

NATIONAL TRANSPORTATION SAFETY BOARD

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



June 30, 2017

MATERIALS LABORATORY FACTUAL REPORT

Report No. 17-056

1. ACCIDENT INFORMATION

Place : Boise, Idaho
Date : September 21, 2015
Vehicle : Aero Commander 680E, N222JS
NTSB No. : WPR15LA265
Investigator : Samantha Link, AS-WPR

2. COMPONENTS EXAMINED

Parts of rudder pedal assembly
Fragments of rivets

3. DETAILS OF THE EXAMINATION

Figure 1 shows parts from the left rudder pedal, as received. Attached to the pedal was a plastic bag containing six fragments of fractured rivets. The pieces were all from the upset ends (tails) of the rivets. The fracture surfaces of these rivets are shown in Figures 2 and 3. The rivets were arbitrarily labeled 1 through 6 for the purposes of this report.

As shown in Figures 2 and 3, the rivet tail fractures were generally flat, exhibiting visual linear marks consistent with smearing across the fracture face. The side adjacent to each rivet fracture surface exhibited bulging deformation away from the center of the rivet shank. On the diametrically opposite sides, the rivets exhibited deformation patterns inward toward the rivet. These features were consistent with overstress shearing toward the bulged sides.

The rivet fracture surfaces were examined using a scanning electron microscope. Approximately half of each rivet fracture surface exhibited smearing features consistent with post-fracture damage. The undamaged regions of the rivet fracture surfaces exhibited ductile dimple rupture, as typified in Figure 4. The dimple rupture features were oriented in along the direction of the smearing. These features were consistent with shearing overstress.

The chemical composition of the rivets was examined using energy dispersive x-ray spectroscopy. The chemical composition was consistent with a 2000-series aluminum alloy.

Erik Mueller
Materials Research Engineer



Figure 1 – The rudder control pedal and bagged rivet tails, as received.



Figure 2 – The fracture surfaces of tails of rivets 1 through 3, as received.

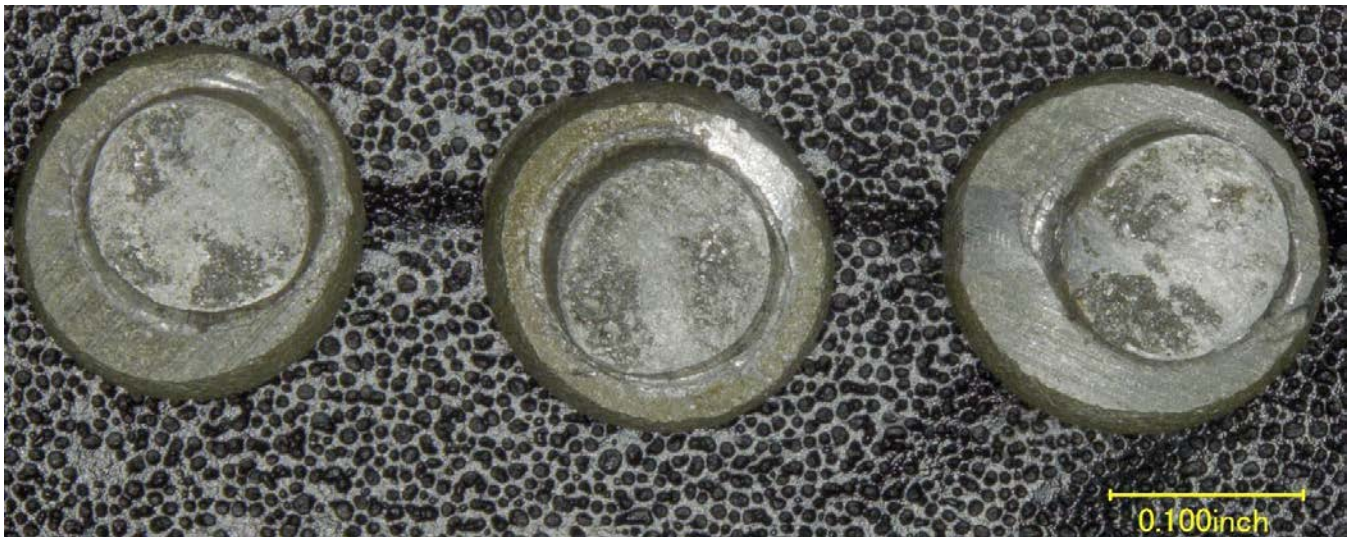


Figure 3 – The fracture surfaces of tails of rivets 4 through 6, as received.

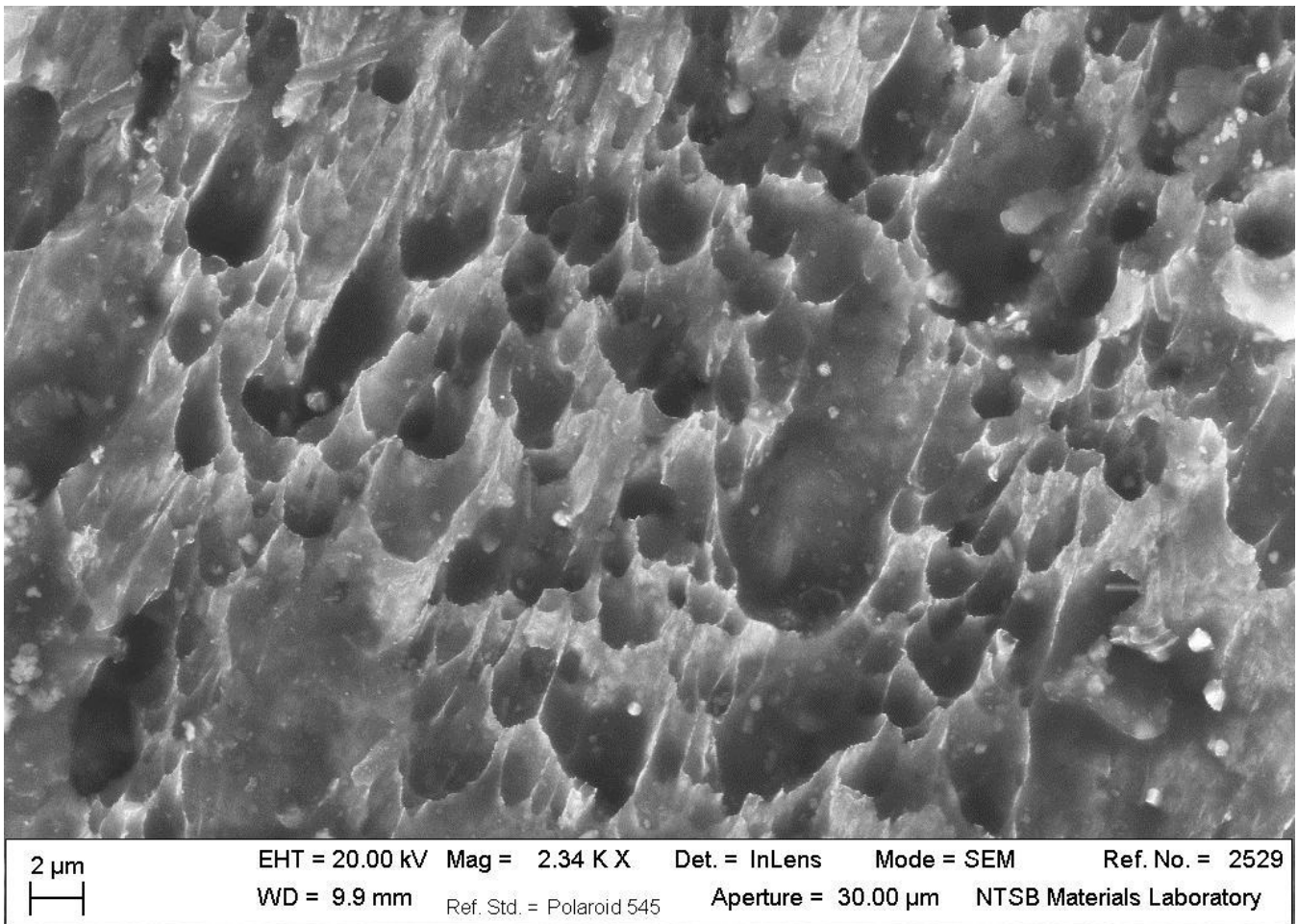


Figure 4 – Secondary electron micrograph of a typical portion of the fracture surface of rivet 4, showing slanted ductile dimple rupture.