ADVISORY WIRE

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REFERENCE NO:	AW700-34-0346, Rev 02	INFORMATION TYPE:	Maintenance Operational
ATA:	34-11	EFFECTIVITY:	Global Express / XRS (9002 - 9312, 9314 - 9380, 9384 - 9429) Global 5000 (9127 to 9383, 9389 to 9400, 9404 to 9431 and 9998)
SUBJECT:	**Air Data Computer (ADC) and Pitot-Static Probes – Altitude Split and Troubleshooting Guidance**		

1. REFERENCES:

   1.1. Advisory Wire (AW) AW700-00-0178 – No Fault Found Corrective Action Plan released 7 October 2005.

   (http://cic.bombardier.com) in Technical Library > Advisory / Alert Wire > Global > Advisory Wire

   1.2. SmartFix Plus – Observed Faults – Altitude Indication Split / ALT Miscompare on PFD Altitude Tape

   1.3. AMM TASK 34−11−01−160−801 “Cleaning of the Pitot−Static Probes”

   1.4. AMM TASK 10−12−00−420−801 “Installation of the Covers and Plugs”

2. INTRODUCTION:

Revision 2 of this Advisory Wire (AW) is to inform operators about efficient troubleshooting practices of altitude split indication conditions in order to maximize aircraft availability and reduce the No Fault Found (NFF) rate of Micro Air Data Computers (MADC) / Advanced Micro Air Data Computer (AMADC) and Pitot-Static probes unscheduled removals. The Pitot-Static probes are part the Bombardier Failure Review Board (FRB) investigation for improvement. This AW also provides acceptance criteria for altitude split.

3. DESCRIPTION:

In the AW700-00-0178 (Ref. 1.1), the MADC / AMADC from Honeywell were identified as part of the Top 10 NFF. Following the introduction of some corrective action initiatives, the NFF rate has been reduced from 65% to 30% with only 5 units were NFF in 2014 out of 23 unscheduled removals. Consequently the MADC / AMADC were moved in a monitoring status on Top 10 NFF.

As part of the continuous NFF monitoring for the MADC (PN 7014700-628) and AMADC (PN 7030700-70708), Bombardier and Honeywell reviewed the details of all removals that were declared NFF to establish the trends and associated action plans. At the time of the release of the Advisory Wire (Ref. 1.1), the main NFF trend was related to altitude splits.

Since the majority of these NFF have been determined to be true NFF resulting from an improper troubleshooting, we have further improved guidelines and troubleshooting information. These improvements to troubleshooting information can be found in the Bombardier SmartFix Plus tool (Ref. 1.2), in the Observed Faults > ATA 34 > “Altitude Indication Split/ALT Miscompare on PFD Altitude Tape”. The latest updates are related to ADC strapping configuration check through the PMAT, Static Source Error Compensation (SSEC) configuration check and a simpler in flight recording table.

The following are more details on the conditions and other contributing factors that generate most MADC / AMADC NFF:

i) Altitude Split indications:

As a guideline, barometric altitude indications difference (altitude split) of up to 200 feet in flight between altimetry systems as selected for view on the Primary Flight Displays (PFD) may be acceptable and is still within the capability to perform RVSM operations.

For instance, the pilot PFD (ADC 1) and co-pilot PFD (ADC 2) are the usual flight information in view and used, making altitude splits between pilot and co-pilot PFD, the generally reported condition.

Since the altitude split value varies between one Global to another, it is important that operators / flight crews be familiar with the particular altitude split characteristic values between the different altimetry systems of their particular aircraft at specific speed, altitude, weight and flight phase.

Slow split increases over a certain period of time (i.e. months) from particular altitude split characteristic values are considered normal condition. This is attributed to the different drift characteristics between ADCs and Pitot-Static probes deterioration over time.

For this reason, we have checks in the TLMC Part 2 section 5-10-13 (RVSM qualified aircraft), where the ADCs are tested at regular intervals and the Pitot/Static probes have a life limit to ensure the system performance over time is maintained.

However, in a case where an altitude split significantly increases from particular altitude split characteristic values over a short period of time (same flight leg or from one flight leg to the next), or reaches 200 feet associated with the amber ALT Miscompare annunciation, it should be further investigated.

Any new altitude split value should always be compared with the normally acceptable particular altitude split characteristic values for that aircraft on similar flight profiles (speed, altitude, weight, flight phase).

In conclusion, it is highly recommended to follow all troubleshooting instructions in the Bombardier SmartFix Plus tool (Ref. 1.2). Do not replace an MADC / AMADC that passes the AMM functional test, as this demonstrates proper static operation of the MADC / AMADC while the altitude split is most likely associated with aerodynamic effects that cannot be tested or reproduced by any ground test.

In such a case, replacing an MADC / AMADC will not correct the altitude split observed on the aircraft and when removed, will result in a No Fault Found (NFF).

ii) ADC3 FAIL and ADC3 MISCOMP CAS messages:

As part of the continuous NFF monitoring, Bombardier identified a trend associated with ADC3 FAIL and ADC3 MISCOMP (miscompare) CAS message.

To provide additional troubleshooting information and collect data on those events to better understand the situation, Bombardier and Honeywell have made available a Troubleshooting Checklist (Ref. Appendix A) to be completed and returned to Bombardier when an ADC3 FAIL or ADC3 MISCOMP occurs. This will help us introduce a corrective action to reduce the NFF rate. The Troubleshooting Checklist (Ref. Appendix A) provides guidelines for in-flight procedures, additional troubleshooting and a flight test data sheet to be completed.

The ADC FAIL and MISCOMP are two (2) separate and unrelated CAS messages. For the ADC FAIL, the Integrated Avionics Computer (IAC) is not observing a valid Avionics Standard Communication Bus (ACSB) transmission from the MADC / AMADC or has flagged some of the data as invalid. An ADC FAIL should have an associated CAIMS or Fault Warning Computer (FWC) fault message and the associated SmartFix Plus troubleshooting should be followed.

The MISCOMP (miscompare) CAS message is monitored by the Automatic Flight Control System (AFCS) and indicates a discrepancy in the value of the data on one MADC / AMADC versus the other two. Therefore the miscompare is not necessarily due to a MADC / AMADC failure and troubleshooting per Ref. 1.2 should be performed.

iii) Additional contributing factors to Altitude Splits

a) Contamination, damage or degradation of the Pitot-Static probes

The vendor analysis of the probes involved in altitude split issues concluded that some probes had suffered from oxidation over years of service that resulted in blackening and roughening of the probes surface with apparent pitting. Three major contributors may result in blackening and roughening of the probes:

- Atmospheric contaminants principally sulfur and chlorine can exacerbate the oxidation
- Erosion effect from acid rain and dust during normal flight
- Aircraft cleaning solutions left on the probes, which often contains corrosive elements

Altitude split conditions may also be attributed to externally induced damages to the Pitot-Static probes or residues accumulated around the drain or static sensing holes.

The SmartFix Plus tasks (Ref. 1.2) has instructions to perform a detail inspection of the Pitot-Static probes and verify the probes alignment. It also recommends external and internal cleaning of the probes (Ref. 1.3). To avoid damaging the Pitot-Static probes particular care should be taken during aircraft external cleaning. Cleaning agents should not come in contact with the Pitot-Static probes as they may accelerate Pitot-Static probes corrosion. If such contamination occurs, do an external cleaning of the Pitot-Static probes.

Note that internal cleaning involves removal of the probes, soaking in clean warm water and flushing them with dry nitrogen. In many of the in-service cases, this method of cleaning the Pitot-Static probes was proven successful and prevented unscheduled removals of Pitot-Static probes.

If the cleaning of the probes is unsuccessful to reduce the altitude split to an acceptable level, Bombardier CRC should to be contacted for further troubleshooting guidance.

To prevent Pitot-Static probes contamination, it is recommended to always use protective covers GSE 10X−12−19 (Ref. 1.4) every time the aircraft is in maintenance or parked.

b) Contamination or leak of the static lines

Partial blockage or leakage of the static lines may cause split in altitude readings. These can easily be detected and corrected by performing the contamination removal of the static lines and a leak check of the static lines. Particular care must be taken for Air Data Test set-up when performing the system leak check as the task is designed to check one system at a time, leaving other systems open to ambient pressure with a purpose to detect an eventual inter-system leak or cross lines (i.e. incorrect installation, Pitot-Static probes internal leakage).

c) Deformations or excessive steps and gaps of the doors and panels in the Zone 4 RVSM area

Out of tolerance gaps and mismatches (steps) on the Zone 4 RVSM area may distort the airflow around the Pitot-Static probes and induce errors in measuring the altitude. If an altitude split is noticed after aircraft painting, maintenance or repair of the doors and access panels in the Zone 4, it is likely that it is caused by excessive gaps and mismatches. The SmartFix Plus tasks (Ref. 1.2) has instructions to verify and corrected the out of tolerance steps and gaps.

d) Out of calibration Air Data Computer (ADC)

Out of specification / calibration ADC may be a contributor to an altitude split, which will be visible as out of tolerance value identified during the ground test. An altitude split that is associated with aerodynamic effects cannot be tested or reproduced by an ADC ground test. However, the SmartFix Plus tasks (Ref. 1.2) has instructions to check the integrity of the ADC system by performing the applicable Functional Test. Replacement of a MADC / AMADC that passed the functional test will not fix the altitude split and it will result in an NFF.

4. ACTION:

Operators should be familiar with the altitude split characteristics, the additional contributing factors and follow the associated SmartFix Plus troubleshooting recommendations (Ref. 1.2). In cases of ADC3 FAIL or ADC3 MISCOMP message the MADC / AMADC the Troubleshooting Checklist (Ref. Appendix A) should be completed. The above recommendations should be completed prior to rejection of an MADC / AMADC.

Should you have any queries pertaining to this Advisory Wire (AW), please contact your Bombardier Field Service Representative (FSR) or the Customer Response Center (CRC).

Appendix A

No 3 Micro Air Data Computer (MADC) or Advanced Micro Air Data Computer (AMADC) Troubleshooting Checklist

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This checklist provides troubleshooting information and record information on the ADC3 FAIL and ADC3 MISCOMP CAS messages that may result NFF when MADC/ADC is replaced.

GEX A/C SN: _____
Contact Name and Phone: _____

ADC3 Part Number Removed: _____
ADC3 Unit Serial Number: _____

ADC3 Part Number Installed: _____
ADC3 Unit Serial Number: _____

Time/Date of the event: _____

In Fight Procedures

- If ADC3 is reported as fault, proceed as follow:
    - ADC3 MISCOMP CAS
        - Was the condition intermittent or continuous?
        - During the event, do an ADC reversion; visually check the value for ADC3 altitude or airspeed on pilot or copilot PFD and record ADC's 1, 2, 3 value for comparison:

	Altitude	Airspeed
ADC1		
ADC2		
ADC3		

Added information as required:

_____
_____
_____
_____
_____
_____

- Was an altitude or airspeed split present at the time of the Miscompare? Yes___ No___

  If Yes:

  - Complete the attached Flight Test Data Sheet as much as practical.

  - ADC3 FAIL CAS
    - Was the condition intermittent or continuous?
    - During the event, do an ADC reversion; visually check the status of ADC3 on pilot or copilot PFD. Check the altitude and the airspeed tape for a red X across the tape. Check the vertical speed for the red VS check the pilot or copilot MFD MAP and PLAN format for SAT, TAS or TAT invalid data.
    - ADC FAIL CAS will be confirmed if the above show failure as well. Record details below.

  Added information:

_____
_____
_____
_____
_____
_____

On Ground Troubleshooting procedures:

- CAIMS message at the time of the event:
  - Active _____
  - Stored _____
  - Flight _____
  - Ground _____

- Perform troubleshooting in accordance to SmartFix Plus. Finding?

If the fault is intermittent and no fault is being returned to CAIMS, perform the following automatic test from the System Diagnostics / MADC / LRU TEST menu, in an attempt to isolate the fault condition:

TEST NAME	RESULT (Test Pass or Fault Code – four (4) digit)
ADC TEST	
TEMP PROBE INTERFACE TEST	
ADC SWITCH OUTPUTS TEST	
CONFIGURATION STATUS	

- Perform troubleshooting in accordance to SmartFix Plus. Finding?

NOTE:

If the two Functional Tests (Pitot-Static System, AMM Task 34-11-00-720-802 and Air Data Computer System, AMM Task 34-11-00-720-801) were successfully completed, the MADC / AMADC should not be replaced as a result of an altitude or airspeed split. Please contact your local Bombardier FSR for further troubleshooting.

For an intermittent ADC3 MISCOMP, we recommend to swap ADC's and monitor the situation.

- Was the MADC / AMADC replaced as a result of performing a CAIMS or a CAS message Fault Isolation Task or following the Corrective Action from the IMT Fault Code Lookup table?

  Yes___ No___ If Yes, provides details (i.e. Task No.)

  _____
  _____
  _____
  _____
  _____

  Details of the reason for removal:

  _____
  _____
  _____
  _____
  _____

- Any other parts (LRU) replaced on the aircraft during the troubleshooting of the same condition?

  _____
  _____
  _____
  _____
  _____

- Other useful comments (other maintenance performed on the A/C prior to this condition).

  _____
  _____
  _____
  _____
  _____

Please send all this information's to Louis Martel by email at:

Louis Martel
Avionics Specialist – Global
louis.martel@aero.bombardier.com

Flight Test Data Sheet

A/C ____ Date __/__/____ Leg ____

MADC	Speed	Altitude	SAT	TAT	PEM/ Time	Fuel Load
1	200 Knot	15000				
2						
3						
EISI						
1	0.80 M	31000				
2						
3						
EISI						
1	0.85 M	31000				
2						
3						
EISI						
1	MMO	31000				
2						
3						
EISI						
1	0.80 M	41000				
2						
3						
EISI						
1	0.85 M	41000				
2						
3						
EISI						
1	0.85 M	47000				
2						
3						
EISI						