International Civil Aviation Organization

Automatic Dependent Surveillance – Broadcast (ADS-B)
Study and Implementation Task Force

Brisbane, Australia, 24-26 March 2003

Agenda Item 2: Review of ADS-B Activities

d) Review activities by Asia/Pacific States in trials and demonstration of ADS-B;

AUSTRALIAN ADS-B TRIAL

SUMMARY

This paper describes the ADS-B Trial being conducted by Airservices Australia near Bundaberg Queensland Australia

(Presented by Australia)

1. Airservices Australia operational deployment of an ADS-B system

Airservices Australia has initiated a project to conduct an operational trial of ADS-B for ATC surveillance in a region near Bundaberg Queensland. The project will install a single ADS-B ground station, equip a number of aircraft with ADS-B avionics, and modify an operational air traffic management system to process and display ADS-B tracks.

The objectives of the trial are:

- To provide and demonstrate operational benefits to airline and airspace users in the selected area. Airservices has the objective of using ADS-B tracks to separate aircraft. Data collection and operational validation will occur and new radar like separation standards will be produced before the system is used to separate aircraft.
- To provide first hand operational experience of ADS-B for ATC surveillance in the Australian environment including the development of procedures and training.
- To provide cost-benefit information and practical information before widescale deployment of ADS-B for radar like surveillance within Australia is considered.

Australia considers that ADS-B technology opens the possibility of cost effective ATC surveillance in areas of Australia where radars cannot be justified. Potentially surveillance could be provided over the whole continent as it is today for VHF voice communication. Safety and commercial benefits will result when compared with the inefficencies of today's procedural control in these areas.

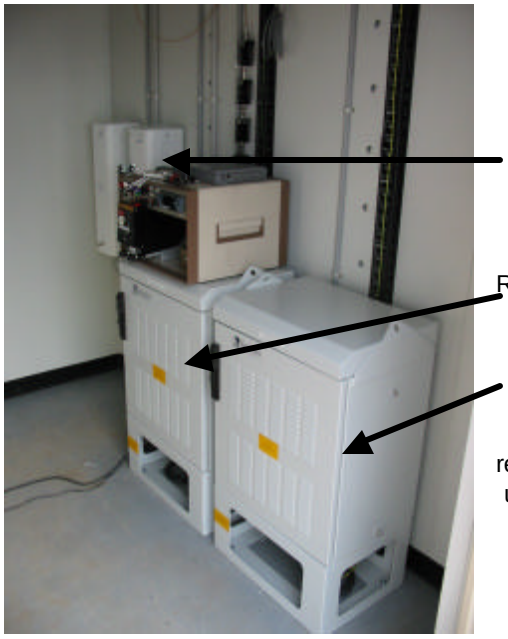
2. Technical details

Tenders were called in 2001 for equipment to support an operational trial of ADS-B surveillance. The call for tenders did not specify the technology, nor did the assessment process favour any technology Rather the choice was made largely on financial, risk and functionality grounds. Contracts have been signed to supply the following:

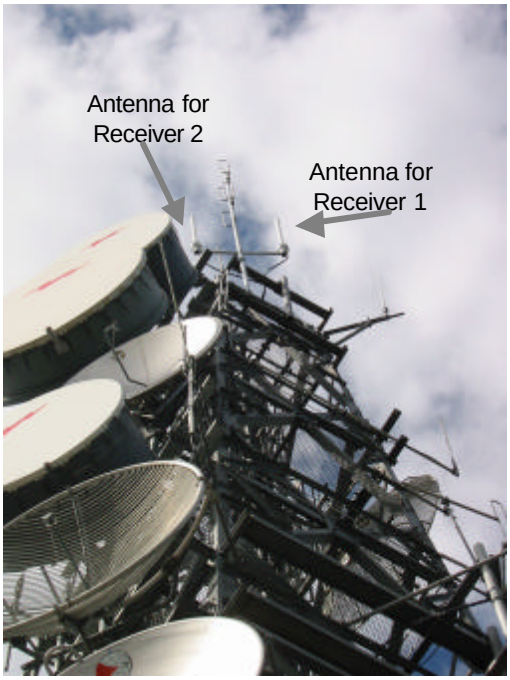
- Honeywell KT73 Mode S transponders with ability to transmit Downlink Formats 17 and 18. DF=18 (as defined in RTCA/DO-260) will be used for installations in TCAS aircraft because the KT73 will be an additional non-interrogatable unit. DF=17 will be used for non TCAS aircraft because the KT73 will replace the current ship transponder.
- Honeywell KLN94 navigators to provide positional and integrity data.
- A fully duplicated Sensis ground station with omni directional antennas which outputs Asterix Cat 21 messages. For the trial a completely passive ground station will be used. The antenna used is an omni directional antenna of 8dB gain.
- Software changes to The Australian Advanced Air Traffic System (TAAATS). ADS-B tracks will be presented to controllers on the same screen as radar, ADS-C and flight plan tracks. The system will include coupling of ADS-B tracks with flight plans, short term conflict alert, minimum safe altitude warning and danger area infringement warning.
- The TAAATS training simulator will be updated to support ADS-B.
- ADS-B tracks will be displayed to operational air traffic controllers only when there is no radar detection available for a particular aircraft. This strategy has been chosen (rather than attempting to fuse ADS-B and radar tracks) to remove the need for retesting of the radar system integrity during commissioning activities. TAAATS will automatically monitor an ADS-B site monitor (parrot) to provide end-to-end system integrity checks.
- Additional details are available from Airservices Australia's website at www.airservices.gov.au

3. Ground station

The Airservices Australia ADS-B Ground station at Bundaberg is a typical ADS-B site. It is installed on a site belonging to another agency and the antennas are installed on the other agency's tower. The equipment comprises two "bar fridge" size units as illustrated.



The system has two antennas for reliability purposes.



These photographs show that site deployment can be simple.

The ADS-B receiver equipment can be readily installed at existing sites. The most significant issue for each site is the data communications link sending data back to the ATC centres.

The cost of deploying this ADS-B ground station are known thus keeping the risks of cost increases low.

4. Current status

The ground system was installed in mid 2002. The site was generating ADS-B data reports to the Brisbane centre 5 days after the equipment arrived in Australia. Installation was easily accomplished. Technical training has been completed and all technical procedures have been developed.

The changes to the ATC automation system completed factory tests in the second half of 2002. Site acceptance tests have recently been completed at the Airservices Australia test and evaluation facility in Melbourne. These changes will be rolled out on the operational platform in Brisbane in the April/May 2003 timeframe coupled with some hardware upgrade activities. However, the Brisbane ATC training system will be converted to a temporary operational platform to demonstrate ADS-B this week during the ADS-B Task Force meeting.

The general aviation mode S transponders able to transmit ADS-B are expected to achieve TSO certification from the FAA in March 2003. These avionics are currently installed on 2 Beech 200 aircraft. Installation on further aircraft will take place after the TSO approval is received.

ATC procedures have been developed to use ADS-B. A Draft AIC supplement has been prepared and is attached.

A design safety case has been submitted to the Australian regulator and an implementation safety case is near completion.

5. Performance results

Excellent performance has been achieved in the pilot ADS-B system. Graphs are attached which show :

- Reception performance from an Air New Zealand aircraft squittering DF11 at a range in excess of 250 Nm
- Reception performance from the GA class ADS-B transponders installed in the Beech 200 aircraft.

In summary, coverage is only really limited by line of sight limitations and is better or equivalent to SSR radar performance.

6. Recommendations

It is recommended that the meeting note the conduct of the Australian ADS-B pilot deployment and note the excellent performance achieved using mode S extended squitter.

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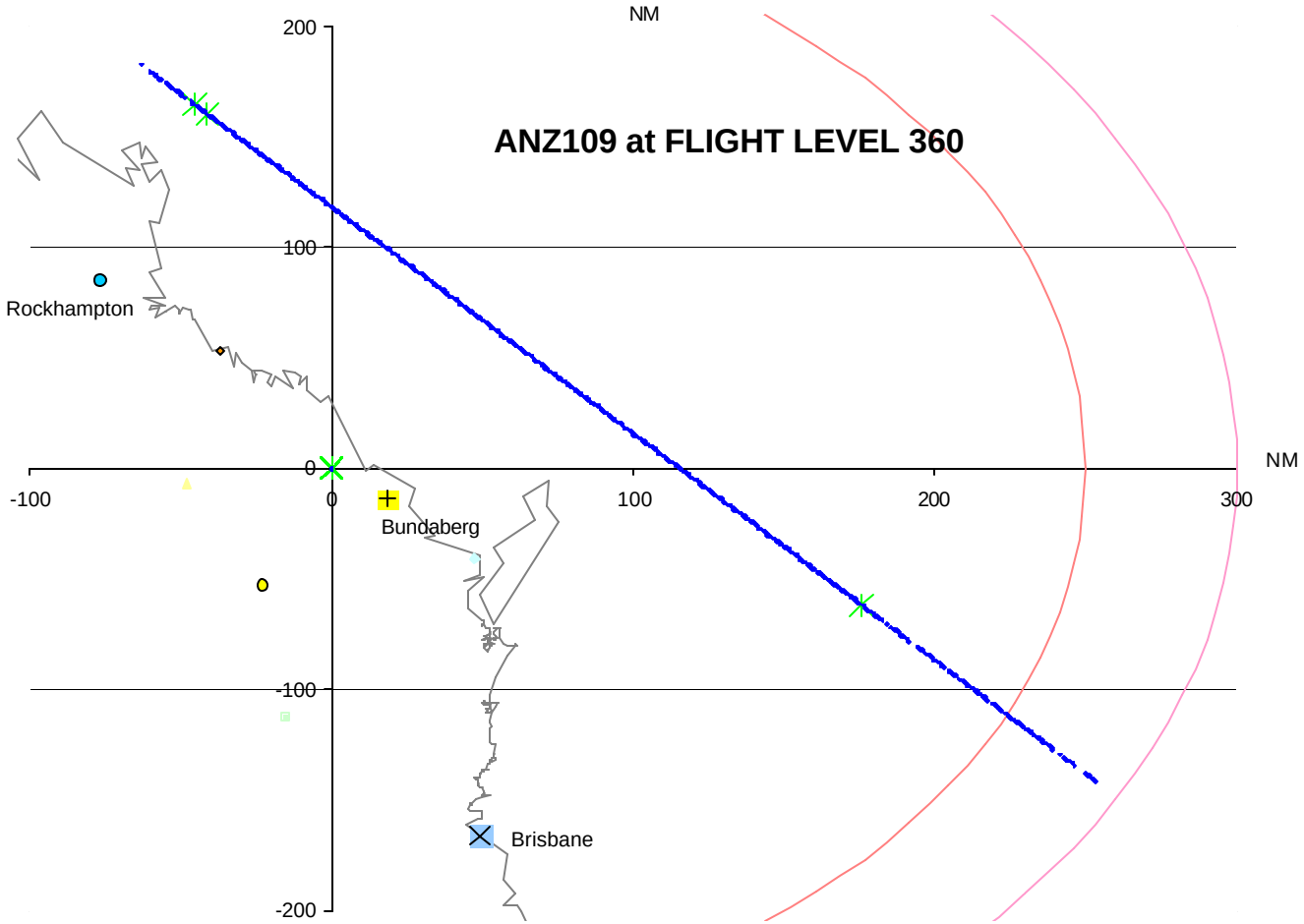
NM
ANZ109 at FLIGHT LEVEL 360
200
100
0
-100
-200
-100
0
100
200
300
NM
Rockhampton
Bundaberg
Brisbane

Two Aircraft manoeuvring at Hervey Bay 60 nm from the ground station. Coverage extends down to 100 feet above the airport at this location.

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AIP SUPPLEMENT

AIRAC

HXX/03

FILE : 2003/XXX **DATE : XX XXX 03**

AUTOMATIC DEPENDENCE SURVEILLANCE – BROADCAST (ADS-B)
OPERATIONAL TRIAL
BUNDABERG – QUEENSLAND

1. INTRODUCTION

1.1 Airservices Australia is conducting an operation trial of Automatic Dependent Surveillance Broadcast (ADS-B) technology in the airspace surrounding Bundaberg Queensland. The objective of the deployment is to demonstrate real operational benefits to operators in that region and to build a working knowledge of ADS-B in Australia.

1.2 The ADS-B systems will enable Airservices Australia to provide radar-like surveillance and related air traffic services to a limited number of aircraft that operate in the Wide Bay – Burnett region.

2. BACKGROUND

2.1 ADS-B is a function of specialised aircraft avionics that transmits information, such as position, altitude, aircraft identification and velocity. This data is broadcast at rapid intervals for utilisation by any ground based user or aircraft that requires it.

2.2 ADS-B is a secondary form of surveillance, with radar systems remaining as the primary form.

2.3 ADS-B information is used in a manner similar to surveillance data derived from radar systems. When aircraft are appropriately equipped and within range of a ground station receiver, ADS-B will become a source for aircraft position and altitude beyond or below radar coverage or when radar surveillance systems are unavailable.

3. DEFINITIONS

3.1 ADS-B (Automatic Dependent Surveillance-Broadcast): A surveillance application of specialised aircraft avionics that transmits aircraft data at specified intervals via a broadcast mode, digital data link. Transmitted data includes position, altitude, aircraft identification and velocity.

3.2 ADS-B Ground Station: A ground based facility that receives ADS-B information from aircraft and transmits it to air traffic control facilities.

3.3 Surveillance: For the purpose of this document, "surveillance" is defined as the display of aircraft identification, position, speed and altitude information on air traffic control screens which is derived from primary and secondary radar systems and ADS-B.

3.4 ICAO 24 Bit Aircraft Address: A six character alphanumeric identification code which is programmed into each specific aircraft's Mode S transponder during installation. This code, sometimes referred to as the 24 bit code, provides a digital identification of the aircraft and is used by the air traffic system to link information contained in a flight notification to aircraft position information received via ADS-B.

4. ADS-B OPERATING PROCEDURES

4.1 Except as described below, ADS-B procedures and services are identical to those prescribed for radar in AIP ENR 1.6. The procedures outlined below shall apply to participating aircraft operators with an effective date/time to be notified by NOTAM.

4.2 **Avionics Operation:** In order to keep aircraft modifications to a minimum, the majority of aircraft participating in the ADS-B operational trial have the specialised ADS-B equipment installed outside the cockpit with no pilot access to the avionics. In these cases, the avionics will be set to power-up, initialise and broadcast automatically.

In some participating light aircraft, the avionics are installed in the cockpit and may be used as the aircraft's primary transponder and GPS navigator. In this configuration, pilots should operate the avionics in the appropriate modes at all times. The transponder's Aircraft Identification should always be set to show aircraft registration (tail number). See relevant operator handbooks.

4.3 **Flight Notification:** From the specified effective date, participating aircraft operators should include the ICAO 24 Bit Aircraft Address code for the aircraft in the other information field (item 18) of the flight notification. See examples on the following pages.

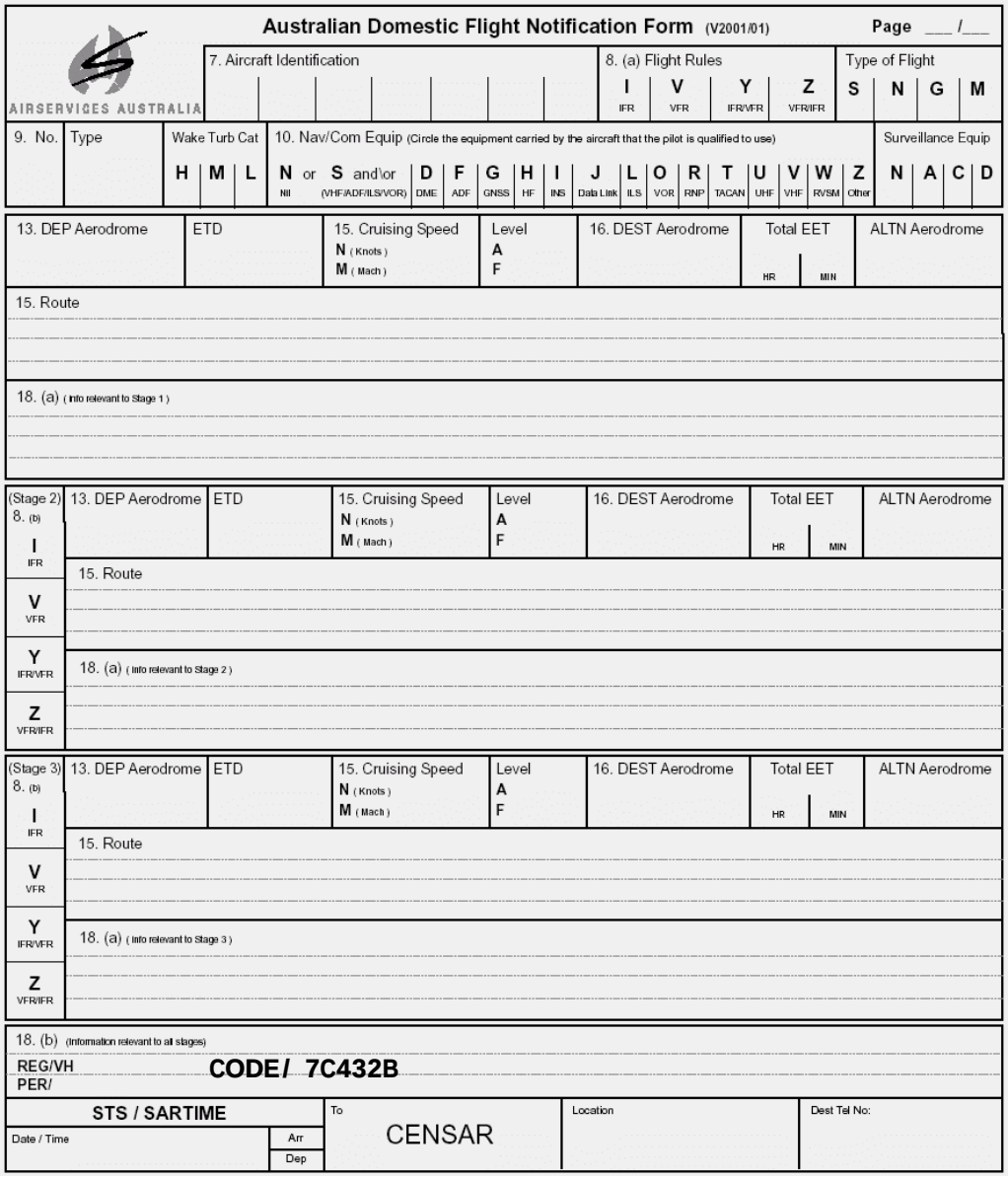
Inclusion of this code provides a means for the air traffic control system to automatically correlate flight plan information with ADS-B data from a specific aircraft.

The 24 bit codes allocated to aircraft participating in the ADS-B trial may be requested through the ADS-B website at www.airservicesaustralia.com/adsb or from the Airservices Australia Briefing Office on 1800 805 150 (Telstra PhoneAway system – call charges apply).

Note: Inclusion of the Mode S code in a flight notification is an indication to ATC that the ADS-B avionics are appropriately certified and that the flight crew is qualified for ADS-B operations. If this is not the case, do not enter the Mode S code.

For aircraft operators submitting flight notifications via paper forms, insert the characters "CODE/" in item 18b followed by the 6-character alphanumeric Mode S code.

Example



AIRSERVICES AUSTRALIA

Australian Domestic Flight Notification Form (V2001/01) Page ___ /___

7. Aircraft Identification | 8. (a) Flight Rules: I IFR, V VFR, Y IFR/VFR, Z VFR/IFR | Type of Flight: S N G M

9. No. | Type | Wake Turb Cat: H M L | 10. Nav/Com Equip (Circle the equipment carried by the aircraft that the pilot is qualified to use): N or S and\or (N Nil, S VHF/ADF/ILS/VOR), D DME, F ADF, G GNSS, H HF, I INS, J Data Link, L ILS, O VOR, R RNP, T TACAN, U UHF, V VHF, W RVSM, Z Other | Surveillance Equip: N A C D

13. DEP Aerodrome | ETD | 15. Cruising Speed: N (Knots) M (Mach) | Level: A F | 16. DEST Aerodrome | Total EET: HR MIN | ALTN Aerodrome

15. Route

18. (a) (Info relevant to Stage 1)

(Stage 2) 8. (b): I IFR, V VFR, Y IFR/VFR, Z VFR/IFR

13. DEP Aerodrome | ETD | 15. Cruising Speed: N (Knots) M (Mach) | Level: A F | 16. DEST Aerodrome | Total EET: HR MIN | ALTN Aerodrome

15. Route

18. (a) (Info relevant to Stage 2)

(Stage 3) 8. (b): I IFR, V VFR, Y IFR/VFR, Z VFR/IFR

13. DEP Aerodrome | ETD | 15. Cruising Speed: N (Knots) M (Mach) | Level: A F | 16. DEST Aerodrome | Total EET: HR MIN | ALTN Aerodrome

15. Route

18. (a) (Info relevant to Stage 3)

18. (b) (Information relevant to all stages)

REG/VH

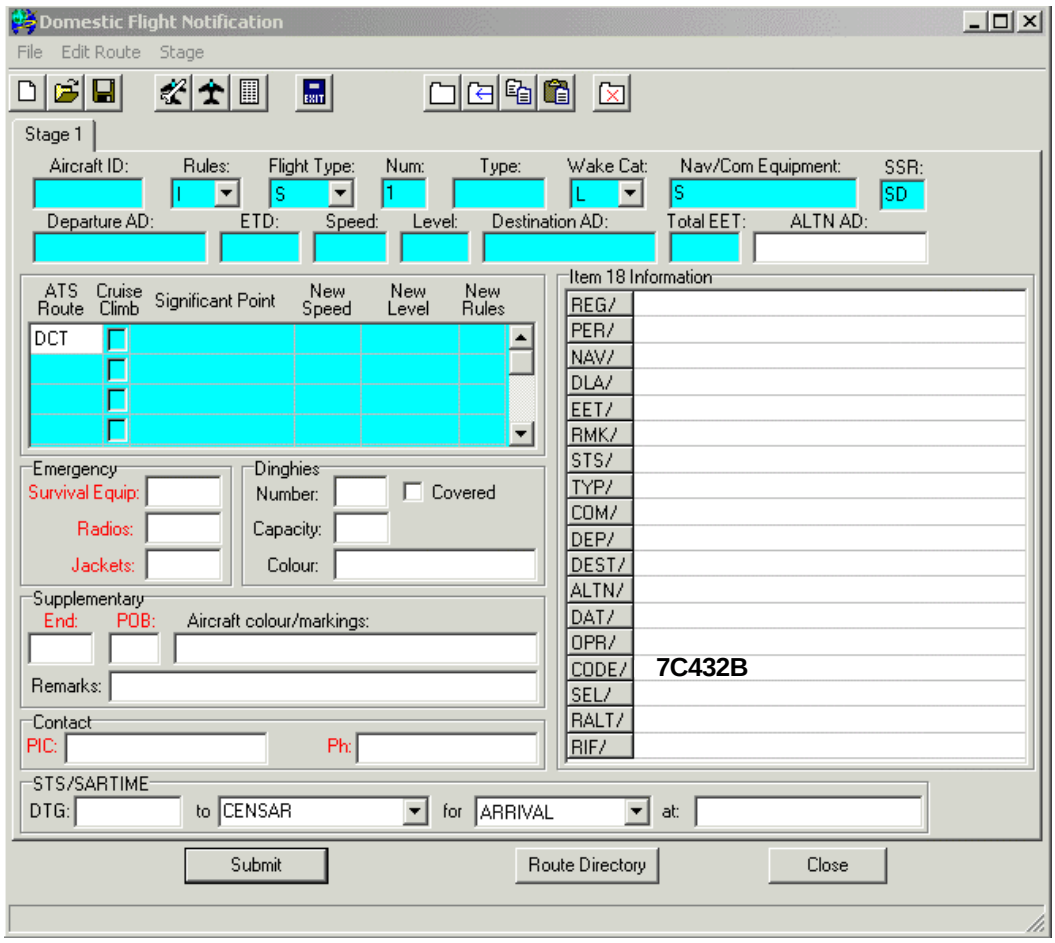
PER/

CODE/ 7C432B

STS / SARTIME | Date / Time | Arr | Dep | To: CENSAR | Location | Dest Tel No:

For aircraft operators using computer based flight notification forms, type the 6-character Mode S code directly into the CODE/ box of the Other Information or Item 18 section.

Example



4.4 **Communications.** The following phraseologies may be used in communication with Air Traffic Services facilities providing ADS-B services:
Provision of Service (AIP Gen 5.13.1)
a. SURVEILLANCE CONTROL TERMINATED [DUE (reason)]
b. SURVEILLANCE SERVICE TERMINATED (instructions)

When ATC is unable to provide Radar (or ADS-B) Information Service (RIS)
SURVEILLANCE SERVICE NOT AVAILABLE

When a RIS is terminated
SURVEILLANCE SERVICE TERMINATED – FREQUENCY CHANGE APPROVED

When an aircraft is required to stop transmitting ADS-B data
STOP ADS-B TRANSMISSION

Note: Requests to stop ADS-B transmissions shall only be made in the event of know or suspected airborne or ground system faults. In aircraft without pilot access to the ADS-B avionics, the pilot shall deactivate the ADS-B transponder in accordance with procedures approved by the aircraft operator. **If this is not possible, advise ATC immediately.**

Other phraseologies contained in AIP in reference to operations in radar coverage will also be applied to ADS-B operations.

4.5 Hazard Alerting. Controllers will broadcast reduction in ADS-B services when conditions meet the unexpected and critical nature of AIP GEN 2.11. All other outages will be notified by NOTAM.

Pilots shall advise ATC of loss of accuracy of the GPS as per AIP ENR 14.4.11.2 for operations in all classes of airspace. Note: ATC may adjust separation prior to a pilot's notification as result of a change in the Navigational Uncertainty Category (NUC) received from the aircraft avionics. RAIM is one of the components that determines the NUC.

5. OPERATIONAL TRIAL AREA

5.1 The ADS-B ground station is located approximately 25 nautical miles northwest of Bundaberg, Queensland. Surveillance capability at IFR lowest safe altitudes in the area is expected out to a range of approximately 100 nautical miles, abutting the radar coverage that already exists in the region above 12,000 feet.

ADS-B coverage above 10,000 feet is expected to exceed 150 nautical miles.

ADS-B signal coverage at ground level is expected at Bundaberg Airport.

6. CANCELLATION

6.1 This AIC will be cancelled by check list summary.

7. DISTRIBUTION

By AVFAX and Airservices Australia web site only.