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National Transportation Safety Board

Washington, D. C. 20594

Safety Recommendation

Date: November 14, 1988
In reply refer to: A-88-156

Honorable T. Allan McArtor
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On September 20, 1988, a Bellanca Model 8KCAB airplane, N50702, crashed at Oswego, Illinois, after sustaining an in-flight structural failure of the right wing. According to witnesses, the pilot was performing aerobatics and had just initiated a relatively high-speed, positive g maneuver when the failure occurred. The airplane then entered a spin to the right and crashed into the ground at full power. The pilot, although wearing a parachute, failed to exit the airplane and was killed.

The National Transportation Safety Board's investigation of the accident disclosed that the pilot's folding seatback had failed on both the left and right sides. The failure on the right side occurred at the seatback hinge point where the attaching bolt pulled cleanly through the seatback tube (the side brace and clevis were not deformed); the failure on the left side occurred at the welded junction of the seat's lower side tube and seatback side brace and reflected substantial seatback bending loads toward the right side of the airplane. This failure pattern suggests that initial failure of the seatback frame occurred in flight at the right side hinge point. As a result, it is believed that the pilot fell backward and inadvertently exceeded the airplane's design stress limits by pulling or jerking on the front control stick as he fell, or by hitting or jamming the rear control stick; the flat metal straps welded to the seatback frame were bent forward, apparently from forceable contact with the rear control stick. Because of the effects of spin inertia loads and airloads while the pilot was in a supine position, the Safety Board believes that the pilot was immobilized and prevented from exiting or attempting to exit the airplane. In addition, an examination of the wreckage revealed that the emergency door hinge pins were secure and in place, and the hinge pin release ring, normally just adjacent to the pilot's right hand, had not been activated (pulled). Moreover, the pilot's lapbelt and shoulder harness remained buckled.

The Safety Board is aware of several service difficulty reports (SDR) submitted to the Federal Aviation Administration (FAA) regarding failures of the folding seatback frames in both Bellanca 7 and 8 series airplanes. Most of these failures, as in the case of N50702, occurred at the seatback hinge point or at the welded junction of the seat's lower side tube and seatback side brace. Some typical comments contained in the reports include:

- Entered snap roll; adjustable seat broke 3-3/8 in. forward on frame - both sides. Seat back jammed control.
- Pilot's forward seat broke at the diagonal brace allowing seat back to tilt and jam rear control stick during aerobatics.
- Pilot's seat failed during snap roll; forward members broke allowing seat back and pilot to fall against rear control stick.
- During flight the front seat back left hinge failed allowing front seat back/pilot to fall onto rear stick causing nose up.
- During snap roll, front seat back broke laying pilot in prone position, jamming rear control stick. Broke at pivot bolt.
- During snap roll maneuver, right part of seat frame broke at weld and bottom back strap broke on right side. Right part of seat back traveled about 10 inch into rear cockpit, touching control stick.

On February 18, 1987, Transport Canada, the Canadian Department of Transportation, issued Service Difficulty Alert (SDA) No. 87-01 relating to these failures. The alert, applicable to Bellanca Aircraft Models 7ECA, 7GCAA, 7GCBC, 7KCAB, 8GCBC, and 8KCAB/pilots' seat-folding backrest frames, states:

> Recently a Bellanca 7GCBC aircraft crashed shortly after takeoff. The preliminary investigation by the Canadian Aviation Safety Board indicates that the crash was due to a failure of the folding backrest frame of the pilot's seat at the pivot point of the backrest. Failure of the backrest can cause the pilot's weight to suddenly shift rearward, pinning the rear flight control stick and causing the aircraft to pitch into a nose-up attitude from which recovery is unlikely.
>
> Transport Canada strongly recommends that operators/pilots conduct a visual inspection of the backrest frame with the aid of a hand magnifier, for circumferential cracks originating at the pivot point bolt holes, before next flight and periodically thereafter. It is also recommended that a magnetic particle or a liquid penetrant inspection of the area be performed on or before the next 100-hour inspection.
>
> Transport Canada suggests that pilots also consider removing the rear flight control stick, if it is not being used.

An alert similar to Canadian SDA No. 87-01 was issued by the FAA in the February 1987 issue of Advisory Circular (AC) No. 43-16, *General Aviation Airworthiness Alerts.*

On May 19, 1976, Bellanca issued Service Letter No. C-125, *Reinforcement of the Front Adjustable Seat (P/N 7-1498)*, applicable to Models 7ECA, 7GCAA, 7GCBC, 7KCAB, 8GCBC, 8KCAB, and all previous serial numbered aircraft in which this seat is installed as retrofit per kit No. 252. An excerpt from the letter states:

> We have received reports concerning failures of the front adjustable seat in the aircraft noted above. This failure is considered to be caused by application of excessively high loads on the upper portion of the seat back.

Compliance with the service letter, which provides for structural reinforcement of the left and right side lower seat frame side tubes (new seat frame P/N 7-1513 or kit No. 253), was mandated by Airworthiness Directive (AD) No. 76-22-01, effective November 2, 1976. However, no similar structural reinforcement was provided for the lower (hinge) portion of the rather fragile folding seatback frames. As a result, the Safety Board believes that a placard should be installed in these airplanes prohibiting pulling or pushing on the upper portion of the seatback. Moreover, a modification should be made to the folding seatback frames to increase their strength and to ensure a higher level of structural integrity consistent with all applicable design load criteria.

On May 5, 1973, the Bellanca Aircraft Corporation issued Service Letter No. 109, *All 1972 and 1973 Champion Aircraft Models 7ECA, 7GCAA, 7KCAB, 7GCBC, and 8KCAB Manufactured Prior to May 1, 1973, Equipped With Folding Back Seat Frame*, and recommended that it be complied with before further flight. The letter states:

> Examine the hinge or pivot bolts on the folding back rest frame to make sure that a hex head type bolt has been used and secured with an elastic stop nut. Also, make sure that the present bolt is not worn or distorted. If replacement is required, it should be accomplished by using an AN3-7A bolt and an AN365-1032 elastic stop nut. All seats equipped with folding back rest require two (2) each of the bolts and nuts.

The Safety Board concurs with this service letter.

Since 1983, Bellanca 7 and 8 series airplanes with folding seatback frames have been involved in several dozen fatal accidents involving loss of control in flight. In some of the accidents, like the one involving N50702, an in-flight structural failure of the wing also occurred. While seat failure has not been causally linked to any of the accidents, except in the case of N50702, the chronology of seat failures in these airplanes, together with the circumstances surrounding some of the accidents, strongly suggest such a failure to be a distinct possibility. As a result, the Safety Board believes that a number of expedient remedial actions are necessary, including an immediate visual inspection and subsequent periodic magnetic particle or dye penetrant inspections of the folding seatback assembly, and the prohibition of aerobatic maneuvers until the latter inspection has been performed or an appropriate structural modification to the seats has been incorporated.

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

> Issue an emergency airworthiness directive (AD) applicable to Bellanca 7 and 8 series airplanes equipped with folding seatback frames, requiring:

Before further flight

(1) A visual inspection of the left and right sides of the welded lower seat frame side-tube/side-brace junction and seatback hinges for evidence of cracks (using 10X magnification), elongation of hinge bolt holes, or deformation. Any component found defective should be repaired or replaced. This inspection is to be repeated at 10-hour intervals of flight until item (5) or (6) below has been accomplished.

(2) Compliance with Bellanca Service Letter No. 109 concerning folding seatback frame hinge bolts.

(3) The prohibition of aerobatic maneuvers unless item (5) or (6) below has been accomplished.

Within the next 10 hours of flight

(4) The installation of a placard prohibiting pulling or pushing on the upper portion of the folding seatback frame.

Within the next 50 hours of flight

(5) A magnetic particle or dye penetrant inspection of the left and right sides of the welded lower seat frame side-tube/side-brace junction and seatback hinges for evidence of cracks. Any component found cracked or otherwise defective should be repaired or replaced. This inspection is to be repeated at 50-hour intervals of flight until item (6) has been accomplished.

Within 9 months from the effective date of the AD

(6) The incorporation of an appropriate modification to the folding seatback frames to increase their strength and to ensure a higher level of structural integrity consistent with all applicable design load criteria. As an additional precaution, the modification may include a suitable means (for example, a cable attachment) for restraining aft movement of the seatback frame in the event of failure for any reason. (Class I, Urgent Action) (A-88-156)

KOLSTAD, Acting Chairman, and BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in this recommendation.

By: James L. Kolstad
Acting Chairman