



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: February 23, 2000

In reply refer to: A-00-22

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

On August 15, 1998, about 0955 eastern daylight time, a Piper PA-18-150, N3981Z, operated by Sky Signs, Inc., experienced an in-flight structural failure of the left wing and crashed during an attempted banner tow pick-up at a private airstrip in Conway, South Carolina.¹ The commercial pilot, the sole occupant, received minor injuries, and the airplane was substantially damaged. Visual meteorological conditions prevailed, and no flight plan had been filed. The flight was conducted under 14 Code of Federal Regulations Part 91 and originated about 5 minutes before the accident.

The National Transportation Safety Board's investigation revealed that the left-wing forward lift strut² had separated from the wing in flight. Metallurgical analysis revealed that the separation was precipitated by corrosion of the lift strut's forward attach fitting (see figure 1).³ The corrosion originated on the front face of the fitting, near its connection to the forward lift strut, in an area concealed by the leading edge of the wing. A cross-section of the fitting revealed that corrosion had completely penetrated it.

¹ For more information, see Brief of Accident MIA98LA226.

² The PA-18-150, like all other Piper high-wing airplane models, has a forward lift strut and an aft lift strut installed on each wing.

³ The outboard end of the forward lift strut connects to the wing spar via two similarly constructed carbon steel attach fittings that are bolted to the forward and aft sides of the spar web. The fittings are shaped like "C" channels and are 12.5 inches long by 1 inch wide.

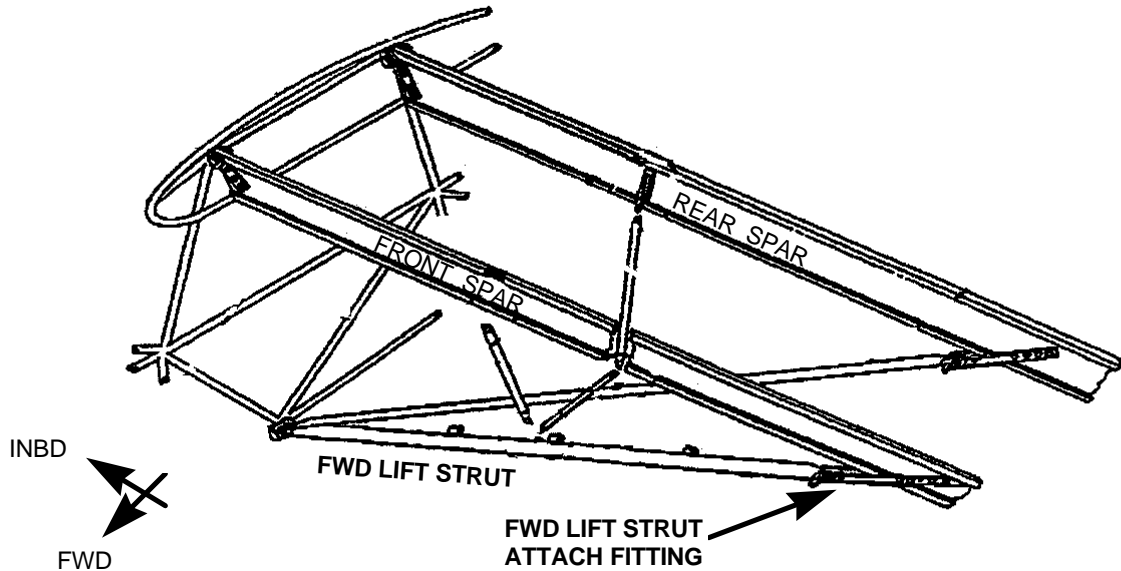


Figure 1. Typical Wing Structure of a High-Wing Piper Airplane

The Safety Board also examined the forward attach fitting from the right (intact) wing's forward lift strut and found evidence of moderate corrosion damage in the same area as in the left wing fitting. Minor corrosion was found on the aft attach fittings. The airplane's maintenance records indicated that the accident airplane was covered with Ceconite⁴ on October 21, 1967, after 761 hours of operation, and it had not been re-covered since. The airplane had been operated 9,731 hours since it was manufactured in 1963 and had undergone a 100-hour inspection 10 days before the accident. No comments regarding corrosion were found in the maintenance records pertaining to the 100-hour inspection. The applicable Piper 100-hour inspection checklist does not specify an inspection for corrosion on the wing lift strut attachment fittings.

The lift strut attach fittings connect the outboard end of the forward lift strut to the forward and aft faces of the wing spar (see figure 2). Each fitting is bolted to the spar through an aluminum filler block that is sandwiched between the fitting and the spar web. The lower (inboard) portions of both fittings protrude beneath the lower surface of the wing and can be easily inspected. The upper (outboard) portion of the aft fitting is installed behind the front spar and can be inspected via an access panel underneath the wing. However, there are no access panels forward of the front spar; therefore, it is not possible to inspect the upper portion of the forward fitting without removing a portion of the wing leading edge. The only opportunity to inspect the entire forward fitting typically occurs when the wing skin needs to be replaced.

⁴ Ceconite is a synthetic fabric used to cover aircraft structure. It is widely used to replace the skin on older airplanes originally manufactured with cotton and linen fabrics, which have a much shorter service life.

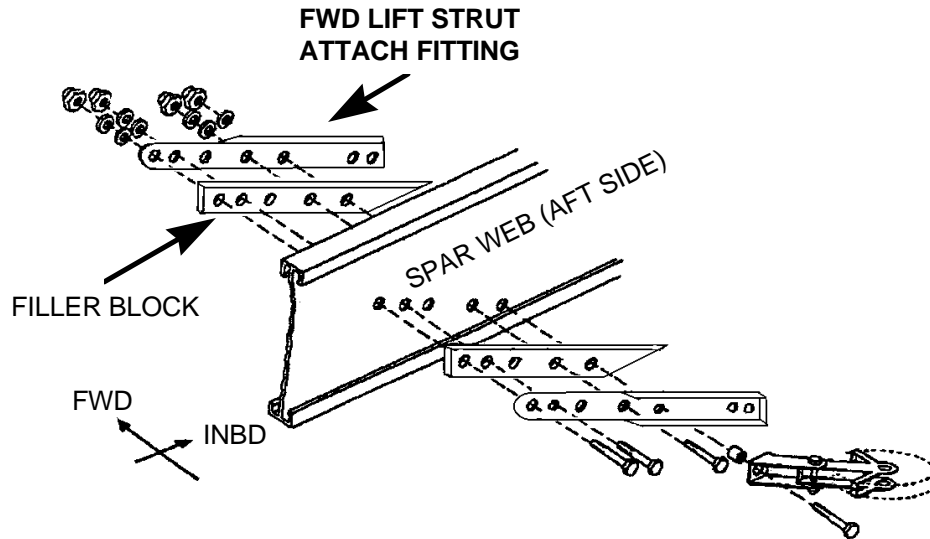


Figure 2. Close-up View of Forward Lift Strut Attach Fitting Assembly

The Safety Board is aware that until the introduction of Ceconite and other synthetic materials in the 1960s, airplanes covered with cotton and linen fabric were typically re-covered about every 5 years because of the degradation of the natural dope and fabric materials. Frequent re-covering allowed adequate access and the opportunity to fully inspect all structural components of the wing. However, the synthetic fabrics now used are extremely durable and may never need to be removed and replaced, thus eliminating regular opportunities to inspect for corrosion of the entire surface of the wing lift strut attach fittings.

The Safety Board is aware of other similar incidents of corroded lift strut attach fittings. The operator of the accident airplane submitted three forward attach fittings from two of its undamaged PA-18-150 airplanes to the Safety Board for metallurgical examination. The examinations revealed severe corrosion on all three fittings in the same areas as on the fittings from the accident airplane. Additionally, a corroded fitting from a PA-12 lift strut was submitted to the Safety Board by the owner of a company that rebuilds high-wing Piper aircraft; severe corrosion was found in the same area as on the accident fitting, and minor corrosion damage was found on the aft portion of the fitting.

Additionally, a review of the FAA's Service Difficulty Report (SDR) database revealed two other reports of corroded fittings. One report of a Piper J3 Cub, N7106D, dated February 23, 1990, stated that a lift strut fitting "rusted through just above wing strut attach bolt hole," which is located in the area that was corroded in the accident fittings. The other SDR was dated 1982 and reported a "bent" fitting on a Piper PA-18-150, N7863D.

On October 21, 1998, the Federal Aviation Administration (FAA) Aircraft Certification Service issued Special Airworthiness Information Bulletin (SAIB) No. ACE-99-01 to "alert owners/operators of all High Wing Piper Airplanes of possible corrosion problems with the strut attach fittings internal to the wing." The SAIB cited the Conway accident and recommended that

owners/operators of the affected aircraft perform immediate inspections of the aft and lower portions of the subject fittings.... If any evidence of corrosion is detected, the forward portion of the subject fitting should also be inspected. The extent of the corrosion damage should be evaluated by an appropriately licensed mechanic and the parts repaired or replaced accordingly. These areas should then be inspected on a recurring basis during annual and/or 100 hours inspections.

The SAIB stated that the FAA would continue its investigation of the Conway accident and issue an airworthiness directive (AD), if required, based on its analysis. The Safety Board notes that the FAA has not published an AD since it issued the SAIB.

Further, the Safety Board also notes that the SAIB does not specify how to inspect the forward attach fitting if corrosion is detected on the exposed surfaces that protrude beneath the wing and that the surface condition in the aft area of the fittings may not adequately represent the surface condition in the area of the forward portion of the fitting that protrudes into the bottom skin of the wing and is hidden from view. Therefore, a lack of corrosion in the aft area does not preclude the possibility of corrosion on the forward portion of the fitting. In most of the fittings that the Safety Board examined, minor corrosion was noted on the aft attach fittings and the exposed lower portions of the forward fittings, while severe corrosion was detected on the area of the forward portion of the fitting that protrudes into the bottom skin of the wing. This area is more susceptible to corrosion because the bottom surface of the leading edge mates with the forward face of the front spar web, which creates a confined space that traps moisture.

According to The New Piper Aircraft, Inc., 14 different models of high-wing Piper airplanes⁵ have a similar lift strut wing attach fitting design, and a total of 51,635 airplanes with these model numbers have been manufactured. The company also reported that no maintenance manual exists for these airplanes and that their owners are directed to use Advisory Circular (AC) 43.13-1, "Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair," for guidance. Although the AC provides useful guidance for visual corrosion inspection, the Safety Board is concerned that the information is too general and does not adequately address the specific corrosion problem areas associated with the lift strut attach fittings on high-wing Piper airplanes.⁶

The Safety Board is very concerned that undetected corrosion of the forward lift strut attach fittings installed in high-wing Piper airplanes could cause a catastrophic in-flight structural failure. Although the Conway accident did not result in a loss of life, if a similar failure had occurred at a higher altitude it would likely have resulted in a loss of control and fatal injuries to the airplane occupants. The Safety Board notes that the area on the fitting most susceptible to

⁵ The models include the J-2, J-3, J-4, J-5, PA-11, PA-12, PA-14, PA-15, PA-16, PA-17, PA-18, PA-19, PA-20, and PA-22 airplanes.

⁶ Chapter 6 of the most recent revision of AC 43.13-1B, dated September 8, 1998, addresses inspection for corrosion and protection against corrosion. The AC does not address the location of the corrosion found on the accident airplane.

corrosion cannot be adequately inspected without removing a portion of the wing leading edge. Therefore, the Safety Board believes that the FAA should require The New Piper Aircraft, Inc., to develop a recurrent inspection procedure adequate to detect corrosion of any portion of the lift strut attach fittings installed on high-wing Piper airplanes and require that owners of these airplanes implement those recurrent inspection procedures.

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

Require The New Piper Aircraft, Inc., to develop a recurrent inspection procedure adequate to detect corrosion of any portion of the lift strut attach fittings installed on high-wing Piper airplanes and require that owners of these airplanes implement those recurrent inspection procedures.
(A-00-22)

Chairman HALL and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred with this recommendation.

By: Jim Hall
Chairman