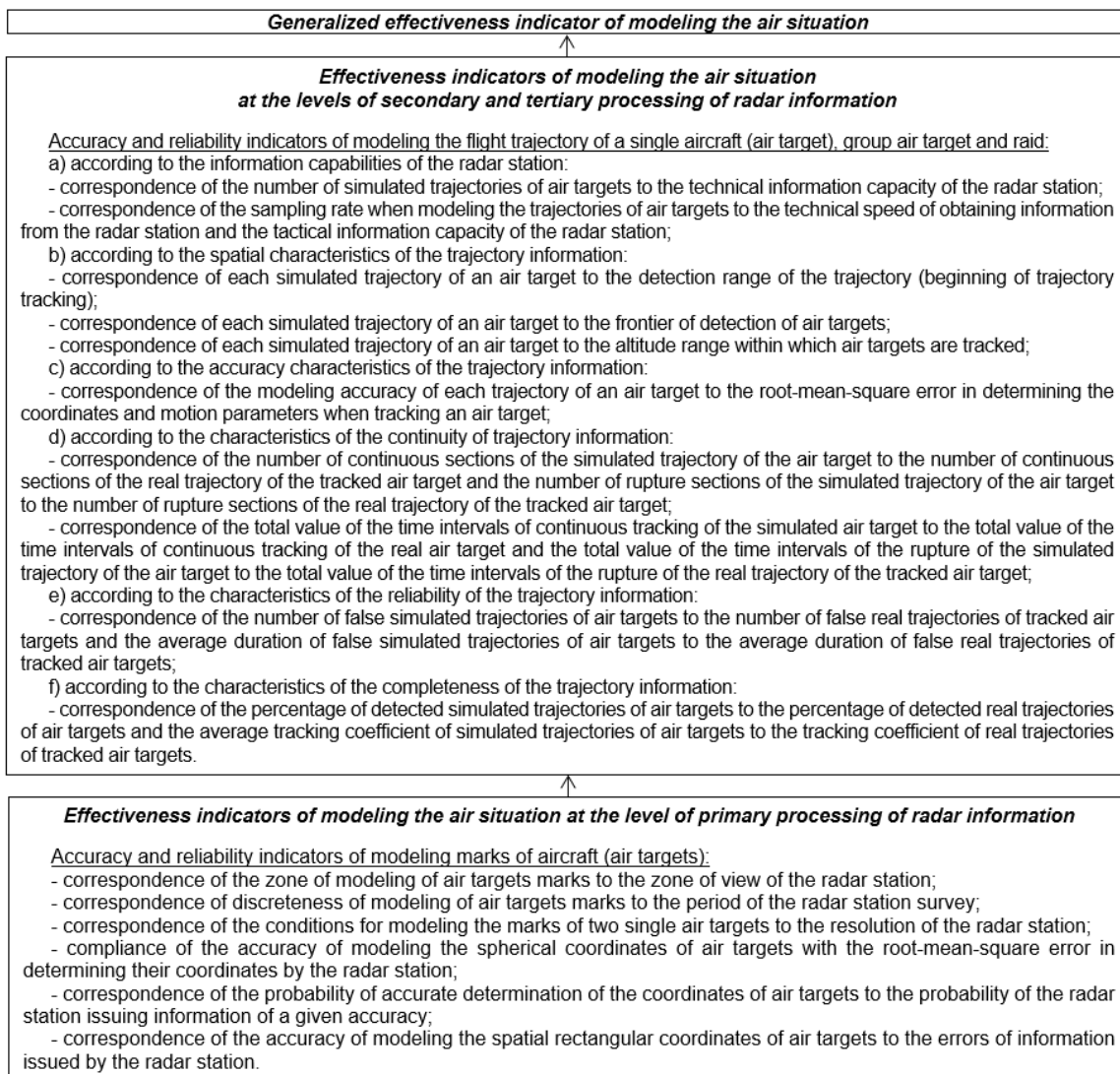


Figure 1. The system of effectiveness indicators of modeling the air situation

III. CONCLUSIONS

As a result of the studies carried out, the indicators of the effectiveness of modeling the air situation were substantiated. These indicators characterize the accuracy and reliability of modeling for the levels of primary, secondary and tertiary processing of radar information, in particular, and the effectiveness of modeling the air situation, in general. The correspondence of the quantitative values of the accuracy and reliability indicators of modeling to the values of the quality indicators of the processing of radar information determines the effectiveness of the modeling. At the same time, the main feature characterizing the effectiveness of modeling the air situation according to the indicated indicators at the level of primary processing of radar information is the correspondence of the signal parameters of the simulated air targets to the parameters of the echo-signals of real air targets, and the main feature characterizing the efficiency of modeling the air situation according to the indicated indicators at the levels secondary and tertiary processing of radar information is the correspondence of the motion parameters and trajectories of simulated air targets to the motion parameters and trajectories of real air targets.

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