

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 18, 2023

SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT

ANC21LA073

A. ACCIDENT

Location:	Fairbanks, AK
Date:	August 16, 2021
Time:	1452 Local
Aircraft:	Cessna 208B
Registration:	N97HA

B. SYSTEMS GROUP

Chairman:	Adam Huray National Transportation Safety Board Washington, DC
Member:	Matthew Rigsby Federal Aviation Administration Fort Worth, TX
Member:	Casey Love Textron Aviation Wichita, KS
Member:	Rett Leaf Wright Air Service Fairbanks, AK

C. ACCIDENT SUMMARY

On August 16, 2021, about 1452 Alaska daylight time, a Cessna 208B, N97HA, was substantially damaged when it was involved in an inflight upset near Fairbanks, Alaska. The pilot and eight passengers were not injured. The airplane was operated by Wright Air Service as a Title 14 *Code of Federal Regulations* Part 135 scheduled commuter flight, as flight number 440.

D. AIRCRAFT EXAMINATION

D.1 Aircraft Information

Make: Cessna

Model: 208B

Registration: N97HA

Serial Number: 208B0610

Date of Delivery: 06/27/1997

Modifications¹: The aircraft was equipped with the Blackhawk STC which installed the 867 SHP Pratt & Whitney PT6A-140 engine.

The aircraft was equipped with the Aeroacoustics Payload Extender.

The aircraft was equipped with the Aeroacoustics STOL kit.

The aircraft was equipped with landing gear tire mud scrapers

D.2 Aircraft Inspection

On Aug 20-21, 2021, FAA Inspectors from the Fairbanks FSDO, the Wright Air Service Director of Safety, and the Textron Air Safety Investigator performed an examination of the accident aircraft. The NTSB participated in the investigation virtually. The aircraft was located in a Wright Air Service maintenance hangar at Fairbanks International Airport (see Figure 1).

¹ These modifications were obtained from Textron records for the accident aircraft.



Figure 1: Aircraft at Time of Examination

A visual examination for obvious signs of deformation and impact was conducted on the aircraft exterior. No detailed inspection of the aircraft major structure was performed during this systems examination. The airframe remained intact. There was no evidence of impact or fire. Two slight wrinkles existed in the leading edge of the right wing. The inboard wrinkle was 6 feet outboard of the wing root. The outboard wrinkle was 5 feet inboard of the wing tip. A ¼ inch crack in the upper cabin skin radiated from a rivet common to the right wing forward attach fitting. The right aileron was bent downward 6 inches at the midspan (see Figure 2). The inboard and outboard aileron attach fittings were bent toward the center of the aileron and twisted slightly downward. The left wing leading edge was slightly wrinkled 6 feet outboard of the wing root. A visual inspection of the horizontal stabilizer attach bolts was performed with no anomalies noted. A visual inspection of the elevator torque tube fasteners also did not reveal any anomalies. All flight control surfaces were examined for secure structural attachment with no anomalies identified.



Figure 2: Damage to Right Aileron

The control locks were not engaged at the time of the examination. Control cable continuity was established for the ailerons, aileron tab, elevators, elevator tabs, rudder, and rudder trim. Measured cable tensions and control surface deflections can be found in Appendix 1. The flap indicator, flap handle, flap actuator, and flap surface positions all were consistent with a flaps up position. The elevator trim indicator in the cockpit indicated full nose down trim and the elevator trim actuator was in a 15.7 degrees up position. According to Textron these values indicate the elevator trim indicator and actuator position were in agreement. The rudder trim indicator in the cockpit indicated neutral and the rudder trim actuator was not measured. The aileron trim indicator in the cockpit indicated neutral and the aileron trim actuator was consistent with a neutral trim tab position (see details below for how this determination was made due to damage to the right aileron). Evidence of lubrication was observed throughout movable portions of the control system.

The damaged right aileron initially prevented full operation of the aileron system by coming in contact with the trailing edge closeout panel of the wing when traveling downward. The position in which the aileron system tended to return to, or remain in, when placing the control wheel in the wings level position will be referred to as the compromised zero position. From the compromised zero, an inclinometer was placed on the left aileron and zeroed. The left aileron travel from that position measured 6.5 degrees up and 11.3 degrees down. The right aileron travel was measured in the same manner. It traveled 18.3 degrees up and 3.9 degrees down. The left aileron was then forced upward into a position where it was faired with the wing tip and measured to be 4.7 degrees up from the compromised position. Wing and floorboard panels were removed to facilitate inspection of the aileron control cable

routing and condition. No anomalies in the cable routing were observed. The right aileron was removed, and the operation of the aileron system was then smooth with both aileron wing bell cranks able to contact the stops.

The aileron trim system was immobile until the right aileron was removed. The aileron trim indicator in the cockpit was observed in the neutral position before attempted operation. As a result of damage to the right aileron, trim tab travels could not be directly measured. After the right aileron was removed, the trim tab push/pull rod ends were braced together by inserting one bolt that extended through both of them to prevent independent rotation, and the trim system operated smoothly. The aileron trim cable tension was measured at zero. The aileron trim actuator attach position common to the displaced right aileron outboard attach point was displaced inboard approximately 0.10 inch. Forcing the trim tab actuators outboard toward their original position increased the tension on the cables. The trim tab stops remained secured to the cable with no indications of slippage. With the aileron trim indicator in the cockpit set to neutral the aileron push/pull rods measured 1.98 inches which is consistent with a neutral trim tab position.

The aileron autopilot servo cable was secured on the capstan with the swage ball in place. The bridle cable clamps remained in place on the aileron control cables and did not exhibit signs of slippage. Friction band force was not measured but aileron operation with the right aileron removed was considered light with no binding noted.

The elevator trim cable stops were secure and did not exhibit signs of slippage. The elevator/pitch autopilot servo cables were secured to the elevator bellcrank. The cable was wrapped around the capstan with the swage ball in place. The electric pitch trim chain was in place around the sprocket with tension.

The aircraft was equipped with electrically heated propeller anti-ice boots. The boots were functionally tested in the hangar using ground power by holding the prop anti-ice switch in the manual position and rotating the propeller by hand. The boots became warm to the touch.

The aircraft was equipped with pneumatically inflated de-ice boots on the leading edges of the wings, horizontal stabilizer, vertical stabilizer, wing lift struts, landing gear fairings, and the front of the cargo pod. The boots were functionally tested per the Aircraft Maintenance Manual (AMM), Rev 28, section 30-10-00, steps 11A (1-9) with the engine running. The steps were also repeated in the hangar using regulated shop air. All steps were completed satisfactorily.

The pitot/static and stall heat switch was turned on for approximately 30 seconds. The pitot/static probes and stall vane were hot to the touch.

A pitot/static tester was connected to the pilot side pitot system and a leak test was performed satisfactorily before conducting the low airspeed awareness system test in accordance with AMM, Rev 28, section 34-11-02. The BELOW ICING MIN SPD light illuminated and the stall warning horn sounded at 107 kts when airspeed was decreasing.

The light extinguished at 109 kts when airspeed was increasing. This stall warning horn is activated by turning the prop anti-ice switch on, and by design should activate in a range between 105-115kts.

The left fuel tank gauge indicated 710 lbs and the right fuel tank gauge indicated 1100 lbs. The left fuel selector handle was on and the right fuel selector handle was off.

D.3 Autopilot Test

The Garmin GFC 600 autopilot was operationally tested in accordance with the Garmin GFC 600 Pilot's Guide, Section 2.1 Pre-Flight Test, and passed the test with no anomalies identified. In addition, with the autopilot engaged, the elevators and ailerons were manually moved demonstrating that the servos could be forcibly overpowered per design. When up elevator force was applied to the elevator control with the autopilot engaged, the pitch trim wheel ran to the nose down stop and continued to apply force against the stop. Force was continuously applied to the elevator control for approximately 20 seconds after the trim reached the stop position, and as per design the autopilot did not disengage.

D.4 Non-Volatile Memory Downloads

The aircraft was equipped with a Garmin GFC 600 Autopilot, a GTN 650Xi Garmin Touch Navigator, and a GTN 750Xi Garmin Touch Navigator. Garmin was consulted regarding the non-volatile memory within these units and a local Garmin certified avionics shop performed the downloads.

D.4.1 GFC 600 Autopilot

The software version loaded in the GFC 600 was 2.32. The downloaded data was converted to readable format by Garmin. The data relevant to this investigation can be found in the file named "Garmin GFC 600 - Attachment 1", and a description and plots of the data parameters can be found in the file named "Garmin GFC 600 Autopilot - Specialist's Factual Report", both located in the public docket for this investigation. The data are recorded at 1 Hz in SI units (International System of Units). Two additional files containing autopilot assert and fault log data for the accident flight can be found in the files named "Autopilot Asserts" and "Autopilot Fault Logs" located in the public docket for this investigation.

A group review of the recovered data did not identify any unexpected operation of the autopilot.

D.4.2 GTN 650Xi

The GTN 650Xi Garmin Touch Navigator was downloaded. For the accident flight, an assert titled "IOP_wx_main" was recorded at time 22:35:09. This assert was recorded because parsing PIREP data failed. The condition was not latching and cleared itself. A second assert titled "IOP_b_waas" was recorded at time 22:52:22. This assert was recorded because there was a loss of lock on 4 out of the 5 tracked satellites at the time that the assert was logged.

There was also a separate log file titled "Waas_diag_log" which had the following information in it from the accident flight:

08-16-2021 @ 22:51:58	Lost lock on 9 of 12 channels.
08-16-2021 @ 22:52:14	Lost lock on 8 of 10 channels.
08-16-2021 @ 22:52:22	Lost lock on 4 of 5 channels.

D.4.3 GTN 750Xi

The GTN 750Xi Garmin Touch Navigator was downloaded. For the accident flight, an assert titled "IOP_wx_main" was recorded at time 22:35:10. This assert was recorded because parsing PIREP data failed. The condition was not latching and cleared itself. A second assert titled "IOP_b_waas" was recorded at time 22:52:14. This assert was recorded because there was a loss of lock on 9 out of the 10 tracked satellites at the time that the assert was logged. There was also a separate log file titled "Waas_diag_log" which had the following information in it from the accident flight:

08-16-2021 @ 22:51:59	Lost lock on 9 of 12 channels.
08-16-2021 @ 22:52:14	Lost lock on 9 of 10 channels.
08-16-2021 @ 22:52:49	Frame sync timeout, ch 0, svid 10
08-16-2021 @ 22:52:51	Frame sync timeout, ch 6, svid 8
08-16-2021 @ 22:52:52	Frame sync timeout, ch 9, svid 22

Adam Huray
Mechanical Engineer

Appendix 1: Airplane Inspection Measurements

Reference Maintenance Manual (MM) 27-30-00 Elevator System Inspection/Check

- i. Elevator Cable Tension: 55 lbs. @ 68°F (requirement is 60 +/-5 lbs. @ 70°F)
- ii. Elevator Travel Up: 24.6° (requirement is 25 +/-2°)
- Elevator Travel Down: 20.9° (requirement is 20 +/-2°)

Reference MM 27-30-02 Elevator Trim Inspection/Check

- i. Elevator Trim Cable Tension: 17 lbs. @ 68° (requirement is 20 +/-5 lbs. @ 70°)
- ii. Elevator Trim Travel Up: 15.7° (requirement is 15 +/-2°)
- Elevator Trim Travel Down: 17.2° (requirement is 15 +/-2°)

Reference GFC 600 Install Manual Addendum, Textron Aviation 208/208B

- i. Elevator Autopilot Servo Cable Tension: 20 lbs. @ 54°F (requirement is 20 +/-5 lbs. at 70°F)

Reference MM 27-10-00 Aileron Spoiler Inspection/Check

- i. Aileron Loop Cable Tension (Left Wing): 31 lbs. @ 68°F (requirement is 40 +/-5 lbs @ 70°F)
- ii. Aileron Loop Cable Tension (Right Wing): 33 lbs. @ 68°F (requirement is 40 +/-5 lbs @ 70°F) -
- iii. Aileron Cabin Loop Cable Tension: 23 lbs. @ 68°F (requirement is 20 +/-5 lbs. @ 70°F)
- iv. Roll Bridle/Interconnect Cable Tension: 13 lbs. (1/16 cable 15 lbs.) @ 68°F
(requirement is 12 +/- 2 lbs @ 70° (reference GFC 600 Install Manual Addendum, Textron Aviation 208/208B))
- v. Left Aileron Travel Up (after right aileron was removed): 26.4° (requirement is 25 +4/-0°)

Left Aileron Travel Down (after right aileron was removed): 17.5° (requirement is 16 +1/-0°)

vi. Right Aileron Full Travel: not measured due to damage (see Section D.2)

vii. Left Spoiler Inboard Corner Gap: 0.3 inches (requirement is 0.01-0.03 inches)

Left Spoiler Outboard Corner Gap: 0.6 inches (requirement is 0.01-0.03 inches)

viii. Left Spoiler Travel: 39.5° (requirement is 40 +/-5°)

ix. Right Spoiler Inboard Corner Gap: 0.01 inches (requirement is 0.01-0.03 inches)

Right Spoiler Outboard Corner Gap: 0.04 inches (requirement is 0.01-0.03 inches)

x. Right Spoiler Travel: 40.5° (requirement is 40 +/-5°)

Reference MM 27-10-02 Aileron Trim Inspection/Check

i. Aileron Trim Cable Tension: 0 lbs. @ 68°F (requirement is 3 lbs. maximum)