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TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 6: Future direction
6.1: Implementation plans and methodologies

WAYS AND PROSPECTS OF DEVELOPMENT OF AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST AND ADJACENT APPLICATIONS IN THE RUSSIAN FEDERATION

(Presented by the Russian Federation)

EXECUTIVE SUMMARY	
"In recent years, a number of applications have started to become a reality for ATM, but they have not been completely deployed" (ASBU working document, Module No B0-40, paragraph 1.1.1.). This working paper draws attention of the Conference to the significant benefits which can be derived from early deployment of two-way data link applications, standardized by ICAO and proven by the test flights. **Action:** Action by the Conference is invited to agree to the recommendation in paragraph 9.	
References:	Working document for the aviation system block upgrades: Module N° B0-40: Improved Safety and Efficiency through the initial application of Data Link En-Route; and Module N° B1-90: Initial Integration of Remotely Piloted Aircraft (RPA) into Non-Segregated Airspace

1. INTRODUCTION

1.1 The extended implementation of the automatic dependent surveillance–broadcast (ADS-B) based on the satellite navigation and data links will be one of the main trends in the global air traffic management. Together with the economic benefits where a gradual replacement of radar surveillance is concerned the use of incoming signals on board an aircraft will provide for the situational awareness of pilots and improve the safety of flights. Data links implementing ADS-B stimulate development of adjacent applications, that is operative meteorological awareness, aeronautical information management, search-and-rescue operations, wake turbulence warnings, etc.

2. GENERAL WAYS OF ADS-B IMPLEMENTATION

2.1 Both the Russian Federation and other States are actively implementing ADS-B based on 1090 ES extended squitter. In future such system will allow to diminish and then probably totally to replace all secondary surveillance radars for ATM surveillance. We should note that the development of ADS-B based on 1090 ES anticipates mainly a so-called ADS-B Out scenario, when data about an aircraft position is received by ground ATC only. Just this type of ADS-B to 2020-2025 is being considered in NextGen and SESAR programs.

2.2 According to the program, adopted by the Ministry of Transportation of the Russian Federation, together with the implementation of ADS-B based on the 1090 ES data link the use of VDL-4 data link is considered mainly for the surveillance in the lower airspace (helicopters, general aviation, unmanned aircraft systems, etc.). VDL-4 also may complement 1090 ES in the upper airspace. Deployment of this additional data link provides for the on-board implementation of various additional adjacent applications.

3. SITUATIONAL AWARENESS

3.1 Among the other applications, the situational awareness is being noted first of all. The pilot sees on a cockpit display of traffic information (CDTI) the relative positions and movement vectors of near-by aircraft . The traffic surveillance on board is executed directly from equipped aircraft via ADS-B. The transmittance of data about non-equipped aircraft is done by ground uplink of position information via TIS-B. This feature provides for benefits on the situational awareness immediately after the installation of the equipment on the first aircraft, without waiting for the equipment installation on the other aircraft.

3.2 The situational awareness serves as a basis for such applications as surface movement and provision of the safety of actions on the runway. Surface vehicles must be equipped with GNSS receivers; VDL-4 or AeroMax may be used as data links; in the latter case data about positions of surface vehicles comes to the board an aircraft via ATC. ADS-B use for search-and-rescue operations attracted the interest of UTAir and GasPromAvia airlines. Insufficient efficiency of COSPAS/SARSAT system for the aviation's search-and-rescue operations is well known and can be explained by the fact, that the system must function in case of an aircraft accident when in most cases transmitters, antennas and feeder lines are destroyed; emergency beacons might go deep into ground or water, etc. Search-and-rescue operations based on ADS-B use the idea of "the latest ADS-B message", that means that the search area is defined on the information, contained in the last ADS-B message after which data from ADS-B stops to come. This data is transmitted to near-by helicopters that fly to the accident location and perform search-and-rescue operations guided by positions of all aircraft on CDTIs.

4. METEOROLOGICAL AND AERONAUTICAL INFORMATION AWARENESS

4.1 The VDL-4 data link provides for the meteorological awareness. Aircraft receives FIS-B data from near-by ATC centres; the data comes both as standard text messages and, for instance, as contours of dangerous meteorological events drifting in the airspace – thunderstorms, icing, increased wake turbulence, etc. Aeronautical data is managed the same way – by the transmittance of information about restricted for flight zones, closed runways and taxiways, etc. All these applications were shown in demo flights of UTAir helicopters at the end of 2011. Similar tests of GasPromAvia helicopters will take place in November 2012 at the 600-km long route of Yamal-Bovanenkovo, where in 2012 seven VDL-4 ADS-B ground stations have been installed. As a result, instead of procedural air traffic control the surveillance of helicopters along the whole route will be executed by ADS-B at 200-300 m altitude, that cannot be provided by traditional radar surveillance means (which are absent, as a matter of fact, and their installation would demand significant investments and operational expenses that is not economically justified in the Northern regions due to the insufficient traffic); other above mentioned applications will be implemented as well.

5. UNMANNED AIRCRAFT SYSTEMS INTEGRATION IN CIVIL AIRSPACE

5.1 At the present time works on the implementation of unmanned aircraft systems (UAS) into the non-segregated airspace are intensively conducted all over the world. It's universally recognized, that this work is

far from finalized. Nevertheless, in May 2011 in Saint-Petersburg the joint flights of piloted and unmanned aircraft in single airspace were successfully demonstrated for the participants of the ICAO Unmanned Aircraft Systems Study Group meeting. These flights were based on the provision of various awareness (situational, meteorological, aeronautical information, etc) through the VDL-4 data link for pilots, in both piloted and remotely piloted aircraft. There were managed the incursion of a car onto the runway, various air collisions, etc. The results of flights showed that a viable, flexible and local fault-tolerant network system based on VDL-4 data link existed in the airspace; in case when the transmission of some information via one link section was violated, this information was delivered through other link sections. A concept of VDL-4 patch was developed, amending the UAS situation in any civil airspace and providing for the safety of all ATM participants. The essence of the concept is as follow: some enclosed functional envelope consisting of a group of unmanned aircraft and a ground site, all equipped with VDL-4 transponders, performs surveillance and control of all unmanned aircraft; the interaction with ATC is being done via the ground computer of VDL-4 patch. In such a case, ATC system operates in its traditional manner; ATC controllers know the positions and intentions of all UAS. At the same time, all UAS remote pilots are aware of positions of all other aircraft within certain FIR and comply with instructions of ATC controllers.

6. WAKE TURBULENCE SAFETY SYSTEMS

VDL-4 use proves to be efficient in the creation of wake turbulence safety systems. An aircraft which causes a wake turbulence zone behind itself (aircraft-generator) calculates parameters of this zone considering regime of flight, aerodynamic configuration of airplane, atmospheric conditions and other parameters, and then broadcasts this information to ATC ground site and to near-by aircraft. Having received this information the aircraft-follower calculates the zone of the wake turbulence dangerous effect taking in mind its own aerodynamic characteristics, atmospheric conditions, etc. and performs maneuvers to avoid entering this dangerous zone. Thus providing controllers and pilots in affected aircraft with accurate and timely information on wake vortex it allows to take appropriate actions to avoid hazardous situations.

7. ADS-B AND ADJACENT APPLICATIONS IMPLEMENTATION IN THE RUSSIAN FEDERATION

7.1 It seems that just at the present time a number of abovementioned applications may be implemented mainly on a basis of VDL-4 data link. Now in the Russian Federation a few pilot projects on the implementation of mentioned applications based on VDL-4 have started. Up to 2020 according to the program approved by the Ministry of Transportation of the Russian Federation is foreseen the creation of a ground structure consisting of about 100 ground stations with 1090 ES and about 300 ground stations with VDL-4 providing for the required surveillance coverage at altitude 4 200 m.

8. CONCLUSIONS

8.1 At the present time the aviation community meets some challenges concerning the implementation of such applications as ADS-B In, TIS-B, FIS-B, A-SMCGS, S&R, solving the wake turbulence safety problem, operation of unmanned aircraft systems in civil airspace. This situation is caused by limited abilities of a currently applied data links. Some hopes are set on newly developed data links, which seem to arrive not earlier than in 2030. However, it is not evident that these new data links will be able to solve the above problems in the nearest future. We have a gap between the actual demand for Datacom (both surveillance and communications) and the availability of these new envisaged data links. One more question is: what to do until

these hypothetical data links arrive? It seems that, at least for the mentioned period, we may successfully use VDL-4 to solve the above tasks; VDL-4 has the complete set of ICAO, European Telecommunication Standards Institute (ETSI) and European Organisation for Civil Aviation Equipment (EUROCAE) standards. Within available and being developed target programs of national air traffic management system, modernization of the Russian Federation plans to realize ADS-B implementation both on 1090 ES data link basis and using VDL-4 as a complement in the airspace where ADS-B implementation on 1090 ES data link basis is impossible or economically impractical. and to provide additional communications services such as these described above. This use of two data links in complementarity configuration would also provide a pragmatic use of existing ICAO standards.

9. ACTION OF THE CONFERENCE

9.1 The Conference is invited to:

a) take into account the information about significant benefits of an early deployment of automatic dependent surveillance — broadcast and adjacent applications based on two-way VDL-4 data link, standardized by ICAO, European Telecommunication Standards Institute (ETSI) and European Organisation for Civil Aviation Equipment (EUROCAE), while considering comparatively low expenses of the deployment of a related ground infrastructure and on-board equipment;

b) make a recommendation to include in the future work programme of ICAO a development of a concept of creation of self-reserved data wireless networks in the air for the purpose of interchange of information on relative positions of aircraft, their movement vectors, their operative flight plans and their wake vortex traces. These networks should be based on a two-way data links for provision of a surveillance and air traffic control, including the integration of the UAS flights into non-segregated airspace as well as aspects of the wake turbulence safety in order to increase capacity of the airspace while providing a prescribed level of flight safety for civil aircraft.

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