ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 2: Safety and security in air traffic management (ATM)

Agenda Item 6: Aeronautical navigation issues

6.3 : Amendments on aeronautical navigation subjects in relevant ICAO documents including the *Global Air Navigation Plan for CNS/ATM Systems* (Doc 9750), Annex 10 — *Aeronautical Telecommunications* and other documents as necessary

6.4 : Directions for future development of aeronautical navigation services

GNSS AUGMENTATION IN SUPPORT OF A-SMGCS

(Presented by Sweden)

SUMMARY

This paper emphasises the need for a common global navigation satellite system (GNSS) augmentation for surveillance and advanced surface movement guidance and control systems (A-SMGCS).

Action by the conference is in paragraph 5.

1. INTRODUCTION

1.1 Current surface movement guidance and control systems (SMGCS) procedures are based primarily on the "see and be seen" principle to navigate and maintain spacing between aircraft and/or vehicles on the aerodrome movement area. However, there have been increasing numbers of accidents and incidents during surface movements, including runway incursions. Contributing factors include the progressive increase in traffic, the complexity of airport layouts and the increasing number of operations that take place in low visibility conditions. Therefore, advanced capabilities are needed to ensure adequate spacing when visual means are not adequate, and to maintain aerodrome capacity in all weather conditions.

1.2 The availability of position data is fundamental for surveillance functions in all phases of flight. The accuracy requirement is varying depending on the phases. Manoeuvring on the ground at airports in an advanced surface movement guidance and control system (A-SMGCS) environment requires the highest level of accuracy, a requirement that is valid for aircraft as well as ground vehicles because they are operating in the vicinity of each other. ICAO provisions are available for systems supporting precision approach and landing, but no provisions are at hand for ground vehicles.

1.3 The most convenient way of deriving a vehicle's position is by making use of the global navigation satellite system (GNSS), requiring GNSS augmentation data to be available for ground vehicles as well.

2. BACKGROUND AND RATIONALE FOR GNSS AUGMENTATION TO SUPPORT A-SMGCS

2.1 In the current and future communications, navigation, surveillance/air traffic management (CNS/ATM) environment, a GNSS position is an integral part of the surveillance using automatic dependent surveillance — broadcast (ADS-B). The A-SMGCS concept addresses the reality of future increases in surface movement operations. This growth in operations will lead to increased surface congestion and affect the safety of the ground operations unless new techniques are available and implemented.

2.2 Improved guidance and procedures should be in place to allow safe operations on the aerodrome surface, considering visibility condition, traffic density and aerodrome layout; pilots and vehicle drivers to follow their assigned routes in a continuous, unambiguous, and reliable way.

2.3 Improved aerodrome visual aids providing guidance for surface movement operations should further become an integrated component of the surface movement system. The application of A-SMGCS will lead to a reallocation of responsibilities for the various system functions. Less reliance will be placed on the ability of the pilot or control authority to provide a visual surveillance function and some functions will use automated elements to provide routing, guidance and control. A-SMGCS also depends on an efficient interface with the ATM planning function. This is consistent with the surveillance techniques using ADS-B. In order to ease the integration of air and surface movement in the new ATM environment it is critical that the same common augmentation be used. GNSS and GNSS augmentation is the key navigation and surveillance technology to be used and exploited for various phases of aviation operations. It is highly desirable that a similar concept and technology be used for A-SMGCS.

3. A-SMGCS AT STOCKHOLM/ARLANDA AIRPORT

3.1 Stockholm-Arlanda is one of Europe's busiest airports. VHF digital link (VDL) Mode 4 will serve as a common platform for A-SMGCS and distribution of operational data at Arlanda.

3.2 In 2001 implementation started by establishing one VDL Mode 4 ground station. Around 45 vehicles will be equipped with VDL Mode 4 transceivers during 2003. Extensive trials forming the basis for the safety case and operational approval is expected during the autumn of this year. The system will be operational by the end of next year. When fully implemented, the system will perform the following services:

a) *GNSS augmentation*. Airborne and mobile ground users will benefit from this service;

b) *ADS-B reporting*. A large number of airport surface vehicles, including rescue, airport maintenance and snow removal vehicles, will be ADS-B equipped. Whereas the airport authority is in a position to equip its own vehicles and require that other vehicles operating on the airport be equipped, it cannot yet mandate that aircraft carry ADS-B equipment. However, a number of SAS and other operators' aircraft are already fitted with prototype VDL Mode 4 equipment, and the number of equipped aircraft will gradually increase in the coming years. ADS-B reports from vehicles and equipped aircraft will be displayed to tower controllers (fused with position data from ground radars), and to relevant airport authority units and external commercial users;

c) *Flight information service — broadcast (FIS-B)*. This service is supporting the distribution of various types of meteorological data and airport data;

d) *Information broadcast (INFO-B)*. This is a non-standardised service allowing information from an information database at Arlanda Airport to be broadcast to various users. Information will include flight number, aircraft type, estimated/actual departure and landing times, parking gate, handling agent, etc. The benefit is that all users have immediate access to the most current information;

e) *Traffic information service — broadcast (TIS-B)*. TIS-B reports will be generated and broadcast for non-equipped airport vehicles and aircraft;

f) Departure clearance (DCL) service; and

g) *Controller-pilot data link communications (CPDLC)*.

3.3 The introduction of ADS-B together with GNSS augmentation based on VDL Mode 4 in the A-SMGCS system used in the tower at Arlanda Airport will increase the safety and efficiency through unique identification of vehicles and it will also update position data from vehicles where the surface movement radar is lacking coverage. After the operational approval the Swedish Civil Aviation Administration (CAA) will continue to equip more vehicles with VDL Mode 4 at Arlanda. Plans are being made to install similar equipment at the airports in Malmö and Gothenburg.

4. SUMMARY

4.1 Due to increased traffic and congestion on the aerodrome surface, advanced capabilities are needed to ensure spacing when visual means are not adequate, and to maintain aerodrome capacity in all weather conditions. This requires robust navigation and surveillance equipment and operations. The technology being considered and used for complex operations is GNSS and GNSS augmentation. Hence, it is a reasonable requirement that the same technology be developed and implemented for A-SMGCS.

5. ACTION BY THE CONFERENCE

5.1 The conference is invited to:

a) note that, in an A-SMGCS environment, there is a need for having access to GNSS augmentation data in a cost-efficient way so that both aircraft and ground vehicles are equipped as indicted in this paper; and

b) recommend that ICAO develop appropriate requirements and provisions for a GNSS augmentation system that is supported by the same systems that are used for ADS-B, in support of all aircraft and vehicles operating in an A-SMGCS environment.

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