July 17, 2020

U.S. Department of Transportation
Docket Operations, M-30, West Building Ground Floor, Room W12-140
1200 New Jersey Avenue SE
Washington, DC, 20590

Subject: Piper Aircraft, Inc. Comments to the "Supplemental" Notice of Proposed Rulemaking AD, Docket No. FAA-2018-1046; Product Identifier 2018-CE-049-AD

Introduction

Piper Aircraft, Inc. ("Piper") originally provided comments to Notice of Proposed Rulemaking Docket No. FAA-2018-1046 ("NPRM") in a letter from Simon Caldecott (President & CEO of Piper) dated January 15, 2020. On June 3, 2020, the FAA issued a "Supplemental" Notice of Proposed Rulemaking, Federal Register (Vol. 85, No. 107) ("SNPRM") to the NPRM and reopened the comment period to allow public comment on this new revision.

While the FAA addressed many of the concerns raised by Piper to the NPRM in its original comments, Piper takes issue with this SNPRM in two main respects:

1. The completion of the National Transportation Safety Board ("NTSB") investigation of the April 4, 2018 accident involving a Piper PA28R-201 owned, operated, and maintained by Embry Riddle Aeronautical University (NTSB Final Accident Report dated 9/3/19), subsequent to the issuance of the original NPRM, now makes clear that the underlying premise for the issuance of the original NPRM is no longer valid; and
2. Even assuming a valid basis for the issuance of an Airworthiness Directive to further continue an investigation of this matter, the SNPRM still contains an overly broad number of aircraft models unrelated to the aircraft that is the subject of the inquiry.

Piper respectfully submits the following comments in support of these positions.

Discussion

Issue# 1: NTSB Investigation Results Do Not Support the Issuance of an Investigative Airworthiness Directive

In a July 9, 2020 letter to the U.S. Department of Transportation, the NTSB Chairman, a graduate and recipient of an honorary doctorate from Embry Riddle Aeronautical University ("ERAU"), expressed support for the FAA's issuance of a targeted SNPRM to further assist in the investigation of the April 4, 2018 accident involving a Piper PA28R-201 owned, operated, and maintained by ERAU. The results of the NTSB's investigation do not, however, support any such further investigation efforts.

Service Bulletins issued by Piper Aircraft, and approved by the FAA, dating back to the 1980s (Piper Service Bulletins 886, 978, and 978A), which covered the accident aircraft, have provided mechanics with detailed parameters and procedures for decades surrounding when and how to remove wings to inspect wing spars in the manner being suggested by the FAA in this SNPRM. These procedures have been successfully followed for thirty years by numerous owners and operators of these aircraft. Unfortunately, they were not followed by ERAU in this case and it was this failure which was responsible for the accident on April 4, 2018.

These long standing Service Bulletins provide that any of the listed models of aircraft should have its wings removed and the wing spars and bolt holes examined upon the aircraft reaching 1,800 hours, and every 800 hours thereafter, if "a significant part of the total flight time has been spent below one-thousand (1000) feet, AGL altitude." In its report, the NTSB noted that ERAU personnel admitted that (a) it owned this aircraft and the sister Piper aircraft for their entire flight lives; (b) at the time of the accident, the accident aircraft had accumulated 7,690.6 hours of flight time; (c) that ERAU had never performed any wing spar-bolt hole inspections identified in the applicable Service Bulletins on either aircraft; and (d) "commercial flight lesson times averaged 1.4 to 1.8 hours; **most of that time the aircraft was being operated in the airport traffic pattern**, performing takeoffs, landings, and power-off 180° maneuvers. **While in the airport traffic pattern, the airplane operated between 1,000ft agl and ground level**" (emphasis added). Moreover, the Structures Group Chairman's Factual Report dated March 22, 2019 noted that the accident aircraft had "accumulated 33,276 landings prior to the accident flight based on ERAU information documented in their Education and Training Administration program."

Based on the foregoing, ERAU acknowledged to investigators that their use of this aircraft (and the sister Piper aircraft) would have been classified under existing Service Bulletins as "Severe Usage" rather than "normal flight training operations" which would have been classified as "Normal Usage." Notwithstanding this, ERAU never performed the requisite wing spar inspections. Consequently, the underlying premise behind this SNPRM (and the safety risks it creates) is flawed in that there is no evidence to suggest that the issuance of any new inspection parameters or inspection criteria is needed or will prevent further accidents given that ERAU clearly neglected to follow long standing FAA approved safety inspection requirements which resulted in this accident. Safety is not served when investigation results and subsequent FAA and NTSB actions do not take into account the negligence of operators who do not follow existing safety procedures.

In addition to not following the safety procedures contained in the Piper Service Bulletins, the NTSB further found that ERAU also neglected to follow basic maintenance inspection instructions in the Piper Maintenance Manuals. In the "Discussion" section of the SNPRM on page 34122, the FAA makes the following statement: "An investigation revealed a fatigue crack in a visually inaccessible area of the lower main wing spar cap." This statement is followed up later at page 34123 with the following statement: "Regarding the concern about inadequate inspections and maintenance practices, the NTSB report did not indicate there was any evidence of inadequate inspection and maintenance practices." These statements are contradicted by the findings and at best misleading. The fatigue crack that was identified in the NTSB investigation for the accident aircraft was found to have existed for several hundred flight hours before the accident and was accompanied by fatigue cracks of the doubler which would have been clearly visible inside the main spar box long before the accident occurred. [See

USAF Wing Spar Analysis Results, Attachment 3 to Structures Group Chairman's Factual Report; National Transportation Safety Board Aviation Accident Final Report, ERA18FA120, "N106ER Wing Main Spar Examination" at p. 17.]. While this area is inside the center section spar box, it is visually accessible and mechanics are required to examine this area during inspections.

The NTSB found that Piper's Maintenance Manual requires a mechanic to inspect all "wing attach bolts for slippage, damage and overstress" after each hard or overweight landing or severe turbulence. Further, the Piper Maintenance Manual requires a mechanic to "inspect wing spar to fuselage attachment bolts and brackets annually and at 100 hour intervals." By definition, this would require a mechanic to look inside the center section spar box during each of these required inspections. This procedure of examining this area inside the spar box is strictly followed by mechanics and other flight schools and their mechanics. However, ERAU did not follow this procedure and did not conduct this type of inspection for the subject airplane. The NTSB found that Embry Riddle maintenance procedures did not require their mechanics to look inside the spar box and inspect the wing spar attachment bolts and brackets. Rather, their mechanics were only required to examine the main spar attachment bolts outside the spar box on the lower wing surface to make sure the torque striping on the nuts was not broken. This procedure did not allow for inspection of the brackets or proper inspection of the area around the head of the attachment bolts inside the spar box. In its report, the NTSB stated:

> *According to chapter 5 of the Piper Airplane Maintenance Manual (AMM), the 100-hour inspection was a complete inspection of the airplane and was identical in scope to an annual inspection. The 100-hour inspection was divided into several major groups, including a wing group. Item 13 in the wing group stated, "inspect wing spar to fuselage attachment bolts and brackets" and indicated a recommended interval of 100 hours. According to ERAU, the accomplishment of this item involved removing the small plastic covers over the main spar attach bolts on the lower wing surface to ensure the torque striping on the nuts was not broken.* ***The ERAU inspection would not normally look at the head of the bolts inside the center section even though the airplane interior would be removed from the airplane. (Emphasis added) (See National Transportation Safety Board Aviation Accident Final Report, ERA18FA120, at p. 10.)***

This is important since the NTSB found that the maintenance records for the subject aircraft showed that it had experienced at least 1 incident of significant turbulence and at least 16 recorded hard landings including one landing which was described as "very hard" and that 5 of these incidents were recorded within six months of the accident. [Additionally, the NTSB interviewed ERAU's CFIs, who reported that the subject airplane was commonly used for students to perform power-off 180 degree landings which were described as firm and that there were multiple firm landings per flight.] Moreover, the NTSB found that ERAU completed an annual/100 hr. inspection on March 22, 2018 at an airframe time of 7,662.3 hours. This was just thirteen days and 28 flight hours before the accident. Despite the fact that Piper's Maintenance Procedures specified that during this inspection the mechanic was to "inspect wing spar to fuselage attachment bolts and brackets," the NTSB reported that, according to ERAU, the ERAU mechanics did not look at the head of the bolts and brackets inside the center section – even though the airplane interior was removed.

Had ERAU properly followed the Piper Maintenance Manual requirements and utilized the procedures employed by other mechanics and flight schools and their own mechanics, as well

as common sense, they would have inspected the area around the head of the attachment bolts and brackets inside the spar box and would have discovered the fatigue crack in question had propagated to the point that the doubler above the spar had also cracked. This would have been easily visible to any mechanic conducting the inspection properly. Further, it should be noted that during its investigation, the NTSB examined 16 other airplanes from four flight schools (including ERAU) using eddy - current inspection of the outboard attachment holes. The only one that was found to have a fatigue crack was another Piper Arrow that was owned, operated and maintained by ERAU. None of the other planes that were inspected had fatigue cracks, including four airplanes with higher estimated landing cycles and actual flight hours. [See National Transportation Safety Board Aviation Accident Final Report, ERA18FA120, at p. 5.]

Based on the foregoing, Piper respectfully submits that there exists no basis for the issuance of the Investigative Airworthiness Directive contained in the SNPRM.

Issue #2: The SNPRM Still Contains an Overly Broad Cross-Section of Aircraft Models

Even assuming an SNPRM is warranted in the continuing effort to further improve safety, Piper disagrees with the inclusion of the PA-28-151, PA-28-181, PA-32R-300 and PA-32RT-300/T series aircraft for the following reasons:

- Based upon instrumented flight testing performed during type-certification of the PA-28-151 and PA-32R-300 series aircraft, these models each have a measured 'Stress per g' of 95% or less when compared to the instrumented and recorded flight strains performed during certification of the PA-28R-201 series aircraft.
- Based upon instrumented flight testing and additional analysis performed during type-certification of the PA-28-181 series aircraft, the PA-28-181 has a 'Stress per g' of 95% or less when compared to the instrumented and recorded flight strains performed during certification of the PA-28R-201 series aircraft.
- Inclusion of these models contradicts the stated 'greater than or equal to 95 percent of baseline' per Section C. 'Comments Regarding Applicability' of the Supplemental NPRM (page 34124) when the certification wing loads, spar section inertia, and instrumented flight test data are taken into consideration and compared to the 'baseline' PA-28R-201.
- PA-32R-300 series aircraft, as well as Model Year 1979 PA-32-300 aircraft (SN's 32-7940001 to 32-7940290) do not share the same wing construction and installation details as the PA-28R-201 aircraft. The wing assemblies on these aircraft are structurally reinforced as a part of the design to offset the increase in wing loading, which is reflected in the reduced wing stresses measured by the certification flight test data.
- Any such inclusion of the PA-32R and 1979 Model Year PA-32-300 series airplanes into a final rule should be accompanied by an additional service bulletin or revised Service Bulletin 1345 instructions to differentiate the wing construction details of these aircraft from the 'baseline' PA-28R-201 aircraft.
- Despite the support provided by the NTSB Chairman in the above-mentioned July 9, 2020 letter to the U.S. Department of Transportation, the NTSB has been consistently opposed, throughout this process, to the breadth of the models contained in the FAA's

proposed Investigative Airworthiness Directive and has urged the FAA to limit the models to the "PA-28-235 (versus all PA-28 series airplanes), PA-28R series airplanes, and PA-32-260 and PA-32-300 model airplanes that are or have been used in flight training, commercial, or other high-time or high-cycle operations." (NTSB-Weener February 15, 2019 Letter, page 3).

In addition, Piper does not agree with the assessment that the '1993 wing separation' (Ref. NTSB Case No. NYC93FA140) was precipitated by fatigue of the lower main spar cap alone. Neither the NTSB Factual Report nor the NTSB Metallurgist's Factual Report (Report No. 94-34) cite metal fatigue as a probable cause of the accident. While a fatigue crack was noted common to the RH lower main spar cap by the NTSB Metallurgist's Factual Report, several other discrepancies were noted in the 1993 accident which could have contributed to initiation of a fatigue crack where one would not exist in a properly maintained aircraft:

- According to the NTSB Metallurgist's Report (Report No. 94-34), the fatigue origination point was located outboard of the wing attach bolt hole, which is in direct contrast to the fatigue features noted by NTSB Final Report for the 2018 ERAU Accident (ERA18FA120).
- The 1993 aircraft also appears to have not been maintained in accordance with Piper's maintenance procedures, as the nut/bolt installations on the wing spar of the accident aircraft did not match the type design installation requirements.
- According to the NTSB Metallurgist's Report, the RH aft wing attach bolt did not appear to have been installed:

> *"The fuselage and wing lugs of the wing aft attachment fitting were received cut from the aircraft structure. As shown in the upper view of figure 9, the lugs did not appear to be damaged. The Maintenance Manual shows that for this s/n aircraft, the two lugs are connected by an AN5-7A bolt through the holes in each fitting. The investigator was not lugs during assembly (sic). Matching paint and wear patterns on the faying surfaces of each lug, as depected (sic) in the lower view of figure 9, indicated that the lug surfaces had been in direct contact with each other with the bolt holes aligned. Visual inspections also showed that the holes were approximately round showing no appreciable deformation."*

  Previous experience with wing overload related events such as severe turbulence, hard landings, ground handling accidents, etc., as well as component level testing of the aft spar fittings and bolt installation have shown that damage and deformation is not uncommon with the design hardware installed and the fittings subjected to greater than design loads. The lack of an installed aft wing spar bolt on the 1993 accident airplane would result in a fundamental change in the load path common to the wing attach structure which is outside of the design criteria of the PA-28 and PA-32 'Cherokee' series wing installations.

- As noted by the NTSB Metallurgist's Factual Report, the noted fatigue origin did not occur at the bolt hole. Therefore, it is considered dubious that the Bolt Hole Eddy Current (BHEC) inspection method mandated by FAA-2018-1046 alone would detect the observed fatigue damage without additional discrete inspection of the faying surface of

the lower spar cap.

> *"Scanning electron microscope (SEM) examination of the outboard fracture face, after it was cut from the remaining spar, uncovered two distinct fatigue origins in close proximity to each other on the surface of the spar in the areas denoted by arrows "O" in figure 4. Further viewing established that the fatigue progressed upward and aft generally avoiding the hole to the fatigue terminus, indicated by arrowheads in figure 4. Beyond the terminus, the fracture morphology was completely ductile dimples typical of an overstress fracture in ductile aluminum alloys."*

Piper Service Bulletin 886 mandates a discrete, focused inspection of this area for aircraft with damage history as well as improper or unknown maintenance history, however no evidence of compliance with SB 886 or the inspections mandated by FAA AD 87-08-08 for this aircraft exists.

- In response to the 2018 ERAU accident, Piper repeatedly provided proposed Service Bulletins to the FAA which included not only the BHEC inspection techniques, but additional inspections of the lower spar cap faying surfaces using both Fluorescent Penetrant Inspection as well as Surface Eddy Current techniques which were rejected by the FAA.

Other Issues

In addition to the foregoing, the response to the request to use a different eddy current method is inaccurate. There is one single eddy current method/principle used in flaw detection of fastener holes in aluminum aircraft structure and that is documented in SAE ARP4402. Piper SB1345 provides an alternative description specific to the aircraft being inspected and approved by the FAA (and this would look substantially equivalent to SAE ARP4402). Rather, the request to use different eddy current equipment is acceptable provided that the requisite 0.030 x 0.030 inch corner notch in the reference standard is used and that the screen settings are such that the inspection resolution is appropriate for detection of the standard corner notch using the guidance of SAE ARP4402.

Moreover, in its original comments, Piper Aircraft, Inc. disagreed with the FAA's position to report crack indications and any inspection data to the FAA only. The FAA now agrees with Piper and has added Piper's email address on the "Inspection Results Form" contained in Appendix 1. Piper Aircraft, Inc. is requesting to modify the "Inspection Results Form" to also add Piper's mailing address:

Piper Certification Office
2926 Piper Drive
Vero Beach, FL 32960

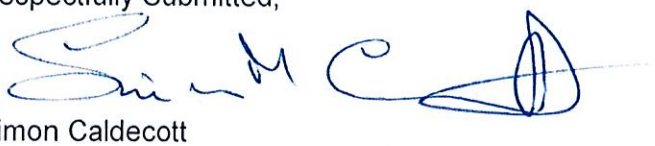
Conclusion

Similar to the original AD 87-08-08 which was issued in 1987 and ultimately rescinded by the FAA, this SNPRM AD activity is not warranted and risks generating more safety issues than it is designed to address. After an exhaustive review, the now-concluded NTSB investigation into the subject accident failed to determine the initiating event behind the subject fatigue crack, but did reveal that an operator failed to follow existing safety procedures and inspection

requirements which would have most certainly detected the existence of the fatigue crack long before it propagated to failure. These safety and inspection procedures were simply not followed. However, to the extent any further investigation of this accident is necessary, the FAA should mitigate further safety risks by aligning the models in its proposal based on analysis related to the accident aircraft. This would require the removal of model PA-28-151, PA-28-181, PA-32R-300 and PA-32RT-300/T series aircraft from Table 1.

Any party wishing to comment directly to Piper Aircraft, Inc. can do so via a dedicated email address for this action at: nprm@piper.com. Pertinent comments and suggestions will be utilized throughout this NPRM process.

Respectfully Submitted,



Simon Caldecott
President and Chief Executive Officer