

Incident to ATR 72-201
registered **F-GVZG**
on 11 September 2011
at Marseille

⁽¹⁾Except where otherwise indicated, the times in this report are in Universal Time Coordinated (UTC).

⁽²⁾Pilot Flying

⁽³⁾Pilot Monitoring

⁽⁴⁾MultiFunction Computer

Time	Around 14:55 UTC ⁽¹⁾
Operator	Airlinair
Type of flight	Commercial Air Transport - Passenger - Airline
Persons on board	Captain (PF ⁽²⁾), copilot (PM ⁽³⁾), two cabin crew and 25 passengers
Consequences and damage	None

MFC⁽⁴⁾ 1B+2B fault during landing run, emergency braking, runway excursion

1 - HISTORY OF THE FLIGHT

The crew took off from Lyon Saint-Exupéry airport at 14:02 with two cabin crew and 25 passengers, bound for Marseille Provence. At destination, they carried out an ILS approach to runway 13L.

Twelve seconds after wheel touchdown, at a speed of around 70 kt, the captain detected an anomaly and then, three seconds later, announced "fault on MFC ... fault on both MFCs" and that he no longer had control of the aeroplane. In his statement he said that the steering wheel did not respond to his actions and that he had the impression that the brakes were not acting normally. He decided to use the emergency braking system.

During the landing roll, the aeroplane deviated from its path, first to the right and then to the left, coming to a halt two thirds along and slightly off the runway. The nose gear was found at 90° to the longitudinal axis of the aeroplane.

The passengers disembarked from the aeroplane and were taken to the terminal by bus.

Inspections carried out after the incident found hard braking marks on the runway and reported that the MFC 1B and MFC 2B FAULT lights were on.

2 - ADDITIONAL INFORMATION

2.1 Description of MFC systems

The ATR 72 has two independent MFCs, each equipped with two modules, A and B, which are also independent. They process the signals from the numerous aeroplane systems. The latter are monitored by one or more modules.

The MFCs control, in particular, the generation of warnings by the CCAS⁽⁵⁾ and manage certain anomalies.

2.2 MFC fault

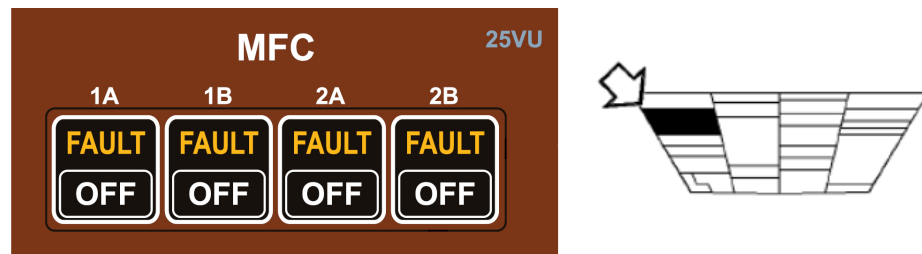
In the event of a fault on one or more of the four modules:

- the corresponding amber light lights up on the overhead panel;
- the MFC amber light lights up on the CAP⁽⁶⁾ ;
- the Master Caution amber light⁽⁷⁾ also starts flashing.

⁽⁵⁾Centralized Crew Alerting System

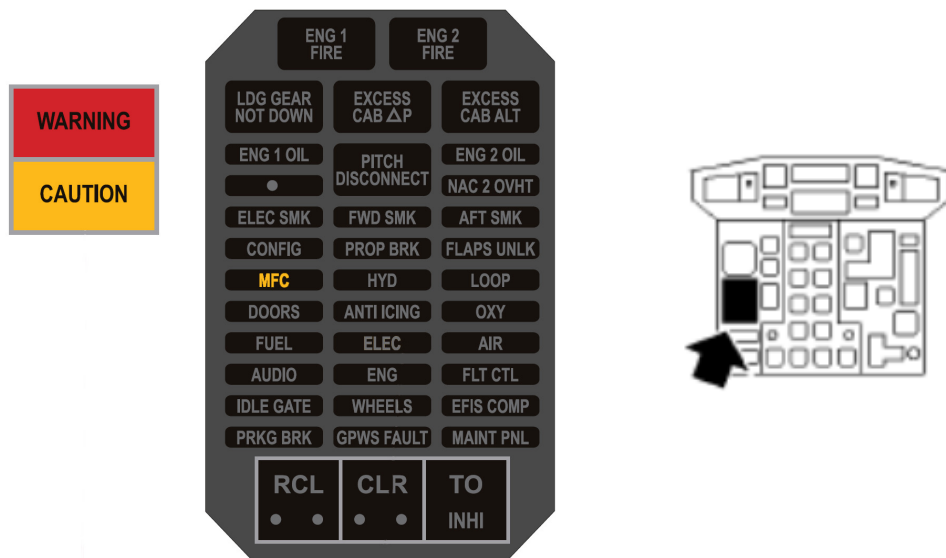
⁽⁶⁾Crew Alerting Panel

⁽⁷⁾Main warning lights



Source: ATR FCOM

Figure 1: Alert on overhead panel



Source: ATR FCOM

Figure 2: Alert on CAP (position in cockpit)

⁽⁸⁾The recorded data shows that the power levers were in the “flight idle” notch after landing which indicates that the IDLE GATE automatic function operated and that the MFC 1B and 2B fault occurred after wheel touchdown.

⁽⁹⁾The anti-skid remains operative

The simultaneous loss of the MFC 1B and 2B modules leads to the loss of several functions or systems including:

- visual alerts on the CAP, except for the MFC amber light and the following red lights: ENG1 FIRE, ENG2 FIRE, EXCESS CAB ALT, EXCESS CAB deltaP, PITCH DISCONNECT and NAV OVTH;
- aural alerts;
- IDLE GATE⁽⁸⁾ automatic function which allows the pilot to position the power lever in the ground idle notch and to use the thrust reversers once on the ground;
- stall warning and stick shaker;
- nose wheel steering;
- touchdown protection which prevents wheels from locking on touchdown⁽⁹⁾.

2.3 Procedure to be followed by crews in event of MFC 1B and 2B fault

MFC 1B+2B FAULT			
R	MODULES 1B+2B OFF / RESET OVERHEAD PANEL MONITOR		
R	MFC 1B+2B MODULES EQUIPMENT LIST CHECK ● Before landing NOSE WHEEL STEERING OFF ANTI-SKID OFF ANTI-SKID FAULT procedure (2.25) APPLY LDG GEAR LEVER DOWN EMER EXTENSION HANDLE PULL CAUTION : LDG GEAR cannot be retracted. ● At touch down IDLE GATE PULL DIFFERENTIAL BRAKING USE ● After landing PACK 1 + 2 OFF ANTI-ICING HORNS OFF PROBES HTG OFF OVBD VALVE FULL OPEN <u>Note</u> : ATPCS ARM light is not available. Autofeather light is lost. <u>Note</u> : External power cannot be used. CAUTION : Before opening any door, PACKS 1 and 2 must be selected OFF and cockpit communication hatch must be open.		
MFC 1B+2B MODULES LOST EQUIPMENT LIST			
R	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> GROUND FAN 1 GROUND FAN 2 AIR X VALVE OUTFLOW VALVE OPENING AFTER LANDING OVBD VALVE AUTOFUNCTIONING CVR ERASE DC STBY BUS UNDV DETECT INV 1 FAULT LIGHT INV 2 FAULT LIGHT MAIN BAT CHG CTL BAT DISCHARGE IN FLIGHT FLAPS ASYMMETRY DETECTION STICK PUSHER INHIBITION STICK SHAKER STALL WARNING PITCH TRIM WHOOLER PITCH TRIM ASYMWARNING AIL LOCK LIGHT if applicable GREEN PUMP LO PR INDICATION RH SIDE WINDOW ANTI-ICING and associated FAULT IND INHIBITION OF HORNS ANTI-ICING ON GROUND </td> <td style="width: 50%; vertical-align: top;"> CCAS MASTER WARNING CCAS MASTER CAUTION CCAS AURAL ALERTS CCAS AMBER ALERTS ON CAP CCAS WARNING ALERTS (CONFIG, PROP BRK, ENG OIL) LDG GEAR CONTROL LDG GEAR Secondary UNLK IND LDG GEAR Secondary GREEN ARROWS BRAKE OVERTEMP ALERTS LH / RH LDG GEAR LEVER LOCKED DOWN ON GROUND NOSE WHEEL STEERING ANTI-SKID "LANDING GEAR NOT DOWN" WARNING BLEED VALVE 1 FAULT IND BLEED VALVE 2 FAULT IND ARM LIGHT IND PROP BRAKE RED UNLK LT if applicable LEFT and RIGHT AUTO CL </td> </tr> </table>	GROUND FAN 1 GROUND FAN 2 AIR X VALVE OUTFLOW VALVE OPENING AFTER LANDING OVBD VALVE AUTOFUNCTIONING CVR ERASE DC STBY BUS UNDV DETECT INV 1 FAULT LIGHT INV 2 FAULT LIGHT MAIN BAT CHG CTL BAT DISCHARGE IN FLIGHT FLAPS ASYMMETRY DETECTION STICK PUSHER INHIBITION STICK SHAKER STALL WARNING PITCH TRIM WHOOLER PITCH TRIM ASYMWARNING AIL LOCK LIGHT if applicable GREEN PUMP LO PR INDICATION RH SIDE WINDOW ANTI-ICING and associated FAULT IND INHIBITION OF HORNS ANTI-ICING ON GROUND	CCAS MASTER WARNING CCAS MASTER CAUTION CCAS AURAL ALERTS CCAS AMBER ALERTS ON CAP CCAS WARNING ALERTS (CONFIG, PROP BRK, ENG OIL) LDG GEAR CONTROL LDG GEAR Secondary UNLK IND LDG GEAR Secondary GREEN ARROWS BRAKE OVERTEMP ALERTS LH / RH LDG GEAR LEVER LOCKED DOWN ON GROUND NOSE WHEEL STEERING ANTI-SKID "LANDING GEAR NOT DOWN" WARNING BLEED VALVE 1 FAULT IND BLEED VALVE 2 FAULT IND ARM LIGHT IND PROP BRAKE RED UNLK LT if applicable LEFT and RIGHT AUTO CL
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The procedure to be followed by the crew is given above.

2.4 Personnel information

The captain had logged around 6,000 flight hours of which 5,400 were on type and 70 were in the last three months.

The copilot had logged around 1,600 flight hours of which 1,200 were on type and 138 were in the last three months.

2.5 Similar events

Several similar events which occurred before or after this incident were reported to the BEA. The BEA retrieved the flight recorders for some of these.

Date	MSN Registration	Place	Summary
25/02/2011	516 F-GVZC	Limoges	At 30 kt during landing run, MFC 1B+2B fault making aeroplane difficult to control.
28/09/2011	520 F-GPYM	Lyon	At 40 kt during landing run, crew lost yaw control. They said that red landing gear warning lights lit up for two seconds, they briefly heard a master caution warning, MFC1B+2B fault. The crew reinitialized MFCs and recovered control of aeroplane.
18/10/2011	748 EI-REL	Glasgow (UK)	During landing run, crew lost yaw control and realised that steering system was ineffective. They observed MFC 1B+2B fault. They reinitialized MFCs and continued taxiing to their parking area.
10/2011 Test flight	811 F-WWXX	Toulouse	While climbing and at around 2,000 ft, crew observed MFC 1B+2B fault after disengaging autopilot.
04/11/2011	981 F-WWEB	Toulouse	After appearance of a VMO warning, crew observed MFC 2B fault.
04/12/2011	516 F-GVZC	Cologne (Germany)	During approach, crew observed MFC 1B+2B fault. They were not able to extend landing gear and conducted a missed approach. They recovered MFCs four minutes later and landed normally.
05/12/2011	590 F-GVZM	Lyon	Crew observed MFC 1B+2B fault during taxiing phase and loss of yaw control. They reinitialized them and continued taxiing to their parking area.
02/11/2012	542 F-GPYL	Lyon	Crew observed MFC 1B+2B fault a short time after disengaging autopilot They reinitialized them and landed normally.

Six events occurred in 2013, seven in 2014 and two before June 2015 (new MFC standard). Since this date, only three events have been reported. They have not been investigated by the BEA.

⁽¹⁰⁾Cockpit Voice recorder

⁽¹¹⁾Warning linked to a change in autopilot mode status

⁽¹²⁾The system cannot emit several warnings simultaneously and fixes an order of priority

⁽¹³⁾Quick Reference Handbook

2.6 Technical examinations of F-GVZG and similar events

Among the events listed in paragraph 2.5, the BEA analysis of the recorded data found that a fault on the MFC audio module was systematically recorded. This module generates the aural warnings.

Work carried out on the CVR ⁽¹⁰⁾ recordings found that the “triple click”⁽¹¹⁾ type aural warning was often partially emitted (only one click was present) at the same time as the MFC 1B+2B fault occurred.

On generating an aural warning, the two modules which ensure the redundancy of this function are synchronized. This synchronization means that the two MFCs generate a single warning taking into account its priority⁽¹²⁾.

Additional examinations carried out on the audio module revealed that the microprocessors processing the generation of warnings (one on each module) could potentially transmit erroneous information when two modules about to simultaneously generate warnings are synchronized.

This error was caused by a failure of the software managing this MFC function.

3 - LESSONS LEARNED AND CONCLUSIONS

3.1 Detection and management of simultaneous MFC 1B and 2B fault

In the event of a MFC 1B+2B fault, the procedure to be followed by the crew lists a series of actions which start with the reinitialization of the MFCs. This procedure requires a large amount of processing time which combined with the element of surprise in flight phases where there is a high workload (short final or wheel touchdown) makes it difficult to carry out. The investigation also revealed that sometimes crews did not immediately detect the fault and that they became aware of it because of its consequences (e.g. loss of steering control system) rather than by its indication by warning lights, in the absence of the associated aural warning.

The MFC 1B+2B fault leads to the loss of numerous systems, including the stall warning and stick shaker. This degraded situation could prove critical when the flight is continued in this configuration as was the case for the event concerning the F-GVZC on 4 December 2011 at Cologne (Germany).

Furthermore, the procedure to be followed in the event of a MFC 1B+2B fault requires the crew to reset the MFCs, monitor the overhead panel and check the list of systems which have been lost in the QRH⁽¹³⁾. It then requires the crew to shutdown certain systems according to the flight phase. However, it does not specify an item for exiting the emergency procedure if the MFCs are recovered.

3.2 Causes

The runway excursion on landing was the result of the loss of control of the nose gear and of it turning so that it was perpendicular to the longitudinal axis of the aeroplane.

The loss of control of the nose gear was due to a simultaneous double fault on MFCs 1B and 2B, detected by the crew during a critical flight phase.

The cause of this double fault was identified and was the result of a system error during the synchronization of the generation of aural warnings for the crew.

The loss of braking power felt by the captain could not be explained by the investigation.

4 - MODIFICATIONS MADE FOLLOWING INCIDENT

The manufacturer published OEB⁽¹⁴⁾ No 28 in April 2015 to inform crews of the procedure to follow. They also developed a new version of the MFC software, standard 6, which eliminates the anomaly which caused the events. This standard has been available as a retrofit since June 2015 and has been installed on aeroplanes on the production line since December 2015.