



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** March 16, 2001

**In reply refer to:** A-01-01 and -02

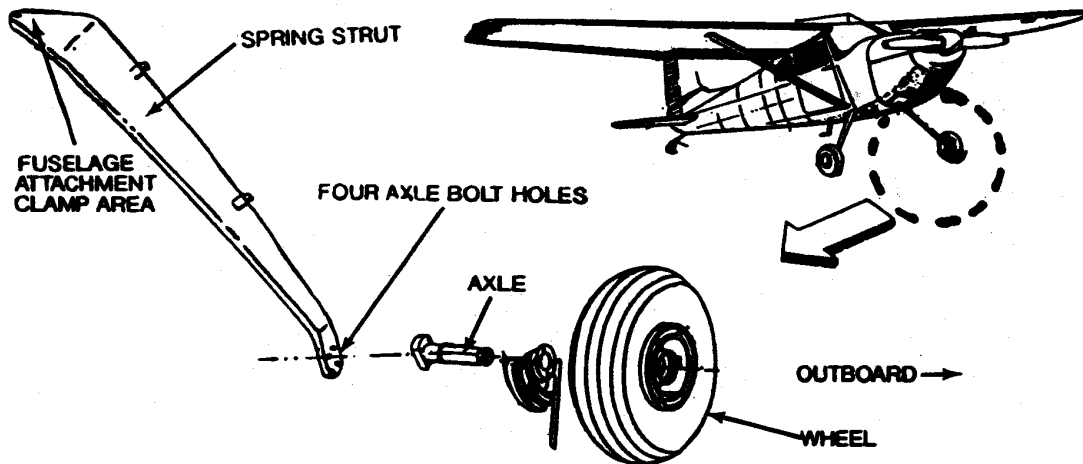
Honorable Jane F. Garvey  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

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In this letter, the National Transportation Safety Board recommends that the Federal Aviation Administration (FAA) take action to address a safety issue concerning corrosion and fatigue cracking of main landing gear (MLG) spring struts on Cessna 170, 180, 185, 190, and 195 series airplanes. The recommendations were prompted by the Safety Board's investigation of a September 14, 1999, accident involving a Cessna 185, N85LC, near Delta Junction, Alaska. This letter summarizes the Board's rationale for issuing these recommendations.

On September 14, 1999, a Cessna 185, N85LC, operated by Tamarack Air Ltd., Fairbanks, Alaska, sustained substantial damage while landing at a remote dirt airstrip near Delta Junction, Alaska. Near the end of the landing roll, the left MLG collapsed and dug into the ground, causing the airplane to nose over. The pilot and one passenger suffered minor injuries; the remaining passenger was uninjured. The flight was an on-demand passenger flight operating under 14 *Code of Federal Regulations* (CFR) Part 135. At the time of the accident, the airplane was 24 years old and had accumulated 5,892 flight hours.

Cessna 170, 180, 185, 190, and 195 series airplanes are tail wheel-equipped with MLG that have a tapered, spring-steel cantilever strut supporting each main wheel (see figure 1). The spring-steel cantilever strut is made from chromium-vanadium steel, which is heat treated and shot peened for added fatigue resistance, and is attached to the fuselage bracket and clamp by bolts at the upper end. The lower end of the spring strut has four holes through which the axle is bolted.



**Figure 1. Cessna 180 Main Landing Gear Spring Strut and Axle Assembly**

The Safety Board's postaccident examination of the Cessna 185 revealed the left MLG spring strut had fractured above the left wheel axle through the upper two axle bolt holes. Further examination of the fractured spring strut at the Board's Materials Laboratory revealed corrosion pitting had caused fatigue cracks to emanate from two regions on the interior surface of the forward upper axle bolt hole.

A review of Safety Board records<sup>1</sup> indicated that from 1984 to the present, 16 of the approximately 76,000 Cessna 170, 180, 185, 190, and 195 series airplanes in service (including the accident airplane) had experienced MLG spring strut fatigue failures;<sup>2</sup> at the time of the failure, the average age of these airplanes was approximately 15 years. Five of the 16 failures occurred at the upper end of the spring strut; fatigue typically initiated from fretting and corrosion pitting near the fuselage attachment clamp area. Eleven of the 16 failures occurred at the lower end of the spring strut; fatigue typically initiated from corrosion pitting in and around the axle bolt holes. In addition, a review of the FAA's Service Difficulty Reports (SDR) data indicated that from 1974 to the present, at least nine other reports exist of cracked or failed MLG spring struts on Cessna 170, 180, and 185 series airplanes.<sup>3</sup> Because previous reviews of SDR

<sup>1</sup> The Safety Board contacted Cessna regarding MLG spring strut fatigue failures, but Cessna had no record of such failures.

<sup>2</sup> Eleven of the 16 failures occurred from 1993 to 1999.

<sup>3</sup> The Safety Board notes that Cessna tail wheel-equipped airplanes and Cessna nose wheel-equipped airplanes have MLG spring struts similar in design. However, a review of Board records indicated that from 1984 to the present, only 5 of the approximately 118,000 Cessna nose wheel-equipped airplanes in service have experienced MLG spring strut fatigue failures. In addition, a review of the FAA's SDR data indicated that from 1972 to the present, no reports exist of cracked or failed MLG spring struts in Cessna nose wheel-equipped airplanes. On the basis of this review, the Board notes that the fatigue failure rate of MLG spring struts in Cessna nose wheel-equipped airplanes is significantly lower than that in Cessna tail wheel-equipped airplanes; therefore, the Board is only addressing spring strut fatigue failures in Cessna tail wheel-equipped airplanes in this letter. However, the Board will monitor the

data have revealed the SDR system frequently underreports service failures, it is likely that other unreported MLG spring strut failures have occurred.

Inspections of the MLG spring strut are required by 14 CFR Part 43 and recommended in the Cessna Aircraft service manual. According to 14 CFR Part 43, airplanes must undergo an annual inspection in accordance with the inspection plan in Appendix D of Part 43, which requires a general visual inspection of the MLG components. In addition, the Cessna Aircraft service manual recommends inspecting the MLG spring strut every 50 hours of service and provides general instructions to inspect the movable and metal parts of the MLG for cracks and corrosion. However, 14 CFR Part 43 and the Cessna Aircraft service manual do not specifically require or recommend a detailed inspection of the MLG spring strut near the fuselage attachment clamp area and axle assembly area for corrosion and cracks, removal of the MLG spring strut to expose the fuselage attachment clamp area and axle assembly area, or the use of nondestructive inspection (NDI) techniques. The Safety Board notes that a detailed inspection of the MLG spring strut near the fuselage attachment clamp area and the axle assembly area for corrosion and cracks can only be accomplished if the spring strut is removed from the fuselage and the axle is removed from the spring strut.

Despite the inspections required by 14 CFR Part 43 and recommended in the Cessna Aircraft service manual, MLG spring strut failures continue to occur. Visual inspections have not prevented all spring strut failures and do not adequately detect the relatively small fatigue cracks before failure occurs. The lack of a requirement for detailed inspections of the MLG spring strut fuselage attachment clamp area and axle assembly area allows airplanes with corrosion and cracks in the spring strut to experience fatigue failures. An initial inspection, involving the removal of the MLG spring strut and the use of NDI techniques to examine the spring strut, should aid in the detection of fatigue cracks that cannot be identified through visual inspections, thereby reducing the possibility of an incident or accident. The Safety Board notes that initial inspections, although beneficial, might not be enough to monitor whether corrosion and cracks are developing in the spring struts. Repetitive inspections performed at appropriate intervals<sup>4</sup> should further reduce the possibility of fatigue failure incidents or accidents.

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

Issue an airworthiness directive to require an initial inspection of Cessna 170, 180, 185, 190, and 195 series airplane main landing gear spring struts, involving the removal of the spring struts from the fuselage attachment clamp and axle assembly and the use of nondestructive inspection techniques to

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spring strut fatigue failure rate in Cessna nose wheel-equipped airplanes to assess whether additional safety recommendations are necessary.

<sup>4</sup> Appropriate intervals would allow early evidence of corrosion and fatigue cracks in MLG spring struts to be detected before a failure occurs. The Safety Board notes that the Cessna Aircraft Company Model 100 Series Continued Airworthiness Program contains an inspection of the MLG outboard spring supports of Cessna 180 and 185 series airplanes that involves removing the MLG spring struts from the airplane every 1,000 hours or every 3 years.

examine the upper and lower ends of the spring struts for corrosion and cracks, at the next 100-hour or annual inspection, whichever occurs first. (A-01-01)

Issue an airworthiness directive to require repetitive inspections of Cessna 170, 180, 185, 190, and 195 series airplane main landing gear spring struts, involving the removal of the spring struts from the fuselage attachment clamp and axle assembly and the use of nondestructive inspection techniques to examine the upper and lower ends of the spring struts for corrosion and cracks, at appropriate intervals. (A-01-02)

Vice Chairman HALL<sup>5</sup> and Members BLACK and CARMODY concurred in these recommendations. Members HAMMERSCHMIDT and GOGLIA did not concur.

By: Carol J. Carmody  
Acting Chairman

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<sup>5</sup> Vice Chairman Hall was serving as the Safety Board's Acting Chairman at the time of his concurrence.