



Chapter 65

Artificial Neural Network for Pre-Simulation Training of Air Traffic Controller

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EXECUTIVE SUMMARY

In this chapter, the four layers neural network model for evaluating correctness and timeliness of decision making by the specialist of air traffic services during the pre-simulation training has been presented. The first layer (input) includes exercises that cadet/listener performs to solve a potential conflict situation; the second layer (hidden) depends physiological characteristics of cadet/listener; the third layer (hidden) takes into account the complexity of the exercise depending on the number of potential conflict situations; the fourth layer (output) is assessment of cadet/listener during performance of exercise. Neural network model also has additional inputs (bias) that including restrictions on calculating parameters. The program “Fusion” of visualization of the state of execution of an exercise by a cadet/listener has been developed. Three types of simulation training exercises for CTR (control zone), TMA (terminal control area), and CTA (control area) with different complexity have been analyzed.

INTRODUCTION

Statistics data (Leychenko, Malishevskiy, & Mikhalic, 2006; Allianz Global Corporate & Specialty. EMBRY-RIDDLE Aeronautical University, 2014; Aviation Accident Statistics, 2018; Statistics of the World's the Largest Aircraft Accidents for the Years 1974-2014, 2018) show us, that causality of aviation accidents didn't change over the past decade: 70-80% of accidents and disasters happened due to human factor, and only 15-20% – through constructive and productive deficiencies of the aircraft. It is important to pay more attention to the training of aviation specialists because they are dealing with equipment that is becoming more complicated from year to year. Modern recommendations of International Civil Aviation Organization (ICAO) are to use information technology in aviation systems as in training as in operation (International Civil Aviation Organization [ICAO], 2007, 2008). Automation is seen as one of many resources available to the human operators, controllers and pilots alike, who retain the responsibility for management and direction of the overall Air Traffic Management (ATM) system. Additionally, unexpected or unplanned events must be a required part of planning and design when considering the systems that would replace the cognitive and adaptive capabilities of controllers or pilots. The development of training for automated systems is more difficult than for non-automated systems. One of the primary challenges in developing training for automated systems is to determine how much a trainee will need to know about the underlying technologies in order to use automation safely and efficiently. Course development based on a task analysis can be more effectiveness than traditional training development techniques.

BACKGROUND

Quality training of aviation experts, including specialists in Air Traffic Services (ATS), occupied the important part in reducing the influence of the human factor (European Organisation for the Safety of Air Navigation [Eurocontrol], 2004a). There are three types of air traffic controller (ATC) training, leading towards the issue and maintenance of an ATC license and associated unit endorsements. Initial training is the first type. ATC training phases (Figure 1) (Eurocontrol, 2004b, 2015):

1. Initial Training.
 - a. Basic Training.
 - b. Rating Training.
2. Unit Training.
 - a. Transitional Training.
 - b. Pre-On-the-Job Training (Pre-OJT).
 - c. On-the-Job Training (OJT).
3. Continuation Training.
 - a. Refresher Training.
 - b. Conversion Training.

Simulation Training is an important part of ATC training. It is a complex of existing forms and methods of training, in which cadets / listeners through the implementation of appropriately formulated complex tasks and exercises under the guidance of the instructor develop skills and practical application

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