

NATIONAL TRANSPORTATION SAFETY BOARD

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



August 31, 2020

MATERIALS LABORATORY FACTUAL REPORT

Report No. 20-046

A. ACCIDENT INFORMATION

Place : Welch, Louisiana
Date : July 2, 2020
Vehicle : Robinson R44, N7511D
NTSB No. : CEN20LA286
Investigator : Courtney Liedler, AS-CEN

B. COMPONENTS EXAMINED

Tail rotor gearbox assembly.

C. DETAILS OF THE EXAMINATION

An overall view of the submitted tail rotor gearbox assembly is shown in figure 1. The four bolts attaching the gearbox housing to the input shaft housing were fractured as shown in figure 2 (black arrows). The forward portions of the four fractured bolts including the bolt heads remained within the attachment holes of the input shaft housing, and safety wire remained attached to the heads.

A close view of each bolt fracture surface is shown in figure 3. The fracture surfaces had uniform matte gray features consistent with ductile overstress fracture. The bolt fractures were generally deformed consistent with fracture under shear loads. Unlabeled arrows in figure 3 indicate the direction of motion associated with the mating side of the fracture relative to the aft side of the fracture shown. The edges of the holes at the upper, right, and lower attachment locations showed sliding contact damage on the sides of the holes as indicated in figure 3 consistent with contact with the mating sides of the fractures. The overall shear deformation pattern was consistent with the tail rotor gearbox housing rotating clockwise (as viewed looking aft) relative to the input housing. This clockwise rotation of the gearbox housing is also consistent with the outboard end of the output shaft displacing downward relative to the housing.

Sliding contact marks corresponding to contact with the tail rotor gearbox input gear were observed on the interior surface of the housing as indicated by white arrows in figure 2. The sliding contact marks were oriented primarily in the longitudinal direction, consistent with little or no rotation to the input gear as the aft portion of the tail rotor gearbox assembly separated from the input shaft housing.

Matthew R. Fox, Ph.D.
Senior Materials Engineer

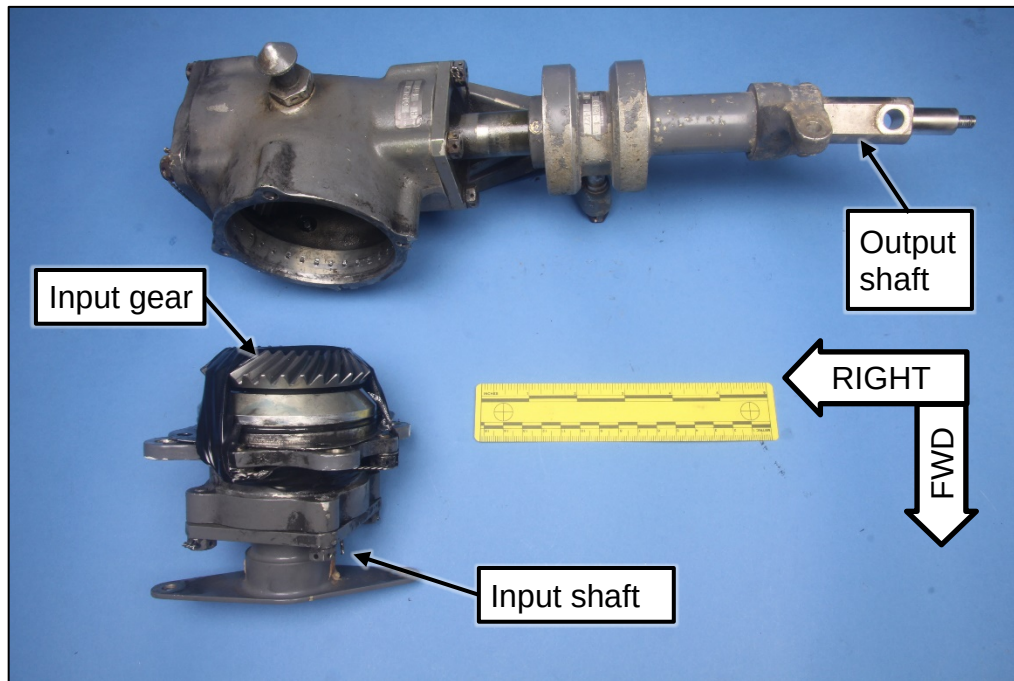


Figure 1. Overall view of the submitted tail rotor gearbox assembly.

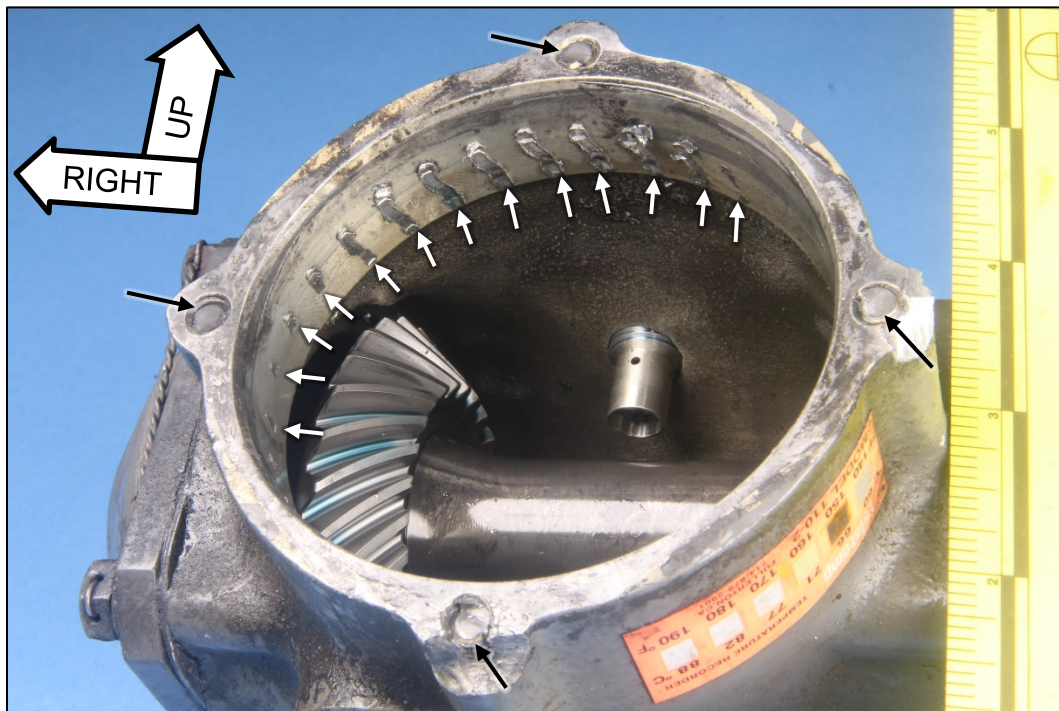


Figure 2. Forward end of the tail rotor gearbox housing showing four fractured attachment bolts (black arrows) and sliding contact marks on the interior surface (white arrows).

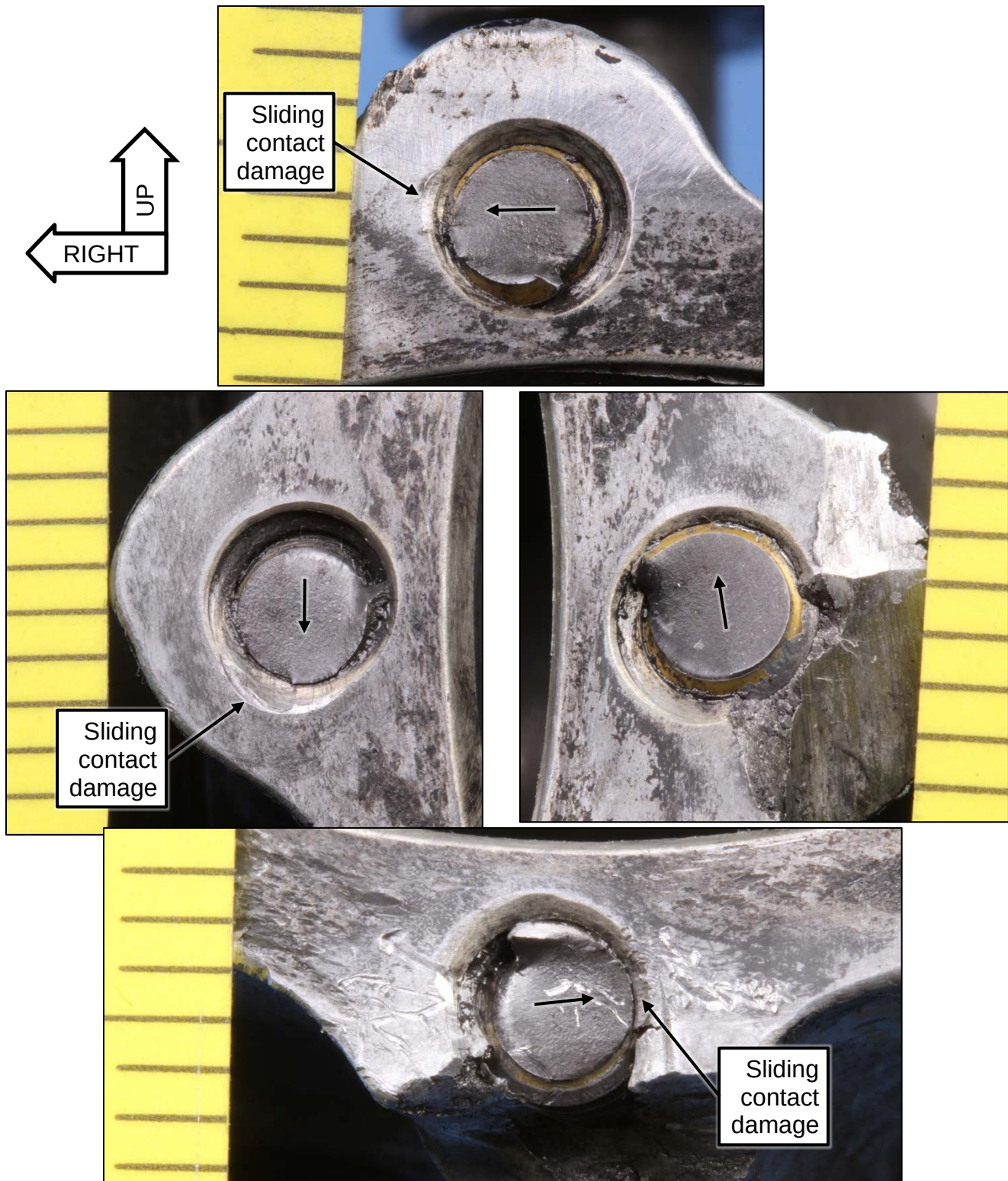


Figure 3. Close views of the fractured tail rotor gearbox housing attachment bolts. Unlabeled arrows indicate the direction motion of the mating side of the fracture relative to the fracture surface shown.