



National Transportation Safety Board

Washington D.C. 20594

Safety Recommendation

Date: July 10, 1997

In reply refer to: A-97-37

Mr. Barry L. Valentine
Acting Administrator
Federal Aviation Administration
Washington, D. C. 20591

The National Transportation Safety Board has completed the investigation of three incidents involving detachment and asymmetric deployment of outboard wing flaps in Beech¹ 1900 series airplanes and is currently investigating a fourth incident, which occurred on June 19, 1997². The flap malfunctions occurred when the flaps became detached from the wing flap tracks. Three of the occurrences involved interference/jamming of the ailerons because of the flap detachment. The incidents occurred during visual meteorological conditions and favorable winds during the final approach to landing. The airplanes, all operating under the provisions of Title 14 Code of Federal Regulations (CFR) Part 135 or 121, were able to land safely, and none of the flightcrews or passengers aboard were injured.

The first incident occurred on March 17, 1995, when the outboard wing flap on a Beech Model 1900C operated by Alpha Aviation, N1568W, became detached and deployed asymmetrically, causing an uncommanded roll of the aircraft while on final approach to the Los Angeles International Airport. The first officer, who was flying the airplane, stated that the airplane was descending normally with 20° of flaps selected until

¹ Beech, formerly Beech Aircraft Corporation, is a subsidiary of the Raytheon Aircraft Company.

² (a) Los Angeles, California, March 17, 1995, Beech 1900C, N1568W (LAX95IA142)
(b) Carlsbad, New Mexico, June 7, 1996, Beech 1900D, N99YV (No Docket-see footnote 5).
(c) Seattle, Washington, January 21, 1997, Beech 1900D, N75ZV (SEA97IA051).
(d) Clarksburg, West Virginia, June 19, 1997, Beech 1900D, N165YV (NYC 97IA123).

300 feet above ground level when the 35°-flap setting was selected and the airplane rolled rapidly about 35° to the left. He said that the uncommanded roll took him by surprise and required him to apply full opposite aileron and considerable control wheel force to counter it.

A postflight examination of the airplane revealed that the inboard and outboard flaps on each side of the airplane had been fully and equally extended in the aft direction. However, the inboard aft flap track roller bearing assembly on the left outboard flap, including the attaching bolt and washer, had pulled through the skin of the flap track hinge bracket, allowing the inboard end of the flap to disengage from the flap track. A circular wear pattern matching the diameter of the bearing outer roller flange was found on the skin of the hinge bracket. The detached inboard trailing edge of the flap was found twisted about 3 inches above its normally installed position in the flap track. The airplane's maintenance records indicated that the airplane had been operated 11,711 hours and 13,291 cycles since new.

The Safety Board determined that the probable cause of this incident was an axial shift of the outer bearing roller for an undetermined reason, resulting in erosion and failure of the flap track hinge bracket/bearing assembly. Factors relating to the incident were the roller bearing and associated bracket assembly within the interior of the flap structure could not be adequately inspected without disassembly, and the lack of inspection criteria in the manufacturer's maintenance manual concerning flap roller/hinge bracket assemblies.

On April 26, 1996, the Raytheon Aircraft Company revised Beech Model 1900/1900C and 1900D maintenance manuals to include new wing flap inspection criteria developed as a result of the Los Angeles incident. The wing flaps were included as a new item (under flight controls) in the airplane's major maintenance schedule. The action required was to "remove flaps and inspect flap roller brackets, rollers, bearings and attachment hardware for wear every 10,000 cycles³ or 5 years, whichever occurs first." Inspection of these components, without removing the flaps, was also listed in the airplane's first 200-hour-interval detailed inspection, and Raytheon recommended that they be reinspected every 1,200 hours thereafter.

The second incident, on June 7, 1996, involved a Beech 1900D operated by Mesa Airlines,⁴ N99YV. The airplane sustained a malfunction of the wing flaps and aileron controls during landing approach to the Cavern City Air Terminal, Carlsbad, New

³ A flight cycle is defined as engine start-up and increase to full or partial power (as required during a normal flight), one landing gear retraction and extension, and a complete shutdown.

⁴Mesa Airlines operates 109 Beech 1900 series airplanes.

Mexico.⁵ The captain reported that immediately after selecting the 35°-flap position, "the yoke twisted out of my hands to the left." He said that he had to apply two or three hard turns to the right before he was able to free an apparently jammed control wheel and return the airplane to a wings-level attitude. He estimated that the airplane reached a bank angle of 40° before he was able to regain control. He stated that during the remainder of the landing approach, very little aileron control was available because the control wheel could be moved or rotated only about 1 inch, left or right.

The captain stated that his subsequent inspection of the left flap disclosed that it was "...tilted up on the inboard side, tilted down on the outboard side, and...the edges of the aileron and flap metal were ripped." The airplane's maintenance records revealed that the flap and the aileron were replaced and repaired, respectively, immediately following the incident and that the airplane had accumulated about 9,000 cycles at the time of the incident.

The third incident, on January 21, 1997, involved a Beech 1900D operated by Mesa Airlines, N75ZV. The airplane began an abrupt roll to the right, about 500 feet above the ground, during landing approach to the Seattle-Tacoma International Airport, Seattle, Washington, after the wing flaps were lowered from 17° to 35°. The pilot stated that "something felt like it jammed and broke free" as he countered the right roll with left control wheel input. He stated that he felt a "pop" when he encountered the jam and needed to apply some rudder and almost full aileron deflection with both hands to keep the airplane in a wings-level attitude for landing.

An examination of the right wing revealed detachment of the inboard aft end of the outboard flap, seizure of the right inboard flap track aft roller bearing, and tearing of the flap bracket assembly. The seized bearing outer roller had shifted on the roller element bearing and allowed the outer roller flange to wear against, and eventually pull through, the skin of the flap track hinge bracket. The three other flap track roller bearings exhibited evidence of dirt, debris, and erosion. The outboard edge of the outboard flap, adjacent to the aileron, was gouged. The airplane's maintenance records disclosed that it had 10,642 cycles of operation.

None of the Beech 1900 airplanes involved in these incidents had been subject to a directed or detailed inspection of flap roller brackets, roller bearings, and attachment hardware, as outlined in Raytheon's April 26, 1996, maintenance manual revisions. The roller bearings used on the inboard wing flaps are sealed; those installed on the outboard

⁵ The Safety Board was not notified of the incident at this time, but was subsequently informed of its occurrence in connection with an investigation of the flight control malfunction involving a Beech 1900D, N75ZV, at Seattle, Washington, on January 21, 1997. The Board conducted a telephonic interview with the pilot to determine the essential sequence of events, but because of the delay in notification and access to parts and other data, did not issue a report or a brief of the incident.

flap sections are unsealed. Sealed bearings designed for installation in the outboard wing flap sections will be made available in the near future.

On May 19, 1997, Raytheon issued Safety Communique No. 137, "Inspection of the Outboard Flap Attachment Brackets and Aft Roller Bearings," applicable to the Beech 1900 and C-12J airplanes. The communique, which was sent to all operators, chief pilots, directors of operations, directors of maintenance, Raytheon Aviation Centers, authorized service centers, and international distributors and dealers, states the following:

Raytheon Aircraft Company (RAC) is issuing this Safety Communique to alert owners and operators of Beech Model 1900 Series Airliners and Model C-12J Airplanes to inspect the condition of the flap aft roller bearings and flap attachment brackets for the outboard flaps. RAC has received three reports of outboard flaps becoming detached from the flap aft roller bearings at the outboard flap inboard flap track. **Detachment of the outboard flap from this roller bearing could result in a flap asymmetric condition and the outboard end of the flap coming into contact with the aileron and inhibiting the travel of the aileron.**

The detachment of this flap aft roller bearing from the outboard flap was a result of the outer flange element of the roller bearing becoming repositioned on the bearing. When this happened, the outer flange element came into contact with the attachment bracket and eventually wore through the bracket, allowing the outboard flap to detach from the aft roller bearing.

The following inspection shall be accomplished as soon as possible after receipt of this Safety Communique or in accordance with the following schedule on all applicable Beech 1900 Series Airliners and Model C-12J airplanes with more than 2,500 cycles on the flaps:

- Aircraft with over 10,000 cycles on the flaps: Inspect within 30 days.
- Aircraft with 5,001 to 10,000 cycles on the flaps: Inspect within 60 days
- Aircraft with 2,500 to 5,000 cycles on the flaps: Inspect within 90 days.

The communique contains the detailed instructions necessary to inspect the aft roller bearings and their outer flange elements for wear and damage, the surfaces of the flap attachment brackets that contact the aft roller bearing for indications of wear (from the flap aft roller bearing outer flange element), and the aft roller bearing attachment holes in the flap attachment brackets for elongation. The communique indicates that revisions to

the applicable maintenance manuals are being issued to change flap inspection intervals by requiring removal and inspection of all flap attachment brackets, roller bearings, and attaching hardware every 2,500 cycles or 5 years, whichever occurs first.

On June 19, 1997, an outboard wing flap on a Beech Model 1900D operated by Mesa Airlines, N165YV, became detached during landing approach to the Benedum Airport, Clarksburg, West Virginia. The captain stated that after the 35°-flap setting was selected, he experienced considerable binding of the aileron control and heard a loud snap under the cockpit floor. The airplane had been operated 3,323 hours and 7,082 cycles since new. The inspection set forth in the communique had not been accomplished at the time of the incident.

A review of Raytheon's Product Improvement Committee database concerning airframe problems disclosed 20 reports of worn flap aft roller bearings and damaged flap brackets in Beech 1900 series airplanes.

Several flightcrews told the Safety Board that during the approach, loss of control appeared imminent, and that high control wheel forces were required as a result of the flap malfunction. Further, they stated that if instrument meteorological conditions or strong crosswinds had existed, they might have lost control of the airplane. Therefore, to prevent any further flap malfunctions, and a possible in-flight loss of control, the Safety Board believes that compliance with the communique should be mandatory. Moreover, in view of the occurrence involving N165YV, the Board believes that the flap inspection compliance intervals outlined in the communique should be reduced accordingly.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an airworthiness directive, applicable to Beech 1900 series airplanes, requiring an expedited initial inspection of the outboard flap attachment brackets and aft roller bearings in accordance with the detailed inspection procedure outlined in Raytheon Aircraft Company's Safety Communique No. 137, and thereafter every 2,500 flap cycles or 5 years, whichever occurs first. (Urgent) (A-97-37)

Chairman HALL, Vice Chairman FRANCIS, Members HAMMERSCHMIDT, GOGLIA, AND BLACK concurred in this recommendation.

By:


Jim Hall
Chairman

Brief of Incident (Continued)

SEA97IA051
FILE NO. 5000

01/21/97

SEATTLE, WA

AIRCRAFT REG. NO. N75ZV

TIME (LOCAL) - 06:20 PST

Occurrence# 1 AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation APPROACH - VFR PATTERN - FINAL APPROACH

Findings

1. - FLT CONTROL SYST, WING FLAP CONTROL BEARING - SHIFTED
 2. - FLIGHT CONTROL, FLAP ATTACHMENT - ERODED
 3. - FLIGHT CONTROL, FLAP ATTACHMENT - DISCONNECTED
 4. - MAINTENANCE, INSPECTION OF AIRCRAFT - INADEQUATE - COMPANY/OPERATOR MANAGEMENT
-

The National Transportation Safety Board determines that the probable cause(s) of this incident was: an axial shift of the aft flap track bearing's outer roller, resulting in erosion and failure of the flap track bracket/bearing assembly. A factor relating to the incident was: inadequate inspection of the flap roller bearing/bracket assemblies.

Format Revision 4/97

National Transportation Safety Board
Washington, D.C. 20594

Brief of Incident

Adopted 04/19/1996

LAX95IA142
FILE NO. 5011 03/17/95 LOS ANGELES, CA AIRCRAFT REG. NO. N1568W TIME (LOCAL) - 10:50 PST

MAKE/MODEL	- BEECH 1900C	FATAL	0	SERIOUS	0	MINOR/NONE	2
ENGINE MAKE/MODEL	- P&W PT6A-65B	CREW	0				
AIRCRAFT DAMAGE	- Minor	PASS	0		0		17
NUMBER OF ENGINES	- 2						

OPERATING CERTIFICATES - Commuter air carrier
NAME OF CARRIER - ALPHA AVIATION
TYPE OF FLIGHT OPERATION - Scheduled
 - Domestic
 - Passenger

REGULATION FLIGHT CONDUCTED UNDER - 14 CFR 135

LAST DEPARTURE POINT - MAMMOTH LAKES, CA
DESTINATION - Same as Incident

AIRPORT PROXIMITY - On airport
AIRPORT NAME - LOS ANGELES INTERNATIONAL
RUNWAY IDENTIFICATION - 24R
RUNWAY LENGTH/WIDTH (Feet) - 8925/ 150
RUNWAY SURFACE - Concrete
RUNWAY SURFACE CONDITION - Dry

CONDITION OF LIGHT - Daylight

WEATHER INFO SOURCE- Pilot

BASIC WEATHER - Visual (VMC)
LOWEST CEILING - None
VISIBILITY - 0010.000 SM
WIND DIR/SPEED - 260 /010 KTS
TEMPERATURE (F) - Unk/Nr
OBSTR TO VISION - None
PRECIPITATION - None

PILOT-IN-COMMAND AGE - 29

FLIGHT TIME (Hours)

CERTIFICATES/RATINGS
 Airline transport, Flight instructor
 Single-engine land, Multiengine land
INSTRUMENT RATINGS
 Airplane

TOTAL ALL AIRCRAFT - 5000
LAST 90 DAYS - 250
TOTAL MAKE/MODEL - 3000
TOTAL INSTRUMENT TIME - Unk/Nr

WHILE ON FINAL APPROACH, THE AIRPLANE EXPERIENCED A RAPID, UNCOMMANDED ROLL TO THE LEFT WHEN THE 35-DEGREE FLAP SETTING WAS SELECTED. THE PILOT WAS ABLE TO COUNTER THE ROLL BY APPLYING FULL OPPOSITE AILERON AND LANDED WITHOUT FURTHER INCIDENT. AN EXAMINATION REVEALED THAT THE WING FLAPS HAD BEEN FULLY EXTENDED IN THE AFT DIRECTION, BUT THAT THE INBOARD TRAILING EDGE OF THE LEFT OUTBOARD FLAP HAD BEEN FORCED UPWARD ABOUT 3 INCHES. THE INBOARD AFT FLAP TRACK ROLLER BEARING ASSEMBLY, INCLUDING THE ATTACHING BOLT AND WASHER, HAD PULLED THROUGH THE SKIN OF THE FLAP TRACK HINGE BRACKET. AN ANALYSIS OF THE FAILED PARTS BY BEECH REVEALED THAT THE OUTER ROLLER WAS LOOSE ON THE BEARING AND COULD BE SHIFTED AXIALLY. A CIRCULAR WEAR PATTERN MATCHING THE DIAMETER OF THE OUTER ROLLER FLANGE WAS FOUND ON THE PORTION OF FLAP TRACK HINGE BRACKET WHICH HAD PULLED OUT. BEECH CONCLUDED THAT THE BEARING OUTER ROLLER HAD SHIFTED ON THE ROLLER ELEMENT BEARING AND ALLOWED THE OUTER ROLLER FLANGE TO WEAR AGAINST THE SIDE OF THE FLAP HINGE BRACKET UNTIL THE BEARING ASSEMBLY WAS PULLED OUT. THE FAILED FLAP TRACK HINGE BRACKET AND BEARING ASSEMBLY IS CONTAINED WITHIN THE INTERIOR OF THE FLAP STRUCTURE.

Brief of Incident (Continued)

LAX95IA142
FILE NO. 5011

03/17/95

LOS ANGELES, CA

AIRCRAFT REG. NO. N1568W

TIME (LOCAL) - 10:50 PST

Occurrence# 1 AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation APPROACH - VFR PATTERN - FINAL APPROACH

Findings

1. - FLT CONTROL SYST, WING FLAP CONTROL BEARING - SHIFTED
 2. - FLIGHT CONTROL, FLAP ATTACHMENT - ERODED
 3. - FLIGHT CONTROL, FLAP ATTACHMENT - DISCONNECTED
 4. - MAINTENANCE, INSPECTION OF AIRCRAFT - INADEQUATE
 5. - CONDITION(S)/STEP(S) NOT LISTED - MANUFACTURER
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The National Transportation Safety Board determines that the Probable Cause(s) of this Incident was:
AN AXIAL SHIFT OF THE OUTER BEARING ROLLER FOR AN UNDETERMINED REASON, RESULTING IN EROSION AND FAILURE OF THE FLAP TRACK HINGE BRACKET/BEARING ASSEMBLY. FACTORS RELATING TO THE INCIDENT WERE: THE ROLLER BEARING AND ASSOCIATED BRACKET ASSEMBLY WITHIN THE INTERIOR OF THE FLAP STRUCTURE COULD NOT BE ADEQUATELY INSPECTED WITHOUT DISASSEMBLY; AND LACK OF INSPECTION CRITERIA IN THE MANUFACTURER'S MAINTENANCE MANUAL CONCERNING FLAP ROLLER/HINGE BRACKET ASSEMBLIES.

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