

Fire on main left landing gear during taxiing after landing

Aircraft	ATR 72-200 registered EI-REJ
Date and time	19 April 2011 about 21 h 50 ⁽¹⁾
Operator	Air Contractors
Place	AD Paris Charles de Gaulle (95)
Type of flight	Scheduled international cargo transport
Persons on board	Captain (PF); Copilot (PNF)
Consequences and damage	Left main landing gear seriously damaged by fire

⁽¹⁾All times in this report are in Universal Time Coordinated (UTC), except where otherwise specified. Two hours should be added to obtain the legal time applicable in metropolitan France on the day of the event.

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.

HISTORY OF FLIGHT

The following facts are based on recorded data and crew testimony.

The crew was carrying out a flight from Cork (Eire) to Paris Charles de Gaulle (95). They landed on runway 09 L at Paris Charles de Gaulle at 21 h 46. They cleared the runway via taxiway Z5. The controller cleared them to continue taxiing on taxiway K6, cross runway 09 R and asked them to contact the ground controller at the end (see figure 1).

At 21 h 48 the crew noted that the power required to cross the runway was unusually high, but decided to continue taxiing and to analyse the problem later. The crew contacted the ground controller. The latter gave them taxiing instructions as far as taxiway B.

Twenty seconds later, the "BRK TEMP HOT"⁽²⁾ high brake temperature warning appeared⁽³⁾. The Captain told the copilot that he had not used the brakes. The crew made the connection between the need to display unusual power for taxiing and this warning. The crew continued taxiing as far as taxiway B. The Captain noted that the left wing was tilted abnormally. At 21 h 50 he decided to stop the aeroplane. The copilot informed the controller of the situation.

⁽²⁾The "BRK TEMP HOT" warning is triggered when the temperature sensors on the wheels detect a temperature above 150°C. During taxiing, there is no procedure defined by the operator or manufacturer associated with this warning.

⁽³⁾The following amber lights illuminate: "Master Caution" and "Wheel" on the Crew Alerting Panel and the "HOT" light on the central instrument panel. An aural "single chime" signal sounds.

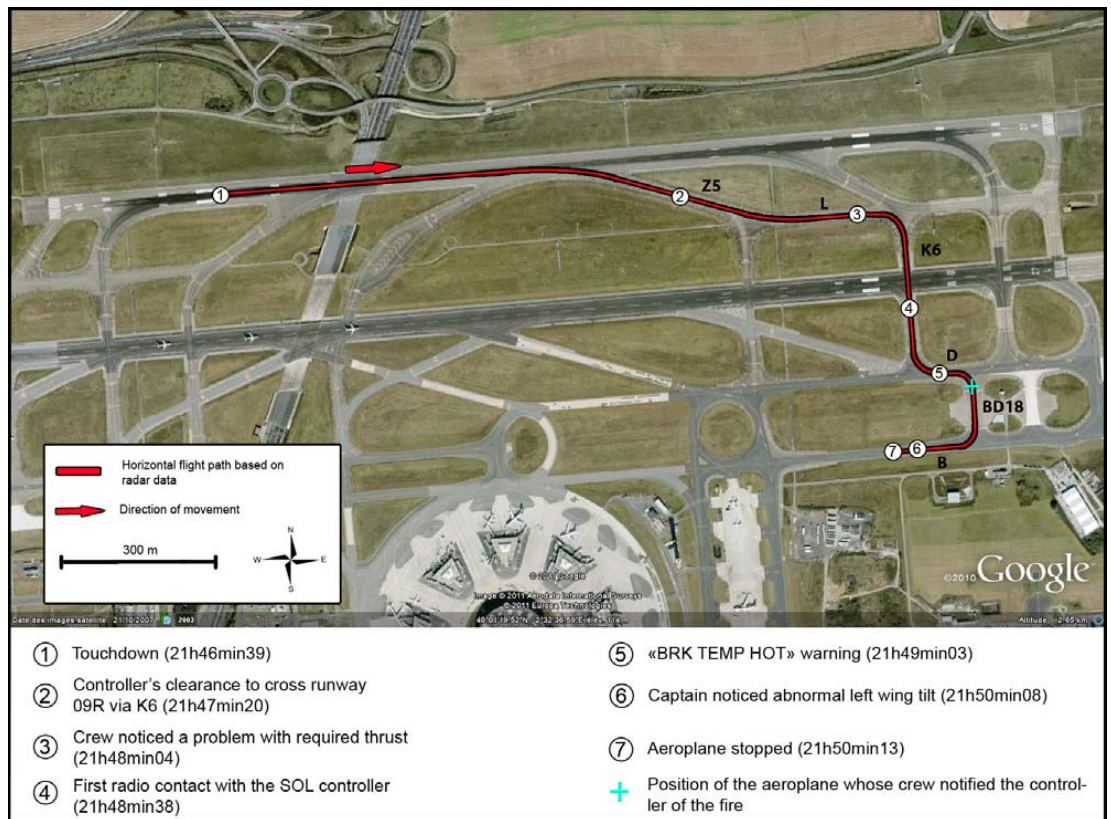


Figure 1: Aeroplane trajectory

⁽⁴⁾EI-REJ's crew was English-speaking.

At 21 h 51 min 40, the crew of the aeroplane that was following EI-REJ (in blue in Figure 1) informed the controller in French⁽⁴⁾ that there was a fire on the aeroplane in front of them.

About 8 seconds later, not having obtained any response, they asked the controller if he had received their last message.

At 21 h 51 min 52, the controller informed him that he had received the message.

At 21 h 51 min 58, the controller requested the crew of EI-REJ to confirm the presence of fire on the aeroplane. The copilot answered that they had a high temperature on the left side of the aeroplane. At 21 h 52 min 05, the Captain decided to shut down the engines and disconnect the electrical power. The controller informed them that the RFFS was on its way.

⁽⁵⁾There is no associated fire warning.

At 21 h 52 min 08, the crew of the aeroplane that was following EI-REJ announced in English to its crew that there was fire on the left main landing gear⁽⁵⁾.

The crew evacuated the aeroplane and the RFFS extinguished the fire.

ADDITIONAL INFORMATION

Description of braking system

The four wheels of the main landing gear are each equipped with carbon brakes. The four brakes are interchangeable. The brakes are made up of two rotating disks and five pistons. The pistons are hydraulically activated to a maximum pressure of 3,000 PSI and are returned to position by springs.

Brake wear is assessed using an indicator pin located on the spreader plate. When the brakes are fitted on the wheels, the spreader plate is no longer visible and only the section of the indicator pin shown with an X in Figure 3 is visible. When this section is no longer visible, it means that the brakes have reached the wear limit.

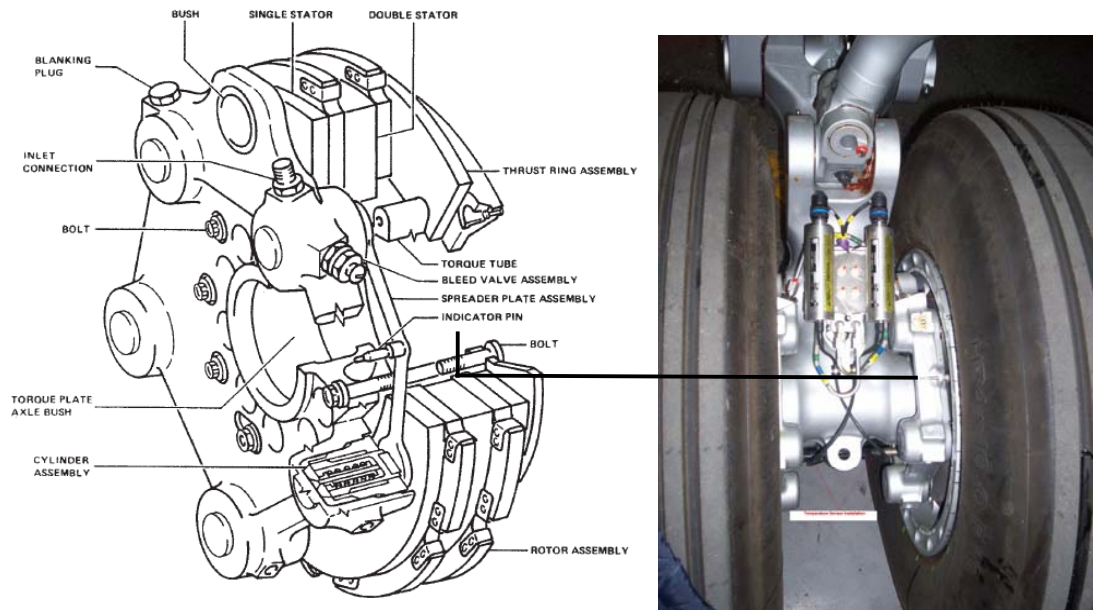


Figure 2: A brake block

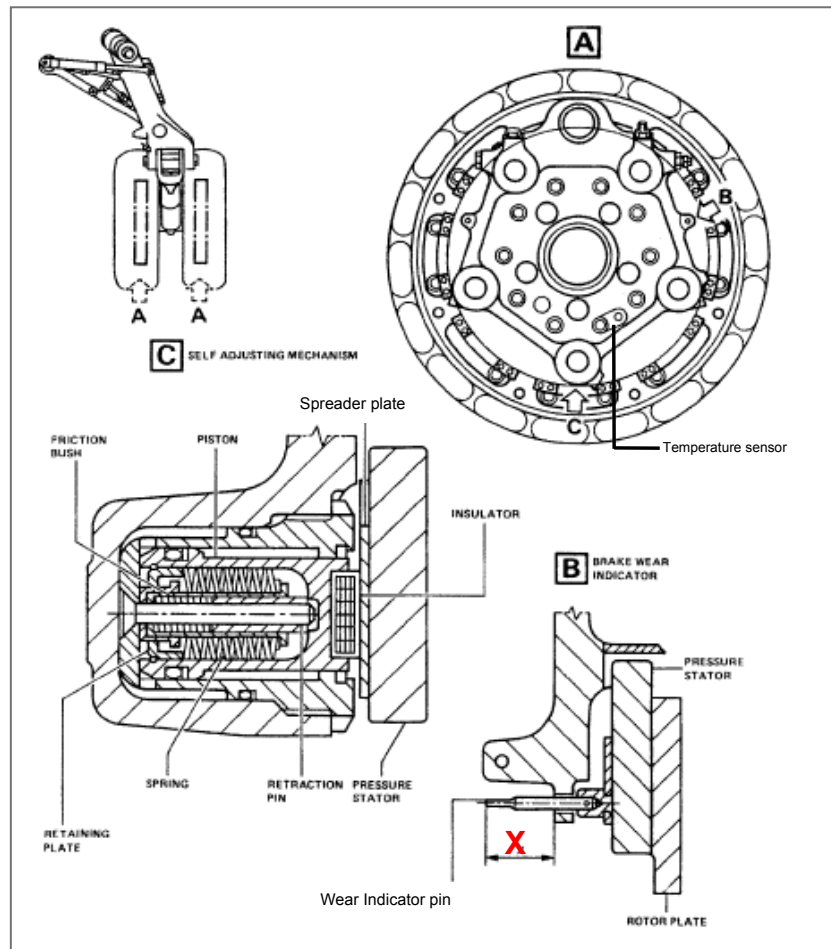


Figure 3: Detailed diagram of the brake block

The braking system has a single temperature warning that is triggered when one of the four temperature sensors (see figure 3) detects a minimum temperature above 150°C.

The wheel fuses are triggered at a temperature of 177°C

Technical examinations

Observations made on the aeroplane showed that there was a fire in the region of the 2 brake blocks on the left main landing gear. The latter, as well as a section of the associated fairings, was significantly damaged. It had to be completely replaced.

The fuses on the wheels tripped.

Examination of the brake blocks showed that the outer brake block (n°1) was more damaged than the inner brake block (n°2).

Wear on brake block n°1 had exceeded the limit defined by the manufacturer. The spreader plate bearing the brake wear indicator was distorted before the accident and this distortion made it impossible to assess the real wear on the brake block, which appeared to be correct. The wear could not be detected⁽⁶⁾ during the daily maintenance checks. The equipment manufacturer indicated that this wear does not affect braking efficiency. However it did not specify if this wear could encourage a brake block piston malfunction.

⁽⁶⁾The spreader plate is not visible without the wheels being removed.

Damage to the two brake blocks following the fire made it impossible to determine if there had been an internal malfunction prior to the fire.

Crew Statement

The crew indicated that they had not used the brakes during taxiing on landing. They stated that they had used the brakes for the first time shortly before turning left on taxiway D.

The increase in power required for taxiing did not seem worrying to them.

They did not experience any difficulties in controlling the aeroplane while it was taxiing. When the high brake temperature warning sounded, they checked and noted that the parking brake was not engaged.

They heard the message from the other aeroplane informing them that there was a fire on the left main landing gear. From that moment on, the Captain noticed the reflection of flames on the wing and decided to evacuate the aeroplane.

Similar Events

The aeroplane manufacturer recorded three events for which the brake blocks were damaged by overheating. The circumstances and consequences of these events were different. The manufacturer had not identified the cause of the overheating.

Action Taken by the Equipment Manufacturer

The equipment manufacturer responsible for brakes designed a new spreader plate. Modifications were considered to avoid distorting the plate during normal operation of the aeroplane so that the wear indicator truly represented the condition of the brake block. This new model is currently being validated by the aeroplane manufacturer. Not having determined the cause of the brake block overheating as yet, the equipment manufacturer had not put in place corrective actions at the time of publication of this report.

LESSONS LEARNED AND CONCLUSION

It is likely that the brake block overheating resulted from the pistons being blocked. It was not possible to establish nor to exclude a direct link between excessive out-of-tolerance block wear and the pistons being blocked.

This blockage obliged the crew to make an abnormal increase in thrust to maintain normal speed during taxiing. The brake block temperature then rose until it triggered the "BRK TEMP HOT" warning. There was either a pre-existing hydraulic fluid leak or one that was subsequent to the increase in temperature. The hydraulic fluid projected on to parts where the temperature had reached or exceeded its flashpoint, causing it to ignite.

BRK TEMP HOT procedure:

The procedure defined by the manufacturer and the operator does not take into account the triggering of this warning during taxiing. The crew did not have instructions for this phase of flight.

The crew of the accident aeroplane continued taxiing for just over one minute. They stated that they had checked that the parking brake was not engaged and then decided to stop.

Fire warning:

The aircraft systems could not indicate this fire to the crew as there were no sensors near the main landing gear intended for this purpose. The crew of EI-REJ was informed of the presence of a fire in the left main landing gear region by the crew of another aeroplane. This enabled rapid detection of the fire and safe evacuation by the crew.

Conclusion

The fire in the left main landing gear was probably due to the blocking of the brake block piston(s) during taxiing and to a hydraulic fluid leak. The investigation did not make it possible to determine the origin of the hydraulic fluid leak. It is possible that the blocking of the pistons was caused by out of tolerance wear on the brake block. This wear could not be detected due to a distortion of the spreader plate.