

NATIONAL TRANSPORTATION SAFETY BOARD

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



November 6, 2018

MATERIALS LABORATORY FACTUAL REPORT

Report No. 18-079

A. ACCIDENT INFORMATION

Place : Broomfield, Colorado
Date : May 7, 2018
Vehicle : Cessna 182E, N3292Y
NTSB No. : CEN18LA162
Investigator : Andrew Todd Fox, ASI-CEN

B. COMPONENTS EXAMINED

Nose landing gear torque link assembly, fractured into two pieces, P/N: 0543034-497;
Four wheel yoke attachment bolts;
Fractured piece of attachment block.

C. DETAILS OF THE EXAMINATION

Pieces of a nose landing gear torque link assembly from a Cessna 182E, N3292Y, were submitted to the NTSB Materials Laboratory for examination. The torque link assembly, as it was received by the lab, is shown in figure 1 along with four attachment bolts and a fragment of the nose wheel yoke attachment block. The upper torque link arm was fractured near its upper end. One of the attachment bolts was bent and the block fragment exhibited features consistent with bending overstress.

The fracture in the upper arm is shown, viewed from its left side, in figure 2a and the upper face of the fracture is shown in figure 2b. For convenience, the sides of the arm were labelled "top" and "bottom" as indicated in figure 2a, as if the link were installed and the gear retracted. As the gear is extended, the link rotates about a bushing at the upper end until an arm (rotation limit arm) near the pivot point hits a stop block. The link was fractured adjacent to the rotation limit arm and, when viewed from the side, exhibited a downward bend. The top side of the link exhibited cracks in the paint along the web and the left and right flanges as shown in figure 2c, consistent with tensile deformation. By contrast, the web and flanges on the bottom side of the link did not exhibit any paint cracks, as indicated in figure 2d.

As otherwise noted, the fracture surface exhibited a rough appearance with 45° shear lips near the outer surfaces, consistent with tensile overload. However, there was a fracture region on the bottom side of the right flange that exhibited a comparatively flat appearance, indicated by the yellow dashed region in figure 2b. That region is shown in greater detail in figure 3a. Examination of the left flange revealed a crack in the bottom

side of the flange in approximately the same longitudinal position as the flat fracture region on the right side. The crack was closed (as opposed to open due to tensile deformation).

The piece of the link assembly with the upper fracture face was cleaned in accordance with standard laboratory protocols and the flat fracture region on the bottom part of the right flange was examined using a scanning electron microscope (SEM). A low magnification image of the flat fracture region is shown in figure 4a. Much of the fracture exhibited features consistent with impact or smearing damage but in some areas, striations consistent with fatigue were observed such as at the location indicated in figure 4a, which is shown in figure 4b. Another area close to the overstress region is shown in figure 4c which also exhibited discernable fatigue striations.

Taken as a whole, the observations were consistent with a downward bending overstress fracture in the upper torque link with preexisting fatigue cracks present on the compressive side of the bending load.

Donald Kramer, Ph.D.
Sr. Materials Engineer

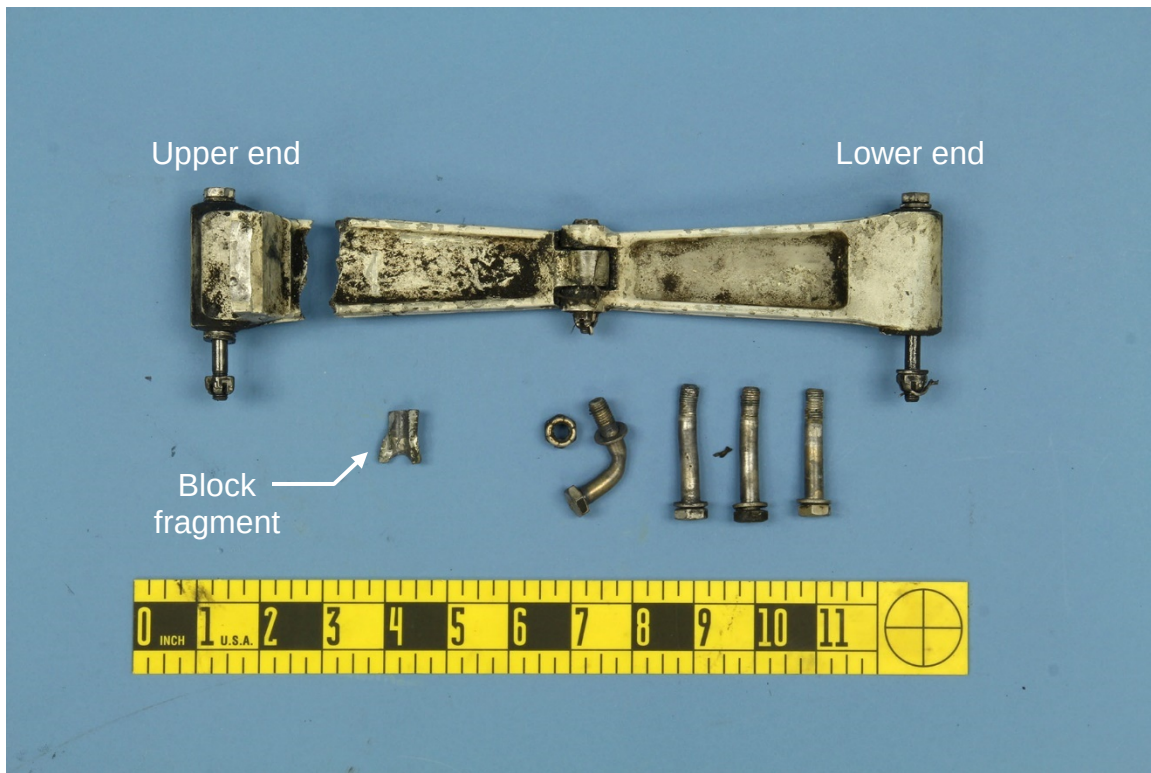


Figure 1: Image of the fractured torque link assembly, nose wheel yoke attachment bolts, and attachment block fragment.

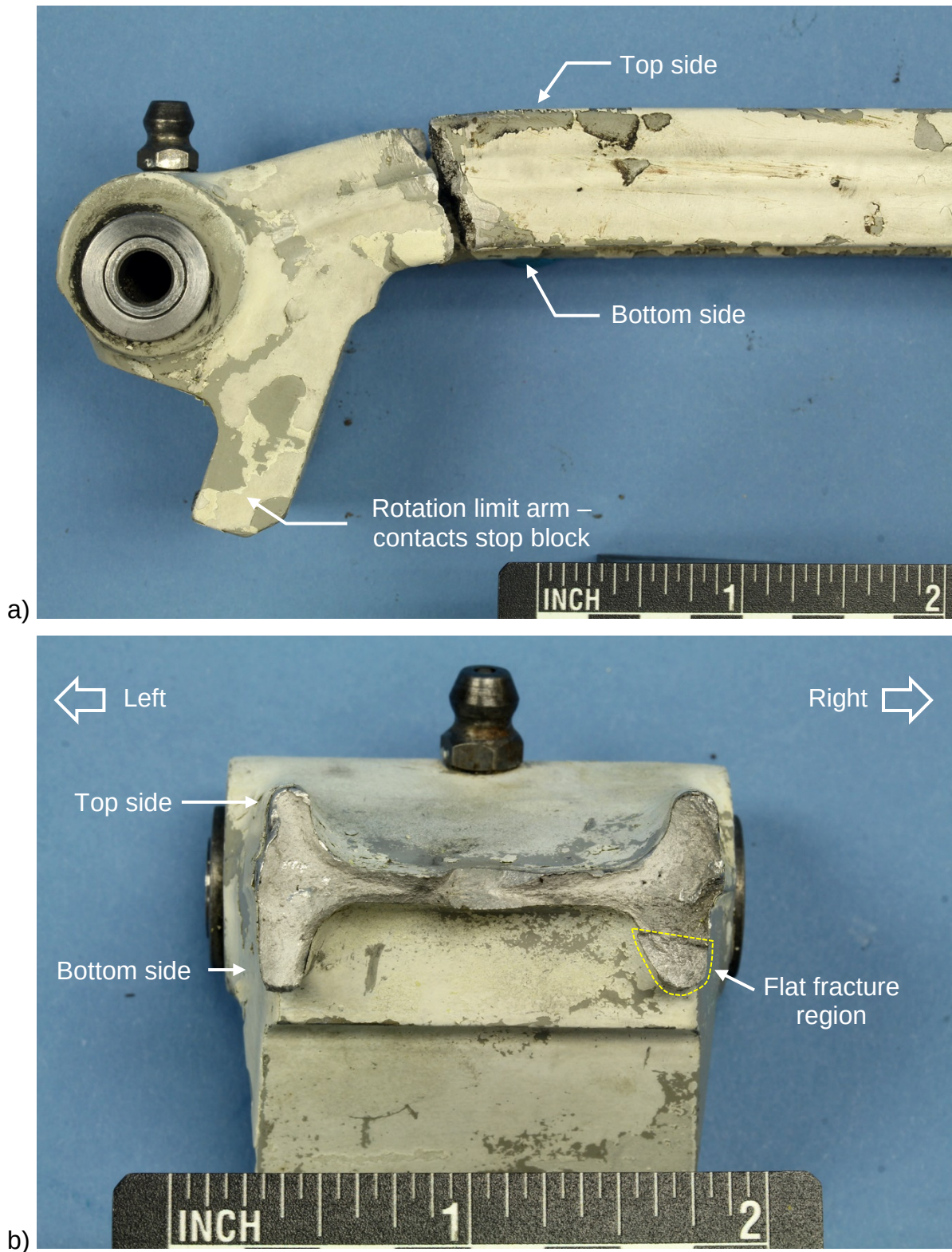
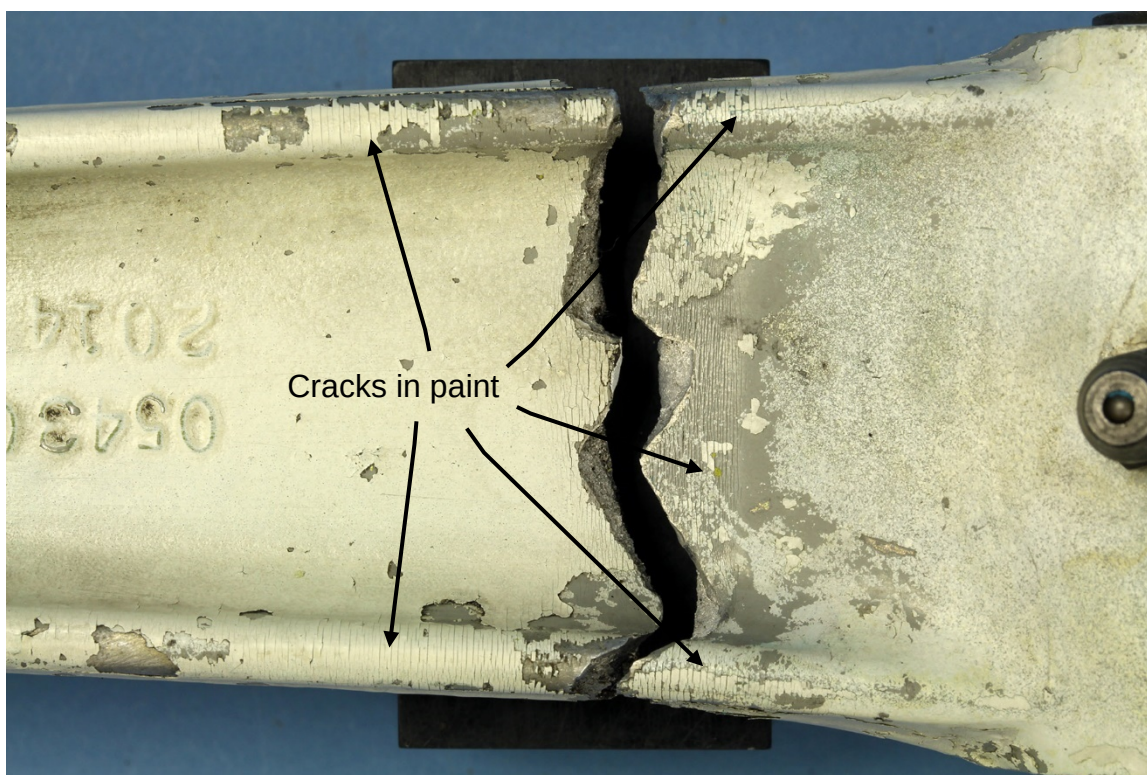


Figure 2: a) Left side view of the torque link assembly showing a downward bend; b) image of the fracture surface;



c)



d)

Figure 2 (cont.): c) image of the torque link assembly top side in the vicinity of the fracture showing cracks in the paint; and d) image of the bottom side in the vicinity of the fracture where no cracks were observed in the paint.

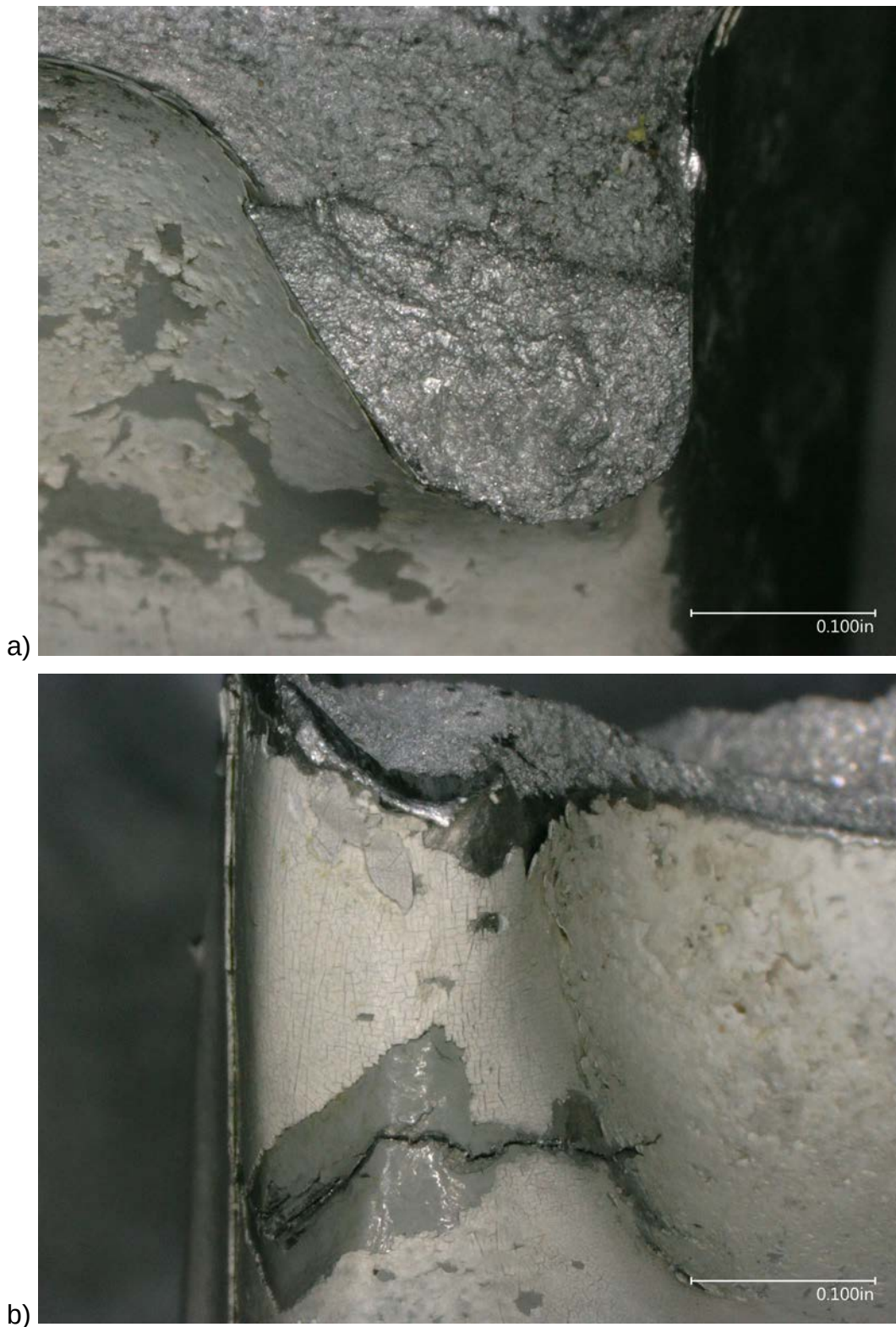


Figure 3: a) Image of the flat fracture region on the right side of the upper link fracture surface and b) side view image of a crack on the left side of the upper link in approximately the same longitudinal location as the fracture on the right side.

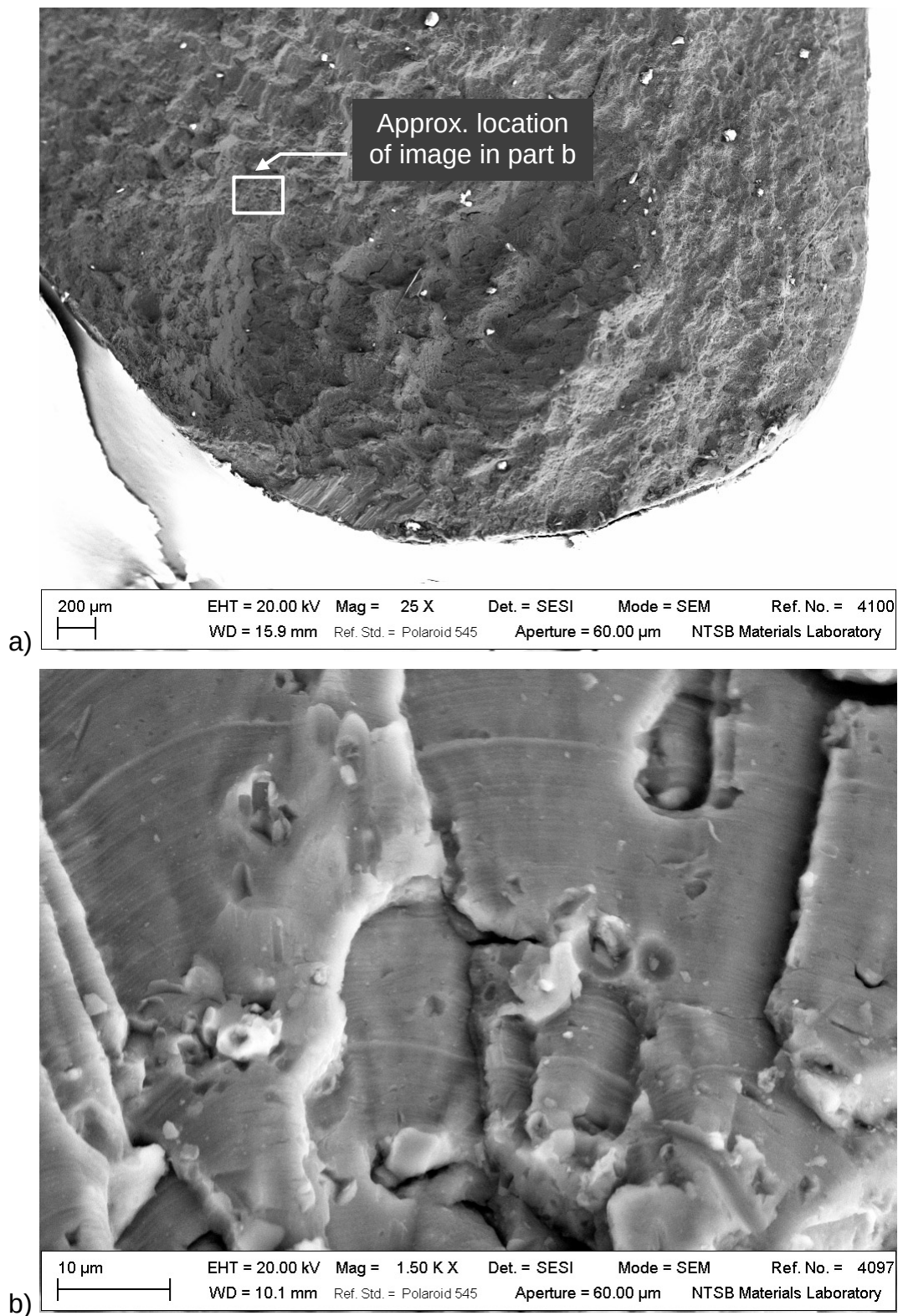


Figure 4: a) Low magnification scanning electron microscope image of the flat fracture region on the right side of the fracture and b) higher magnification image approximately at the location indicated in part a showing fatigue striations.

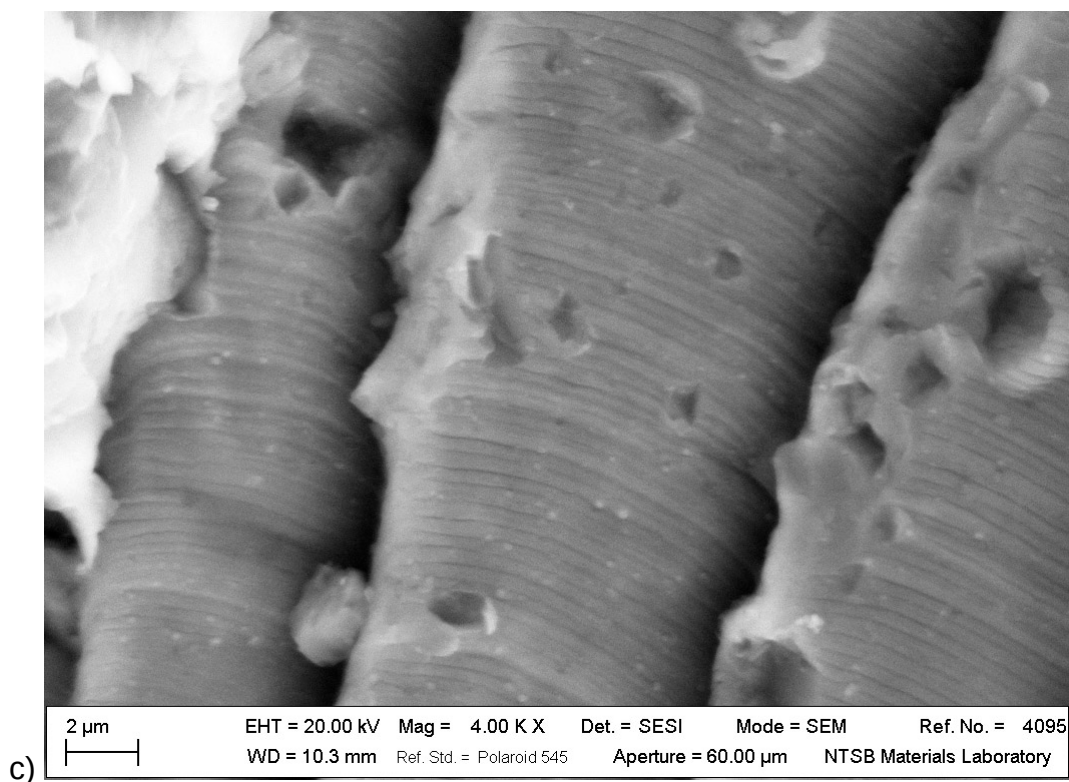


Figure 4 (cont.): c) another region close to the overstress region that also exhibited fatigue striations.