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Analysis of the existing classification of potentially conflict situations for air traffic controllers simulators

As the practic shows, the classification of PCS currently used has its drawbacks which make it difficult to use them in the automatization of simulator training. Therefore,we consider the the classification of the PCS which was proposed by A.Nedelko according to the requirements for its application in air traffic controllers simulators.

First of all, the necessary to introduce a new classification of potentially conflict situations was caused by the necessary to systematize possible situations in the air, and to highlight the most preferable ways to solve the specified potentially conflict situation (PCS). In the designation of this classification, it was taken into account that it will greatly facilitate the creation of exercises for controller's simulators.

The existing classification used by the UkSATSE has a fairly branched view. However, many items of this classification can be combined, because the possible ways of solving conflicts are similar.

Complexes of the new generation allow the student to evaluate independently without the participation of an instructor. It is made on the basis of a comparison of the applied method of solving PCS with the methods determined according to the classification. For this reason, it makes sense to simplify the existing classification, since the more it is branched, the more difficult it is for the artificial intelligence of the simulator to determine the type of PCS. An example of the training systems of the new generation is the Fusion complex, developed in Flight academy of the National Aviation University (FA NAU).

Let us represent the positions of two aircraft in the horizontal and vertical planes. Relatively to each other, they can be on passing or oncoming tracks, in an alternate profile or at one height. For a more visual display, let's present an updated classification in the form of a table.

We will explain the information given in Table 1

- horizontal marked trend change the provisions of the aircraft in the vertical plane;
- vertical marked trend change the provisions of the aircraft in the horizontal plane,
- in the body tables letter index marked with a variety of situations mutual location.

Table 1

A combination of options change the provisions of the armed forces at different classes of conflicts

	Same-direction traffic	No change	opposite traffic
Same-direction traffic	**A**	**B**	**C**
No change	**D**	**-**	**E**
Opposite traffic	**F**	**G**	**H**

Let us consider each option:

Same-direction movement

In this version of the movement speed aircraft are different, it is the speed of the back of flying aircraft has a great speed in the horizontal plane.

A - both aircraft move in passing direction in both planes (figure 1, figure 2). that is, and vertical and horizontal planes vectors movement of both aircraft sent in passing direction (aircraft are in the climbing or descending, with flying takes place at the for same-direction tracks).

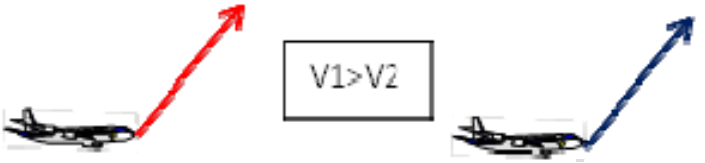

Figure 1 Same-direction traffic – climbing

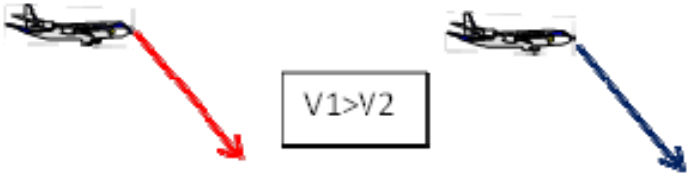

Figure 2 Same-direction traffic - descending

B – in horizontal plane both aircraft move on same-direction courses without changing the height of flight (horizontal flight), that is, we have the situation

compression in horizontal flight (figure.3). This PCS can occur at all stages of flight from departure in the airport of departure ending with flight on final to the airport destination. Since at the moment there is a huge amount of different types of aircraft, the controller must be constantly monitor trends to reduce the horizontal interval in the process of compression.

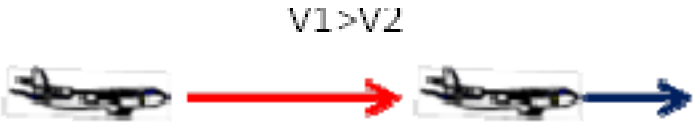

Figure 3Same-direction horizontal traffic

C – in horizontal plane aircraft move on same-direction courses, and in the vertical plane - meet each other, ie vectors movement aircraft directed such a way that in horizontal their direction the same, and in the vertical they intersect (figure 4). This example presents a classic situation climbing-descending, which often occurs in the areas TMA when there are departure and arrival of aircraft through one corridor.

Figure 4 Same-direction traffic – crossing the FL

Next we consider the options PCS when the horizontal interval does not change, that is the speed of aircraft horizontal are equal.

D - in this situation at a constant horizontal interval, vectors movement in the vertical plane of both the aircraft are in the same direction (figure 5).

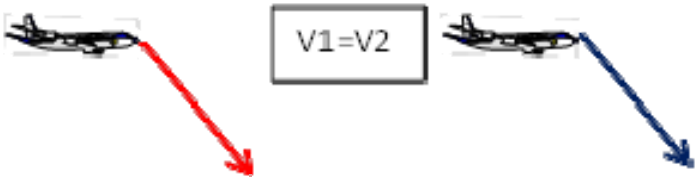

Figure 5 Same-direction vertical traffic

E - in this situation at a constant horizontal interval, vectors movement aircraft in the vertical plane aimed at the opposite direction (figure.6).

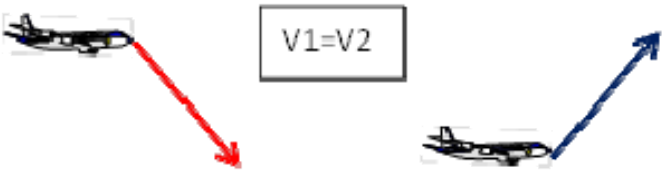

Figure 6 Opposite vertical traffic

Next we consider the options opposite traffic:

F - both aircraft move on the oposite courses, and in the vertical plane - in the same direction, that is horizontal vectors movement aircraft directed towards one another, and in the vertical plane is stored same-direction of motion vectors, that is both aircraft at the same time are either in the climbing, or in the descenfing (figure 7 and figure 8).

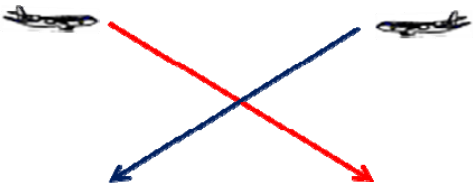

Figure 7 Opposite traffic – simultaneous descent

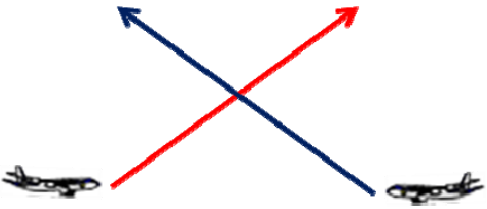

Figure 8 Opposite traffic - simultaneous climb

G – in horizontal plane both aircraft move on the opposite courses without changing the height of flight (figure 9). This situation is characterized by rapid decrease in the horizontal the distance between the aircraft and requires a quick decision-making resolution PCS, as there is no safe vertical interval.

Figure.9 Opposite traffic - no change in the height of flight

H - both aircraft in the horizontal and vertical planes are moving in opposing directions, that is vectors movement converge (for vertical and horizontal plane). This situation is characterized by rapid decrease in the horizontal and vertical

distance between the aircraft and requires a quick decision-making in the process of resolution PCS (figure 10).

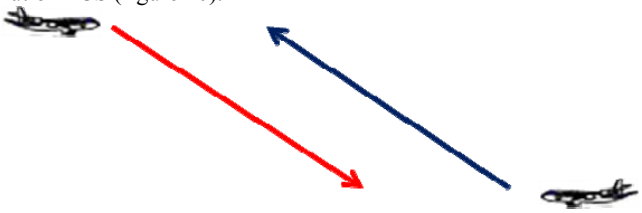

Figure 10 Opposite traffic in the horizontal and vertical planes

Classification of PCS used by UkSATSE is too detailed. This makes it formalization difficult to implemented in view of complexity create algorithm determine the class PCS for controller's simulator. When using the proposed us classification scheme determine the class PCS becomes much easier that makes it easier to the process of creating simulators with a high level of automation.

References

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