International Civil Aviation Organization

AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST SEMINAR AND ELEVENTH MEETING OF AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) STUDY AND IMPLEMENTATION TASK FORCE (ADS-B SITF/11)

Jeju, Republic of Korea, 24-27 April 2012

Agenda Item 6: **Review States' activities and interregional issues on trials and implementation of ADS-B and multilateration.**

ADS-B SURVEILLANCE IMPLEMENTATION IN FIJI

(Presented by Fiji)

SUMMARY

This paper presents the status of implementation of Automatic Dependent Surveillance – Broadcast Out (ADS-B OUT) in Fiji and seeks guidance from the meeting on some issues relating to Quality checks on received ADS-B data from an aircraft with clear agreed guidelines on criteria for acceptance or rejection of the ADS-B data

1. INTRODUCTION

1.1 The Fiji Domestic Airspace is a Non-Radar Airspace (NRA) with procedural air traffic control performed daily by Air Traffic Controllers in the Control Towers at Nadi and Nausori Airports. They are still using paper flight progress strips as a tool to aid them in their work of ensuring safe separation of domestic aircrafts including a mix of aircrafts on international arrivals and departures into and out of the two airports particularly for Nadi Airport.

1.2 In the Nadi FIR which covers a larger Oceanic Airspace, for improved procedural air traffic control, the use of computerised air traffic control display has been provided since late 2001/early 2002 with improved functionalities, situational awareness and alerts to aid the air traffic controller in the Air Traffic Management Operations Centre (ATMOC) at Nadi Airport.

1.3 From the above two distinct scenarios alone, for improved performance and safer, more efficient and effective air traffic movements within as well as in and out of the Fiji Domestic airspace, one can appreciate that the air traffic controllers operating in this airspace require much improved tools using available technology to aid them in their work.

1.4 With observations and monitoring of performances over the years, it was noted by the regulators Civil Aviation Authority of Fiji (CAAF) and the ANSP Airports Fiji Limited (AFL) that a suitable surveillance system is required in the Fiji Domestic airspace. This was further confirmed by an ICAO Audit in 2006 that for requirements of improvement to **Safety** of air traffic control and management in the Fiji Domestic airspace, an appropriate means of surveillance be implemented at Nadi.

1.5 Some options were considered and Radar was noted to be very expensive to purchase, install and maintain when compared to the ADS-B option (a newer technology than Radar) which was proving to be better than RADAR and more cost effective, efficient and provides for more opportunities in the future air navigation requirements including ADS-B IN and associated benefits... MLAT option was considered for Nadi only so as to cater for those existing aircraft that used Mode S transponders but would not be cost-effective to be retrofitted.

1.6 The ADS-B surveillance option was considered the best option for the Fiji Domestic Airspace and it was also considered that a minimum of eight (8) Ground Station (GS) sites would be required for ADS-B with 3 additional sites required for MLAT operation around Nadi. Existing sites & infrastructure were selected to minimize cost of site preparation, installation and time of delivery of the contract since acquisition of land, access and provision of services to remote sites can be a prolonged and challenging issue in Fiji. Through testing, validation, training and operational use of these ADS-B sites, performance can be assessed and possible improvements considered.

1.7 The eleven sites include Rotuma (the most remote site), other remote sites include Delaikoro, Matei, Lakeba, Nausori Tower, Monasavu, and the five (5) sites around Nadi are Lomolomo, Nagado, Nawaka, Denarau and Nadi Tower.

1.8 In addition to our requirement for Surveillance solution there was a critical situation that the current EUROCAT ATM System at that time was degrading in performance as well as not easily adaptable to new requirements thus the need to upgrade or replace the EUROCAT system at the earliest possible time. A Tender was called for the ADS-B Surveillance Systems Project which included the upgrade or replacement of the ATM System. It was later renamed to "ATM replacement with ADS-B Functionalities project".

2. DISCUSSION

2.1 In March 2009, Airports Fiji Limited (AFL) signed a contract with ERA a Czech Republic company (under ownership of SRA of USA) for the provision of the following:

- AURORA ATM System to replace the EUROCAT ATM System with availability of similar and more functionalities/capabilities (ADS-C/CPDLC, FPL, AIDC, GRIB, Accurate flight path modeling, Conflict Probes and Alerts, STCA, MSAW, RAM, CLAM, capability for processing of ADS-B data, etc.)
- ADS-B Surveillance System;
- Training on Systems, Safety Case, Air space redesign and Flight Yield billing system

ERA the contractor with expertise on provision of ADS-B & MLAT Systems with training took on project management role and teamed up with:

- **ADACEL of Montreal Canada** for the provision of the AURORA ATM System for Oceanic Control, Nadi and Nausori Towers and a Business Continuity/ Training (BCST) system with Technical training; and

- **Airways International of New Zealand** to provide initial Air Traffic Controller training on AURORA System as well as Safety Case, Airspace Redesign and Flight Yield billing system.

- **Telecom Fiji Limited (TFL)** to provide the dedicated ADS-B Communications Network Infrastructure for the AFL ADS-B System as part of the ERA contract.

2.2 This project has many challenges as expected firstly in the Communications Network which has been worked on progressively to improve and approach final discussions and possible signing of a Service Level Agreement (SLA) between Airports Fiji Limited (AFL) the ANSP and Telecom Fiji Limited (TFL) the Communications Services Provider. It has taken longer than expected but it is a critical component which could be the weakest link in the whole surveillance system so it needs patience and perseverence with commitment to ensure that appropriate solution is provided and timely decisions made.

2.3 Ten of the eleven sites are connected through the ADS-B Communications Network and fed to a Central Processing System which then outputs an Asterix data to the AURORA ATM System. The remaining one which is the most remote site is Rotuma which has available to it only VSAT communications link.

2.4 Due to the high latency (> 300ms) on arrival of the data at the CPS it was treated as a dedicated ADS-B Ground Station with its Asterix data output fed directly into the ATM system. It is being considered that tracks from this site may need to be presented with a degraded signal for use with appropriate separation standards to be decided. The sites providing Asterix output to the AURORA ATM System (refer table below) are Nadi CPS (with duplicated servers for ADS-B & MLAT) and Rotuma (with duplicated ADS-B Ground Stations).

Item	Name of Station	Location	Latitude	Longitude	SAC	SIC	Range Coverage	Installation Date
01	Rotuma1	Rotuma	12:28:53.4240S	177:04:17.9220E	26	204	200NM	2011
02	Rotuma2	Rotuma	12:28:53.4240S	177:04:17.9220E	26	205	200NM	2011
03	TP1 – Cat021	Nadi CPS	17:45:31.6800S	177:26:46.7160E	26	200	200NM	2011
04	TP2 - Cat019	Nadi CPS	17:45:31.6800S	177:26:46.7160E	26	202	200NM	2011
05	TP2 – Cat021	Nadi CPS	17:45:31.6800S	177:26:46.7160E	26	201	200NM	2011
06	TP2 – Cat019	Nadi CPS	17:45:31.6800S	177:26:46.7160E	26	203	200NM	2011

2.5 To add to the challenge, it was necessary and critical to implement the replacement of the Oceanic EUROCAT System and commissioning the AURORA Oceanic System first due to the degradation of the EUROCAT system and risk should an unrecoverable crash occur so the AURORA Oceanic system was commissioned on 1st July 2010. Whilst one problem was addressed successfully, we now were restricted to conducting most of the tests that followed on the Business Continuity System/Training (BCST) before testing on the main Oceanic platform on a reduced and controlled duration at a date/time when traffic is low and risks manageable.

2.6 Further challenge faced is to encourage the fifty (50) Fiji registered aircraft to equip with appropriate ADS-B avionics. Of these 50, five (5) appear to be equipped but these need to be checked for suitability which leaves a total of 45 requiring appropriate ADS-B equipage.

2.7 The ATM Replacement and ADS-B Surveillance Project has progressed successfully through all phases of the project contract (including FAT, SAT and final parts of RAT) but not without challenges. However, more reliability tests and validation checks with appropriate analysis is to be conducted internally. Refer to Attachment 1 for indication on traffic capture on Management Terminal display for the ADS-B Central Processing System... One of the major requirements is to understand and apply appropriate quality checks on the Asterix data that is received to determine which is good data and which is bad and dealing with them accordingly. Assistance will be required from the meeting and from ICAO and neighbouring States and expertise to provide guidance on the subject.

2.8 The system is expected to commence with ADS-B service performance requirements Category Tier 2 (refer Attachment 2 – extract from APANPIRG 18) and be available in August 2012 for commencement of ATC Surveillance training. Following completion of training, with wide consultations and with extensive use of the system with improvements made where required for Category Tier 1 performance, the objective is to ensure reliable performance in the surveillance environment before scheduling a date for reduction of separation standards down to 5NM in the Domestic Airspace.

2.9 With further reliability testing, data collection, validation and analysis work to be done as well gaps to be identified and addressed, it was decided not to provide data at this stage until they are verified and confirmed.

2.10 The priority applied to the aircraft targets on the AURORA ATM display are as follows:

- Priority of target are as follows from top to least;
  - ADS-B
  - MLAT
  - ADS-C
  - FPL
- On the Aurora, the symbols are as follows;
  - **X** – MLAT
  - ✦ – ADS-B
  - ✈ ADS-C (un-filled for FPL)

2.11 ”Fiji is considering options to achieve early equipage of Fiji registered aircraft in order to facilitate earlier commencement of surveillance training of air traffic controllers. Discussions are ongoing with meetings being held to provide suitable means for owners of those Fiji registered aircraft which are not yet equipped. There is a need to also consider bringing forward the mandate date, which is currently set at 13th December 2012, so that controller training may commence in the second half of this year.”

2.12 Whilst performing this major project on the ATM Replacement and ADS-B Functionalities, the FPL 2012 upgrade is being conducted with FAT done at ADACEL Factory in Montreal in March 2012 and SAT recently conducted earlier this month. Fiji plans to conduct trials with FAA soon followed by other neighbouring ANSPs Airways NZ and Air Services Australia (ASA). Currently on track for the 15th November 2012 cutover date for FPL2012 Upgrade.

2.13 Fiji is exploring opportunities to provide further benefits and sought assistance from FAA for inclusion and participation on ITP trials within the Nadi FIR.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the contents of this paper; and

b) provide comments or advice especially in the areas of Quality checks on the Asterix data that is received and dealing with them appropriately.

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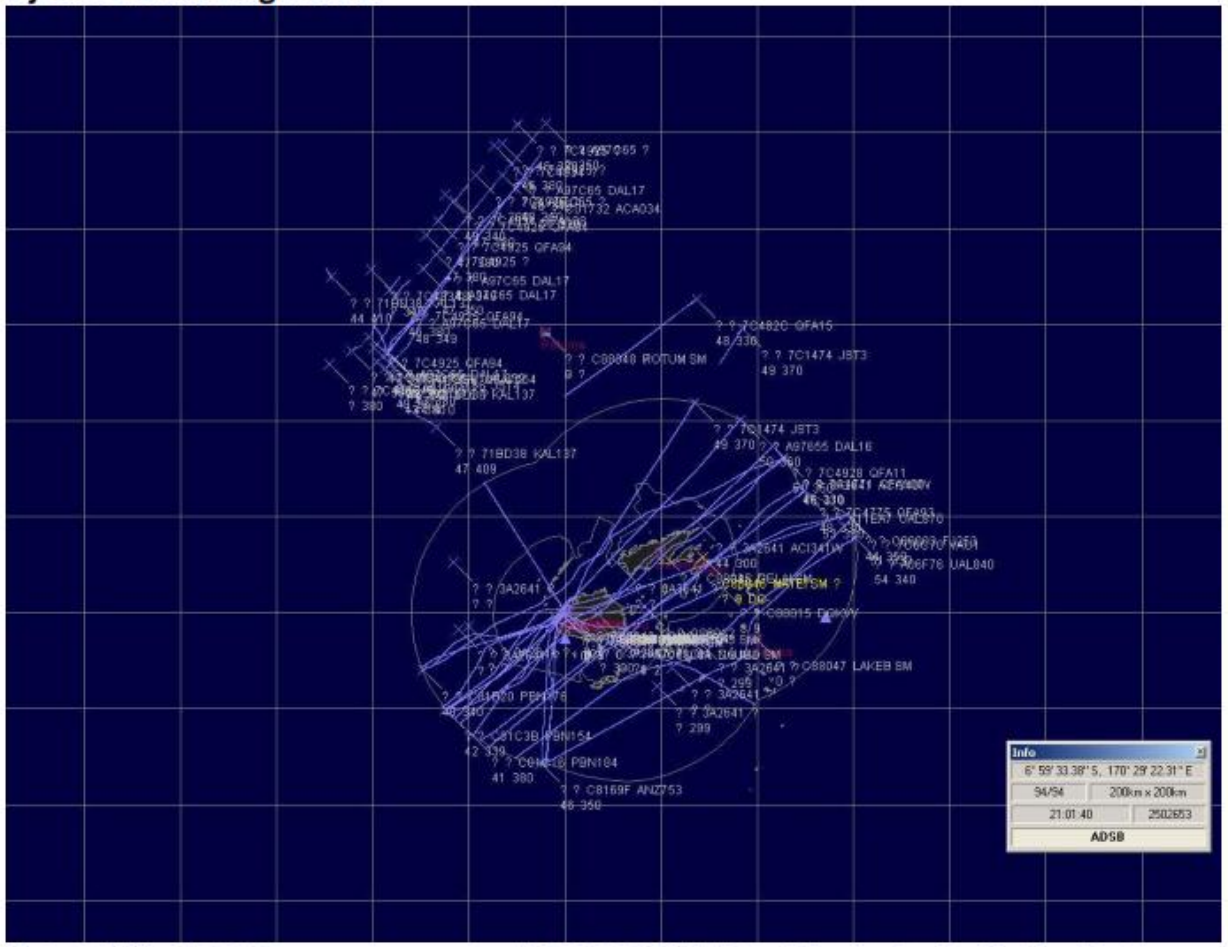
Fiji ADS-B coverage area.



Note: Fiji's ADS-B coverage area with ADS-B flights. Also included is the Rotuma ADS-B coverage. ADSB flight tracks are towards the north-west of the Rotuma ADS-B ground station and one to the right heading south east.

BASELINE ADS-B SERVICE PERFORMANCE PARAMETERS

The following table provides guidelines for various performance requirements of ADS-B Category (Tier) 1, 2 or 3 services that States may consider when acquisition of an ADS-B managed service agreement with a service provider:

Service Parameter	**Category 1 (Tier 1)** **5nm separation capable commensurate with Radars (separation/vectoring/high performance with reliability, integrity & latency)**	**Category 2 (Tier 2)** **Situational awareness similar to ADS-C (safety net alerts, SAR, supports procedural separation without voice, not 5nm separation)**	**Category 3 (Tier 3)** **Position Reporting with Enhanced Flight Operation**
Aircraft Updates	1 second < Rate < 5 seconds as Operationally required	1 second < Rate < 20 seconds as Operationally required	1 second < Rate < 60 seconds as Operationally required
Network Latency	95%: < 2 seconds of ground-station output	95%: < 15 seconds of ground-station output	95%: < 60 seconds of ground-station output
Reliability 1	2 autonomous ground-stations including antenna, each providing data, no common point of failure	1 unduplicated ground-station including antenna	1 unduplicated ground-station including antenna
Reliability 2 - MTBF	Each ground-station including antenna to have MTBF >10,000 hrs	Each ground-station including antenna to have MTBF >10,000 hrs	Each ground-station including antenna to have MTBF >10,000 hrs
Reliability – Communications Infrastructure	Completely duplicated, no common point of failure	Unduplicated, MTBF > 400 hrs	Unduplicated, MTBF > 200 hrs
Reliability – Total ADS-B Service	Total Service MTBF > 50,000 hrs	Total Service MTBF > 400 hrs	Total Service MTBF > 200 hrs
Availability – Total ADS-B Service	Total Service Availability > .999	Total Service Availability > .95	Total Service Availability > .90
Integrity – Ground Station	Site monitor, including GPS RAIM, monitored by RCMS	Site monitor, including GPS RAIM, monitored by RCMS	Site monitor, including GPS RAIM, monitored by RCMS
Integrity – Data Communications & Processing	All systems up to ATM system, errors < 1 x 10E-6	All systems up to ATM system, errors < 1 x 10E-6	All systems up to ATM system, errors < 1 x 10E-6