

NATIONAL TRANSPORTATION SAFETY BOARD

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



March 25, 2019

MATERIALS LABORATORY FACTUAL REPORT

Report No. 18-106

A. ACCIDENT INFORMATION

Place : Anchorage, Alaska
Date : March 25, 2018
Vehicle : Champion 7GC, N4844E
NTSB No. : ANC18LA030
Investigator : Mike Hodges, AS-ANC

B. COMPONENTS EXAMINED

Main landing gear strut threaded sleeve and jam nut.

C. DETAILS OF THE EXAMINATION

An overall view of the submitted sleeve and jam nut are shown in figure 1. The sleeve had reportedly fractured from the lower end of the right main landing gear during the accident landing sequence. In describing the landing, pilot reported that upon landing on a dry asphalt runway, the airplane touched down and ground looped¹ to the left.

Illustrations of the main landing gear components in the static position and with the oleo strut assembly² in the extended position are shown in figures 2 and 3, respectively. As assembled on the airplane, the oil-filled oleo strut tube extends and retracts within the oleo strut covered frame to provide shock-absorbing movement for the axle strut and wheel assembly. The oleo strut cap and jam nut are attached to the lower end of the oleo strut tube. The lower end of the oleo strut assembly is attached to the axle strut, and the upper ends of both the axle strut and the oleo strut assembly are attached to the fuselage as shown.

As manufactured, the oleo strut cylinder assembly consists of the oleo strut tube with a stuffing box (for the piston seal) brazed at the upper end of the tube and a sleeve with external threads brazed onto the exterior of the tube near the lower end of the tube. Internal threads in the oleo strut cap and jam nut engage with the threaded sleeve to attach the cap to the tube and lock it in place.

As shown in figure 1, the sleeve had fractured from the lower end of the oleo strut tube. The jam nut was in place on the sleeve, and the external threads on the sleeve

¹ A ground loop is an unintended ground maneuver where the airplane makes a sudden uncontrolled turn.

² An oleo strut is a shock absorber with concentric cylinders filled with oil and compressed air to provide a damping function.

were intact. The oleo strut cap and the rest of the oleo strut assembly was not included with the submitted components.

The fracture occurred through the braze fillet at the upper side of the sleeve. Views of the fracture surface and sleeve interior surface are shown in figures 4 through 6. The interior surface of the sleeve had relatively prominent circumferential machining marks that extended around most of the circumference. However, a relatively smooth area where the circumferential machining marks were absent was observed as indicated in figure 4. Pits with orange-colored oxidation was observed in the smooth area and an adjacent area with circumferential machining marks as indicated in figure 4. The orange oxidation and pits extended around approximately 1/3 of the circumference. A chamfer between the inner diameter and the upper end of the sleeve was mostly covered by the braze fillet but was partially visible in areas such as the area noted in figure 6.

The inner diameter of the sleeve was measured using a micrometer. Across the diameter near the middle of the smoother area, the inner diameter measured 1.761 inch near the upper end of the sleeve and 1.764 inch near the lower end. Across the diameter perpendicular to the first measurements, the inner diameter measured 1.757 inch near the upper end of the sleeve and 1.756 inch near the lower end.

The braze material had a light yellow color in contrast to the silver and dark gray color of the sleeve surfaces. Fracture of the braze material occurred through the fillet through the middle of the fillet as shown in figure 4, near the upper side of the fillet as shown in figure 5, and close to the chamfer surface as shown in figure 6. Large voids were present at the interior surface of the fillet in some areas, and the largest void is shown in figure 5. The fracture also intersected smaller spherical voids in the fillet such as those indicated in figure 4. Fracture features were generally uniform in color with no evidence of post-fracture rubbing or long-term oxidation. Secondary crack openings and deformation to the fillet material was consistent with ductile overstress fracture with the sleeve moving downward relative to the oleo strut tube.

Most of the interior surface of the sleeve had a dark gray color with areas of oxidation as noted above. However, adjacent to the void shown in figure 5, the upper end of the sleeve had a yellow color consistent with a thin coating of braze material. A bracket in figure 5 indicates the extent of the thin braze coating extending up to 0.2 inch below the chamfer. The circumferential machining marks remained visible on the interior surface in the coated area, and none of the machining grooves on the interior surface of the sleeve were filled with braze material. According to the engineering drawing for the oleo strut tube assembly provided by a representative of American Champion Aircraft Corporation, the sleeve-to-tube joint should have a continuous braze fillet around the circumference of the tube. A note in the engineering drawing pertaining to the sleeve-to-tube joint stated the braze must penetrate and be evident on the opposite side of the sleeve and be continuous around the circumference.

Matthew R. Fox, Ph.D.
Senior Materials Engineer

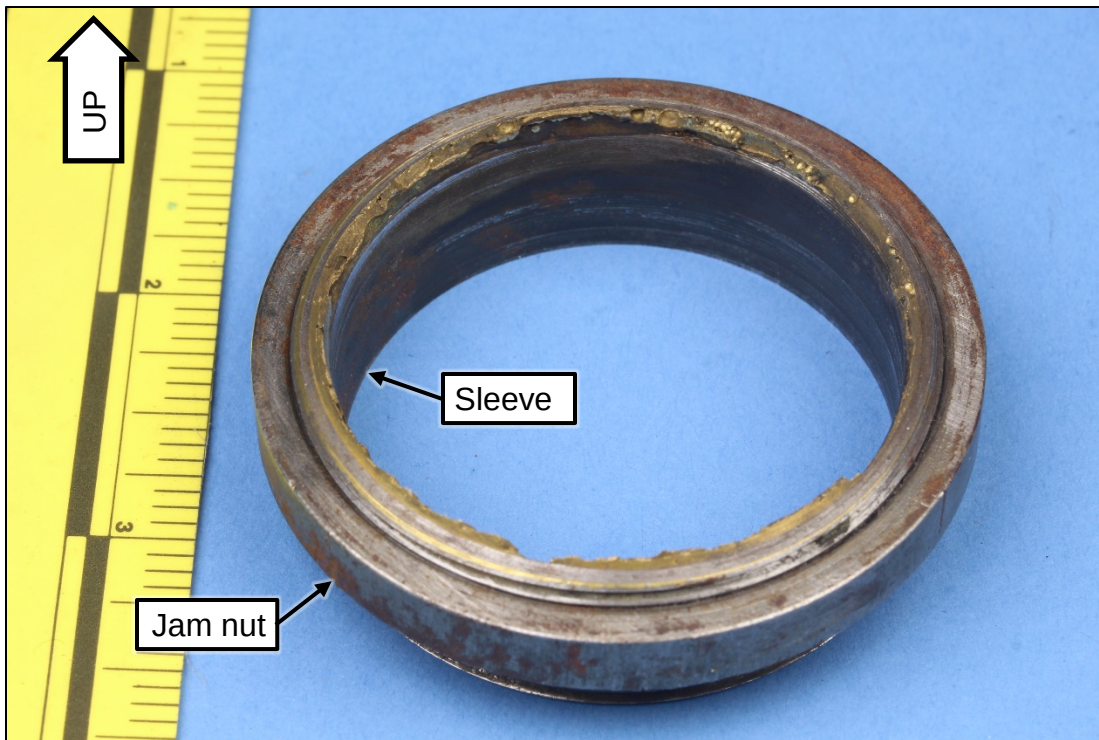


Figure 1. Overall view of the submitted threaded sleeve with attached jam nut.

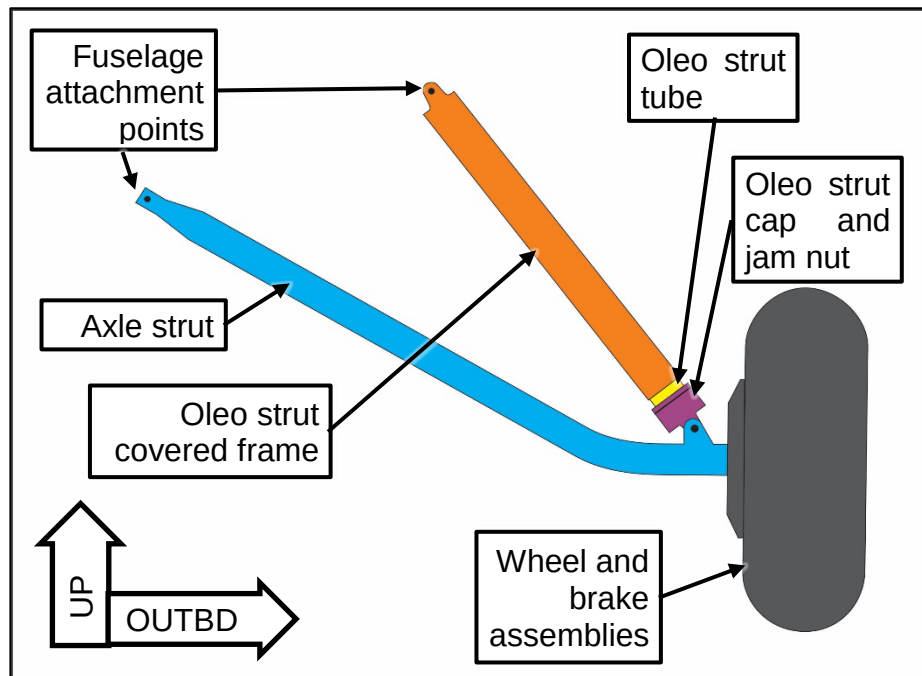


Figure 2. Schematic drawing looking forward illustrating the right main landing gear components with the oleo strut assembly in the static position.

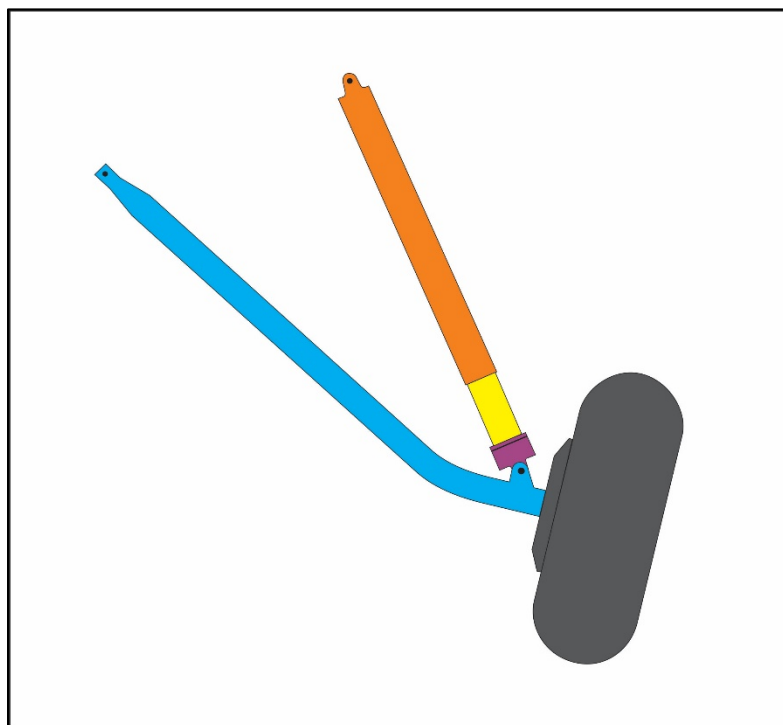


Figure 3. Schematic drawing looking forward illustrating the right main landing gear components with the oleo strut assembly in the extended position.

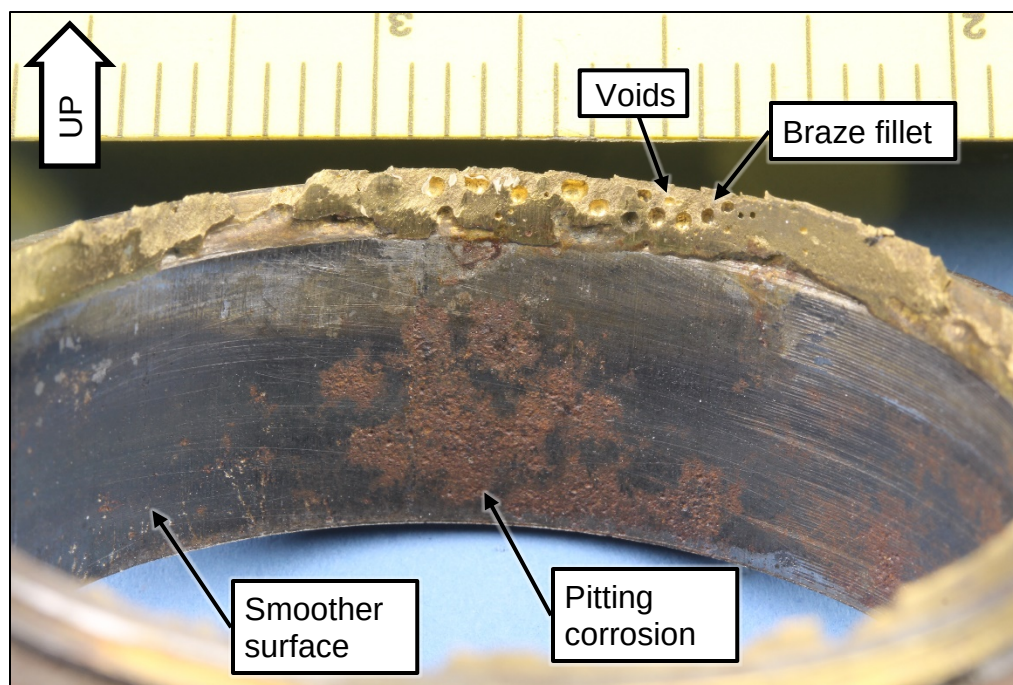


Figure 4. Interior face of the sleeve in a smoother area with pitting corrosion.



Figure 5. Interior face of the sleeve showing a void across most of the fillet radius. An unlabeled bracket indicates a gold-colored surface appearance adjacent to the braze fillet.

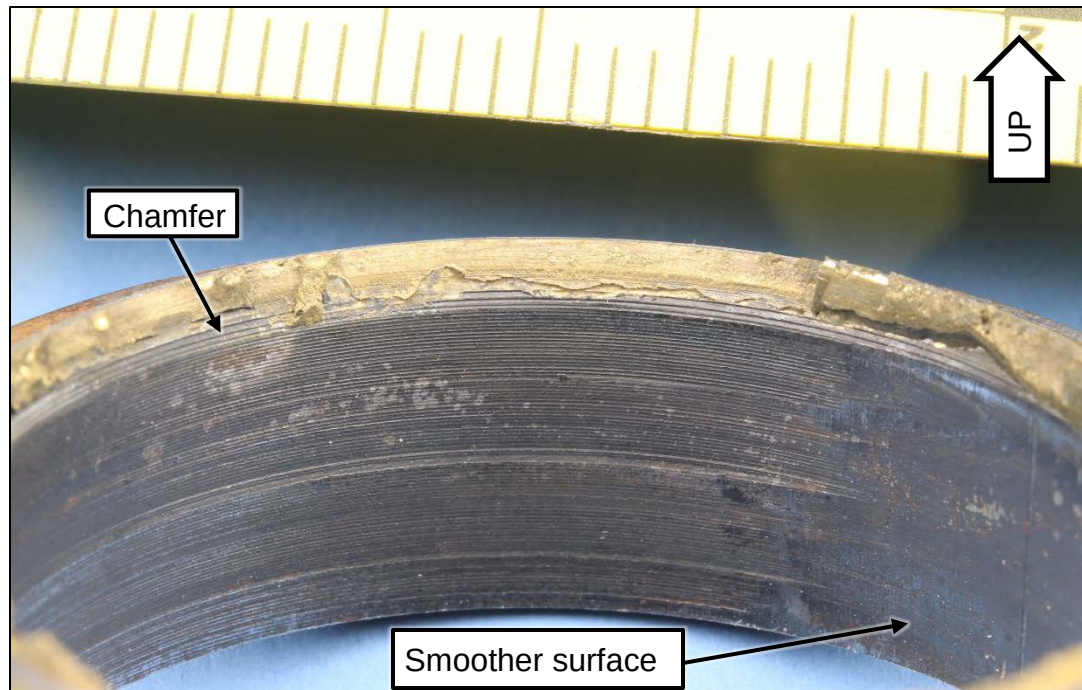


Figure 6. Interior face of the sleeve showing the chamfer surface at the upper side of the sleeve that was not covered by braze metal.