

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR24LA141

BRAKE SYSTEM EXAMINATION

August 12, 2024

A. ACCIDENT

Location: Nokai Dome, CO
Date: August 12, 2024
Time: 0800MST
1500UTC
Airplane: N50101
Manufacturer: Cessna
Model: T206U

B. BRAKE SYSTEM EXAMINATION

IIC Michael Hicks
National Transportation Safety Board
Phoenix, AZ

C. SUMMARY

Functional tests revealed normal operation of the brake system during examination. However, due to impact damage, the integrity of the right main landing gear hydraulic system was compromised and therefore inconclusive.

D. DETAILS OF THE EXAMINATION

1.0 Initial Overview

Visual examination of the landing gear revealed that the nose gear strut had completely separated from the lower fuselage (Figure 1). The left main landing gear spring assembly remained attached to the lower fuselage within the channel. The left wheel, inboard and outboard cup bearing seats were fracture separated. The wheel remained attached to the landing gear by the main gear axle. The tire was unremarkable.

The right main landing gear spring assembly was separated from the channel (Figure 5). The inboard retention bolt sheared, and a portion of the shank remained in the spring assembly bore. The forward (Figure 7) and aft channel retention bolt and nut remained in the channel, with deformation identified on the aft upper channel surface (Figure 6). The landing gear spring was separated from the hydraulic brake line (Figure 1), and the wheel was separated from the spring (Figure 2). The main gear axle was separated from the landing gear spring.



Figure 1: Forward right side view of the airplane with impact separated nose landing gear and right main landing gear.



Figure 2: Close up view of the separated right main landing gear wheel and caliper with impact damage to hydraulic line AN fitting, and deformation to axle attachment bolts.



Figure 3: Top to bottom view of impact separated right main landing gear spring



Figure 4: Bottom to top view of impact separated right main landing gear spring



Figure 5: Initial view of right main landing gear spring lower fuselage separation.



Figure 6: Close up view of left main landing gear spring aft channel separation.



Figure 7: Close up view of left main landing gear spring forward channel separation.



Figure 8: Initial view of the left main landing gear, connected hydraulic fluid line and caliper.

2.0 Operational Test

The left main landing gear hydraulic line was unremarkable and remained attached to the left main gear axle and caliper. Pressure was applied to the pilot seat, left brake pedal with the master cylinder attached. Manual application of the left brake pedal revealed that the left brake caliper pistons functioned normally, applying pressure to the torque plate lining and the back plate lining. A subsequent release of the brake pedal application revealed a corresponding retraction of the pistons, torque plate lining, and back plate lining. The hydraulic brake line was removed at the AN fitting, the manual application of brake pedal pressure was applied and hydraulic fluid was observed emanating with force (Figure 10).

The right main landing gear hydraulic brake line was separated and extended about 2 ft from the lower fuselage. The separated end of the hydraulic brake line was placed in mason jar filled with water (Figure 9). Manual application of the left seat, right brake pedal with the master cylinder attached revealed a corresponding pressure throughout the brake line, observed by the outflow pressure indicated by bubble formation in the water of the mason jar.



Figure 9: Right hydraulic brake line function test showing mason jar and bubble production, pressure indication.



Figure 10: Left main gear hydraulic brake line function test showing fluid pressure at AN fitting body.

Subsequently, compressed air was applied to the hydraulic connection AN Fitting, which produced a corresponding application of the caliper pistons. The right brake caliper pistons functioned normally applying pressure to the torque plate lining and the back plate lining. A subsequent release of the brake pedal application revealed a corresponding retraction of the pistons, torque plate lining, and back plate lining.

2.1 Left Brake

The left and right main landing gear wheels were equipped with aftermarket 29 x11-10 Air Hawk tires, and the main gear brake assemblies were manufactured by Cleveland Wheel and Brake Systems. The left wheel sustained impact damage to the inboard and outboard wheel half assembly cup bearings (Figure 11) (Figure 12). The inboard and outboard wheel half cup bearing lips were fracture separated. The left wheel was removed from the main gear axle by removing the cotter pin and retaining nut. The inboard assembly revealed impact damage to the cup bearing lip, retainer ring, felt grease retainer seal, felt grease seal, retainer and cone bearing. The left outboard wheel assembly revealed impact damage to the cup bearing lip, retainer ring, felt grease retainer seal, felt grease seal, retainer and the cone bearing was missing most of its roller bearings. Once disassembled, neither the inboard or outboard cup bearing lip was found between the wheel halves, and about 33 percent of its diameter surface was not present.



Figure 11: View of damage to the left wheel outer half.



Figure 12: View damage to the left wheel inner half and bearing assembly.

The left main landing gear inboard shims remained unremarkable and wedged between the main gear axle and landing gear spring. The caliper remained attached to the disc assembly but separated from the torque plate. The caliper was removed from the disc and revealed that the pressure plate assembly, the torque plate and back plate assemblies were intact. The pressure plate and back plate linings were present and unremarkable (Figure 14).



Figure 13: Left main gear cylinder, pressure plate and back plate.

2.2 Right Brake

The right wheel separated from the right main gear spring. The separation point was located at the upper and lower main gear axle bolts which were stripped at their respective threads and bent. One of the shims remained attached to the main gear axle, while one shim was not present during the examination. The inboard and outboard wheel half assembly cup bearings were unremarkable. The right wheel was removed from the main gear axle by removing the cotter pin and retaining nut. The inboard wheel assembly revealed an unremarkable cup bearing lip, retainer ring, felt grease retainer seal, felt grease seal, retainer and cone bearing. The outboard wheel assembly revealed an unremarkable cup bearing lip, retainer ring, felt grease retainer seal, felt grease seal, retainer and cone bearing.



Figure 14: View of the right main landing gear break assembly.

The right main landing gear brake caliper remained attached to the disc assembly and torque plate. The caliper was removed from the disc and revealed that the pressure plate assembly, the torque plate and back plate assemblies were intact

(Figure 15). The pressure plate and back plate linings were present and unremarkable. The right brake caliper pistons were unremarkable (Figure 16).



Figure 15: Close up view of right main landing gear brake caliper pistons with pressure plate removed.

2.3 Cockpit Instrumentation

The airplane was equipped with a Garmin G1000 system that contained non-volatile memory. However, only one data card was present and did not provide flight data.

Submitted by:

Michael Hicks
Investigator-in-charge