

NATIONAL TRANSPORTATION SAFETY BOARD

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



September 5, 2017

MATERIALS LABORATORY FACTUAL REPORT

Report No. 17-060

A. ACCIDENT INFORMATION

Place : Shoreham, New York
Date : December 11, 2016
Vehicle : Beech A36
NTSB No. : ERA17LA069
Investigator : Daniel Boggs

B. COMPONENTS EXAMINED

Fractured crankshaft from a Continental IO-550-B1A engine.

C. DETAILS OF THE EXAMINATION

Figure 1 shows a photograph of the as-received crankshaft. Main and rod journals were numbered sequentially back to front, starting with main journal number 1 (MJ#1) and rod journal number 1 (RJ#1) on the right side of the page. A fracture intersected the aft radius of main journal number 6 (MJ#6). The forward end of MJ#6 and the propeller flange were not submitted and presumed missing. Visual examination of this crankshaft revealed the surfaces of RJ #6 and RJ#1 exhibited evidence of black-brown tint and a rough texture. The surfaces of RJ#5, RJ#4, and RJ#2 showed evidence of blue tint and contained evidence of metal transfer from the shell bearings. The surfaces of MJ#3 and RJ#2 exhibited a luster appearance and showed evidence of fine circumferential abrasion marks, with no evidence of blue or black tint. A steel wire was inserted into and pushed through the oil lubrication holes for the main and rod journals. No evidence of obstruction was found in the oils holes. The end of the wire that was pushed through the oil holes contained no evidence of metal fragments.

Bench binocular microscope examination of the fracture face revealed crack arrest marks typical of fatigue cracking emanated from the surface of MJ#6, adjacent to the aft radius, in the area indicated by bracket "O" in figure 2. Fatigue propagation was in the general direction indicated by arrows in figure 2. The fatigue crack terminated in the area indicated by dashed lines in figure 2. A portion of the main journal was missing from the area enclosed by a solid line in figure 3. The areas outside of the fatigue zone and the area enclosed by a dashed line in figure 3 contained features typical of overstress separation.

The aft face of the fracture was cut from the main journal to facilitate examination, and was ultrasonic cleaned in Alconox, a commercial detergent. Scanning electron microscope examination of the fracture face revealed the origin of the fatigue crack contained mechanical damage from relative movement between the mating fracture faces that obliterated the fine fatigue crack features. The surface of the main journal was covered with metal deposits. X-

ray energy dispersive spectroscopy analysis of the deposits produced major elemental peaks of zinc and minor elemental peaks of iron, oxygen, and carbon. The fatigue zone contained coarse fatigue striations. The areas outside of the fatigue zone and within the dashed line in figure 3 contained micro-void coalescence features typical of overstress separation.

Hardness testing of the surface of the MJ#2 produced an average hardness value of 73HR30N, typical hardness value for the surface of main and rod journals on a crankshaft.

Frank Zakar
Senior Metallurgist

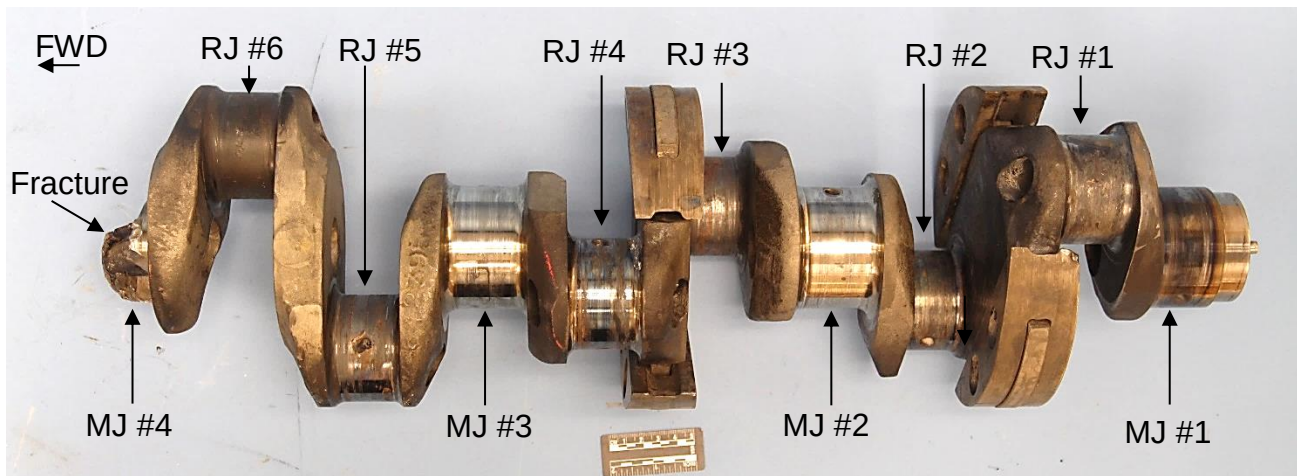


Figure 1. Photograph of the crankshaft that fractured at the aft fillet of main journal number 4 (MJ#4). The forward end of the crankshaft is located on the left side of the page. Main and rod journals are numbered sequentially back to front, starting with MJ#1 and rod journal number 1 (RJ#1) on the right side of the page.

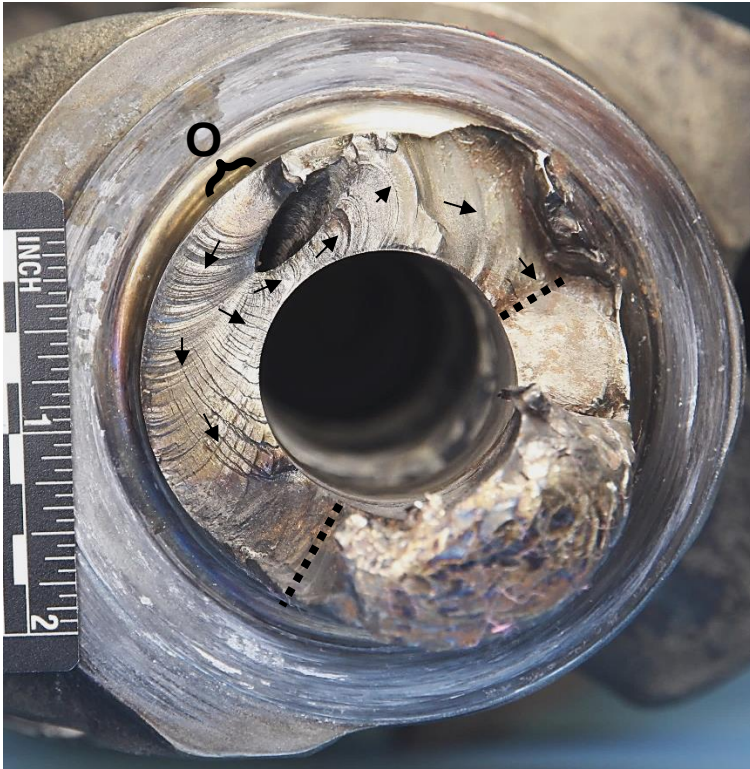


Figure 2. Close-up photograph of MJ#6 fracture face showing a fatigue crack that emanated from the aft radius, in the area indicated by bracket "O".

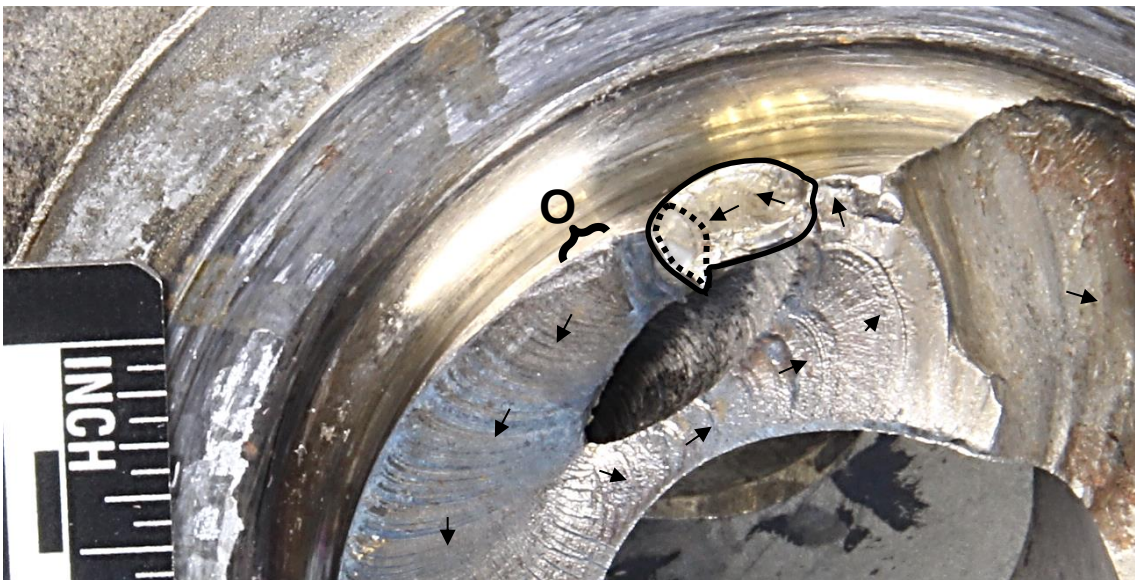


Figure 3. Another close-up view of the MJ#6 in the area of the fatigue crack origin area indicated by bracket "O" in figure 2. A portion of the main journal was missing from the area enclosed by a solid line. The area enclosed by a dashed line contained features typical of overstress separation (micro-void coalescence).