ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 1: Introduction and assessment of a global air traffic management (ATM) operational concept
1.2 Enabling concepts in support of the global ATM operational concept :

UNITED STATES ENDORSEMENT OF THE AUTOMATIC DEPENDENT SURVEILLANCE — BROADCAST (ADS-B) CONCEPT OF USE

(Presented by United States)

SUMMARY

This action/working paper proposes an approach toward developing global standards for ADS-B applications.

REFERENCES

"Automatic Dependent Surveillance — Broadcast Concept of Use" AN-Conf/11-WP/6
"Strategy for Global Interoperability of ADS-B"
"Initial ADS-B Application for Global Interoperability", AN-Conf/11-WP/41

1. INTRODUCTION

1.1 The United States Federal Aviation Administration (FAA) through the Operational Data Link Panel (OPLINKP) along with the U.S. standards body RTCA are working closely with the member States of ICAO to define and develop a comprehensive concept of use for an initial set of the Automatic Dependent Surveillance — Broadcast (ADS-B) enabled operational applications. These ADS-B applications are proposed to serve as the basis for promoting global interoperability of ADS-B enabled operations for both the near term and beyond.

1.2 The ADS-B Concept of Use is being progressed by the ICAO OPLINK Panel. It describes the ADS-B system and its possible roles in the future communications, navigation, and surveillance/air traffic management (CNS/ATM) system. The OPLINK Panel will issue revised editions of the document as required to reflect any changes that occur.

2. DISCUSSION

2.1 In the early 1990's, ICAO approved the concept of Future Air Navigation System (FANS) based on satellite technology, which later evolved into CNS/ATM. The traditional air traffic control (ATC) surveillance system has limitations that constrained its capabilities in the current and future ATM environment. These limitations were detailed in the Draft Global Air Navigation Plan for CNS/ATM Systems (Chapter 1, Article 1.1) and include the following:

a) limited or no coverage, due to lack or limitations of the data sources (PSR, secondary surveillance radar (SSR). This includes non-equipped continental areas, low altitudes, non-continental areas, surface movements, silence cones, blind areas, antenna screening etc. In some cases (e.g. oceanic areas), this results in the need for procedural control, using voice reports;

b) mechanical rotation of the classical radar antennas, leading to inefficient scanning periods, impossibility of adapting the reporting rate to ATC needs etc. (Note: E-SCAN antennas may offer an alternative in this case);

c) garbling, fruit and splitting (resulting in false or lost targets);

d) unavailability of aircraft derived data, beyond the Mode A/C (i.e. Mode A identification and altitude);

e) non-homogeneous operation, caused by the current existence of a diversity of systems with different performance and capabilities;

f) in some regions the shortage of Mode A codes (only 4096 available) requiring frequent changes of code during the flight, which may also create identification ambiguities;

g) lack of capability to support future airborne situation awareness applications, because the corresponding surveillance data are not available to the aircrew; and

h) lack of capabilities to support airport surface Surveillance applications.

2.2 Due to constraints like these and cost, the necessary levels of capacity, flexibility and efficiency required to meet the future predicted air traffic growth could not be met by the existing surveillance systems. Various surveillance technologies have been developed to address these limitations. These include the SSR Mode S with enhanced services, ADS-Contract (ADS-C), and ADS-Broadcast (ADS-B).

3. CONCEPT OVERVIEW

3.1 The first meeting of the ICAO Air Traffic Management Concept Panel (ATMCP/1) defined the air traffic management operational concept as a description of the services that will be required to operate the global air traffic system up to and beyond 2025. The operational concept addresses **what** is needed to increase user flexibility and maximise operating efficiencies in order to increase system capacity and improve safety levels in the future air traffic management system. The extensive work which has taken place to date and that which is currently underway have convinced ICAO that ADS-B functionality has the potential to be one of the key elements necessary in achieving these operational concept goals.

3.2 The ADS-B Concept of Use describes ADS-B as one of the enablers of this future global CNS/ATM system. The description of ADS-B in this context is addressed to include functionality, the role of ADS-B in ATM, operational improvements, and typical applications. The applications are illustrated by use of various operational scenarios. These scenarios include all phases of flight in a gate-to-gate environment; contain certain aspects of the air-air, air-ground, ground-air and ground-ground interactions and the human and automated elements of the system. Finally, the concept addresses important issues for consideration by States while addressing implementation.

3.3 During the development of the ADS-B Concept of Use, considerations were made for other co-existing enablers (ADS-C, TIS-B[1], controller-pilot data link communications (CPDLC), etc.) in order to identify their complementary roles in the various operational scenarios.

3.4 The overall objective is to develop a common understanding of terms, definitions and possible uses of ADS-B in the future environment. A secondary objective is to do this early enough in the various stages of development to influence and facilitate that development.

3.5 The Automatic Dependent Surveillance — Broadcast (ADS-B) Concept of Use provides a description of the ADS-B system and its detailed role as an application enabling important changes in the future CNS/ATM system.

3.6 The description of the role of ADS-B takes into account the heterogeneous and evolving situation with respect to the available ground infrastructure, the aircraft capabilities, the airspace regimes etc. This considerably affects the transition from the current to the future system.

3.7 The ADS-B Concept of Use illustrates a number of typical operational scenarios. These scenarios describe the various possible flight phases in a gate-to-gate environment, i.e. including airport surveillance. They provide the description of the interactions between the airborne, ground, human and automated elements of the system. Furthermore, the scenarios describe a number of the supported applications and the role of ADS-B as an enabler in a mixed surveillance environment. These chosen scenarios were intended as illustrative examples and do not include all the possible uses of ADS-B.

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[1] TIS-B (Traffic Information Service – Broadcast) is a service, which enables position, and other data for non-ADS-B equipped aircraft to be broadcast via ADS-B. It is seen as an important means of supporting ADS-B services during the transition period when it is not feasible or cost-effective to equip all aircraft with ADS-B.

3.8 The ADS-B Concept of Use describes the role of ADS-B in supporting the future Surveillance service. This goes much beyond the current classical ground-based surveillance service and is extended to include air to air use as well as the capability to provide additional data such as state vector and trajectory intent. The levels of surveillance, which should be supported by ADS-B, are basic surveillance, enhanced surveillance (using state vector) and intent-based surveillance (using trajectory intent) on the ground and in the air, as applicable.

3.9 It should be noted that the ADS-B role, as detailed in the ADS-B Concept of Use, is complementary to other enablers such as SSR Mode A/C, SSR Mode S or ADS-C.

3.10 An analysis of the impact on various levels (operational, organizational etc.) stemming from the introduction of the ADS-B system is also presented in the ADS-B Concept of Use document.

3.11 A number of potential issues can be raised associated with the use of ADS-B. The operational concepts presented are at varying levels of maturity. We expect this concept for the operational use of ADS-B to evolve.

3.12 The technical aspects of the ADS-B Concept of Use should be coordinated with the appropriate ICAO technical panels to ensure consistency with ADS-B technical characteristics.

4. ACTION BY THE CONFERENCE

4.1 The conference is invited to agree on the following recommendation:

Recommendation 1/ - ICAO Activities on ADS-B Concept of Use

That ICAO:

a) adopt the initial ADS-B Concept of Use, as presented in ANConf/11-WP/6, as an ICAO operational “living” document;

b) assign the appropriate ICAO panel or study group to follow international research and development work in the area of ADS-B applications, and update / maintain the ADS-B Concept of Use document;

c) assign work to the appropriate Air Navigation Commission panels to work cooperatively to ensure that the ADS-B Concept of Use is properly aligned with existing operational and technical documents; and

d) utilize the ADS-B Concept of Use document, in its current form and as it matures, as a basis for development of potential standards and recommended practices (SARPs) and guidance material for air-to-air and air-to-ground surveillance applications.

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