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DECISION-MAKING IN AN EXTRAORDINARY SITUATION SUCH AS PILOT INCAPACITATION

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Introduction. In the world of aviation industry, the occurrence of emergencies always confronts pilots and ATC. These situations demand immediate action and decision-making under significant stress and limited time. One of the most challenging scenarios of emergencies involves incidents of pilot incapacitation or inability to perform their duties. This scientific study is dedicated to analyzing the decision-making process in extraordinary circumstances and examining strategies and methods that can be utilized to enhance the level of safety and efficiency [1; 2].

Materials and methods. A comprehensive approach was utilized to analyze the decision-making process in extraordinary situations. Various sources, including real-life cases and expert evaluations, were utilized to analyze decision-making in emergency situations resulting from pilot incapacitation. Next, using the method of expert assessments, the sequence and duration of necessary operations in such situations was determined [3]. Furthermore, experts' agreement and dispersion levels for each factor were examined to assess consensus and heterogeneity in their assessments. The time needed to perform necessary procedures in the event of pilot incapacitation using the Expert Judgement Method is presented in Table 1.

Table 1. Structural-timing table of procedures

№	Opera-tion	Description of operation	Supported by	Operation (ordered)	t, c
1	a_1	Receive a message from the crew about the problems on the aircraft	-	b_1	5
2	a_2	Acknowledge the problems	a_1	b_2	5
3	a_3	Ask about the pilot's condition and ability to control the aircraft	a_1, a_2	b_3	20
4	a_4	Ask for the crews' intentions when the situation permits	a_3	b_4	14
5	a_5	Separate the aircraft from other traffic	a_4	b_9	35
6	a_6	Establish contact with airports to provide assistance	a_3	b_5	23
7	a_7	Establish contact with emergency and rescue services	a_3	b_6	14
8	a_8	Provide time for the crew to assess the situation	a_3	b_7	15
9	a_9	Support the flight experiencing problems with any information request	a_3	b_8	31

Results: Using the structural-time table, a deterministic decision-making model was developed for Air Traffic Control (ATC) as a network graph (Fig. 1). The model identified a critical time of T_{cr} =75 seconds for ATC actions and delineated the critical path as Skr = b1, b2, b3, b4, b9.

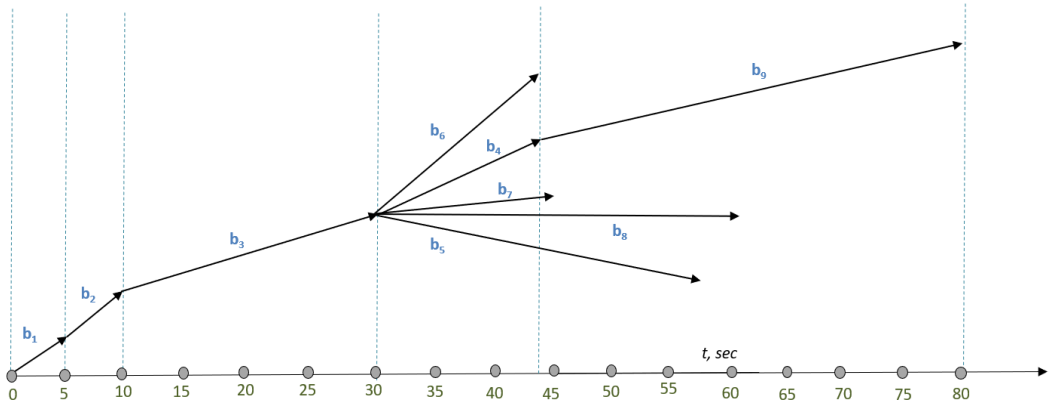

Fig.1. Network graph of the procedures

In situation, when there is no response from the pilots regarding their condition and ability to control the aircraft at operation b_3, activating the autopilot becomes necessary. The Aircraft Flight Control System (AFCS) facilitates this process by detecting pilot incapacitation through various sensors and monitoring systems, including gyroscopes, accelerometers, and GPS. Once pilot incapacity is detected, the AFCS automatically assumes control of the aircraft, maintaining specified courses and altitudes using the autopilot. The AFCS also includes auto-stabilizers to ensure flight stability by compensating for aircraft movements and oscillations. In certain scenarios, the AFCS can autonomously land the aircraft if equipped with automatic landing features and configured accordingly. Furthermore, integration with an Automatic Crisis Management System (ACMS) enables the AFCS to automatically transmit emergency information to aviation authorities such as ATC and emergency rescue services, depending on its configuration and capabilities.

Conclusion

In this study, decision-making in extraordinary situations such as pilot incapacitation was examined. A decision-making model was developed to effectively manage these critical situations and ensure flight safety. An integral part of this process is the ability to automatically switch to autopilot in the event of pilot incapacitation, facilitated by the Aircraft Flight Control System (AFCS). Therefore, its installation on board aircraft is important [4].

References:

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