

Aviation 5617



National Transportation Safety Board

Washington D.C. 20594

Safety Recommendation

Date: February 26, 1997

In reply refer to: A-97-12

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

On August 19, 1995, a Bellanca Scout Model 8GCBC N86587, sustained an in-flight structural failure of the right wing and crashed on Lufker Airport, East Moriches, New York, killing the pilot. The Model 8GCBC is a two-place tandem, strut-braced, high-wing airplane constructed with sitka spruce wing spars and covered with Dacron fabric. The flight was being conducted for the purpose of aerial advertising, (banner towing). According to a witness, the pilot was attempting to engage the banner but missed it and was in a climb maneuver when the wing snapped and folded upward and inboard. The airplane rolled to the right, descended and impacted the ground, and was engulfed in flames shortly thereafter.

Between December 9, 1983, and September 8, 1984, three Bellanca Scout Model 8GCBC airplanes crashed after each of the airplanes had sustained an in-flight structural failure of the wing. Five persons were killed. The accidents occurred at: Wilmot, New Hampshire, September 8, 1984 (N86859), Houston, Texas, April 8, 1984 (N4167Y); and Saskatchewan, Canada, December 9, 1983 (C-GKZG). Reportedly, each of the airplanes had been repaired preceding the accident after having been blown over on the ground during high winds or after having been flipped over during landing. As a result, the Safety Board, on March 7, 1985, issued Safety Recommendation A-85-20 to the Federal Aviation Administration (FAA) recommending the issuance of an airworthiness directive (AD) to ensure prompt detection and proper repair of wing structural damage. Subsequently, the FAA issued AD 87-18-09, effective October 15, 1987, applicable to all Model 8GCBC airplanes equipped with wood spars. The AD was issued to preclude in-flight structural failure of the wing due to wood fiber compression failure and provided inspection procedures for evidence of compression failure on the rear side surface of the front spar and the front side surface of the rear spar. The inspection was required to be accomplished only once unless, subsequent to the effective date of the AD, the airplane was involved in an accident that may have resulted in structural damage to the wings, in which case it was required to be accomplished again.

The accident airplane (N86587) had been utilized for agricultural spraying and glider towing as well as banner towing operations. The maintenance records for N86587 indicated that all applicable ADs had been accomplished including AD-87-18-09, which was complied with on September 25, 1987. Maintenance records also indicated that on December 12, 1989, the right wing of N86587 was removed, recovered with fabric, and reinstalled. There was no record of any previous damage to the wings. However, a new wing tip rib was also installed at this time.¹

The Safety Board, with assistance from the U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, determined that there was no evidence of preimpact decay or inadequate wood quality (moisture content or specific gravity) that would have predisposed the wing spar of N86587 to fail. Because of the extensive damage and ground fire, the precise cause of the wing spar failure could not be determined. However, preexisting, undetected spar compression failure is possible.

In the September 1995 issue of FAA Advisory Circular (AC) 43-16, General Aviation Airworthiness Alerts, wing spar cracks in a Bellanca Scout Model 8GCBC were reported as having been discovered during the course of routinely replacing the wing fabric:

While installing new fabric on the left wing, several small cracks were found on the front wing spar.

The cracks were located near the strut attachment point where two doublers were installed. The doublers were located on the forward and aft sides of the spar, and the cracks appeared to originate in the spar at the corner where each doubler ends. All of the cracks were approximately .75-inch long, and it was necessary to replace the wing spar. The submitter did not speculate concerning the cause of this defect. It would be wise to inspect this area for similar defects at every opportunity.

Canadian AD CF-92-07, also applicable to all Bellanca Scout Model 8GCBC airplanes with wood wing spars, was issued by Transport Canada effective May 1, 1992. The objective of AD CF-92-07, detection of spar compression failure, is identical to that of AD 87-18-09. However, AD CF-92-07, which is required to be accomplished at intervals not exceeding 500 flight hours, is based on a significant amount of technical and empirical wood spar inspection data that was probably not available at the time AD-87-18-09 was issued.

The Canadian Forces Central Region, Cadet Branch, at Astra, Ontario, operates a fleet of Model 8GCBC airplanes in glider towing operations. Because of potentially adverse structural effects from the intense nature of their operation, such as increased structural loads, exposure to low level gusts, and rough landing areas, etc., the Cadet Branch conducted inspections for wood spar compression failure on their airplanes at 100-hour intervals using a fibre optic borescope to

¹ In accordance with 49 CFR 830.2, Definitions, damage to the wing tips is not considered substantial damage for purposes of accident definition.

view areas of the spar that would otherwise have been difficult or impossible to inspect. As a result, the Cadet Branch was able to provide Transport Canada with a wealth of information that was used in the formulation of AD CF-92-07. Several compression cracks were found in the spars in areas not currently delineated in AD-87-18-09, such as on top of the spars, along glue lines behind the spars' plywood doubler plates, and behind the ribs nailing flange. Based on their experience, the Cadet Branch believes it highly unlikely that a compression crack would be detected on the aft face of the front spar unless it were in advanced propagation.

The following is an excerpt from AD CF-92-07.

~~Compression cracks have been reported on a significant number of aircraft. In some cases, cracks have remained undetected by previous inspection per FAA Airworthiness Directive (AD) 87-18-09. Compression cracks have been found emanating from the upper surface of wing spars and progressing downward, cutting across the grain at the following areas:~~

- Front spar at both ends of the reinforcement plate for the lift strut attachment,
- Front spar rib attachment points located at the ribs inboard and outboard of the spar reinforcement plate,
- Rear spar at the lift strut attachment point, and
- Rear spar rib attachment points located at the ribs adjacent to the rear strut attachment.

~~In most cases, the compression cracks propagated along the glue line of the reinforcement plates or behind the rib attach flanges. Consequently, the inspection required by AD-87-18-09 may not detect cracks in these areas.~~

To prevent in-flight failure of the wing spars, accomplish the following.

1. Cut inspection holes in the upper wing fabric skin just aft of the front spar and forward of the rear spar, beside the ribs adjacent to the ends of the plywood reinforcement plate.

Notes.

- (a) The front inspection holes are to be sealed with fabric after the inspection to prevent the inspection cover, if installed, being sucked-off in flight (by the presence of low pressure in the area).
- (b) Alternatively, the inspection holes may be cut in the bottom wing skin if the inspection of paragraph 2 of this directive is to be accomplished.

using a borescope with a flexible probe. In this case, normal cover may be used for all inspection holes.

2. Apply a downward force at the wing tip and inspect the front and rear spars for compression cracks, either using a borescope with a flexible probe, or visually with a strong light and a mirror. The inspection must include the following areas on the rear face of the front spar, the front face of the rear spar, and the top surface of both spars at the corresponding locations which are in line with them:
 - front spar reinforcement plate glue lines;
 - rear spar strut attachment point; and
 - front and rear spar rib attachment nail holes.

The above procedures provide for improved, detailed inspection of the critical, less accessible areas of the wing spars and appear to facilitate early, reliable detection of wing spar compression failure.

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

Issue an Airworthiness Directive superceding AD 87-18-09, applicable to all Bellanca Scout Model 8GCBC airplanes with wood wing spars, that requires a comprehensive inspection of all critical areas of the spars for evidence of compression cracks. Areas of the spar required to be inspected should include the top surfaces of both front and rear spars adjacent to: the front spar reinforcement plate glue lines; the rear spar lift strut attachment point; and the front and rear spar rib attachment nail holes. The inspection should subsequently be conducted at intervals not exceeding 500 flight hours and subsequent to any incident that results in damage to the wings. If compression failure is detected, the spar should be repaired or replaced before further flight (A-97-12)

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

By  Jim Hall
Chairman