

October 11, 2024

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: Comments to the Notice of Proposed (NPRM), Docket No. FAA-2024-2142,
Project Identifier AD-2024-00033-A

I am an owner of a PA-28R-201 that will be affected by this NPRM. I am also a Ph.D. candidate in the school of Computer, Data & Information Sciences at the University of Wisconsin–Madison.

The FAA's inspection and replacement schedule proposed under this NPRM is not grounded in correct statistical analysis of wing spar failures, nor is it consistent with the US Department of Transportation's guidance on valuing actions taken to prevent fatalities.

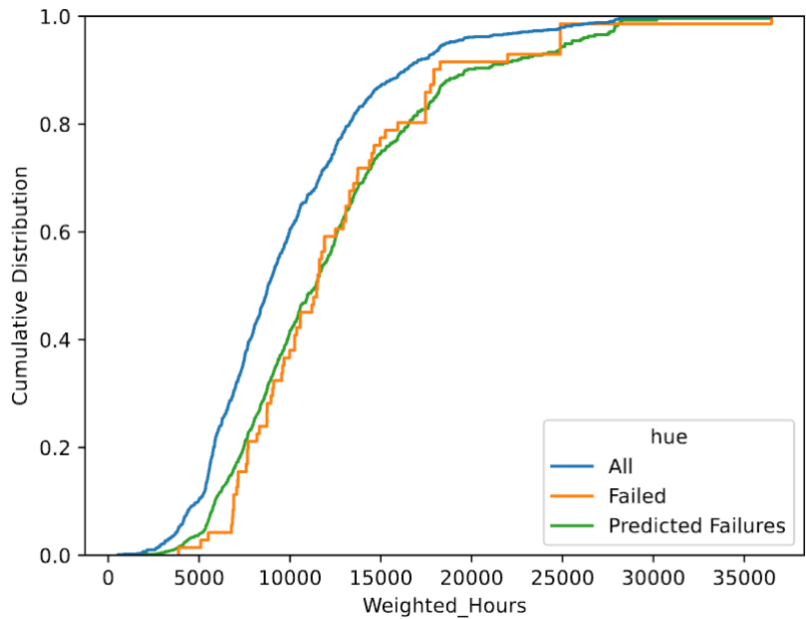
Fatigue vs. occurrences as a cause of wing spar failure

As Piper Aircraft, Inc. has noted in their comment (<https://www.regulations.gov/comment/FAA-2024-2142-0008>), virtually all wing spar failures that have been investigated have been the result of specific occurrences or extreme conditions under which aircraft are operated. Such a failure mode is not consistent with spar life limits as proposed under this NPRM.

SAIB 2022-20 initially used anecdotal data (with a notable lack of any statistical analysis) to argue that wing spar failures are a result of fatigue and therefore warrant life limits. I doubted the correctness of this statement and, in October 2022, made a FOIA request for all spar inspection results. After receiving this data over one year later, I performed a statistical analysis of failed inspections to evaluate whether failures result from fatigue or random occurrences such as hard landings, wing strikes, etc.

I evaluated observed spar failures under the assumption that failures are *random* in time, and occur with some mean time between failures (i.e., not the same as fatigue, which would be characterized by an increasing rate of new failures beyond some point). I fit a statistical model to the actual observed failure rate and plotted cumulative spars, failures, and expected failures by CSH.

Result: The MTBF of PA28 wing spars is 510,000 hours. In terms of rate of inspection failures, the actual hazard ratio between commercial and non-commercial hours is 1.17, not the 2, 3, or 17 figures used in prior SBs and ADs. The resulting distribution of failures is plotted below:



Here, we see that by simulating failures under an assumed model of random occurrences (e.g., hard landings), the number of inspection failures predicted almost perfectly lines up with those seen in practice.

My results further support the findings by Piper Aircraft, Inc., who noted that they performed extensive reliability analysis that was not in support of the AD requirements as proposed in the NPRM.

Conclusions/Recommendations:

- Observed inspection failures are consistent with a memoryless, occurrence-based failure mode. This also reinforces Piper’s statistical analysis, and their analysis of the actual observed accident and inspection failure planes. Such an occurrence-based model is not consistent with life limits as proposed in the AD.
- The inspection MTBF of PA28 wing spars is 510,000 hours. The ratio of MTBFs for commercial and non-commercial hours is 1.17, far lower than the 2-3 used in the AD. The AD excessively punishes owners of aircraft with commercial histories. All limits and intervals in the AD should be raised in a lower CSH ratio should be used.
- Under the occurrence model (as validated by this analysis and Piper’s) spars can fail at any time, so initial inspection delays are not warranted. If there is to be an AD enacted (which the comment from Piper strongly suggests should not occur), then initial inspection delays are not warranted.

AD Cost and DOT VSL guidance

The FAA, operating under the Department of Transportation, ought to follow DOT guidance when estimating the cost and benefit of a given rulemaking action. The NPRM fails to

provide an overall estimate for compliance costs even though, owing to initial inspection requirements, the approximate age of the fleet is known. However, analyzing the data from Piper Aircraft, Inc., we see that a reasonable estimate for overall cost to the fleet is approximately \$1.5 billion. This figure is equal to 113 times the DOT Valuation of a Statistical Life. Given the rate of spar failures is stable or even declining, it is highly unlikely that this AD will prevent even a tenth this many fatalities. Its cost/benefit ratio is therefore entirely inconsistent with the guidance set out by the FAA's own parent agency.

Conclusions

The FAA's decision to propose an AD that is even more conservative than Piper's own SB is not based in statistical fact, concrete observation of observed failure modes, or its own mandates on safety. It is especially concerning that the FAA has been overtly opaque on the entire management of PA28 wing spar safety: SAIB 2022-20 presented unfounded and anecdotal attacks on the PA28 spar's safety record; my FOIA request was delayed for over a year to provide an internally-available spreadsheet; and the FAA has now overstated its collaboration with Piper, rejected rigorous data provided by Piper, and made recommendations that are not self-consistent.

I urge the FAA to reject this proposed AD and develop a plan that is consistent with factual analysis and the public interest.

Respectfully,

Eric Pauley