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Subject: WPR23LA128 Structures Report

Contact: Clinton Crookshanks, Structures Engineer, NTSB

Mr. Crookshanks evaluated pictures of the accident airplane and provided the following observations.

The wing is a one-piece carbon fiber replacement that was installed on the airplane around 2000. The left wing and aileron separated during the accident.

The aileron is connected to a torque tube that runs along the aft side of the rear spar into the fuselage. The torque tube passes through an inboard trailing edge rib at the wing root and an outboard trailing edge rib adjacent to the inboard end of the aileron. The trailing edge is made from carbon fiber skins with a foam core. The mostly intact aileron, attached torque tube, and both trailing edge ribs separated from the wing and the torque tube fractured from the bellcrank in the fuselage (figures 1 and 2).



Figure 1 - Left Aileron and Torque Tube (Courtesy of Pilot)



Figure 2 - Left Wing (Courtesy of Pilot)

The intact carbon fiber outboard trailing edge rib remained with the torque tube. There was no apparent damage to the outboard trailing edge rib carbon laminate. The forward halves of the upper and lower flanges and the forward flange of the outboard trailing edge rib were separated cleanly from the wing consistent

with an adhesive type failure at the interface between the carbon and adhesive (figures 3-5).

The aft halves of the upper and lower flanges of the outboard trailing edge rib were separated from the trailing edge skins with a cohesive type failure through the adhesive (figures 3 and 5). The lower flange also had evidence of foam core material in the bond line (figure 6). There was excess adhesive on the inboard side of the outboard trailing edge rib (figure 7). In contrast the inboard trailing edge rib was fractured through the carbon and the remaining upper and lower flanges had portions of the wing structure substrate still attached. There was not a failure in the bond line at the inboard trailing edge rib. There was no damage to the outboard aileron pin. The aileron torque tube was bent aft near its attach point to the aileron.

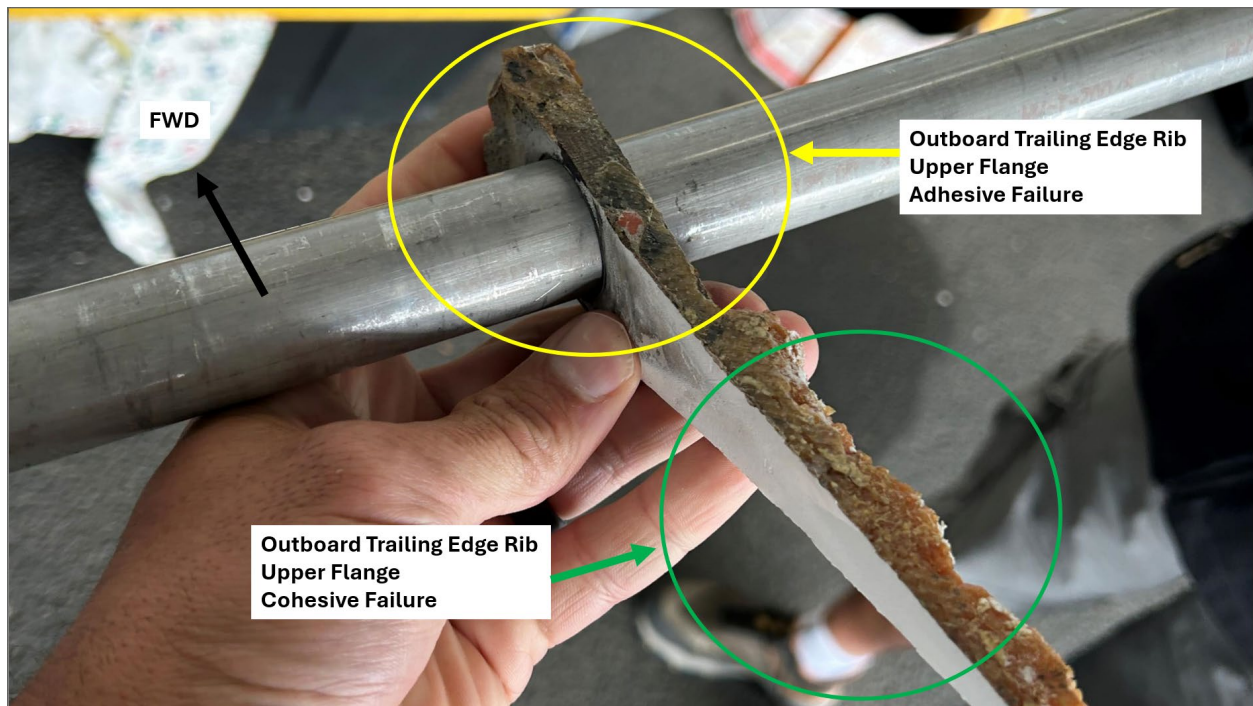


Figure 3 - Outboard Trailing Edge Rib Upper Flange (Courtesy of Pilot)



Figure 4 - Outboard Trailing Edge Rib Forward Flange (Courtesy of Pilot)

**Outboard Trailing Edge Rib
Upper Flange
Cohesive Failure**



**Outboard Trailing Edge Rib
Lower Flange
Adhesive Failure**

Figure 5 - Outboard Trailing Edge Rib Lower Flange (Courtesy of Pilot)



Figure 6 - Lower Wing Skin (Courtesy of Pilot)



Figure 7 - Outboard Trailing Edge Rib Forward Flange (Courtesy of Pilot)

The left wing separated mostly intact during the accident. The upper trailing edge skin was separated and not recovered above the location of the aileron torque tube. The upper trailing edge skin was torn at the forward end, separated along the skin bond at the trailing edge, and fractured through the foam core in the middle. The main spar fractured just outboard of the attach bracket. The photos show fiber tearing and crushing consistent with overload failure (figure 8). The aft spar attach bolt pulled inboard through the wood lug in double shear and fractured the carbon fiber face sheet on the aft side (figure 9). The carbon fiber face sheet on the forward side was not fractured and was damaged consistent with the head of the bolt or nut pulling through. The aft spar attach bolt remained intact in the fuselage lug.



Figure 8 - Main Left Wing Spar Separation (Courtesy of Pilot)



Figure 9 - Aft Spar Attachment (Courtesy of Pilot)

The available evidence suggests that the outboard trailing edge rib failed along the bond lines between the rib, rear spar, and trailing edge skins. There was evidence of foam core in the bond line. There was no obvious evidence of preexisting cracking in the bond line evident in the photos.