INTERNATIONAL CIVIL AVIATION ORGANIZATION

AFI PLANNING AND IMPLEMENTATION REGIONAL GROUP FIFTEENTH MEETING (APIRG/15)

(Nairobi, Kenya, 26 – 30 September 2005)

Agenda Item 4: Air Navigation and Aviation Security (AVSEC) issues
4.2: Communications, Navigation and Surveillance

INTRODUCTION TO AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) IMPLEMENTATION AND RELATED ASPECTS

(Presented by SITA)

The purpose of this paper is to present:

- The relevant developments to the new technology
- The concept of Automatic Dependant Surveillance – Broadcast
- The ICAO recommendations for the introduction of this technology
- The regional service approach to ADS-B data collection and distribution
- ADS-B implementation in ASIA/Pacific region
- The SITA and Airsevices Australia joint development for a regional ADS-B service

1. Introduction

1.1 Implementation of ADS-B technology has the potential to provide significant improvements and efficiencies in the global ATM system. Following number of recent significant developments in the industry it is becoming increasingly important that the region establishes an ADS-B implementation trials Programme. The purpose of such a Programme would be to evaluate the technology and assess the benefits that ADS-B implementation can bring to this region.

1.2 The specific relevant developments include:

a. The 11th Air Navigation Conference's endorsement of ADS-B implementation using the Mode S Extended Squitter as the transmission link;
b. The fact that all new AIRBUS and Boeing airframes are being forward fitted with the capability to transmit ADS-B out messages (a spin off from the European Mode S Enhances Surveillance mandate (effective March 2007) to equip with Mode S;
c. The operational implementation of ADS-B is underway in one State (Australia) with an Initial Operational Capability of 1Q06;

d. The IATA Roadmap, "One Sky…Global ATM, A Strategic Vision for Future Air Traffic Management", clearly endorses the implementation of ADS-B as a radar "gap filler" and/or replacing existing en-route surveillance systems with ADS-B at the end of their useful life;

e. The SITA/Airservices Australia strategic partnership to deliver "regional ADS-B" services building on the combined capabilities of both organisations to provide solutions covering ATM system upgrades specifications, procedure developments, safety case developments, controller training and ADS-B data service delivery.

11th Air Navigation Conference

1.3 The 11th Air Navigation Conference, held in Montreal, by Sep/2003 acknowledged ADS-B as a key data link application in a future ATM environment, providing new surveillance capabilities for both aircrew and air traffic services. Three recommendations were provided related to the initial adoption of ADS-B technology:

- **Recommendation 1/6 — Endorsement of the automatic dependent surveillance-broadcast (ADS-B) concept of use and recommendations for further work.**

- **Recommendation 1/7 — Ground and airborne automatic dependent surveillance-broadcast (ADS-B) applications for global interoperability**

- **Recommendation 7/1 – Strategy for the near-term introduction of ADS-B**

  That States:

  a) note that a common element in most of the approaches currently adopted for early implementation of ADS-B is the selection of the SSR Mode S extended squitter as the initial data link; and

  b) take into account this common element to the extent possible in their national and regional implementation choices in order to facilitate global interoperability for the initial introduction of ADS-B.

1.4 In the same meeting it was agreed that this rapidly developing technology would be critical to the success in implementing a more advanced and global ATM system and that States which did not have comprehensive radar surveillance coverage should recognize the potential for early benefits from using ADS-B as an alternative to radar to support en route and approach traffic control, using existing avionics packages.

1.5 Early adoption of this technology would particularly assist in improving air traffic services in areas where a cost/benefit analysis could not justify an expensive radar infrastructure.

1.6 Among a number of new technologies/programs presented then, the ANC pointed out Mode S Extended Squitter be the initial data link choice as per recommendation 7/1.

2. The ADS-B Concept

2.1 Automatic Dependent Surveillance-Broadcast transmits each aircraft's position that can be received and presented to both ATC and other aircraft within range for display, so that the pilot and the controller can "see" all aircraft in the area. ADS-B can be used both for ATC/ATM tasks and for collision

avoidance, and built to continue transmitting the last known position after a crash to trigger search and rescue and can have interfaces for optional data e.g. from weather detection equipment or electronic Inertial systems.

2.2 In addition to traditional positioning and navigation data, ADS-B can also provide obstacle and terrain warnings, show other traffic and with special provisions, severe weather to be avoided. Other aircraft also see you on their display, and so does ATC on a radar-like screen. En-route, a pilot can "see and avoid" other traffic on the screen, a sort of "VFR in clouds". ATC provides arrival and departure sequencing and acts as a safety net or backup. ADS-B can further safely guide aircraft on ground in fog from runway to gate or vice versa showing other surface traffic to avoid collision with.

2.3 The main operational benefit of this service is situational awareness. In its purest form, this service will not require a ground infrastructure. However many of the possible implementations of this service will require extensive infrastructure.

2.4 The ADS-B transmissions from aircraft can be received by “ADS-B Receivers” installed on the ground (each having a typical range of 200 NM), converted to a standard format (e.g. Eurocontrol Asterix Category 21) and presented to Surveillance Data Processing Systems that enable the fusion with flight plan, ADS-Contract and radar data.

2.5 ADS-B avionics is now an option on most new commercial aircraft, and current forecasts indicate that most modern international aircraft will be upgraded to ADS-B capability mid 2008.

3. The ASIA-PACIFIC Implementation

3.1 The ICAO’s Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) has established an ADS-B Implementation Task Force to plan the implementation of ADS-B in the Asia/Pacific Regions.

3.2 ADS-B technology can address the following shortcomings for Air Traffic Management surveillance in the Asia/Pacific Region:

- Reliability (ageing radars), ADS-B technology is far cheaper and provides equal or superior performance;
- Surveillance is simply not available in some parts of the airspace, due to either financial constraints or the nature of the territory prohibiting the installation and operation of radar equipment;
- Limited cross border radar data sharing, ADS-B could be a catalyst to promote cross- border data sharing to improve inter State co-ordination;

3.3 In this context presented, the Air Navigation Services Providers (ANSP’s) are faced with high costs for upgrades, replacement and maintenance of surveillance infrastructure. Also Air Traffic Management infrastructure upgrades have a long track record demonstrating lengthy delays and cost overruns. Finally, securing funding for CNS/ATM infrastructure upgrades generally takes much time, and in the mean time resulting airspace user penalties such as efficiency/capacity X non-optimal routes and safety compromises.

3.4 The ICAO Asia/Pac APANPIRG made a decision to start implementation of “ADS-B out”, i.e. for the provision of “radar like services” in the region from January 2006 onwards. An specific task force, the “ADS-B task Force” was established to progress ADS-B implementation and co-ordination plans in the region.

4. The SITA and Airservices Australia partnership

4.1 Airservices Australia has embarked on an operational implementation of ADS-B based on Mode-S Extended Squitter. Known as the "Upper Airspace Programme", it will result in ADS-B coverage throughout Australian airspace by end 2005 from 28 sites across the country.

4.2 In October/2004, SITA and Airservices Australia (ASA) set up a strategic partnership to promote the concept of "Regional ADS-B Service" provision as a response to International Civil Aviation Organization (ICAO) decision that ADS-B be introduced into the region from January 2006 onwards. The delivery of ADS-B data is, in principle, no different to the ADS-Contract (ADS-C) service that SITA provides today to the majority of the world's Air Navigation Service providers that have implemented this technology in their ATM systems.

4.3 A key implementation option is to take advantage of existing SITA VHF sites where the necessary infrastructure, (e.g. power, network connection) is already available. ADS-B receivers would be integrated into the existing SITA VHF equipment and the network connection speed upgraded to comply with the requirements for handling ADS-B data.

Fig 1 - SITA VHF Ground Stations with ADS-B Capability"

4.4 As partners, SITA and Airservices Australia will undertake trials and demonstrations at key locations in the region to illustrate the potential value and benefits of ADS-B technology including the promotion of cross FIR boundary data sharing.

4.5 Airservices Australia is contributing its experience and expertise in ADS-B technology planning and implementation based on its pioneering operational deployment in Australia. SITA brings to the project its global presence and 20 year experience in the delivery of managed air/ground data communications services that enable Air Traffic Controllers to exchange data messages with pilots.

4.6 A typical demonstration system will comprise a number of sites connected via a SITA Virtual Private Network service that will make data available to interested ANSPs and airlines in the region. The demonstrator will also provide key display systems at participating sites.

4.7 SITA has acquired the required expertise to, jointly with an ANSP or a Regional group of ANSPs, set up a basic set of requirements in order to develop a technical description on purposes, air-ground requirements and infrastructure for an operational trial.

4.8 SITA is currently conducting an ADS-B trial in the UK that has, to date deployed ADS-B receivers (from a UK company called QinetiQ) at London Heathrow and Stanstead airports. Two additional receivers will be deployed by the end of this year at London Gatwick and Luton Airports. Results obtained to date clearly demonstrate the increasing numbers of ADS-B equipped aircraft and the accuracy of ADS-B data when compared to radar data as well as providing SITA with the data required to provision the necessary network capacity.

4.9 SITA considers that this is an opportunity for other regions to move towards regional CNS infrastructure solutions that will ultimately result in cost savings/ operational efficiency optimisation and corresponding reductions in air navigation service charges.

5. Recommended Action

5.1 The meeting is invited to**:**

a) note the information provided in this working paper; and provide feedback;

b) develop a recommendation for a funded ADS-B trial program based on available technology and services in order to improve the awareness of ADS-B and evaluate the benefits to the Air Traffic Management in the region;

c) note that SITA is willing to support such a trials program based on its current partnership with Airservices Australia, proven global data link service delivery experience (including ADS-C) and the on-going ADS-B trials that SITA has initiated in other parts of the world.

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