# Chapter 22
# Development Specifics of the Tower Controller Intelligent Training System

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## ABSTRACT

*The activity of the tower controller is connected with the implementation of a rather complex set of measures to ensure takeoff and landing operations. In connection with this, the aviation specialist should possess the number of professional competencies, which are formed by mastering the theoretical material and consolidating it in practice. Frequently, the initial consolidation in practice is performed by using automated training systems, especially intelligent training systems are in a great demand. Therefore, this chapter is devoted to the specifics of the development of such type aviation-focused system, which are given on the example of the intelligent training system "Tower Controller." The prototype of this system was developed at Flight Academy of the National Aviation University, Ukraine. Its key differential peculiarity is focused on major stages of the decision-making process of the tower controller instead of visualization from the tower window.*

## BACKGROUND

Analysis of materials of the National Bureau of Air Accidents Investigation of Ukraine, data from the State Aviation Administration of Ukraine and the Flight Safety Foundation gives evidence of the fact that a significant number of aviation accidents and incidents occurs during take off and landing of an aircraft (Approach, n.d.; National Bureau of Air Accidents Investigation of Ukraine, 2014, 2015, 2016; State Aviation Administration of Ukraine, 2013; Statistical Summary, n.d.).

DOI: 10.4018/978-1-7998-5357-2.ch022

During take off engines are operated with take-off mode. There is a risk of their failure at the moment when an airplane performs take-off run, which may cause an inability to get off the ground or incapability to stop on a runway. That is why, there is a point during take off, at which a pilot makes the decision whether it is better to take off or slow down. If the failure occurs after passing this point, then take off should be done under any conditions (even with one working engine).

The next danger, which is connected with take off, is an incorrect plane balance. For take off a pilot uses take-off configuration of an aircraft, which is based on a plane balance, calculated before a flight. Whether this calculation is correct can be determined only after getting off the ground.

The other hazard is the crosswind. It may hinder take-off operations and take a ship down from a runway.

A landing is also a rather complicated stage. It is caused by several factors. One of these factors is the wind, especially the crosswind and the heading wind. It makes difficult to aviate a plane. If the wind changes its direction or abruptly stops, then an aircraft may sharply lose an altitude and bump into the ground.

The second factor is a visibility. Of course, it also complicates takes off, but visual cues play a much greater role for landing. Poor visibility conditions may lead to a collision with obstacles in an area of an aerodrome or to landing outside a runway.

The third factor is a plane balance. Centering on landing differs from centering on take off. This is explained by fuel consumption during flight. The next factor is a coefficient of adhesion. After touching down, there may be a risk of skidding an aircraft or other problems, connected with a surface state of a runway.

The factors, described above, are not a complete list of those, which affect the complexity of taking off and landing. So, all of them should be taken into account for ensuring safe flight operations.

One of the participants of take-off and landing stages is a Tower controller. He ensures (Dnipropetrovsk regional branch, Zaporizhzhya air traffic service system, 2013):

- Aerodrome control service;
- Flight information service;
- Emergency service.

In the process of aerodrome control service, a Tower controller provides permissions for arriving and departing crews, as well as a various pieces of information, aimed at the maintenance the discipline in an aerodrome zone in order to prevent collisions between aircraft. Also a Tower controller interacts with the airfield maintenance and supply service on the issue of permits for works on the airfield. The airfield maintenance and supply service reports a Tower controller about destroyed surface of the runway, the absence of appropriate marking, the repair work in the aerodrome working area, etc.

The purpose of flight information service is the provision of consultations and information to ensure the safe and efficient performance of flights (Dnipropetrovsk regional branch, Zaporizhzhya air traffic service system, 2013). For example, aircraft crew may initiate the request to a Tower controller for getting meteorological information such as weather forecast for the aerodrome, the weather forecast for landing, aerodrome warning, warning about wind displacement at the aerodrome and other additional information.