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PROPOSAL OF A2A INFORMATION SYSTEM FOR SAFETY IMPROVEMENT IN AERODROME TRAFFIC ZONES OF NON-TOWERED AIRPORTS

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ABSTRACT

The air traffic at non-towered airports has grown considerably in recent years. This increase in air traffic puts greater demands on both: the pilots and the dispatchers of the flight information service. The AFIS dispatchers, when gathering information on aircraft position, depend on voice communication with the pilots. Such a communication leaves room for error and inaccuracy. There are eighty-six non-towered airports in the Czech Republic at present. None of them operates a radar information based air traffic surveillance system. This paper describes a new system that increases safety in the Aerodrome Traffic Zone (ATZ) of non-towered airports. The authors of this paper are currently developing an A2A (Aircraft to Airport) system which will make possible an exchange of information between the person who provides AFIS and an aircraft through a mobile data network.

KEYWORDS: mobile data network, non-towered airport, aerodrome traffic zone, aerodrome flight information system, information system, cloud, GPS

INTRODUCTION

The majority of airports, not only in Europe but globally, falls in the category of non-towered airports. Air traffic at these airports congregates in their aerodrome traffic zones (part of the air space intended to protect the airport air traffic) that are bordered with a circle with radius of 3 NM (5 500 m) from the airport reference point and they extend. To the altitude of 4 000 ft. (1 200 m). More than 80% of all general aviation aircraft entering these zones in Europe are not equipped with an ADS-B transponder. These aircraft use less versatile technologies such as collision avoidance technology FLARM [3]. FLARM transmits GPS coordinates and altitude of an aircraft to its surrounding area. This system is currently mounted in the majority of gliders and into some helicopters and small aircraft. Another system used in general aviation aircraft is the community developed OGN Tracker. OGN Tracker lacks a collision avoidance technology and it cannot be detected by FLARM but it can communicate information on position of other aircraft within the ONG network. Navigation for landing of aircraft equipped with FLARM or OGN Tracker is done through a voice radio communication between AFIS dispatchers and pilots. But AFIS dispatchers know neither the exact coordinates of the aircraft nor their altitude. The heavier the air traffic becomes, the greater demand it puts on AFIS dispatchers' attention [4]. That is the reason some AFIS providers are already looking for new airport surveillance systems but in most cases the solutions are only software ones and they do not communicate with the real-time air traffic.

In contrast to the abovementioned systems, the information exchange of the A2A System is not based on voice radio communication and the system aggregates information from all abovementioned systems. Using the A2A System, the dispatcher can see on his screen all aircraft equipped with either of the abovementioned systems plus those aircraft equipped with A2A. For the system to function, the airport must be equipped with receivers of all signals: FLARM, OGN, and ADS-B signals.

A2A SYSTEM

The designed information system A2A for ATZ of non-towered airports is based on information transmission from the aircraft to AFIS via mobile data network.

The A2A software consist of three modules:

- Twoclient type modules – A2A Aircraft and A2A Airport
- Oneserver type module – A2A Cloud (database and application server)

Figure 1: ATZ and A2A system

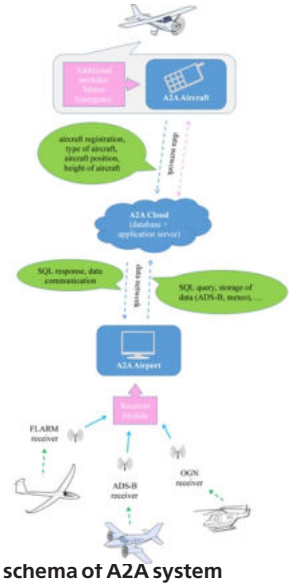

Figure 2: Block schema of A2A system

The solutions designed by the authors will improve the safety of air traffic in ATZ of non-towered airports [1],[2] since it provides the dispatchers with real-time surveillance information on positions of aircraft in the ATZ (Fig. 1).

A2A AIRCRAFT MODULE

A2A Aircraft Module is an application that transmits the aircraft position and it is intended for pilots' use. This module is a native application for mobile devices installed to mobile phones or tablets on board of the aircraft. The application is being developed for two main platforms: the iOS and Android. When the aircraft enters the ATZ, the application connect automatically to the A2A Cloud and it sends its registration, aircraft type. In return, it receives a unique identifier for communication during given session together with information on weather situation at the airport. During the session the application continuously broadcasts information on its position and altitude to the cloud. If an emergency occurs, the pilot sends information on the emergency through the application (i. g. electric system failure).

A2A AIRPORT MODULE

A2A Airport Module is intended to provide airport surveillance information. A web application shows position of aircraft onto a map underlay and it is accessible via a web browser. The information on registration, aircraft type, position and altitude of an aircraft is obtained from the A2A Cloud System. The A2A Airport System makes real-time data updates with queries to the Cloud. Furthermore, the module is connected to an auxiliary module Receiver which aggregates data from external receivers (FLARM, OGN, and ADS-B). These receivers also provide information on registration, aircraft type, position and altitude of the aircraft. The information is stored to the server database through the A2A Airport Module. The cloud also receives information on the weather situation at the airport.

In addition, the module also keeps an automatized log of arrivals and departures together with records of landing fees.

A2A CLOUD

A2A Cloud is a cloud solution of a server which runs a database and an application server. The database server is built on a relational database management system. The database server stores all information sent from the client modules. Application server integrates a web application and access to the database

CONCLUSIONS

The A2A System provides surveillance information on traffic at non-towered airports. The system interlinks available technologies into one surveillance output and distributes the information from more sources through its own communication channel based on data communication through mobile network. Practical measurements carried out throughout the Czech Republic territory show that the use of mobile network operators' infrastructure in ATZs is feasible even though the transceivers' signal is not primarily directed vertically.

Introduction of a surveillance information, as suggested in this paper, can firstly lower the stress load of AFIS dispatchers, secondly increase the safety of air traffic, and lastly excel the quality of service provided. By no means, the solution suggested in this paper is to substitute air traffic control service. Thus the pilots will still be responsible for the flight management and separation minima compliance. As its chief benefit, this system brings a significantly better surveillance information to the AFIS dispatchers thus it increase their awareness of the actual air traffic in ATZ.

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