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SIMULATION OF THE AIRBUS 380 EVACUATION

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ABSTRACT

A minute and a half, this is the given time to evacuate the aircraft in case of need after an emergency landing. This period is fixed no matter how many passengers are on board, no matter other considerations. The aircraft must be evacuated within 90 seconds. To improve current strategies and protocols for efficient evacuation, a comprehensive study of passengers' behavior should be conducted. This study includes the analyses of different scenarios that could happen during an accident and the definition each aircraft's characteristics, taking into account external factors that may affect the evacuation time. To develop such a study nowadays, object-oriented simulation tools are used. Simulation allows us to create a close system model, so every different scenario can be studied. We present a model to analyze different scenarios for evacuating an airbus 380. Our aim is to determine the best scenarios to be considered in those situations.

1 A380 SIMULATION MODEL, ASSUMPTIONS AND IMPLEMENTATION

For aircrafts with a capacity of more than 44 passengers, the evacuation, including members of the crew, is required under 90 seconds, and must be guaranteed on emergency conditions. The compliance with this requirement must be demonstrated using realistic simulations, using the test criteria indicated in Appendix J of CS-25, unless is found a combination of analysis and testing, to provide equivalent data thus the obtained in a real demo. Several studies have been done to analyze the risk factors on the cabins. As an example (Hsu & Liu, 2011), discuss the risk factors related to the structure of the airline cabins. On (Y.-H. Chang & Yang, 2010) the perceptions of the safety of passengers on a real accident are analyzed. From these analysis, it is clear that the procedures and the crew assistance are key elements in the airplane evacuation process. As an example, on (Y.-C. Chang, 2012) the differences between the safety on passengers with reduced mobility and regular passengers in case of accident is considered.
The model presented is based on an A380 airplane of AirFrance. The structure of the plane is composed by two main decks. The main deck is composed by 354 seats distributed in different spaces, 5 emergency exits on the right hand side of the aircraft, 5 more on the left, and 10 emergency ramps located at each door. The upper deck has 168 seats, 3 emergency exits on the right hand of the aircraft, 3 more on the left, and 6 emergency ramps located at each door.

The evacuation of the Airbus 380 is an emergency strategy that must assure that more than 500 people of the airplane are leaving as quickly as possible. The plane has 16 emergency exits, 6 of which are found on the top floor (upper deck) and 10 in the lower floor (main deck). The manufacturer has designed two independent routes of evacuation, one for each of the decks, avoiding the use of the internal stairs. To some experts, this independent evacuation is not possible because does not take into account the fear caused in passengers when jumping through the emergency chutes or sliding when the height is significant. In that sense, the upper deck slides have a height greater than 20 m. For this reason, the more efficient evacuation strategy would be one that combines the evacuation between the two plants. Hence in this project, we analyze the proposed strategy to evacuate an aircraft based on a strategy of two independent routes.

2 EXPERIMENTATION AND RESULTS ANALYSIS

After ensuring the model behaves as expected, we define a set of scenarios to analyze the evacuation protocols. We conduct 50 replication on every proposed scenario. We focus on the mean, minimum and maximum time needed for passengers to leave the plane. The results obtained from the experimentation are summarized in Table 1.

Table 1. Results obtained from the execution of the simulation model with the 50% of the doors operative. The time is presented in seconds.

	100% of the doors operative			50% of the doors operative		
	100 %	85 %	70%	100 %	85 %	70%
Mean time	38,29	33,24	28,17	58,94	51,36	43,50
Minimum time	3,81	3,84	3,73	3,95	3,96	4,17
Maximum time	101,59	88,334	72,24	152,16	160,66	115,43

Table 1 shows that we can detect that with less doors operative the variability of the model increases, becoming this factor a key element to consider if this is a good strategy. It has been observed that evacuating all passengers in less than 90 seconds is a very difficult task to fulfill. The reason behind this is there are many cases in which some factors increase the evacuation time (and its variability). Our results show first that the occupation is a factor directly related to the evacuation time. On one hand, the more passengers there are in the plane, the longer it will take to evacuate it and vice-versa. On the other hand, decreasing the number of emergency exits increases both the time to evacuate all passengers and the variability of the time needed to perform this evacuation. Second, after analyzing visually the model execution, we can conclude that passengers in the upper deck leave the aircraft before many other passengers located on the main deck. This suggest that some free resources (gates) in the upper deck could be used by the passengers located on the lower deck with a more elaborate evacuation plan. Finally, the graphical 3D representation of the tool can be used to teach the procedures and protocols used on an evacuation and to visually analyze new proposed alternatives.

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