

NATIONAL TRANSPORTATION SAFETY BOARD

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



September 2, 2014

MATERIALS LABORATORY FACTUAL REPORT

Report No. 14-061

A. ACCIDENT INFORMATION

Place : Middle Grove, New York
Date : August 27, 2013
Vehicle : Lake Model 250, N522WB
NTSB No. : ERA13LA382
Investigator : Timothy W. Monville, AS-ERA

B. COMPONENTS EXAMINED

Piston, connecting rod, connecting rod bolt, and nut from the number 6 cylinder of a Lycoming IO-540-C4B5 engine.

C. DETAILS OF THE EXAMINATION

An overall view of the submitted components is shown in figure 1. The connecting rod was fractured through one side of the the strap at the crankshaft end of the connecting rod. The strap segment on the other side of connecting rod was deformed inward, and a fractured connecting rod bolt was trapped in the deformed strap segment. A deformed connecting rod nut was also received as shown in figure 1. The connecting rod cap, mating fractured strap segment, connecting rod bolt, connecting rod nut, and head end of the fractured connecting rod bolt were not included in the submitted components.

A view of the fractured end of the connecting rod as received is shown in figure 2. The deformed strap segment was deformed such the fractured end of the trapped connecting rod bolt contacted the fracture face of the fractured strap segment. The area of the fracture at the bolt contact area indicated in figure 2 was obliterated, and the surface was worn smooth.

The deformed segment of the strap was cut from the remainder of the connecting rod to facilitate cleaning and further examination of surface features. After cutting, the connecting rod bolt was free to slide out of the deformed strap segment. The connecting rod pieces and the connecting rod bolt were cleaned using soapy water and a soft-bristle brush followed by rinsing with alcohol.

A close view of the cleaned fracture surface for the fractured strap on the connecting rod is shown in figure 3. Relatively smooth fracture features with curving crack arrest marks were observed on the fracture surface, features consistent with

fatigue fracture. Four brackets in figure 3 indicate fatigue origins located at both the outer and inner faces of the strap. One bracket in figure 3 indicates the area of the fracture that was obliterated by wear from contact with the fractured end of the connecting rod bolt trapped in the deformed strap segment. Dashed lines in figure 3 indicate the approximate boundaries of the fatigue crack features. The fatigue crack features extended across nearly the entire fracture surface.

A view of the split line face on the deformed strap segment is shown in figure 4 after cutting the segment from the rest of the connecting rod and cleaning. Fretting damage, as indicated with arrows in figure 4, was observed on the face. The hole for the connecting rod bolt was enlarged, deformed around the edges, and worn smooth consistent with contact with the trapped connecting rod bolt.

A view of the cleaned connecting rod bolt after removal from the strap is shown in figure 5. The bolt was fractured adjacent to the larger-diameter section of the grip. Fracture features were mostly on a slant plane and were relatively rough in the transverse portion of the fracture, features consistent with ductile overstress fracture. Brackets in figure 5 indicate areas of the threads adjacent to the grip where the thread peaks were worn. The areas of worn thread peaks corresponded to contact with the worn areas around the bolt hole in the deformed strap segment. Threads at the end of the bolt were intact and showed no evidence of impact or wear damage.

A close view of the connecting rod nut is shown in figure 6. The nut was impacted and deformed mainly on the clamping face and the opposite face of the nut. The nut remained intact around the circumference, and intact threads were observed on the interior of the nut as shown in figure 6.

Engine log books indicated that the engine had been overhauled and installed with zero hours time since major overhaul (TSMOH) on December 15, 2011. On June 12, 2012, leaks were noted at the number 4 and number 6 cylinder through bolts at a time of 43.4 hours TSMOH. An annual inspection was conducted on June 21, 2013, and the log book entry noted the engine had accrued 141.3 hours TSMOH.

Matthew R. Fox
Senior Materials Engineer

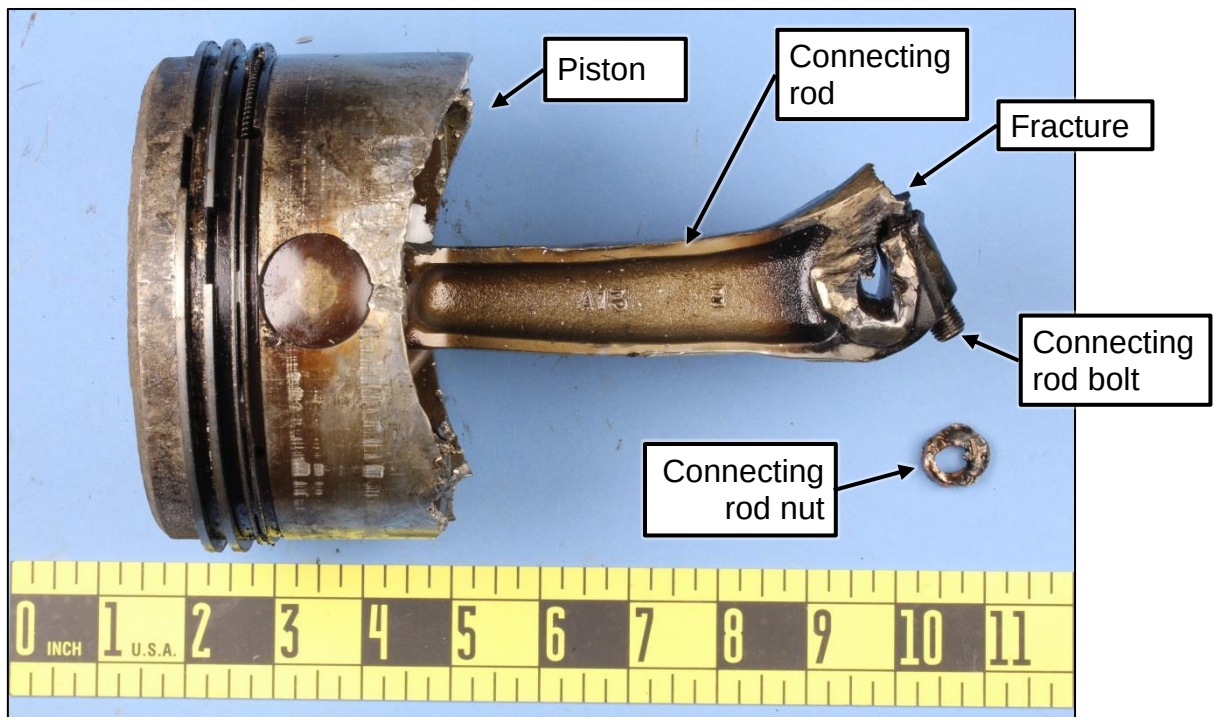


Figure 1. Overall view of the submitted components.

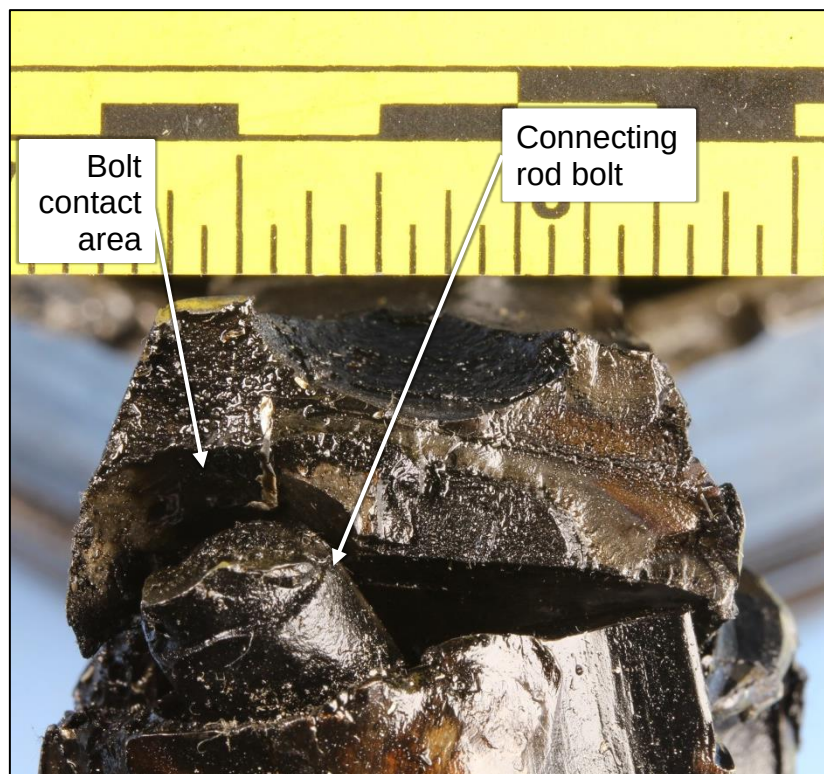


Figure 2. View of the fractured end of the connecting rod bolt as received.

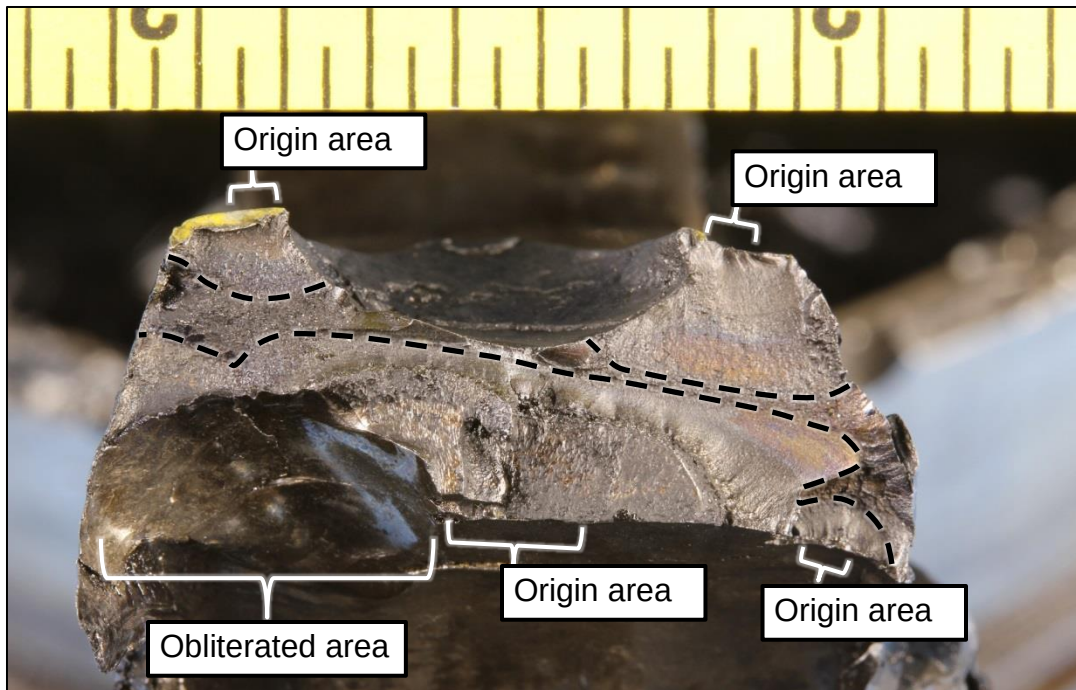


Figure 3. View of the connecting rod fracture after cutting away the deformed strap segment and cleaning the fracture. Dashed lines indicate fatigue boundaries and brackets indicate fatigue origin areas and an area obliterated by wear.



Figure 4. View of the split-line face for the intact strap segment after cutting and cleaning. Arrows indicate areas of fretting damage on the surface.



Figure 5. View of the connecting rod bolt piece after removal from the connecting rod and cleaning. Brackets indicate areas of worn thread peaks.



Figure 6. Close view of the connecting rod nut showing intact internal threads.