

NATIONAL TRANSPORTATION SAFETY BOARD

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



August 24, 2016

MATERIALS LABORATORY FACTUAL REPORT

Report No. 16-075

1. ACCIDENT

Place : Littleton, NC
Date : April 24, 2016
Vehicle : Maule M7-235B, N367FS
NTSB No. : ERA16LA181
Investigator : Heidi Kemner, AS-ERA

2. COMPONENTS EXAMINED

Pieces of sectioned float skin

3. DETAILS OF THE EXAMINATION

On April 24, 2016, about 1500 eastern daylight time, an amphibious Maule M7-235B, crashed while attempting to land on a lake near Littleton, North Carolina. The private pilot and two passengers were not injured. According to the pilot, during the takeoff, he noticed that the airplane was veering "severely" to the left; however, he continued the takeoff. The pilot performed a "normal" landing, however, when the airplane touched down, it veered to the left, nosed over, and came to rest in the water. A post-accident examination of the airframe revealed that the bottom of the left float skin was partially separated along a rivet line. In addition, the left float was bent in a positive direction, about 20 degrees. Sections of the float skin were sent to the NTSB Materials Laboratory for further examination.

Figure 1 shows the float skin sections, as received. The sections had been labeled 1A, 1B, 2A, 2B, and 2C prior to receipt. The sections labeled 1 were stated as having come from the inside of the left float behind the left main gear bulkhead. The fractures of these two sections were along a line of rivets. The mating halves of this section were approximately 8.25 inches long, with the fracture along 15 rivet holes. The white paint had partially spalled near the rivet locations; the underlying green primer was generally still adhering to the skin, underneath the spalled paint.

The sections labeled 2 were from outside of the left float behind the left main gear bulkhead. The largest piece (2A) was 7.25 inches long, with the main fracture surface along 14 rivet holes. Like the other pieces, the outer white paint exhibited spalling near the rivet holes, with cracking parallel to the fracture surface.

The fracture surfaces were examined visually, as shown in Figure 2 through Figure 4. The fracture surfaces of all of the parts exhibited single or double shear lips with associated necking of the wall thickness as shown in Figure 2 and Figure 4. The fracture surfaces exhibited a generally rough texture, with a dull luster. Examination using a scanning electron microscope (SEM) revealed dimple rupture (Figure 5). All of these features were consistent with failure from overstress on a thin-walled structure.

Examination of the rivet holes revealed that they had been chamfered (see Figure 3). Some of the fracture surface area exhibited some more reflective regions, but these were consistent with post-fracture smearing. There were no indications of abusive machining defects on the sections submitted.

The chemical composition of the piston crown was inspected using energy dispersive spectroscopy (EDS) and x-ray fluorescence (XRF). The composition was consistent with type 6061 aluminum alloy.

The hardness of the parts was inspected per ASTM E18.¹ The hardness averaged 54 HRBW (55 HR30TW). The electrical conductivity of the parts was inspected per ASTM E1004.² The conductivity averaged 45.8% IACS. These data were consistent with a T6 temper for a 6061 aluminum alloy, per AMS 2658.³

Erik M. Mueller
Materials Engineer

¹ ASTM E18 – *Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials*. ASTM International, West Conshohocken, PA.

² ASTM E1004 – *Standard Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy-Current) Method*. ASTM International, West Conshohocken, PA.

³ AMS 2658 – *Hardness and Conductivity Inspection of Wrought Aluminum Alloy Parts*. Society of Automotive Engineers, Warrendale, PA.

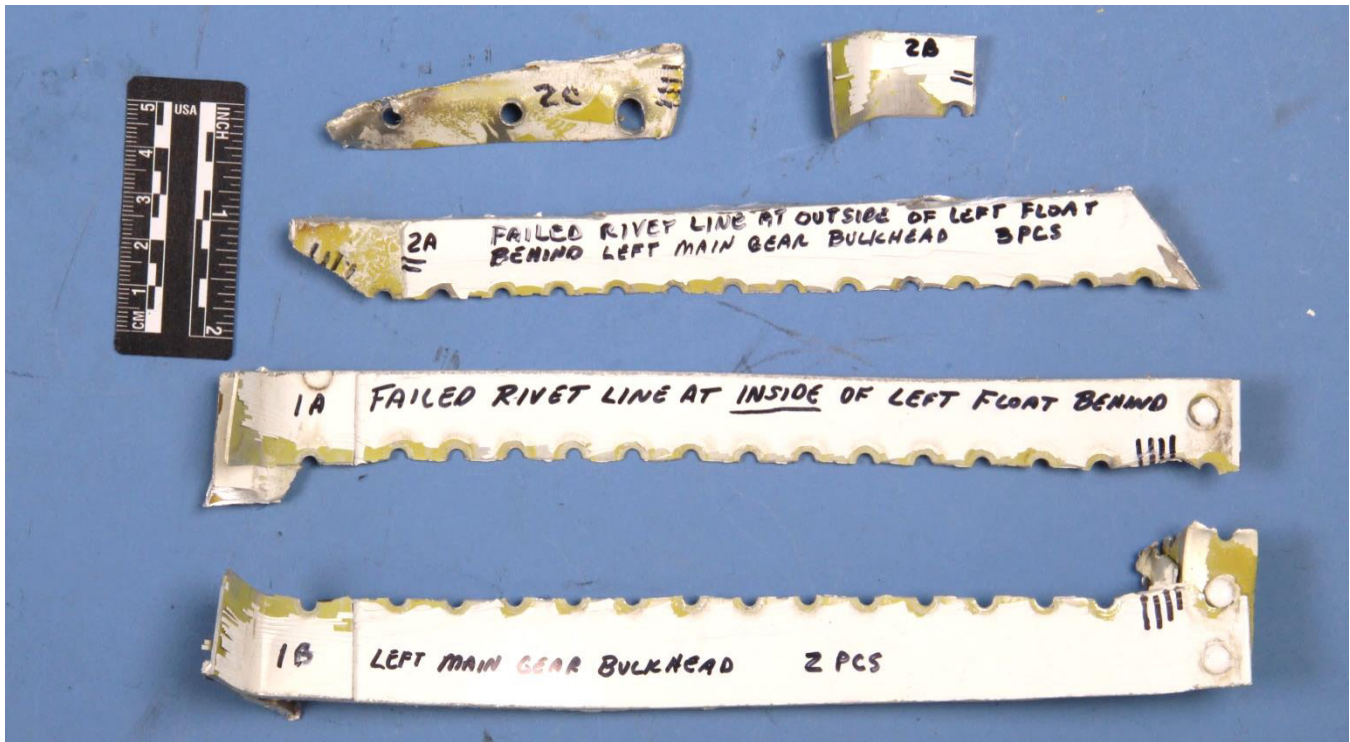


Figure 1 – The underside of the piston crown, as received. The two fatigue cracks are highlighted at the oil drain holes (arrows) where they were located.

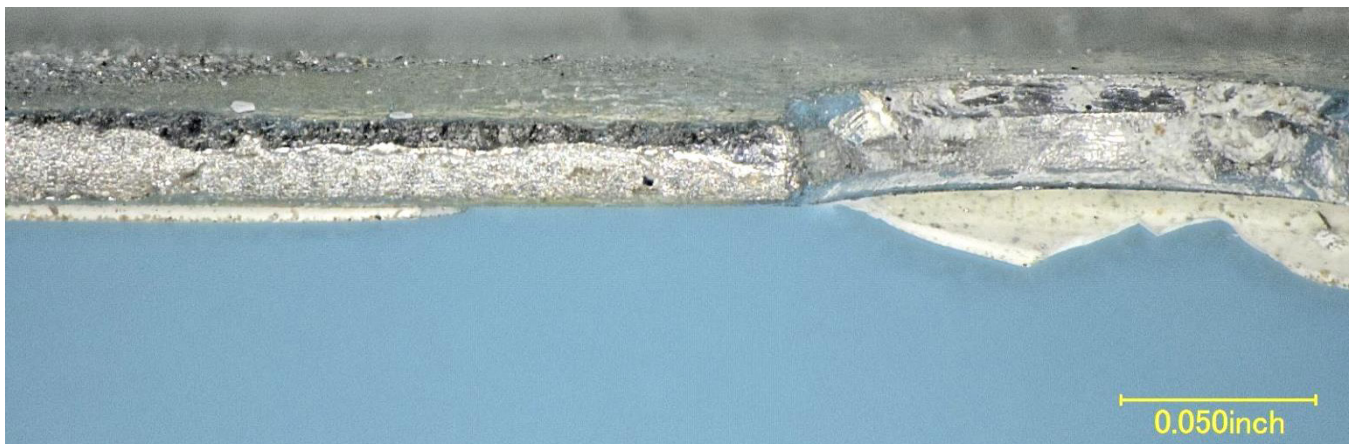


Figure 2 – A portion of the fracture surface on section 1B, showing a cup-shaped morphology near a chamfered rivet hole.

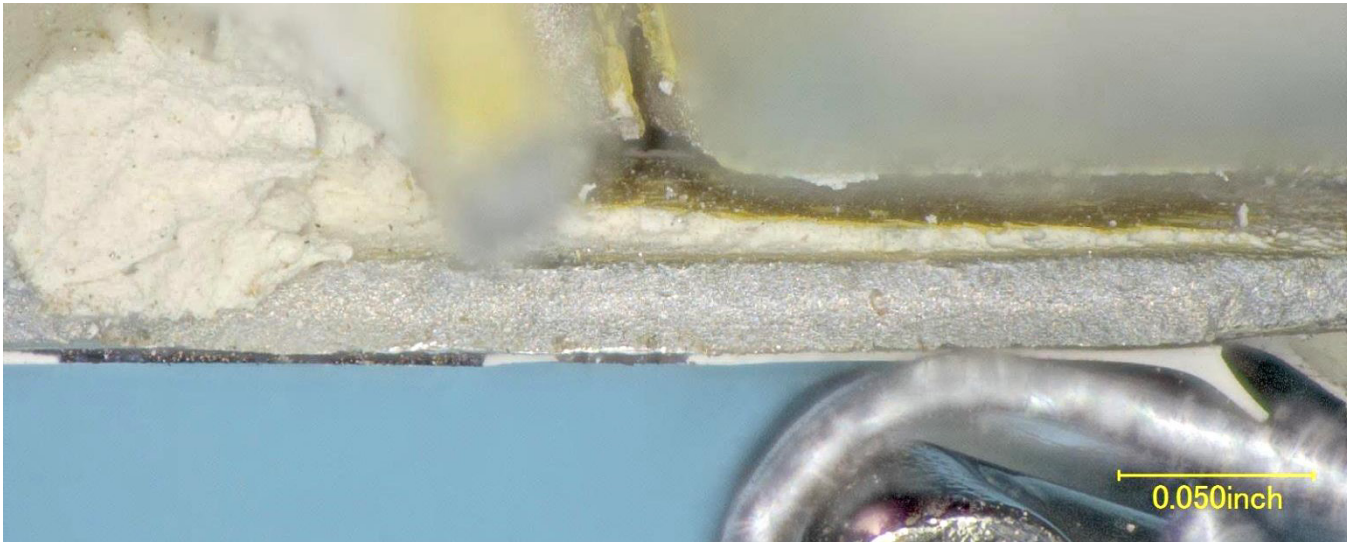


Figure 3 – View of the cup-shaped fracture surface of section 1B, near a marked area of interest at the edge of the fracture line.

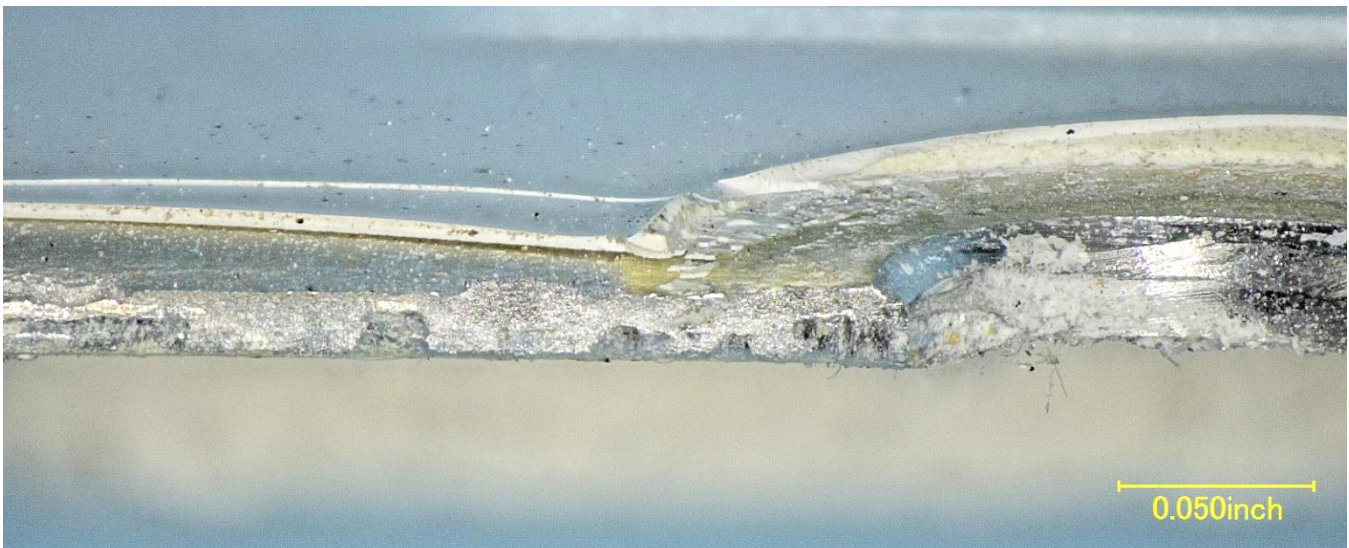


Figure 4 – An area of section 2A, with a 45° slanted fracture surface near a chamfered rivet hole.

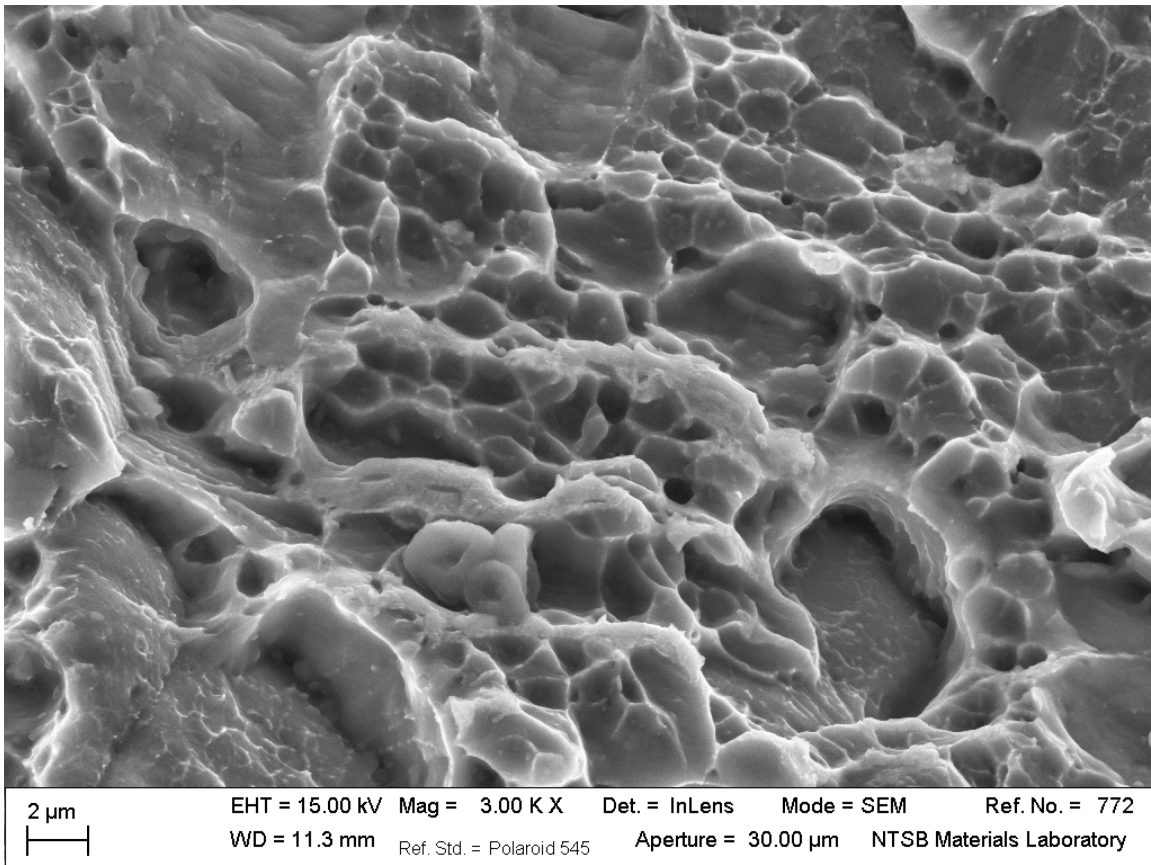


Figure 5 – Secondary electron (SE) micrograph of dimple rupture observed on the fracture surface of section 2B.