

AI2014-1

**AIRCRAFT SERIOUS INCIDENT  
INVESTIGATION REPORT**

**PRIVATELY OWNED**

**J A 3 6 8 9**

**January 31, 2014**



The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board (and with Annex 13 to the Convention on International Civil Aviation) is to prevent future accidents and incidents. It is not the purpose of the investigation to apportion blame or liability.

Norihiro Goto  
Chairman,  
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

# AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

## RUNNING OFF THE SIDE OF A RUNWAY DURING LANDING PRIVATELY OWNED FUJI HEAVY INDUSTRIES FA-200-180, JA3689 AT SATSUMA-IOJIMA AIRFIELD, MISHIMA-MURA, KAGOSHIMA PREFECTURE, JAPAN AT AROUND 11:40 LOCAL TIME, NOVEMBER 25, 2012

December 6, 2013

Adopted by the Japan Transport Safety Board

|          |                    |
|----------|--------------------|
| Chairman | Norihiro Goto      |
| Member   | Shinsuke Endoh     |
| Member   | Toshiyuki Ishikawa |
| Member   | Sadao Tamura       |
| Member   | Yuki Shuto         |
| Member   | Keiji Tanaka       |

### 1. PROCESS AND PROGRESS OF THE INVESTIGATION

On November 25, 2012, the Japan Transport Safety Board designated an investigator-in-charge and another investigator to investigate this serious incident. Comments were invited from parties relevant to the cause of the serious incident.

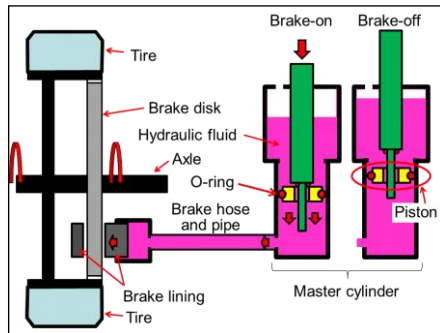
### 2. FACTUAL INFORMATION

|                                  |  |
|----------------------------------|--|
| <b>2.1 History of the Flight</b> | <p>According to the statements of the captain, the history of the flight is summarized as follows.</p> <p>On November 25 (Sunday), 2012, a privately owned Fuji Heavy Industries FA-200-180, registered JA3689, left an apron of Yakushima airport at 11:08 JST (UTC+9hrs) with the captain and three passengers on board. As the captain checked braking action during taxiing and found it normal, the aircraft took off at 11:11 for Satsuma-Iojima airfield for sightseeing.</p> <p>After the captain made low flying over Satsuma-Iojima airfield and confirmed no wind, he made approach to the runway 36 at about 70kts and landed at around 11:40. Just after touch-down, both of left and right brakes worked normally but the left brake immediately became so light as if to step on a sponge, and then became ineffective.</p> <p>The captain could not decelerate the aircraft as he expected, because he had to control the aircraft with adjusting right brake force so as not to veer off the runway centerline, while stepping fully on the left brake pedal.</p> <p>The captain thought to become airborne, but decided to run into meadows in the right of the runway with applying still available right brake hard, in considering the case not to be able to fly over the grove of</p> |
|----------------------------------|--|

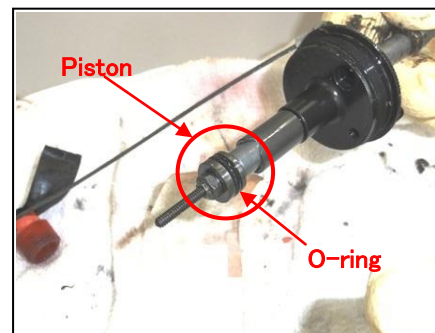


**2.8 Detail Examination of Brake Master Cylinders**

The left and right master cylinders in the brake system were removed from the aircraft and examined for hydraulic fluid leaks. In the left master cylinder, fluid leaks were confirmed. Then the left master cylinder was disassembled and it was found that a rubber-made O-ring mounted on the piston to prevent fluid leaks was worn out.



Schematic of brake system



Worn O-ring

**2.9 Airplane Maintenance Information**

(1) The service manual of the aircraft instructs to check the brake master cylinder for hydraulic fluid level and leaks at flight hours of 50, 100 and 500 respectively. In addition to these checks, it instructs to replace the O-ring as necessary at 1,000hrs check. The 1,000hrs check items were added in December 1974.

Procedures and specific work at the 1,000hrs check are to check for hydraulic fluid level in the master cylinders and for external leak in accordance with check item No.8 of the periodic inspection chart, and after disassembling the master cylinders to perform check item No.9, visually check the O-ring mounted on the piston and replace it if there exist any defect. The 1,000hrs check also requires cleaning the inside of the master cylinders, reassembling the disassembled master cylinders and adding hydraulic fluid.

(2) According to the flight log book of the aircraft, the last two 1,000hrs checks were performed on October 2011 and October 1998 respectively.

(3) According to the licensed mechanic and the assistant mechanic who were in charge of the last 1,000hrs check, they were to use the periodic inspection chart of the service manual for recording performed checks and work, and to put check marks on the performed items and write in jointly the name of parts or materials if replaced.

(4) It was confirmed on the record of the last 1,000hrs check that there was a check mark on the check item No.9 which instructs to replace the O-ring as necessary. However, there was no record of the O-ring name that is expected to be recorded when replaced.

| PERIODIC INSPECTION CHART |  |                     |     |     |      |
|---------------------------|--|---------------------|-----|-----|------|
| Section and No.           | Requirements   | Inspection Interval |     |     |      |
|                           |  | 50                  | 100 | 500 | 1000 |
| 8                         | Check master cylinder for proper oil level and also check for leaking. | ○                   | ○   | ○   | ○    |
| 9                         | Change O-ring of master cylinder (as required).                        |                     |     |     | ○    |

Periodic inspection chart of service manual (excerpt)

|                                    |  |
|------------------------------------|--|
| <b>2.10 Additional Information</b> | Cessna 172P, 206G and T207 are equipped with master cylinders (Cessna P/N: 0541138-22) of the same series as that of the master cylinder (Cessna P/N: 0541138-20) installed on the incident aircraft, and mount an O-ring (P/N: MS28775-110) of the equivalent specification as that of the O-ring (P/N: AN6227B-8) mounted on the incident aircraft. For those Cessna models, the O-ring is to be replaced when the master cylinder is disassembled. Moreover, in the model 206G and T207, the O-ring is to be replaced in every 5 years. |
|------------------------------------|--|

### 3. ANALYSIS

|                                    |   |
|------------------------------------|---|
| <b>3.1 Involvement of Weather</b>  | None  |
| <b>3.2 Involvement of Pilots</b>   | Yes   |
| <b>3.3 Involvement of Airplane</b> | Yes   |
| <b>3.4 Analysis of Findings</b>    | <p>(1) It is probable that the captain could not anticipate the left brake would become ineffective as he performed brake check during taxiing and found normal function before take-off and the left brake was effective just after touch-down. It is highly probable that the left brake became ineffective at the landing and the aircraft ran off the runway to the right as the captain intentionally applied the right brake hard, and then the nose wheel was tackled by the meadows and the aircraft came to a halt after tumble.</p> <p>(2) Since the wear of O-ring in the left master cylinder of the brake system was confirmed, it is highly probable that the left brake system became ineffective because the master cylinder could not maintain sealing capability and brake fluid pressure could not be sufficiently transmitted to the brake linings.</p> <p>(3) In the record of the 1,000hrs check performed on October 2011, the check mark indicating to have carried out the replacement was recorded on the check item which instructs to replace the O-ring as necessary. However, it is highly probable that the O-ring had not been replaced at the time of this check, in consideration of the fact that the O-ring of the left master cylinder was worn out enough to result in the hydraulic fluid leaks although this serious incident occurred after about a year and only about 46 flight hours since the last check, and that there is no requirement in the service manual to replace the O-ring in the case of no defect, and that there was no record of the O-ring name which is to be recorded when replaced.</p> <p>(4) It is possible that the wear of the O-ring was caused from aging deterioration.</p> |

#### **4. PROBABLE CAUSES**

It is highly probable that this serious incident occurred when the left brake became ineffective, and the aircraft ran off the runway to the right as the captain intentionally applied the right brake hard, and came to a halt after tumble in the meadows, and thus became unable to taxi by itself.

It is highly probable that the left brake system became ineffective because the O-ring of the left master cylinder in the brake system was worn out, and the master cylinder could not maintain sealing capability and could not sufficiently transmit the brake fluid pressure to the brake linings.

It is possible that the wear of the O-ring was caused from aging deterioration.

#### **5. RECOMMENDATIONS PURSUANT TO THE ACT FOR ESTABLISHMENT OF THE JAPAN TRANSPORT SAFETY BOARD**

In order to contribute to prevention of recurrence of the similar serious incident, based on the results of this serious incident investigation, the Japan Transport Safety Board recommends Fuji Heavy Industries Ltd. pursuant to Article 27 paragraph (1) of the Act for Establishment of the Japan Transport Safety Board as follows:

In the Fuji Heavy Industries FA-200 series aircraft, the O-ring of the master cylinder in the brake system is to be replaced if found defective when the master cylinder is disassembled and visually inspected at the 1,000hrs check. However, an O-ring tends to expand when soaked in hydraulic fluid, and in addition, the O-ring becomes hardened when pressured and may have wear or damage which is hard to recognize visually. Therefore, it is recommended to consider that the O-ring should be replaced when the master cylinder is disassembled and usable duration of the O-ring should be established.