AVIATION IN THE XXI-ST CENTURY

INTERNATIONAL CIVIL AVIATION ORGANIZATION
NATIONAL ACADEMY OF SCIENCES OF UKRAINE
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY

PROCEEDINGS

THE FOURTH WORLD CONGRESS "AVIATION IN THE XXI-st CENTURY"

"Safety in Aviation and Space Technologies"

Volume 1

September 21-23, 2010
Kyiv, Ukraine

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SYMPOSIA

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MONITORING OF PRIVATE AVIATION FLYING

Two different ways of aircraft flight monitoring in the bottom airspace have been represented. Wireless communication network based conception has been proposed to use for control and navigation.

Introduction

Today general aviation is very fast changing and progressive part of aviation industry. A lot of advantages make general aviation very useful and popular. Nowadays small airplane or helicopter costs like a good new car therefore more and more people use it in their life. So, quantity of helicopters and small airplane is increased rapidly every year.

General aviation in Ukraine also is developed. One year ago our government and Prime minister were changed some regulation documents in aviation. Some changes have been made in documents which regulate flight space using. The main here is that nowadays pilots don't need make request for flight if they are going to flight in the bottom airspace (up to 1500 m under sea level).

It has been first small, but very important step to develop private aviation in Ukrainian airspace. It is very good because nowadays a lot of municipal services can use it. For example air ambulance, police air patrols, crop dusting, rescue team, forest fire fighting and many other services use it. But also we have some problems in this context.

General aviation flying in the bottom airspace must guarantee very high level of safety. Safety fly of general aviation is very important. General aviation accidents statistic data do not look good for counties where many private and commercial aircrafts flight every day. On fig.1 is represented number of general aviation accidents for USA during 1996-2005 years [1]. It shows decreasing tendency but it contains more than enough number of accidents every year.

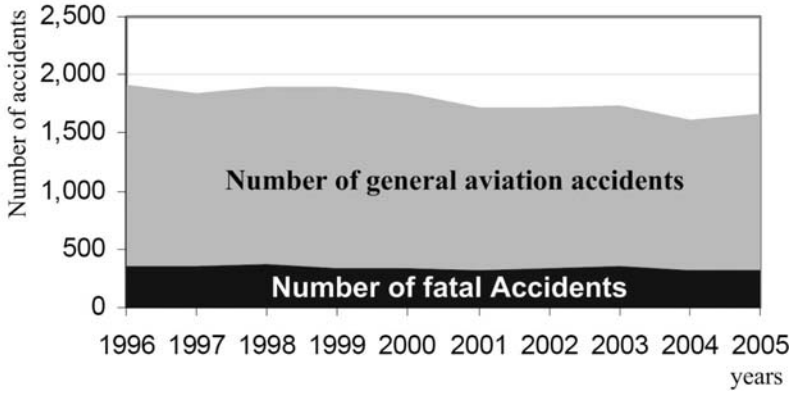

Fig.1. Number of general aviation accidents for USA during 1996-2005 years

One of the big problem which has been connected with general aviation that bottom airspace is not possible to be controlled. It is uncontrolled any radar service and air traffic service. Current radar and secondary radar systems can't cover bottom airspace. It has some technical aspects and depends on reflected ability radio signals from ground.

ADS-B conception

Automatic dependence surveillance broadcast (ADS-B) conception helps here. ADS-B is a cooperative surveillance technique for air traffic control and related applications being developed as part of the Next Generation Air Transportation System.

An ADS-B-equipped aircraft determines its own position using a global navigation satellite system and periodically broadcasts this position and other relevant information to potential ground stations and other aircraft with ADS-B equipment (fig.2). ADS-B can be used over several different

data link technologies, including Mode-S, Universal Access Transceiver, and VHF data link (VDL Mode 4)[2].

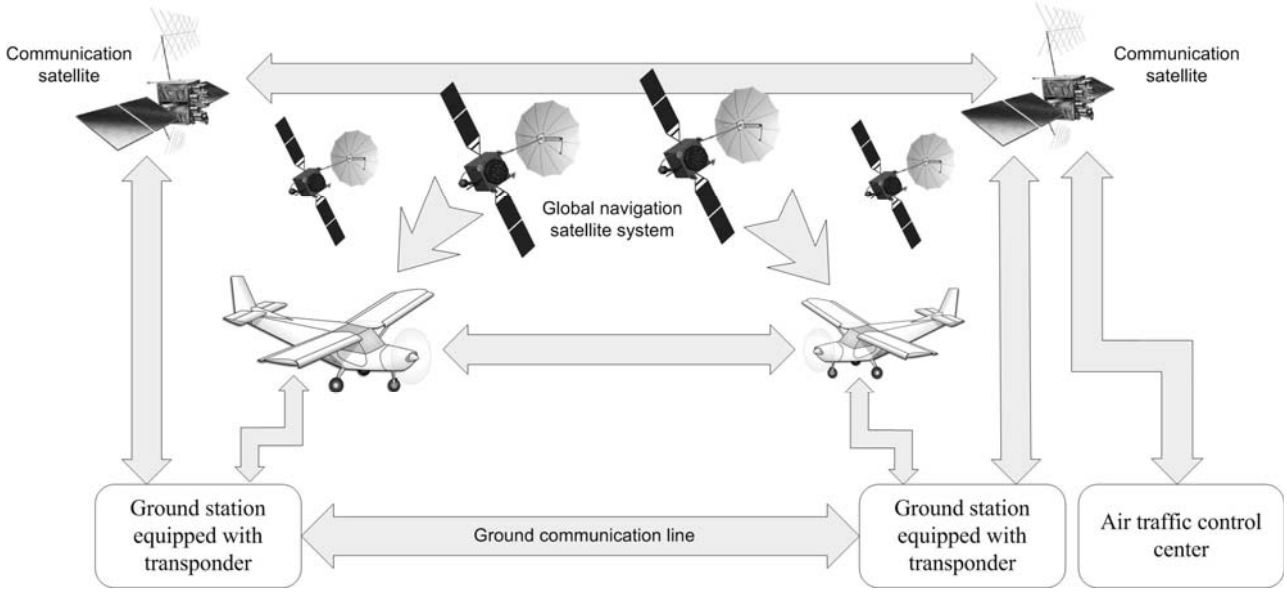

Fig.2. ADS-B conception structure

ADS-B provides accurate information and frequent updates to airspace users and controllers, and hence supports improved use of airspace, reduced ceiling/visibility restrictions, improved surface surveillance, and enhanced safety, for example through conflict management.

ADS-B is the best solution for improve safety of flight not only for general aviation. But development and technical realization of this conception are very expensive and need some time.

Wireless communication networks

Other way to solve the problem of low altitude flying aircraft control is usage of ground wireless communication networks. Nowadays wireless communication networks develop rapidly. Companies which are provided communication service cover more than 98% territory of Ukraine. Cell phone service is very popular and rapidly changing.

Cover area of airspace makes possible to use cell phone system on board of aircraft if the altitude isn't very big. Typical equipment is used to transmit aircraft position and other data to air traffic control (ATC) center by wireless communication ground networks [3-5] (fig.3). Many aviation services may be represented for owners of aircraft on board:

- weather broadcast;
- map information;
- airport information (SID, STAR, Approach procedures);
- communication;
- surveillances data and many other information.

Wireless communication networks are possible to realize navigation function. Different methods will be used to estimate aircraft location in cell organization network. The basic methods are:

- Cell of Origin;
- Signal Strength;
- Time of Arrival;
- Time Difference of Arrival;
- Enhanced Observed Time Difference.

This different methods combination will produce good accuracy of coordinates' estimation. Accuracy of this depends on location of aircraft and base station configuration. If airplane equipped with special devises to work with ground cell based network flies, service provider will estimate coordinates information about location of airplane. Then coordinates of each airplane will be

compared with closed airspace areas location. If the service is recognized illegal crossing of the closed airspace frontier, owner of airplane will be responsible for it.

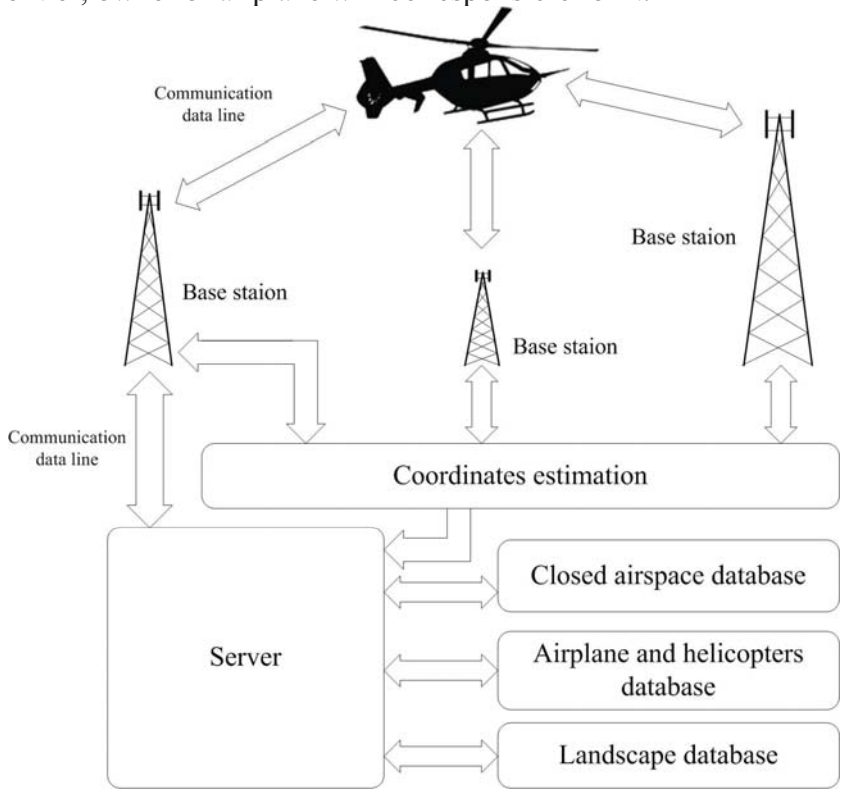

Fig.3. ATC conception based on wireless communication networks

Conclusion

ADS-B conception is the best solution for aircraft control in bottom part of airspace, but it's very expensive and needs time for practical realization in Ukraine area. Wireless communication network has already covered the whole territory but needs an agreement with service provider. Wireless communication network provides communication, high speed data line and positioning therefore realization of this conception is more suitable for our country.

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