



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 8, 2010

In reply refer to: A-10-44 and -45

The Honorable J. Randolph Babbitt
Administrator
Federal Aviation Administration
Washington, D.C. 20591

The National Transportation Safety Board (NTSB) has investigated two accidents involving Piper PA-46-350P airplanes that resulted from fatigue cracking in the attachment between the nose landing gear (NLG) actuator and the engine mount. Such fatigue cracks can lead to the collapse of the NLG, which could cause a serious or catastrophic accident if the separation occurred at a critical point during takeoff or landing or if the aircraft collided with parked aircraft or aircraft waiting at taxiways.

On August 16, 2009, about 1130 eastern daylight time,¹ a Piper PA-46-350P, N548C, experienced an NLG collapse during landing at the Orlando-Sanford International Airport, Sanford, Florida.² The private pilot and passenger were uninjured, and the airplane sustained substantial damage. No flight plan was filed for the 14 *Code of Federal Regulations* (CFR) Part 91 personal flight, nor was one required to be filed by the Federal Aviation Administration (FAA). Visual meteorological conditions (VMC) prevailed at the time of the accident.

On May 19, 2007, about 1305, a Piper PA-46-350P, N411MD, experienced an NLG collapse during landing at the Indianapolis Metropolitan Airport near Fishers, Indiana.³ The pilot and passenger were uninjured, and the airplane sustained substantial damage. No flight plan was filed for the 14 CFR Part 91 personal flight, nor was one required to be filed by the FAA. VMC prevailed at the time of the accident.

The NLG actuator on Piper PA-46-350P airplanes is bolted via two attachment feet to the lower aft engine mount, which is constructed of welded tubes (see figure 1). The NLG actuator extends down and forward from the attachment feet and attaches to the NLG. During taxi,

¹ All times in this letter are eastern daylight time, based on a 24-hour clock.

² Preliminary information regarding this accident, NTSB case number ERA09LA471, is available online at <http://www.nts.gov/ntsb/query.asp>.

³ The report for this accident, NTSB case number CHI07LA151, is available online at <http://www.nts.gov/ntsb/query.asp>.

takeoff, and landing, the attachment feet transmit loads from the NLG to the engine mount, thus creating repetitive tensile stress in the engine mount attachment feet areas and, in some cases, leading to fatigue cracking.⁴

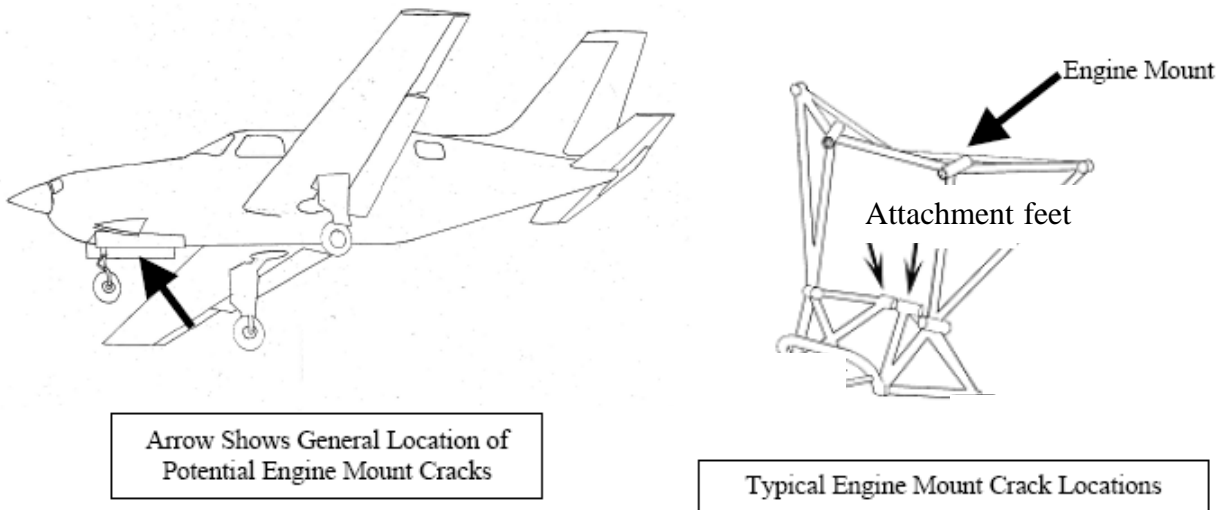


Figure 1. Piper PA-46-350P crack locations on engine mount

Piper PA-46-310 and -350P airplanes have either an original engine mount or a redesigned engine mount (see figure 2).⁵ In the original design, each attachment foot is a two-piece part consisting of a metal disk welded to the end of a metal tube, which is then welded to the engine mount support tubes. In the redesigned engine mount, each attachment foot is a one-piece machined part made from a single piece of steel, eliminating the welding within the feet themselves. However, on both the original and redesigned engine mounts, the attachment feet are welded to the engine mount support tubes, which is where fatigue cracking has been identified by the NTSB.

The airplane in the Sanford, Florida, accident was equipped with a redesigned engine mount that was installed at the time of manufacture. The NTSB's postaccident examination of N548C revealed that the right attachment foot had fractured at the engine mount support tube. The NTSB materials laboratory's examination of the fractured foot revealed a fatigue crack emanating from multiple origins at the exterior of the joint where the attachment foot was welded to the support tube. At the time of the accident, the airplane was 8 years old and had accumulated 711 flight hours with 878 cycles since new (CSN).

⁴ The onset and propagation of fatigue cracks vary from aircraft to aircraft because the tensile stresses in the engine mount will vary with airport conditions and the severity of maneuvers.

⁵ Although the NTSB has only investigated accidents involving the PA-46-350P, the NTSB notes that the PA-46-310 has the same original and redesigned engine mounts and therefore may be susceptible to the same fatigue cracking.

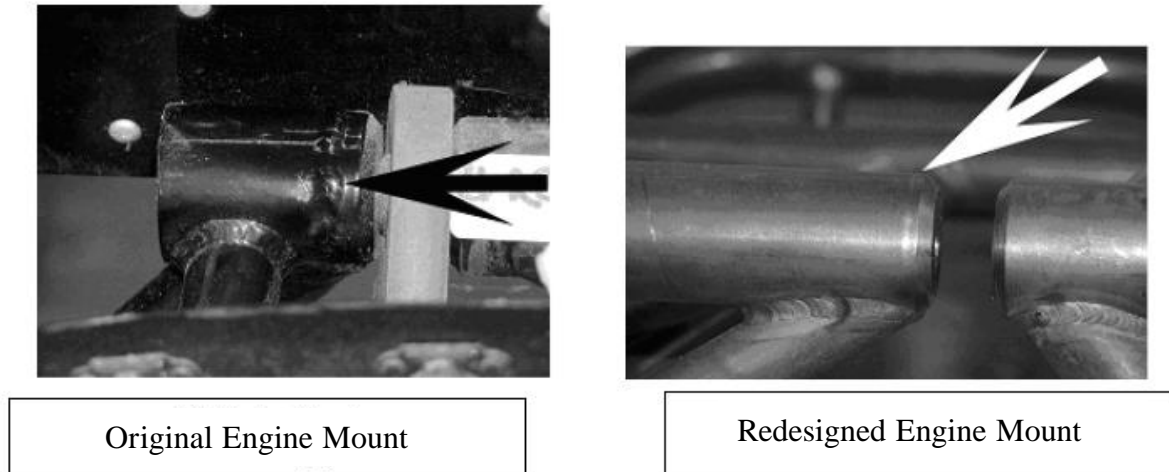


Figure 2. Original engine mount with two-piece foot and redesigned engine mount with one-piece machined foot

The airplane in the Fishers, Indiana, accident had a redesigned engine mount that was installed on March 21, 2003. The airplane had accumulated 542 flight hours and an estimated 1,400 cycles since then. At the time of the accident, the airplane was 7 years old and had accumulated a total of 772 flight hours.⁶ The NTSB's postaccident examination of N411MD revealed that the right attachment foot had separated from the rest of the engine mount due to fatigue cracking⁷ where the attachment foot was welded to the support tube.

The NTSB also notes that a similar incident of fatigue cracking of an NLG attachment foot was found on September 29, 2009, during a routine inspection of a Piper PA-46-350P airplane. The airplane was 5 years old and had accumulated a total of 678 flight hours with 600 CSN and was equipped with the redesigned engine mount.

On April 22, 2002, Piper issued mandatory Service Bulletin (SB) 1103, recommending that operators of PA-46-310P, -350P, and -500TP⁸ airplanes inspect the NLG actuator attachment foot area of the original engine mounts for evidence of fatigue cracking. The SB indicated that such cracking had been found in this area of some original engine mounts. The inspection included visual and liquid penetrant inspection at the next regular scheduled maintenance event and each 100 hours in service or at the annual inspection, whichever occurred first. If cracks were found, the original engine mounts were to be replaced with the redesigned engine mounts before returning to service. SB 1103 does not subject the airplanes with redesigned engine mounts to repetitive inspections, and replacing the original engine mount with the redesigned engine mount relieves the need for repetitive inspections. Piper issued several

⁶ The airplane's annual inspection was conducted 5 months prior to the accident, and no discrepancies with the engine mount were noted.

⁷ The NTSB determined that the probable cause of this accident was the fatigue separation of the engine mount's nose gear actuator attachment foot during landing.

⁸ The PA-46-500TP airplane has a differently redesigned engine mount than the PA-46-310 and -350P.

updates of SB 1103, none of which subjected the redesigned engine mounts to repetitive inspections.⁹

The NTSB is concerned that the redesigned engine mounts on Piper PA-46-310 and -350P model airplanes have attachment foot areas susceptible to fatigue cracking similar to the fatigue cracks identified by Piper on the original engine mounts. The NTSB concludes that the tensile stresses applied to the redesigned engine mounts could lead to fatigue fractures in the NLG actuator attachment foot areas. However, redesigned engine mounts are not currently subject to the inspection provisions of SB 1103, nor is compliance with SB 1103 required.¹⁰ Although the NTSB is not aware of incidents or accidents involving original engine mounts that have not been inspected, the NTSB believes that inspections of the original engine mounts should also be mandatory in order to detect fatigue cracking. Therefore, the NTSB recommends that the FAA require repetitive inspections for fatigue cracking of the NLG actuator attachment foot areas on all Piper PA-46-310 and -350P engine mounts and require replacement, if necessary.

As previously noted, Piper redesigned the engine mounts on the PA-46-310 and -350P in an effort to prevent fatigue cracking at the attachment foot areas. However, based on the accidents discussed above, this redesign does not appear to have been successful since fatigue cracking has also occurred in the redesigned engine mounts. Therefore, the NTSB recommends that the FAA require Piper to redesign the PA-46-310 and -350P engine mounts so that they are not susceptible to fatigue cracking in the attachment foot areas.

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

Require repetitive inspections for fatigue cracking of the nose landing gear actuator attachment foot areas on all Piper PA-46-310 and -350P engine mounts and require replacement, if necessary. (A-10-44)

Require Piper to redesign the PA-46-310 and -350P engine mounts so that they are not susceptible to fatigue cracking in the attachment foot areas. (A-10-45)

In response to the recommendations in this letter, please refer to Safety Recommendations A-10-44 and -45. If you would like to submit your response electronically rather than in hard copy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our secure mailbox. To avoid confusion,

⁹ On January 27, 2003, Piper issued SB 1103A, which superseded SB 1103 and added initial inspection time and criteria for inspection. On November 15, 2003, Piper issued SB 1103B to require inspection of the NLG actuator mounting bolt to ensure that sufficient threads engaged with the lock nut after engine mount replacement. On February 11, 2009, Piper issued SB 1103C to remove the PA-46-500TP models affected because those models have differently redesigned engine mounts.

¹⁰ Although the FAA emphasized the importance of compliance with Piper's service information, it determined that the airworthiness concern associated with this cracking was not an unsafe condition warranting issuance of an airworthiness directive. (See [http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSAIB.nsf/\(LookupSAIBs\)/CE-09-13?OpenDocument](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSAIB.nsf/(LookupSAIBs)/CE-09-13?OpenDocument).)

please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Chairman HERSMAN, Vice Chairman HART, and Member SUMWALT concurred in these recommendations.

[Original Signed]

By: Deborah A.P. Hersman
Chairman