



**Twenty First Meeting of the
Informal South Pacific ATS Co-ordinating Group (ISPACG/21)**

Auckland, New Zealand, 6-8 March 2007

Agenda Item 7: Any other business

Use of ADS-C Meteorological data by the Bureau of Meteorology

(Presented by Airservices Australia)

SUMMARY

This working paper describes the benefits of providing meteorological data received in ADS-C reports to meteorological offices and how this information is used and relayed to other agencies.

1. INTRODUCTION

1.1 Meteorological Offices obtain wind reports from a number of sources. These include ground reports, radio-sondes and aircraft reports.

1.2 The increasingly widespread use of ADS-C has the potential to provide meteorological offices with continually updated wind and temperature information from a wide variety of locations. This could result in an improvement to the wind and trajectory modeling, with corresponding improvements to the wind information used by airlines and air traffic services units.

2. CONTENTS OF AN ADS-C REPORT

2.1 All ADS-C reports contain the “Basic” ADS-C Group. This ADS Group contains the 4D position of the aircraft as well as FOM (Figure of Merit) and other navigational data.

2.2 Additional ADS-C groups can be included in an ADS-C report – the information downlinked by the aircraft is in accordance with the ADS contract uplinked by the ATSU. ADS-C groups that are available include:

- Flight Identification Group;
- Earth Reference Group;
- Air Reference Group;
- Airframe Identification Group;
- Meteorological Group;
- Predicted Route Group (PRG);
- Intermediate Projected Intent Group; and

- Fixed Projected Intent Group.

The Meteorological Group contains Wind speed, True wind direction and temperature.

2.3 When an ADS-C report is received that contains meteorological information, there is a responsibility for this information to be relayed onwards by the ATSU. *Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM) Doc 4444 p 4.12.6* refers:

“4.12.6 Forwarding of meteorological information

4.12.6.1 When receiving ADS reports which contain a meteorological information block, air traffic services units shall relay the basic ADS and meteorological information blocks without delay to the world area forecast centres (WAFCs) and, as appropriate, to regional area forecast centres (RAFCs)”.

2.4 Until recently, TAAATS was not able to request Meteorological data in ADS contracts. This functionality is now available, and the capability to forward this information to the Bureau of Meteorology is expected to be available in the near future.

3. DISCUSSION

3.1 After an ADS-C report received by ATSU, the following process occurs:

- Specific data from the ADS-C report is extracted and transmitted to the Bureau of Meteorology in an agreed format. This format of these messages is described in the attachment to this working paper.
- BOM filters out what it determines to be “erroneous” information. This is data that is not consistent with the existing wind and temperature model.
- The data incorporated into various models (wind, climate etc)

3.2 How is this data used?

3.2.1 Meteorological forecasting, by either humans or computers, relies on being able to accurately describe the “initial state” of the atmosphere. The most vital variables for this purpose are: wind (direction and speed), air temperature and water vapour content. ADS-C data can provide two out of three of these variables and can be obtained at a lower cost relative to that derived from conventional methods (e.g. radiosonde programs).

3.2.2 Much of the benefit to airlines will arise out of the resulting improvements to the forecasting ability of the Meteorological Agency and the improvement in the quality of the services and diagnostics it is able to provide to the aviation community as a result. Improved and more accurate weather forecasts, products and diagnostics for the aviation industry means:

- Improved Flight Operations
- Improved Safety
- Operational Cost Savings

3.3 How do other agencies access this information?

3.3.1 Meteorological data is encoded into WMO data formats and transmitted to other meteorological agencies via a global telecommunications system that is referred to as the GTS. Meteorological agencies that run their own global numerical models assimilate data from all areas of the globe into their models.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

- a) Note the use of ADS-C met data by meteorological offices when this information is made available to them.
- b) Note the benefits to the aviation community through improved weather reporting.

Attachment A

Format of messages sent to the Bureau of Meteorology

A.1 The format used essentially follows the WMO protocols for AMDAR messages which will more readily facilitate Bureau system acceptance of and (as necessary), re-transmission of the data.

Header	ADS
	Date & Hour (DDHH)
Message Fields	Phase of Flight (from decode of vertical_rate data: ASC = positive value; DES = negative value; LVR = 0 value)
(in order)	Flight Callsign (group of letters, figures or a combination thereof identical to or the code equivalent of a/c callsign - normally 2 letters + up to 4 figures)
	Latitude (degrees & minutes South - DDMMS)
	Longitude (degrees & minutes East - DDDMME)
	Date & Time (DDHHMM)
	Altitude (flight level = 3 figures)
	Temperature (degrees Celsius in 3 figures to 0.1°C resolution - MS = minus; PS = positive [e.g. -52.5 = MS525; +2.5 = PS025])
	Wind Direction/Speed (Direction in degrees true to 3 figures - positive reading in ADS message means direction is between 0-180° and can be taken at face value while negative readings mean direction is between 180-360°, and reading has to subtracted from 360 to arrive at actual direction [i.e. -59.0625=301°]) (Speed knots in 3 figures to 1.0 knot resolution [e.g. 77 knots = 077])
	Turbulence (prefix TB required but level commented out [/] as it is not currently reported)
	System (prefix S required but following two digits commented out [//] followed by value 1 to indicate high precision temperature reading)

Note. Discussions are still underway with regard to the rounding of wind speed and temperature information. These issues are expected to be resolved in the near future.

A.2 Example:

```
ADS<SP>DDHH<CR><LF>
PoF<SP>CALLSIGN<SP>DDMMS<SP>DDDMME<SP>DDHHMM<SP>FLIGHTLEVEL
<SP>TEMP<SP>WINDDIRECTION/SPEED<SP>TB/<SP>S//1
```

A.3 The following example shows the contents of an ADS-C report as well as the associated ADS message as it would be transmitted to the Bureau of Meteorology.

```
CA0175 B-2069 Fri Oct 1 00:03:22 2004
ACKNOWLEDGEMENT (TAG ID: 3 )
cntrct_req_no: 2
BASIC REPORT (TAG ID: 7 )
latitude: -31.562862 degrees --> 31 33.7S
longitude: 150.177948 degrees --> 150 10.6E
altitude: 37004.000000 feet
time_stamp: 196.375000 seconds --> 03:16
tcas: 1 --> TCAS available
```

fom: 6 nsr: 1 --> More than 1 unit operating
EARTH REFERENCE GROUP (TAG ID: 14)
Next param is valid
true_track: 130.429688 degrees
ground_speed: 493.000000 knots
vertical_rate: 0.000000 ft/min
METEOROLOGICAL GROUP (TAG ID: 16)
wind_speed: 72.500000 knots
Next param is valid
wind_direction: -59.062500 degrees
temperature: -52.500000 degrees

ADS 0100
LVR CA0175 3133S 15010E 010003 F370 MS525 301/073 TB/ S//1

A.4 Multiple reports can be included in a single ADS message. The format would appear as:

ADS 1422
LVR CA0175 3133S 15010E 010003 F370 MS525 301/073 TB/ S//1
LVR CA0175 3140S 15010E 010027 F370 MS525 301/073 TB/ S//1

A.5 Sample ADS messages based on wind data downlinked from QFA10 2nd Mar 2007 during Tailored Arrivals data analysis.

DES QF0010 3618S 14229E 021917 F370 MS493 278/061 TB/ S//1
DES QF0010 3622S 14240E 021918 F369 MS488 276/062 TB/ S//1
DES QF0010 3625S 14251E 021920 F349 MS498 283/051 TB/ S//1
DES QF0010 3625S 14251E 021920 F349 MS498 283/051 TB/ S//1
DES QF0010 3629S 14302E 021920 F327 MS433 286/047 TB/ S//1
DES QF0010 3632S 14313E 021921 F306 MS393 290/041 TB/ S//1
DES QF0010 3636S 14323E 021922 F286 MS338 281/044 TB/ S//1
DES QF0010 3639S 14333E 021924 F266 MS288 271/039 TB/ S//1
DES QF0010 3643S 14343E 021925 F247 MS248 276/037 TB/ S//1
DES QF0010 3646S 14352E 021926 F227 MS183 274/036 TB/ S//1
DES QF0010 3649S 14401E 021927 F208 MS133 279/025 TB/ S//1
DES QF0010 3651S 14410E 021928 F190 MS103 279/028 TB/ S//1
DES QF0010 3654S 14418E 021929 F171 MS068 273/022 TB/ S//1
DES QF0010 3654S 14418E 021929 F171 MS068 273/022 TB/ S//1
DES QF0010 3657S 14426E 021930 F154 MS035 266/025 TB/ S//1
DES QF0010 3702S 14432E 021931 F137 MS015 260/030 TB/ S//1
DES QF0010 3706S 14438E 021932 F121 PS028 266/026 TB/ S//1
DES QF0010 3710S 14443E 021933 A107 PS078 263/021 TB/ S//1
DES QF0010 3710S 14443E 021933 A107 PS078 263/021 TB/ S//1
DES QF0010 3716S 14445E 021934 A103 PS088 264/026 TB/ S//1