ADVISORY WIRE

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REFERENCE NO:	AW700-31-0473 Rev.1	INFORMATION TYPE:	Maintenance
ATA:	31-41	EFFECTIVITY:	Global Express / XRS (9002 - 9312, 9314 - 9380, 9384 - 9429) Global 5000 (9127 to 9383, 9389 to 9400, 9404 to 9431 and 9998)
SUBJECT:	**Integrated Avionic Computer (IAC) – No Fault Found (NFF) investigation Conclusions**		

1. REFERENCES:

1.1. Aircraft Maintenance Manual (AMM) TASK 31-41-01-960-801 Integrated Avionics Computer (IAC), Replacement of the Internal Battery

1.2. Honeywell Service Information Letter (SIL), D201402000051R002, Global Express P-2000XP IC-800/IC-810 Integrated Avionics Computer (IAC), Internal Battery Information and Internal Battery Maintenance, dated 30 Jun 2015

1.3. AMM TASK 45−45−00−970−822, Access to Non−Volatile Memory (NVM) Management

1.4. “Periodic Erase/Download of the IAC NVM Data”, Customer Forum & Newsletter, Volume 12 / Issue 7, released 7 April 2014

1.5. Data-loader DL-950 Loading Erratic, AW700-34-0241 Rev. 2, released 16 January 2012

1.6. Maintenance Planning Document (MPD), Optional Maintenance, Section 3.2 Servicing, Chapter 5 Task number 31-41-00-301, released 11 May 2015

All references are located on the CIC website (http://cic.bombardier.com/) within the Technical Library

2. INTRODUCTION:

This Advisory Wire (AW) is to provide operators information on the latest conclusions and recommendations on the Integrated Avionic Computer (IAC) No Fault Found (NFF) investigation. This revision provides recent findings pertaining to the IAC internal battery that can lead to unnecessary removal of the IAC as well as additional troubleshooting information.

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3. DESCRIPTION:

The IAC IC-800/810 (P/N 7017300-61009/-62009 and Post Batch 3 P/N: 7017300-61010/-62010) has been identified as part of the Top Ten NFF due to its high NFF rate of 49% based on September 2014 data.

As part of the NFF initiative, Bombardier and Honeywell reviewed the details of all removals that were declared NFF to establish the trends and associated action plans.

The main NFF trend was identified as IAC internal battery related malfunctions, with the following primary reasons for removal as:

- General IAC battery issues
- Limited troubleshooting test procedures or unable to reproduce intermittent failures
- FMS databases loading issues

Bombardier has reviewed each of these trends in detail and is providing the following recommendations to the operators to reduce the NFF rate.

3.1. **General IAC battery issues** - Units declared NFF but battery replaced during Honeywell testing

Bombardier recommends that operators replace battery periodically through a dedicated AMM Task (Ref. 1.1). According to Honeywell a typical expected shelf life of the battery installed in an IAC is approximately one (1) year, so when installed on an aircraft where the battery is only under load during power off, a maintenance free operation for approximately 15 months is expected. When the internal IAC battery is inoperative or low any of the following may occur:

- Flight Management System (FMS) Aircraft and Custom database erased or corrupted
- FMS setup options as last known present position, date and time will revert to default settings during the next power-up
- FMS parameters as active flight plan, performance entries and offside radio commands will be lost and will be automatically loaded from the cross-side IAC when the LRU is powered up and the system comes up in DUAL mode
- Non-volatile memory data lost (including stored faults and engine trend/exceedance data)
  Note: FMS Navigation Data base will not be lost

A full list of possible failures generated by a discharged IAC battery can be found in Honeywell Service Information Letter (SIL) D201402000051 (Ref. 1.2).

The IAC has a built-in battery monitor to detect a low battery condition at each power up. A battery message will be displayed by way of central aircraft information maintenance system (CAIMS) on the AM-200 portable maintenance access terminal (PMAT) or the FMS CDU. However, in service experience has shown that a low or marginal battery voltage even when not triggering any of battery messages may affect operation of the functions using holdup power listed in SIL (Ref. 1.2). The AMM Task (Ref. 1.1) may be used to verify the battery voltage prior to suspecting a faulty IAC.

Bombardier's proposal to have an optional maintenance task included in the Maintenance Planning Document (MPD) document for IAC Battery replacement every 15 months was approved by the Industry Steering Committee (ISC) after having considered the following factors:

- The battery is not charged during normal IAC operation and is not rechargeable
- Each time the aircraft power is off, the IAC internal battery is used to keep the Random Access Memory (RAM) memories powered. Considering that the Global fleet has an average of 700 flight hours a year, the IAC battery is almost always under load conditions. The IACs are powered only between 7 and 10% of a whole year (700 Hours), thus depleting the batteries when the aircraft is parked

The new optional maintenance task was included in the MPD release dated May 11th, 2015 (Ref. 1.6). Bombardier recommends that operators follow the new MPD task based on the IAC internal battery design and usage, where the interval can be adjusted based on operation profiles.

As a reminder, each time the IAC battery is replaced, before re-installing the IAC in its rack, the battery dedicated label needs to be manually updated with the date of replacement (refer to Figure 1 for the label position on the side of the IAC).

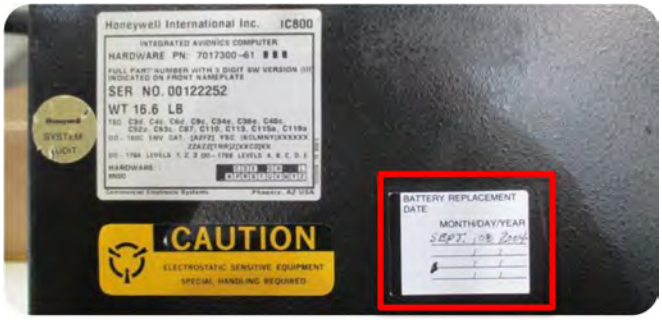

Figure 1 - Battery replacement label Location

3.2. **Limited troubleshooting test procedures** or unable to reproduce intermittent failures

Since part of the NFF cases have been determined to be avoidable through proper troubleshooting procedures, additional and improved troubleshooting information is now available as part of the Smart Fix Plus tool under:

- Observed Faults – ATA 34 – FMS BATTERY MAINT REQ (CYAN): Troubleshooting – By Observed result – ATA 34 – FMS FAULT MESSAGES ON SCRATCHPAD
- Troubleshooting – By Observed result – ATA 34 (new smart fix observation related to FMS INTERMITTENT FAILURES and DATABASE LOADING ISSUES).
- Troubleshooting – By Observed result – ATA 22 (New smart fix observation related to intermittent autopilot failures)

After completing the Smart Fix Plus troubleshooting procedure regarding intermittent FMS and Auto Pilot failures, if it is determined that the IAC need replacement, please ensure that the Material Return Authorization (MRA) document be filled as follows in the reason for removal field:

"INTERMITTENT FAILURE: [Add detailed failure description]"

Each time the reason for removal states “INTERMITTENT FAILURE”, Honeywell will troubleshoot the unit accordingly to an Engineering Special Instruction (ESI) 0037-1057-002 created to reproduce intermittent failures through temperature cycles tests.

In the past few years, Honeywell developed four different modifications upgrades with the aim of reducing IAC intermittent failures. As a result, the quantity of repeated NFF, generated by intermittent IAC failures, can be reduced through the implementation of those IAC MODs. Bombardier initiated a new process to have the following MODs installed on each IAC that goes back to Honeywell for maintenance/repair due to intermittent issues:

- Mod P: Examine Condition of Solder and Humiseal on the Circuit Card Assemblies (CCA)
- Mod Y: Make Sure Servo Discrete Update Window Test Passes
- Mod M: Examine the Flight Guidance/Digital Processor (FG/DP) Central Processor Unit (CPU) CCAs A3 and A5 for a Specified Vendor Part and replace if necessary
- Mod N: Change Capacitor and Resistor Values on Flight Guidance Input/Output (FG I/O). An Automatic Flight Control System (AFCS) & Yaw Damper (YD) fail message on start-up has been found to happen intermittently on the IAC of customer aircraft during start. This intermittent condition is caused by incorrect capacitor and resistor values on the FG I/O CCA A6.

“YD fail” message appears to be the most frequent reported issue among those NFF IAC removed due to intermittent failures. When the Display Units (DUs) are in full configuration (6 DUs active) the IAC 3 is generating the Crew Alerting System (CAS) list displayed on the Engine Indicating and Crew Alerting System (EICAS) display (DU 3). Even though the YD 1 and 2 are controlled by the IAC 1 and 2, there have been instances in which the “YD fail” message was erroneously generated by the IAC 3 due to issues related to the Fault Warning Computer (FWC) 3.

In order to prevent replacement of the wrong IAC when intermittent YD failures happen, Bombardier developed the following trouble-shooting procedure which will be added in the SmartFix observation “FMS INTERMITTENT FAILURES and DATABASE LOADING ISSUES”.

<u>“YD Fail” trouble shooting procedure:</u>

- Follow instructions given in SmartFix ATA 22-00-00 Auto flight, EICAS − YD 1 (2) FAIL (Caution).

  NOTE: JB4 (PCB2, PCB4 and PCB5) doesn’t need to be checked as the internal JB’s relays are not currently connected.

Additional Trouble-shooting tips:

- Swap SPDA 2 - If failure is on YD 1 (YD servo power passing through IAC 1)
- Swap SPDA 3 - If failure is on YD 2 (YD servo power passing through IAC 2)

  NOTE: The procedure is to isolate any possible loose contact pins on the SPDAs and the IAC that can cause “YD fail” CAS msg.

- Swap IAC 1 if only “YD 1 fail” is posted
- Swap IAC 2 if only “YD 2 fail” is posted

- If both “YD1 and YD 2 fail” CAS messages were displayed, set SG3 to ALT and check if the CAS messages ARE still displayed – EICAS display is fed by IAC 2
- If NO CAS message is displayed, swap IAC 3, to confirm failure of FWC 3
- Download stored faults relative to the flight when “YD fail” CAS message appeared
- Check the instructions given in the AW 700-31-0187 Rev. 2 - Co-Pilot Baro Set Knob Selection Causing ASCB Bus Controller Reversion

In case that Bombardier CRC support is needed for deeper investigation, be sure that the following information is passed on to BA CRC support people:

- Which YD was engaged when the CAS message was posted?
- Which FD mode was in use?
- What happened to the AFCS after the CAS message “YD fail” was posted? Did the system switch to the other YD/AP System?
- While YD 1 is engaged and “YD 1 fail” is intermittently posted what happens if YD 1 is disconnected and YD 2 is engaged? Is “YD 2 fail” message displayed?

Scheduled IAC NVM erase:

Bombardier recommends that operators consider scheduling periodic IACs NVM clean-ups as this will help to avoid having IAC units replaced due to intermittent failures. Field experience shows that sometimes intermittent failures have been cleared through IAC NVMs erase. The following are CAIMS messages associated with intermittent failures that can maybe be cleared through IAC NVMs erase:

- “FMS 1 inop”,
- “external ascb fault”,
- “external monitor fault”,
- “SG Inop”,
- “iac/ext clk interface”,
- “IAC/LX arinc intfc”,
- “external monitor fault”,
- “FMS – invalid – IAC fault”.

Prior to erasing a NVM it is always suggested to download and save its content.

The procedure that should be always followed is the AMM Task 45−45−00−970−822 (Ref. 1.3). Operators should also keep in mind, that in order to avoid any sort of NVM download issues, it is recommended to start CAIMS before launching the NVM download software and to keep it open until the NVMs’ download is completed.

Additional info on the IAC NVMs erase procedure can be found in the “Periodic Erase/Download of the IAC NVM Data” Forum Article (Ref. 1.4).

3.3. **FMS databases loading issues**

Some of the IACs involved in the NFF investigation were replaced due to FMS databases loading issues. For some units, the failure description was matching the scenario described in the Advisory Wire AW700-34-0241 Rev. 2 (Ref. 1.5). When a FMS database loading issue is experienced, before

replacing the IAC, operators should refer to this Advisory Wire to determine whether the issue is caused by a faulty IAC or by a faulty Data Loader DL-950.

4. ACTION:

Bombardier recommends that operators familiarize themselves with the information contained in this AW revision and to follow the recommendations before replacing an IAC.

This Advisory Wire information will be included in the Bombardier Maintenance training programs to raise awareness pertaining to IAC troubleshooting and NFF.

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).