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A.V. Zemlianskyi, N.A. Salo, I.Yu. Unhul
(Flight Academy of National Aviation University, Ukraine)

Fusion modulating complex decision-making support subsystem overview

The issues of organizing the automatic fixation of violations in the modeling complex of the air traffic controller Fusion are considered. Safety, regularity and conditional efficiency evaluation criteria are taken into account

The automatic recording of violations is a distinctive feature of the Fusion modulating complex (MC) and allows to form a preliminary assessment of the exercise completion. The automatic recording comprises of many parameters and includes the following components:

Safety assessment is based on the guidance documents' demands regarding maintaining separation. For the purpose of identifying separation violations an aircraft safety zone model was developed. The aircraft safety zone is a cylinder, the center of which is the aircraft (figure 1). The size of the safety zone depends on the structure of the airspace and the guidance documents' demands, which regulate the norms of separation.

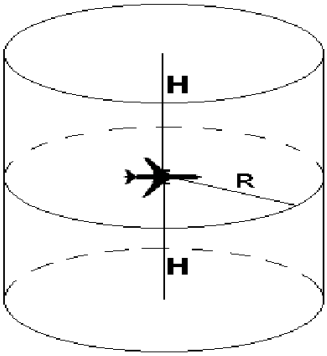

Fig. 1. Spatial safety zone model in MK Fusion

Different aircraft safety zone parameters can be used, if needed, during the exercise formulation.

The learning mode and the decision-making support module (DMSM), during viewing conflict situations, allow to visualize the aircraft safety zone for easier perception and understanding for the instructor. The safety zone on MC Fusion version 1.511 is shown on figure 2.

The regularity assessment is formed based on recording the parameters of the aircraft exit from the responsibility zone, and their comparison with the present (planned) parameters. The regularity assessment pursues two goals: to prevent the exercise from collapsing and forming the skill of maintaining the given aircraft traffic parameters in the zone of responsibility.

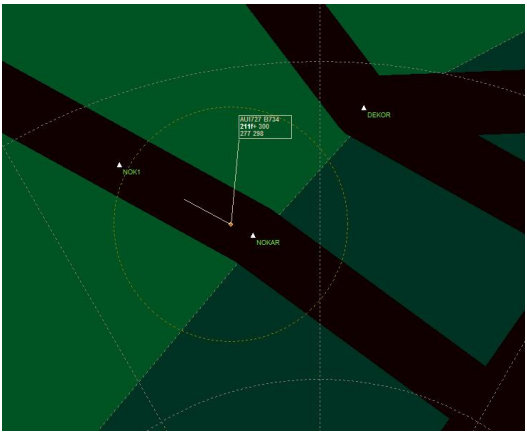

Fig. 2. Safety zone in MC Fusion

The regularity assessment is comprised of 3 parts:

- Consistency with the parameters in the horizontal plane. After the aircraft exits the zone of responsibility, the program checks the distance from the preset point of exit to the factual one. If the allowed deviation is maintained, then the parameter is considered maintained. If the deviation is greater than that allowed, a violation is recorded, if the deviation is 3 times greater then the allowed deviation, a severe violation is recorded.
- Consistency with the parameters in the vertical plane. After the aircraft exits the zone of responsibility, the program checks the distance from the preset point of exit to the factual one. If the allowed deviation is maintained, then the parameter is considered maintained. If the deviation is greater than that allowed, a violation is recorded, if the deviation is 3 times greater then the allowed deviation, a severe violation is recorded.
- Consistency with the parameters of time. After the aircraft exits the zone of responsibility, the program checks the difference in the factual and preset time of exit. If the allowed deviation is maintained, then the parameter is considered maintained. If the deviation is greater than that allowed, a violation is recorded, if the deviation is 3 times greater then the allowed deviation, a severe violation is recorded.

The value of the allowed parameter is defined by the instructor depending on the goals of the exercise. For the ease of perception of information, in MC Fusion (starting with version 1.511) viewing the allowed deviation is available, for the purpose of assessing regularity in the horizontal plane (figure 3). The assessment bears an advisory nature. The assessment of conditional cost-effectiveness aims to determine the efficiency of the chosen methods of resolving the potential conflict situations (PCS).

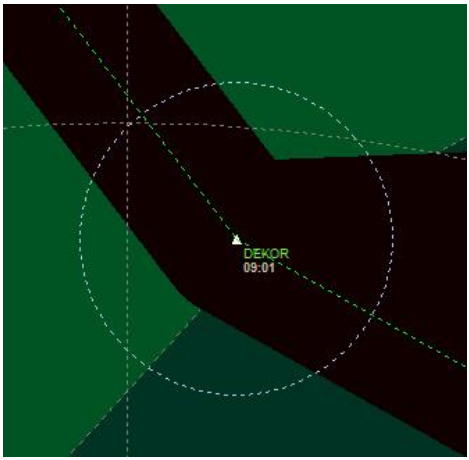

Fig. 3. Displaying the allowed deviation in MC Fusion

It is based on the conditional fuel consumption of each aircraft during horizontal flight. The fuel consumption is called conditional because it is not possible to model real fuel consumption for a chosen aircraft type, which in reality depends on many parameters: engine mode of operation and their technical condition, aircraft load and meteorological conditions. When the aircraft flight parameters (climbing, descending, velocity) are changed, the program records the time of each change (for example, an aircraft climbing). While forming the assessment, an increasing or decreasing coefficients, regarding the conditional consumption during horizontal flight, are applied to the consumption in each regime of flight. The cost-effectiveness assessment bears an advisory nature.

Thus, we can make the conclusion, that MC Fusion provides a wide array of decision-making support capabilities for air traffic controllers. Additionally, the open architecture of MC Fusion, its constant improvement allows to make the conclusion, that MC Fusion is suitable as an instrument for further research of decision-making support systems for air traffic controllers.

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