ADS SUMMARY OF ISSUES

1. Format being used for transmission on the GTS is AIREP – lower temperature resolution.
2. Observations are not always identifiable with aircraft ID.
3. Appears that little or no QC is applied.
4. ICAO has a policy (WAFCs to have responsibility for receiving data from ATCs and putting on GTS) but appears that this is not being followed.
5. Are ATCs putting data onto the GTS directly?

AMDAR JOINT MEETING TO CONSIDER POSSIBLE ACTION

1) The format for transmission of ADS data;
2) The establishment of an global email group for exchange of information and reporting on AMDAR data issues;
3) The action is dealt with by the expert meeting of data managers in 2012;
4) The Panel requests ICAO to cease transmission of ADS data onto the GTS until such time as:
    i. A standard data format is prescribed by WMO (Panel);
    ii. Satisfactory QC methods are specified by WMO and complied with by ICAO;
    iii. BUFR format is utilised for transmission of ADS data on the GTS;
    iv. ADS data is only transmitted as long as the data is identifiable against an aircraft ID;
    v. A strategy for putting the data onto the GTS is specified and adopted by WMO including consideration of a set of designated global data centres (1 to 3) having responsibility for QC and GTS transmission.

ADS-C FORMAT AND DATA QUALITY ISSUES

Sep 2011 Email Correspondence between various re ADS data transmission.

---------- Forwarded message ----------
From: **Bradley Ballish** <Bradley.Ballish@noaa.gov>
Date: Wed, Sep 28, 2011 at 2:50 PM
Subject: Re: ADS Data on the GTS
To: Lockett Dean <dlockett@wmo.int>
Cc: "Halsey, Neil" <NHalsey@icao.int>, "Verner,Gilles [CMC]" <Gilles.Verner@ec.gc.ca>, "Sarrazin,Real [CMC]" <Real.Sarrazin@ec.gc.ca>, "Fournier,Gilles [NCR]" <Gilles.Fournier@ec.gc.ca>, "Mr. Jitze Van der Meulen" <jitze.van.der.meulen@knmi.nl>, "Grooters, Frank (KNMI)" <frank.grooters@knmi.nl>, "Mr. Miroslav Ondras" <mondras@wmo.int>, Herbert Puempel <HPuempel@wmo.int>, Bradley Ballish <Bradley.Ballish@noaa.gov>

Colleagues,

One concern I have about ADS data as well as AIREPS, is that it is difficult for NWP centers to accurately decode reports at waypoints names. Part of this problem is that the waypoints keep changing with time. Another problem is that waypoint names are often not unique. For example, we are even getting ADS reports at waypoint names, like the report below at waypoint VALDI. According to my latest waypoint file, that is several months old, there are two VALDIs in the North Atlantic area. Which one should we use for the report below?

UANT99 KDDL 230835^M^M
ARP COA123 VALDI 0835 F340 MS52 291/45 KT^M^M

N29129 DDL BGO 230835 F82A^M^M.

It seems that we mainly only get true AIREP reports on the GTS from Portugal and South America. However, at local data processing centers, there can be many reports just giving a waypoint name. Is it possible to suggest that data communication centers supply the lat-lons of such reports for the GTS rather than the waypoint name? Even better would be to supply the lat-lons, and then almost like a comment to the far right of the message, list the waypoint name. This later option would be best, since my past research has shown that certain exact lat-lon pairs for AIREPS are often often causing track-check errors. Then the originators of the location errors can be more easily notified of what is wrong with certain waypoint processing.

Also, I tried very hard to find out if the US is getting ADS reports in the Pacific where we could really use them. No one in the FAA, ARINC or the US Weather Service could answer this.

If anyone is interested, I can find a recent report I made concerning the processing of AIREP waypoint names and send it to you.

Best Regards

Brad

---------- Forwarded message ----------
From: **Halsey, Neil** <NHalsey@icao.int>
Date: Tue, Sep 27, 2011 at 11:52 PM
Subject: RE: ADS Data on the GTS

Dear all

Please note that I was attending the WMO IPET – DRC last week and am running an ICAO study group this week which has made it difficult for me to keep up with my email. I will be able to answer your questions regarding ADS met data fully at the AMDAR Panel meeting in Quebec City. However, for now I can point out that the information requirements are contained in the ICAO Annex 3, Chapter 5 and Appendix 4 and that the message format is contained in ICAO PANS-ATM (Doc 4444, 4.11.4. It should be noted that these data should be transmitted via the AFS (ICAO Aeronautical Fixed Service) from the ATS unit concerned to the responsible Met Watch Office and to the World Area Forecast Centres (WAFC) only. The WAFCs are then responsible for sending this information on to the GTS as basic data.

I can clarify all of this at the meeting or could do it by correspondence next week if desired.

Thanks

Neil Halsey

MET/AIM Section
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tel: +1 (514) 954 8219 ext. 6107
Skype: icao-nhalsey

From: Verner,Gilles [CMC] [mailto:Gilles.Verner@ec.gc.ca]
Sent: 27 September 2011 13:58
To: Lockett Dean
Cc: Sarrazin,Real [CMC]; Fournier,Gilles [NCR]; Mr. Jitze Van der Meulen; Grooters, Frank (KNMI); Mr. Miroslav Ondras; Halsey, Neil; Herbert Puempel; Brad Ballish
Subject: RE: ADS Data on the GTS

Hi Dean,

Thank you for the messages below and apologies for not replying earlier, just too many things on my plate.

I concur with what you and Jitze are saying below. Currently, as far as I know, the ADS met data is reaching NWP centres in AIREP code (some with a slightly modified content to include an aircraft identifier). But the data can still be processed by users as standard AIREP. This is not ideal of course, but at the time this was done there were not too many options available.

ADS met data from the Gander Oceanic areas are received and processed for NavCanada by Arinc. This is where the data in encoded in AIREP code and transmitted to CMC over the AFTN network for further transmission to the GTS. At the time this arrangement was set-up, the use of BUFR code was unfortunately not feasible for technical reasons. And I fully agree that the use of the AIREP code (I do not think that CODAR was used for this) is not really appropriate for ADS like data. I have looked at some of the ICAO documentation, and Doc. 8896 Manual of Aeronautical Practices (2008), in particular Chapter 7 and Appendix 10 which provides the ICAO template for routine air reports by air-ground data link. This template clearly provides temperature in tenths od degrees and has provision for aircraft identification and registration, wind quality flag, turbulence and relative humidity. So this is probably what is available for further processing.

So I believe that what we are missing is an appropriate code form to transmit this ADS-Met information to users, including NWP centres. This would be a very important realization.

For the quality framework, it is essential that some aircraft identification (not only the flight number) be available to users. This is why we had insisted a few years ago to get access to some form of aircraft identification. This has allowed us to evaluate and monitor the quality of the ADS data in a very similar way as we do for AMDAR (and other aircraft data transmitted in BUFR) and this is used to update our monthly black-lists as well as other monitoring statistics. And if the aircraft ID can be used to identify an airline or an observing programme (as is possible with AMDAR) then statistics can be provided by airlines, programmes, types of aircraft, etc. And this of course becomes very useful to identify problems or issues with some data and fix it. As an example, at the beginning of ADS data there was an issue with wind direction from the B777, this type of monitoring was able to identify it and this eventually led to the resolution of the issue. But I do not think that I need to convince any of you of the utility of data quality monitoring, we must just need to be able to perform it.

With my best regards,

Gilles Verner
CMC

From: Lockett Dean [mailto:dlockett@wmo.int]
Sent: 16 September, 2011 06:59
To: Verner,Gilles [CMC]
Cc: Sarrazin,Real [CMC]; Fournier,Gilles [NCR]; Mr. Jitze Van der Meulen; Grooters, Frank (KNMI); Mr. Miroslav Ondras; Mr Neil Halsey; Herbert Puempel; Brad Ballish
Subject: Re: ADS Data on the GTS

Dear Gilles,

Thanks for your email and the copy of correspondence on the subject of ADS data. (I have changed the subject to reflect this discussion.)

Technically or theoretically speaking, this may not necessarily be a matter for the AMDAR Panel as, in reality, the data is not derived from the AMDAR Program but from an ICAO program (ADS). However, having said that, the AMDAR Panel was certainly involved in the specification for the inclusion of the reporting of met. data with ADS reports. From my own perspective and that of WMO, these are certainly aircraft observations and so I do think it will be necessary for me to try and work towards resolution of some of the issues associated with this data. It may well be that it is something that can be given to the CBS Expert Team for Aircraft Observations, ET-AIR to work on (meeting conjointly with the AMDAR Panel in December).

As it turns out, we have Neil Halsey from ICAO attending the AMDAR Panel meeting in Canada and so it will be an opportune time to address the matter and the various issues so, at the least, I can assure you that it will be on the agenda and discussed.

Clearly one of the chief issues is how the data is formatted and identified. AIREP seems to have become the adopted standard but I'm not sure that is appropriate for a couple of reasons including temperature resolution.

A second is the quality evaluation process for these data and the method for black-listing poor quality aircraft.

Jitze Van der Meulen who is the AMDAR Panel's Project Manager for the development of the AMDAR Data Quality Framework is also aware of the matter and wrote the following below on the issue recently.

I have cc'd others that might have a say and I would like to make sure that all the issues are identified and understood.

Any comments and clarifications are welcome.

Thanks and regards,

Dean.

Dear Dean,

Frank Grooters forwarded your e-mail to me after some discussion with him on the significant increase of 'AUTO AIREP' reports the last two years, especially from aircraft crossing the North Atlantic. Please look at the three attached images delivered by ECMWF for today, a year and two years ago (all 6 h observational blocks at 00 UTC in August). These images can be found on the ECMWF website at: http://www.ecmwf.int/products/forecasts/d/charts/monitoring/coverage/dcover!aircraft!00!pop!od!mixed!w_coverage!latest!/. I understand that these 'AUTO AIREP' reports are generated using the ADS-B system (some services, like KLM uses ADS-C as well, with 'C' for 'Contract').

I am not so sure if some Quality Evaluation is in practice for this data source. Considering the doc. you attached I could not find details on the code related to meteorological data. A relevant point is the meta data on how air temperature is calculated (modified to static air temperature and smoothed or not) and the resolution (in 1 K or in 0.1 K). If the resolution is in 1 K then it's very relevant if the value is obtained after rounding (to the nearest value) or by truncation. In case of truncation a negative (cold) bias of about 0.5 K can be expected. Similar experiences were found already with Mode-S data (local radar reports).

Another QEv point for me is the fact that AIREP can be reported in the traditional alphanumeric reports FM41, whereas AMDAR is reported in FM42. The data designator in the bulletin header $T_1T_2A_1A_2$ii can be used to discriminate on forehand AIREPS from AMDAR (for alphanumeric codes, T_1 = **U** for upper air data, T_2 = **A** for AIREP FM41 and **D** for AMDAR FM42). For BUFR encoded bulletins however this is not possible because for both we have $T_1T_2A_1A_2$= **IUA**x, with usually x = **X** ('area not definable'). For the contents of the bulletin itself the generating centre is free to choose what template/sequence should be used from Cat. 11, Table D (ASDAR, ACARS, AMDAR), so that doesn't give the possibility to distinguish between AIREP and AMDAR either. Another method could be to distinguish based on originating centre, but that's not so easy, especially not for US centers (may be ECMWF uses that work around, but I am not sure). Also sequence [0 02 062], *Type of aircraft data relay system*, used in the ACARS template [3 11 002] -> [3 01 065] does not give as solution because that sequence is out of date.

May be it's useful to put these issues on the agenda for next ET AIR meeting.

Kind regards,
-Jitze

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the Netherlands http://www.knmi.nl/~meulenvd/

On Thu, Sep 15, 2011 at 9:08 PM, Verner,Gilles [CMC] <Gilles.Verner@ec.gc.ca> wrote:

Dean,

Enclosed is a message I sent to a few colleagues in early April about this situation. A change in processing at NavCanada and Arinc resulted in more ADS data being distributed.

This brings me to a question for the AMDAR Panel: is there going to be a coordinated approach for the collection and distribution of the ADS data? This may not be part of the mandate of the AMDAR Panel but is certainly of interest to the community of users of automated aircarft data.

With my best regards, and many thanks for your interest in the CMC monitoring activities,

Gilles Verner

Gilles Verner

Chef, Assimilation et contrôle de qualité des données

Centre météorologique canadien

Prévisions et services météorologiques et environnementaux

Chief, Data assimilation and Quality Control

Canadian Meteorological Centre

Weather and Environmental Prediction and Services
(514) 421-4624

Email Correspondence between Brad Ballish NCEP and Randy Baker UPS, Sep 2011, re ADS-C data processing and quality issues.

Randy,

So far, most of the ADS reports are in the North Atlantic area which already has good coverage with AMDAR data. However, I believe we may be able to get ADS data from other areas where we really need the data. Dean Lockett told me that they have been seeing the ADS reports in Australia for years, but the data is not put on the GTS as there is no WMO or ICAO directives to do this or how to do this. There are some links with data coverage maps in some of the emails, if you can not find such a link with ADS data displayed, I can find one from Pat Pauley that clearly keeps the ADS reports differently from regular AIREPS.

I have not heard any feedback from Robert Tegeder of the FAA or from the Gulf Stream company on the status of fixing these 180 degree wind direction errors. When I get time, I can study some of the more recent ADS reports to check on this.

Thanks

Brad

On 9/15/2011 11:23 PM, rtbaker@ups.com wrote:
Brad,

In researching this issue, I have discovered that these ADS reports are part of ADS-C which replaces the voice position reports with automated binary digital messages which go directly to the ATS agency where it is decoded by the host computer. They then compose a position report with the met data to make it look like the voice reports. The original message does have the aircraft tail number, but that information is dropped during the conversion.

This makes it difficult to track errors; are they errors in coding on the aircraft, errors of input on the aircraft, or errors in decoding on the host end?

I have a question for you, since these messages are primarily over oceanic locations.

1) How many ADS reports per day are you receiving now, and how does this compare with 1, 2, or 3 years ago?

2) How many AMDAR reports do you receive each day over OCEANIC areas?

My sense is that ADS reports tend to come from data-sparse areas where there is little other data (AMDAR or anything else). I'd like to know if there is some data to support or reject that idea.

The following is from WORLD AREA FORECAST SYSTEM OPERATIONS GROUP (WAFSOPSG/4) which met in Cairo in Feb of 2008:

6.6 Procedures for quality control of meteorological information
included in the ADS messages

6.6.1 The group recalled that no progress had been made in the sub-task related to the quality control of meteorological information included in the ADS messages due to the fact that automatic dependent surveillance (ADS) reports were not properly identified and could not therefore be distinguished from the traditional voice routine air-reports. Recent amendments to ICAO provisions introduced the registration number of the aircraft in the ADS reports. This identification, would in principle allow for the quality control of MET information in the ADS messages.

6.6.2 The group recalled that this sub-task had been introduced as a result of Recommendation 1/7 of the MET Divisional Meeting (2002). The implementation of a systematic quality control of the MET information contained in the ADS messages had been considered important in 2002 in view of the expected growth of ADS messages containing MET information. In practice, the number of such ADS messages had remained stable while the number of air-reports from the WMO aircraft meteorological data relay (AMDAR) Programme had undergone an explosive growth over the past few years. Currently, the global number of daily AMDAR reports was of the order of 200 000 while the ADS reports were two orders of magnitude fewer. The group was aware of the fact that WAFCs used all types of air-reports, including AMDAR, ADS and voice reports which, like any upper-air information, were subject to quality control. In view of the limited number of ADS reports available to WAFCs and their minor impact on the quality of WAFCs forecasts, the group agreed that work on this sub-task was no

longer justified and that the sub-task be deleted. In order to achieve this, the group formulated the following decision:

Decision 4/21 - Discontinuation of work on the quality control of MET information included in ADS reports
That, in view of the explosive growth of WMO AMDAR reports, there is no need to pursue work on the quality control of MET information contained in ADS reports.

I'd be interested in your thoughts on this. It would appear to me that there is an opportunity to require the ATS agencies to append tail number information to the ADS reports.

Currently, these ADS reports are voluntary, but will become required in the Atlantic in 2013, and in the Pacific thereafter. This should lead to an even further increase in these kinds of reports.

Randy

-----Original Message-----
From: Bradley Ballish [mailto:Bradley.Ballish@noaa.gov]
Sent: Wednesday, April 20, 2011 3:40 P
To: Baker Randy (air1rtb)
Cc: Pat PAULEY; Bradley Ballish
Subject: Questions of Aircraft ADS Data

Dear Randy:

A number of aircraft data experts at NWP centers have
recently been concerned in both the significant increase in
the total number of AIREP reports in the North Atlantic since early
March 2011 as well as an increase in reports that appear to have
wind direction errors of about 180 degrees.

The increase in reporting appears to be due to a style of reports
that we think are called Automatic Dependent Surveillance (ADS) data.
The ADS reports over the North Atlantic are automated position reports for
the air traffic control folks that handle the North Atlantic trans-oceanic
routes--Shanwick for the eastern half, and Gander for the western half.
Wikipedia has some background info at:
http://en.wikipedia.org/wiki/North_Atlantic_Tracks.

These reports from UPS are fine, but we have some questions about the
meaning of parts of the reports. For example in the following line:
N259UP QXT AOE 200507 F47A, N259UP is the aircraft tailnumber, but what
does the "QXT AOE 200507 F47A" mean?
Below are some raw reports from UPS from today. Further below
are some other reports that have this problem of the 180 degree wind
direction error. Dr. Patricia Pauley from the Navy Research Lab has found
that most of the US reports with this error are Gulfstream models flying
at higher than normal altitudes. We are getting these sorts of errors from
non-US aircraft, which maybe more difficult for us to deal with.

Is there someone we could contact at the FAA or ICAO to try and get these
direction errors fixed as well as to find out if even more of these ADS
reports can be expected?

Thanks for your help,

Dr. Bradley Ballish NCEP and
Dr. Patricia Pauley

UPS raw reports from today:
UANT99 KDDL 200507
ARP UPS204 5716N01612W 0506 F310 MS46 214/82 KT

N259UP QXT AOE 200507 F47A

UANT99 KDDL 200508
ARP UPS204 5717N01617W 0506 F310 5800N02000W 0522 5900N03000W MS46
214/83 KT
N259UP QXT AOE 200508 F49A

UANT01 CWAO 200704
ARP UPS204 5730N04300W 0704 F310 MS50 215/40 KT
N259UP QXT AOW 200704 F79A

Sample raw reports with the 180 degree error:

UANT01 CWAO 191839
ARP MMOMO 5024N03222W 1838 F410 MS54 083/46 KT
MMOMO QXT AOE 191839 A57A

UANT01 CWAO 200145
ARP N800AL 5211N05334W 0145 F410 MS44 056/26 KT
N800AL DDL YQX 200145 A08A

UANT99 KDDL 201019
ARP N60TC 5213N01600W 1019 F400 MS57 038/25 KT
N60TC QXT AOE 201019 A05A

UANT01 CWAO 171759
ARP EJM505 6155N05117W 1759 F430 MS39 065/23 KT
N550KF DDL XXE 171759 A54A

WORLD AREA FORECAST SYSTEM OPERATIONS GROUP (WAFSOPSG)

SEVENTH MEETING

Venue:TBD

Agenda Item ?.?:

ADS MET DATA

(Presented by IATA)

SUMMARY

This paper provides describes a rapidly increasing source of meteorological data that is bypassing AMDAR QC processes, resulting in a high number of incorrect weather reports. These reports are ADS-C reports that contain position report meteorological data that formerly were reported by voice, but are now automated.

INTRODUCTION

1.1 WFSOPSG Decision 4/21 decided not to address ADS met data QC due to the fact that AMDAR data was rapidly increasing and that ADS met data was expected to be a tiny percentage of the total met data.

DISCUSSION

2.1 The original discussion regarded ADS as a source of met data, and decided to table this issue due to the low number of ADS reports relative to AMDAR reports. At the time, AMDAR reports numbered 200,000 per day, with ADS reports approximately two orders of magnitude fewer.

2.2 Meanwhile, ADS-C has rapidly increased in conjunction with FANS/CPDLC and has compulsory position reporting points which in many cases require met data.

2.3 This ADS-C data bypasses the normal AMDAR data collection and QC process. Furthermore, the data is not text data (using a packed hexadecimal format). The format of the position reports with met data (DM#48 – Downlink Message number 48) can be found in ARINC Spec 622, RCTA DO-258A, and GOLD (Global Operational Data Link Document).

2.4 These messages go directly to the ATS agency, where it is decoded within the host computer system. Although the original report contains the aircraft tail number, the final decoded report only gives the flight number. This decoded report is then passed onto the WAFCs. It is difficult to track down if a problem with the met data is due to incorrect coding on the aircraft, a bad sensor input, or an incorrect decode at the ATS agency.

2.5 AMDAR QC experience shows that monitoring aircraft by tail number is essential to tracking down subtle but significant temperature errors (foreign material causes a TAT probe warm bias), and to report back to the airline a problem with a particular aircraft.

2.6 The Washington WAFC has noted a sharp increase in wind errors where wind directions were off by up to 180 degrees, which is often caused by aircraft units with software errors that transposed the sign of the wind prior to computing the wind vector (direction and speed). These reports are from these ADS-C position reports.

2.7 CPDLC will be required in the Atlantic in 2013, with the Pacific expected to follow, which will further increase the number of these automated met reports.

2.8 Erroneous met data in data-sparse oceanic regions are more likely to affect global weather forecast models compared to data-rich areas. This makes proper QC of ADS-C data as important if not more important than QC of AMDAR data.

ACTION BY THE WAFSOPSG

The WAFSOPSG is invited

3 to make changes so that ADS-C met data goes through the same QC process as AMDAR data.

4 For the purpose of proper QC, require the ATS agency to append the aircraft tail number to the decoded position reports that are passed on to the WAFCs.

- **END –**