

AVIATION OCCURRENCE REPORT
SEPARATION IN FLIGHT - COWLING

CONTACT AIRWAYS LTD.
BEECH KING AIR 100 C-GNAA
EDMONTON, ALBERTA 50 NM N
26 SEPTEMBER 1995

REPORT NUMBER A95W0180

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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Summary

The Beech King Air 100 was on a night instrument flight rules (IFR) medevac flight from Fort McMurray to the Edmonton Municipal Airport, Alberta. On descent through 18,000 feet, at approximately 200 knots indicated air speed (IAS), the aircraft yawed and began to vibrate excessively. The flight crew observed that the upper aft section of the left engine cowling was detached and lodged against the leading edge of the left wing, outboard of the engine. They declared an emergency, continued the descent at 150 knots IAS, and landed without further incident or injury. The detached cowl fell to the runway during the landing roll. Subsequent visual examination of the empennage determined that the outboard 22 inches of the left elevator had also departed from the aircraft before landing.

Other Factual Information

Clear skies, smooth flight conditions, and light surface winds existed at the time of the occurrence. The aircraft was dedicated to medevac flights, and was normally fuelled and hangared to be available for a prompt departure.

Both crew members were licensed in accordance with existing regulations. The captain had approximately 2,500 hours of flight experience on King Air aircraft. The first officer had approximately 80 hours on type.

The captain and first officer were telephoned at their residences at approximately 0230 mountain daylight time (MDT) and assigned to the flight. They arrived at the airport at 0300, towed the aircraft from the hangar and conducted the pre-flight inspection on a partially lit area of the ramp. The captain opened the cowling on the right engine, checked the security of the oil cap, and resecured the cowling. The first officer did a similar check on the left engine. The captain assisted with the examination of the left engine with his flashlight when the first officer's flashlight began to dim. The first officer subsequently closed the left cowling and secured it in what he believed to be the normal fashion. The preflight inspection was completed approximately one-half hour before the arrival of the medevac passengers, and there was no evidence that it was done in a hurried manner.

The flight departed Fort McMurray at 0355 with the two crew members and three passengers on board. The aircraft climbed to flight level 200 (FL200) and proceeded en route without incident for approximately 45 minutes. During the initial descent into Edmonton, the cowling opened and separated from the nacelle.

The upper aft cowling on the King Air 100 is a hoop-shaped panel that is approximately 30 inches long. It is secured by two hinges on the left side and two latches on the right side. The cowling hinges upward and outward from the inboard side of the left nacelle to expose the plenum and accessory sections of the Pratt and Whitney PT6 turboprop engine.

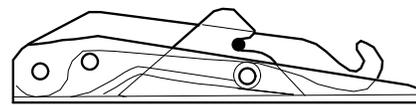
The aircraft was fitted with Part No. H296K854 cowling latches, which were manufactured by Hartwell Corporation and shipped to Beech for production from 1967 to 1970. These latches were replaced by Part No. H296K1135 latches in 1970 and the Part No. H296K854 latches were supplied only as spares when requested. The current production Part No. H296K1135 latches have stronger trigger springs and steel hooks for improved service life. Beechcraft Service Instruction (SI) No. 0597-242 recommends that the aft cowl door latches on King Air 100 and other models be inspected at each scheduled inspection for conditions that could allow the

All times are MDT (Coordinated Universal Time minus six hours) unless otherwise noted.

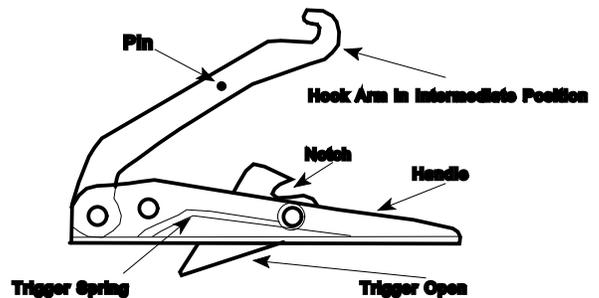
cowling to come open in flight. The SI indicates that the latch may be subjected to internal pressure while in flight, and recommends replacing the earlier latches with the improved version if excessive wear, distortion, or other deterioration of the latch is noted.

The intact condition of the latch assemblies indicated they were unlatched at the time the cowling separated from the aircraft. The forward latch was twisted slightly; however, it operated smoothly. The rear latch was difficult to operate due to misalignment. Wear patterns indicated this condition had existed for some time; however, there were no reports that the rear latch had been difficult to operate before the occurrence.

Both the H296K854 latches and the H296K1135 latches are an overcentre toggle-type latch. The primary locking action is due to tensile loading and the toggle effect between the handle and the hook arm. The edges of the trigger are notched pawls that engage pins on the hook arm to act as a secondary locking device. The top of the trigger must be pushed to release the latch. The trigger is retained in the closed position by a spring. The trigger hinge is set toward the top of the trigger. A pressure differential between the inside and outside of the cowling will tend to open the trigger if the pressure is great enough to overcome the spring and friction resistance. Light tensile loading on the hook will permit the handle to open if the trigger releases.



LATCH ENGAGED



LATCH DISENGAGED

The aircraft manufacturer reported that the plenum area of the cowling may reach a differential pressure of up to 1.1 psi at 200 knots IAS, due to the combination of ram air effect in the inlet and airflow over the nacelle. Post accident testing determined that the trigger on the forward latch would disengage with an internal air pressure of about one pound per square inch. Calculation determined that with the trigger disengaged, at least 300 pounds of hook tension would be required for the toggle mechanism to keep the handle shut. The rigging of the cowling and the tensile loading on the latches before the occurrence could not be determined.

The left cowling forward latch trigger reportedly protruded into the airstream during flight, and the latch had disengaged on at least one previous flight. Maintenance personnel had visually examined and function-checked the forward latch approximately five weeks before the accident, following the report of the in-flight opening. The

latch closed securely, there was no evidence of wear, and no maintenance was accomplished.

Examination determined that the elevator had failed slightly inboard of the outboard hinge, and that the outboard 22 inches had departed with the balance weight. The balance weight was recovered in a field approximately 20 miles north of the Edmonton Municipal Airport. The remainder of the missing elevator structure was not recovered. Examination indicated the failure was a result of a severe up/down bending vibration. The concentrated nature of the damage indicated that there may have been pre-existing damage in the vicinity of the failure; however, no such damage was identified on the recovered components. Control of the aircraft could have been lost had the elevator sustained more damage.

A review of the aircraft logs identified that the left elevator had been inspected in accordance with Airworthiness Directive (AD) 76-22-03 on 11 September 1994; 368.8 hours before the occurrence. A crack was found in a tip rib. Beechcraft repair kit Part No. 100-4005-1S was installed to reinforce the area, and the aircraft was returned to service. The failure occurred inboard of the reinforced area, at the next weakest point.

Analysis

It could not be determined if the left upper aft cowling latches were secured properly before the aircraft departed. It is considered probable, however, that the cowling would have opened sooner if the latches had not been engaged before take-off, as there is normally a pressure differential across the cowling that tends to force it open. The rear latch was misaligned following the accident and wear patterns indicated that the condition had existed for some time. This discrepancy would have made it more difficult to operate the rear latch, and would have increased the likelihood of the rear latch being improperly secured when the cowling was closed. Testing demonstrated that differential air pressure could disengage the trigger on the forward latch because of the weak trigger spring. If the front latch disengaged in flight, as had occurred on at least one previous occasion, the front of the cowling may have lifted as the airspeed increased during the descent. The rear latch could have subsequently disengaged because of the effect of ram air flow in the accessory compartment or because it was not secured properly to begin with.

The detached cowling lodged on the leading edge of the left wing immediately forward of the outboard end of the left elevator. The buffeting generated by the displaced cowling was sufficient to excite a destructive vibration in the elevator. There may have been pre-existing discrepancies in the vicinity of the failure; however, no such condition was identified on the components available for examination.

The following Engineering Branch reports were completed:

LP 138/95 - Performance Analysis

LP 173/95 - Engine Cowl Latch Assembly

Findings

1. No physical evidence was found to indicate whether the latches were engaged before flight.
2. The aircraft was fitted with early production Part No. H296K854 cowling latches that have weaker trigger springs than the current version Part No. H296K1135 latches.
3. The design of the latches is such that a pressure differential across the latches results in a force on the latches in the direction in which they open.
4. The forward latch had reportedly unlatched in-flight previously.
5. Testing determined that the forward latch could be triggered open by a differential pressure equal to that present across the cowling in flight.
6. Wear patterns indicated the rear latch may have been misaligned for some time, which would have made it more difficult to operate.
7. The left elevator tip failed as the result of a severe up/down bending vibration that was induced by buffeting from the displaced cowling.

Causes and Contributing Factors

It is probable that the left cowling opened in flight because of the combination of weak latch trigger springs and pre-existing damage on the rear latch. The left elevator failed because of buffeting induced by the displaced cowling.

Safety Action Taken

As a result of this occurrence, Contact Air has made the following change to the Company Standard Operating Procedures:

When possible all night flight walk-arounds are to be completed inside the hangar, with all necessary hangar lighting on. This assists the crew to prepare the aircraft for flight and eliminates the need to use a flashlight for the walk-around.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Zita Brunet and Maurice Harquail, authorized the release of this report on 04 April 1996.