

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR22LA340

MATERIALS LABORATORY

Factual Report 23-007

January 24, 2023

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A. ACCIDENT INFORMATION

Location: Banning, California
Date: September 10, 2022
Vehicle: Bell 206L-1, N242BH
Investigator: Fabian Salazar, AS-WPR

B. COMPONENTS EXAMINED

Tail rotor drive shaft assembly pieces.

C. EXAMINATION PARTICIPANTS

Specialist Matthew R. Fox, Ph.D.
NTSB
Washington, DC

D. DETAILS OF THE EXAMINATION

An overall view of the submitted components are shown in the upper image in figure 1. The components included tail rotor drive components including a driveshaft assembly with an intact flex coupling at one end and a separated coupling at the other end. A diagram showing the properly assembled components of the separated coupling is shown at the middle right in figure 1. Two fractured bolt pieces with attached nuts remained trapped within the flange on the pulley side of the coupling as shown in the middle left image in figure 1. No washers were installed between the nuts and the flange at either location. Six washers, a bolt piece, and a nut recovered from the helicopter tail boom were also included as shown in figure 1.

The fracture surfaces of the bolt pieces trapped in the pulley flanges had relatively flat features with curving crack arrest lines across most of the fracture surfaces, features consistent with fatigue fracture. A close view of one of the bolt fracture surfaces is shown in the lower right image in figure 1. Ratchet marks consistent with multiple fatigue origins were located on one side of the bolt as indicated with a bracket. A mating fracture surface was observed on the recovered bolt head piece as shown in the lower left image in figure 1 as evidenced by the corresponding shapes of the ratchet marks and crack arrest lines. Although orange and dark red oxides formed in different locations on each fracture, these oxides were consistent with post-fracture oxidation.

One flange of the pulley was cut using a handheld bandsaw to liberate the nut end of the bolt piece that mated to the recovered head piece. The length of the shank from the nut clamping face to the fracture origin was 0.097 inch. On the head side, the shank length from the underside of the head to the fracture origin was 0.397 inch, for a total bolt shank length of 0.494 inch between the clamping faces of

the head and the nut. The thickness of the pulley flange was 0.164 inch, and the thickness of the flange on the drive shaft assembly was 0.161 inch. For reference, the total thickness of the drive ring adjacent to one of the bolts on the intact coupling was 0.119 inch.

The six recovered washers shown in the upper image in figure 1 consisted of 4 washers that were relatively thicker than the remaining 2 washers. The thicker washers were approximately 0.058 inch thick, and the thinner washers were approximately 0.029 inch thick.

Four washers are specified for use on each bolt attaching the pulley flanges to the drive ring on the coupling as shown in the diagram in figure 1. The specified washers have two thicknesses; the thinner washer has a specified nominal thickness of 0.032 inch, and the three thicker washers have a specified nominal thickness of 0.063 inch.

Submitted by:

Matthew R. Fox, Ph.D.
Chief Technical Advisor - Materials

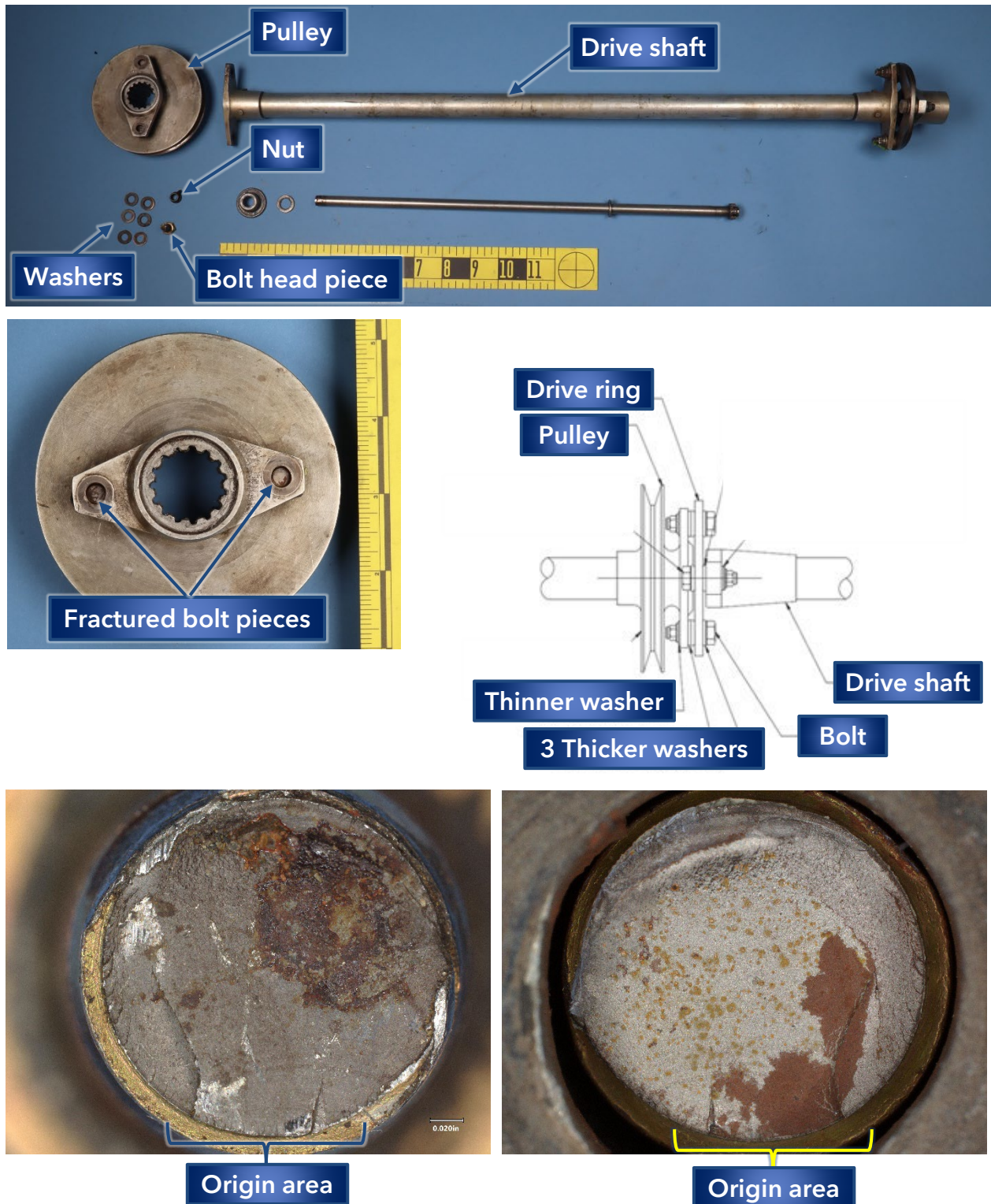


Figure 1. Overall view of the submitted components (upper image). The middle left image shows the bolt fractures trapped in the pulley flange, and the middle right image shows an assembly diagram. Mating fractures on the recovered bolt head piece and one of the bolt pieces trapped in the pulley flange are shown in the lower left and right images, respectively.