

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



September 28, 2022

MATERIALS LABORATORY FACTUAL REPORT

Report No. 22-070

A. ACCIDENT INFORMATION

Place : Marathon, Florida
Date : December 29, 2021
Vehicle : Cessna 207, N1596U
NTSB No. : ERA22LA097
Investigator : Adam Gerhardt, AS-ERA

B. COMPONENTS EXAMINED

Number 2 connecting rod assembly and bearing pieces and bearings from the numbers 1 and 3 connecting rods from a Continental IO-520-F engine.

C. DETAILS OF THE EXAMINATION

An overall view of the submitted number 2 connecting rod assembly and bearing pieces and bearings from the numbers 1 and 3 connecting rods are shown in figure 1. The number 2 connecting rod assembly was fractured in multiple locations at the big end of the assembly. The bearing halves for the number 3 connecting rod were darkened near the middle of the bearing around the circumference, and displaced and smeared babbitt material was observed on the interior surfaces. The bearing halves for the number 1 connecting rod had a nominal appearance with no indication of abnormal wear or damage.

The number 2 connecting rod beam and small end portions had a mix of white and orange deposits and oxides on the surfaces consistent with exposure to sea water.¹ However, the big end of the connecting rod was tinted black consistent with exposure to high heat during operation. The number 2 bearing was mostly missing, and the submitted recovered pieces were thinned, fractured, and severely deformed with dark heat tinting. The interior faces at the big end of the connecting rod were tinted a dark color, particularly on the beam side of the surfaces, and showed circumferential scoring and smeared metal (see figures 2 and 3).

The connecting rod bolts were fractured in multiple locations. Fracture features on the bolts were relatively rough consistent with ductile overstress fracture.

¹ Following engine failure, the accident airplane ditched in the Florida Bay near Marathon, Florida.

The cap fractured into two pieces as shown in figure 3. Much of the fracture surfaces were damaged by post fracture contact, and most of the remaining surface had rough features consistent with ductile overstress fracture. However, one area had relatively flat features with a smoothly curving boundary as shown in figure 4, features consistent with fatigue. The fatigue features emanated from a relatively broad origin area at the interior surface as shown in figure 4. The dashed line in figure 4 indicates the fatigue boundary, and the total area of the fatigue region represented less than 5 percent of the total cross-sectional area.

The connecting rod was also fractured through the straps on either side of the beam. The straps were arbitrarily labeled "A" and "B" as indicated in figure 2. Mating sides of the strap A fracture are shown in figure 5. Both sides of the fracture were substantially damaged by post fracture impacts. However, remaining fracture features showed flat fractures with curving arrest lines, features consistent with fatigue. Fatigue features emanated from multiple origins on the interior surface and from at least one origin area on the exterior surface. Unlabeled arrows in figure 5 indicate approximate locations of fatigue origins, including damaged areas where the origin location was estimated based on features observed on the mating fracture face. The fatigue cracks emanating from the interior and exterior surfaces appeared to intersect near the middle of the strap cross-section through the thickness at the location indicated with a dashed line. The entire extent of the fatigue boundary and other likely origin areas were obliterated by post fracture damage to both sides of the fracture.

Mating sides of the strap B fracture are shown in figure 6, where features similar to the strap A fracture were observed. Both sides of the fracture were substantially damaged by post fracture impacts. However, remaining fracture features showed areas with flat fractures with curving boundaries, features consistent with fatigue. Fatigue features emanated from at least one origin on the interior surface and from multiple origins on the exterior surface. Unlabeled arrows and brackets in figure 6 indicate approximate locations of fatigue origins, including damaged areas where the origin location was estimated based on features observed on the mating fracture face. The fatigue cracks emanating from the interior and exterior surfaces intersected near the middle of the strap cross-section through the thickness, but rougher features were observed near the outer edges consistent with ductile overstress fracture of the remaining ligament. The entire extent of the fatigue boundaries and other likely origin areas were obliterated by post fracture damage to both sides of the fracture.

Matthew R. Fox, Ph.D.
National Resource Specialist - Materials



Figure 1. Overall view of the submitted number 2 connecting rod and bearing pieces and bearings from the numbers 1 and 3 connecting rods.

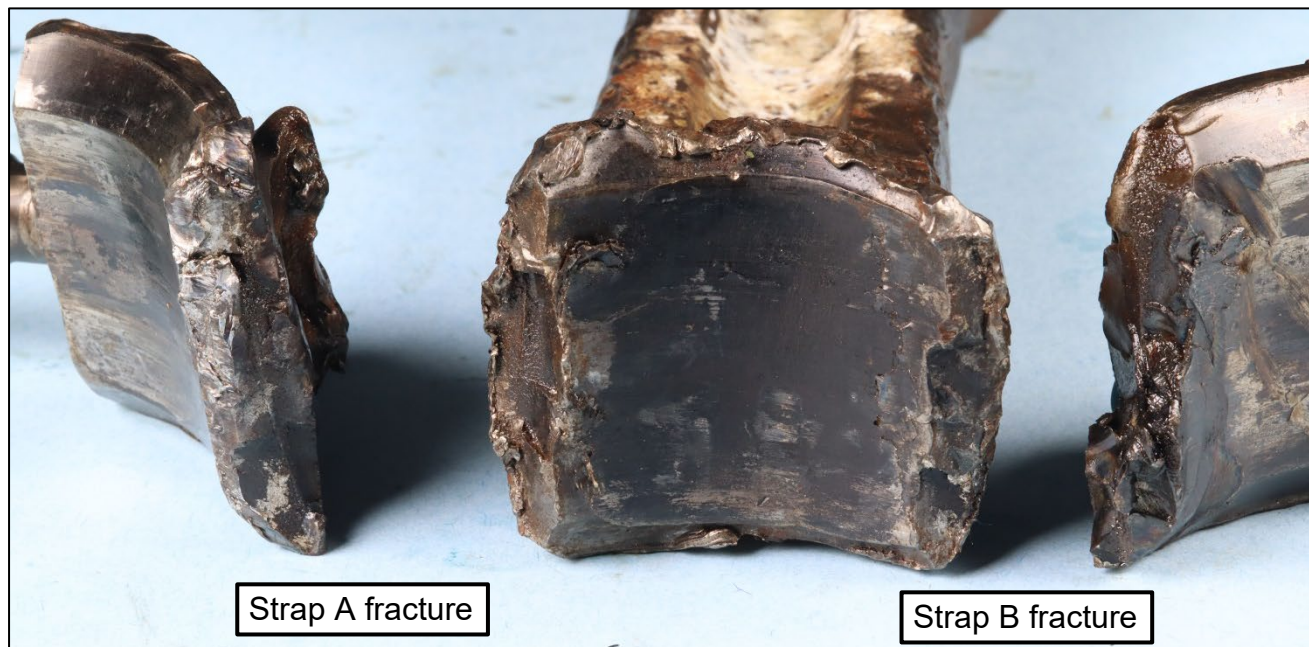


Figure 2. Interior surfaces at the big end of the number 2 connecting rod.



Figure 3. Interior surface of the fractured number 2 connecting rod cap.

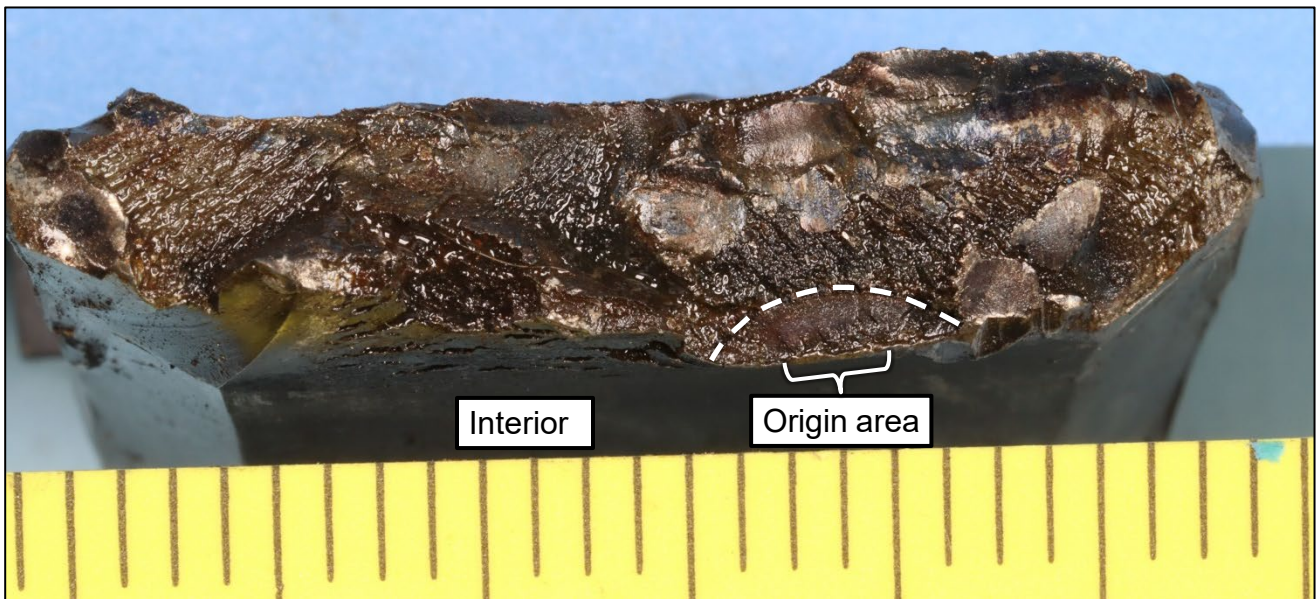


Figure 4. Fracture surface of the number 2 connecting rod cap. A dashed line indicates the boundary of a fatigue region.



Figure 5. Mating fracture faces on strap A of the number 2 connecting rod. Dashed lines indicate partial fatigue boundaries, and arrows indicate approximate origin areas.

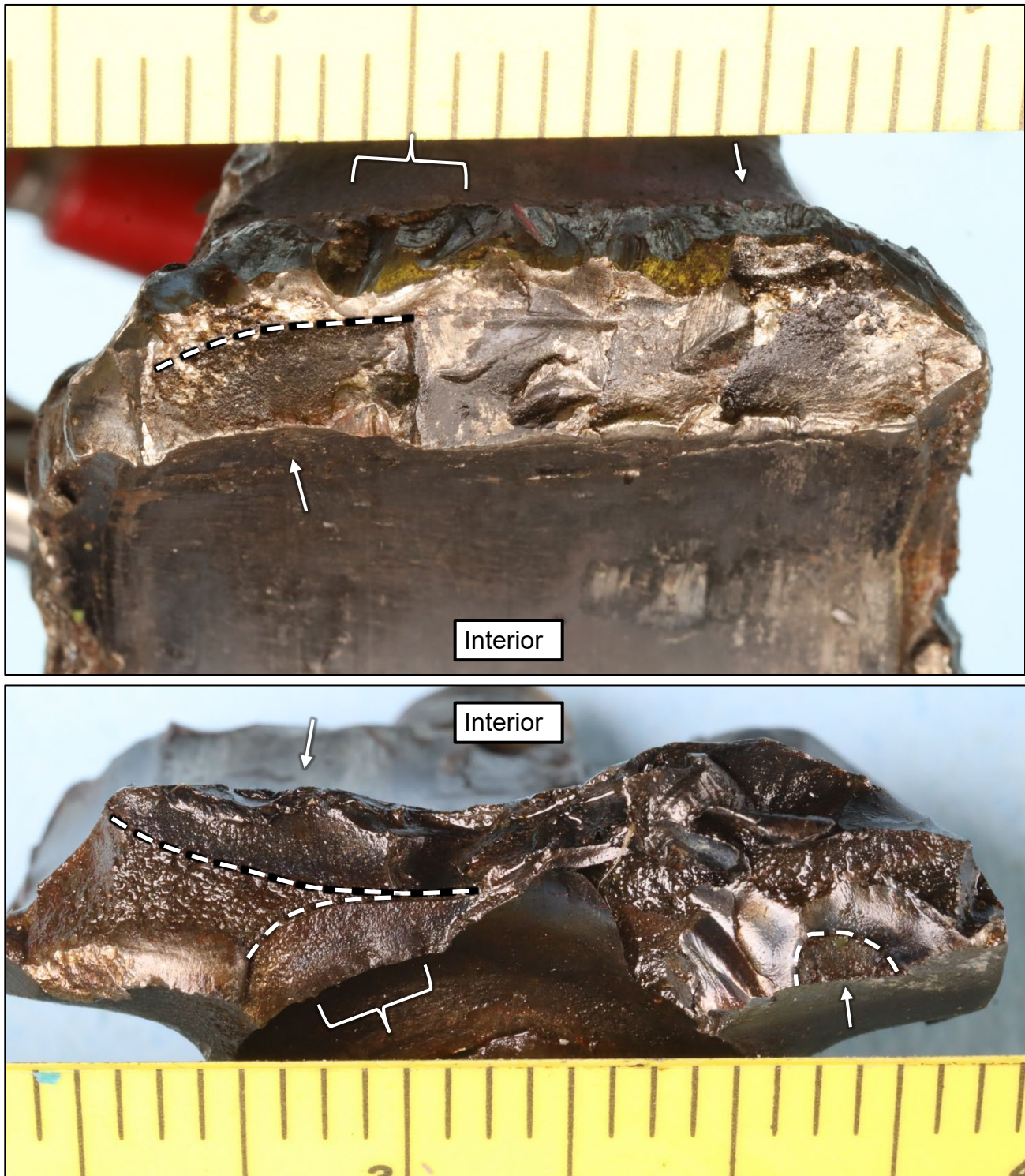


Figure 6. Mating fracture faces on strap B of the number 2 connecting rod. Dashed lines indicate partial fatigue boundaries, and arrows and brackets indicate approximate origin areas.