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MERGING PRIMARY DATA OF JOINT AIR SPACE SURVEILLANCE SYSTEMS

D.B. PAVLOVA^{1*}, G.E. ZAVOLODKO^{2}, I.I. OBOD^{3***}**

^{1.} Aspirant, Department of Information System, NTU "KhPI", Kharkiv, UKRAINE

^{2.} Associate Professor, Department of information systems, Candidate of Engineering Sciences, NTU "KhPI", Kharkiv, UKRAINE

^{2.} Doctor, professor, Department of Microprocessor Technologies and Systems, Kharkiv National University of Radio Electronics, Kharkiv, UKRAINE

*email: *Pavlova.D.Borisovna@gmail.com, **Ann.Zavolodko@gmail.com,

*** prof.Obod@gmail.com

The basis of the airspace control system information support is surveillance systems [1,2], which can be either distributed or combined. To improve the quality of information support for decision makers in the airspace control system, the surveillance systems information is being processed. Data processing from surveillance systems is divided into primary, secondary and tertiary [3]. The merging of these airspace surveillance systems is usually carried out at the tertiary processing stage [4]. So, in [5], data integration for several sensors of surveillance systems in air traffic control was studied and it was shown that the creation of redundancy of information and software support can improve the accuracy of tracking air objects and resistance to sensor errors.

[6–9] described a set of algorithms that combine primary radar data and Identification Friend or Foe (IFF) systems data. Algorithms for data preprocessing that are used to remove false radar targets are described and IFF data preprocessing is induced. The described merging algorithms include alignment of coordinates of air objects obtained from various sensors, correlation between contacts, initiating tracks, updating tracks and processing hypotheses of tracks.

In this paper had been considered the option of merging primary radar data and IFF systems at the primary data processing stage.

As shown in [4], the integral indicator of the quality of information support for an airspace control system with the existing option for data fusion can be the probability of information support, which, for the general case, can be written as

$$P_{\text{inf}} = D_{PR} \cdot D_{IFF} \cdot P_{\text{per}} \cdot P_{\text{obe}} \cdot P_{\text{por}},$$

where D_{PR} - probability of correct detection of an air object by primary radar , D_{IFF} - probability of correct detection of an airborne IFF system, P_{per} - probability of correct flight information transfer by IFF system, P_{obe} - probability of combining coordinate and flight information IFF system, P_{por} - the probability of comparing the coordinate information of primary radar systems and IFF systems.

Probability comparison of coordinate information of primary radar systems and IFF systems P_{por} and acts as the probability of merging data of the considered information systems.

In the proposed option of data fusion, which is carried out at the stage of primary data processing and, therefore, joint detection of airborne objects by two channels is carried out, the integral indicator of the information support quality for users can be the probability of information support, which is defined as:

$$P_{inf} = D_{00} \cdot P_{por},$$

where D_{00} - probability of detecting an air object with the considered option of data merging.

The paper presents calculations of the probability of information support for consumers of the airspace control system with the considered merger model of primary radar systems and IFF systems as a function and shows that for the signal-to-noise ratio of the primary radar and IFF systems of component 0.6 with a signal-to-noise ratio of 2.3 the probability of information support for the existing model of data fusion is only 0.05. At that time, for the proposed model of data fusion, the probability of information support is 0.8; 0.88 and 0.92 with the availability factor of the aircraft responder IFF system equal to 0.8; 0.9; and 1, respectively.

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